

LOOKING BEYOND RESERVES:

RESOURCES OTHER THAN RESERVES

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Lecture to SPE Swiss Section

on the occasion of the

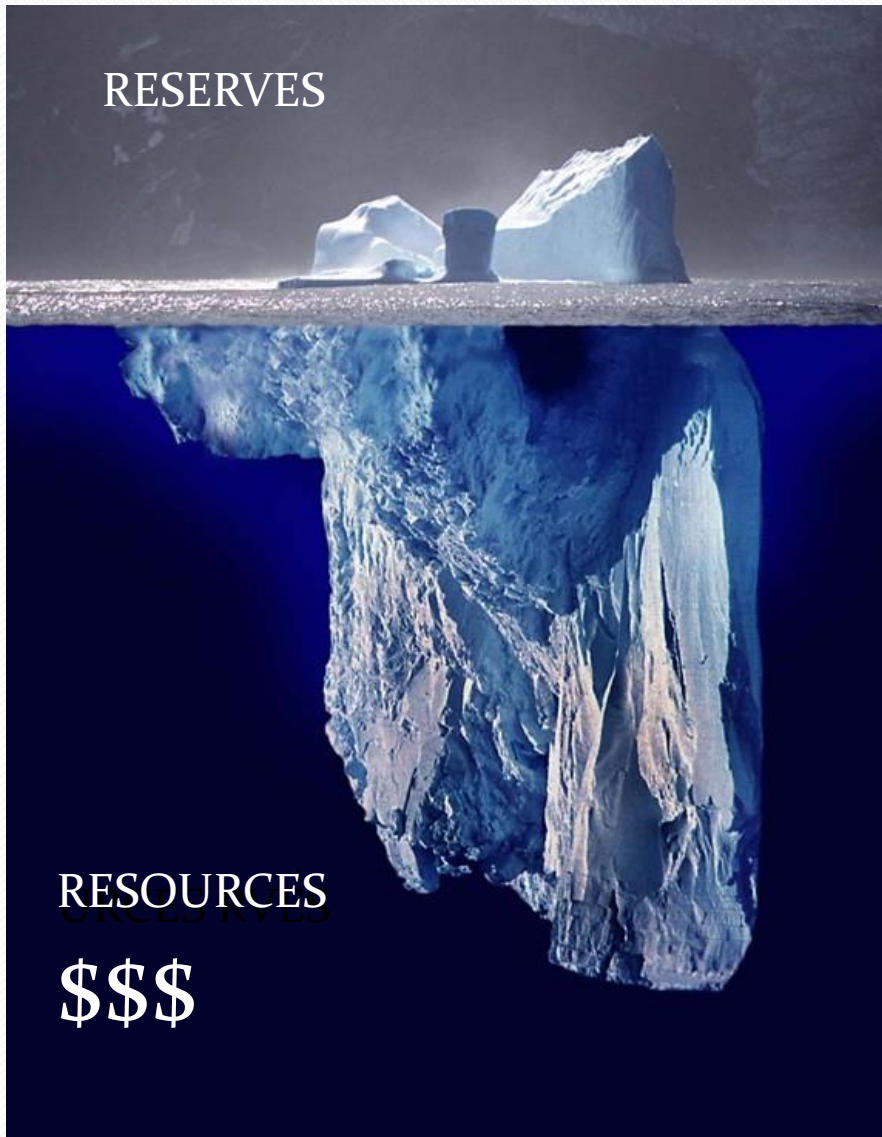
UNECE Expert Group on Resource Classification, Fifth Session

Geneva, 1 May 2014

CAVEAT

- Many of the issues in my talk are general, but it will be focussed on oil and gas and on the reporting of oil and gas resources for financial purposes.
- I do not speak for the Alberta Securities Commission, from which I retired two years ago.

