

What makes FSRU Projects Economic?



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Why FSRUs?



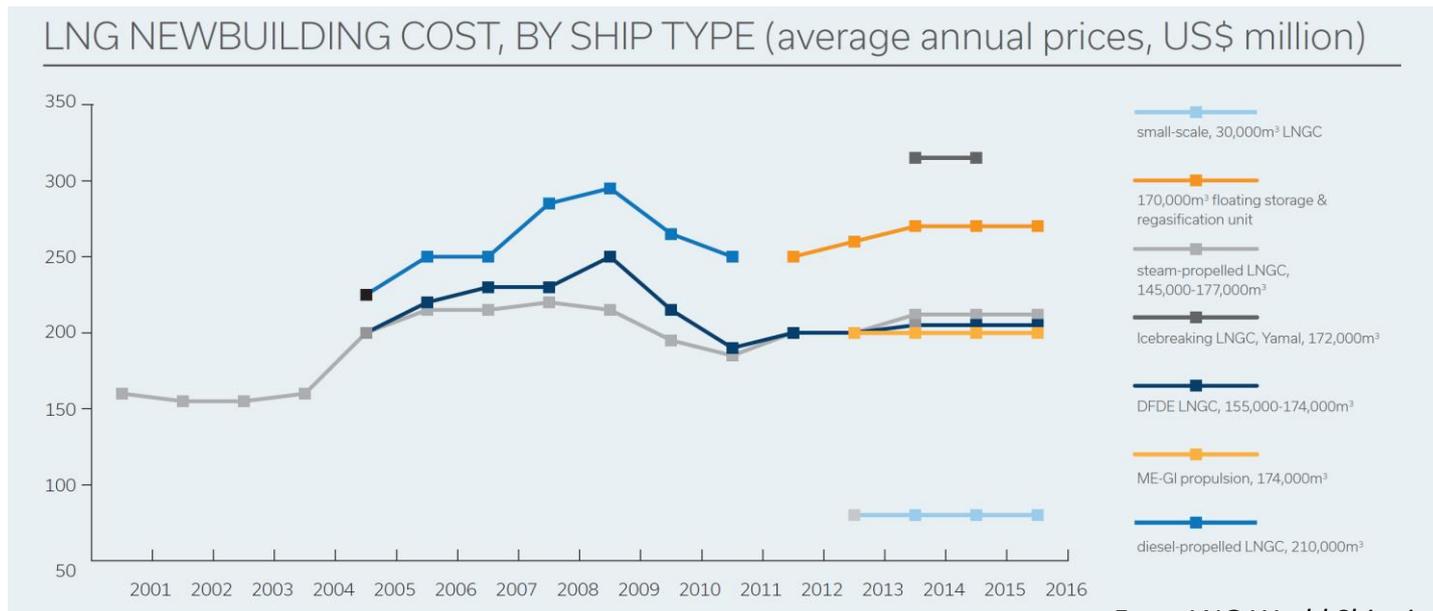
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- Everyone wants LNG!
- Actually people want electricity and gas to power is fastest
- Why FSRUs?
- Perception that they are
 - faster to market
 - cheaper to install
- than conventional onshore terminals



FSRUs cost drivers

- Complex ships
 - Shipbuilding cost model rather than process plant
 - Ship building costs relatively static
 - Known quality and no local content/skills issues
- Easier to finance
 - Relocatable to other projects
 - Can trade if no import terminal work
- Competition
 - 3 usual suspects have become 4
 - Many trying to enter the market



Are FSRUs good or import terminals bad?

Import terminal

- Normal scope
 - Dredging/harbour works
 - Marine facility/jetty
 - LNG storage tanks
 - LNG pumps and vaporisers
 - Fiscal metering
 - Utility systems
 - Pipeline connection to gas user

FSRU does not equal a shipyard unit



FSRU

- Normal scope
 - LNG storage tanks
 - LNG pumps and vaporisers
 - Fiscal metering
 - Utility systems
- Who does?
 - Dredging/harbour works
 - Marine facility/jetty
 - Fiscal metering
 - Pipeline connection to gas user

How much do FSRUs really cost?

