THE OXFORD INSTITUTE FOR ENERGY STUDIES

A RECOGNIZED INDEPENDENT CENTRE OF THE UNIVERSITY OF OXFORD

UNIVERSITY OF OXFORD

Cost Analysis

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The Economics of Energy Corporations (2)

Key Cost Elements

Main assumptions

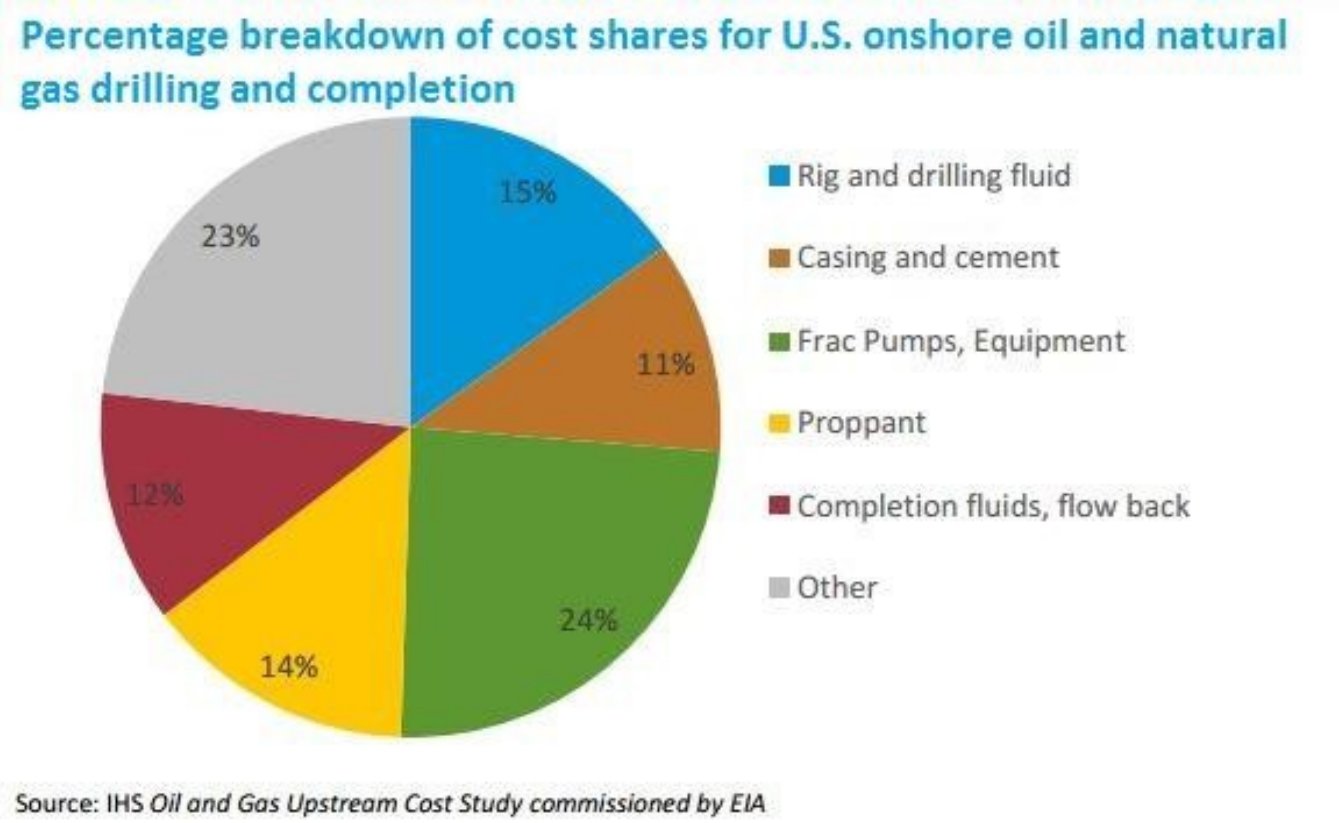
- Capital expenditure (initial investment)
- Operating expenditure (ongoing cost of operations)
- Transportation (getting the product to market)
- Taxes (operating taxes and profit tax)
- CAPEX, OPEX, Transport and Tax

Capital Expenditure - CAPEX

Key parameters

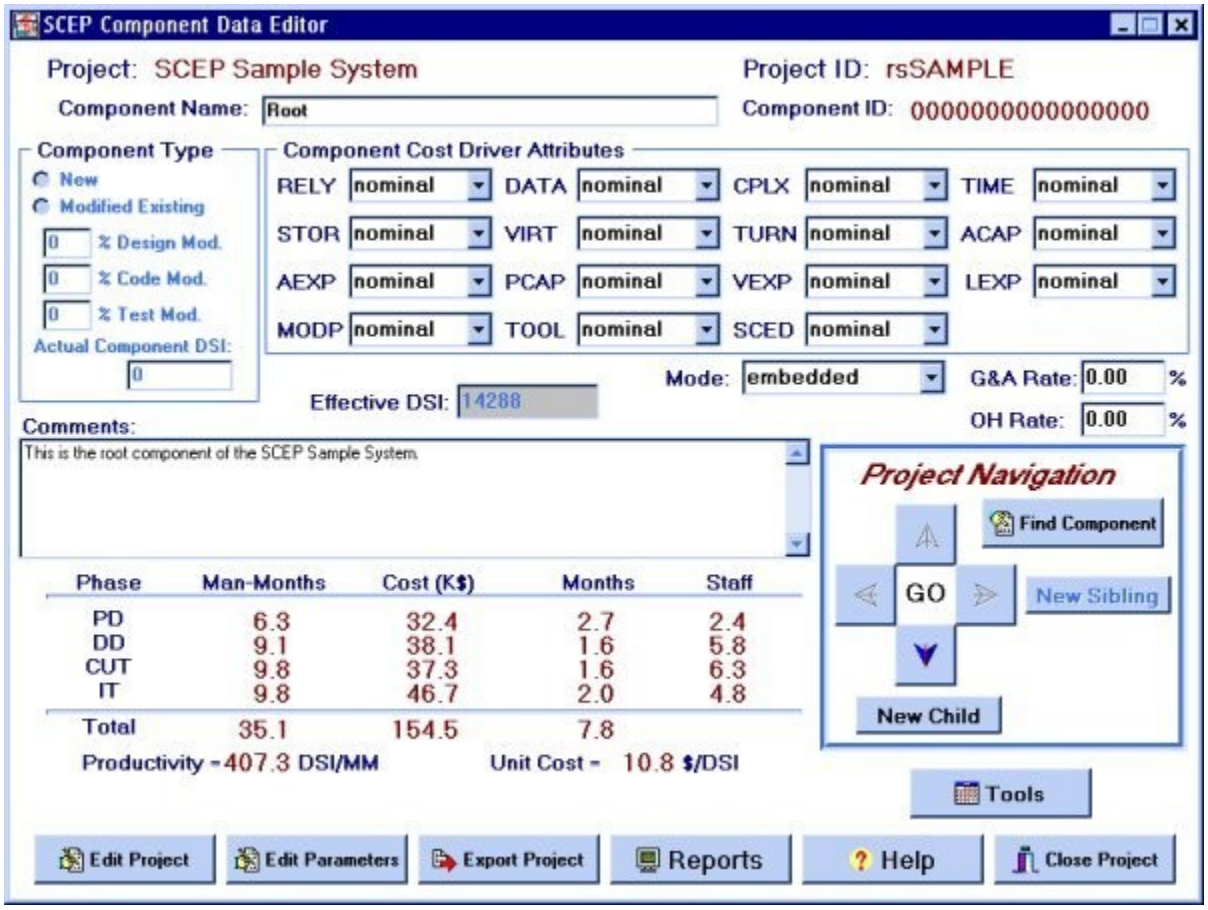
- Size of field
- Difficulty of geology
- Location of field
- Quality of oil/gas
- Competition for contractors / availability of local companies

