



THE OXFORD
INSTITUTE
FOR ENERGY
STUDIES

A RECOGNIZED INDEPENDENT CENTRE OF THE 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

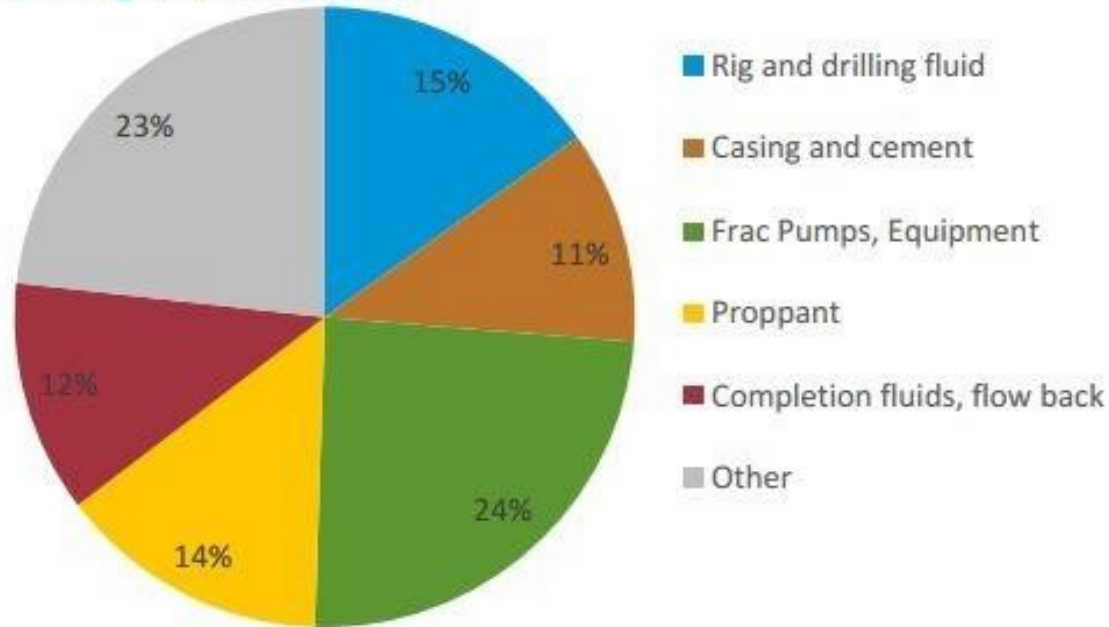
Key parameters

- 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

Percentage breakdown of cost shares for U.S. onshore oil and natural gas drilling and completion



Source: IHS Oil and Gas Upstream Cost Study commissioned by EIA

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



Complex models are used by engineers

Project: SCEP Sample System Project ID: rsSAMPLE
Component Name: Root Component ID: 0000000000000000

Component Type
 New
 Modified Existing
 % Design Mod.
 % Code Mod.
 % Test Mod.
Actual Component DSI:

Component Cost Driver Attributes
RELY nominal DATA nominal CPLX nominal TIME nominal
STOR nominal VIRT nominal TURN nominal ACAP nominal
AEXP nominal PCAP nominal VEXP nominal LEXP nominal
MODP nominal TOOL nominal SCED nominal

Effective DSI: 14288 Mode: embedded G&A Rate: 0.00 %
OH Rate: 0.00 %

Comments:
This is the root component of the SCEP Sample System.

Phase	Man-Months	Cost (K\$)	Months	Staff
PD	6.3	32.4	2.7	2.4
DD	9.1	38.1	1.6	5.8
CUT	9.8	37.3	1.6	6.3
IT	9.8	46.7	2.0	4.8
Total	35.1	154.5	7.8	

