



National Mineral Resources Classification and Reporting Systems and UNFC-2009: An Australian perspective

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Introductory remarks

- **Most countries with significant mining sectors regularly evaluate their national mineral stocks**
 - To inform policies and decision by providing information on what is likely to be available for mining
- **Governments cannot undertake resource assessments for all known mineral deposits**
 - Staffing/expertise limitations and lack of access to sensitive data on economic viability of deposits
- **National reporting needs to be based on company reports on individual deposits**
 - Companies listed on the Australian Securities Exchange are required to report publicly, using the Joint Ores Reserves Committee (JORC) Code

Introductory remarks

- Geoscience Australia (and predecessor organisations) has conducted an annual nationwide assessment of identified resources for all major and selected minor mineral commodities since 1975
 - Published as *Australia's Identified Mineral Resources* (available online)

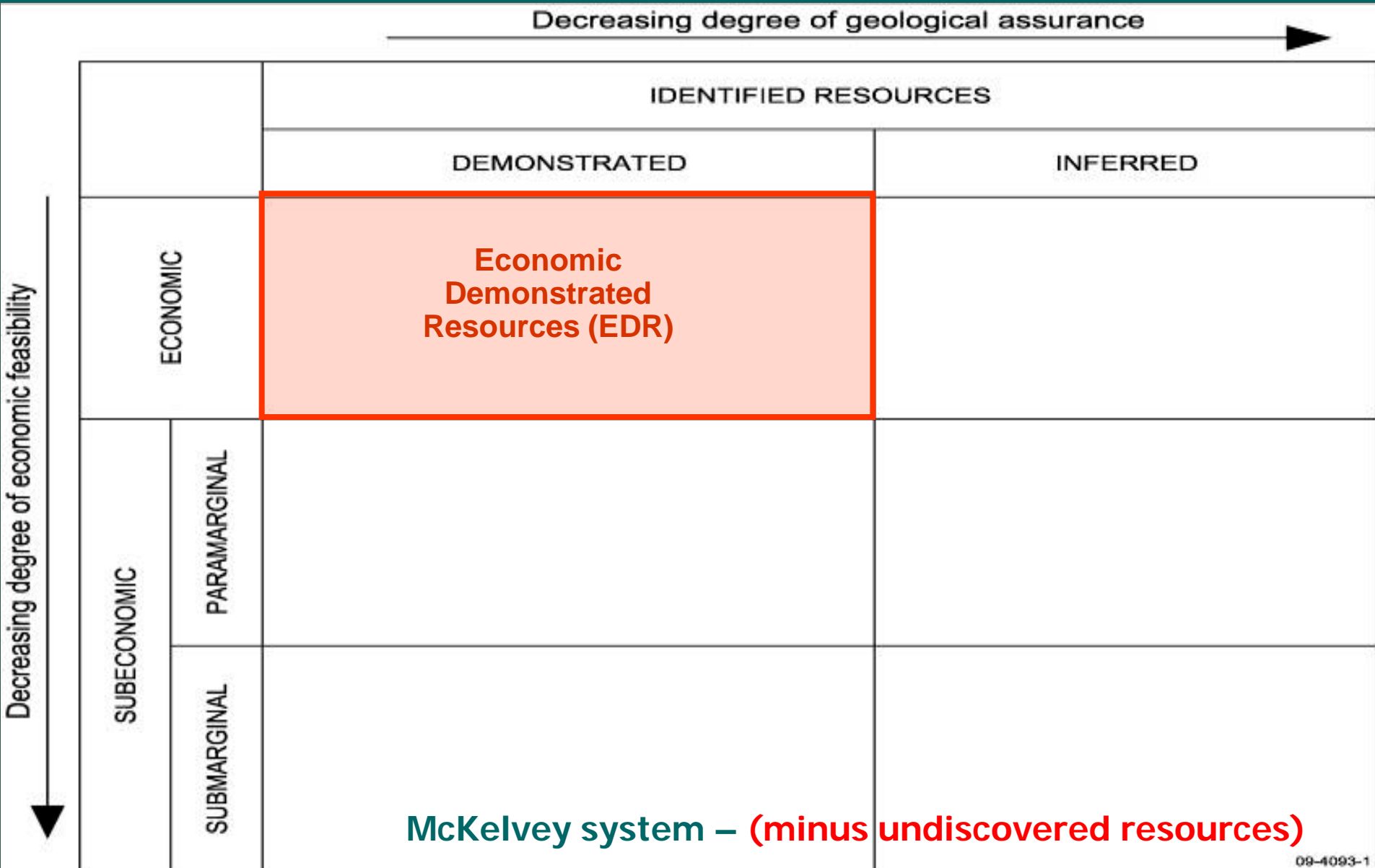
International developments

- **Committee for Mineral Reserves International Reporting Standards (CRIRSCO) is promulgating its Template for public reporting of mineral reserves and resources**
=~ JORC Code
- **Petroleum Resources Management System (PRMS) is also being promulgated internationally**
- **United Nations Framework Classification (UNFC)**
 - **Inputs from CRIRSCO and petroleum groups**

Outline of presentation

- **Describes the Australian national minerals resources reporting system and the CRIRSCO [JORC] Template**
- **Maps the national system to CRIRSCO Template and to UNFC-2009**
- **Briefly mentions**
 - **How Australia's petroleum resources are reported**
 - **The special case of U resources classification**
- **Considers national reporting under the UNFC**
 - **To provide information on resources likely to be available in short, medium and long time scales**

