

Deepwater Gas Pipelines direct from the Middle East to India

"A project whose time has come"

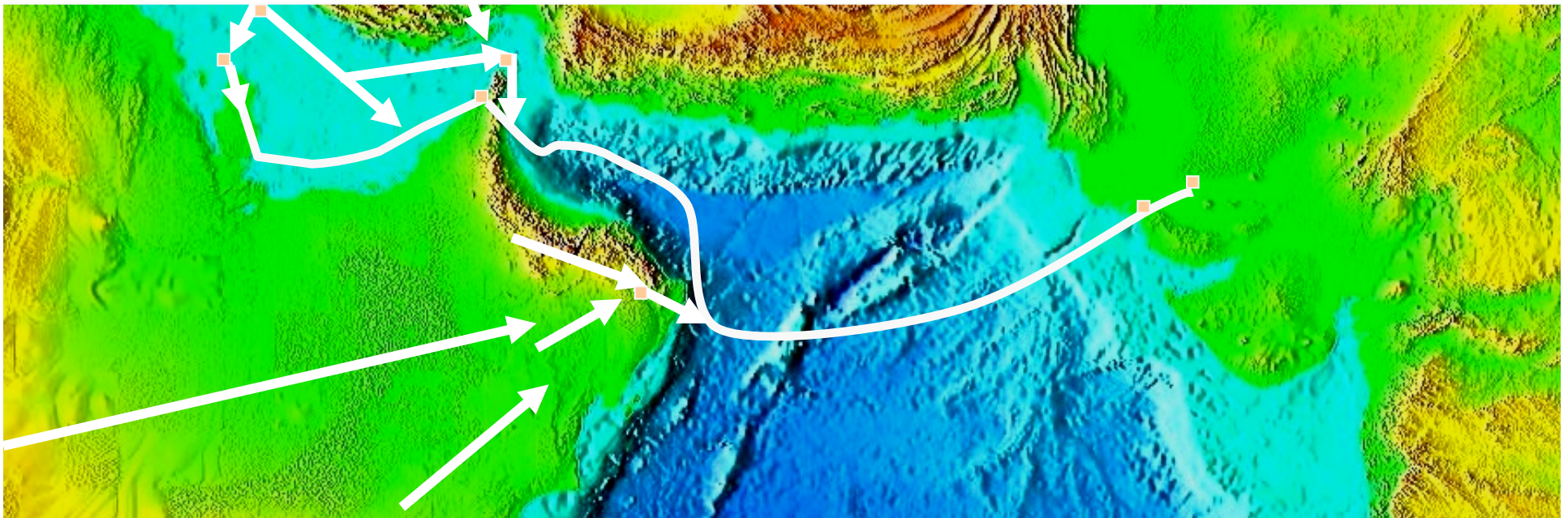
**India Energy Conference
October 4th 2008
New Delhi**



Building on Previous Experience



SAGE will build on the extensive study of the deepwater route started during the mid 1990's, strengthened by the development work now undertaken by SAGE and the major body of industrial deepwater pipelay experience over the last decade. SAGE will reach water depths of around 3,500 meters and will be over 1,000km in length.



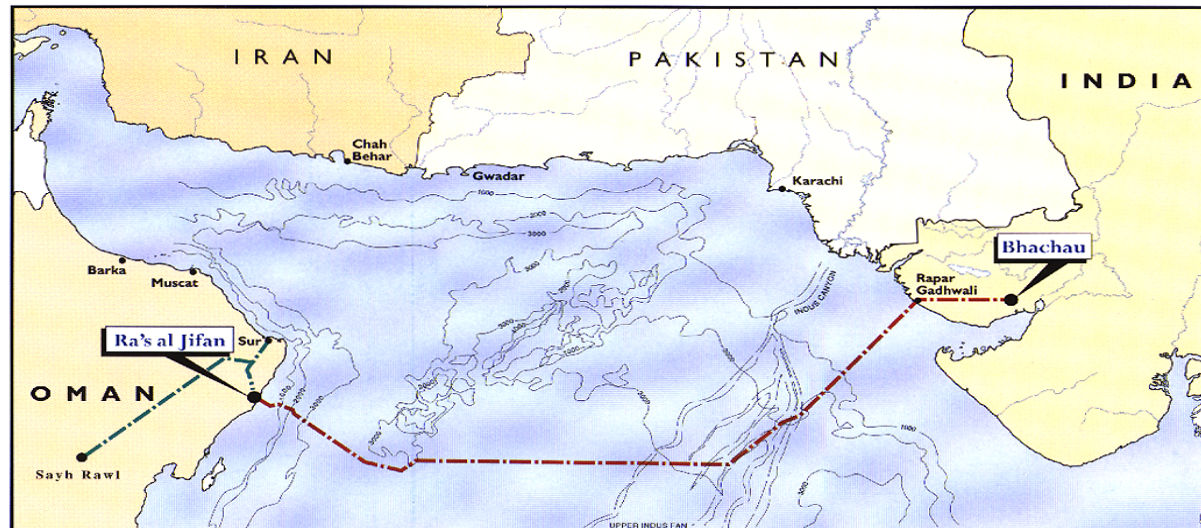
- Multiple gas sources expected from across the Gulf region and Middle East
- Gas Gathering network will grow with its "Hub" in UAE, Oman or elsewhere
- Landfall locations to be set by Gas source and Commercial considerations
- Fully surveyed route from the 1990s project used as "base case" for costings

October 2008

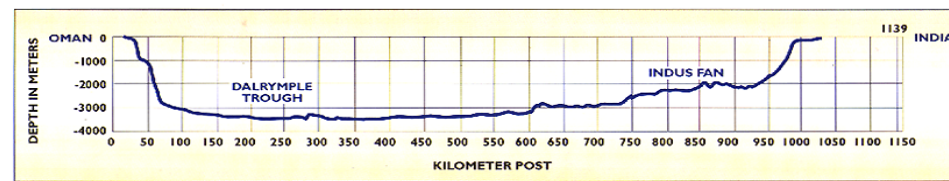
Proprietary to South Asia Gas
Enterprise PVT Ltd (SAGE)

2

Deepwater pipeline technology was first developed over 10 years ago on the Oman-India project.....



