

United Nations Framework Classification (UNFC) - how it works in practice and its application to solid minerals

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Government of India
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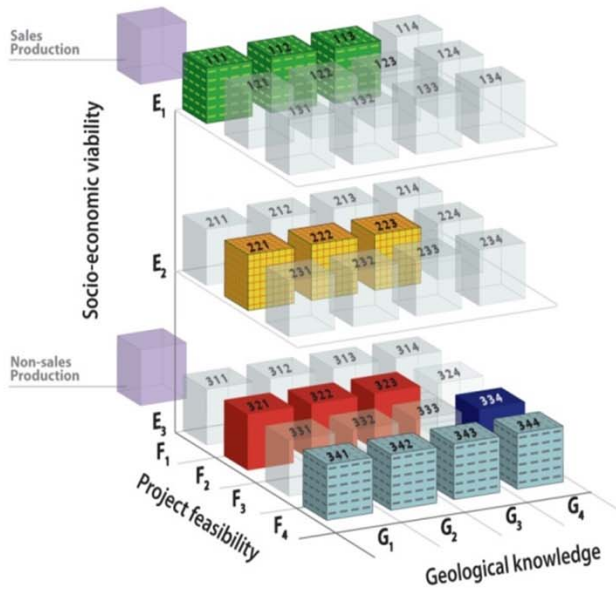
1. Introduction

2. What is UNFC? How does it work?

3. Specifications

4. Bridging Documents

5. Summary and observations

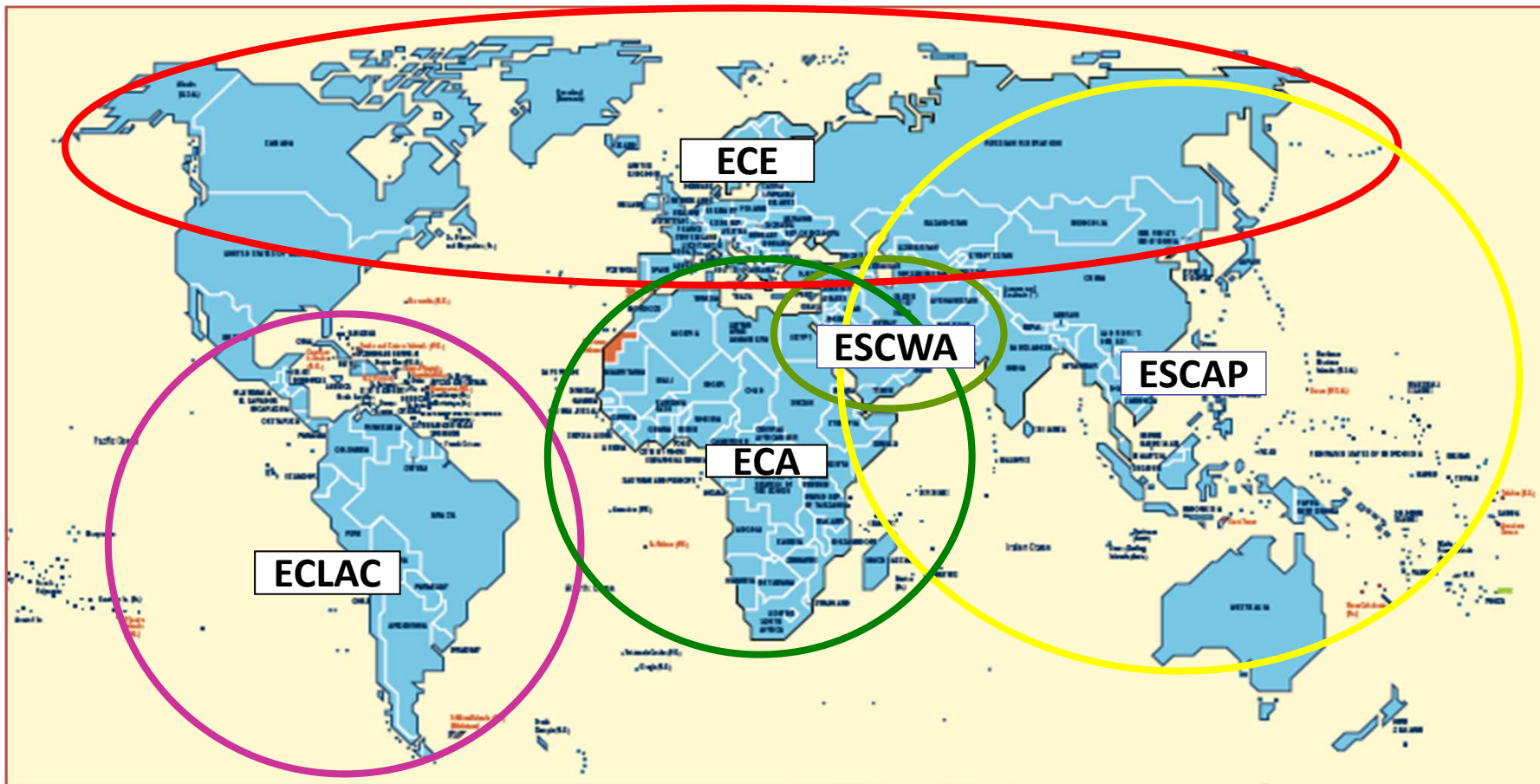


Introduction

- **UN Economic Commission for Europe (UNECE)**
- **Why the United Nations is involved in resource classification**
- **Mandate**
 - **ECOSOC Decision 2004/233**
- **History/development of the UNFC**



UN regions ...