Breakdown of costs for US onshore fields



- Different contractors for each element, can costs will vary by region and level of competition

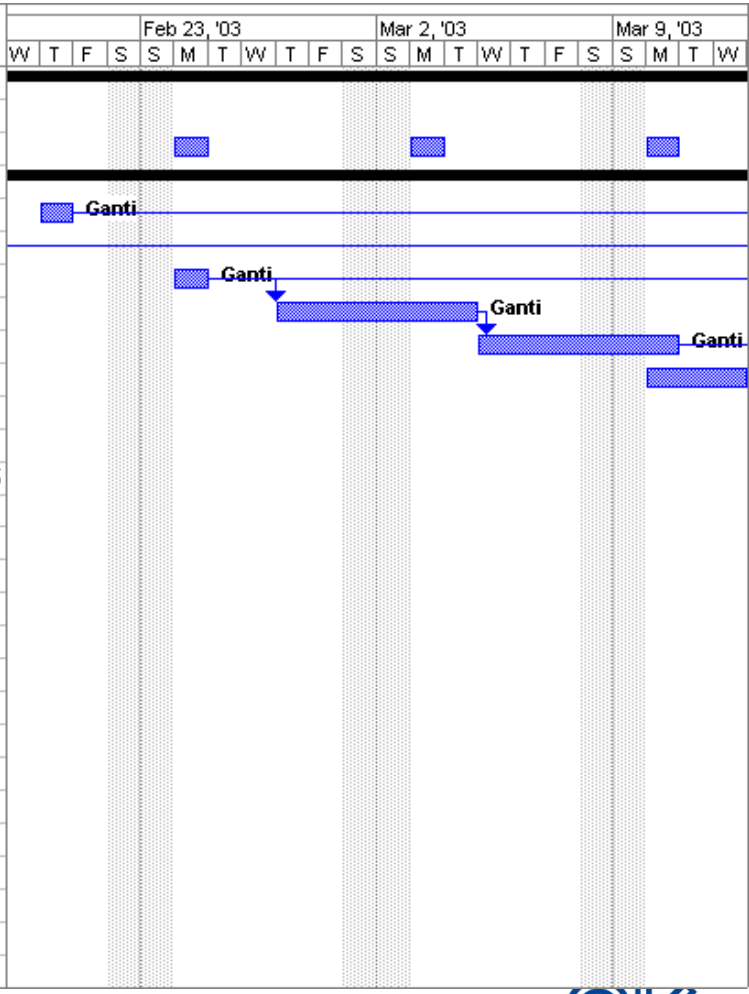
Complex models are used by engineers



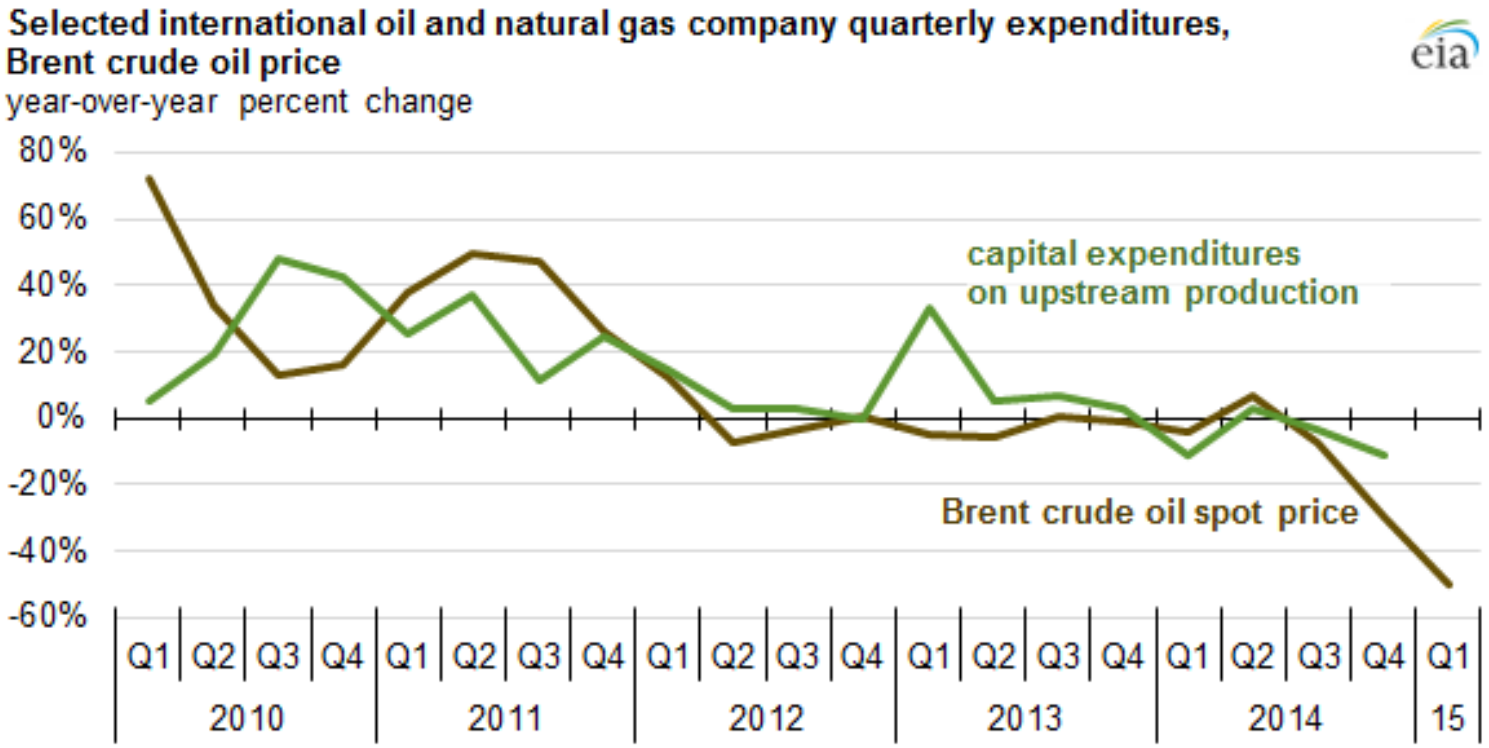
- Cost estimates based on historical precedent and prices of key inputs today
- Steel price a key input, for example