Productivity - 407.3 DSI/MM Unit Cost - 10.8 \$/DSI

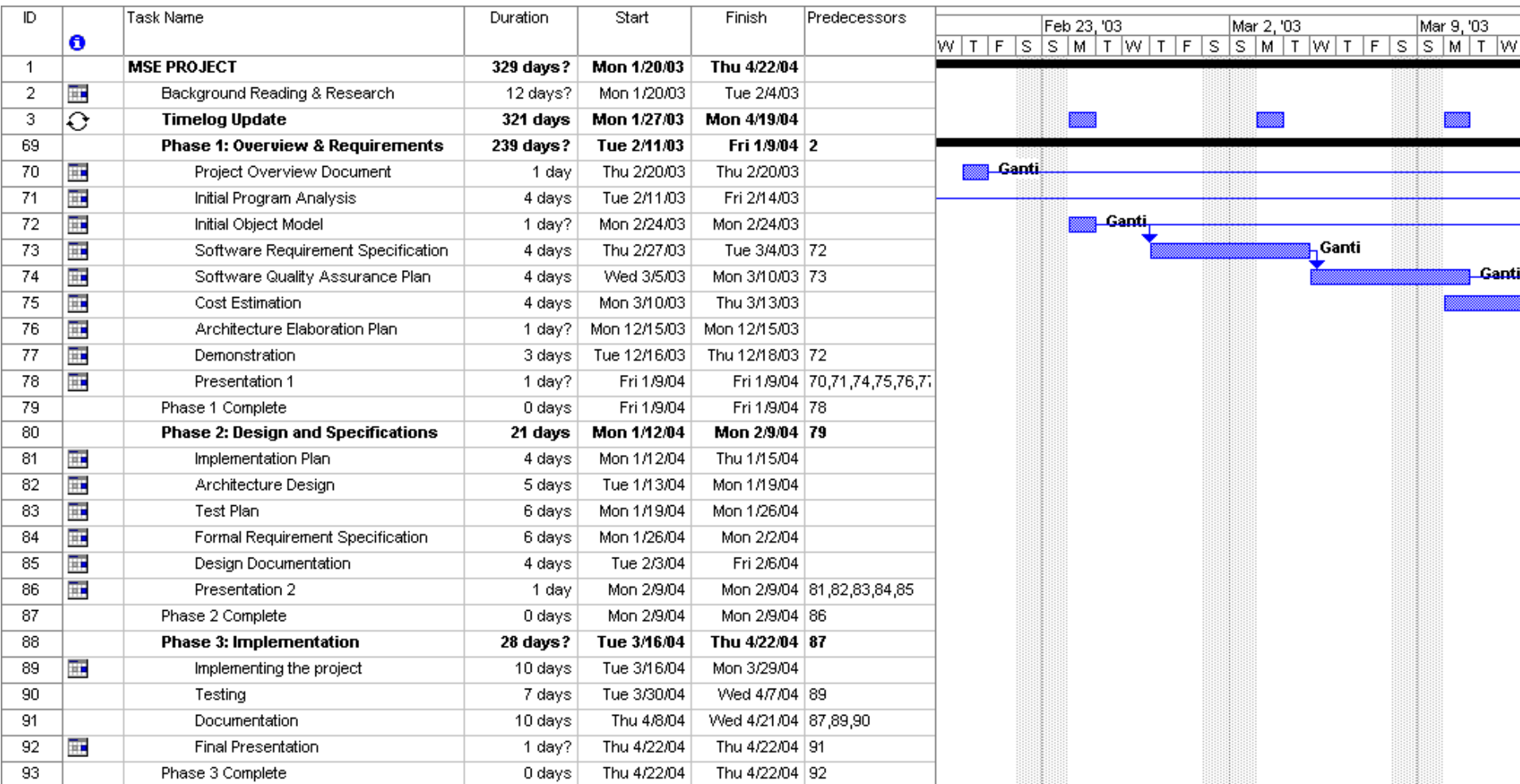
Project Navigation
Find Component
GO
New Sibling
New Child
Tools

Edit Project Edit Parameters Export Project Reports Help Close Project

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

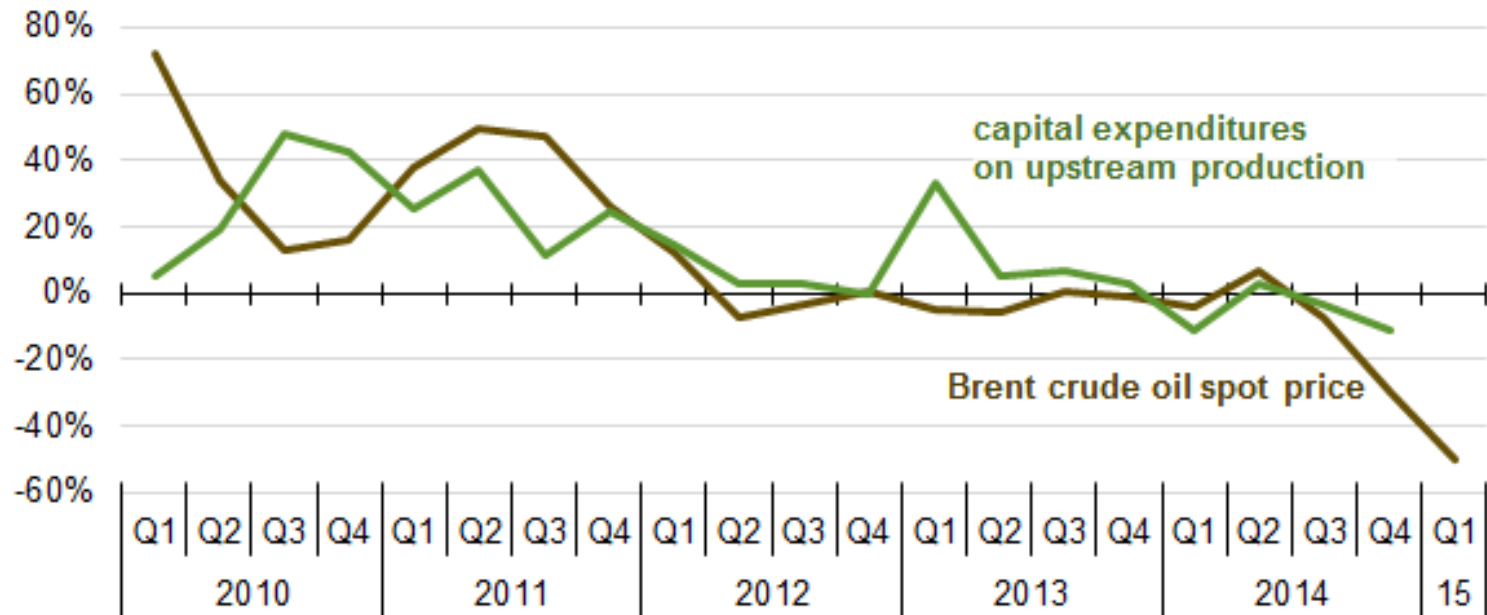


Timing and planning is vital, with any slippage being potentially very expensive



Spending trends tend to move with the oil price

Selected international oil and natural gas company quarterly expenditures,
Brent crude oil price
year-over-year percent change

