The Evaluation of Oil and Gas Developments

CLSA Commodities Forum

Hong Kong, March 2011

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Declaration

The assessment of petroleum assets is subject to uncertainty because it involves judgments on many variables that cannot be precisely assessed, including reserves, future oil and gas production rates, the costs associated with producing these volumes, access to product markets, product prices and the potential impact of fiscal/regulatory changes.

The statements and opinions attributable to RISC Pty Ltd are given in good faith and in the belief that such statements are neither false nor misleading. In carrying out its tasks, RISC Pty Ltd has considered and relied upon information in the public domain.

Whilst every effort has been made to verify data and resolve apparent inconsistencies, neither RISC Pty Ltd nor its servants accept any liability for its accuracy, nor do we warrant that our enquiries have revealed all of the matters, which an extensive examination may disclose.

We believe our conclusions are sound but no warranty of accuracy or reliability is given to our conclusions.

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Introduction

- RISC was established in 1994 to provide advice to investors and stakeholders in oil and gas developments across the full range of disciplines required to make key investment decisions
- RISC has completed over 1300 assignments in over 68 countries for nearly 500 clients. Since January 2000, RISC has been the principal technical and economic advisor on transactions whose total value exceeds US$220 billion.
- Although RISC advises a wide range of clients on issues relating to all stages of the E&P project lifecycle, our core skillsets remain:
  - Evaluation of hydrocarbon developments through analysis of seismic, inplace volumes, development plans and reserves, costs, schedules, commercial structures and discounted cashflow analysis
  - Applying the knowledge gained from project analysis to help clients make better decisions with greater confidence.
- This presentation highlights a few insights from this wealth of experience

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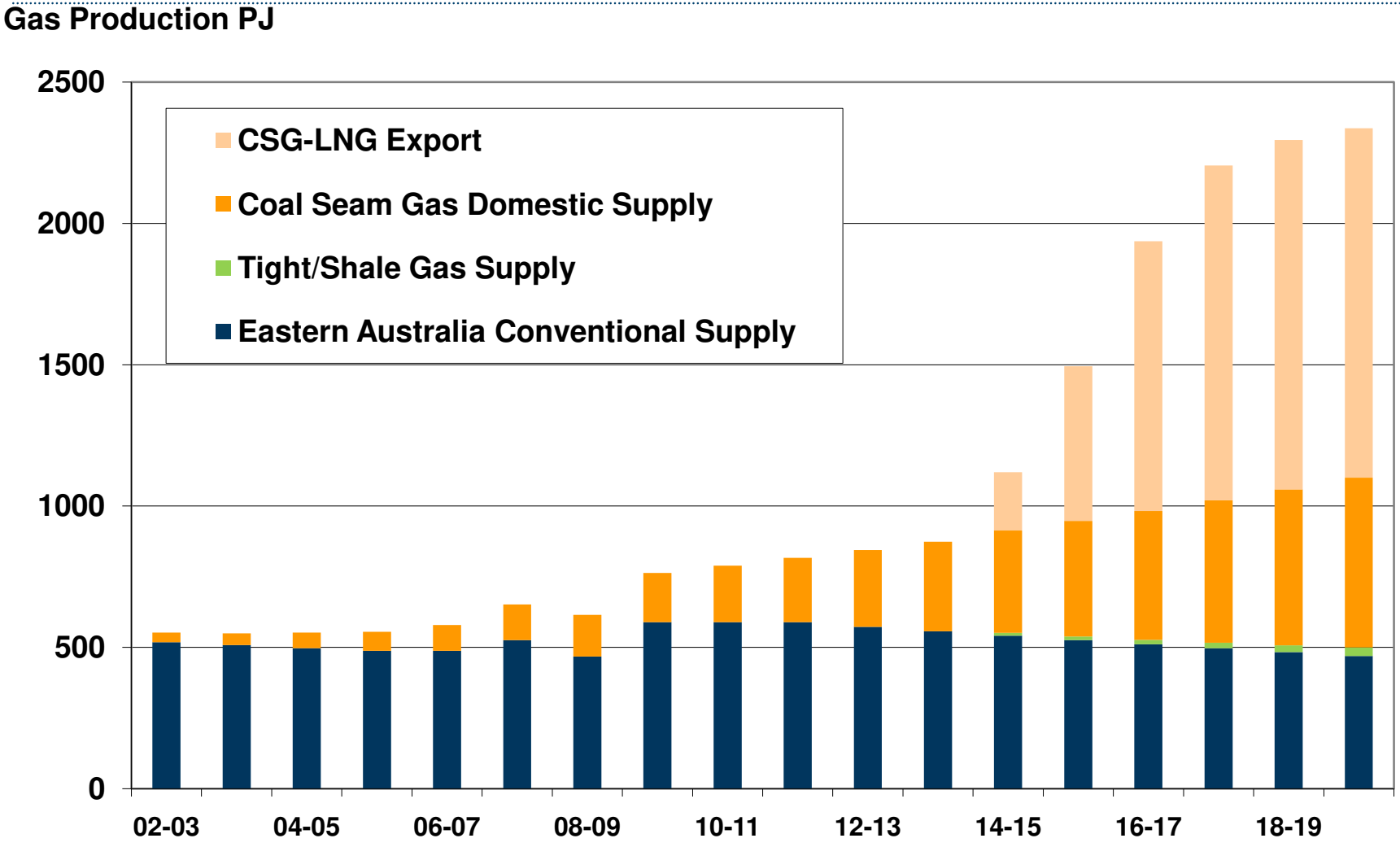
Presentation Structure