Timing and planning is vital, with any slippage being potentially very expensive

ID	Task Name	Duration	Start	Finish	Predecessors
1	**MSE PROJECT**	**329 days?**	**Mon 1/20/03**	**Thu 4/22/04**	
2	Background Reading & Research	12 days?	Mon 1/20/03	Tue 2/4/03	
3	**Timelog Update**	**321 days**	**Mon 1/27/03**	**Mon 4/19/04**	
69	**Phase 1: Overview & Requirements**	**239 days?**	**Tue 2/11/03**	**Fri 1/9/04**	**2**
70	Project Overview Document	1 day	Thu 2/20/03	Thu 2/20/03	
71	Initial Program Analysis	4 days	Tue 2/11/03	Fri 2/14/03	
72	Initial Object Model	1 day?	Mon 2/24/03	Mon 2/24/03	
73	Software Requirement Specification	4 days	Thu 2/27/03	Tue 3/4/03	72
74	Software Quality Assurance Plan	4 days	Wed 3/5/03	Mon 3/10/03	73
75	Cost Estimation	4 days	Mon 3/10/03	Thu 3/13/03	
76	Architecture Elaboration Plan	1 day?	Mon 12/15/03	Mon 12/15/03	
77	Demonstration	3 days	Tue 12/16/03	Thu 12/18/03	72
78	Presentation 1	1 day?	Fri 1/9/04	Fri 1/9/04	70,71,74,75,76,7
79	Phase 1 Complete	0 days	Fri 1/9/04	Fri 1/9/04	78
80	**Phase 2: Design and Specifications**	**21 days**	**Mon 1/12/04**	**Mon 2/9/04**	**79**
81	Implementation Plan	4 days	Mon 1/12/04	Thu 1/15/04	
82	Architecture Design	5 days	Tue 1/13/04	Mon 1/19/04	
83	Test Plan	6 days	Mon 1/19/04	Mon 1/26/04	
84	Formal Requirement Specification	6 days	Mon 1/26/04	Mon 2/2/04	
85	Design Documentation	4 days	Tue 2/3/04	Fri 2/6/04	
86	Presentation 2	1 day	Mon 2/9/04	Mon 2/9/04	81,82,83,84,85
87	Phase 2 Complete	0 days	Mon 2/9/04	Mon 2/9/04	86
88	**Phase 3: Implementation**	**28 days?**	**Tue 3/16/04**	**Thu 4/22/04**	**87**
89	Implementing the project	10 days	Tue 3/16/04	Mon 3/29/04	
90	Testing	7 days	Tue 3/30/04	Wed 4/7/04	89
91	Documentation	10 days	Thu 4/8/04	Wed 4/21/04	87,89,90
92	Final Presentation	1 day?	Thu 4/22/04	Thu 4/22/04	91
93	Phase 3 Complete	0 days	Thu 4/22/04	Thu 4/22/04	92



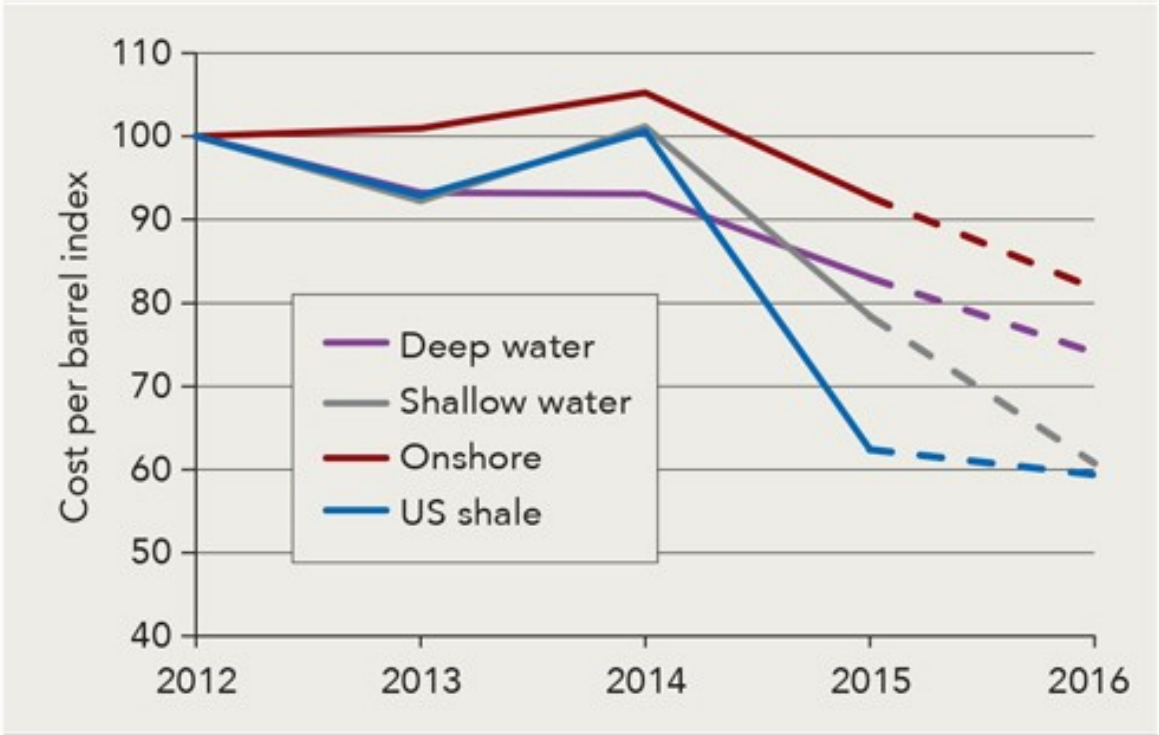
Spending trends tend to move with the oil price



- As prices and revenues rise, so companies are keen to spend more and contractors are able to charge more
- The oil industry is renowned for not being very cost efficient

