

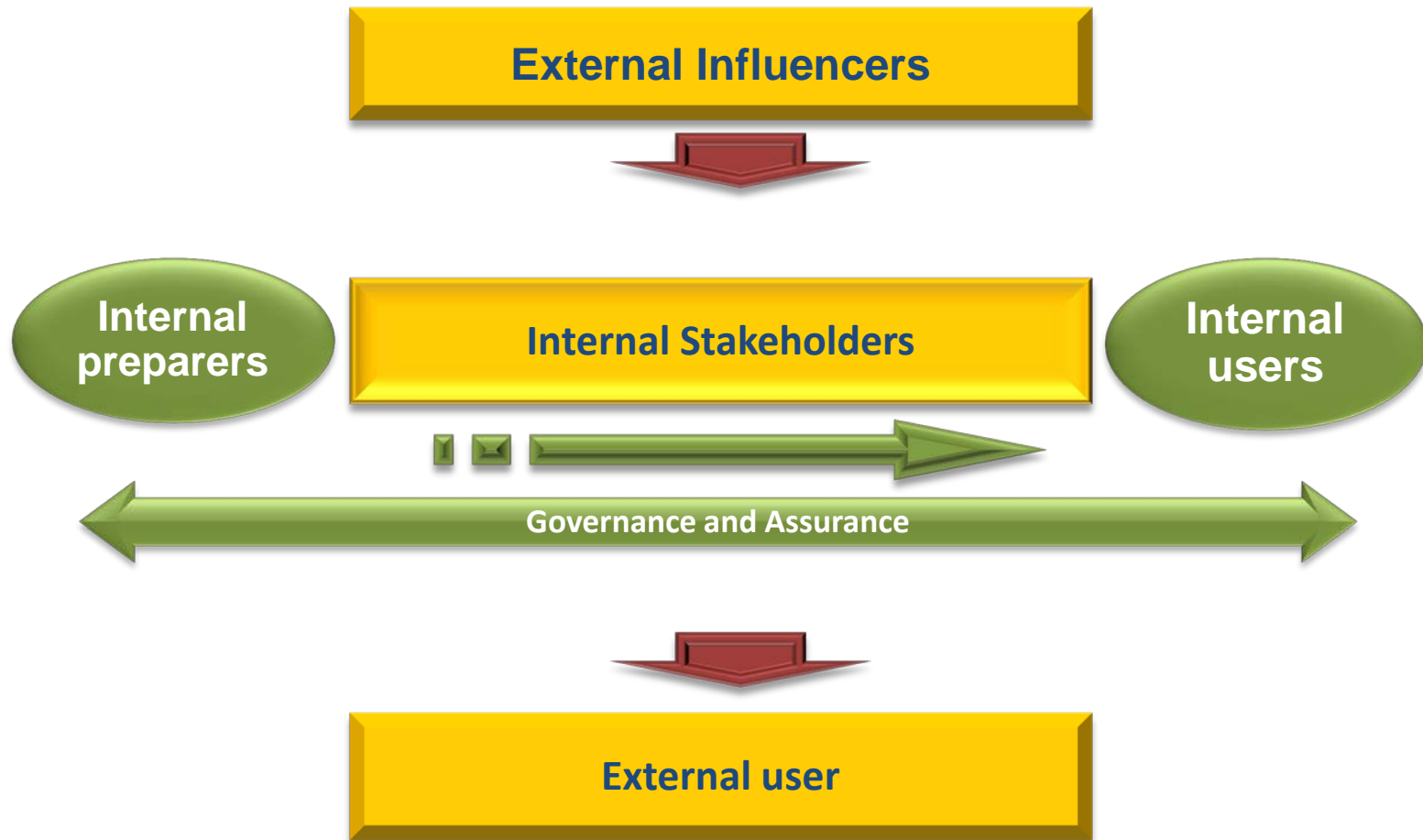
# UNFC–2009 - Applications in Uranium and Thorium Resources: Focus on Comprehensive Extraction