- Resource Estimation Challenges for Coal Seam Gas
- Project Schedule and Cost Forecasting
- Uncertainties in Economic Evaluation

The CSG Industry has transformed Eastern Australian Gas Supply



Source: RISC Analysis

Resource Estimation – Key Principles

- Society of Petroleum Engineers has developed the Petroleum Resources Management System (PRMS). This is a project based approach for classifying hydrocarbon resources:
  - Links resource to a project and associated cash flow schedules
  - Classes reflecting the chance of commerciality:
    - Reserves (reasonable expectation that project will proceed)
    - Contingent Resources (discovered but not yet commercial)
    - Prospective Resources (yet to be discovered)
  - Categories reflecting the Uncertainty in volume estimates
    - Proved: high degree of confidence (90% chance) that estimate will be exceeded (1P, 1C, Low Estimate)
    - Proved + Probable: equally likely that estimate will or will not be exceeded (2P, 2C, Best Estimate)
    - Proved + Probable + Possible: unlikely (10% chance) that estimate will be exceeded (3P, 3C, High Estimate)

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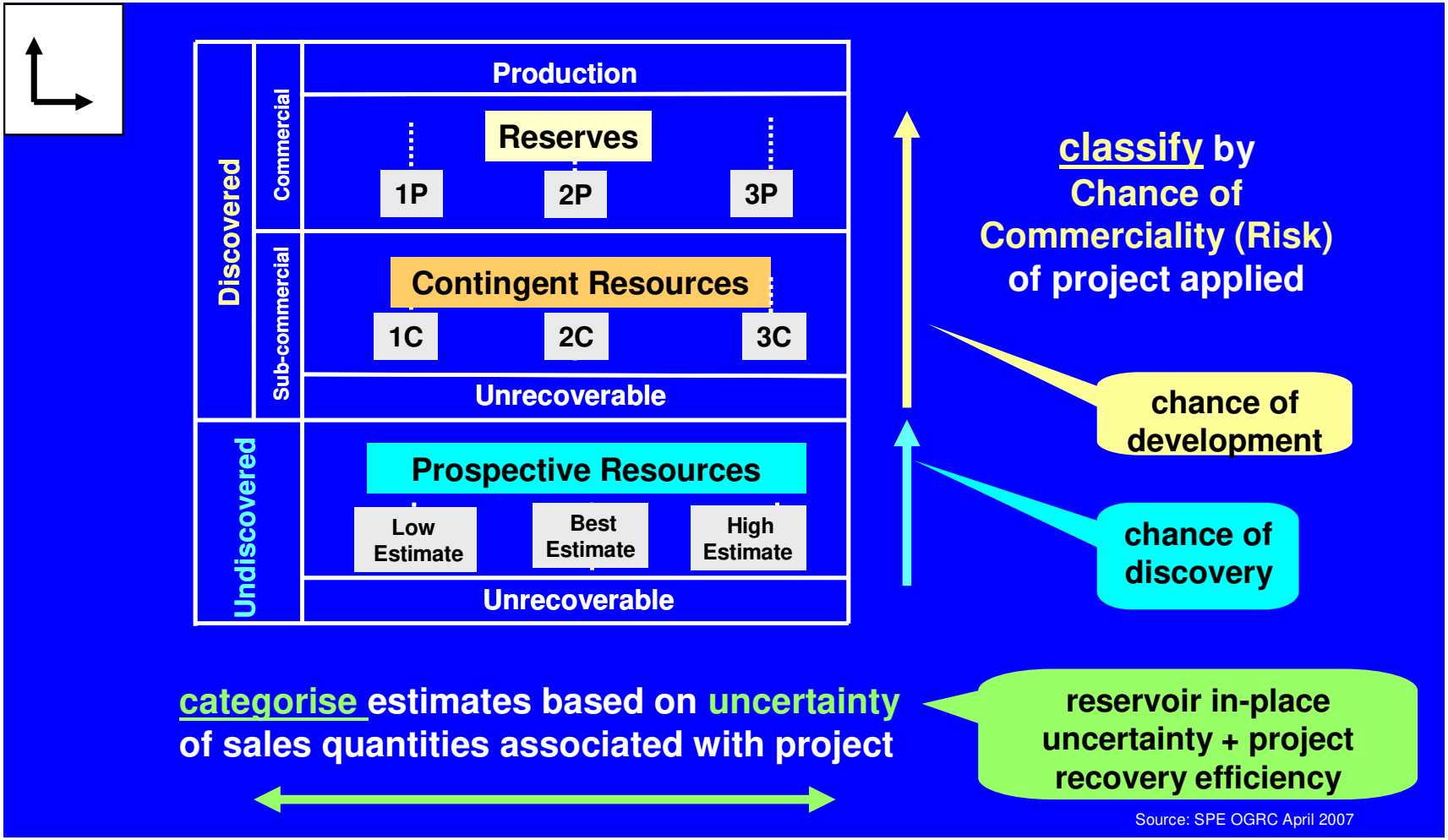
PRMS Classification & Categorisation