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UNECE – 56 member States



Why the United Nations?

- **Sustainable development and Sustainable Energy for All**
- **UNECE provides a regional forum for Governments to develop practical instruments in the form of conventions, regulations, norms and standards**
- **Neutral platform, all stakeholders involved**
- **Open and transparent process**
- **Convening power – no comparable forum exists**
- **UNFC is a voluntary system, not mandated by the UN**
- **UNFC is a global project (ECOSOC Decision 2004/233)**



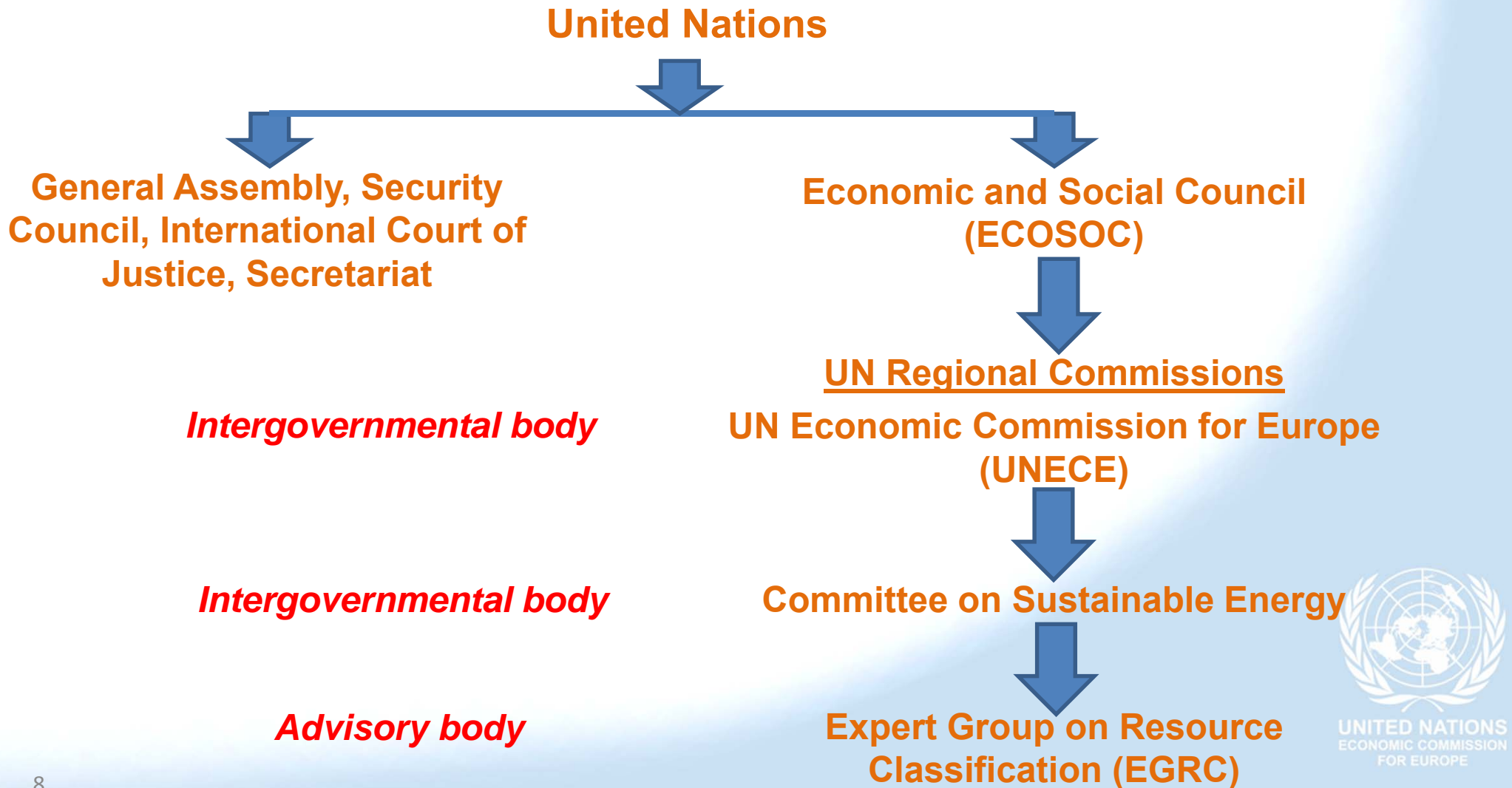
UNFC and ECOSOC

ECOSOC Decision 2004/233

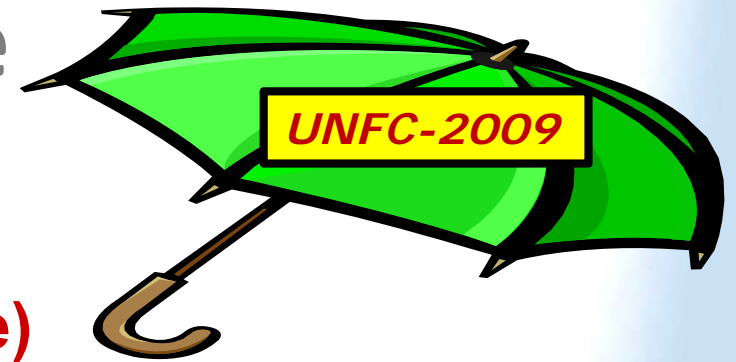
“At its 42nd plenary meeting, on 16 July 2004, the **Economic and Social Council**, recalling its decision 1997/226 of 18 July 1997, welcomed the endorsement by the Economic Commission for Europe of the United Nations Framework Classification for Fossil Energy and Mineral Resources and decides to invite the **Member States of the United Nations, international organizations and regional commissions** to consider taking **appropriate