## *How it works and Stakeholder Benefits*

*David MacDonald  
Santiago  
9-12 July 2013*



# Stakeholders of our reported resources

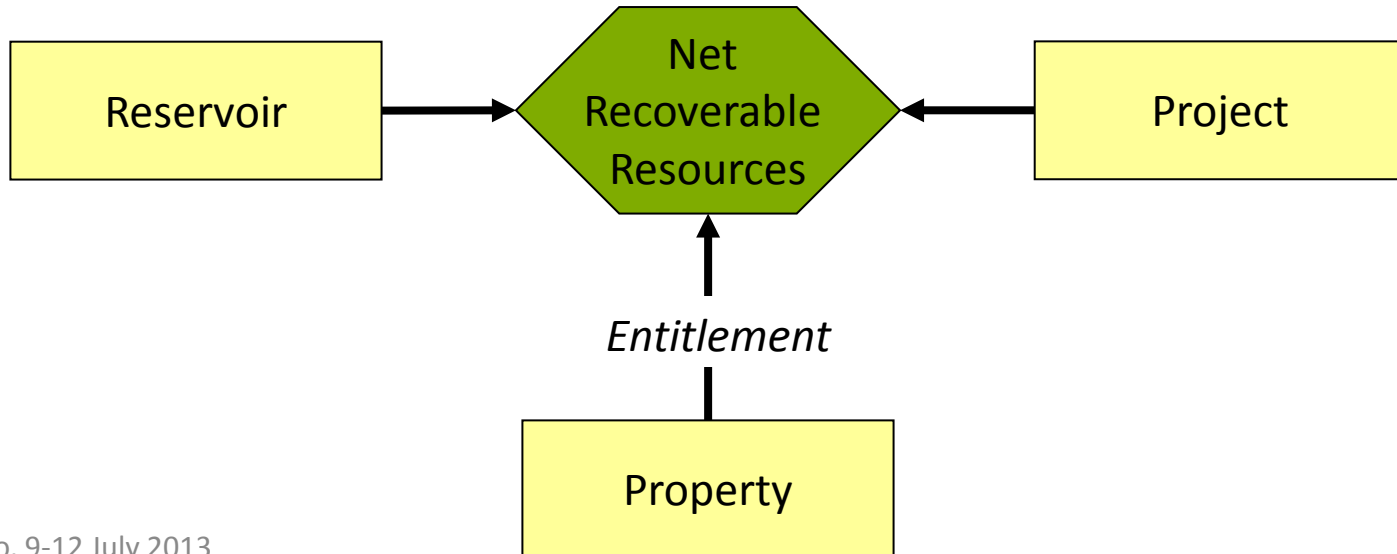


## Diversity in stakeholder characteristics

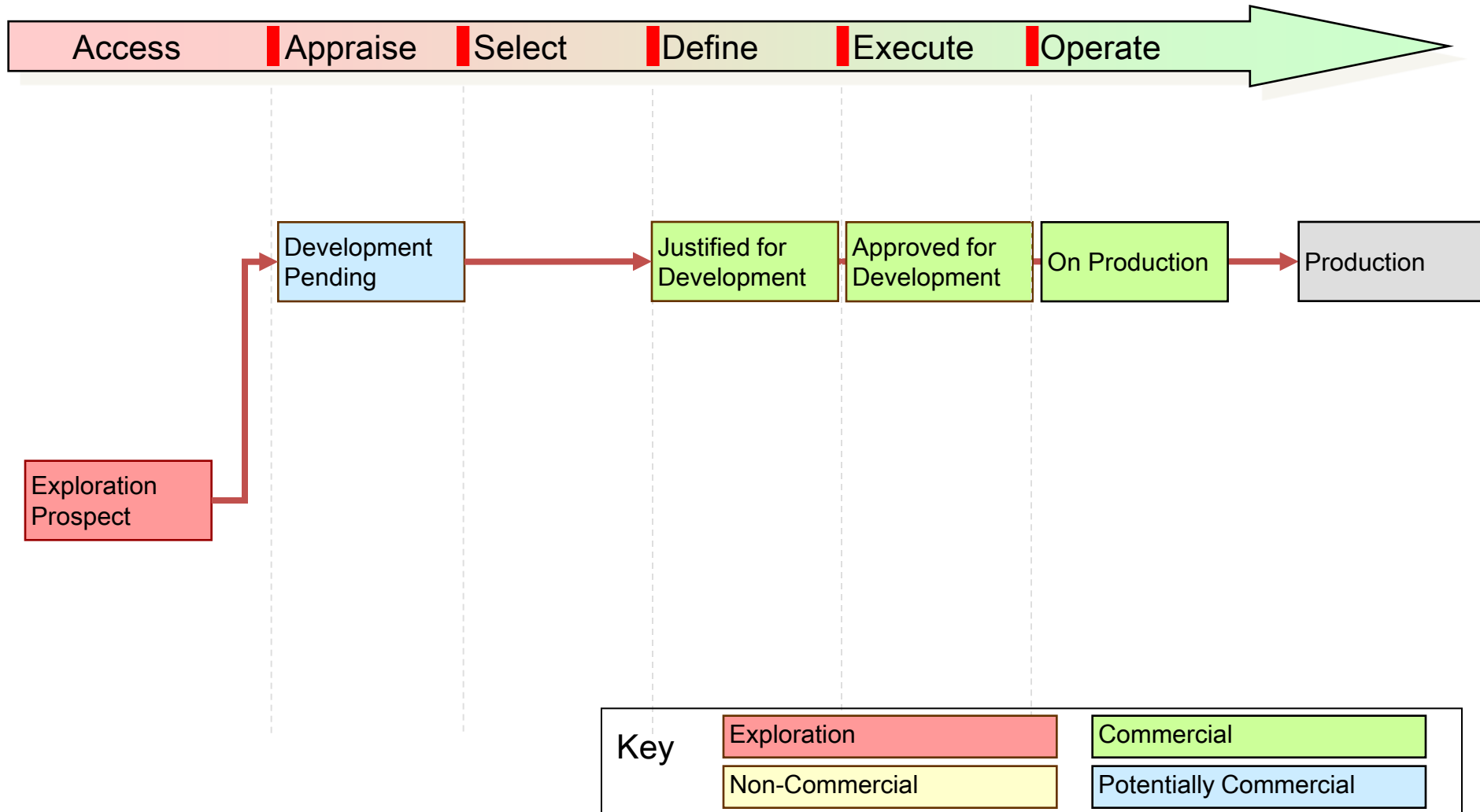
- **Ability to tailor reporting information**
  - Range of information available- financial statements or beyond?
- **Level of sophistication**
  - **Sophisticated users**
    - Industry specialists
    - Use of information as inputs to own analysis using own assumptions
    - Use of full range of value relevant information
  - **Less sophisticated users**
    - Greater reliance on financial statements
- **Conflicts between stakeholders?**
  - Views on cost/ benefit of information
  - View of what is useful information
  
- **Is there one ‘answer’ that meets the needs of all users?**

# Principles for resource identification

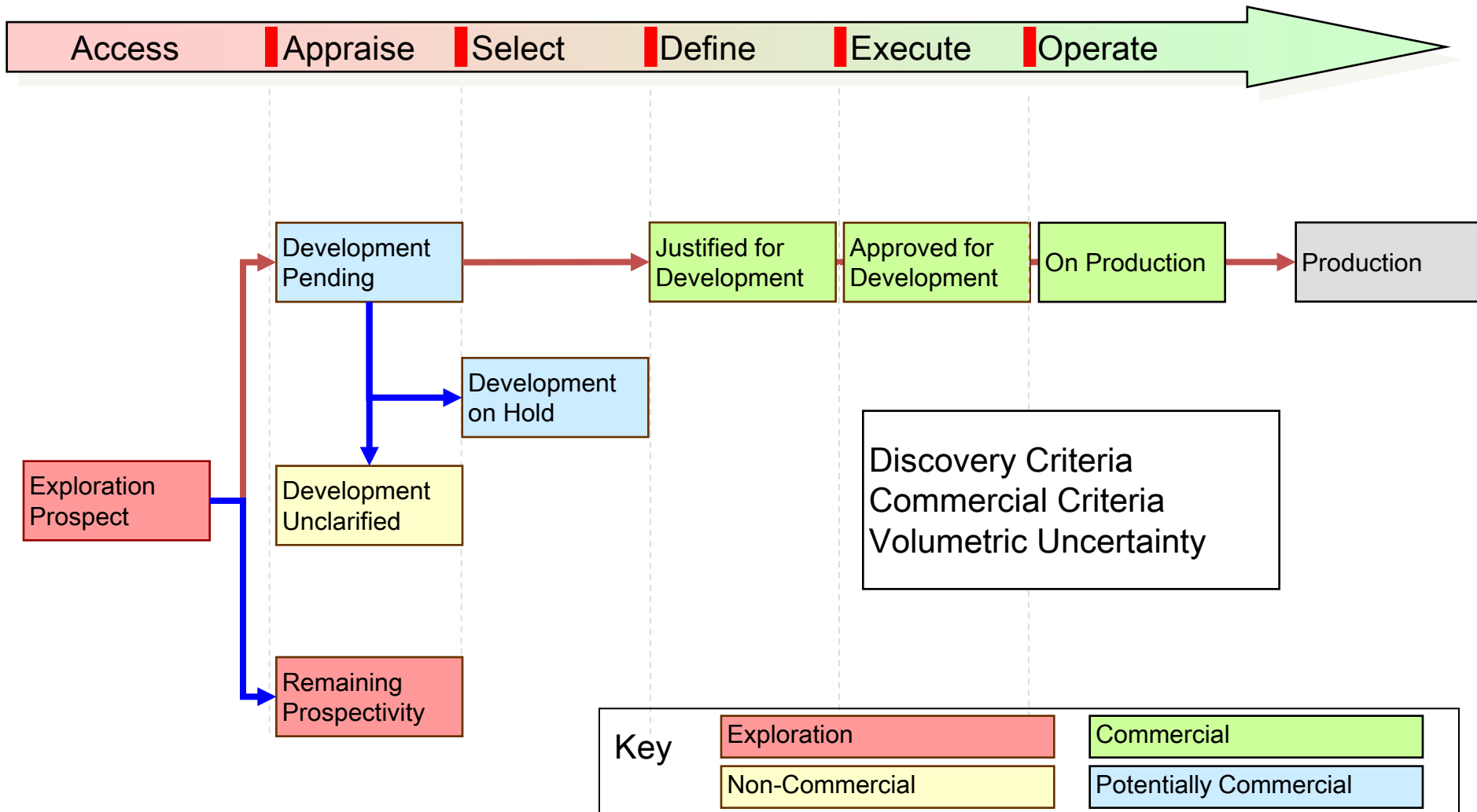
- **Project based**
  - Project management
- **Classification of total volume**
- **Clear boundaries between categories**
  - Discovered resources
  - Commercial reserves



