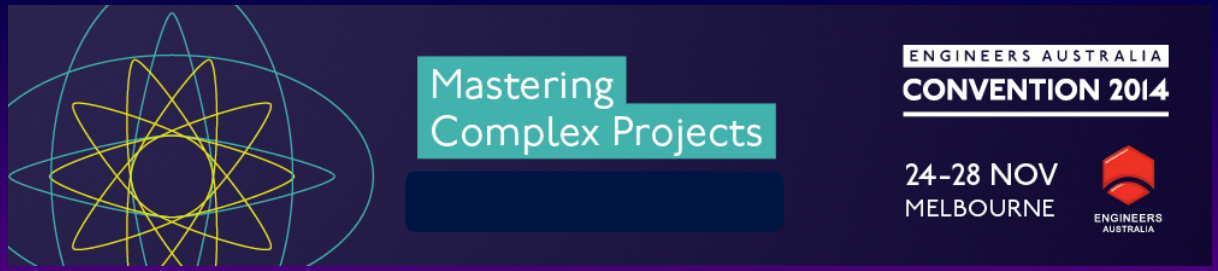

Australian Lessons for Developing Large and Complex Projects

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Presentation Outline

- Australia's poor large project performance
  - 3 examples
  - Causes
- Changed market conditions
- Need for new approaches
  - Learn the lessons
  - Use new technique for assessing project and asset
- Conclusions and Recommendations

Australia's Poor Project Performance

- IPA (2009): 74% of completed large/complex projects they had assessed had been failures
- PwC (2012): only 2.5% of companies delivered their projects to time & cost targets; of rest, 92% of failures due to management, 8% technical
- E&Y (2014) show this is a global problem:
  - 53% (best Europe) to 89% (worst Middle East) cost overrun (by average 51% best in Nth Am to 102% worst in Latin America);
  - 55% (best Nth Am) to 87% (worst Middle East) schedule overrun.
- Australia not worst but far from best

PROJECT EXAMPLES

Three Examples of Large and Complex Australian Projects which failed to meet their time and cost targets

BHP Hot Briquetted Iron (1995-99) - 1

- HBI desired by BHP Iron Ore to expand flat products in booming SE Asian markets; inadequate process testing
- Project "self-executed" by Operator BHPIO - promised Board threshold 15% RoI by cutting $400m capex
- Poor project management & controls resulted in 1 year delay & 50% cost overrun ($1.6b to $2.4b)
- 97/98 Asian Financial Crisis occurred during construction
- FINMET Process killed maintenance workers
- Plant was shut down then razed to the ground

BHP Hot Briquetted Iron (1995-99) - 2

- Main picture shows HBI process plant under construction; right upper shows explosive demolition, lower right compacting scrap

BHPB Nickel Projects (2004-08) - 1

- BHP acquired Nickel assets with WMC, wanted to be Tier 1 producer
- Limited life lateritic ore deposit near Ravensthorpe in SW WA was site for mine and novel process concentrator
- 30 year old Yabulu Nickel Refinery in QLD came with Billiton. BHPB decided to double size to process concentrates from Ravensthorpe
- In Mar 04 both projects were to cost US$1.4b and deliver in Q3 07
- Many changes during construction, major time & cost overruns
- Global Financial Crisis occurred during delayed startup plunging nickel price from record $54k/t in Q1 07 to <$10k/t in Q2 09
- Both facilities shut in Jan 09 , sold with write-downs of US$3.6b

BHPB Nickel Projects (2004-08) - 2

- Top left: Ravensthorpe Concentrator under construction; Bottom right: Yabulu Nickel Refinery

Woodside Pluto Project (2007-12) - 1

- Woodside (WPL) found 4.5TCF Pluto gas fields in 2005 and at FID in Jul 07 committed to a single 4.3 MTPA LNG plant on Burrup Peninsula
- Pluto FEED was only 9 months, to get LNG to market asap
- First Cargo was forecast to occur in Oct 10, just 39 months after FID
- EPCM contract formed with JV FWWP, then finishing NWS Train 5
- Complexity & scale of global project for a stretched Australian market resulted in onshore engineering, logistics and quality problems
- Late engineering & procurement delayed materials for modules resulting in carryover work. Poor quality greatly increased site work
- Increased sitework and delay caused WPL to introduce “motelling” to increase available accommodation for construction workforce by 25%