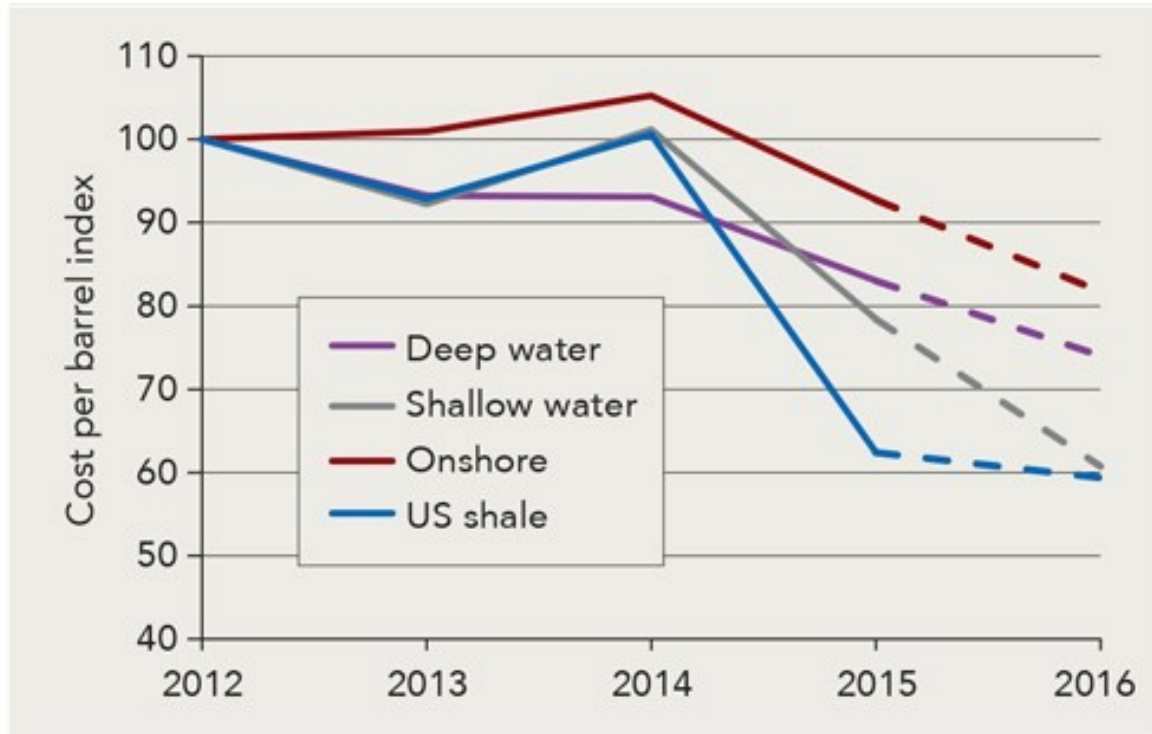


- As prices and revenues rise, so companies are keen to spend more and contractors are able to charge more
- The oil industry is renowned for not being very cost efficient



