Today’s Discussion

- PRMS and Coal Seam Gas (CSG)
- Consequences for reserves bookings and the Australian Gas Market
- Thoughts on professional qualifications for reserves estimators and auditors

Declaration
- The following represents my opinion, for which I accept full responsibility
- You can agree or disagree, that is your informed choice
- If you make a choice, any consequences are also entirely your own responsibility
What is the SPE PRMS?

- The Society of Petroleum Engineers Petroleum Resource Management System (SPE PRMS) is the oil and gas industry’s global standard for resource classification and reporting.
- The PRMS was approved by the board of the Society of Petroleum Engineers in March 2007 and was endorsed by the Boards of the America Association of Petroleum Geologists, the Society of Petroleum Evaluation Engineers and the World Petroleum Council.
- It is a system of technical standards which have five major principles as follows:

  1. The PRMS uses a resources classification framework that is applicable to all naturally occurring conventional and unconventional petroleum.
  2. The PRMS is “Project–Based.”
  3. Resource classification is based on project chance of commerciality.
  4. Uncertainty in recovery of the defined project is evaluated separately from commercialisation risks.
  5. Tests of commerciality can be based on evaluator’s best estimate forecast of future economic conditions.

Source: SPE PRMS 2007
What is a Project in the SPE PRMS?

- Activity or activities that recover petroleum when applied to reservoir or reservoirs
- A project generates petroleum production and cash flow schedules
- The sum of the project future production and cash flow schedules when taken to economic or contractual limits defines the resource recovery
Separate Classification & Categorisation:

- **Production**
  - Reserves
    - 1P
    - 2P
    - 3P
  - Contingent Resources
    - 1C
    - 2C
    - 3C
  - Unrecoverable

- **Prospective Resources**
  - Low Estimate
  - Best Estimate
  - High Estimate
  - Unrecoverable

Classify by chance of commerciality (Risk) of project applied.

Categorise estimates based on uncertainty of sales quantities associated with project.

Source: SPE OGRG April 2007

Source: PRMS 2007
PRMS Reserves Guidelines

To be included in the Reserves class:

- a project must be sufficiently defined to establish its commercial viability.
- there must be a reasonable expectation that all required internal and external approvals will be forthcoming
  And
- there is evidence of firm intention to proceed with development within a reasonable time frame.

**Reasonable Expectation:** Indicates a high degree of confidence that the project will proceed with commercial development

Source: PRMS 2007
PRMS Commercial Criteria for Reserves Booking

Commercial

Economic

Committed

project (at some level) must yield a positive net present value using the evaluator’s assumed conditions and discount rate

project development must be initiated within a reasonable time frame (typically 5 years)

All exceptions should be clearly documented

• Long time scale multi-field gas project underpinned by gas contracts
• Gas cap awaiting blow down after oil rim is produced
• Oil fields awaiting future development due to market eg OPEC countries

Source: PRMS 2007 and RISC analysis
PRMS Reserves & Resources: Risk vs. Uncertainty

• Under the PRMS, risk and uncertainty are treated separately

• Risk applies to the **commercial maturity** of a project hence:
  
  Exploration (Prospective Resource):
  => Chance of Discovery (risk of dry hole)

  Discovery (Contingent Resource):
  => Chance of Development (risk of non-commercial discovery)

• Uncertainty is considered in **recovery** for a given project hence:

  High Confidence  => Proved Reserves (1P or P90)
  Best Estimate    => Proved+Probable Reserves (2P or P50)
  Low Confidence   => Proved+Probable+Possible Reserves (3P or P10)

Source: SPE PRMS 2007 & RISC Analysis
CSG 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 not "equally likely" and the 3P is not low probability outcome!!!
Why is CSG 3P (so far) not a low probability?

• Areal extent of coals generally much greater than permit area
  => greater potential for resource growth

• Conservative N American “well spacing” rules (SEC driven) and mining conventions
  • => significant understatement of higher confidence resources

• “Low” probability 3P may in fact include “higher” probability resources not recognised due to certification process used

• Full life of permit vision not disclosed

• Questionable application of SPE PRMS – even by independent reserves certifiers!!!
How are CSG Reserves booked now?

- 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

- For typical offset well spacing rules, once 1/9 of the acreage has been drilled up on an evenly spaced, all of the acreage will be deemed proved!!
Comments on Current Practice

• May be no direct link between project and reserve
  – Often may have no link between reality of project scope in terms of well numbers / areas to be developed and reserve range quoted
  – can be 1-2 orders of magnitude difference between 1P and 3P reserves for a given property
  – Vastly different scale of development between 1P and 3P e.g. 10’s to 1000’s of wells
  – Vastly different market implied i.e. bcf’s/low Tcf’s to tens of Tcf’s
  – 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 recovery

• Does not provide realistic assessment of project risks and uncertainties

• There is an alternative: refer SPE 117124 Application of PRMS to Coal Seam Gas
CSG Reserve Bookings and the Eastern Australian Gas Market

Gas Reserves (PJ)

- **CSG Possible**
- **CSG Probable**
- **CSG Proved**
- **Conventional 2P**

Difference Reserves - Domestic Demand: 41,000 PJ

Unapproved projects and gas developed or produced beyond 20 year time frame:

- 22,000 PJ

Source: Company websites, ABARE 2010 and RISC Analysis
Eastern States Gas Reserve Statistics

- In aggregate, reserves bookings are 2.8 times Eastern States 20 year gas demand
  - Surplus of 41,000 PJ over 20 year demand
  - PRMS has “reasonable development timeframe” guideline (5-year recommended)
  - If not 5 years, how long is reasonable – 20, 50, why not 100 years?

- Current CSG unproved reserves/production ratios (R/P) are out of line with norms
  - CSG 1P R/P 25 years
  - CSG 2P R/P 149 years
  - CSG 3P R/P 305 years
  - Conventional R/P 2P 13 years
  - Note that no CSG-LNG projects have yet achieved FID (remember Shell and Gorgon?)

- CSG measure of uncertainty ratios are out of line with norms
  - CSG 2P/1P 6.0
  - CSG 3P/1P 12.3
  - Typical conventional LNG project 2P/1P ratio at sanction would be 1.25 - 1.5

- Conclusion? - 1P CSG quantities understated and/or some of the reserves are in fact contingent resources based on project maturity criteria
SPE - Qualifications for Reserves Estimators and Auditors

Revised SPE standards for Auditors & Estimators

• PE, PG or physical science degree or professionally registered
• Estimator - 3 yrs professional experience + 1 yr in estimating
• Auditor - 10 yrs prof. experience + 5 years in responsible charge

AND

• Appropriate competence to assess the properties in question (if not, should decline the assignment)
• Obliged to have ongoing training requirements

Source: SPE Reserves Audit Guidelines 2007
### Qualifications for Reserves Estimator & Auditors

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Source: RISC Analysis
Qualifications for Reserves Estimators and Auditors?

Suggested Minimum Standards?

• PE, PG or physical science degree or professionally registered
• Estimator - 5 yrs professional experience + 3 yrs in estimating
• Auditor - 10 yrs prof. experience + 5 years in responsible charge
• Successful completion of training and accreditation

AND

• Appropriate competence to assess the properties in question (if not, should decline the assignment)
• Obliged to have ongoing training requirements
• Freedom to deliver bad news as well as good => organisation considerations