measures for ensuring worldwide application of the Framework Classification**. The Council notes that this new classification for fossil energy and mineral resources, which now includes energy commodities (for example, natural gas, oil and uranium), is an extension of the earlier framework developed for solid fuels and mineral commodities, on which the Council took similar action in 1997 upon endorsement and recommendation by the Economic Commission for Europe.”



Where does the Expert Group on Resource Classification fit in the UN system?

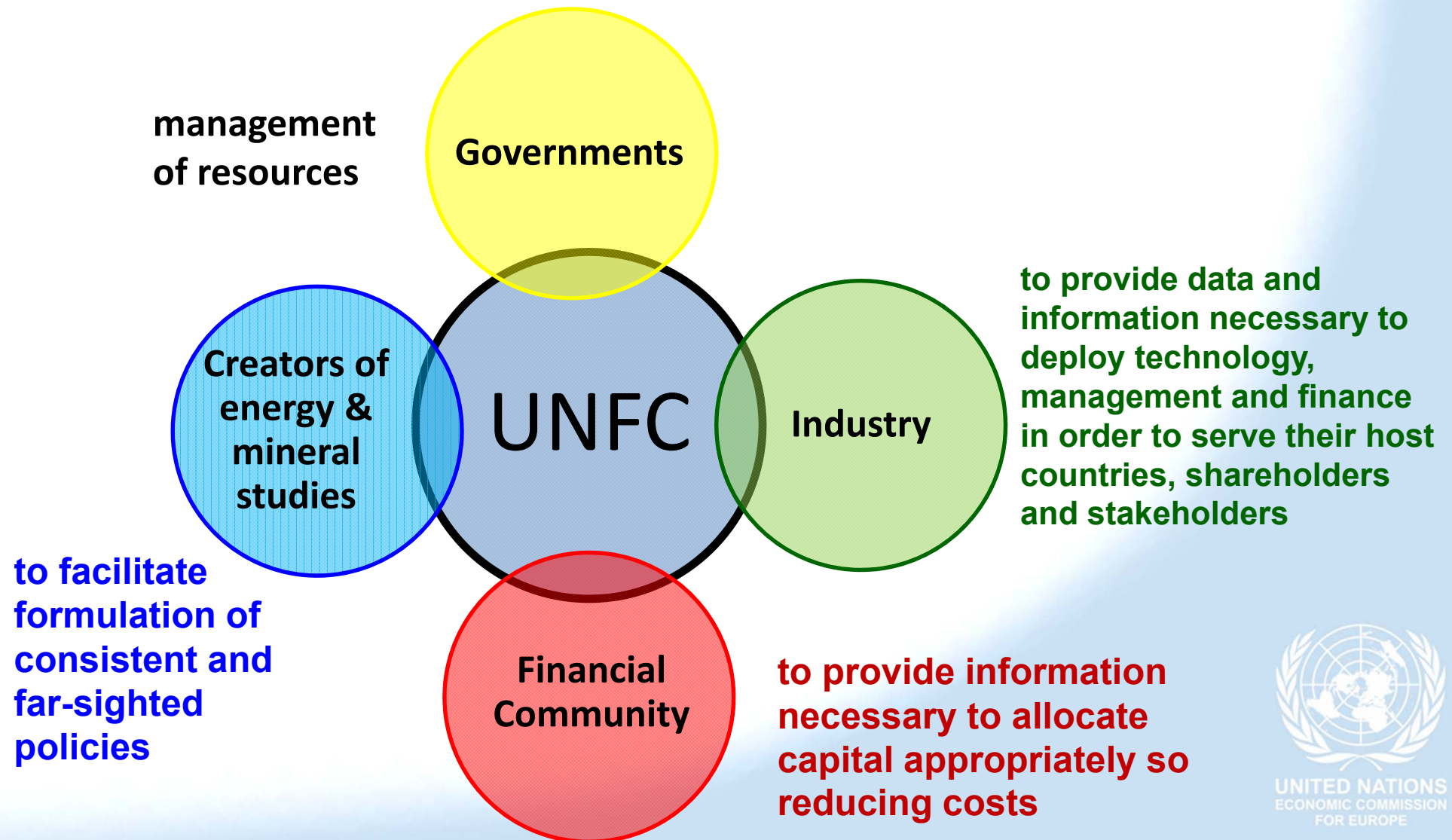


Expert Group on Resource Classification



- **UNFC (development and governance)**
- **Inclusive ... open to all stakeholders worldwide**
 - **Solid minerals, petroleum and uranium**
 - **Application to renewables priority area for member States**
 - **Close collaboration with CRIRSCO (solid minerals) and SPE (oil & gas) – *alignment and specifications***
 - **Close collaboration with IAEA on nuclear fuel resources**
 - **Works on consensus**
- **Five year mandate, reports to Committee on Sustainable Energy – *annual meeting in Geneva***