Recent low prices have forced a re-think on costs

F2: GLOBAL AVERAGE DEVELOPMENT COST PER BARREL INDEX

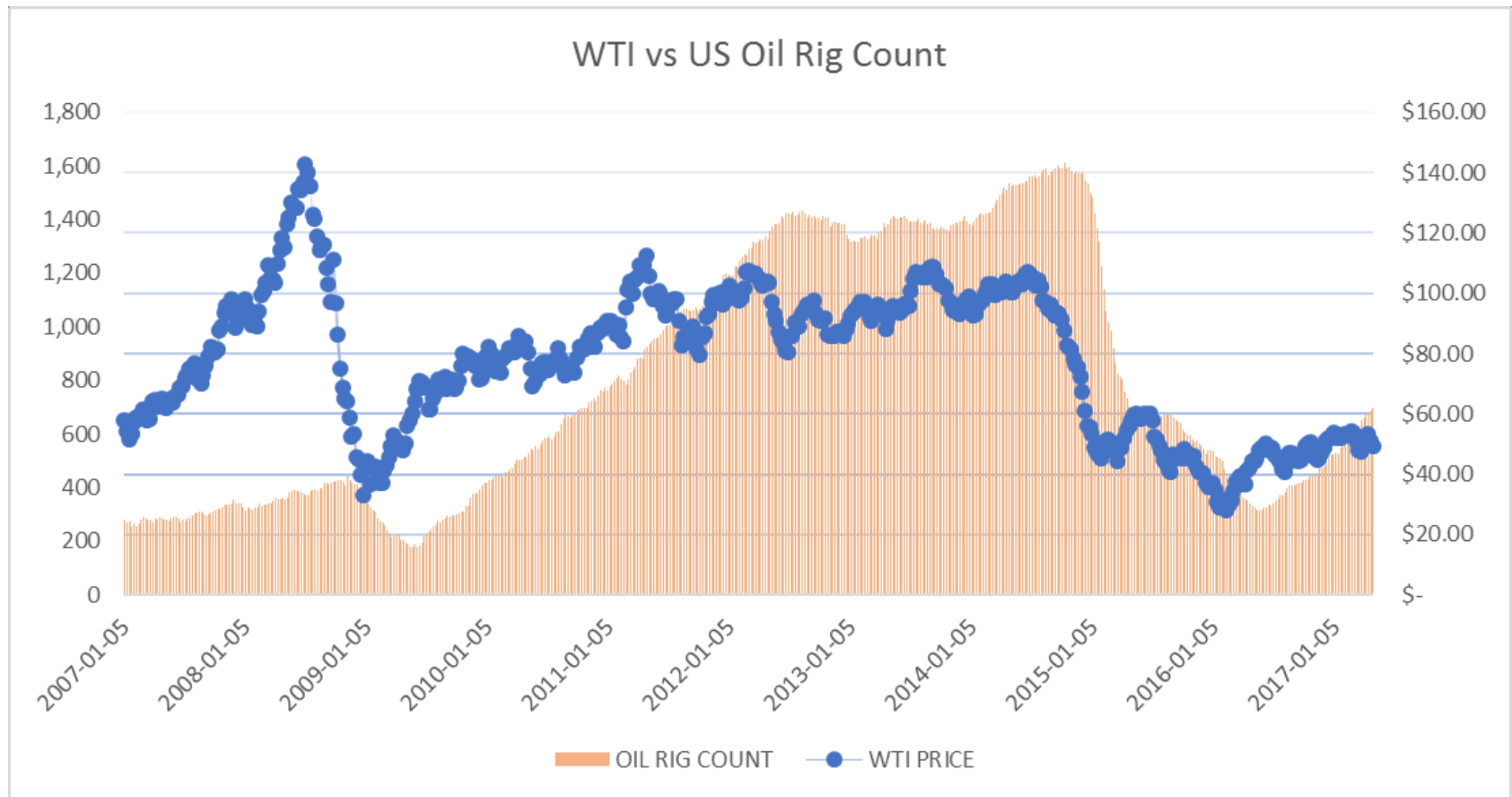


Source: DW250 – Capital Cost Briefing

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



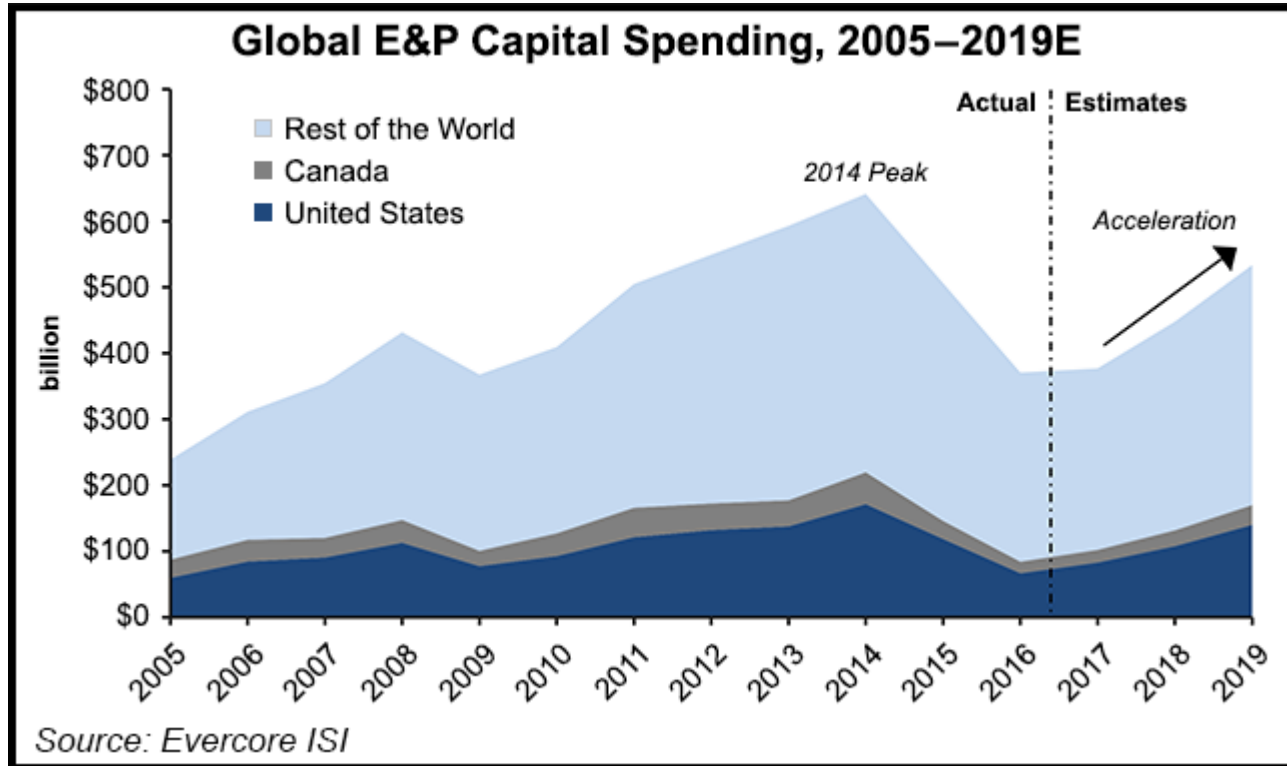
Availability of equipment also a key driver