Recent low prices have forced a re-think on costs

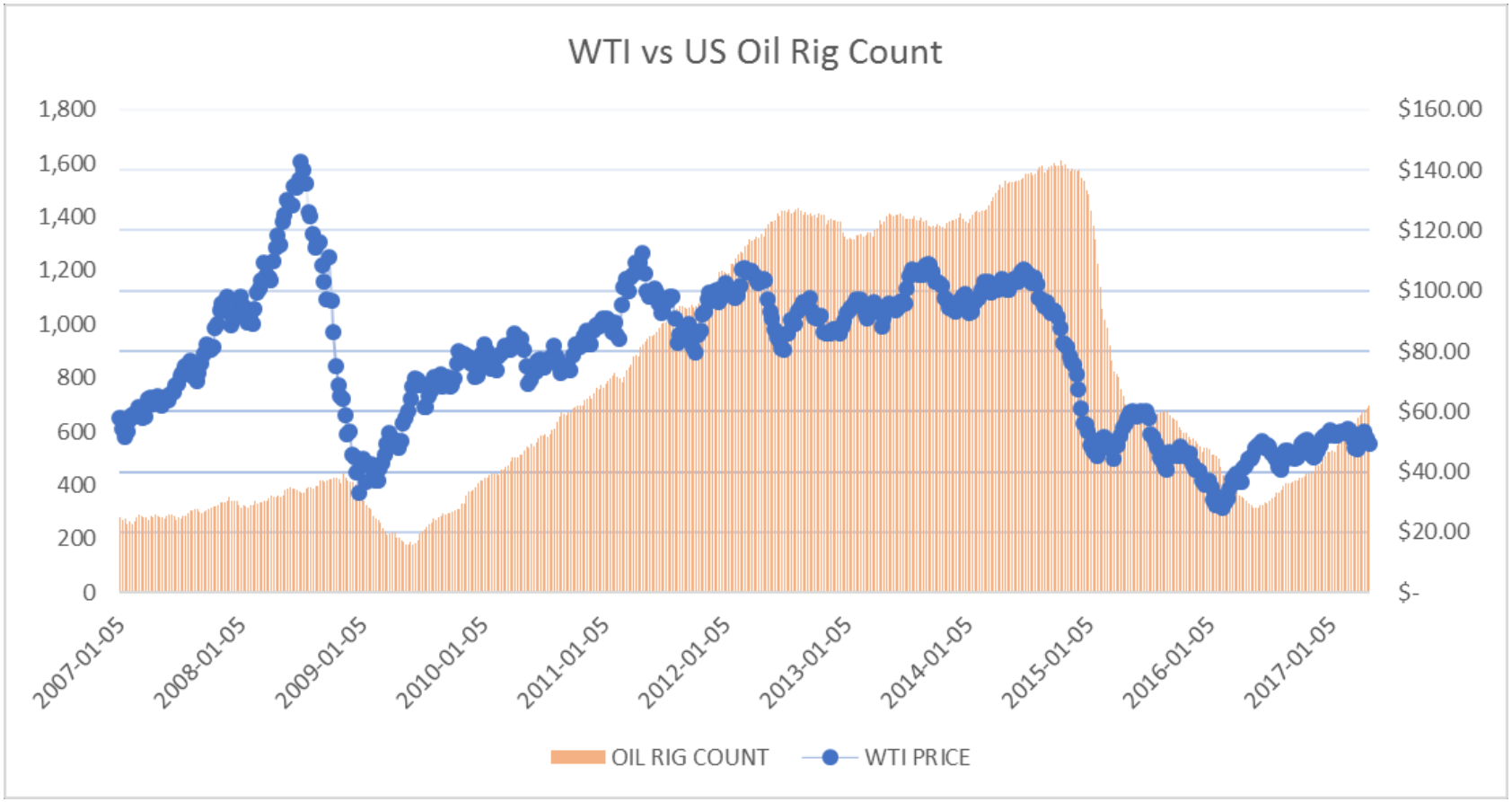
F2: GLOBAL AVERAGE DEVELOPMENT COST PER BARREL INDEX



Source: DW250 – Capital Cost Briefing

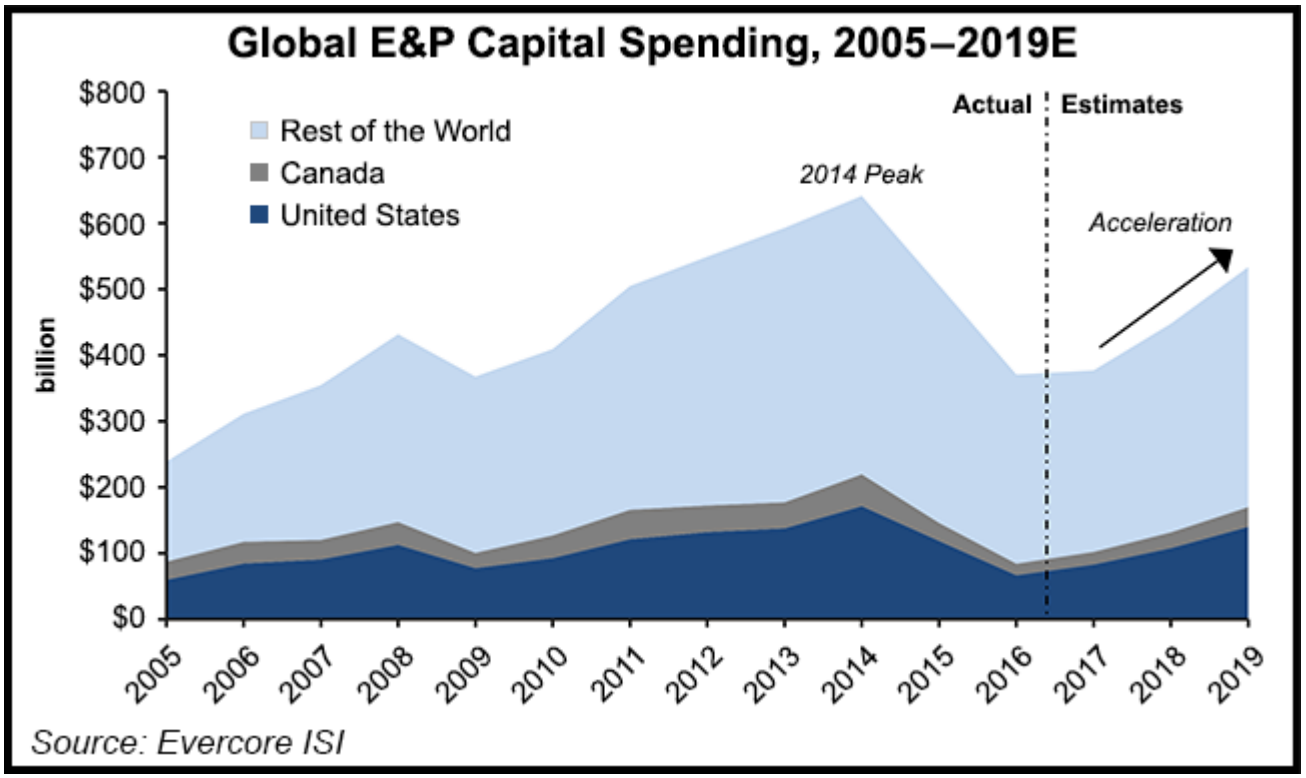
- Upstream costs have been brought down by 30-40% in many countries
- Breakeven oil price for planning purposes now generally $50 per barrel

Availability of equipment also a key driver



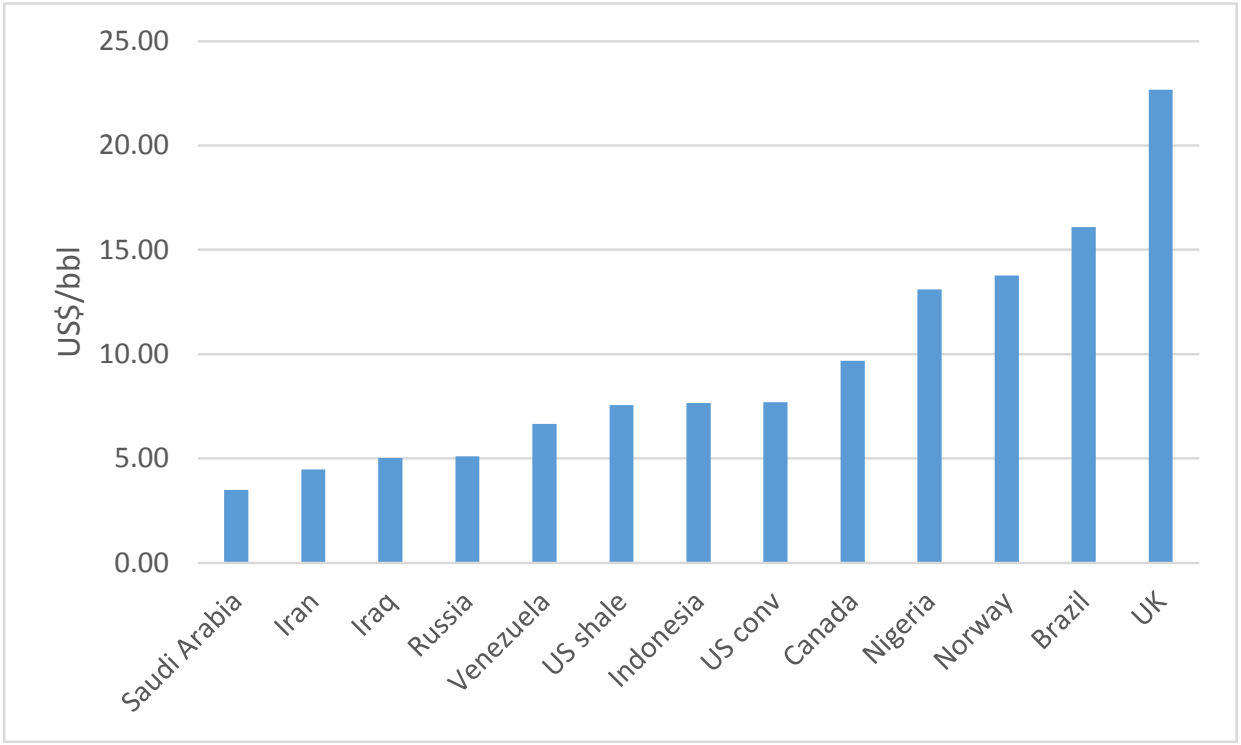
- Competition for equipment drives prices up
- US shale rig count a key indicator
- Australian LNG project cost inflation in 2011-2015

The rebound in oil price has encouraged more spending



- Are we heading for another boon – bust cycle?
- Can the oil industry control costs as oil prices rise?