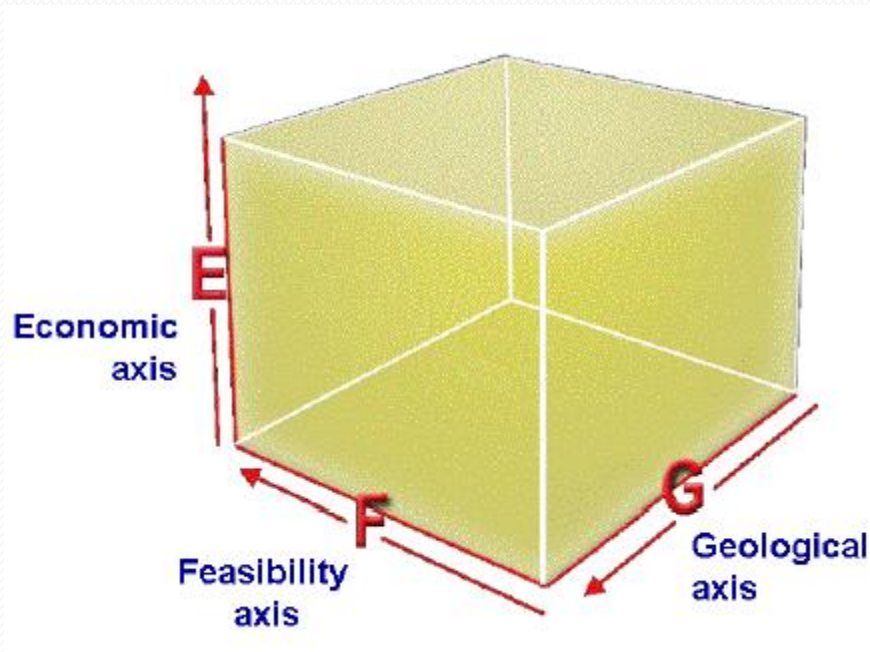
RESERVES



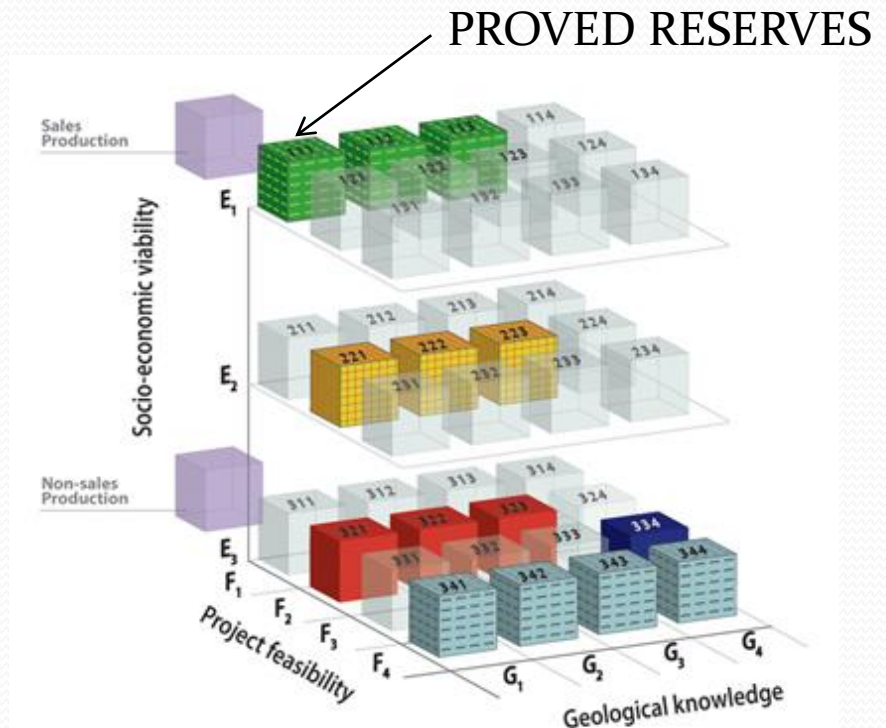
RESOURCES

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UNITED NATIONS FRAMEWORK CLASSIFICATION



- Three criteria:
 - E Economic and Social Viability
 - F Field project status and Feasibility
 - G Geological knowledge



FOR PETROLEUM

OUTLINE

- WHY DO WE: ESTIMATE & CLASSIFY?
- WHO USES IT?
- CANADIAN EXPERIENCE
- CHANGING RESOURCE TYPES
- COGEH RESOURCES OTHER THAN RESERVES
GUIDELINES

WHY DO WE EVALUATE AND CLASSIFY RESOURCES?

- TO COMMUNICATE:
 - Potentially available volumes of oil and gas
 - Resource classes (Chance of recovery)
 - Uncertainty of estimates
 - Timing
 - Commercial viability
- TO MAKE THE TECHNICAL, ECONOMIC, FINANCIAL AND POLITICAL DECISIONS REQUIRED TO OBTAIN AND MANAGE THEIR SUPPLY

UNFC - 2009: I APPLICATION

- UNFC-2009 applies to fossil energy and mineral reserves and resources ... to meet ... the needs of:
 - energy and mineral studies
 - resources management functions
 - corporate business processes
 - financial reporting

UNECE Self-Evaluation Report, 2012–2013

- UNFC is “... a single framework on which to build international energy and mineral studies, analyze government resource management policies, plan industrial processes and allocate capital efficiently.”

USERS

- CORPORATE BUSINESS PROCESSES
 - Investment and operational decisions
- RESOURCES MANAGEMENT FUNCTIONS
 - Plan and administer the optimal use of government owned natural resources
- ENERGY AND MINERAL STUDIES
 - Identify and make decisions on future resource activity
- FINANCIAL REPORTING
 - Provide information to investors to enable them to make investment decisions
 - Raise funds for oil and gas activities

USERS

- Overlap, but not homogeneous
- Different:
 - Objectives
 - Time frames
 - Levels of aggregation
 - Risk and uncertainty profiles

CORPORATE BUSINESS PROCESSES

- Internal investment decisions
 - Optimize operations
- Consistency
 - Internal
 - External consistency not as important
- Internal
 - Review by experts
 - Substantial additional information
- “Project” mostly individual legal entity level:
pool, field

RESOURCE MANAGEMENT FUNCTIONS (e.g. AER, NPD)

- Internal consistency, minimal ambiguity
- External consistency
 - Not necessarily the same as used by
 - Industry
 - Other governments
 - Tailored to government needs
- “Project” at individual legal entity level (pool, field)
sometimes at higher level of aggregation

ENERGY AND MINERAL STUDIES (AER, NEB, NPD, USGS, IEA, etc)

- Internal consistency
- External consistency not as important
 - Different organisations may use different standards
- Aggregated to a high level
- Long time perspective
- “Project” generally large; basin, geological formation, province
- May include resources for which there is no current recovery technology

FINANCIAL REPORTING

- “...to provide financial information about the reporting entity that is useful to existing and potential investors, lenders and other creditors in making decisions about providing resources to the entity. These decisions involve buying, selling or holding equity and debt instruments and providing or settling loans and other forms of credit.”