Woodside Pluto Project (2007-12) - 2

- Modules being unloaded from special “marine low loader” vessel

Woodside Pluto Project (2007-12) - 3

- Change in accommodation conditions caused protracted industrial action in early 2010
- Legislation of Fair Work Act in Jul 2009 substantially increased union rights and enabled extended site stoppages through 2010 to August
- Delays rendered onshore project schedule increasingly unattainable, but a countdown calendar had been adopted by the project, causing reluctance to rebaseline
- Offshore labour costs rose 184% from 2005 to 2011 to >6.6 times Australian Average Weekly Earnings, increasing offshore costs
- Offshore scope was otherwise well managed and executed in a timely way by an experienced Woodside Owners Team

Woodside Pluto Project (2007-12) - 4

- View of Pluto onshore construction on Burrup Peninsula

- First Cargo departed in May 2012, 58 months after FID at a project cost of about $15b, 25% more than the original estimate of $12b

Causes of Australia's Poor Performance

- Loss of project personnel from late 1980s to early 2000s
- Impatience of project owners to get into rising market
- Poor grasp by owners of needs to define and deliver projects
- Increased complexity, project stress due to modular design
- "Tipping into chaos" of many projects due to complexity, design changes and other stressors (Hollmann, 2014)
- Rising demand drives labour rates up, productivity down
- Changes to IR laws swung pendulum too far in favour of unions

Changed Market Conditions

- Boom conditions in Australia of 2003-2012 gone, due to:
  - Appreciation of A$ compared with long term average due to improved Terms of Trade (Value of Exports/Imports)
  - Increase in supply of commodities - principally iron ore, coal, LNG)
  - Reduction in demand by China
    - cooling of growth, credit,
    - maturing of economy from export & infrastructure to services and
    - environmental restrictions on imported coal quality
- So there is a clear need for new approaches to planning and delivering complex projects in the energy and resources sectors

NEED FOR NEW APPROACHES - 1

Learn the lessons of the last 20 years:

- Thoroughly define scope
- Understand investment risks of asset as well as project
- Ensure project specialists assess investment proposal for owner
- Never allow an operating organisation to manage a complex project
- Rethink project delivery strategy to integrate owner and contractor more effectively
- Ensure ample time contingency for procurement & completion of modules
- Drive for higher productivity
- Develop fair but firm industrial relations laws
- Engage specialists with good track record to develop and execute project
- Recruit well and thoroughly train the team to operate the asset
- Retain and release Unallocated Contingency and if necessary, Management Reserve to guide and motivate the project team

NEED FOR NEW APPROACHES - 2

Extend Integrated Cost & Schedule Risk Analysis to full Project and Asset Lifecycle – Integrated Costs, Schedule & Revenue Risk Analysis (IRRA)

Include full project and asset lifecycle

- Integrated Cost & Schedule Risk Analysis (IRA) does not risk-assess a major part of the Total Cost Management framework: the Asset being created by the project to realise benefits, usually including target financial returns
- If IRA is extended to the operation of the Asset through its economic life including Asset Closure, risk analysis can be broadened to include:
  - Opex uncertainties and risks
  - Revenue uncertainties and risks
- Modeling must be capable of representing the full range of uncertainties and risk factors including costs of borrowing and varying DCF rates