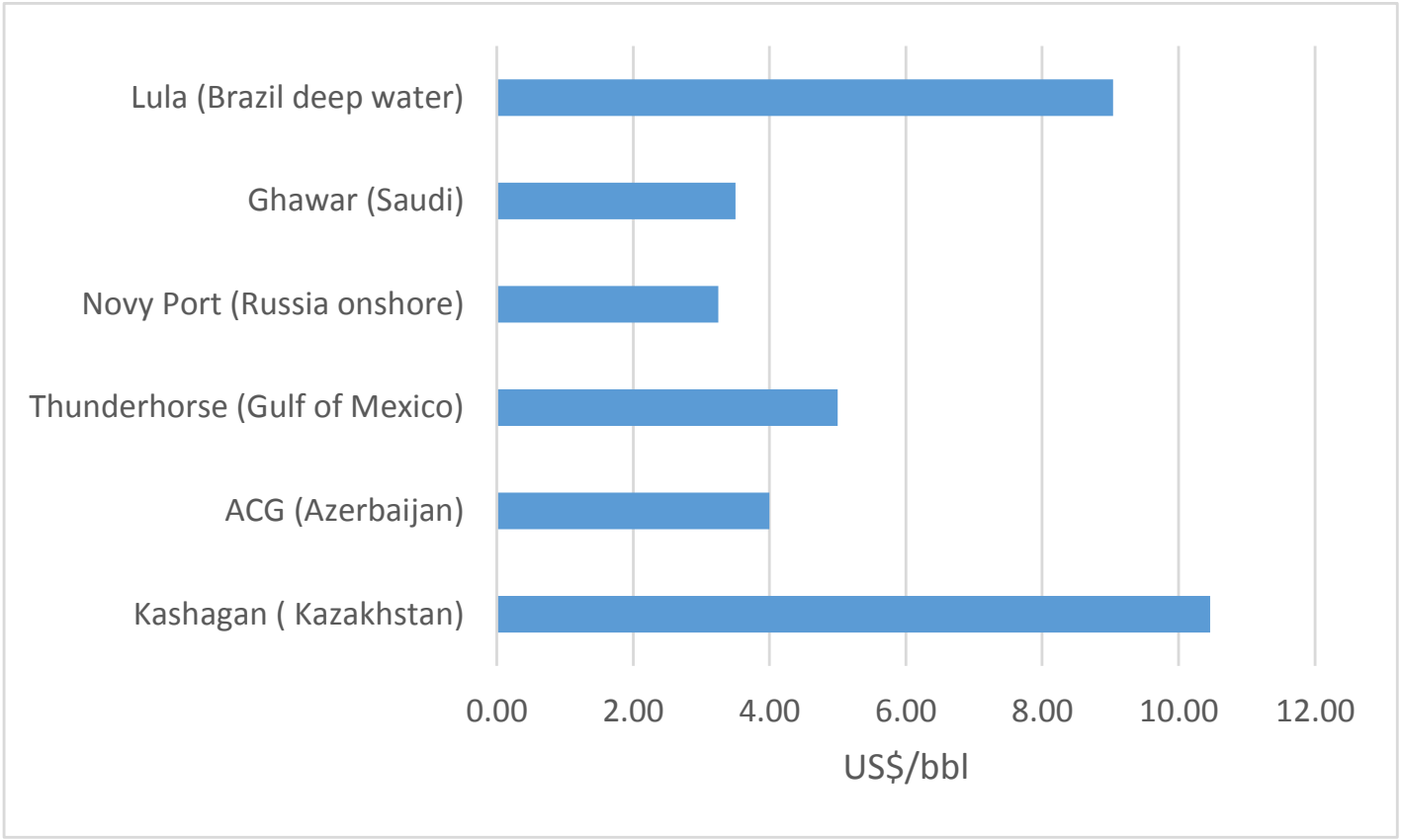
Comparison of capex by countries



Source: Rystad Energy

- Low investment costs in Middle East thanks to huge reserves and easy conditions
- Highest costs offshore, especially in deep water

Comparison of field capex



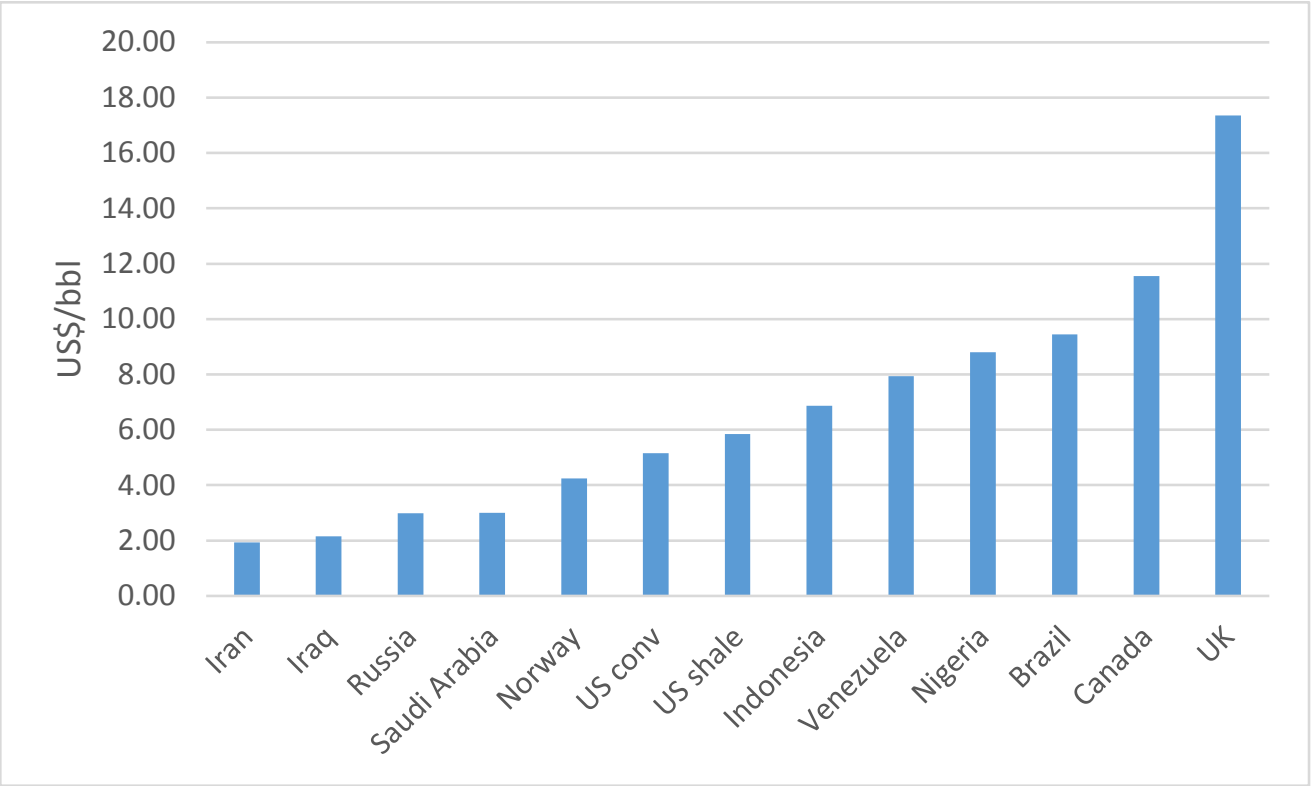
- Specific fields exemplify the country trends
- Offshore fields are more expensive (Lula), as are those with complex geology (Kashagan)
- Onshore conventional fields (Ghawar, Novy Port) are lower cost