# Resource progression

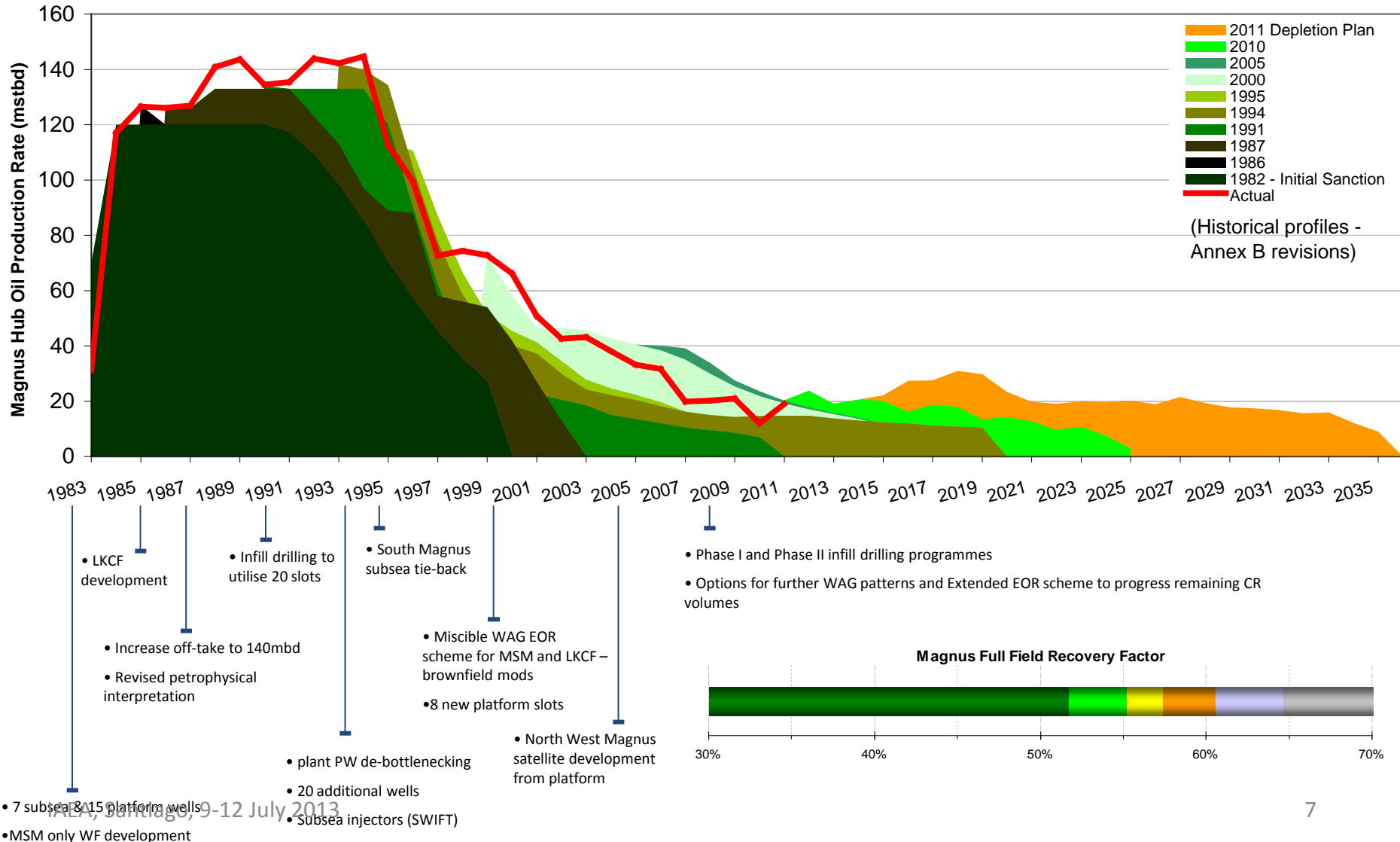


# Resource progression



# Magnus development phases

## Evolution of Magnus Field Production Profiles

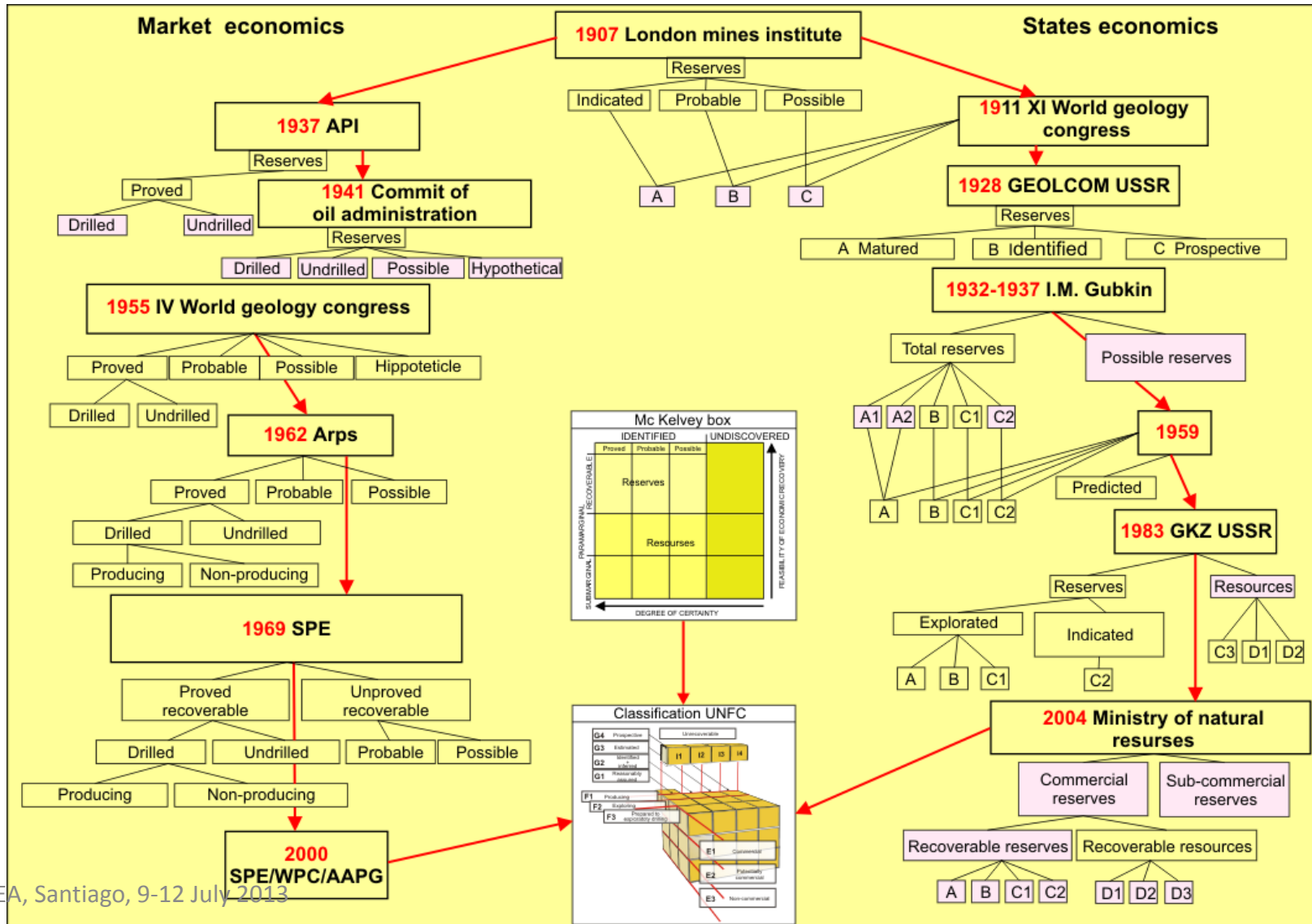


## Resource identification

- **Aids business planning**
- **Investment decisions for individuals and corporations**
- **Allows efficient resource utilisation**
- **Principally an aid to efficient development**



# Resource classification is not finished!



## UNFC – 2009

- **What is it?**
- **How it works**
- **Alignment**
- **Specifications**

## UNFC – 2009

- **United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources**
- **Generic, principles-based system**
  - **Applicable to both solid minerals and fluids**
- **Based on three criteria**
  - Economic and social viability**
  - Field project status and feasibility**
  - Geological knowledge**