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



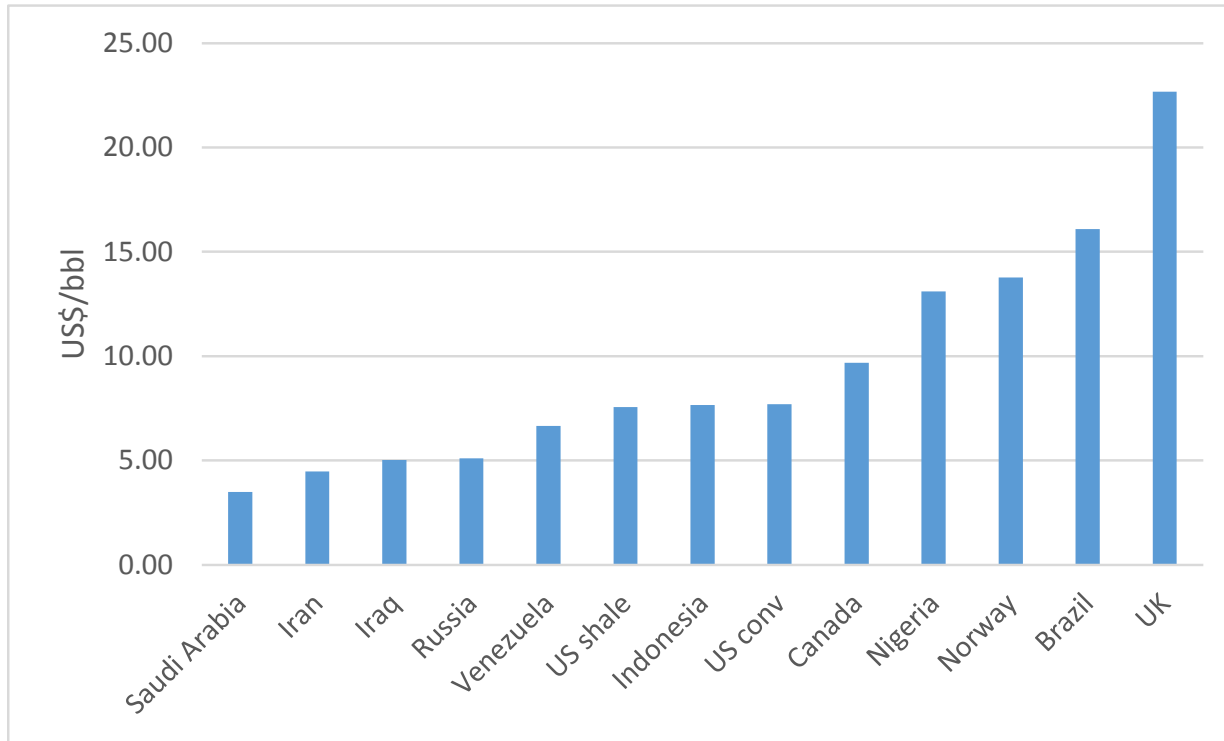
The rebound in oil price has encouraged more spending