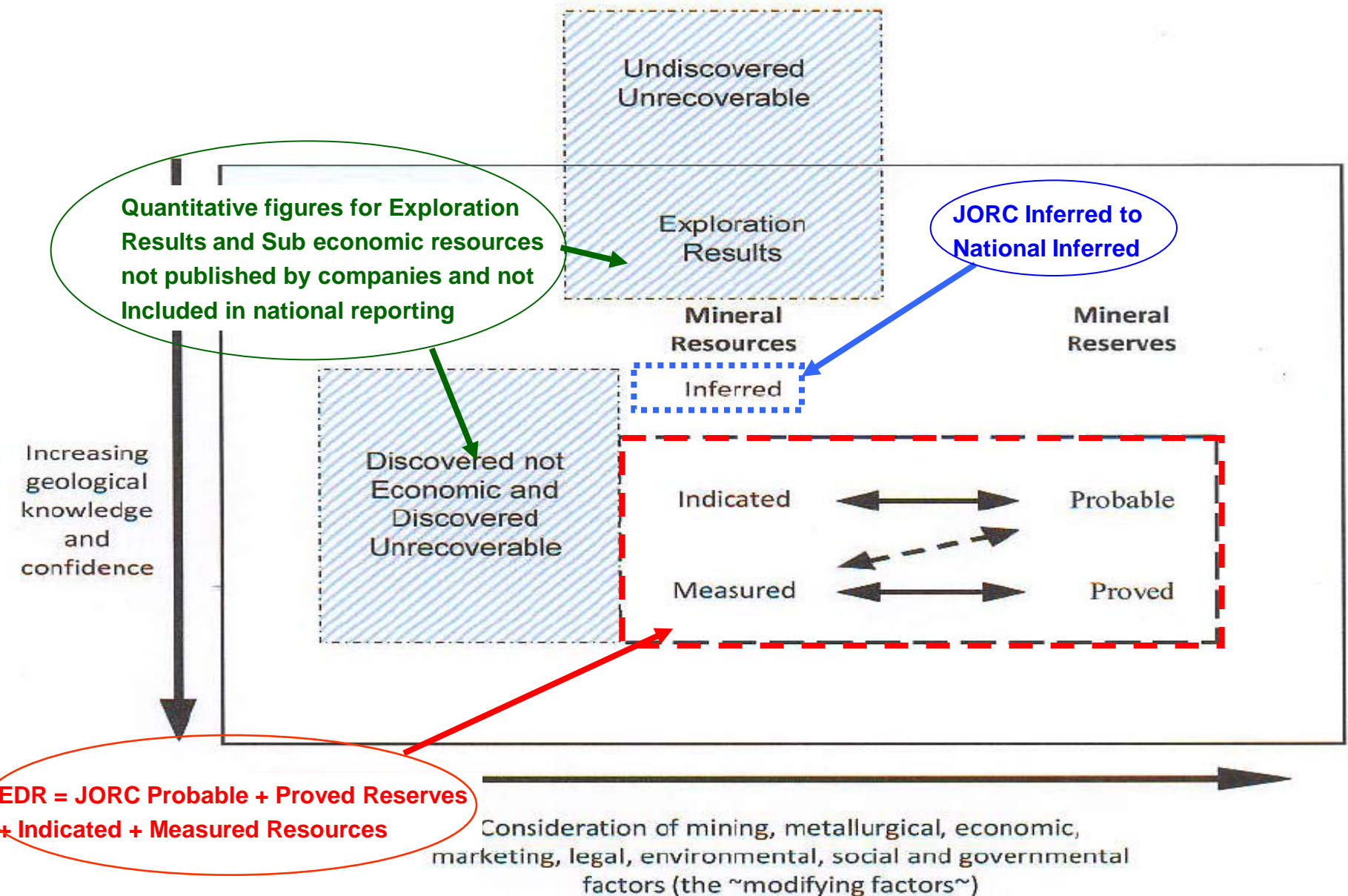
mineral inventories: Australia's system



From company reports to national inventory

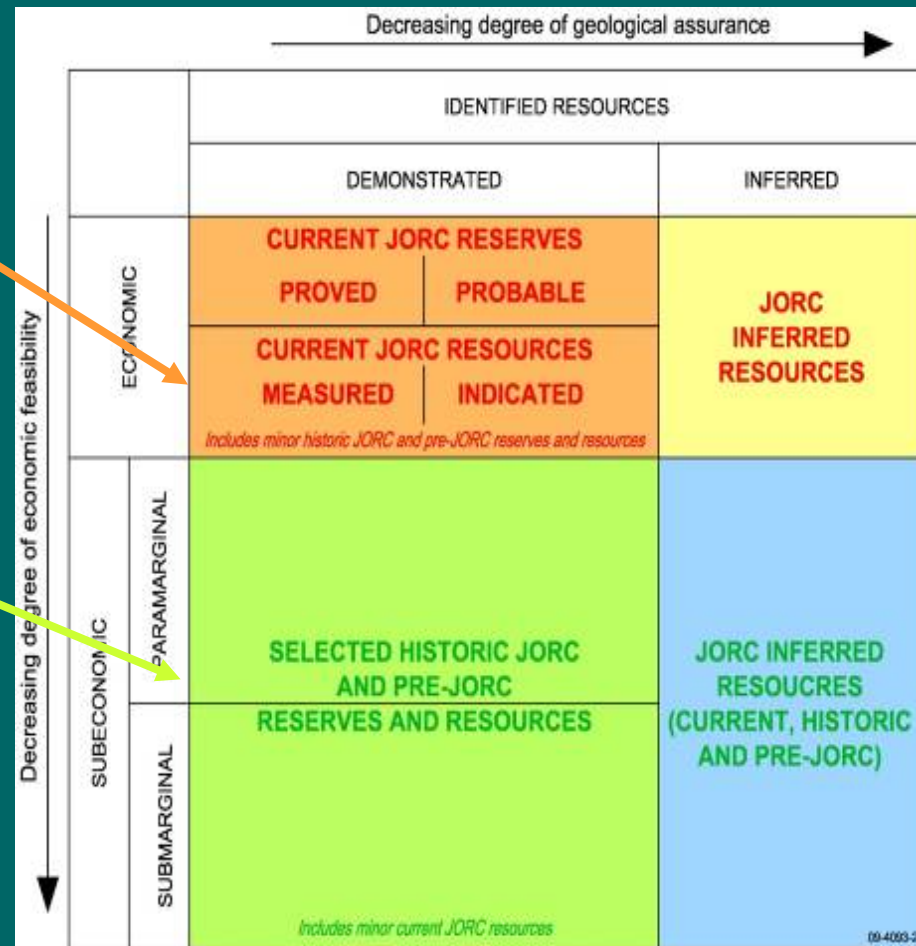
- All resources in JORC-compliant reports must have “**reasonable prospects for economic extraction**”
 - JORC **Reserves** provide commercial (**relatively short term**) view of what is to be mined
- Several JORC categories are aggregated into the key national reporting category: EDR
 - To provide longer perspectives of what is likely to be available for mining
 - Tonnages of contained metals are added up for national totals
 - Cannot add grades and tonnages from different deposits

From company reports to national inventory



Mapping JORC Code to Australia's national system

- Economic Demonstrated Resources (EDR) =**
 'Proved Reserves' + 'Probable Reserves' + 'Measured Resources' + 'Indicated Resources'
 - 'Subeconomic' Resources** mainly from old reports but include some from current company reports assessed to be "promotional"