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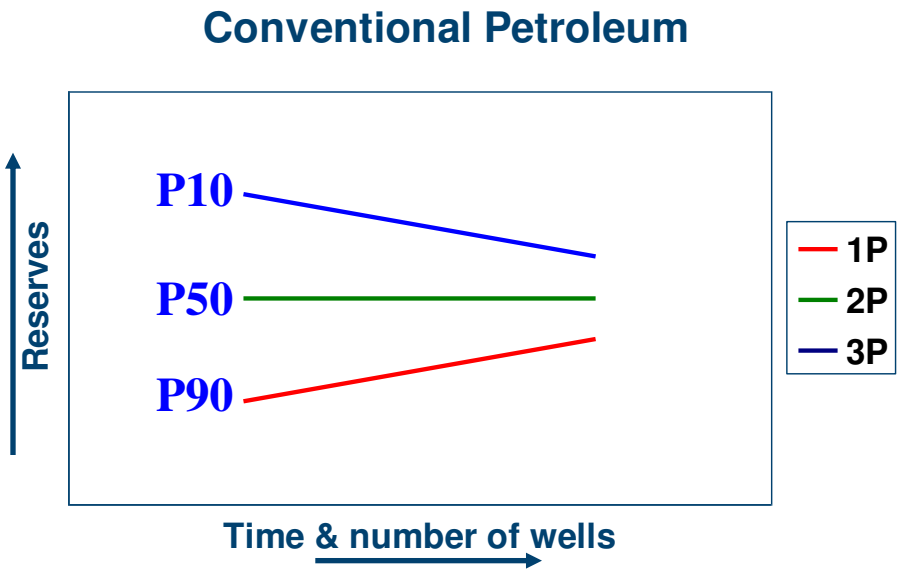
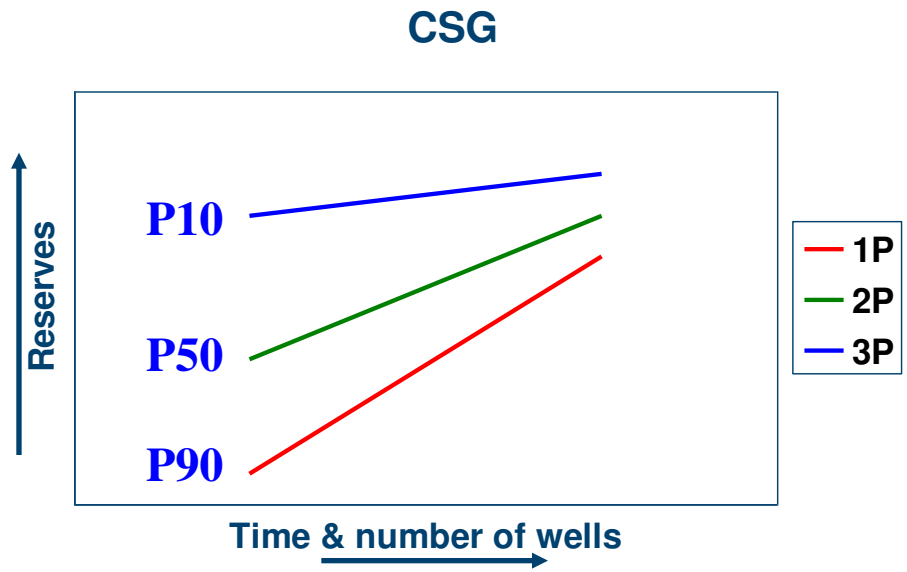
Coal Seam Gas Reserves Growth Paradox





- Trends towards 2P
- Makes sense if 2P is roughly a P50 or 'equally likely" value

- Trends towards 3P value which may also experience growth in immature areas
- Inconsistent with "equally likely" principle
- Why? – the 2P as stated is <u>not</u> "equally likely" and the 3P is **<u>not</u>** low probability outcome!!!