IASB

INTERNATIONAL ORGANIZATION OF SECURITIES COMMISSIONS (IOSCO)

- “...consistent standards of regulation...”
 - “... integrity of securities markets...”
-
- From **IOSCO Objectives**
 - See <http://www.iosco.org/> for more information on IOSCO

FINANCIAL REPORTING

- Information to make investment decisions
- Attract and retain investors
- Users:
 - Compare companies, projects **between entities**
 - Often not experts
 - Often don't have access to proprietary information
- Auditable
- External consistency, minimal ambiguity
- **Credibility is critical**

FINANCIAL REPORTING: SUB-GROUPS

PUBLIC ROLE

- ⊙ Securities (Equity markets)
 - Public
 - Private
- ⊙ Securities exchanges
- ⊙ Underwriters
- ⊙ *Accounting
- ⊙ *Mergers and Acquisitions

INTERNAL ROLE

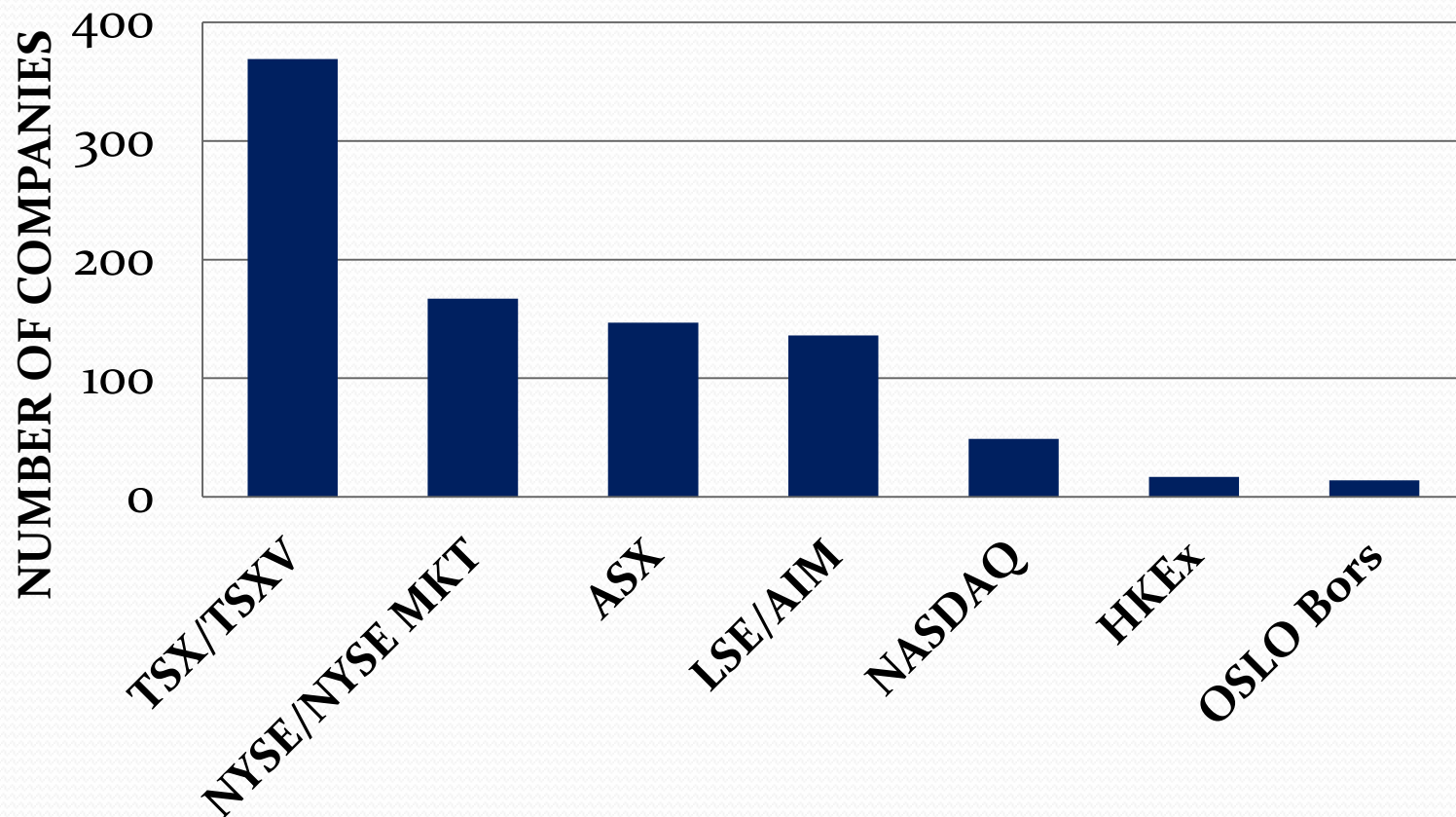
- ⊙ Banks (Debt market)
- ⊙ Financial Analysts
 - Buy side
 - Sell side
- ⊙ Contracts
 - Gas purchase
 - Futures and Forwards

* Internal and External

FINANCIAL USERS

- Need for consistency and comparability **between** companies differentiates them from other users
- Subject to review, audit
- Drives a need for standards