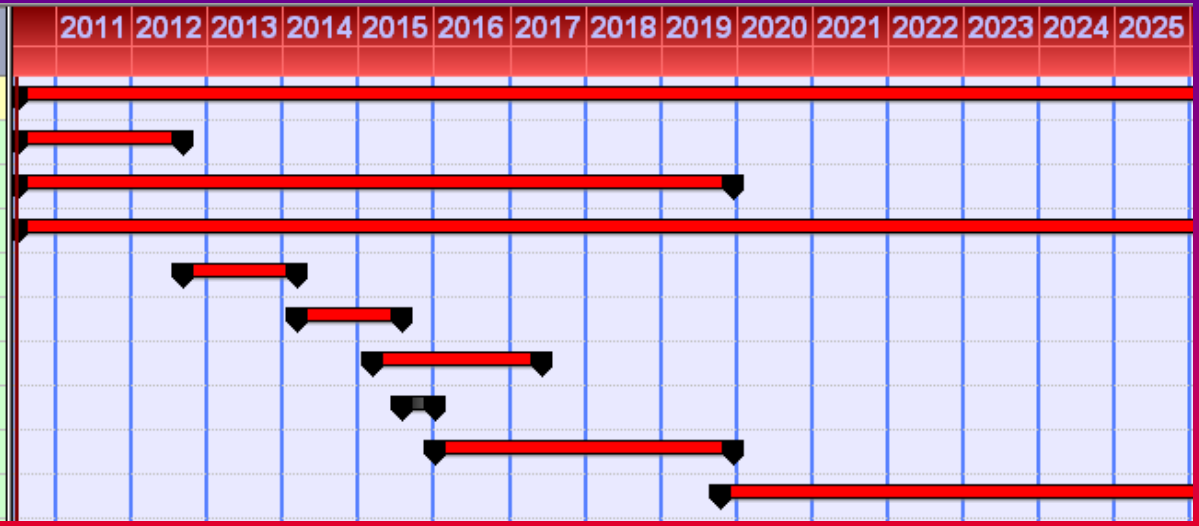
Integrated Costs, Schedule & Revenue Risk Analysis (IRRA)

- We have developed a Floating LNG project model of this extended IRA methodology: Integrated Costs, Schedule & Revenue Risk Analysis – IRRA
- A summarised representation of an FLNG Project and the first few years of production of the asset are shown on the following screen
- Phases from concept to asset closure are included

IRRA Model of an FLNG Project

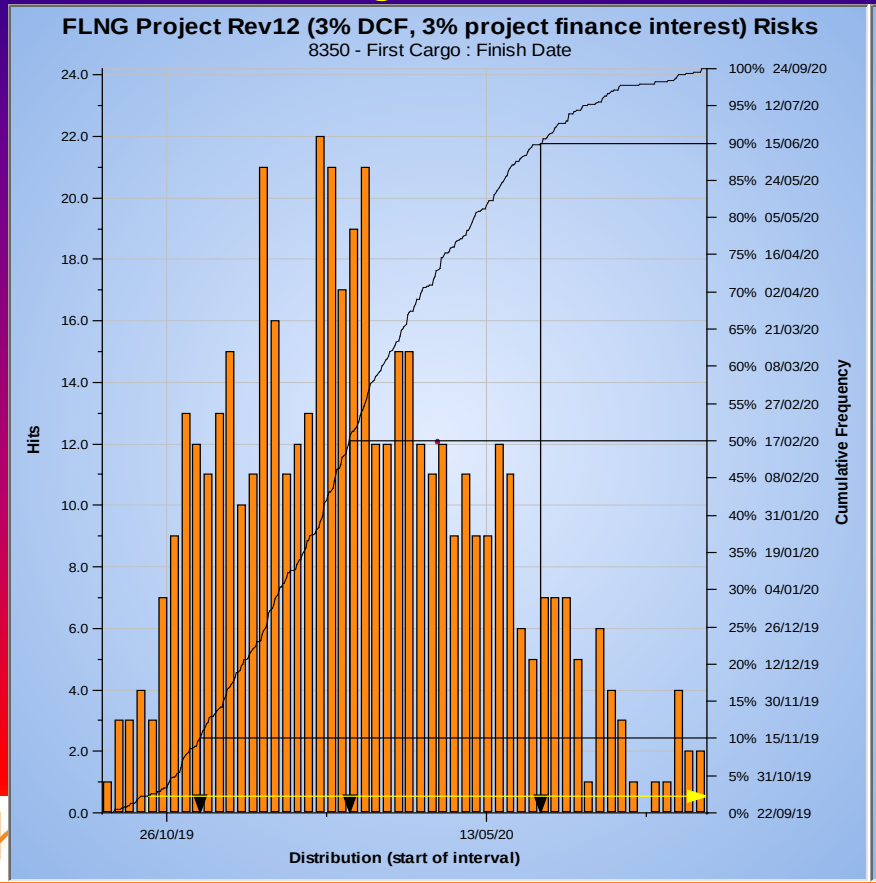
- Key dependencies from engineering to procurement, fabrication, installation are included in the ~200 task model