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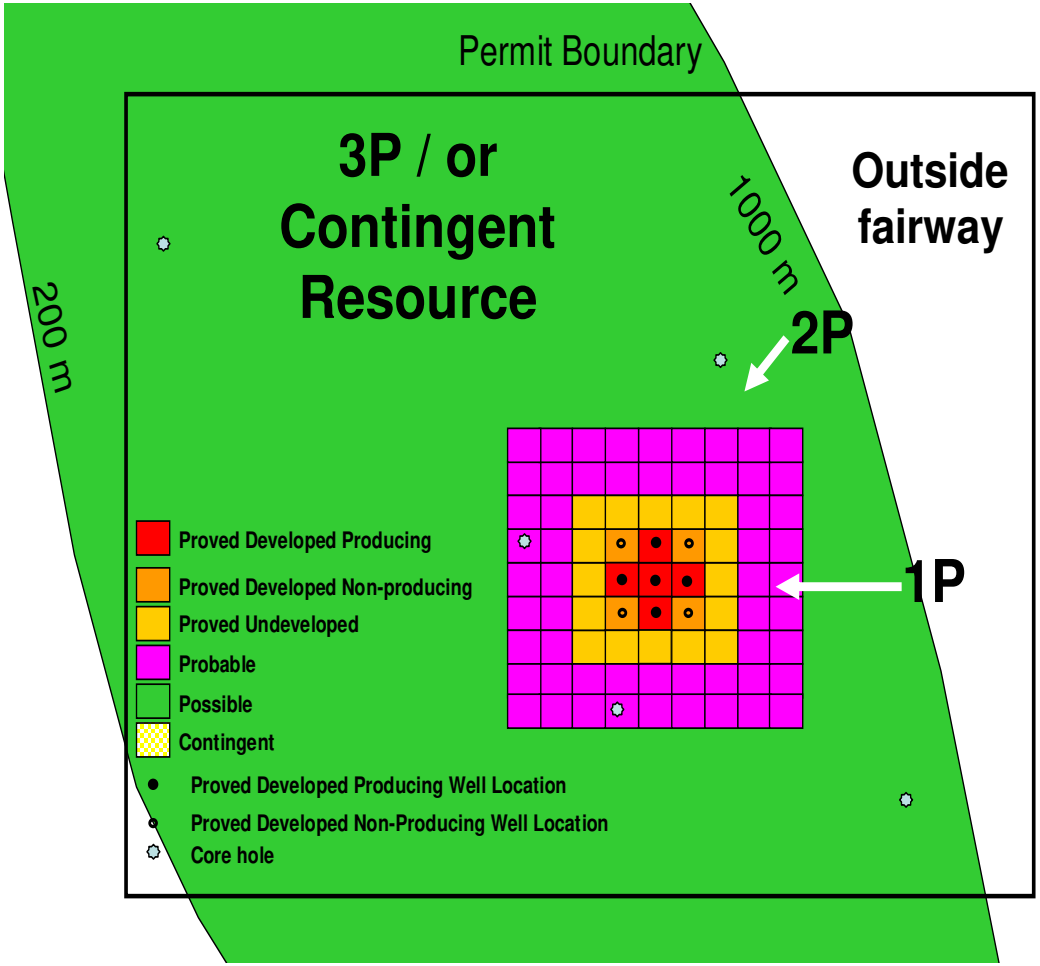
Current Approach to CSG is Not Truly PRMS Compliant

- No link from resource to project
- Deterministic approach based on "mining" conventions and "well spacing" rules
- Legacy from old US SEC and N. American regulations that may not be relevant elsewhere
- Proved undeveloped reserves (PUD): within 1-2 drainage radii from productive well
- Probable: 2 drainage radii away from Proved
- 3P: 2 drainage radii away from Probable – or greater if data allows



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Comments on Current Practice