National minerals inventories: Not a precise science

- Estimating the total amount of each commodity likely to be available for mining in the longer term is **not a precise science**
 - JORC ‘Reserves’, will in general all be mined, but they only provide a short term view of what is likely to be available for mining
 - Most current JORC ‘Measured’ and ‘Indicated’ Resources are likely to be mined
 - Some current JORC ‘Inferred’ and ‘Subeconomic’ Resources will also be mined
 - New discoveries (including extensions to known deposits) will add to the resource inventory

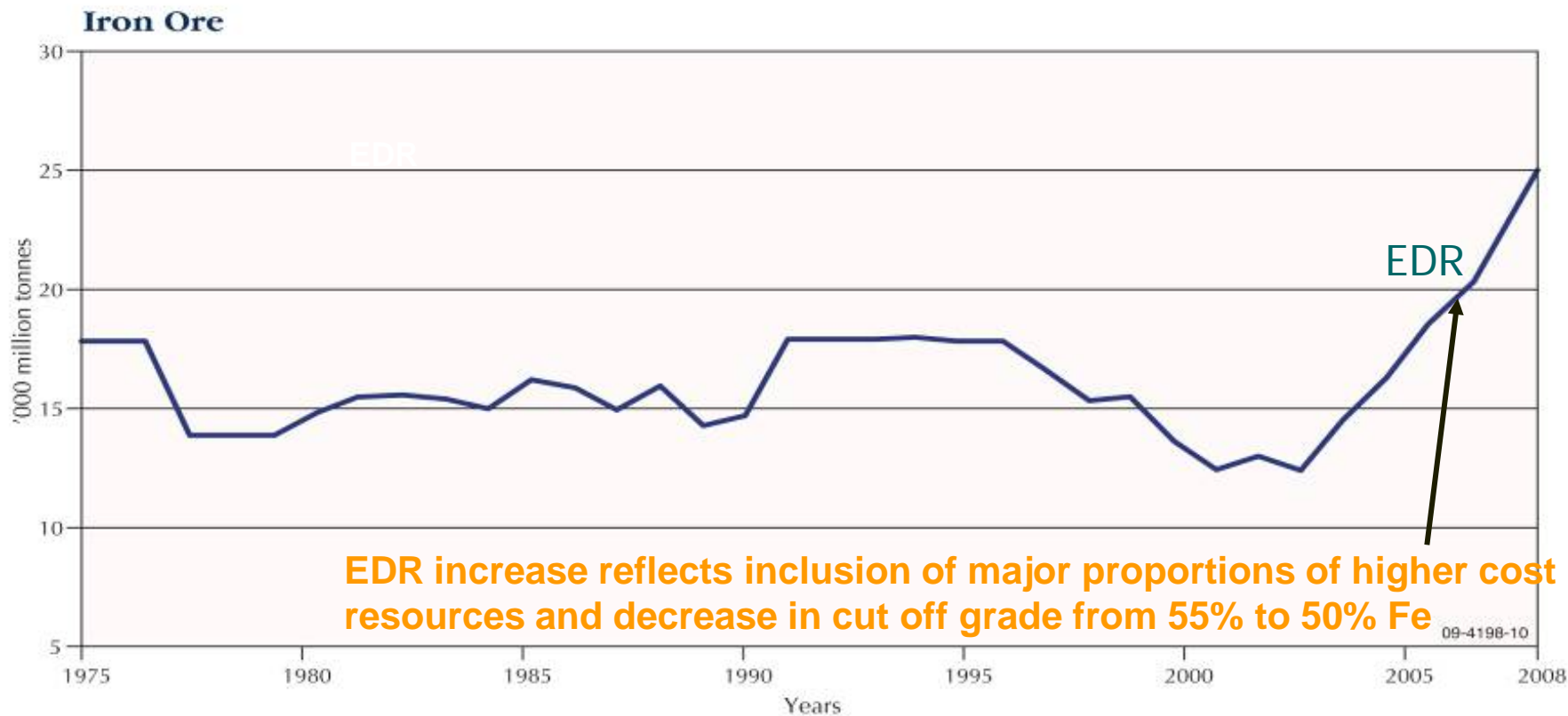
Not all identified resources will be mined in foreseeable future

- **The relative economic quality of a deposits is important in determining when and whether it will be mined**
 - **In an increasingly globalised world, the development of individual deposits will depend on how they compare with competing deposits elsewhere**
 - **Projected returns on investment are important**