- Very location and use specific
- FSRUs are common in developing markets for power generation
- How much gas does power generation need?
 - Now
 - In the future
- Where is the power generation required?
 - Centrally
 - Distributed (by pipe or by wire)



Case study



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- Xanadu has been producing gas for many years but now existing gas production is declining
- Exploration for new reserves is underway but with a 8-10 year lead time to production (if reserves are there)
- Economy growing – more power required for industry (and everyone wants a mobile phone)
- Traditional power sources (hydro) too slow to develop and environmental impact high
- Need soft loans or grants to develop country – coal doesn't attract these
- Poor creditworthiness of government owned utilities
- FSRU looks like just the job!



Host nation issues

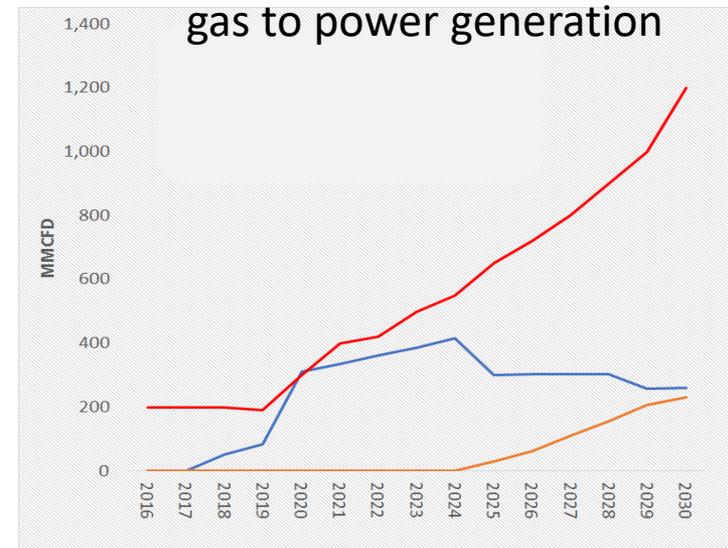


- Creditworthiness
 - They are not – how do they afford permanent LNG?
 - For a FSRU substantial debt is not required - can pay monthly!
- Contract longevity
 - Not sure – FSRUs can be hired for short periods
- Nationalisation
 - May want it but economy more important
- Control
 - Something has to happen now – can give up some control for that
 - But politicians need to be seen to be doing something (schedule) and get re-elected (need benefits)
- Permitting system
 - Offshore oil and gas system can be adapted

Risk



- Is the power generation growth known sufficiently well?
 - 2 GW around the capital
 - 500 MW around the capital and 500 MW in the east
 - 1 GW around the capital, 500 MW in the east and 500 MW in the north
- What is the timescale for operation – now to when?
- Multiple sites and strategies need to be examined



CCGT MW	Gas mmscfd	LNG mtpa
2000	254	1.8
1000	139	0.9
500	76	0.5

What most people want to sell you

The traditional model

- Industry has standardised on FSRU sizes – primarily 173,000 m³ for new builds
- Is this not enough or too much?
- Not a technical question
- FSRU needs to be the same size or preferably larger than the LNGC supplying it
- Where is the LNG coming from?
- Latest LNGCs are 175 – 180,000 m³
- Delivered annual capacity could be very large (3- 5 mtpa)