NUMBER OF COMPANIES ON EXCHANGES



At Dec 2013, from http://tmx.com/en/pdf/OilGas_Sector_Profile.pdf

CALGARY HERALD

The Flotation of Oil Companies

To Stop Extravagant Flotations Is in Best Interests of Calgary and of Legitimate Development—Analysis of Paraffin Oil Company Prospectus—Large Profits for Promoters and Small Ones at Best for Investors

WARNING TO THE PUBLIC

Many Oil Companies Now Being Formed with Extravagant Capital — Do Not Buy Oil Stock Without the Fullest Investigation

CALGARY HERALD 1913

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NATIONAL INSTRUMENT 51-101

- Applies to all Canadian Provinces and Territories
- Administered by the Alberta Securities Commission
- Implemented in 2003
- Updated periodically

NI 51-101 CONSISTS OF

- National Instrument 51-101, 2003
 - Legislation governing oil and gas disclosure of public companies
- Companion Policy 51-101 CP
 - Guidance on the interpretation of NI 51-101
 - Includes Sample Disclosure Tables
 - Etc.
- Staff Notices
 - CSA Staff Notice 51-327. Guidance on Oil and Gas Disclosure

NI 5-101

- Governs all oil and gas disclosure
 - Filings, news releases, corporate presentations, etc.
- Mandates Annual filing of:
 - Proved and Probable reserves
 - Evaluated at Forecast Price
- Allows:
 - Other resource Classes
 - Constant Price case

US SEC/FASB

- Only governs filings
- No reference to external standards
- Mandatory Proved at Constant Price
- Optional:
 - Probable & Possible
 - Sensitivity prices

STANDARDS:COGEH

- Introduced in 2002
- Three volumes, some updates
- Prime requirement is **good engineering and geological practice**
- Suitable, but not written specifically, for Financial reporting
- Uses the PRMS Classification system
- Updates 2007, 2014

CANADIAN OIL AND GAS EVALUATION HANDBOOK (COGEH)

- Volume 1. Reserves Definitions and Evaluation Practices and Procedures.
- Volume 2. Detailed Guidelines for Estimation and Classification of Oil and Gas Resources and Reserves.
- Volume 3. CBM, International Properties, Bitumen, Resources Other than Reserves (mid-2014)

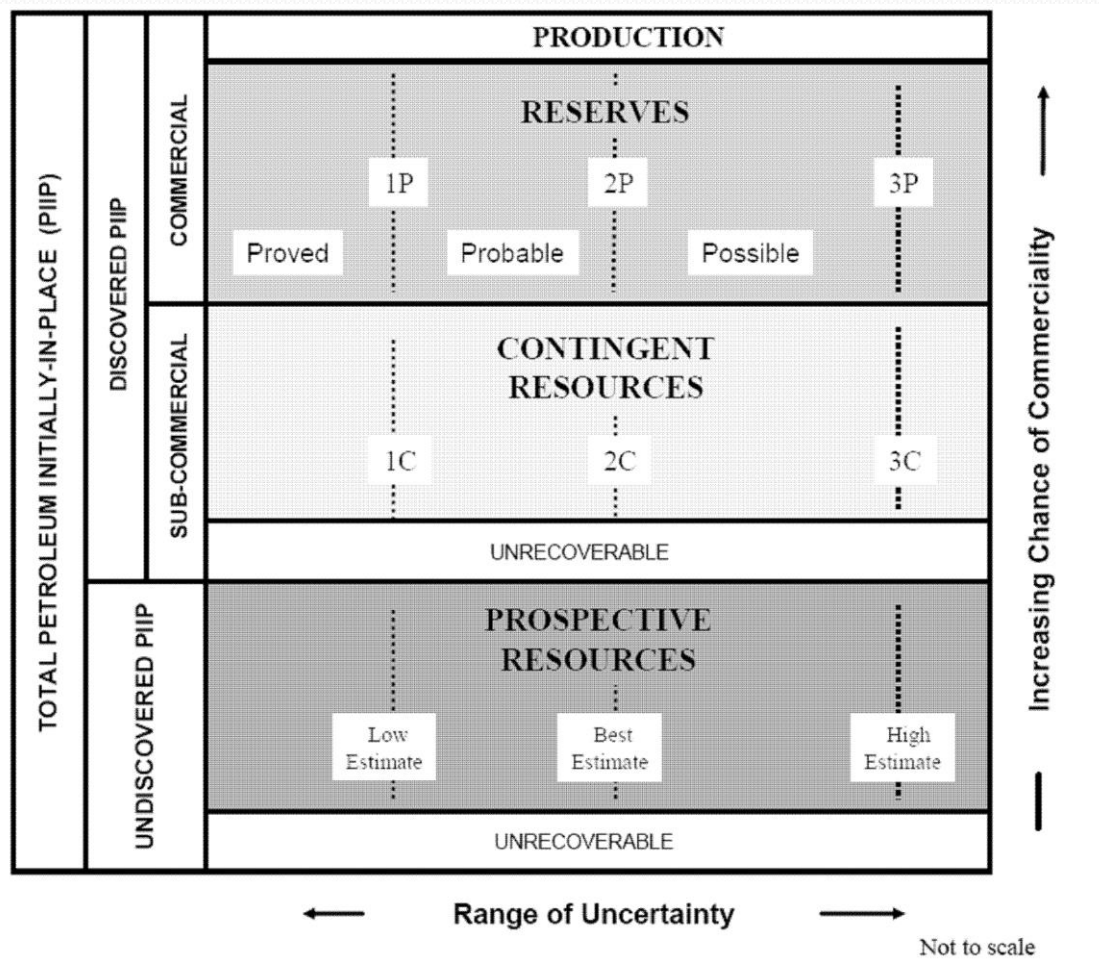
PETROLEUM RESOURCE MANAGEMENT SYSTEM (PRMS)