Operating Costs

Key Assumptions

- Lifting costs – getting the oil out of the ground
  - Electricity
  - Rig costs
  - Employment costs
- Transportation – moving the oil to market
  - Pipeline distance and tariffs
  - Shipping costs and distance
  - Truck or rail freight
- Operating taxes
  - Royalties
  - Export tax
  - Production sharing agreement
  - Other local taxes

Lifting Costs



- Generally calculated by local experts with knowledge of specific environment
- If a general assumption is needed, then company or country metrics can be used

Contrasting operating costs

North Sea

- Tough environment
- Remote location
- Relatively small reserves
- Higher costs per barrel

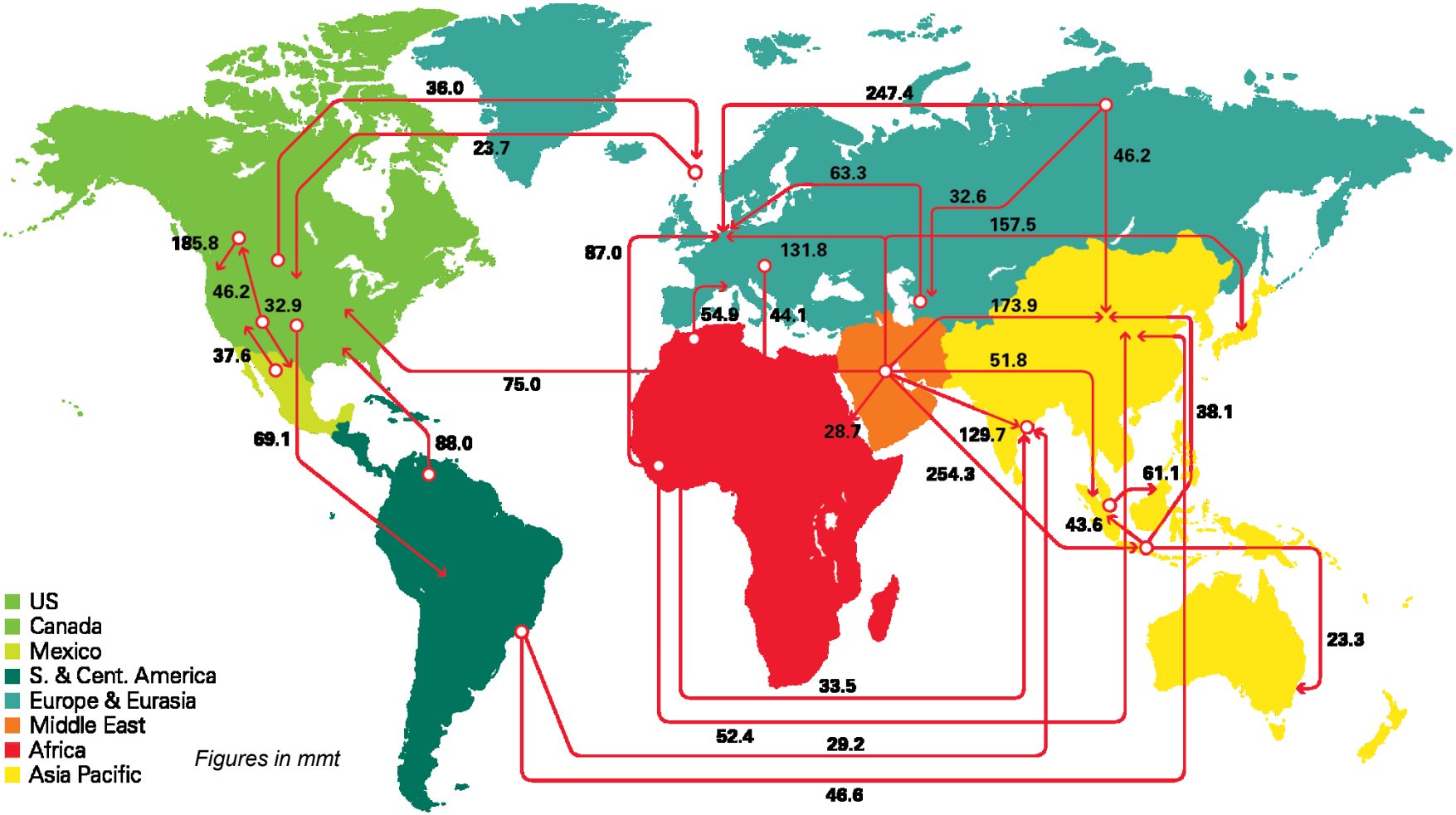
Saudi Arabia

- Huge reserves located in close proximity
- Potential for large synergy benefits
- Relatively benign operating environment
- Low costs per barrel

Long Run and Short Run Costs

- Long Run Marginal Cost = total cost of oil extraction over life of field
- Short run Marginal Cost = cash cost of extracting a barrel of oil today
- LRMC of conventional oil (especially offshore) is high because of significant upfront capital costs
- However, SRMC is low because once costs have been incurred companies will extract oil as long as they can cover operating costs
- For unconventional (shale) oil LRMC is low because capital costs are low
- However, the bulk of costs are on-going operating costs (continuous drilling of new wells) so SRMC is high
- Shale oil more likely to react to low oil prices – faster reaction time and higher short-run costs