UNFC stakeholders



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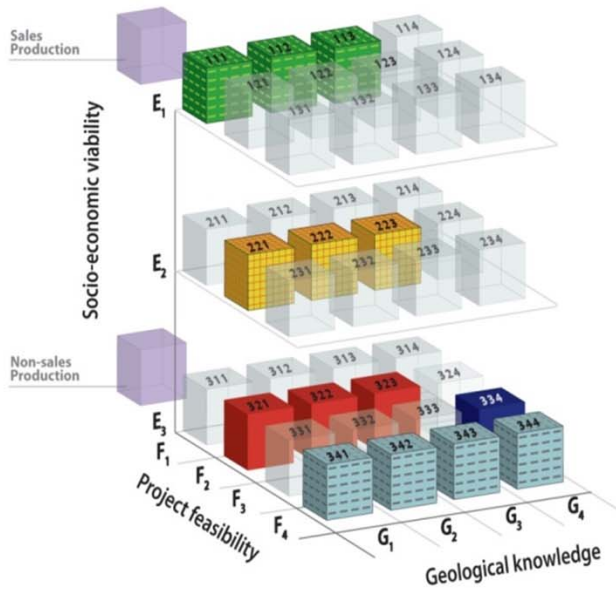
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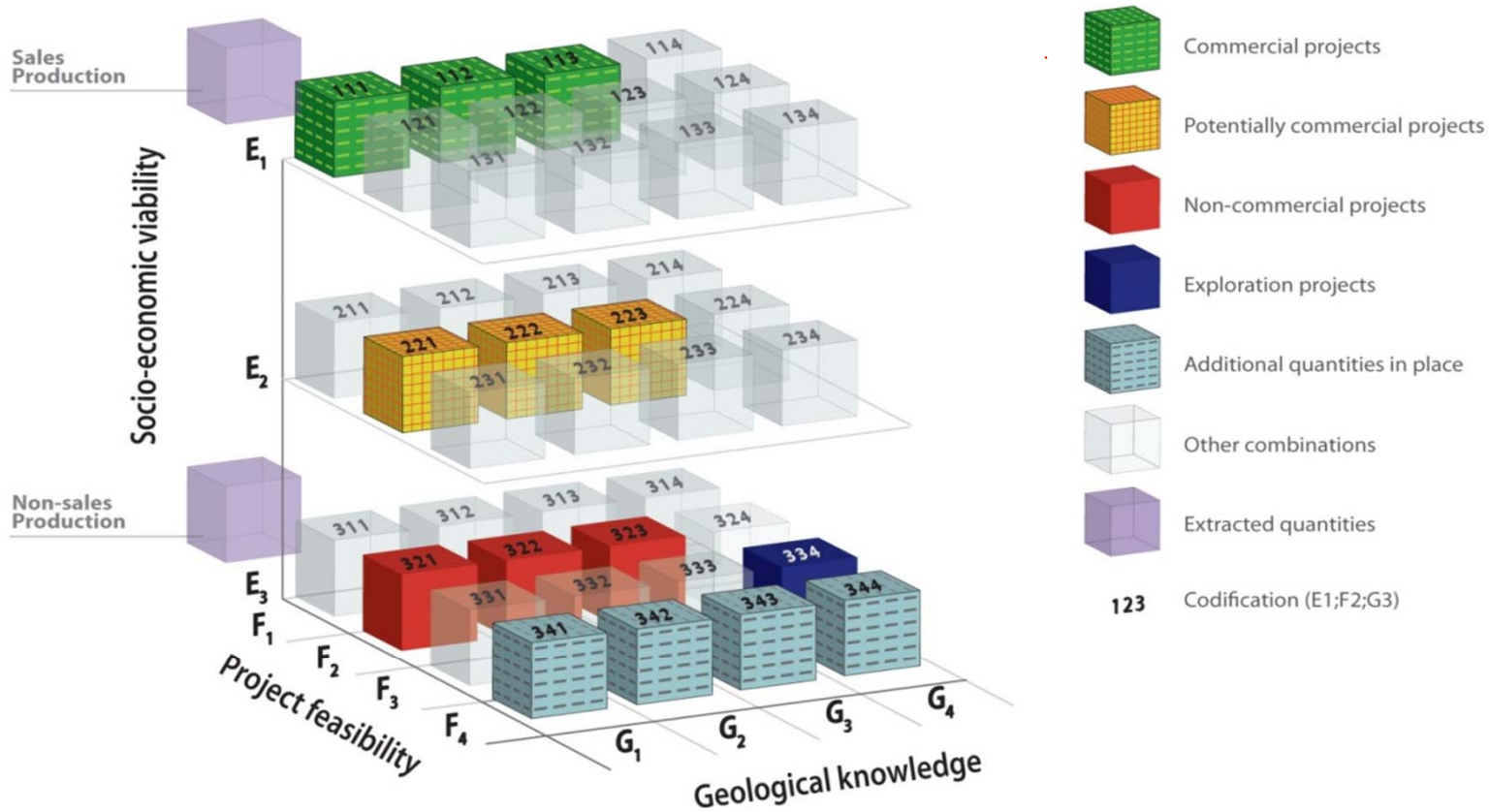