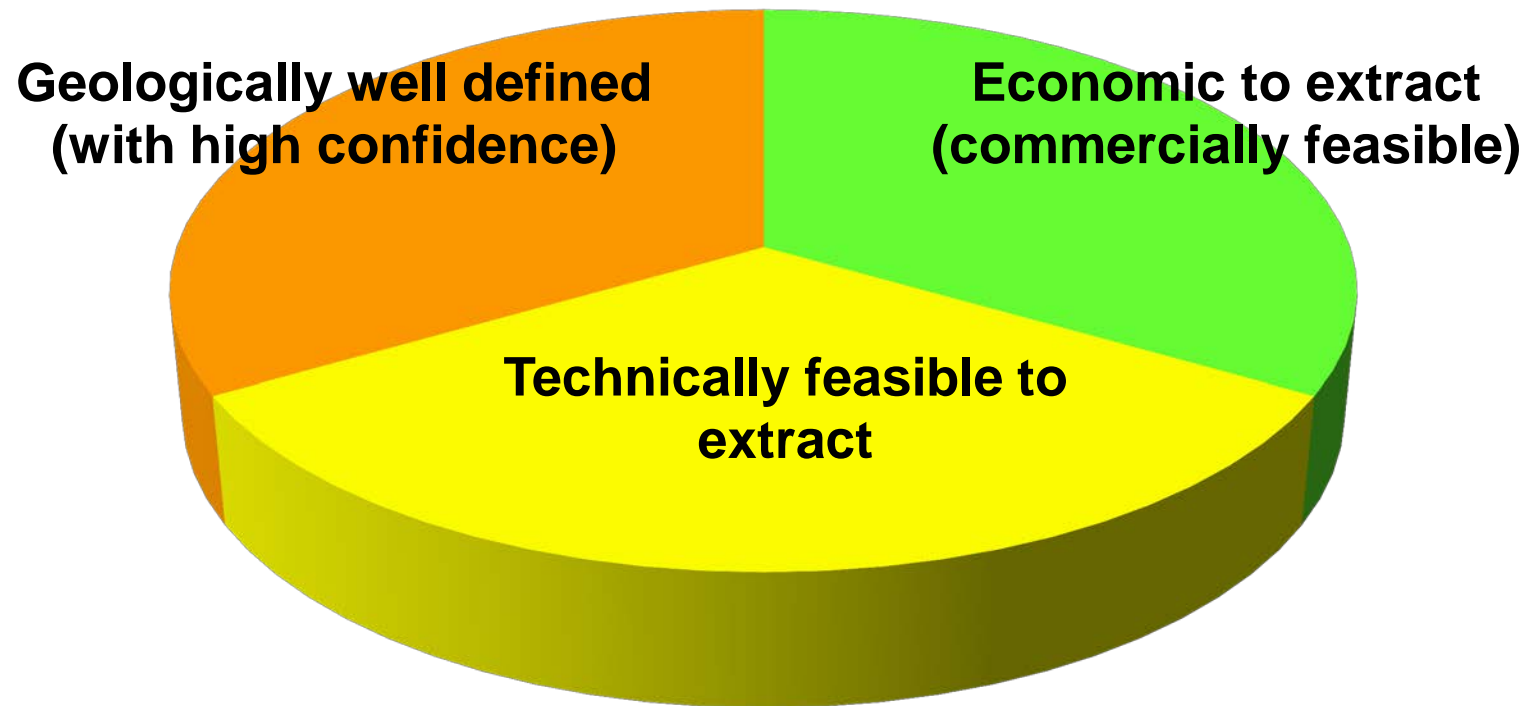
## Why is the UNFC needed?

- **Need for common global language for energy and mineral resource estimates**
  - What are “proved reserves”?
  - What are “resources”?
- **Increasing overlap between mining and oil & gas industries**
  - Major issue with respect to “unconventional” resources
  - Which system applies to mined petroleum solids?
- **Increasing need to be able to compare renewable energy resources with non-renewable resources**