Subsea Route and Sea Bottom Profile.



.....and has now matured

Technical Risk Issues facing the project in 1995:

- Pipe mill upgrades needed to manufacture linepipe.
- Lack of lay vessel with enough tension capability.
Conversion work needed to lay pipe to 3,500m water depth.
- Incomplete understanding of seismic activities and mitigation methods – mudflows, fault lines & slope failures.
- No qualified deepwater pipeline repair system was available.

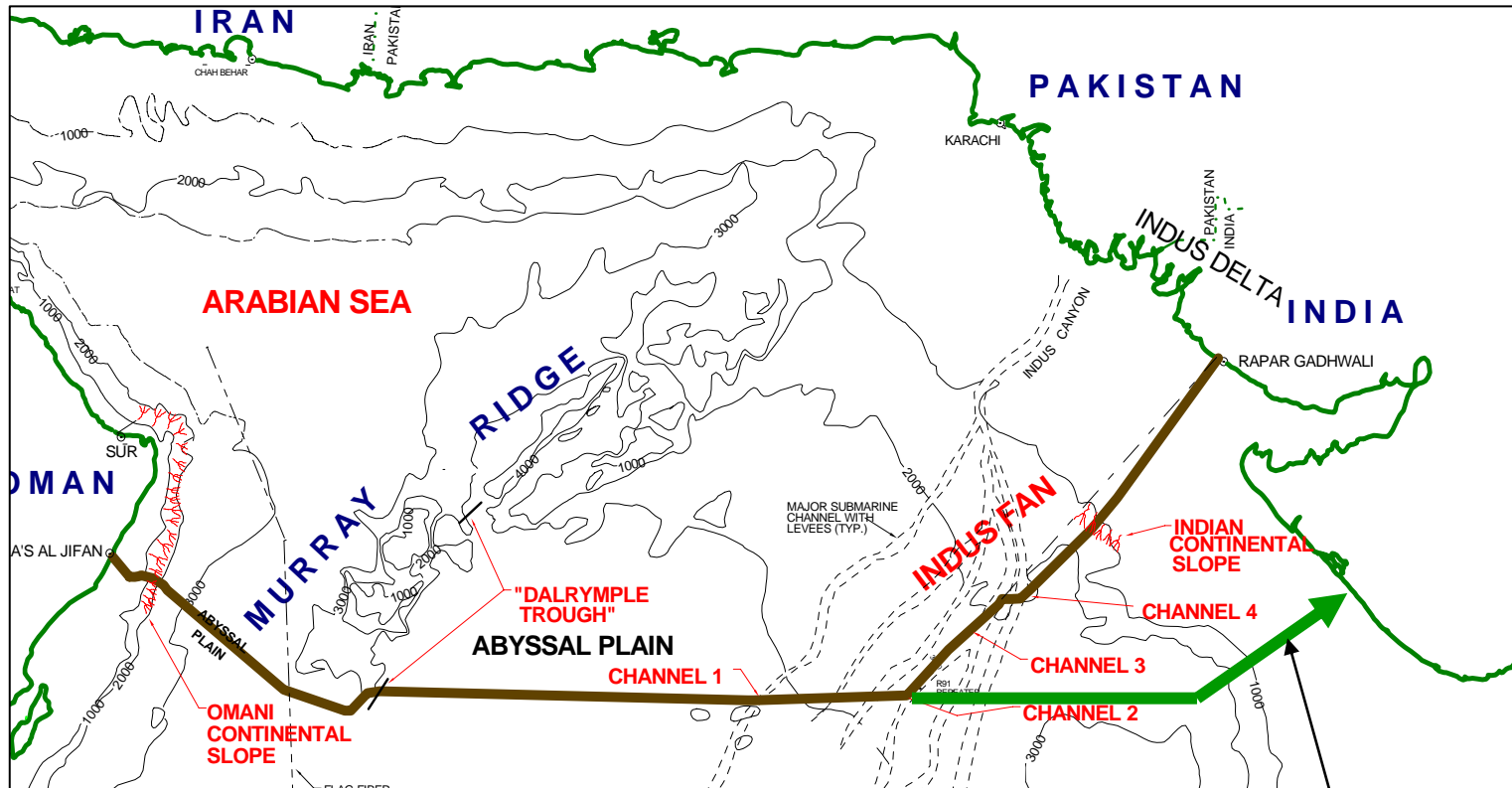
HOWEVER:

- These were not considered to be fatal impediments by the industry and three competitive bids were received and evaluated before the gas was re-assigned elsewhere.

What makes SAGE's Risk Profile lower now?