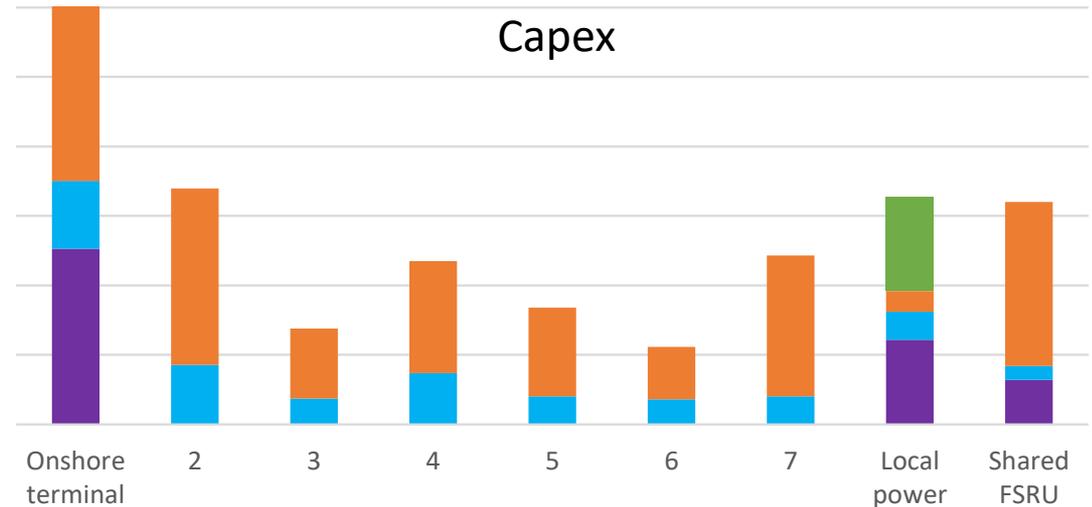


- 173,000 m³ FSRU
- 100 – 1200 mmscfd seawater vaporisers
- 294 m x 46 m x 26.5 m x 12.5 m
- 83,200 dwt
- DFDE engine capable of 18 knots

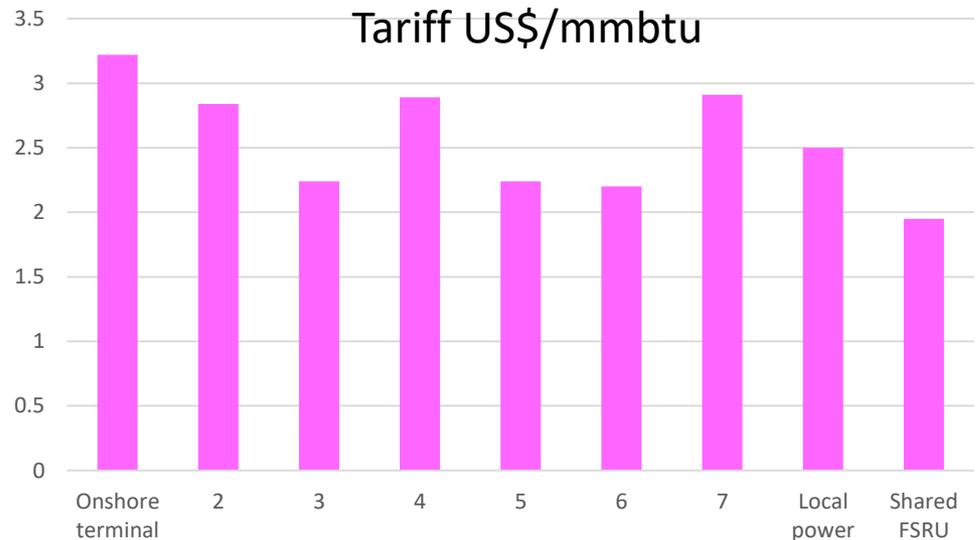
Traditional economics



- 5 sites considered
- FSRUs have the advantage of low Capex
- Traditional onshore terminal looks poor
- Pipeline connection costs dominate – no deep water close to demand centre



- Capex advantage doesn't follow through into discounted economics
- FSRUs better than onshore terminal



FSRU 3, 5 or 6 preferred

Xanadu conclusions

- Timescales and uncertainty favour a floating solution
- Large FSRU gives lowest through life costs
- Three lower cost sites identified – two have short gas pipelines
 - FSRU 3 has significant social/environmental impacts
 - FSRU 5 is on a tower yoke mooring and more detailed availability studies required to confirm uptime
 - FSRU 6 requires a small breakwater
- FSRU 5 preferred
- But terminalling cost too high (>2 US\$/mmbtu)
 - Gas demand for power is too small to efficiently cover costs

Are there other options?