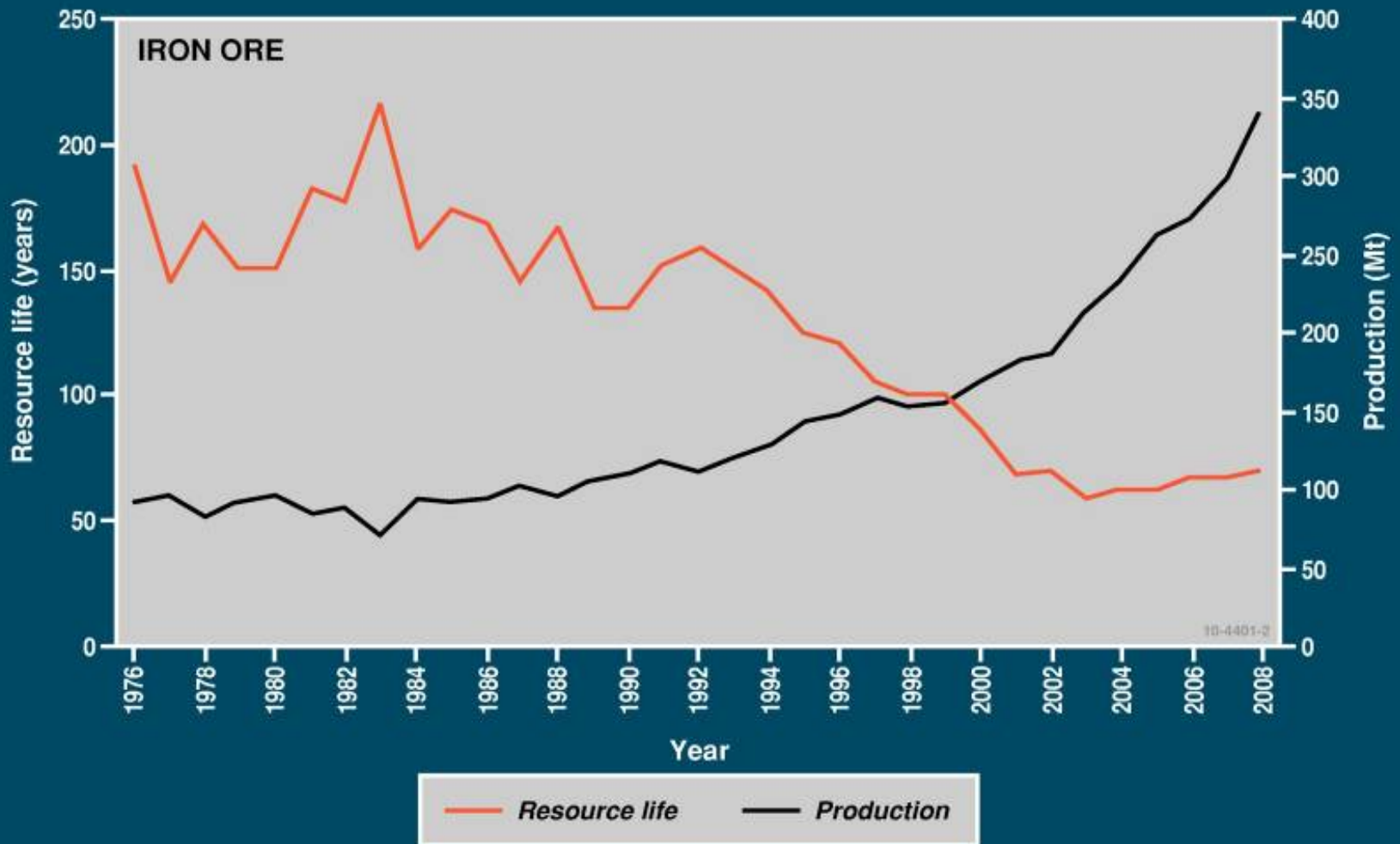
EDR = Key indicator

- **EDR** considered to provide a reasonable and objective indication of what is **likely to be available for mining in the long term (25 years)**
 - Adding JORC Reserves and Resources is not considered a problem in this national context
 - Both “inherently economic”
 - EDR “anticipates” movement of Resources to Reserves
- In addition to EDR, Geoscience Australia also reports national **Reserves** and **Inferred Resources**

EDR



Iron ore production and resource life*



* EDR/Production



Analysis of quality of iron ore resources

Magnetite needs upgrading/pelletizing.
Only minor production in Australia to date

Premium Brockman ore only 6%.
Resource life 25 yrs at current prodn.