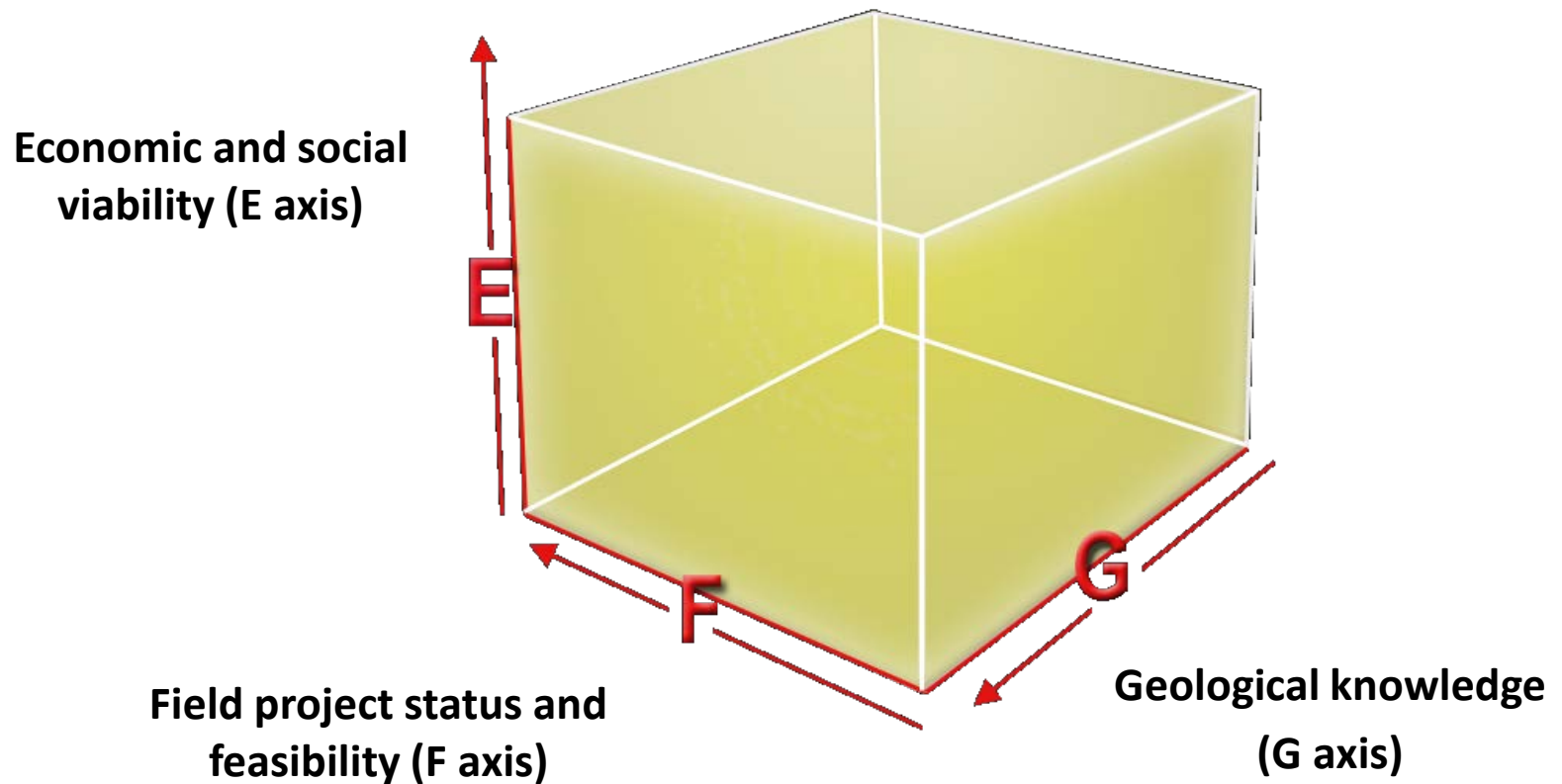
## UNFC – 2009

- **What is it?**
- **How it works**
- **Alignment**
- **Specifications**

## Proved reserves must be ...

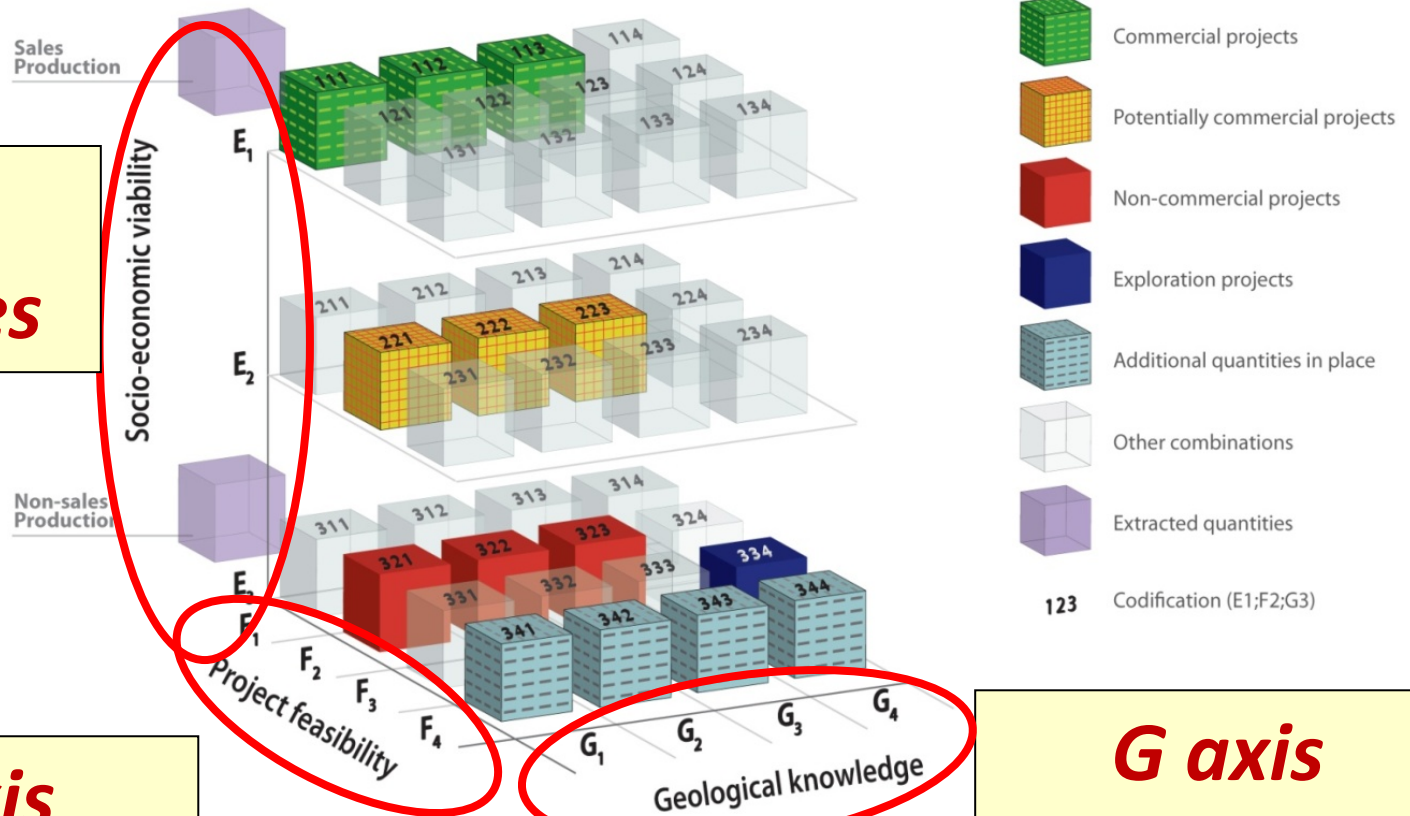


## UNFC – Three criteria



# UNFC-2009 – How it works

***E axis categories***



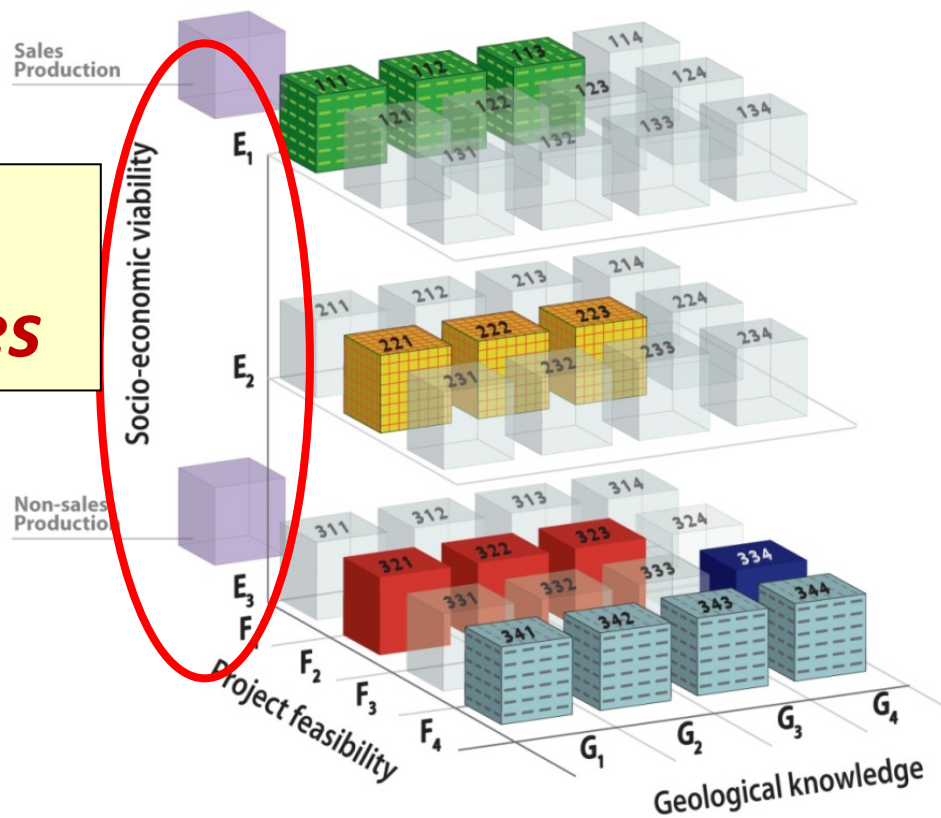
***F axis categories***








***G axis categories***



# UNFC – Categories

***E axis categories***



-  Commercial projects
-  Potentially commercial projects
-  Non-commercial projects
-  Exploration projects
-  Additional quantities in place
-  Other combinations
-  Extracted quantities
- 123** Codification (E1;F2;G3)

## UNFC – E axis

- **Degree of favourability of social and economic conditions in establishing the commercial viability of the project**
- **Includes consideration of market prices and relevant legal, regulatory, environmental and contractual conditions**
- **E1, E2 and E3 categories**
- **E1 is “best”**

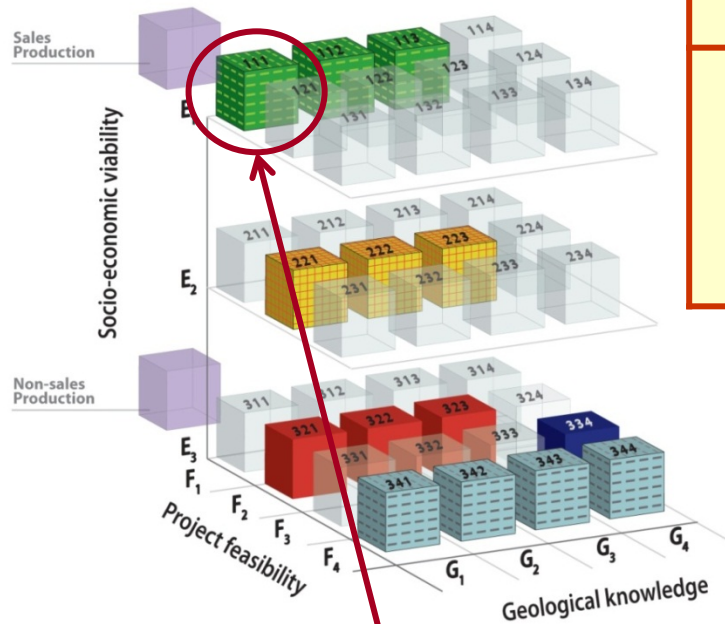
## E axis category definitions

<b>Category</b>	<b>Definition</b>
E1	Extraction and sale has been confirmed to be economically viable.
E2	Extraction and sale is expected to become economically viable in the foreseeable future.
E3	Extraction and sale is not expected to become economically viable in the foreseeable future or evaluation is at too early a stage to determine economic viability.