Oil is a global commodity

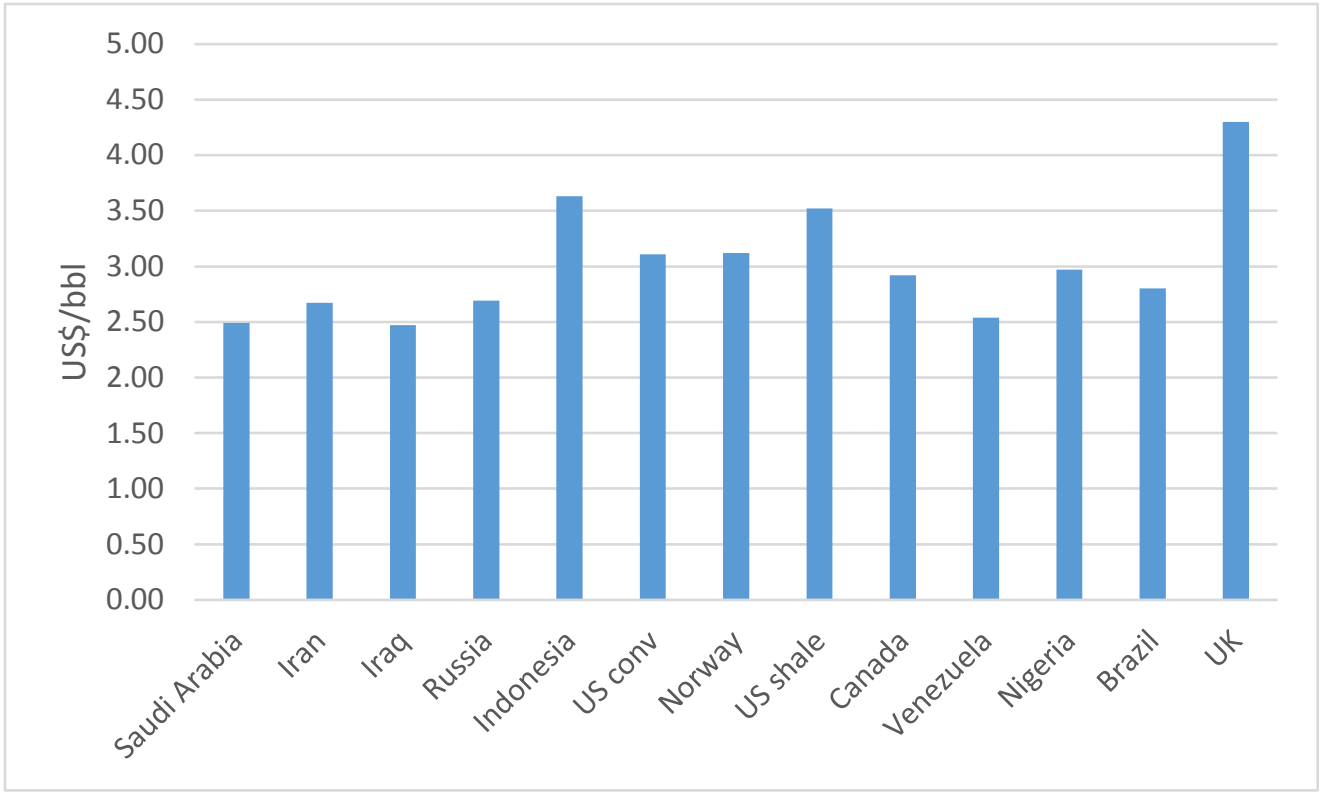


- Oil is traded in multiple directions across the globe
- Much of the trade originates from the Middle East and flows West and East
- Prices are set relative to a set of global benchmarks

Russia’s huge pipeline system

Oil tanker and the Panama Canal

Transportation Cost

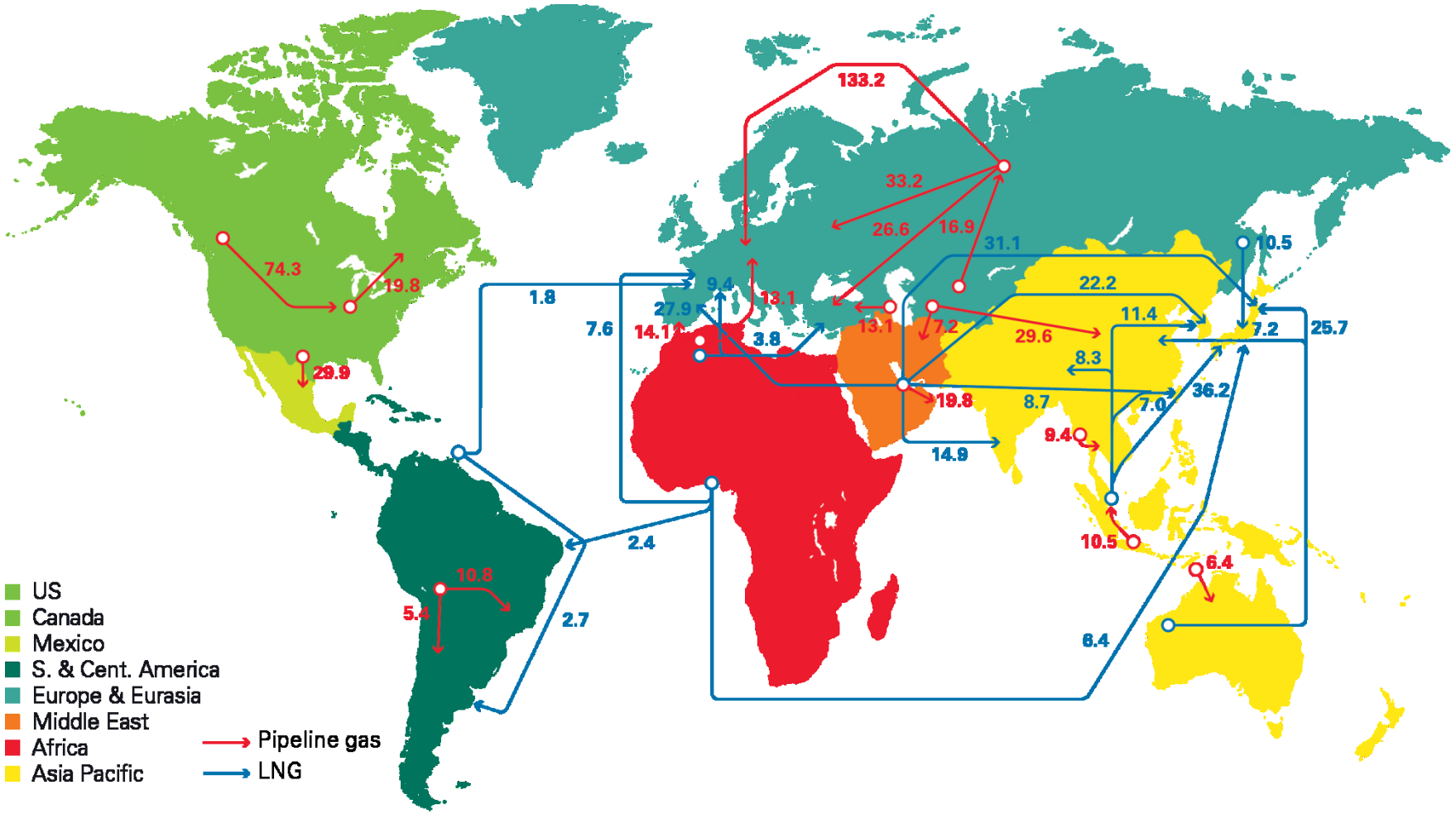


- Main driver of cost is distance
- Mode of transport also important – onshore pipelines versus offshore tankers
- Most expensive is rail or truck transport, due to lower individual volumes

Gas transportation can get complex

- Gas is also transported by pipeline and ship
- Pipelines have dominated, but LNG is globalising the gas market
- Liquefaction and regasification then become an integral part of the value chain
- Costs are increased, but new markets can be accessed
- From a modelling perspective, LNG plants are included in capex, while shipping and regas costs are generally included in transport
- Shipping tariffs are based on journey time (days) multiplied by freight rates, which can vary significantly over time

Gas trade flows (bcm)