Iron ore production and resource life



What do some other countries report?

- **USGS publishes “Reserves”**
 - Comparable with EDR
- **Canada publishes Reserves (JORC equivalent) in operating mines**
 - Except for U (equivalent to EDR)
 - Shorter term perspective on national resources
- **These differences in national reporting are not widely appreciated**

Outline of national petroleum resources reporting in Australia

- No equivalent to JORC
- “Traditional” Petroleum Industry Classification
 - Category 1 comprises current Reserves of those fields which have been declared commercial
 - It includes both Proved and Probable Reserves
 - Category 2 comprises estimates of recoverable Reserves which have not yet been declared commercially viable
 - They may be either geologically proved or are awaiting further appraisal
 - Both categories are at “Proved and Probable” level of certainty

Outline of national petroleum resources reporting in Australia

2. McKelvey Classification

- **Economic Demonstrated Resources**

Resources judged to be economically extractable and for which the quantity and quality are computed partly from specific measurements, and partly from extrapolation for a reasonable distance on geological evidence

- **Subeconomic Demonstrated Resources**

Similar to Economic Demonstrated Resources in terms of certainty of occurrence and, although considered to be potentially economic in the foreseeable future, these resources are judged to be subeconomic at present. They are also at a “proved and probable” level of certainty

Summary outline of national petroleum resources reporting in Australia

- Sum of Category 1 and Category 2 Reserves equals the sum of EDR and SDR Resources
- EDR “anticipates” movement of Category 2 Reserves to Category 1

Mapping to a universal template

- **It is useful to map the various classification and reporting systems for mineral and energy resources to a common base to**
 - Clarify similarities/differences between the systems
 - Enable comparisons between countries' inventories and better estimates of total world stocks
- **The UNFC-2009 is a universal template**
 - Broader coverage than CRIRSCO Template
 - Includes non-commercial and undiscovered
 - Do not need to use all categories

Why we need a universal template

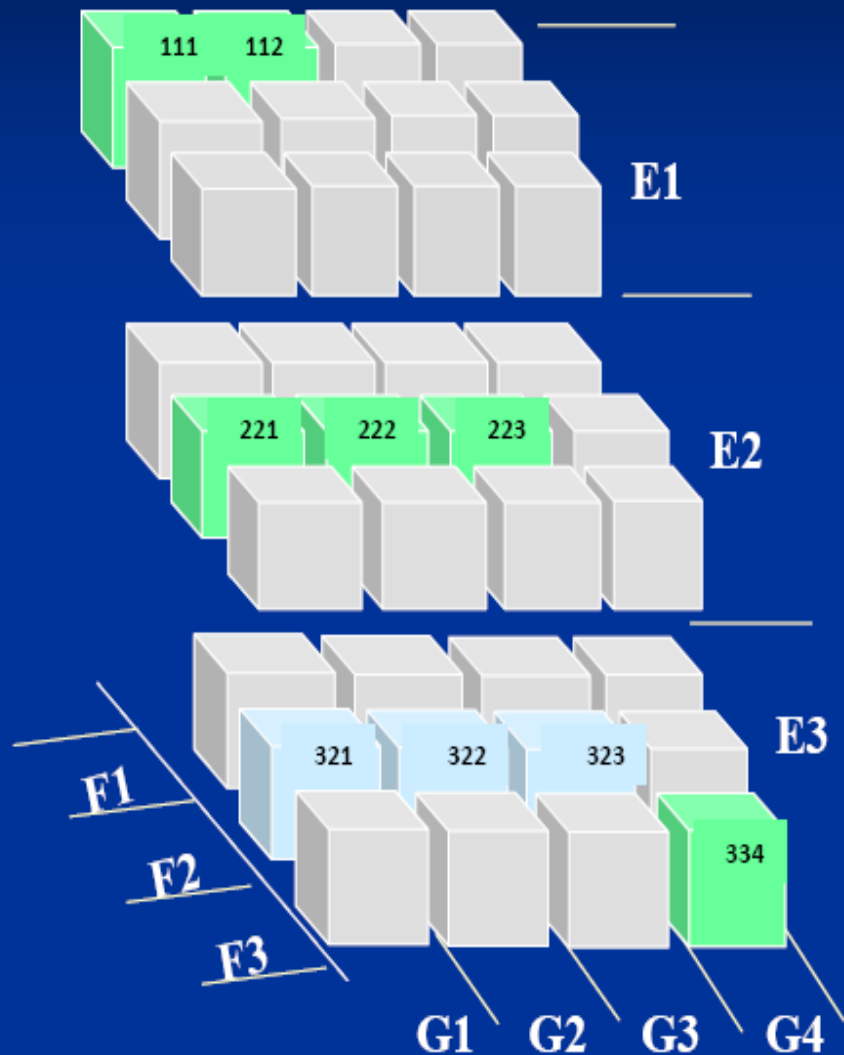
- **When Australia compares its resource stocks with those of other countries, we are not comparing like with like**
 - This has become clear as we mapped to UNFC
- **It means that global totals are not reliable indicators of what is likely to be available for mining**
- **Mapping all to UNFC will make these issues clear and provide a basis for addressing them**