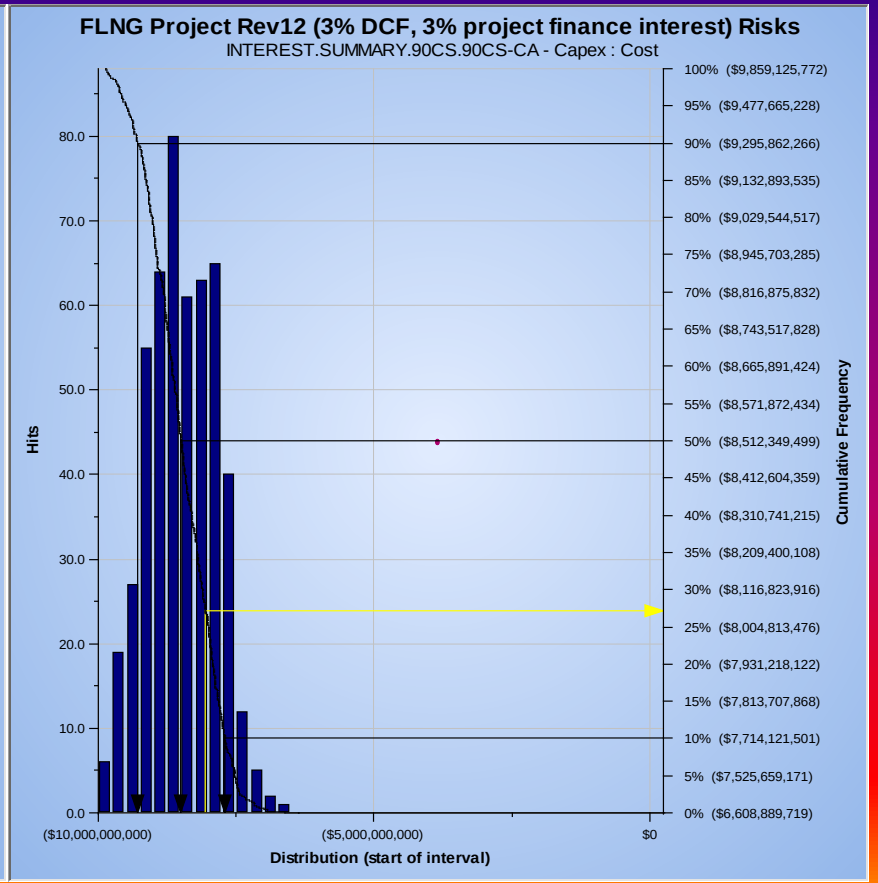
Description	Rem Dur	Start	Finish
FLNG Project	12697	01/07/10	04/04/45
Concept Phase	801	01/07/10	08/09/12
Milestones	3452	01/07/10	12/12/19
Costs	12607	01/07/10	04/01/45
Pre-FEED	547	09/09/12	09/03/14
FEED	505	10/03/14	27/07/15
Safety Case	819	10/03/15	05/06/17
Financial Closure	160	28/07/15	03/01/16
Project Execution	1439	04/01/16	12/12/19
Revenue - Operations & Redeployme...	9305	14/10/19	04/04/45