## UNFC – How it works

- **The category definitions are the building blocks of the system**
- **These are combined (E, F, G) in the form of classes**
- **Class 111 means that the reported quantities have satisfied the definitions for:**
  - **E1, F1 and G1**
- **There are no constraints on combinations, but not all will be meaningful**

# UNFC – How it works



Category	Definition
E1	Extraction and sale has been confirmed to be economically viable.

Category	Definition
F1	Feasibility of extraction by a defined development project or mining operation has been confirmed.

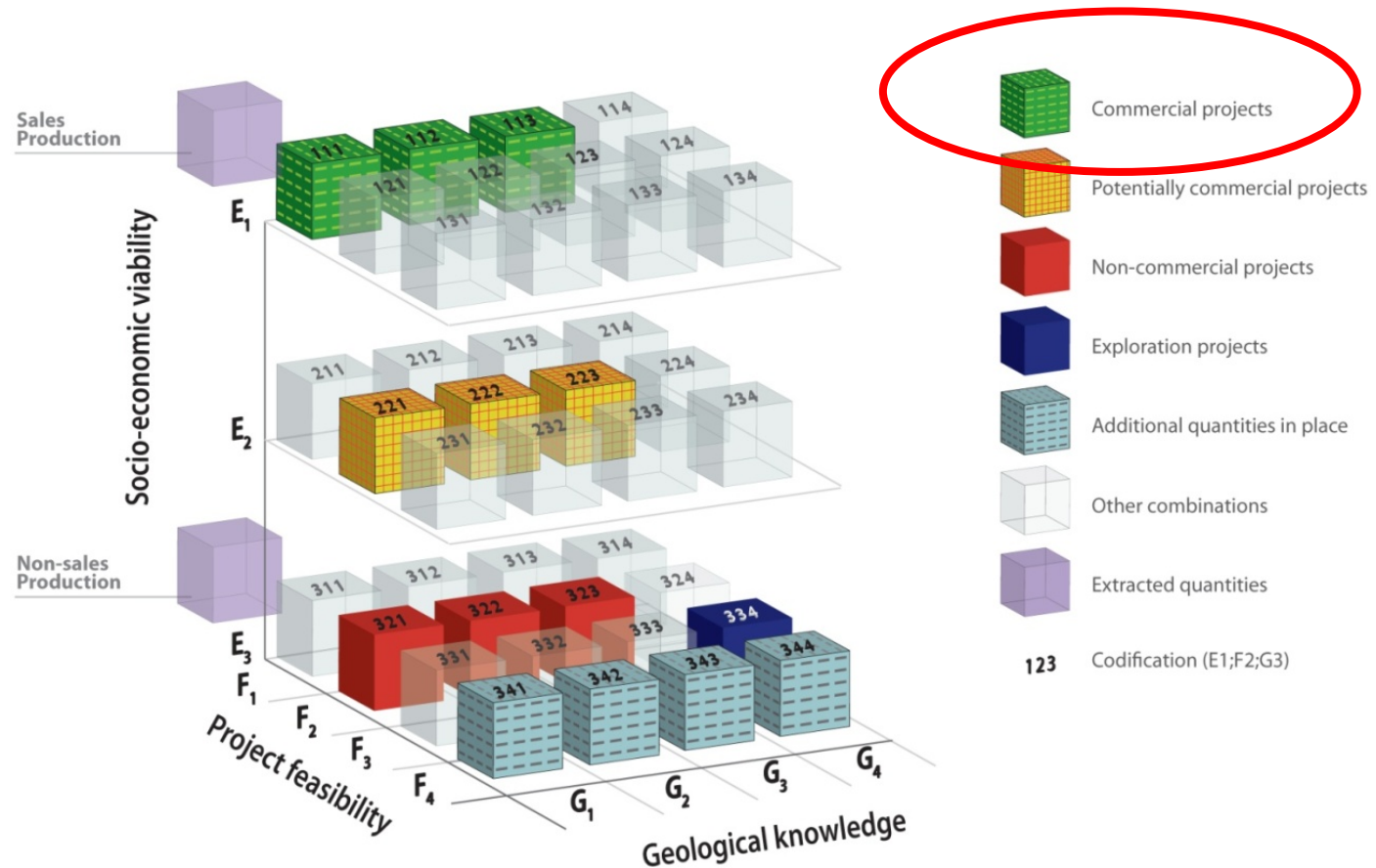
Category	Definition
G1	Quantities associated with a known deposit that can be estimated with a high level of confidence.

**UNFC Class: 111**

## UNFC – How it works

- **Some users prefer the 3D representation of UNFC**
- **Other users prefer a 2D representation**
- **Consensus meant we needed both!**
- **They are simply different visualisations of the same system**
- **Classes may be a single code (e.g. 111) or groups of codes (e.g. 111, 112 and 113)**

# UNFC – Examples of classes



# UNFC – 2D representation

<b>Total commodity initially in place</b>	<b>Extracted</b>	<b>Sales Production</b>			
		<b>Non-sales Production</b>			
		<b><u>Class</u></b>	<b><u>Categories</u></b>		
			<b>E</b>	<b>F</b>	<b>G</b>
	<b>Future recovery by commercial development projects or mining operations</b>	<b>Commercial Projects</b>	<b>1</b>	<b>1</b>	<b>1, 2, 3</b>
	<b>Potential future recovery by contingent development projects or mining operations</b>	<b>Potentially Commercial Projects</b>	<b>2</b>	<b>2</b>	<b>1, 2, 3</b>
		<b>Non-Commercial Projects</b>	<b>3</b>	<b>2</b>	<b>1, 2, 3</b>
	Additional quantities in place associated with known deposits		<b>3</b>	<b>4</b>	<b>1, 2, 3</b>
	<b>Potential future recovery by successful exploration activities</b>	<b>Exploration Projects</b>	<b>3</b>	<b>3</b>	<b>4</b>
Additional quantities in place associated with potential deposits		<b>3</b>	<b>4</b>	<b>4</b>	

***Each class is uniquely defined by its code***



## UNFC – 2009

- **What is it?**
- **How it works**
- **Alignment**
- **Specifications**

# Alignment of systems (schematic)

## UNFC-2009

## PRMS

## CRIRSCO

Total commodity initially in place	Sales Production	Production	Extracted
	Non-sales Production		
	<u>Class</u>	<u>Class</u>	<u>Class</u>
	Commercial Projects	Reserves	Mineral Reserves
	Potentially Commercial Projects	Contingent Resources	Mineral Resources
	Non-Commercial Projects		Not reported
	Additional quantities in place	Unrecoverable	Not reported
	Exploration Projects	Prospective Resources	Exploration Results
	Additional quantities in place	Unrecoverable	Not reported

## UNFC – Sub-categories

- **The system allows further granularity through sub-categories**
- **These are optional**
- **They facilitate mapping with the project maturity sub-classes of PRMS**
- **These sub-classes also align with some mining companies' reporting practices and with the IAEA classification of production centres**

## F axis sub-category definitions

Category	Definition
F1	Feasibility of extraction by a defined development project or mining operation has been confirmed.

Sub-Category	Definition
F1.1	Extraction is currently taking place.
F1.2	Capital funds have been committed and implementation of the development project or mining operation is underway.
F1.3	Sufficiently detailed studies have been completed to demonstrate the feasibility of extraction by implementing a defined development project or mining operation.