- Development of long-standing SPE system
- Introduced in 2007
- Provides the oil and gas standards for UNFC

COGEH AND PRMS

- More similarities than differences between COGEH and PRMS
- PRMS is not recognised as a standard by the SEC or CSA
- COGEH is the standard for NI 51-101, and sort of (not explicit) recognised by the SEC
- Proposal for PRMS-COGEH merger

PRMS CLASSIFICATION*



CLASS

CATEGORY

* Used in COGEH

RESERVES

- Reserves ...anticipated to be recoverable from known accumulations, as of a given date, based on
 - analysis of drilling, geological, geophysical, and engineering data;
 - the use of established technology;
 - specified reasonable economic conditions

CONTINGENT RESOURCE

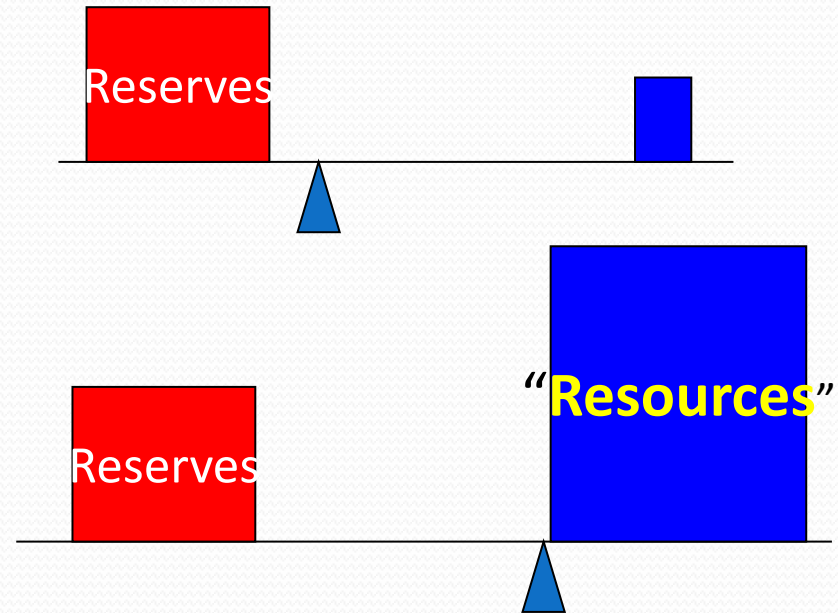
- ... potentially recoverable from known accumulations using established technology or technology under development, ... not commercially recoverable due to one or more contingencies.
- CONTINGENCY A condition that must be satisfied for a portion of Discovered Petroleum Initially in Place to be classified as a Reserve that is:
 - Specific to the project being evaluated, and,
 - Can be expected to be resolved.

COMMERCIAL (Simplified from COGEH)

- Economic viability;
- Market;
- Production and transportation facilities;
- Legal, contractual, environmental, governmental, and other social and economic concerns allow the implementation of the recovery project being evaluated;
- Required internal and external approvals;
- Reasonable timetable (five years is recommended as a maximum but may vary)

A CHANGING BALANCE: CONVENTIONAL TO UNCONVENTIONAL

Conventional: How do we find it?



Unconventional: How do we get it out?

Large supplies of oil and gas from new “unconventional” reservoirs

RESOURCE TYPES

RESOURCE TYPE		COMMON NAME	TRAPPING	STORAGE	STIMULATION ?
CONVENTIONAL		API oil types Natural Gas Natural Gas Liquids	Buoyancy/Seal	Pores & fractures	No
UNCONVENTIONAL	Low permeability gas ¹ (Tight Gas)	Basin Centred gas Tight gas	Buoyancy/Seal but may be other factors	Pores & fractures	Yes
		Shale gas	Adsorption on kerogen, in pores & fractures		Yes
	Low Permeability oil (Tight Oil)	Tight Oil	Buoyancy/Seal but may be other factors	Pores & fractures	Yes
		Shale oil	Uncertain	Pores & fractures	Yes
	Oil sands /carbonates	Bitumen	High viscosity	Pores & fractures	Yes
	Oil shale	Oil shale	Kerogen		Pyrolysis
	Coal Bed Methane (CBM) ⁸		Adsorption in coal micropores, fractures		Yes
	Underground Coal Gasification (UCG)		Not relevant		In-situ generation
	Methane Hydrates		Water (ice) clathrates		Yes