Probabilistic Project Forecasts

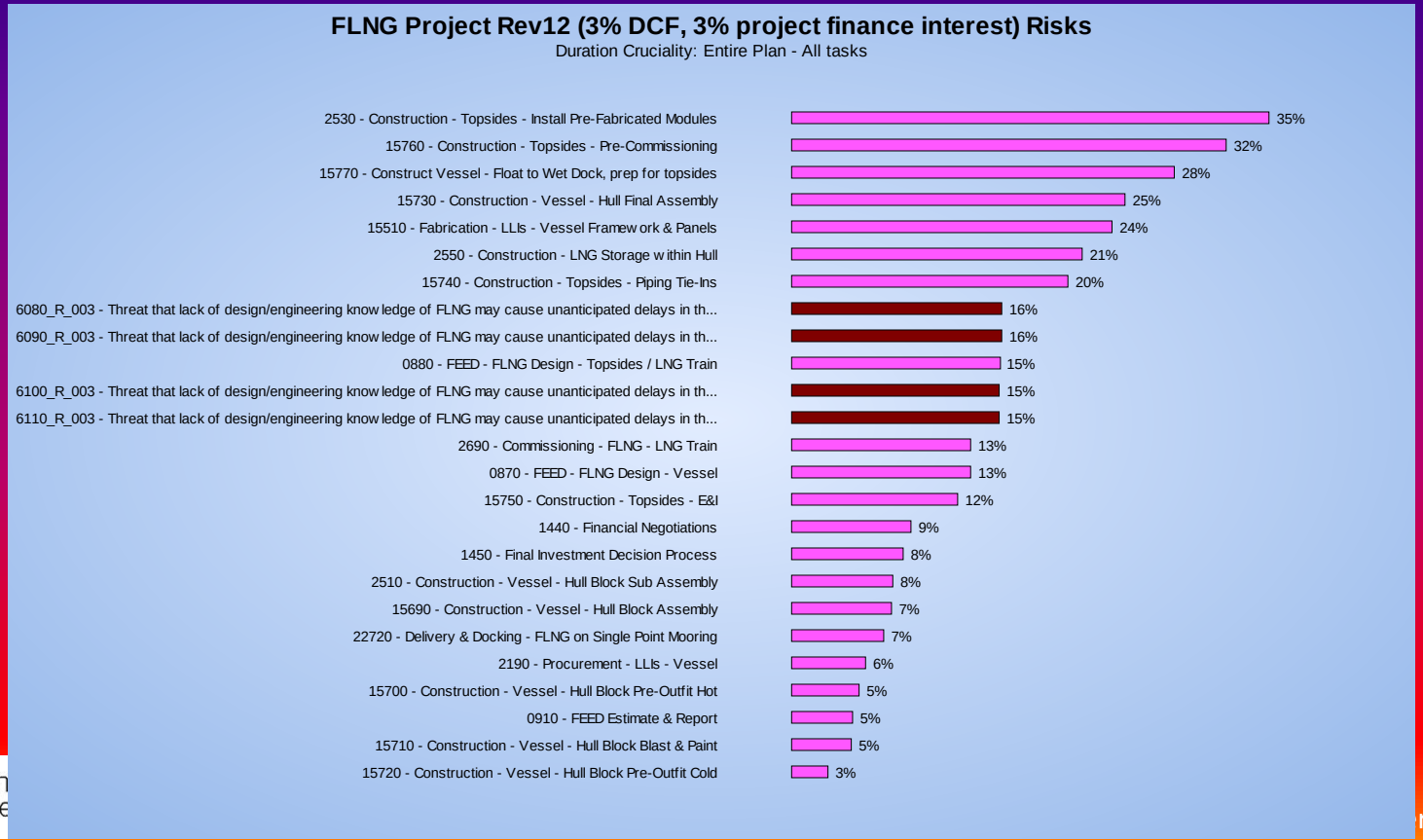
- The usual forecasts of time and cost outcomes can be made, enabling contingencies to be assessed, taking into account all known uncertainties, risk events and factors