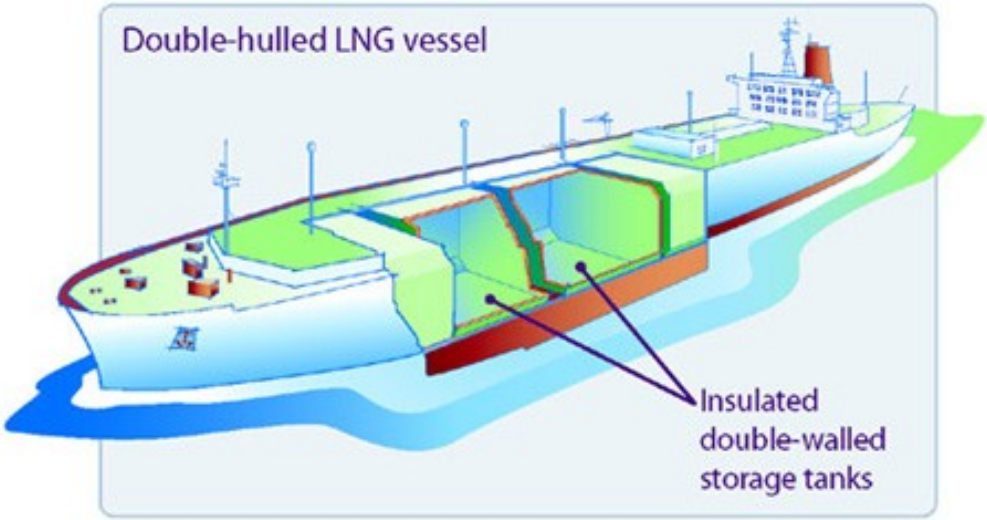


- Gas trade flows via two transport methods – pipeline and LNG
- Historically pipeline flows have dominated, leading to regionalisation
- LNG is now turning gas into a more global commodity

Long Distance Pipeline

Yemen Liquefaction Facility

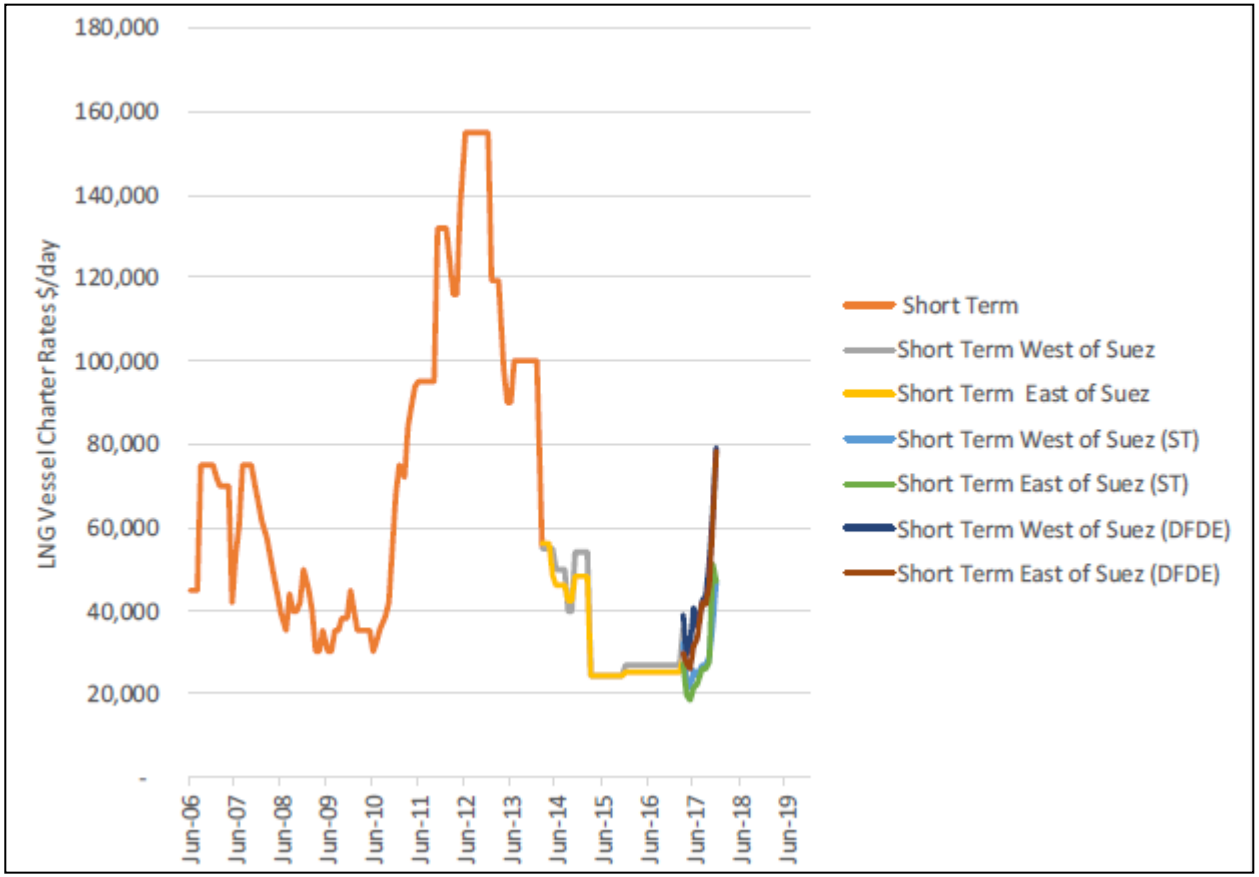
LNG Tankers


Double-hulled LNG vessel
Insulated
double-walled
storage tanks


WILENERGY


GOLAR MAZO
L N G

LNG tanker freight rates



- Significant volatility driven by LNG demand and ship-building investment

LNG Import and Regas Terminal Jurong Island, Singapore

Taxation

Tax and Royalty Regime

- The most common tax regime includes operating taxes and profit tax
- Operating taxes are normally taken from revenues
  - Export tax (on export revenues only)
  - Royalty (on all production)
  - Specific local or regional taxes (for regional government support)
- Revenue taxes are simple to collect, but can be penal because they do not take investment costs into account
- Sometimes governments alleviate the risks of revenue taxes by introducing a sliding scale relative to the oil price

Types of taxes

- Export Tax
  - Normally a % of export revenues
  - Occasionally banded by oil price ranges
  - Focus tax on premium market and prices
- Royalty
  - Ensures that government gets a minimum amount of revenue
  - Can be a % of overall revenues or a fixed amount per barrel of production
  - Very regressive, as takes no account of cost recovery, but very easy to collect to favoured in countries with dubious accounting regulation
- Regional taxes
  - Levied by local governments to support regional infrastructure
  - Often used to fund schools, hospitals etc.
  - Can be open to significant negotiation
- Corporate Tax (Profit Tax)
  - Levied after all costs have been taken into consideration (including other taxes)
  - Often a complex calculation, but does allow for reclaiming of expenses

The Key is Cost Recovery

- Can you get your money back before you start paying higher taxes
- The sooner you recover your money the better for your project economics
- Revenue taxes do not allow for cost recovery
- Depreciation offers some element of cost recovery in a tax and royalty scheme
- Another term for it is “cost oil”, which is used in Production Sharing Agreements (PSAs)

Depreciation

- Depreciation is an allowance against profit tax
- An accounting calculation to reduce “pre-tax profits”
- Has no cash impact
- Reduces corporation (profit) tax and effectively allows cashflow to the company to be increased
- Encourages a faster recovery of costs, although not perfect
- PSA Cost oil has the same impact, and is a subject of fierce negotiation

Production Sharing Agreements

- Specific tax and legal regimes for individual projects
- Negotiated with government before first investment is made
- Legally guaranteed for the life of a project (although this is not always the case)
- Normally based on a split of **cost oil** and **profit oil**, although can also include a royalty payment
- Cost oil allows the company a larger share of revenues until costs are recovered
- Profit oil is the split of revenues after costs have been taken into account – it tends to increase in importance once costs have been recovered
- Governments sometimes also demand a royalty in order to guarantee a minimum amount of revenue immediately

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