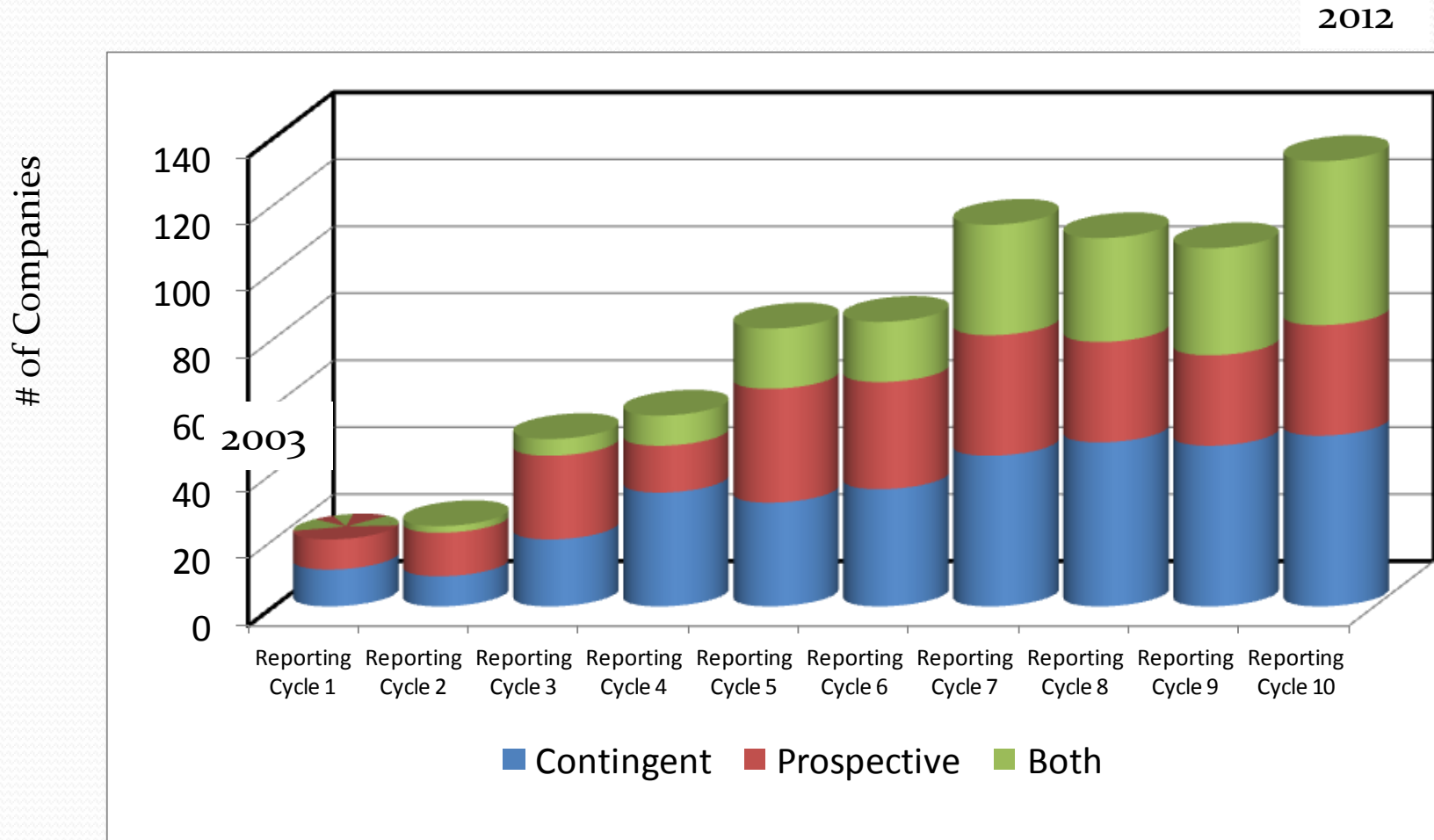
ASC REVIEWS

- 435 Reporting issuers in 2013
- 4680 Oil and gas reviews since 2003
- 50 Countries (Canadian RIs)

ASC REVIEWS OF DISCLOSURE

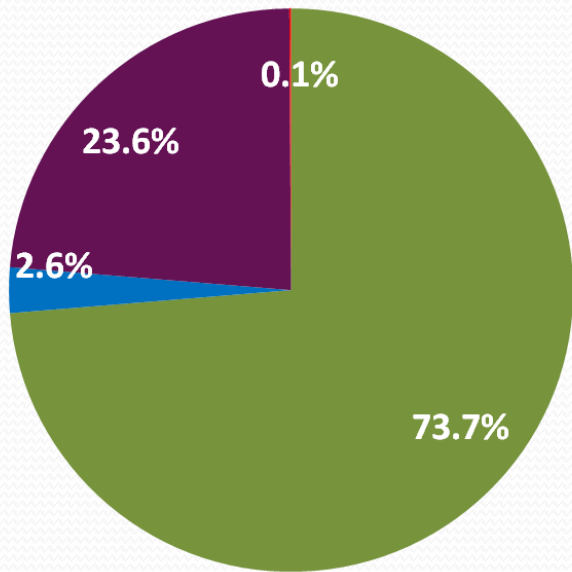
- ANNUAL FILINGS
 - MATERIAL CHANGE REPORTS
 - NEWS RELEASES
 - CORPORATE PRESENTATIONS
-
- SIGNIFICANT CONCERN ABOUT INCONSISTENCY IN EVALUATION AND DISCLOSURE OF CONTINGENT RESOURCES