- Current Practice ties resource estimation to the location and number of appraisal wells, however actual recovered volumes are related to the location and number of development wells in the defined project
  - Vastly different scale of development between 1P and 3P e.g. 10's to 1000's of wells
  - Vastly different scale of investment between 1P and 3P e.g. $10's of millions to $1000's of millions
- Current approach confuses the risk of project being commercial and the uncertainty surrounding project hydrocarbon recovery
- A fully PRMS compliant CSG process will yield much greater insight into the uncertainty range associated with the project resource base
  - Realistic 1P/3P range ***for a Defined Project***
  - Greater transparency in total resource potential
  - Clear distinction between risks (ie chance of success) and uncertainty (ie range in the estimates)

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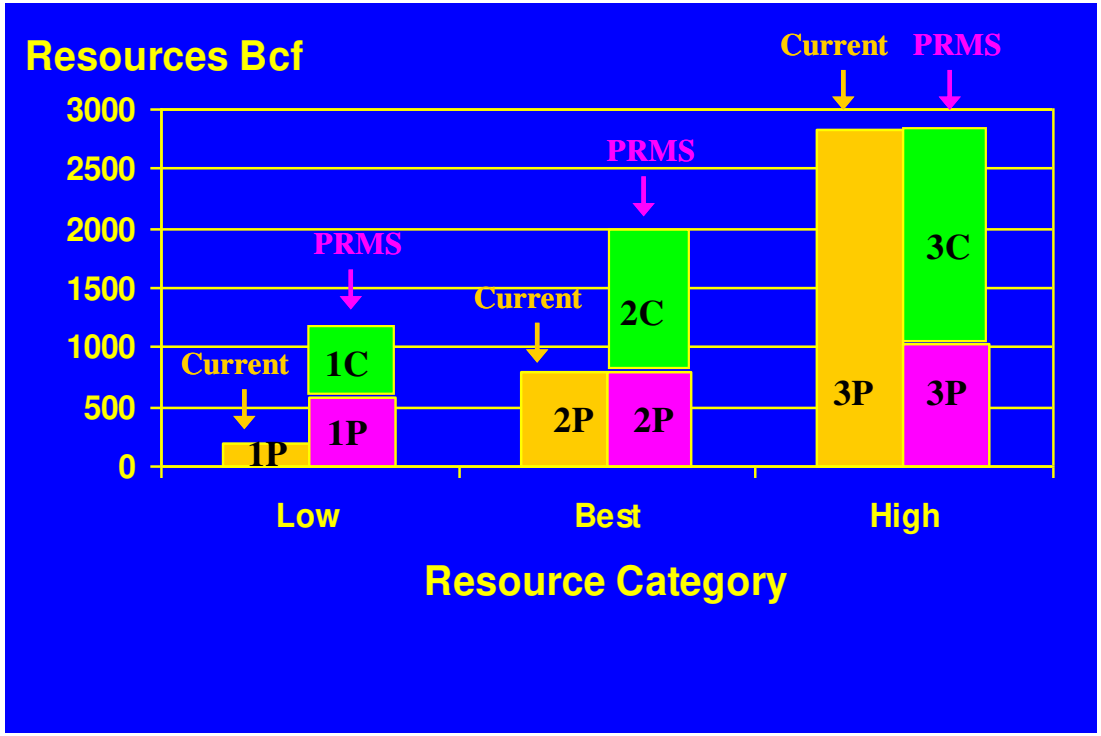
Comparison with Rigorous PRMS Project Based Approach

RISC applies a rigorous PRMS approach to CSG Projects in which appraisal data is the basis for estimation of reserves and resources for a specific project

- 2P reserves often similar in both methods at project sanction
- 1P higher in PRMS compliant case – a more realistic downside based on approved project area
- 3P lower in PRMS compliant case – constrained by approved project
- Contingent Resources carried outside approved project area in PRMS compliant case
- Entire resource base defined
- Superior insight into risks and uncertainties



Project Execution

- Predictions of major resource project schedule and costs will always involve a significant element of uncertainty

- Prior to Final Investment Decision:
  - Schedules will be aspirational, driven by the earliest potential decision date plus the forecast execution duration
  - actual schedule may be driven by eg market capture. Clearest example of this is the “bow wave” of LNG capacity forecast four years ahead.
  - Costs will be dependent on the degree of definition achieved at the time of estimate, as well as uncertainties in estimating methods.