- New generation, large lay vessels.
- Several mills can manufacture pipe (also in India).
- New and improved design methods for free-spanning and geo-hazards.
- Better positioning capabilities during pipelay to avoid seabed hazards.
- Deepwater repair systems available.
- New testing and commissioning philosophies developed by SAGE with DnV permits use of 28-inch pipe:

The work has shown that it is possible to document that a 28" OD pipeline with a 42mm nominal wall thickness made of DNV-SAWL-450 F (steel having a SMYS of 450MPa) exposed to light heat treatment to have sufficient safety level.



Possible re-route suggested by INTEC Engineering to minimize mud flow exposure in Channel 4 (also shorter)

- The pipelay industry has continued to reach into ever deeper water until today, Heerema's new pipelay barge is specified to work beyond 3500m.
- SAGE has a conservative design, well inside current technology guidelines.
- SAGE establishes a natural gas "Energy Corridor" to form a new and politically neutral energy route infrastructure as additional lines are subsequently installed.
- 31.1 Million Standard Cubic Meters per day from each line (1.1BCFD).
- Western Indian gas markets are as close to Middle East as to new gas reservoirs off the Indian East Coast.

SAGE project has economic and technical viability:

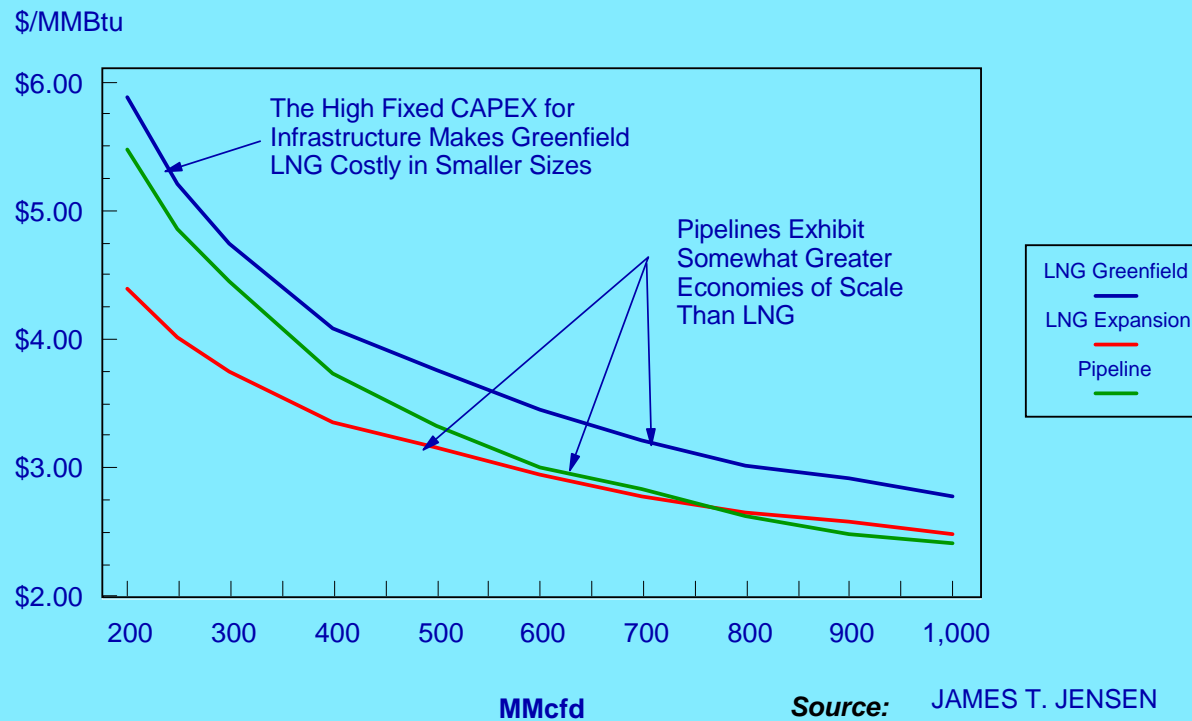
- World class design and build consortium; **low project risk**.
- Route outside of Straits of Hormuz and neighbours' EEZs gives SAGE a desirable **low political risk** profile.
- Non-volatile, long-term bi-partisan pricing un-correlated with and complementary to LNG “spot-market” price volatility for **superior financial risk** profile.
- Replaces **wasteful** use of Naphtha for fertiliser production
- “**Green Energy**” and **carbon reduction** benefits.
- SAGE provides an historic opportunity to West and South Asia for **convergence of regional economic interests**.