What is the UNFC?

- **United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources**
- **Global, generic, principles-based system**
 - Based on three fundamental criteria
 - Uses a numerical coding system
 - Applicable to both solid minerals and fluids
 - Facilitates global communications
- **Fully aligned with CRIRSCO Template and PRMS**
- **Other classification systems can be aligned with the UNFC and linked using Bridging Documents**



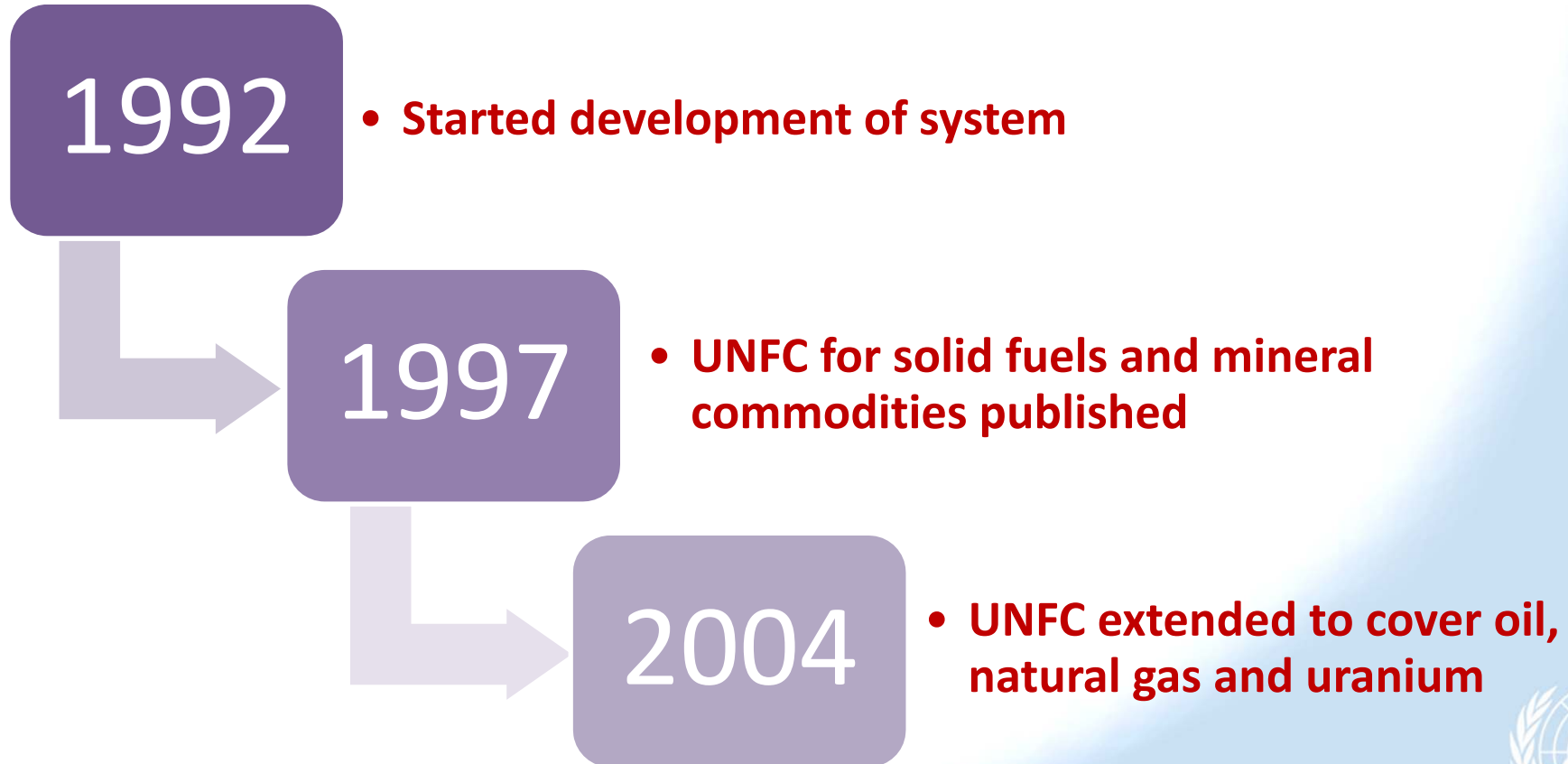
UNFC – Numerical coding



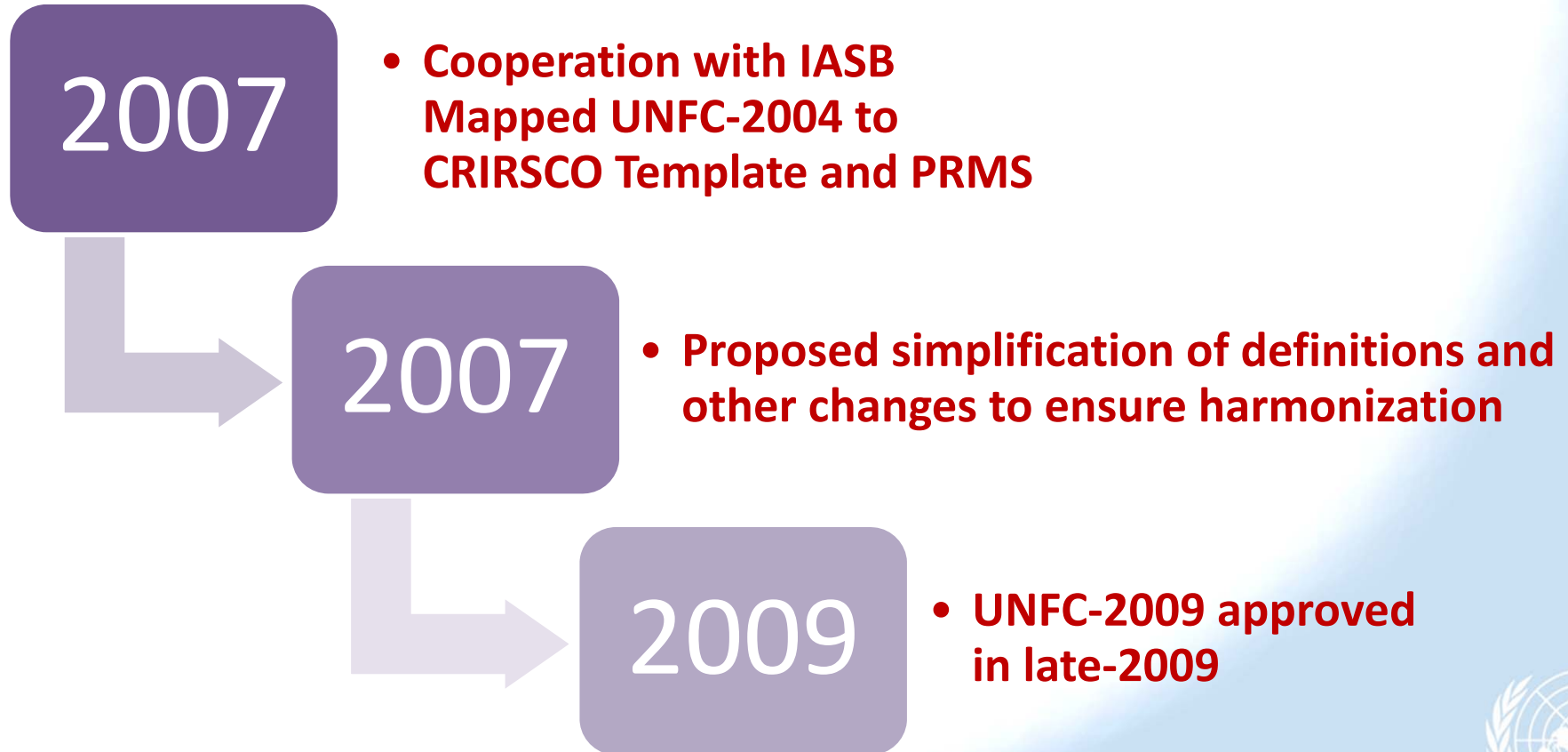
Why is the UNFC needed?