MORE COMPANIES USING OPTION TO DISCLOSE CONTINGENT & PROSPECTIVE RESOURCES

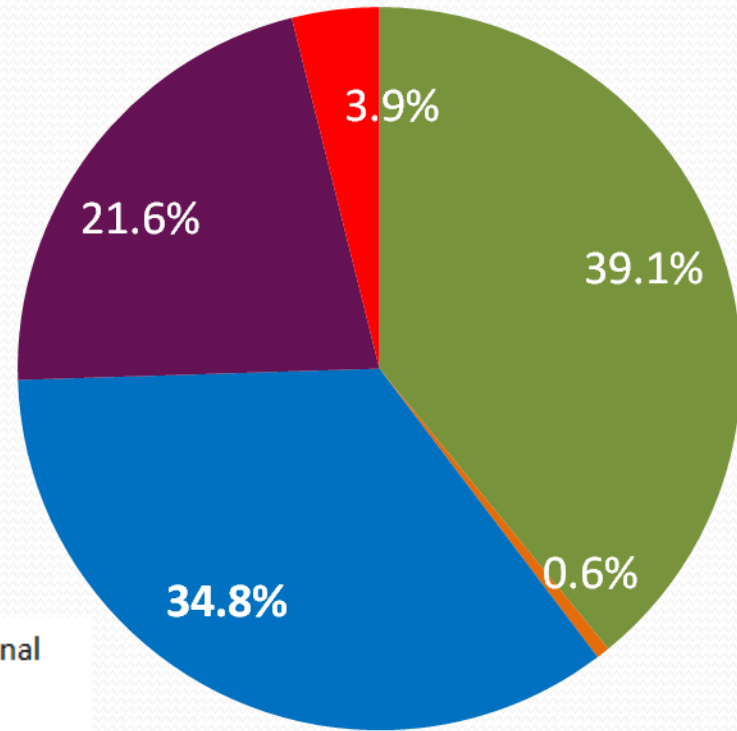


INCREASING UNCONVENTIONAL RESOURCES COMPONENT

YE 2003 (Cycle 1)



YE 2012 (Cycle 10)



- Conventional
- CBM
- Bitumen
- SCO/Shale Oil
- Shale Gas



IMPROVED GUIDELINES

LIMITATIONS OF COGEH AND PRMS

- General guidance for all resource classes
- Focus on conventional reserves
- ASC/SPEE Calgary dealing with other resource classes

ASC REQUEST FOR IMPROVED GUIDELINES

- Letter August 2010 from ASC to SPEE Calgary
- Request to provide improved guidelines
- Concern about losing credibility

- ROTR: Resources Other than Reserves

SPEE CALGARY RESOURCES GUIDELINES SUB-COMMITTEE

- Mandate expanded to include:
 - All Resources Other than Reserves
 - Aspects of Unconventional Resources
- Committee membership
 - Consultants
 - Operating companies
 - Retirees
- Requests for comment from wide variety of parties
- Final review by COGEH Standing Committee

TIMELINE

- 26 Dec 13 – 21 Feb 14. Draft 14 to SPEE members and selected experts for review
- 21 Feb – 23 Apr 14 Draft 15 preparation
- 18 April, Revised Draft 15 to COGEH Standing Committee
- 1- 30 June. Final review, editing, preparation for publishing
- 30 June 14. Publish (in time for year-end reporting)

DRAFT CONTENTS

1. Introduction
 2. General Requirements for Classification of ROTR
 3. Petroleum Initially-In-Place (PIIP)
 4. Projects
 5. Contingent Resources
 6. Discovered Unrecoverable PIIP
 7. Prospective Resources
 8. Aggregation
- Supplementary Glossary

KEY ISSUES

- **Accumulation and Reservoir**
- **What is a “Discovery”, “Known accumulation”?**
- **Extrapolation and use of analogues**
- **Technology**
 - **Established**
 - **Under Development**
 - **Experimental**
- **Project**
 - **Status, Maturity**
- **What is a “Contingency”**
- **Aggregation**

KEY POINTS

- A project scenario is required before resource volumes can be estimated or disclosed.
- The technical requirements for contingent resources are same as reserves.
- The estimation and classification of resources must be based on the results in hand at the effective date of the evaluation, not anticipation.
- Timeline for development should be considered when classifying and evaluating the resources.

EVALUATIONS

- Volumes
- Discounted Net Present Values (NPV)
- Discounted Expected Monetary Values (EMV):
 - $\text{Chance of Commerciality} = \text{Chance of Discovery} \times \text{Chance of Development}$
 - How to estimate Chance of Development?

ACCUMULATION

- ACCUMULATION (no change): *An individual body of petroleum in a reservoir.*

RESERVOIR: CURRENT

- *Current. A porous and permeable subsurface rock formation that contains a separate accumulation of petroleum that is confined by impermeable rock or water barriers and is characterized by a single pressure system.*

RESERVOIR: ISSUES

- **Porous and permeable.**
 - Not so much for “shales”
- **Confined by impermeable rock or water barriers.**
 - Not true for most “unconventionals”
- **Characterized by a single pressure system.**
 - Not necessarily true and how would we know?

RESERVOIR: PROPOSED

- Proposed. *A subsurface rock unit that contains an accumulation of petroleum.*

DISCOVERY

- *NOT PREVIOUSLY DEFINED (COGEH or PRMS)*
- Proposed: *The confirmation of the existence of an accumulation of potentially recoverable petroleum.*
- What is “*potentially recoverable*”, will vary with the user.