The SAGE Project – Key team members



Mr. T.N.R. Rao	<ul style="list-style-type: none"> ▪ Former Petroleum Secretary, Govt. of India and “Architect of the Oman-India Pipeline” ▪ Chairman of the SAGE Advisory Board ▪ Founder Chairman, Hydrocarbons Education & Research Society, Indian School of Petroleum. ▪ Founder Chairman – University of Petroleum & Energy Studies
Subodh Jain	<ul style="list-style-type: none"> ▪ Director: INOX-AIR PRODUCTS Ltd. ▪ Director: South Asia Gas Enterprise PVT Ltd ▪ Director: Siddho Mal & Sons, New Delhi ▪ Former Senior Advisor to original Oman-India Pipeline team
Peter M Roberts	<ul style="list-style-type: none"> ▪ Director: South Asia Gas Enterprise PVT Ltd ▪ Director: VerdErg Ltd, London ▪ Former Project Director of original Oman-India Pipeline
Dr Herman Franssen	<ul style="list-style-type: none"> ▪ Senior Consultant to SAGE ▪ Member of the SAGE Advisory Board. ▪ President, International Energy Associates, USA ▪ Former Economic Advisor to the Oman-India Pipeline project ▪ Former Economic Advisor to the Sultanate of Oman, Ministry of Petroleum
John Stearns	<ul style="list-style-type: none"> ▪ Vice-President, Marine Pipeline Systems, INTEC Engineering Inc., Houston ▪ Former Project Director, Mardi Gras Transportation System ▪ Former Project Manager, Canyon Express Project
Rob Narold	<ul style="list-style-type: none"> ▪ HMC Project Manager for new barge design and construction ▪ HMC Strategic Development Advisor ▪ Sr. Proposals Manager - Manager New Product Development ▪ HMC Deep Water Product Manager
Professor Alastair Walker	<ul style="list-style-type: none"> ▪ Leading International Expert on Marine Pipeline Engineering ▪ Senior Consultant to SAGE ▪ Member of the SAGE Advisory Board ▪ Professor Emeritus, University of Surrey UK ▪ Visiting Professor, University College London
Richard Freeman	<ul style="list-style-type: none"> ▪ Manager, Business and Sales Development, Corus Tubes (Energy), UK.

THE SCALE EFFECT - THE COSTS OF MOVING GAS OVER 1,200 MILES BY PIPELINE AND AS LNG (GREENFIELD AND EXPANSION PROJECTS)



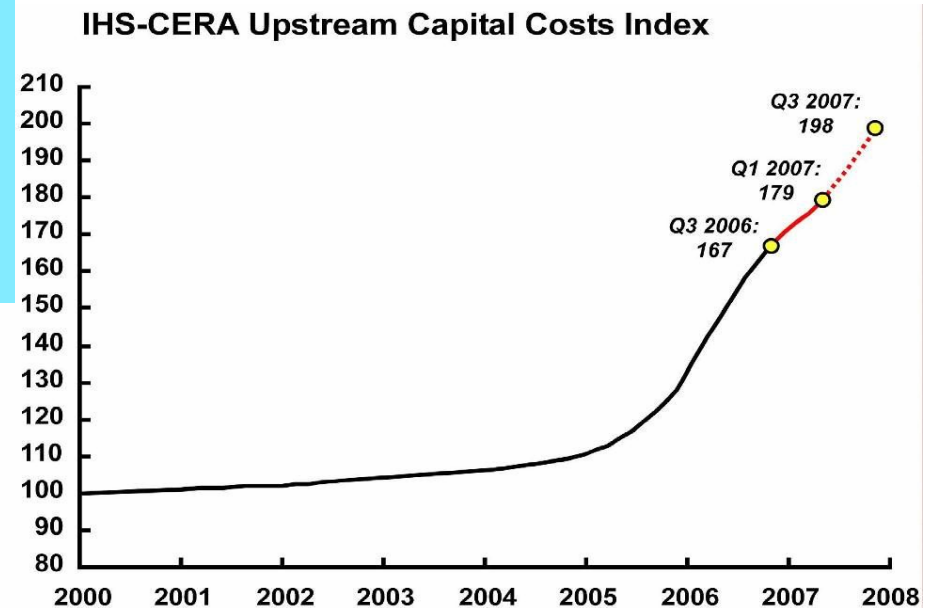
Source: JAMES T. JENSEN
 Jensen Associates
 49 Crescent Street; Weston, MA 02493 U.S.A.
 Website JAI-Energy.com

THE INFLATIONARY PRESSURES HAVE A SIGNIFICANT EFFECT ON THE COMPETITION

- The Past Three Years Has Seen a Dramatic Increase in Construction Costs
- While the Costs of Pipeline Construction Have Risen Substantially, Those of LNG Liquefaction and Regasification Have Been Especially Hard Hit
- At the Turn of the Decade, LNG Plant Construction Costs Were Approaching \$200/Ton of Capacity
- But Current Costs are a Multiple of That Level and There Have Been Several "Problem Trains" That Have Been Quoted at \$1,200 and Above

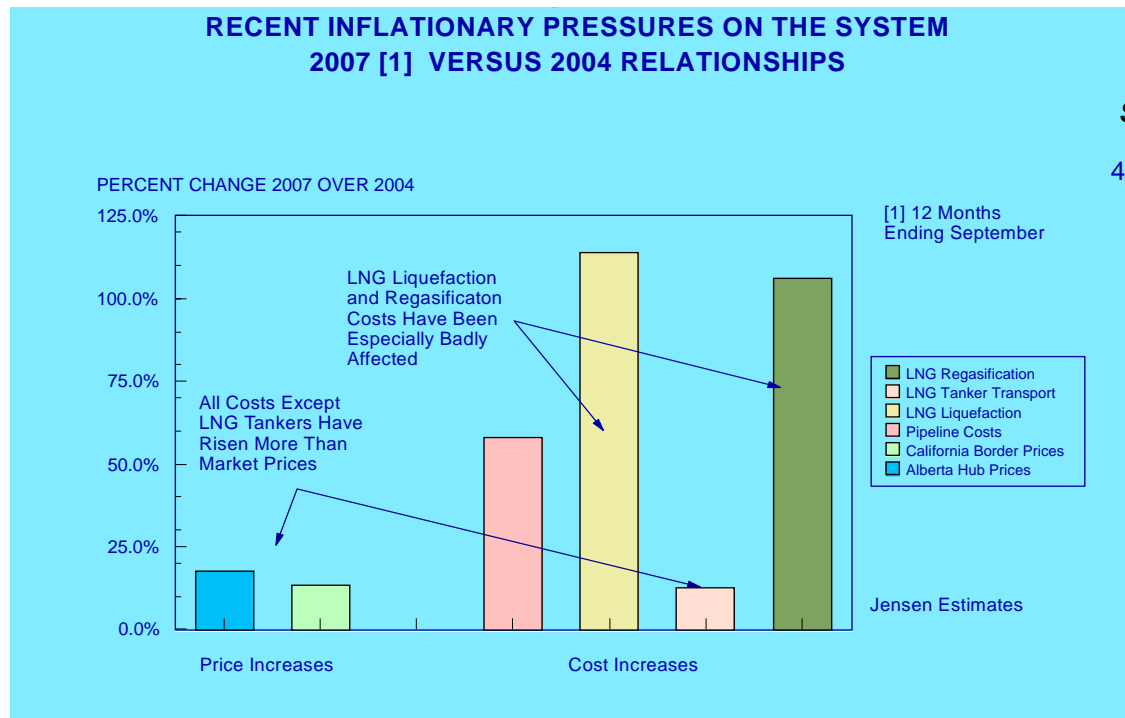
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Website JAI-Energy.com