- Post Final Investment Decision:
  - Cost and Schedule will vary with service and material markets
  - Project Managers will generally set aggressive targets to motivate their teams to deliver the best possible result

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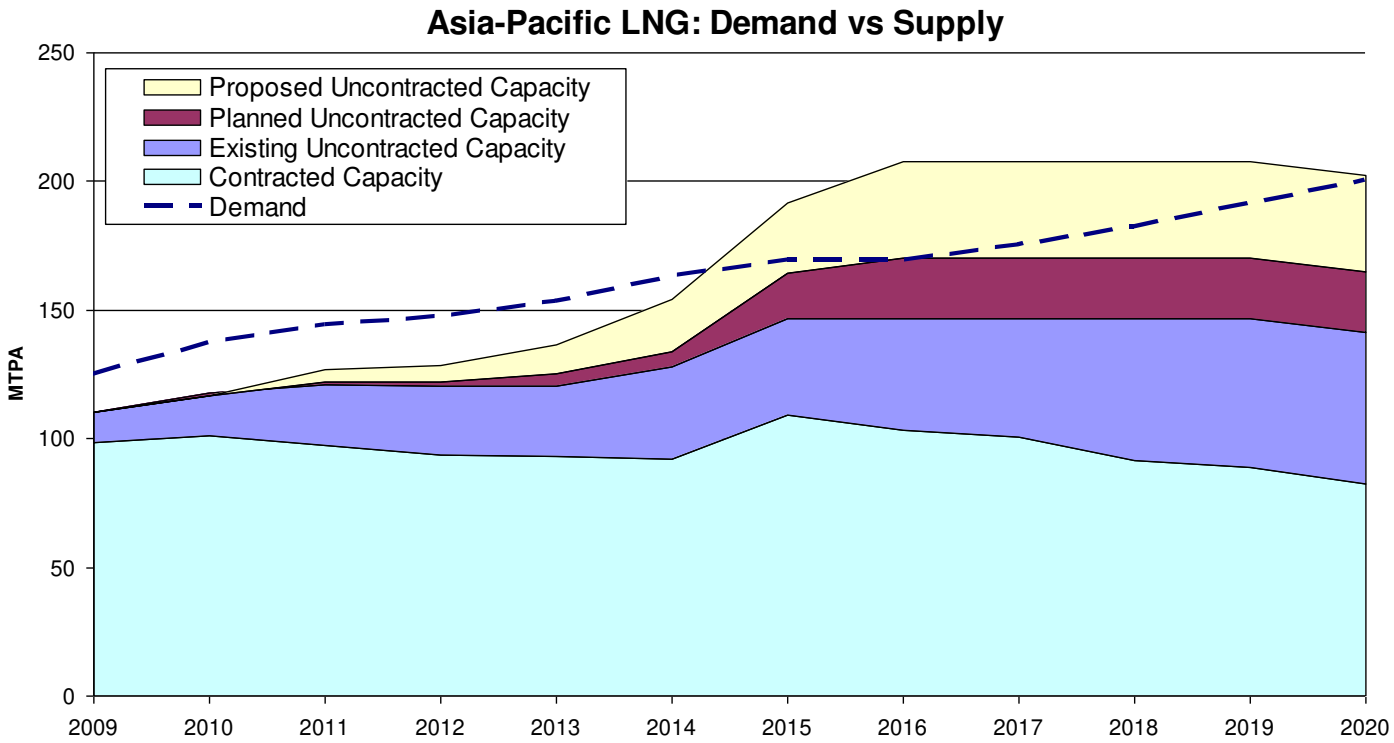
The LNG "bow wave" (2010 forecast)



- Woodside's Pluto expansion, Santos's Gladstone LNG, APLNG, Inpex's Ichthys project and LNG Ltd's Fisherman's Landing project all deferred FID in 2010.
- GLNG has since been approved, but Pluto and Fisherman's Landing have yet to secure gas supplies and Ichthys is now aiming for a decision late 2011.

Source: Unconventional Gas In Australia. May 2010 RISC

Project Execution Schedule and Cost Performance

Major Projects	Commodity	Operator	Budgeted Production	Actual estimated	Budgetat approval(bn)	Actual or estimated cost (bn)
PLUTO	LNG	Woodside	2010	2011	$12	$14
SINO IRON	Iron Ore	Citic Pacific	2010	2011	$US3.85	$US5.2
NORTH WEST SHELF TRAIN 5	LNG	Woodside	2008	2008	$2	$2.6
BODDINGTONS	Gold	Newmont	2008	2009	$1.7	$2.9
CHICHESTER PROJECT	Iron Ore	Fortesque	2008	First output 2008 but full capacity srtill to be reached	$2.4	$3
RAVENSTHORPE	Nickel	BHP	2010(full Production)	n/a shut down	$US1.4	$US2.2
GOVE	Alumina	Alcan/Rio Tinto	2008	2009(but at 80% capacity)	$1.3	$US2.3

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Source: The Australian newspaper

Project Pressures: Manpower and Services

- Chamber of Minerals and Energy of Western Australia estimates the state needs to recruit some 10,000 extra workers through 2011, rising to 37,000 by 2012 to bolster the current 87,500 direct mining employees
- Factor in the far greater number of workers needed for related industries, such as construction, and some estimates put the total number required in the decade to 2020 closer to half a million

- Minerals Council of Australia (MCA) estimates that the number of workers in the Resources sector would need to grow by approximately 86,000 over the next decade for Australian to maintain its place in commodity markets throughout the world.