- **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**

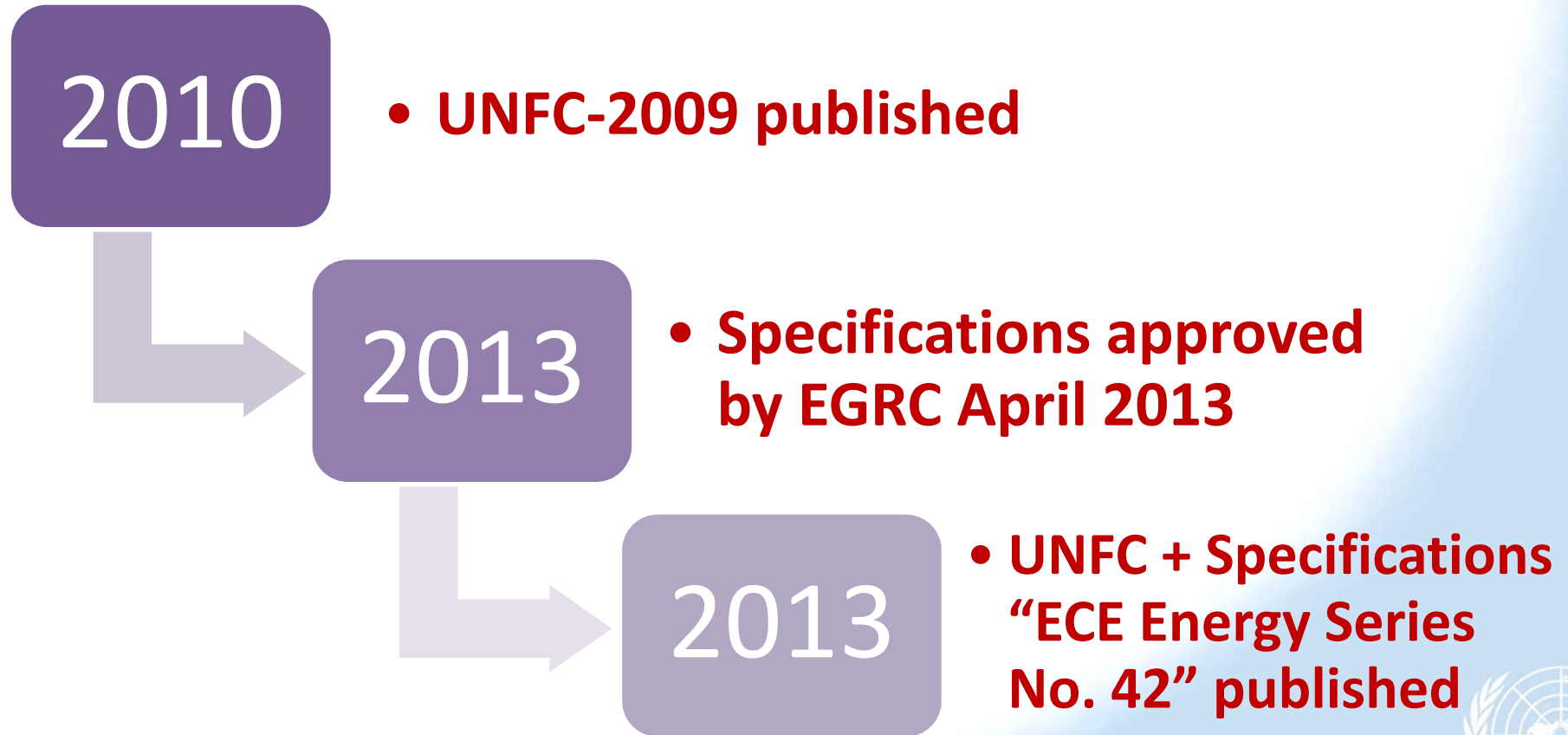
UNFC History



UNFC History (continued)



UNFC History (continued)



A Couple of Anecdotes

- A famous company misrepresents its reserves with collusion of the board of directors
- Application of revised rules significantly alters management's previous estimate
- Risk mitigation not in-place results in revision of field reserves
- Management found to be trading shares prior to release of revised reserves estimates