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Source: Cambridge Energy Research Associates.
70113-3_2210

LNG costs are rising twice as fast as pipeline costs.



Source: JAMES T. JENSEN
Jensen Associates
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Website JAI-Energy.com

CONCLUSIONS of last 3 slides:

- Importing gas by pipeline from the Middle East to West and North India is the natural "default" method - it's too nearby for LNG economics to work properly.
- Ten years ago this underlying reality was obscured by the water depth challenge. Now this is resolved, pipeline transportation is again preferred.

DEMAND:

- India will continue to need more gas. Prices are rising.

SUPPLY:

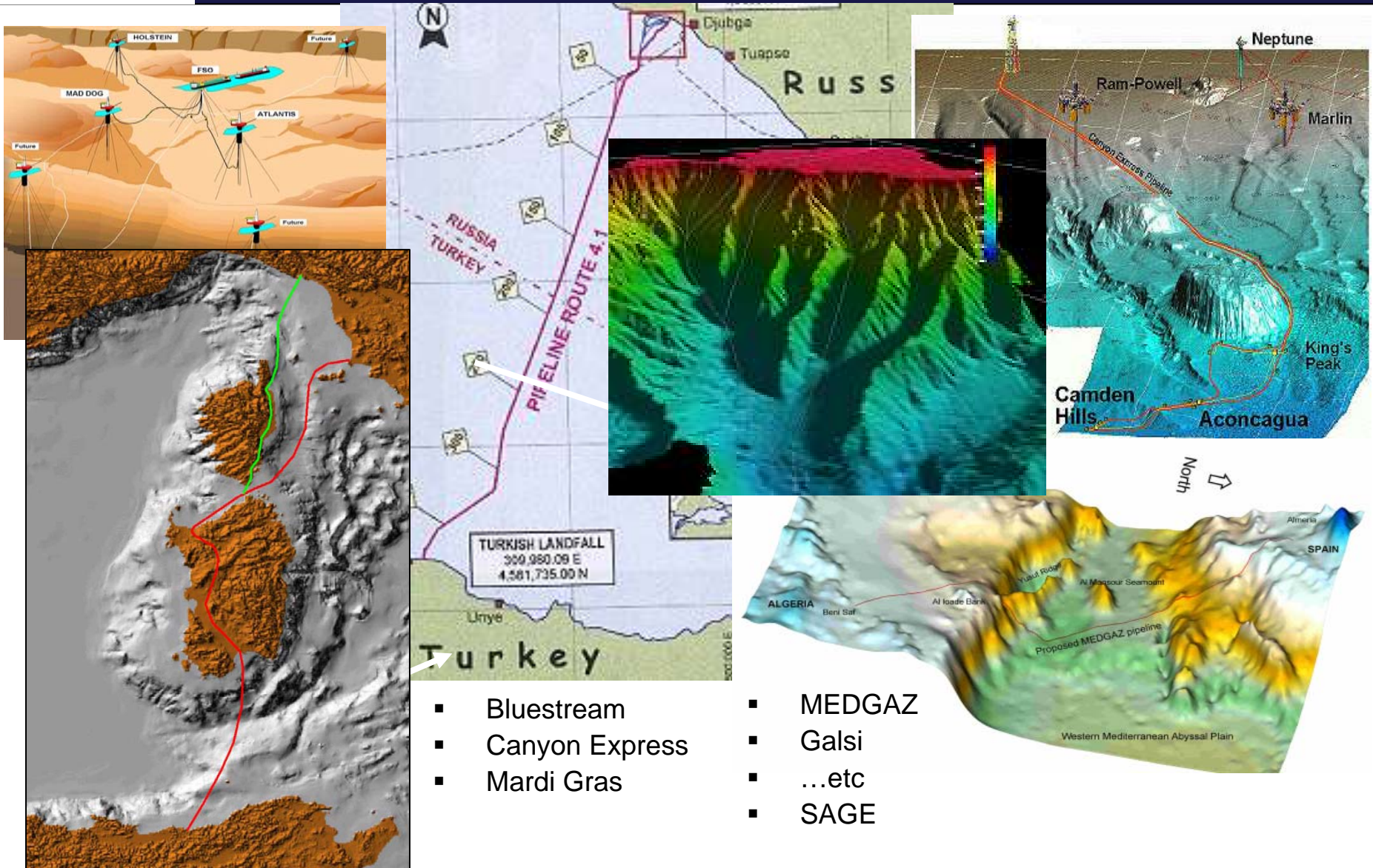
- Over 2000 TCF gas reserves reported to be available in the Middle East. Only 8 TCF required for each SAGE line.