- Projects are impacted not only by direct wage increases but also by lower productivity as resources are stretched, increasing both cost and schedule.

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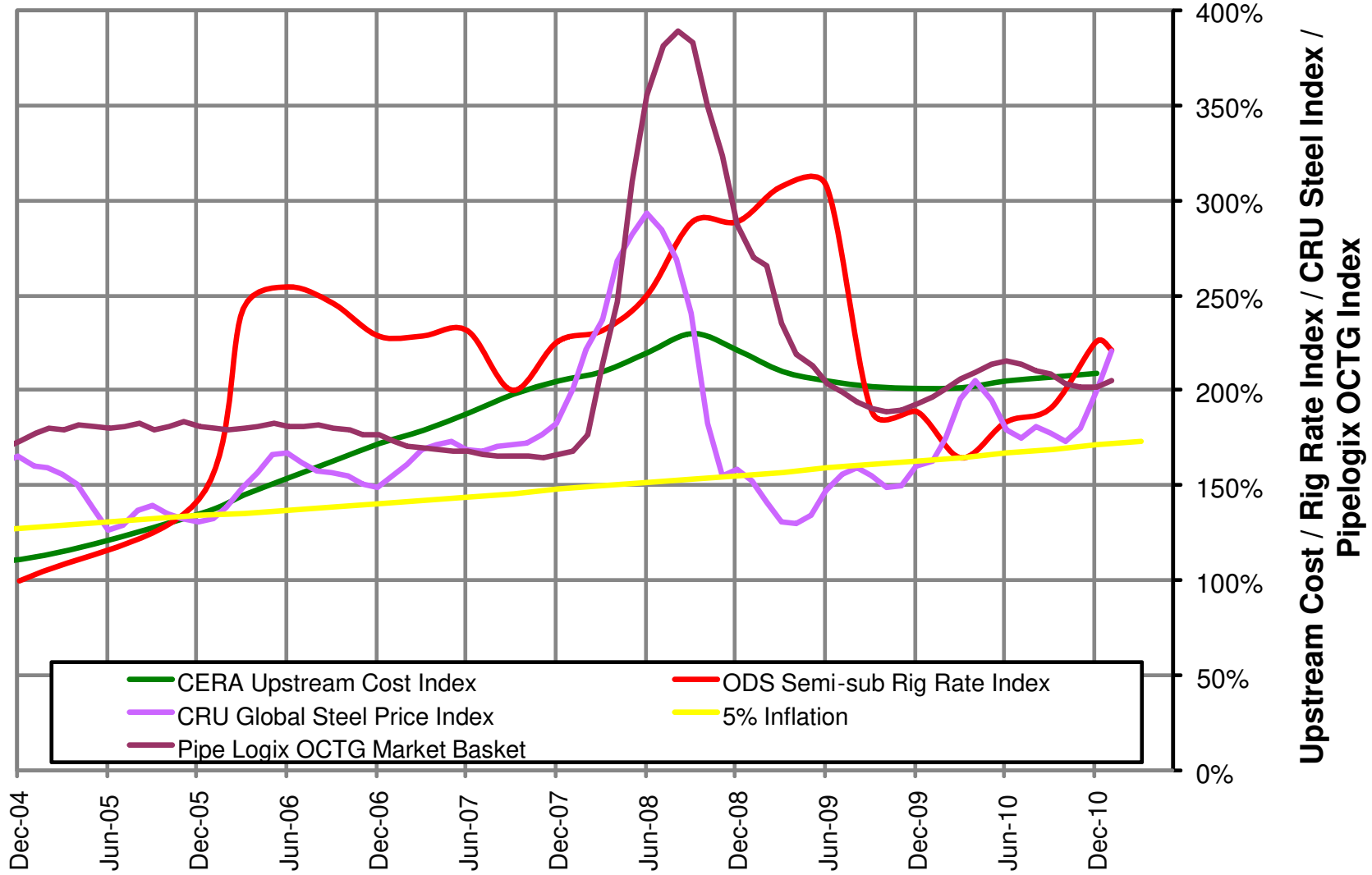
Project Pressures: Materials and Services Costs



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Impact on Cost and Schedule Forecasting

- Forecasts are derived from previous experience on similar recent projects

- Significant variations in cost metrics over short time periods:
  - make it hard to determine at what point in the cycle the reference data was sourced
  - increase the error in forecasting future costs and the underlying metrics which will apply at the time