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



Comparison of capex by countries

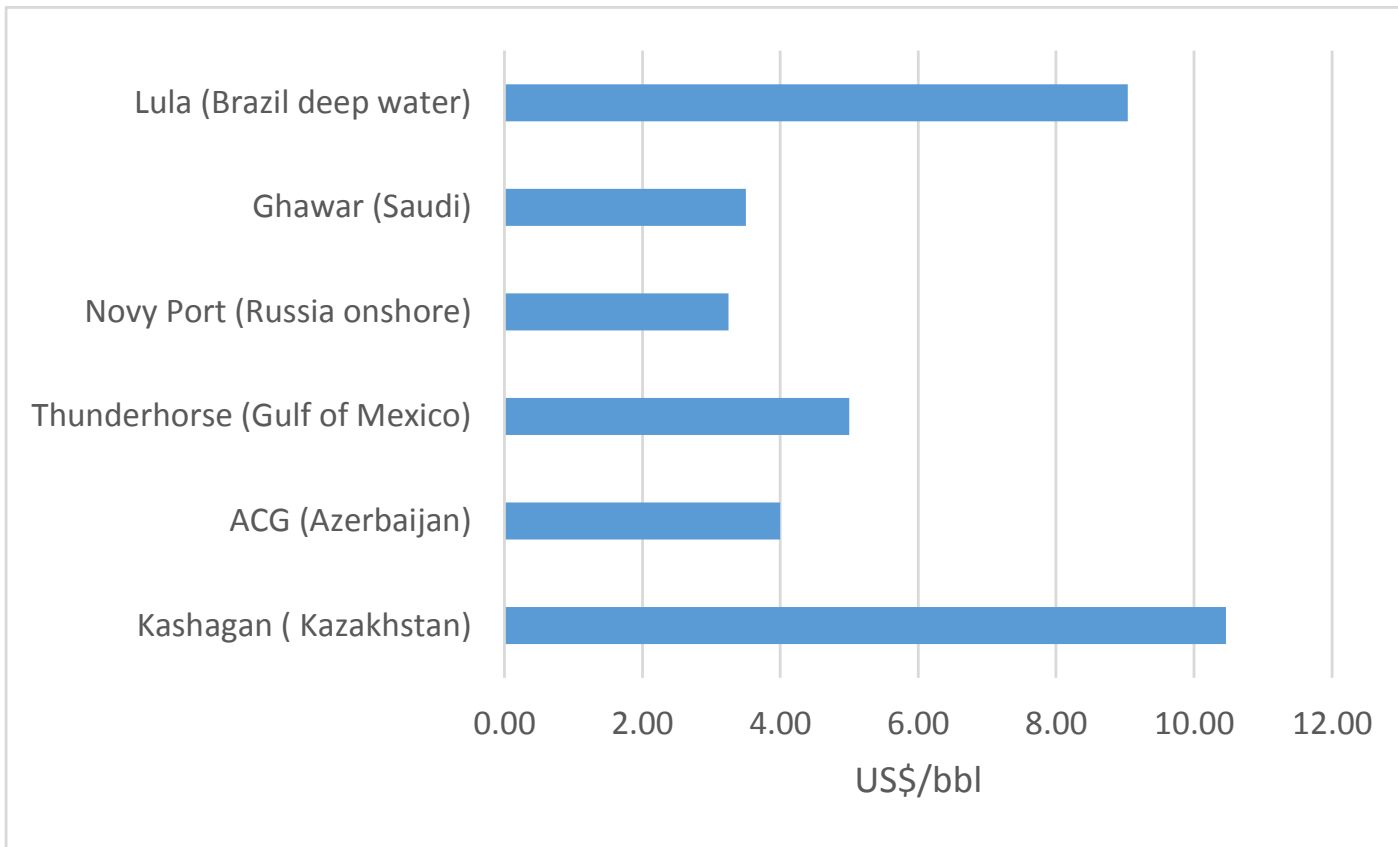


Source: Rystad Energy

- 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



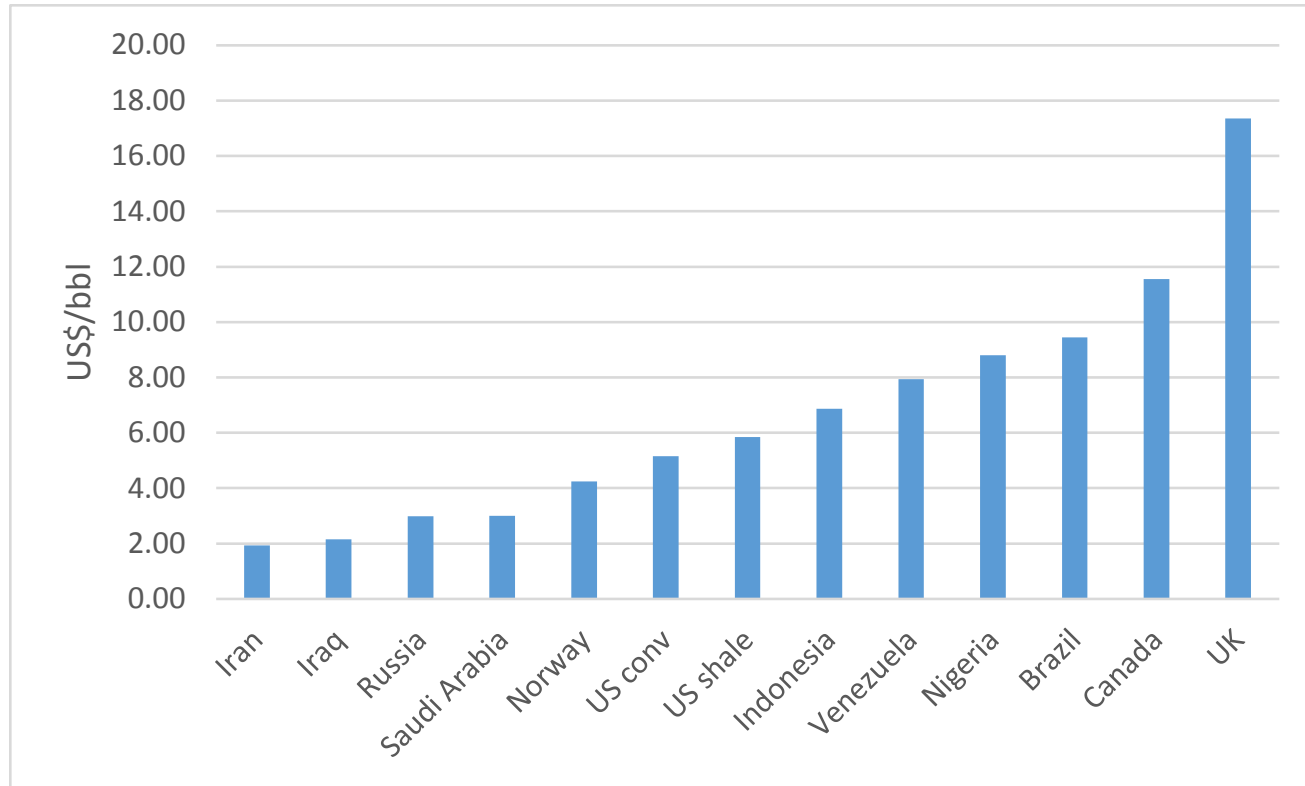
Operating Costs