KNOWN ACCUMULATION: OLD

- *An accumulation that has been penetrated by a well. In general, the well must have demonstrated the existence of hydrocarbons by **flow testing** in order for the accumulation to be classified as “known”. However, where **log and/or core data exist**, and there is **a good analogy to a nearby and geologically comparable known accumulation**, this may suffice.*

KNOWN ACCUMULATION

- “Flow testing” may take years and only after stimulation
- Log and/or core often available
- Good analogy may not be available

KNOWN ACCUMULATION: NEW

- ... penetrated by a well that has demonstrated the existence of potentially recoverable petroleum, where:
 1. demonstrated the existence of moveable petroleum by flow testing, or,
 2. Where there is no flow test, if log and/or core data exist, and there is a good commercial analogue that supports an assumption of the existence of moveable petroleum, or,
 3. **Where log and/or core data demonstrate the existence of an accumulation for which recovery potential can only be justified through extensive testing or experimental technology, this may suffice to permit classification of the associated PIIP as “discovered unrecoverable” until a technically viable recovery technology can be demonstrated.**

ANALOGUES

- The transfer of information from a source (analogue) to a target or subject reservoir
- Current guidance is for reserves: *Fields having similar properties that are at a more advanced stage of development or production history than the field of specific interest; may provide concepts or patterns to assist in the interpretation of more limited data.*

ANALOGUES Cont.

- Analogues for ROTR:
 - May be limited in number and quality
 - Not “*at a more advanced stage of development or production history*”
- But still provide useful information.

ANALOGUES: FACTORS

- Representative nature.
 - Completeness
 - Generally provide a best estimate
 - Scale
-
- Applicability to the subject reservoir should be reflected in the Low-Best-High spread.

EXTRAPOLATION

- Relevance of information as you move away from a control point?
- Geological formation
 - May be able to go a long way
- Presence of hydrocarbons
 - May have information from older wells
- Productivity
 - Assume heterogeneity and limited distance unless there is evidence to support otherwise.
- Geological models, Geostatistics?

RESERVOIR AND RECOVERY PROCESS ANALOGUES

- Reservoir analogue: A reservoir with similar rock properties ... that can be used as a model for the subject reservoir.
- Process analogue: A recovery process ... that can be applied to the subject reservoir

RESERVOIR AND RECOVERY PROCESS ANALOGUES

- **Cannot be considered separately**
- A Recovery Process that is Established Technology for one reservoir may not be Established Technology for another reservoir,
- E.g. SAGD in oil sands vs carbonates

PROJECTS: CONTINGENT RESOURCES

- EVALUATION SCENARIO
 - Projects often large
- RECOVERY TECHNOLOGY
 - Established technology
 - Technology under development
 - Experimental projects
- CONTINGENCIES
- PROJECT STATUS
 - Conceptual
 - Pre-development studies
 - Development studies
- PROJECT MATURITY
 - Pending
 - On Hold
 - Unclarified
 - Not Viable

RECOVERY TECHNOLOGY

- ESTABLISHED TECHNOLOGY. ... proven to be successful in **commercial applications**.
- TECHNOLOGY UNDER DEVELOPMENT Field test to determine the **economic viability** of a recovery process for the subject reservoir.
- EXPERIMENTAL TECHNOLOGY
Field test to determine the **technical viability** of a recovery process for the subject reservoir.

EVALUATION STATUS

- CONCEPTUAL
 - Initial stage, limited data, project details.
- PRE-DEVELOPMENT
 - More detail, enough to continue assessment, not enough for development decision
- DEVELOPMENT
 - Detailed, provides information for decision on development

PROJECT MATURITY STATUS; CONTINGENT RESOURCES From PRMS

- DEVELOPMENT UNCLARIFIED
 - evaluation is incomplete and there is ongoing activity to resolve any risks or uncertainties.
- DEVELOPMENT PENDING
 - resolution of the final conditions for development is being actively pursued (high chance of development).
- ON HOLD
 - reasonable chance of development but major non-technical contingencies that are usually beyond the control of the operator.
- DEVELOPMENT NOT VIABLE
 - where no further data acquisition or evaluation is currently planned and hence there is a low chance of development.

CONTINGENCIES

- TECHNICAL
 - Technology under development
- ECONOMIC STATUS
 - Economic (PRMS Marginal)
 - Sub-Economic (PRMS Sub-marginal)
 - Undetermined
- NON-TECHNICAL
 - Legal, Regulatory approval, Access to Markets
 - Political, Social licence?

SOCIAL LICENCE

- PRMS “When a project is commercial, this implies that the essential social, environmental and economic conditions are met ...”.
- Also specified in UNFC
- COGEH refers to political contingencies, which could include social.
- **Nowadays a major issue, but no guidance.**

AGGREGATION

- Aggregation of individual prospects into an exploration portfolio
- Aggregation of individual well estimates to the property level
- Aggregation across resource classes
 - Potentially very misleading
 - Not allowed in NI 51-101 (or NI 43-101)

EXAMPLE OF REPORT HEADINGS

- Describe the properties
- Resource Estimates
- Economics
- Project
- Project Status
- Recovery Technology
- Project maturity classes
- Contingencies
- Additional information

RECOMMENDATIONS

- Review and update existing COGEH guidance
- Resource specific guidelines
 - Discovery criteria and evaluation guidelines
 - Review CBM, Bitumen guidelines
 - Prepare Tight gas, Tight Oil
 - Provide examples
- Catalogue recovery technologies
- Review glossaries
- Pursue PRMS-COGEH merger
- Develop process for ongoing guidance

HOW WELL DOES UNFC MEET THE NEEDS OF USER COMMUNITIES?

- ⦿ POTENTIALLY VERY WELL, BUT NOT YET FULLY DEVELOPED
- ⦿ NEEDS TO BE TESTED
 - Corporate Business processes
 - Resources Management Functions
 - Energy and Mineral studies
 - Financial Reporting Standards
 - No current use
 - Not yet sufficiently developed