- Cost metrics show correlation with oil price
  - Forecasts should be related to a forward oil price assumption

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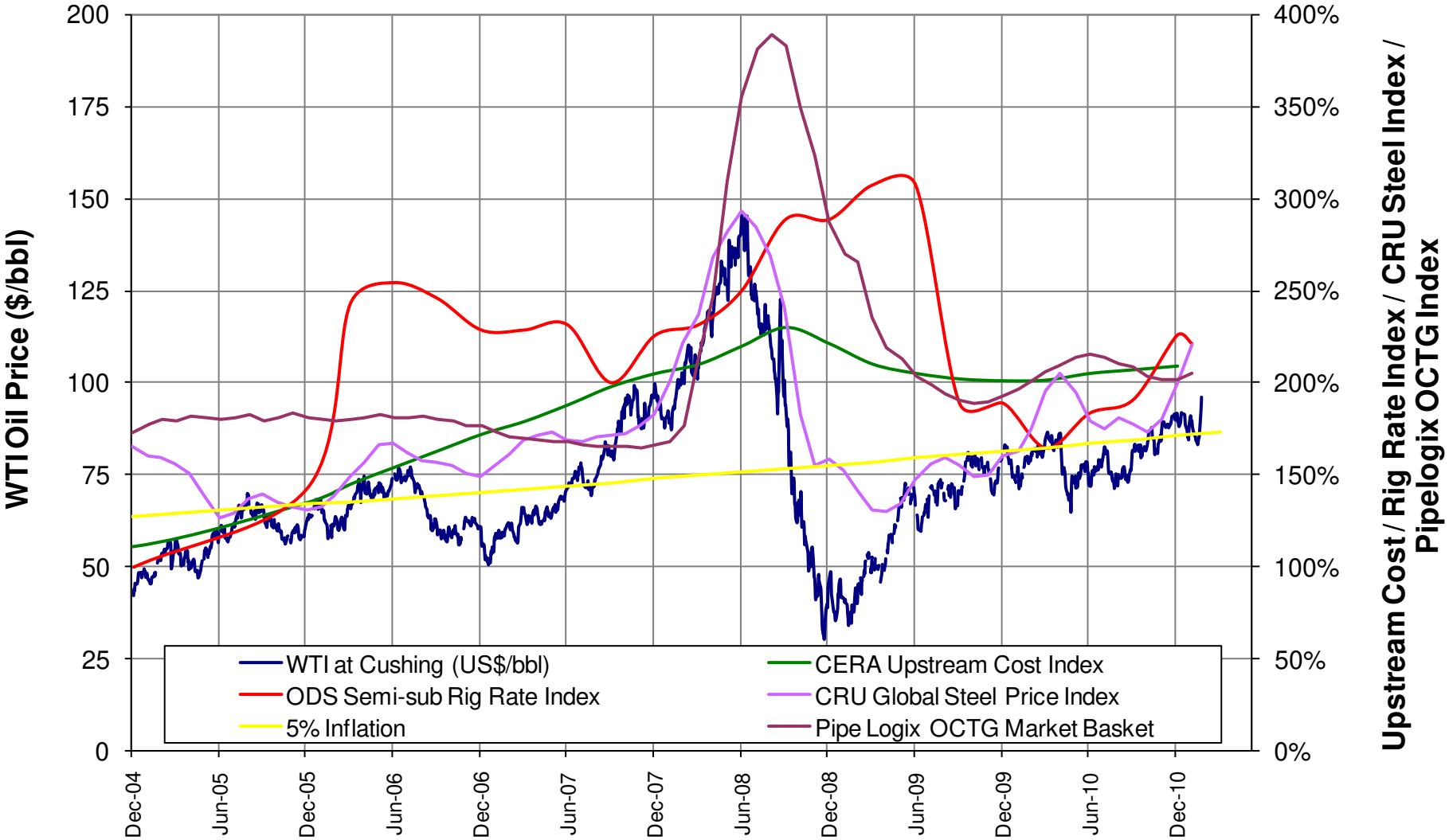
Economic Evaluation – Consistent Assumptions



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Conclusions

- Forecasting of project forward cashflows is not a precise science
- When analysing a project it is important to understand the assumptions underlying the base case forecast cost and production profiles

- Resource estimation in CSG projects should be based on the scope of the proposed development.

- A balanced view of any project should be based on an assessment of the underlying risks and uncertainties and their impact on cost, production and revenue forecasts
  - +/- 20% cost does not always represent the true range of project outcomes
  - Oil price scenarios can impact cost forecasts as well as revenue

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