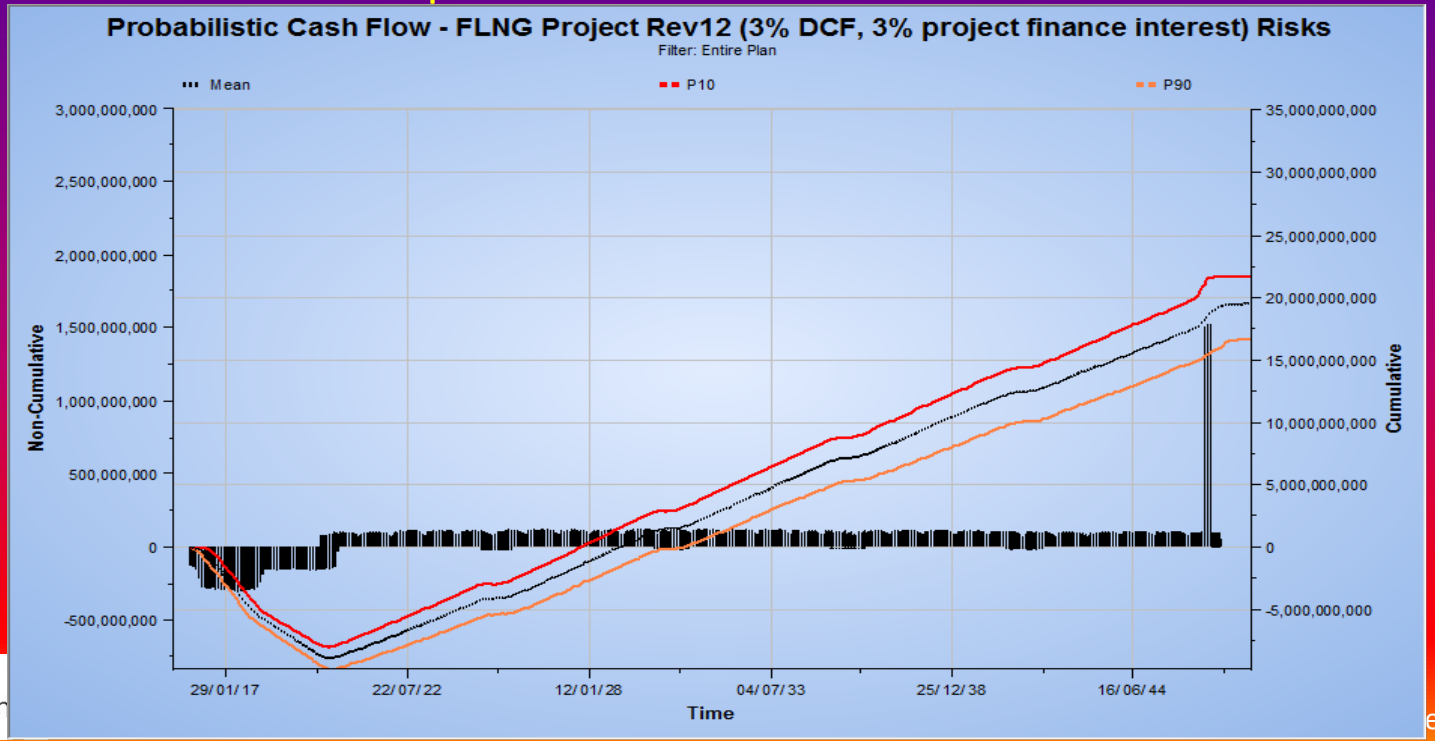
Drivers of Project Outcomes

- As importantly, the drivers of project timing and cost can be identified and ranked to prioritise efforts to optimise risk