Hub and spoke models

- Import centrally and redistribute to multiple import facilities
- Is this still a FSRU?
 - Possibly if one market dominates
 - If it doesn't a converted LNGC (FSU) may be better as the hub
- Do FSRUs work as the spokes?
 - Maybe, but need to be small
 - Onshore terminals can be attractive when small

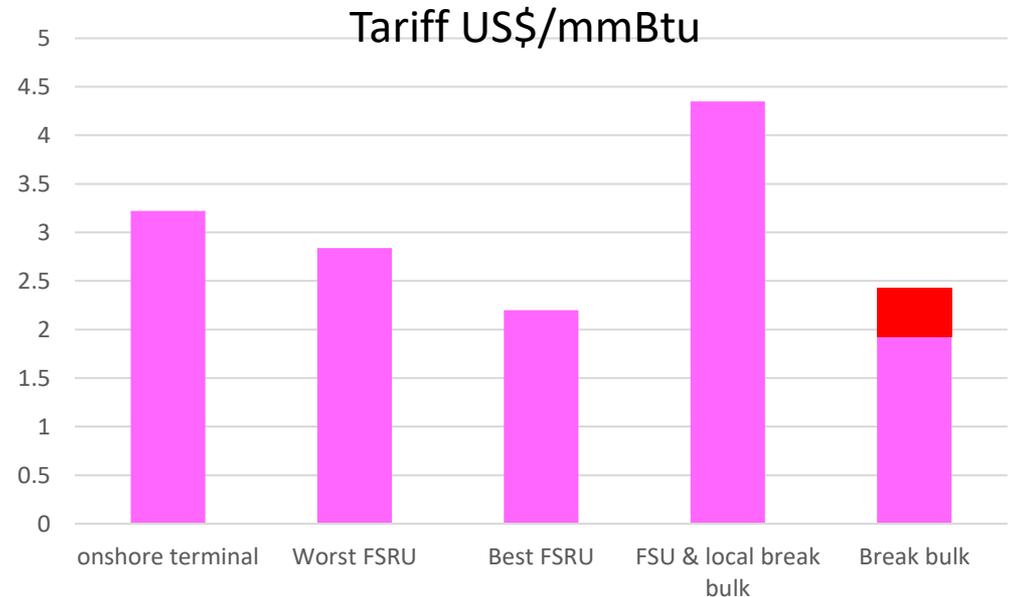
Break bulking

- Do bulk LNG elsewhere
- Only looking at small parcel sizes
- Small LNGCs
- Do FSRUs still work?
 - Maybe, but need to be small
 - Onshore terminals can be attractive when small



Case study economics

- Break bulking looks to be the preferred solution
- Final choice will be determined by the size of the terminalling cost at the regional LNG terminal
 - If low tariff then small ship supply from regional terminal is better
 - If high tariff then bulk import to a FSRU is better

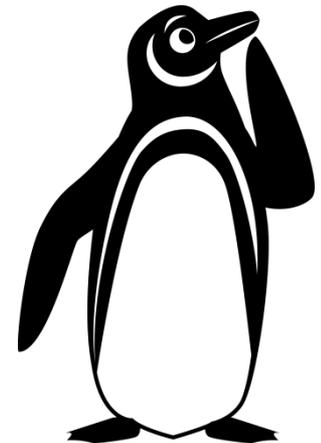


Economics marginal
Gas pipelines too long for small volume of gas required for power generation

Summary



- Power generation needs small gas supplies
- Break bulking if terminally fee is low looks best
- FSRU looks best if terminalling fee is high or power generation grows
- FSRUs have many advantages
- A small FSRU can be replaced by a larger one when (or if) demand grows
- FSRUs alone are extremely cost effective
- Impact of the additional infrastructure required to get the gas to market can be significant and may overwhelm positive FSRU economics



Thank you for your attention

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