# UNFC – Using all sub-categories

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	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
Potential Deposit	Exploration Projects	[No sub-classes defined]	3.2	3	4
	Additional quantities in place			3.3	4

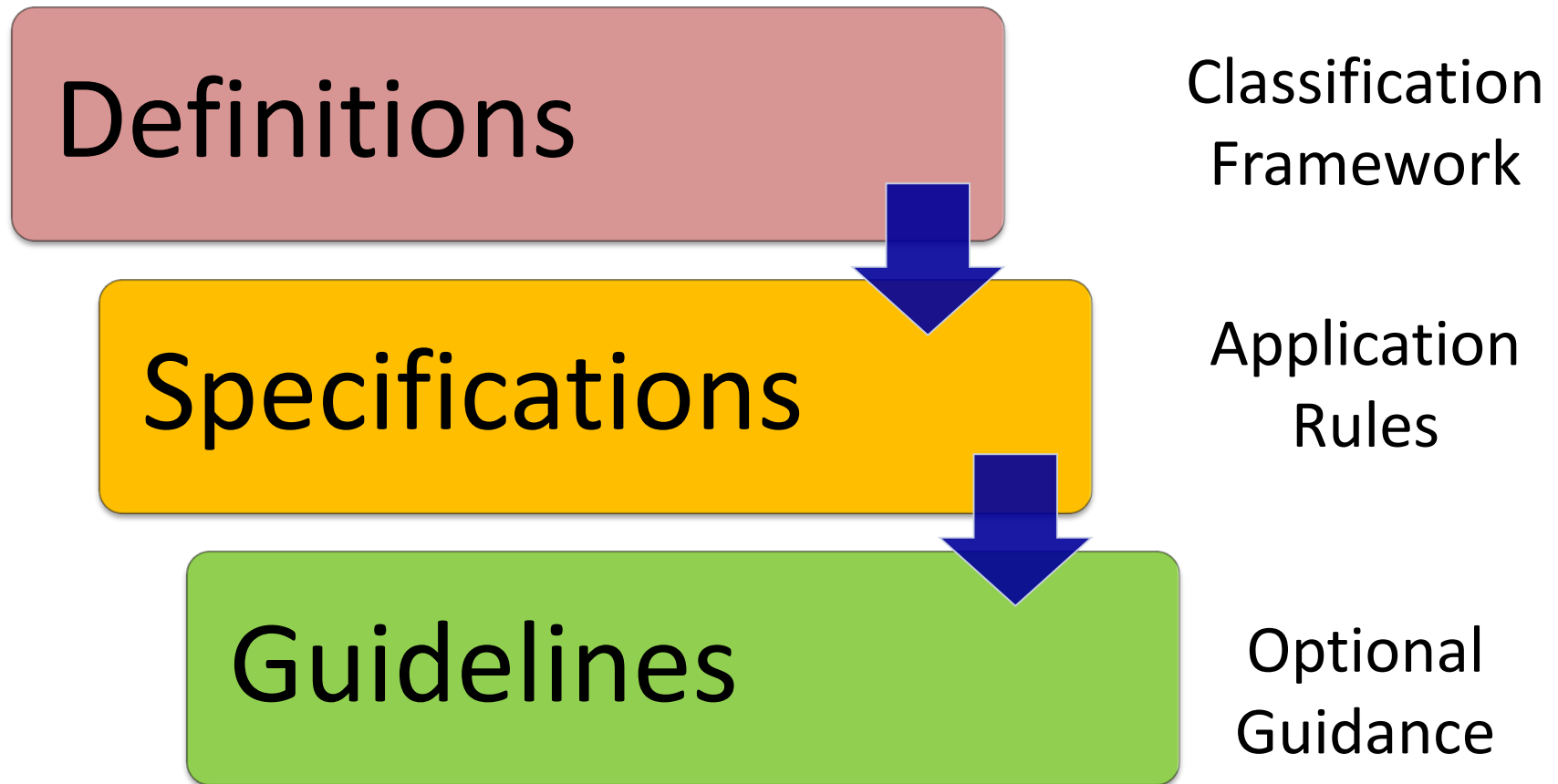
## How can we use alignment?

- **Quantities can be estimated using current well-established commodity-specific systems**
- **Reporting under these systems can continue unchanged**
- **But the same quantities can also be reported under UNFC using the numerical codes**
- **The reporting is then independent of commodity type, extraction methodology and ambiguous terminology (e.g. “reserves”)**

## UNFC – 2009

- **What is it?**
- **How it works**
- **Alignment**
- **Specifications**

# What are specifications?





## What are specifications?

- **Specifications set out the basic rules that are considered necessary to ensure an appropriate level of consistency in application**
- **They provide additional instructions on how the definitions must be applied in specific circumstances**
- **4 themes identified**
  - **Environmental and social considerations**
  - **National resources reporting**
  - **Disclosure**
  - **Commodity specifications**

## Environmental and social considerations

- **Highlights the fact that the E-axis category definitions explicitly include consideration of such issues**
- **Emphasises the need for a “social licence to operate” both before and during extractive activities**

## National resource reporting

- **Government level reporting usually at aggregated level**
- **Not necessarily the same as corporate estimates**
- **Aggregation methodology to be disclosed**

## Disclosure

- **UNFC-2009 is a voluntary system**
- **Unless mandated or restricted by government or other regulatory body, disclosure of resource quantities is at the discretion of the reporter**
- **However, certain generic specifications requiring disclosure of information relevant to the reported estimates are mandatory**

## Commodity specifications & alignment

- **Alignment of UNFC-2009 with the CRIRSCO Template and PRMS**
- **Agreements with CRIRSCO/SPE to provide commodity-specific specifications**
- **Other systems can be used, provided they are “aligned”**

## Commodity specifications & alignment

- **Bridging Documents subject to evaluation by the TAG and endorsement by EGRC to ensure alignment**
- **Quantities can be estimated in “aligned system” or directly, provided all specifications are honoured**
- **Need for generic specifications in order to provide a common basis for reporting at UNFC level**



**UNFC**

**Classification Framework and Category Definitions**

**Generic Specifications**

*Bridging Document*

*Bridging Document*

*Bridging Document*

**Petroleum Specifications  
PRMS**

**Solid Mineral Specifications  
CRIRSCO**

**Other Aligned Systems**

## Generic specifications

- **In these generic specifications, the following words have specific meanings:**
  - **“Shall” is used where a provision is mandatory;**
  - **“Should” is used where a provision is preferred; and,**
  - **“May” is used where alternatives are equally acceptable.**
- **Mandatory generic specifications set a minimum standard for reporting**
- **Commodity-specific specifications for the same issue may be adopted provided they fully meet the requirements**



## Mandatory disclosure issues

- **UNFC numerical codes**
- **Bridging document**
- **Effective date**
- **Commodity or product type**
- **Basis for estimate**
- **Reference point**

## Optional additional sub-categories

- **Expansion of G4 to account for uncertainty**
- **Expansion of F3 to account for maturity**
- **Expansion of F4 to account for technology**

# Guidance on sub-class application

UNFC Classes defined by categories and sub-categories						
Extracted	Sales Production					
	Non-sales Production					
Total commodity initially in place	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
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			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]	3.2	3	4	
	Additional quantities in place			3.3	4	4

## Distinction between E1, E2 and E3

- **Based on “reasonable prospects for economic extraction in the foreseeable future”**
- **Reference to commodity-specific systems for more detailed discussion of “foreseeable future”**
- **Any change in a non-technical issue (e.g. social licence to operate) which leads to a suspension or termination of extractive activities requires a reclassification from E1 to E2 or to E3**

## Confidence levels for G1, G2 and G3

- **Based on “high”, “medium” and “low” confidence**
- **Not specified more precisely at generic level due to fundamental differences between approaches used for commodities extracted as solids or fluids**
- **Reference to commodity-specific systems for more detailed discussion of levels of confidence**