SAGE:

- Project cost of \$2.1 – 3.4 Billion for first line from Oman Coast to India requires tariff of around \$1.1 to \$1.8 per MMBTU. “Learning Curve” savings for subsequent lines.
- SAGE is competitive with and complementary to indigenous gas and LNG. Proximity to Middle East favours pipeline.

Resulting BENEFITS to Investors:

- Tariff share and secure alternative gas sales route, but also investment opportunity in Downstream Power, City Gas Distribution, Fertilizer Projects and CNG systems.

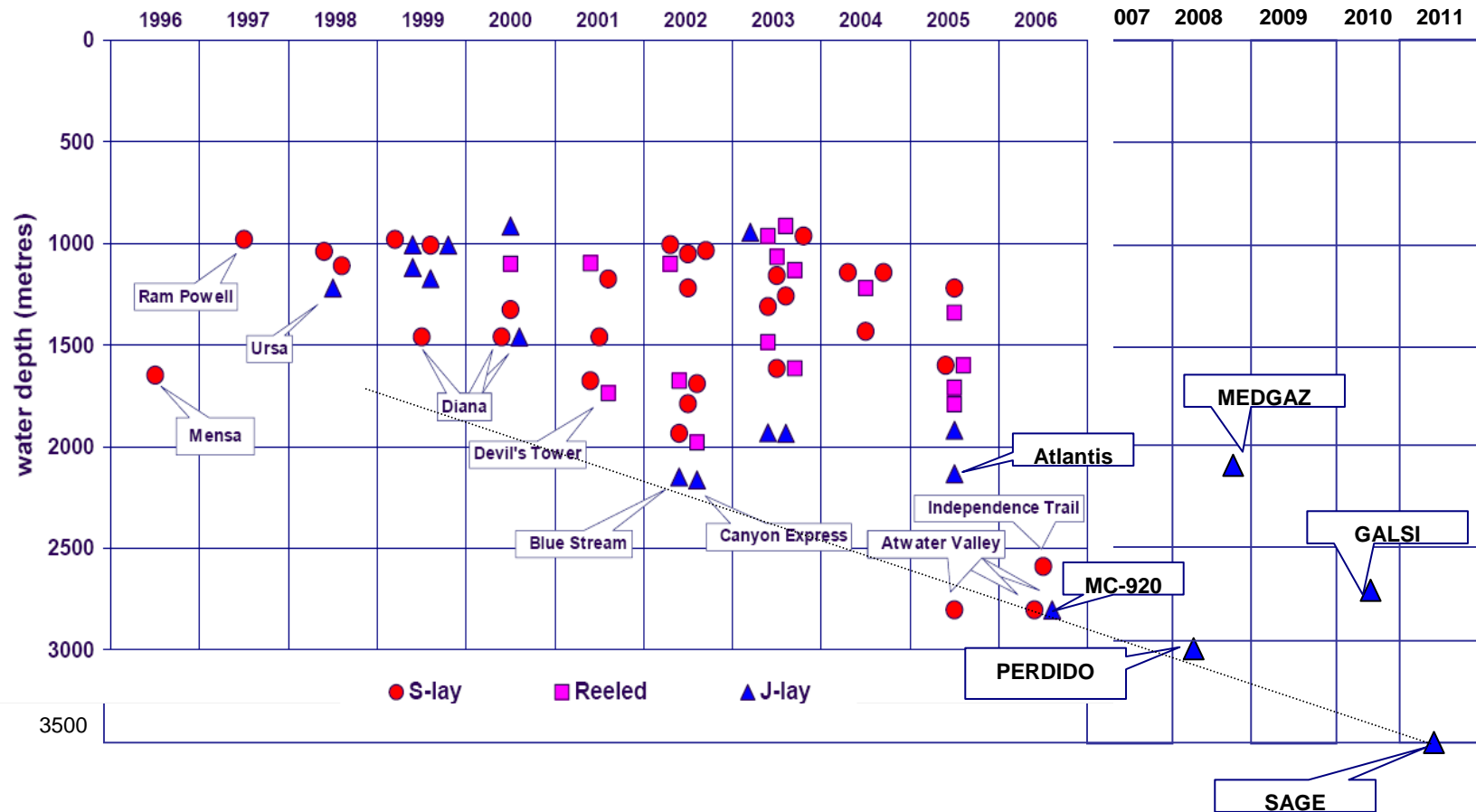


- Bluestream
- Canyon Express
- Mardi Gras
- MEDGAZ
- Galsi
- ...etc
- SAGE

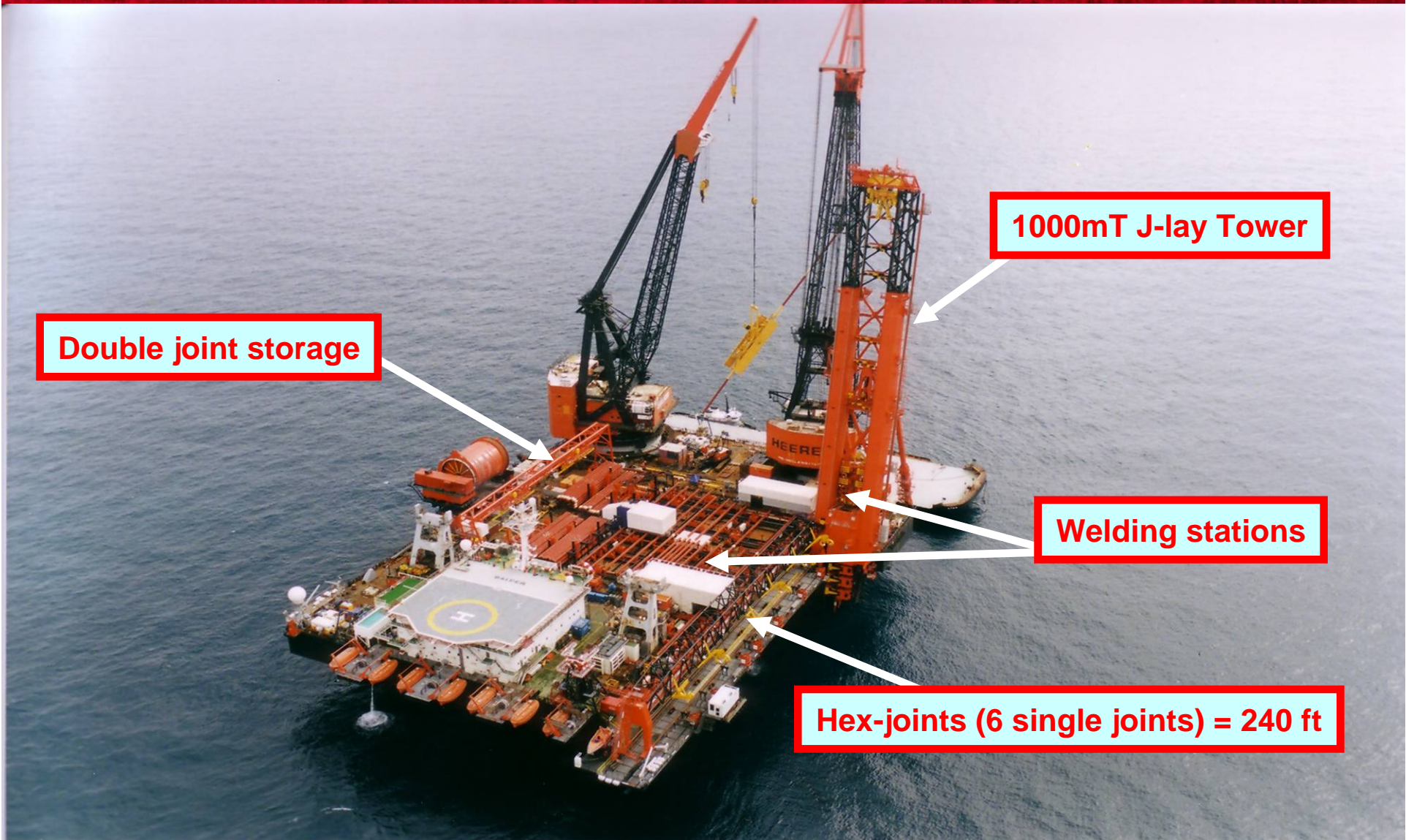
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Proprietary to South Asia Gas Enterprise PVT Ltd (SAGE)

Deepwater trend towards SAGE



Existing J-lay vessel “BALDER”