UNFC as universal template

- **The 2009 version of the UNFC is considerably more developed than its predecessor**
 - Takes account of a range of views
- **Industry, financial, national and international resource reporting systems are being/should be mapped to UNFC-2009**
 - To clarify the similarities and differences between systems in use around the world
- **Many countries already have mandated commercial reporting systems**
 - **These countries will not adopt the UNFC**
 - Other countries may choose to use the UNFC

Mapping CRIRSCO to UNFC-2009

UNFC



111 = Proved Reserves
112 = Probable Reserves

221 = Measured Resources
222 = Indicated Resources
223 = Inferred Resources

334 = Exploration Results
(Notional mapping)

Sub-class level mapping: CRIRSCO – UNFC-2009

UNFC Classes defined by categories and sub-categories

Total commodity initially in place	Extracted	Sales Production				
		Non-sales Production				
	Class	Sub-class	Categories			
			E	F	G	
Known Deposit	Commercial Projects	On Production	1	1.1	1, 2, 3	
		Approved for Development	1	1.2	1, 2, 3	
		Justified for Development	1	1.3	1, 2, 3	
	Potentially Commercial Projects	Development Pending	2 ¹⁰	2.1	1, 2, 3	
		Development On Hold	2	2.2	1, 2, 3	
	Non-Commercial Projects	Development Unclassified	3.2	2.2	1, 2, 3	
		Development Not Viable	3.3	2.3	1, 2, 3	
Additional quantities in place		3.3	4	1, 2, 3		
Potential Deposit	Exploration Projects	[No sub-classes defined] ¹¹	3.2	3	4	
	Additional quantities in place		3.3	4	4	

CRIRSCO/JORC RESERVES

CRIRSCO/JORC RESOURCES

NOT ECONOMIC AND NOT PART OF CRIRSCO/JORC TEMPLATE

A different international classification system: Uranium Group classification system (IAEA/OECD-NEA)

NEA/IAEA Scheme

Reasonably Assured Resources (RAR) recoverable at less than US\$80/ kg U

RAR recoverable at US\$80–130/ kg U

RAR recoverable at greater than US\$130/ kg U

Inferred Resources (IR) recoverable at less than US\$80/ kg U

IR recoverable at US\$80–130/ kg U



Compilation of Australia's uranium and resources

- **Australia's uranium resources are first compiled into the NEA/IAEA cost categories and then transferred to Australian national resource categories**
 - \leq US130/kg U – equates with EDR
 - $>$ US\$130/kg U – equates with Subeconomic DR
- **The transfer of NEA/IAEA cost categories has required periodic adjustments reflecting U prices**
 - Pre- 2005 the cost category for EDR was \leq US\$40/kg
 - From 2005 - 2011 the cost category for EDR \leq US\$80/kg U

Proposed correlation of Australia's uranium resources with UNFC-2009

UNFC Classes Defined by Categories and Sub-categories						
	Extracted	Sales Production				
		Non-sales Production				
	Class	Sub-class	Categories			
			E	F	G	
Total Commodity Initially in Place	Known Deposit	Commercial Projects	On Production	1	1.1	1, 2, 3
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			Justified for Development	1	1.3	1, 2, 3
		Potentially Commercial Projects	Development Pending	2 ^b	2.1	1, 2, 3
			Development On Hold	2	2.2	1, 2, 3
		Non-Commercial Projects	Development Unclarified	3.2	2.2	1, 2, 3
	Development Not Viable		3.3	2.3	1, 2, 3	

RAR
 \leq US\$130/
 kg U

Inferred
 \leq US\$130/kg U

Subeconomic
 $>$ US\$130/kg U

Inferred
 $>$ US\$130/
 kg U

Total Commodity Initially in Place

A special case: In situ leach uranium projects

- **Leaching uranium from sandstone aquifers**
 - **Acid or alkaline fluids extract uranium**
 - **Viable projects cannot declare Reserves as level of knowledge of grades, continuity, recovery rates, disequilibrium not sufficient**
 - **Can be a problem for financing**

Where are we going?