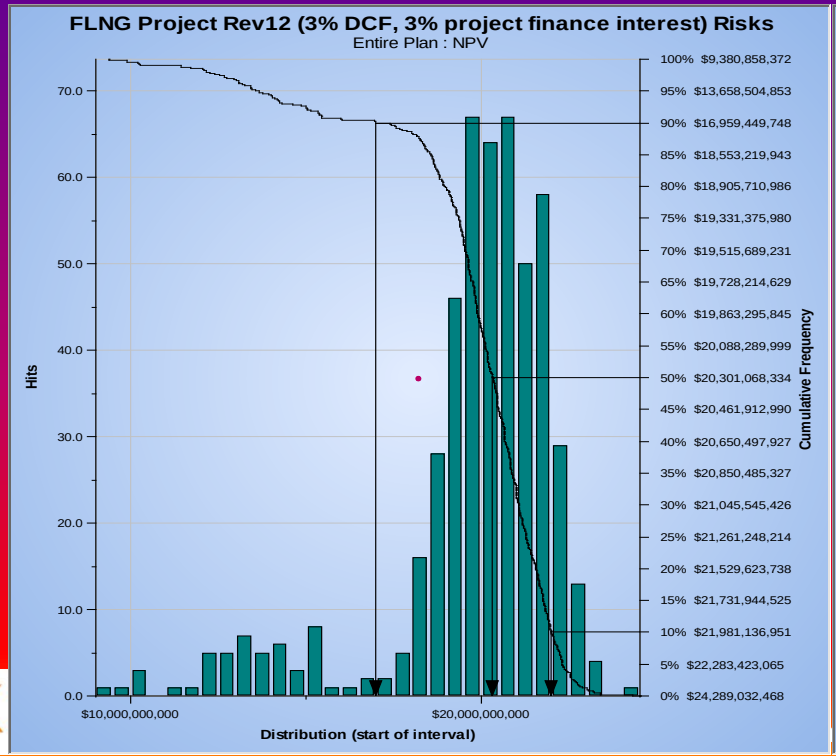
Add in Whole of Asset Life Risk

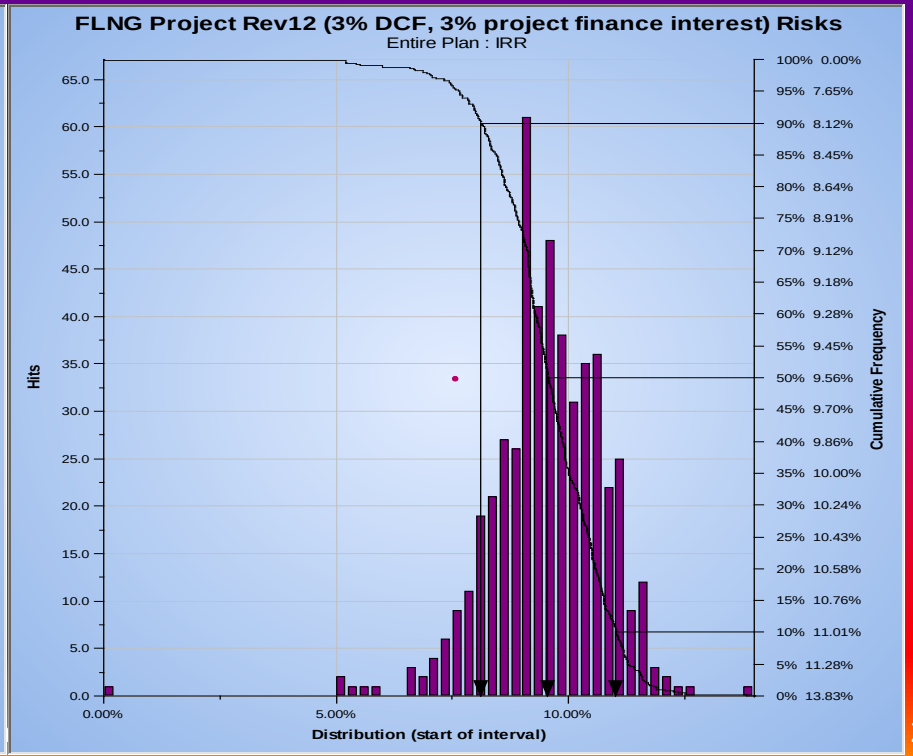
- FLNG projects involve tradeoffs between Capex and Opex
- But such choices also have different risk profiles
- By incorporating Revenue and Opex uncertainties and risks, we can model the financial riskiness of each option



Asset Probabilistic NPVs and IRRs

- Each FLNG option can be modelled with all risk factors and risk events as well as capex and opex uncertainties
- When revenue uncertainty and risks are also modeled, the full riskiness of the investment decision can be assessed





Conclusions and Recommendations

- Australia's relative advantages have largely disappeared
- Need to reduce risk to access Superannuation Funds
- Need for training for senior project managers and directors
- Need for better project management skills
- Need for Balance in Industrial Relations Law
- Plan Projects and Investments thoroughly before Execution

QUESTIONS?

Anyone who wants an electronic copy of the presentation should give me their business card or email me at:
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