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

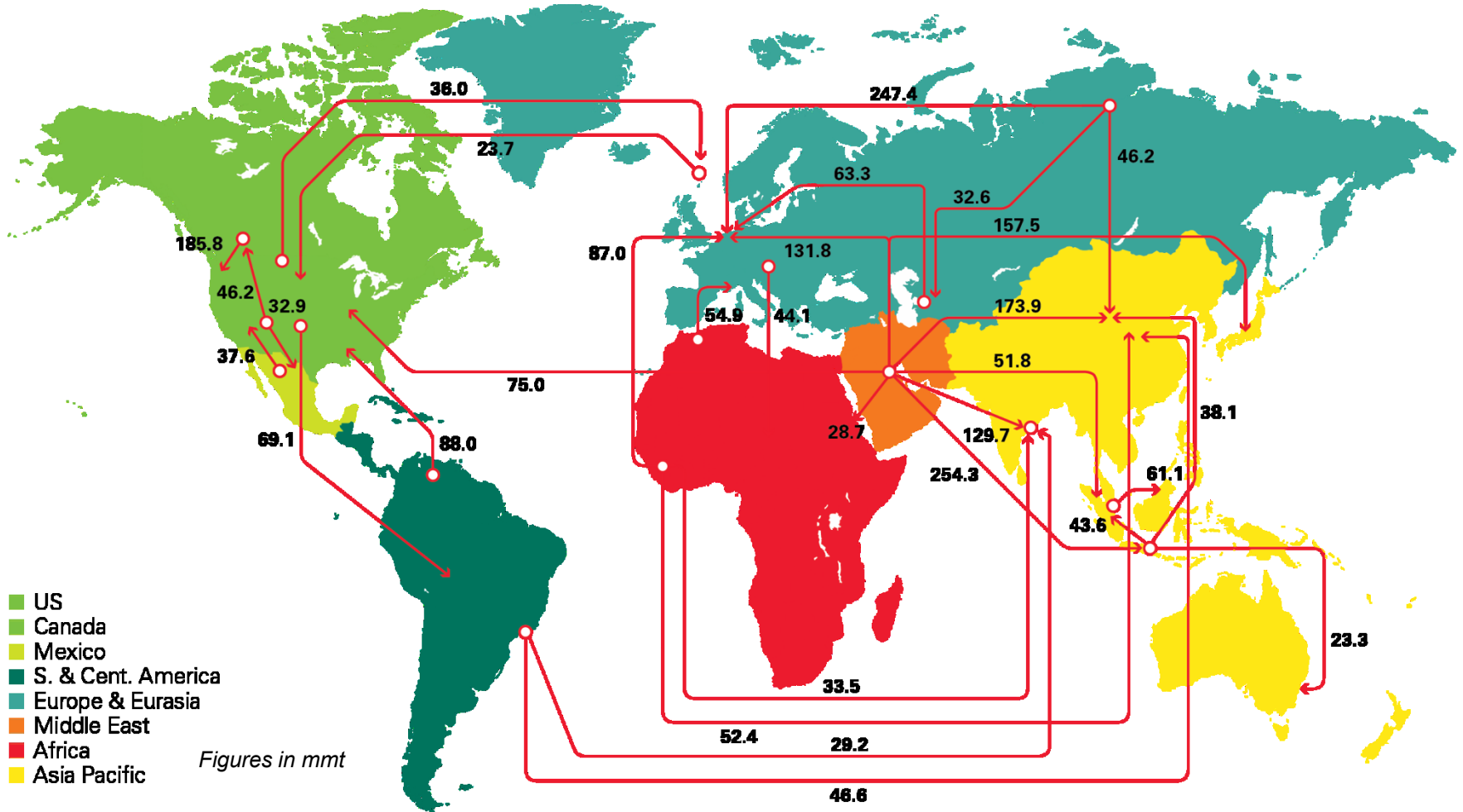


Long Run and Short Run Costs

- 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



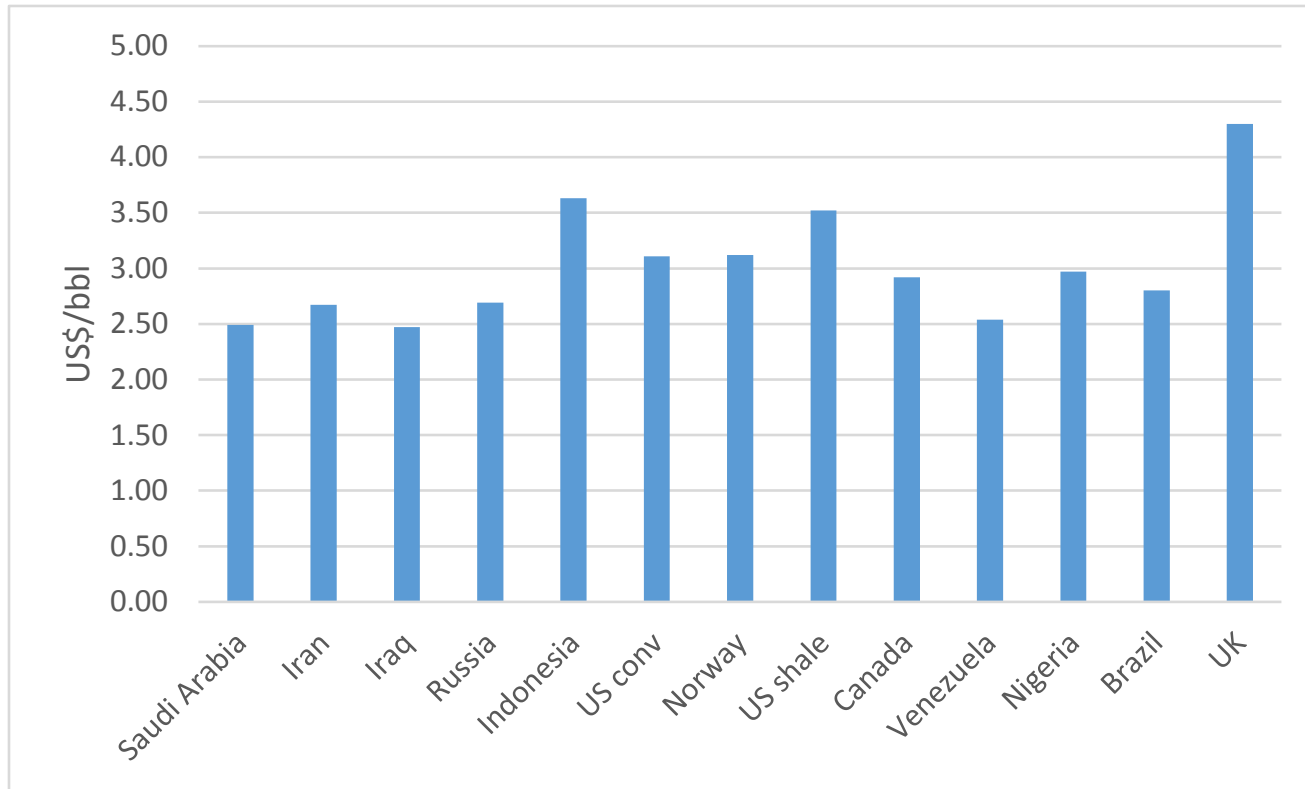
Oil, gas pipelines transiting Ukraine



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