Double joint storage

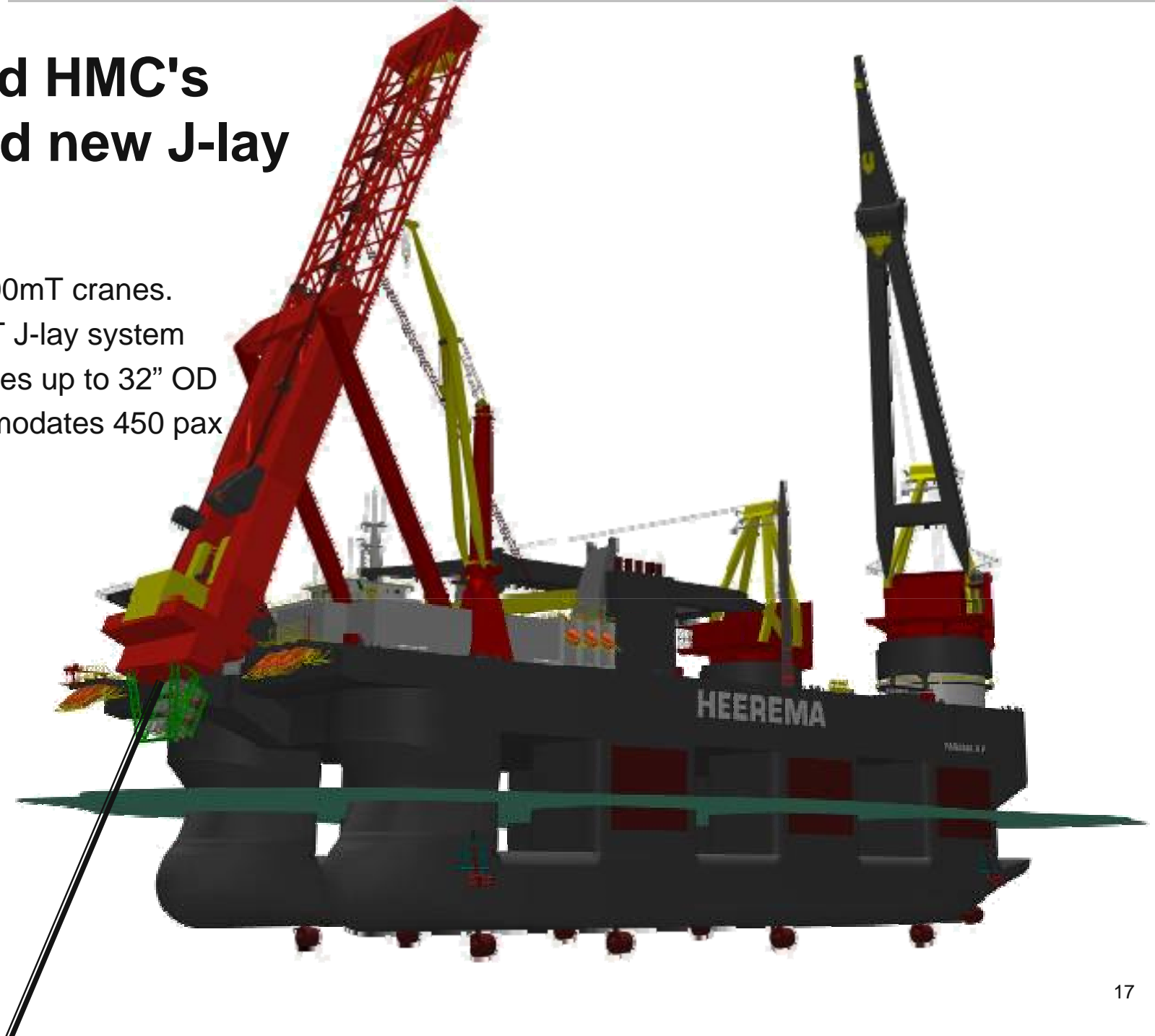
1000mT J-lay Tower

Welding stations

Hex-joints (6 single joints) = 240 ft

.....and HMC's planned new J-lay vessel

- 2 x 5,500mT cranes.
- 2000mT J-lay system
- Pipe sizes up to 32" OD
- Accommodates 450 pax



Assessment of Risk Levels during Operation



Zone	Calculated Failure Probability	'Safety' Level
Oman Shelf	9.81×10^{-2}	0.04
Oman Shelf Break	2.87×10^{-4}	14.0
Upper Oman Slope	9.18×10^{-4}	4.4
Lower Oman Slope	1.44×10^{-3}	27.8
Abyssal Plain (Oman Side)	1.56×10^{-4}	25.6
Murray Ridge*	2.69×10^{-3}	14.9
Dalrymple Trough*	5.37×10^{-3}	7.4
Abyssal Plain (Indian Side)	6.60×10^{-4}	6.1
Indus Fan (Excl. Ch. 1, 2, 4)	4.27×10^{-4}	9.4
Indus Fan Channel 1	2.17×10^{-4}	18.4
Indus Fan Channel 2	3.09×10^{-4}	12.9
Indus Fan Channel 4	7.27×10^{-4}	5.5
Lower Indian Slope	1.96×10^{-4}	20.4
Upper Indian Slope	3.22×10^{-4}	12.4
Indian Shelf Break	1.15×10^{-3}	3.5
Indian Shelf	9.86×10^{-2}	0.04

What does this tell us?

- The deepwater environment is an outstandingly safe, protective and benign location for a gas pipeline.
- The only areas requiring mitigation are the conventional shallow sections near the beach at each end, like on any other pipeline, where trenching and rock-dumping is conventionally applied. This protects the line against anchors and fishing activity.
- The risk from Sabotage is insignificant.

Note:

"Safety" Level means "how much safer than acceptable is it?"

The SAGE Project – Why now?



- SAGE has become **commercially viable** as Indian gas buying price has risen towards World levels, and SAGE technology has lowered transport costs.
- Pressing **need for energy** in India - gas can be absorbed.
- **Technical viability**: huge new HMC barge with twice existing capacity. Several mills can manufacture the pipe.
- **“Outside Hormuz”** route without incursion into Iranian or Pakistani waters or Economic Exclusion Zones.
- LNG “spot market” (currently falling) and CAPEX risks complemented by **long-term** gas pipeline supply contracts.
- Unsatisfied regional appetite for large-scale investment in regional infrastructure; lack of **“good projects”** like SAGE.

HOWEVER:

- Gulf region gas supply currently tight - return to underlying supplier role expected before 2012 - or sooner.

- DnV input - SAGE **economic upgrade** by introducing **heat treatment** into pipe mill Quality Control techniques.
- INTEC Engineering Inc. (now owned by WorleyParsons) just completed **cost/route study** of onshore Gas Gathering system.
- CRISIL (leading Indian Rating and Financial Research agency) completing **Feasibility Study** for Indian and Gulf Investors/Private Equity in response to interest shown.
- SAGE **technology being shared** with rapidly developing Indian Pipe Mills. Mills are very enthusiastic - plate mills planned.
- Middle Eastern **Pipeline and Upstream Companies** are being encouraged to join SAGE Consortium.
- Ongoing contact with **Indian entities** (GAIL/ONGC/IOC/NTPC) as well as Indian Ministries of Oil & Gas/Fertilizer/Power and Foreign Affairs.
- Discussion started with Indian **ship/barge design** agencies.



Middle East to India
Deepwater Pipeline

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Questions?