Greater granularity of national mineral resources reporting

- Australia is trialling further subdivision of EDR to:
 - Distinguish what is likely to be available in **short, intermediate** and **longer time** frames
 - Based on different levels of **assurance of production**
 - These can readily be mapped to the UNFC
- Provide more detail for policy decisions, etc.

Greater granularity of national reporting

- **Economic Resources** (“EDR 1”) = Proven and Probable Ore Reserves (as defined under the JORC Code) [Note this category already published in *Australia’s Identified Mineral Resources* as JORC Reserves]
- **Potential Medium Term Economic Resources** (“EDR 2”) = Measured and Indicated Mineral Resources in existing mines and undeveloped deposits which have had a positive feasibility study/development has been announced
- **Potential Long Term Economic Resources** (“EDR 3”) = Measured and Indicated Mineral Resources in deposits where their grade and tonnage characteristics are similar to deposits being mined elsewhere, but no positive feasibility study/current consideration of mining

Total EDR = sum of EDR1 + EDR2 + EDR3

EDR subdivisions mapped to UNFC-2009

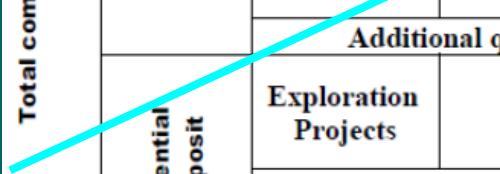
→ Short, intermediate and long term national perspectives

UNFC Classes defined by categories and sub-categories									
	Extracted	Sales Production							
		Non-sales Production							
	Class	Sub-class	Categories						
			E	F	G				
Total commodity initially in place	Known Deposit	Commercial Projects	On Production	1	1.1	1	2	3	
			Approved for Development	EDR 1 1	1.2	1	2	3	
			Justified for Development	1	1.3	1	2	3	
		Potentially Commercial Projects	Development Pending	EDR 2 2	2.1	1	2	3	
			Development On Hold	EDR 3 2	2.2	1	2	3	
		Non-Commercial Projects	Development Unclarified		3.2	2.2	1	2	3
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Additional quantities in place			3.3	2.3	1	2	3		
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Inferred Resources



Paramarginal and Submarginal Resources




Some concluding remarks: National reporting of mineral resources

- UNFC development has focussed on reporting at the scale of individual deposits
 - Now addressing national reporting
- National reporting should be based on of data from individual deposits
 - Only inherently economic/commercial resources should be included
 - The national total for a particular commodity should be derived by reporting the tonnages of that commodity in all deposits for which resources have been estimated
 - **If there is no requirement for companies/others to report resources under their control, this should be included in lease conditions as soon as possible**

National reporting of mineral resources

- Categories used for national mineral resources reporting should align with CRIRSCO/UNFC categories
 - CRIRSCO “**Resources**” encompass deposits of varying commercial attractiveness
 - Some deposits likely to be developed in the short to medium term
 - Others may only be considered for development in the long term
 - UNFC sub-classes “**Development Pending**” and “**Development on Hold**” provide a useful subdivision of the same

National reporting of mineral resources



National category/ UNFC Class	UNFC Subclass	CRIRSCO category
Commercial Deposits [EDR1]	On Production Approved for Production Justified for Development	Proved + Probable Reserves
Potentially Commercial Projects	Development Pending [EDR2]	Measured and Indicated Resources
	Development on Hold [EDR3]	

Resources with lower geological assurance should be reported separately:
Indicated Resources/G3

Summary

- **National reporting should be based on commercial reporting on individual deposits**
 - National totals for mineral commodities derived by summing contained metals in individual deposits
- **It is up to each country to decide what categories it reports**
 - **Should map its reporting categories to UNFC**
 - **To facilitate meaningful comparisons and estimation of global inventories**
- **For major mining nations it is more informative to report national categories which provide short, medium and long term views on what is likely to be available for mining**