Long Distance Pipeline



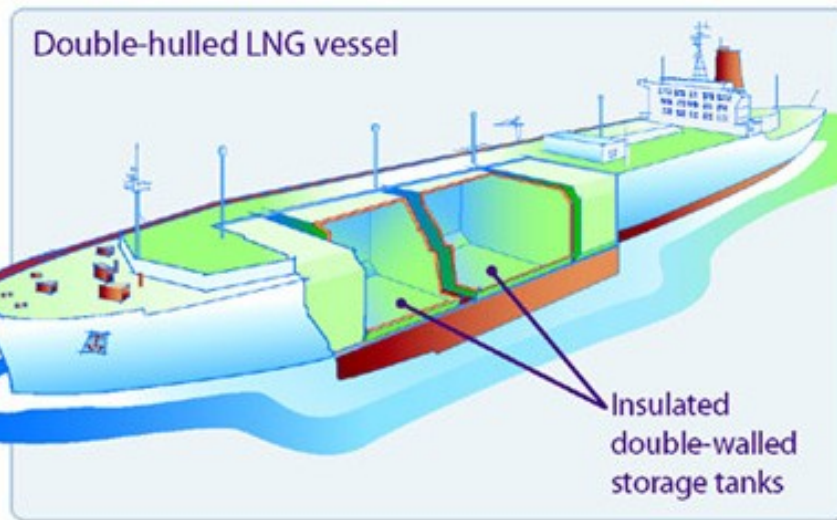


Yemen Liquefaction Facility

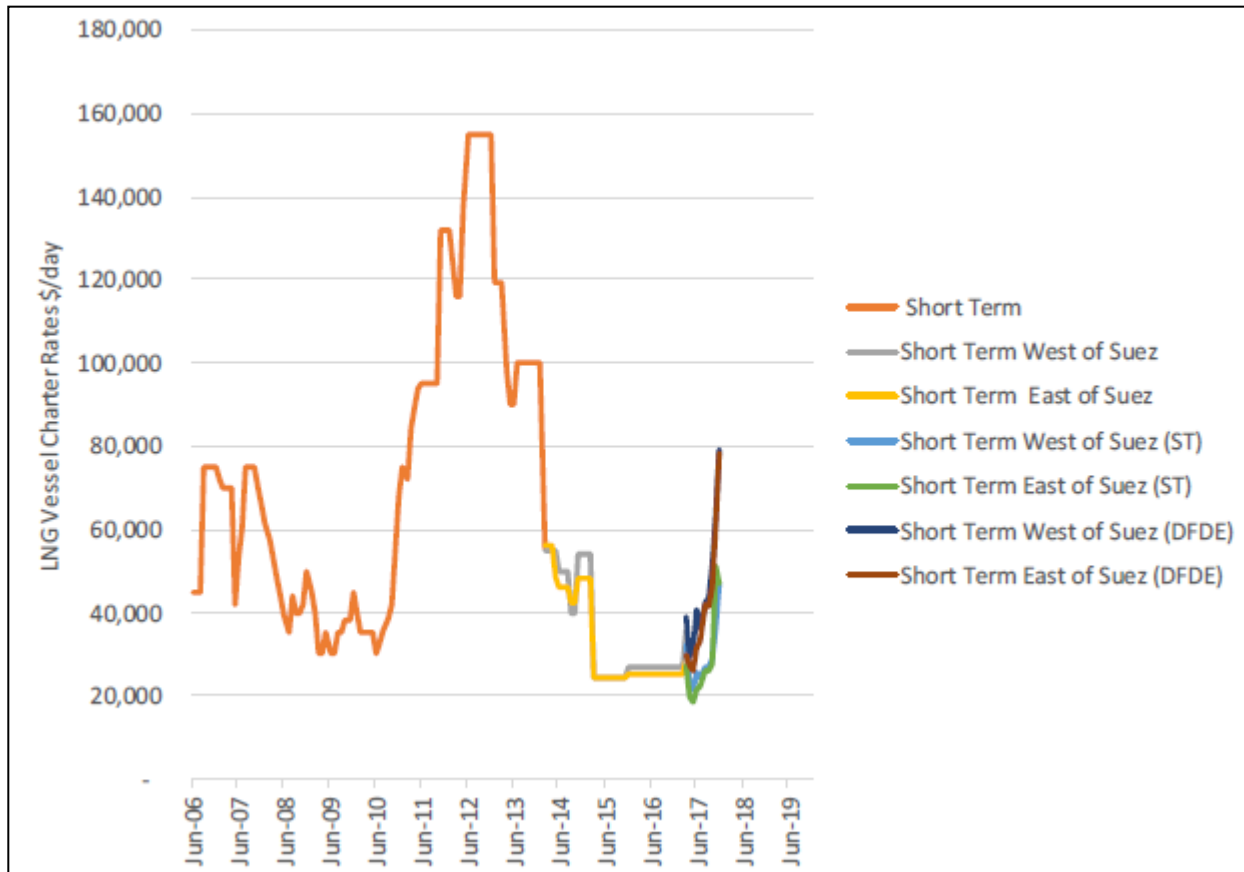




LNG Tankers



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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