# Distinction between recoverable quantities and in situ (in-place) quantities

- **Other than quantities classified as F4:**
  - All quantities must be “potentially recoverable”
  - Associated with actual or possible future projects
  - Based on existing technology or technology under development
  - In situ estimates must have “reasonable prospects for economic extraction and sale”
  - If extraction methodology is expected to lead to significant losses/dilution, this must be disclosed
  - For commodities extracted as fluids, recovery factor should be taken into account

## Aggregation of quantities

- **Requires justification and disclosure of methodology**
- **Requires disclosure of UNFC codes for aggregated classes (e.g. 111+112+221+222)**
- **For projects not classified as E1F1, requires footnote to highlight risk that project(s) may not achieve commercial operation**

## Economic assumptions

- **Assumption of “future market conditions” should reflect either:**
  - **The view of the organization responsible for evaluation**
  - **The view of a competent person or independent evaluator**
  - **An externally published view that is reasonable**
- **The basis (not the forecast) must be disclosed**



## Evaluator qualifications

- **Must possess an appropriate level of expertise and relevant experience associated with the type of deposit under evaluation**
- **More detailed specifications in Aligned System**
- **Possible regulatory requirements for corporate reporting (i.e. for a “competent person”)**

## Units and conversion factors

- **SI Units recommended**
- **Other traditional units permitted**
  - Conversion factors to SI units must be provided
- **Where quantities are converted to energy equivalents (for example), conversion factors must be disclosed**

## Documentation

- **“Estimates of resource quantities shall be documented in sufficient detail that would allow an independent evaluator or auditor to clearly understand the basis for estimation of the reported quantities and their classification”**
- **Not a requirement for external disclosure**

## Optional labels for estimates

- **In addition to numerical codes, the following terms may be used in conjunction with classification on the G-axis:**
  - **Low estimate (G1)** e.g. 111
  - **Best estimate (G1+G2)** e.g. 111+112
  - **High estimate (G1+G2+G3)** e.g. 111+112+113

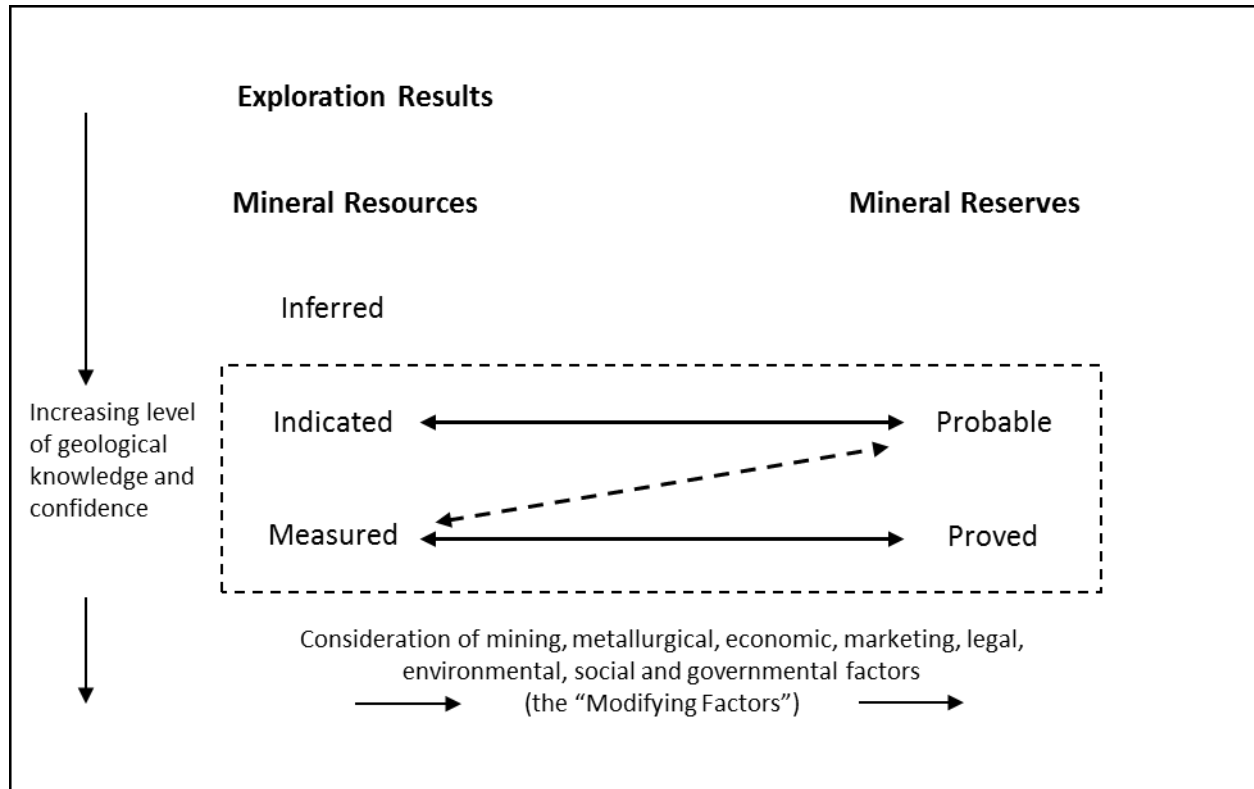
## Extracted quantities that may be saleable in the future

- **Extracted quantities not available for sale (E3.1)**
  - Used, lost, destroyed, disposed of during extraction process and not available for future sales
  - e.g. flared gas
- **Extracted quantities that are “stored” and available for possible future sales (E3.3)**
  - e.g. produced gas injected back into a rock formation
  - e.g. thorium

## Bridging documents

- **Explains the relationship between an Aligned System and UNFC-2009**
- **Consistent format**
- **Generally more granularity in UNFC-2009**
- **Facilitates transfer of quantities to correct class or sub-class**

# CRIRSCO template



# Bridging documents - CRIRSCO

## *Using Categories only*

CRIRSCO Template		UNFC-2009 “minimum” Categories			UNFC-2009 Class
Mineral Reserve	Proved	E1	F1	G1	Commercial Projects
	Probable			G2	
Mineral Resource	Measured	E2	F2	G1	Potentially Commercial Projects
	Indicated			G2	
	Inferred			G3	
Exploration Results		E3	F3	G4	Exploration Projects



# Bridging documents - CRIRSCO

## *Using Sub-categories*

	F1.1	F1.2	F1.3	F2.1	F2.2	F2.3	F3	F4			
E1.1	1	2	3	4							
E1.2	1	2	3								
E2			4	4	5				Mineral Reserve	1	On Production
E3.1	12	12	12	12	12	12				2	Approved for Development
E3.2			6	6	6		8			3	Justified for Development
E3.3			7	7	7	7		11	Mineral Resource	4	Development Pending
										5	Development On Hold
									Inventory (not defined in Template)	6	Development Unclassified
										7	Development Not Viable
										11	Additional Quantities in Place
									Exploration Results	8	
Special Cases	Classification not in Template									12	
	Less Common Mappings										

## Summary of development process

- **UNFC-2009 simplification with generic definitions only** ✓
- **Survey of stakeholder requirements for specifications** ✓
- **Development of specifications** ✓
  - Public comment period
- **EGRC Recommendation of specifications document** ✓
  - Generic specifications
  - Bridging documents with CRIRSCO Template and PRMS

## In summary ...

- **UNFC-2009 is a generic, principles-based system**
  - Applicable to both solid minerals and fluids
  - Uses a numerical coding system
- **Based on three criteria**
  - Economic and social viability
  - Field project status and feasibility
  - Geological knowledge
- **Direct linkage to PRMS and the CRIRSCO Template**
  - Quantities can be estimated using these systems and reported using the UNFC numerical codes
- **Key goal is to provide a tool to facilitate global communications**
  - Other systems can be linked to it (e.g. IAEA “red book” system)
  - Potential to use system for renewable energy and CCS projects