Institute of Mining and Metallurgy

London, 1911





UNFC

Classification Framework and Category Definitions

Generic Specifications

Bridging Document

Bridging Document

Bridging Document

**Petroleum Specifications
PRMS**

**Solid Mineral Specifications
CRIRSCO**

Other Aligned Systems



Structure of system

Definitions

Classification
Framework

Specifications

Application
Rules

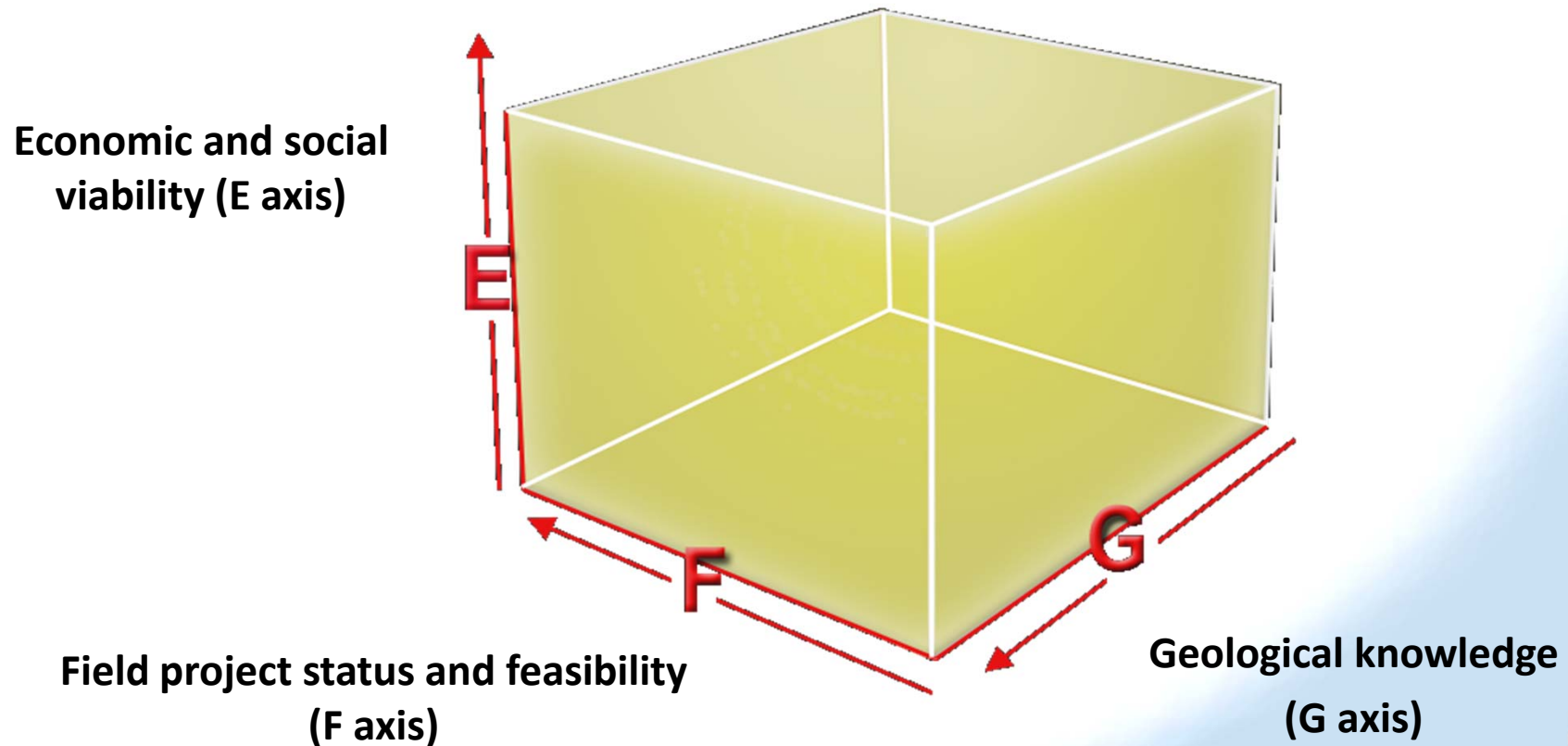
Guidelines

Non-
Mandatory
Guidance



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UNFC – The three criteria



E axis category definitions

Category	Definition
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.

F axis category definitions

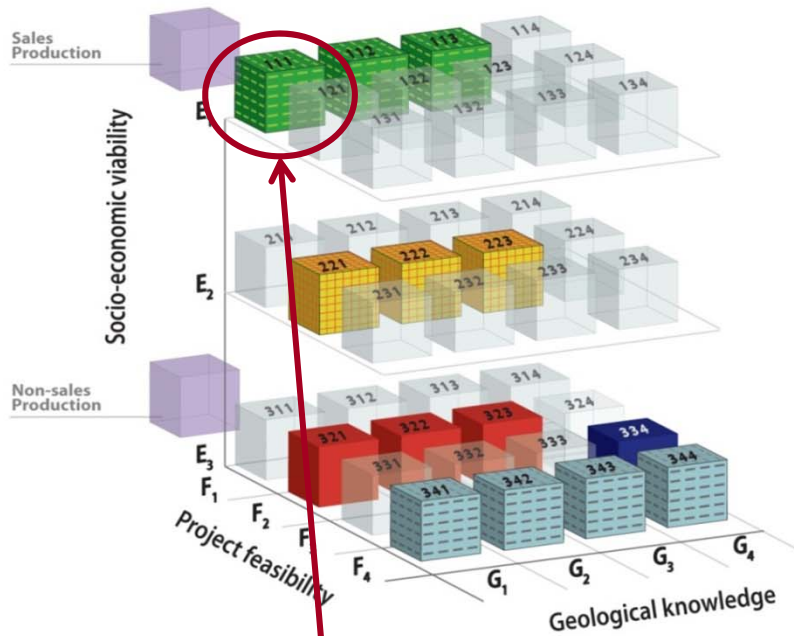
Category	Definition
F1	Feasibility of extraction by a defined development project or mining operation has been confirmed.
F2	Feasibility of extraction by a defined development project or mining operation is subject to further evaluation.
F3	Feasibility of extraction by a defined development project or mining operation cannot be evaluated due to limited technical data.
F4	No development project or mining operation has been identified.

G axis category definitions

Category	Definition
G1	Quantities associated with a known deposit that can be estimated with a high level of confidence.
G2	Quantities associated with a known deposit that can be estimated with a moderate level of confidence.
G3	Quantities associated with a known deposit that can be estimated with a low level of confidence.
G4	Estimated quantities associated with a potential deposit, based primarily on indirect evidence.



UNFC – How it works



UNFC Class: 111

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 – 2D representation

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

Each class is uniquely defined by its code

Alignment of systems (schematic)

UNFC-2009

Total commodity initially in place	Sales Production
	Non-sales Production
	<u>Class</u>
	Commercial Projects
	Potentially Commercial Projects
	Non-Commercial Projects
	Additional quantities in place
	Exploration Projects
	Additional quantities in place

CRIRSCO

Extracted
<u>Class</u>
Mineral Reserves
Mineral Resources
Not reported
Not reported
Exploration Results
Not reported

PRMS

Production
<u>Class</u>
Reserves
Contingent Resources
Unrecoverable
Prospective Resources
Unrecoverable

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”)**

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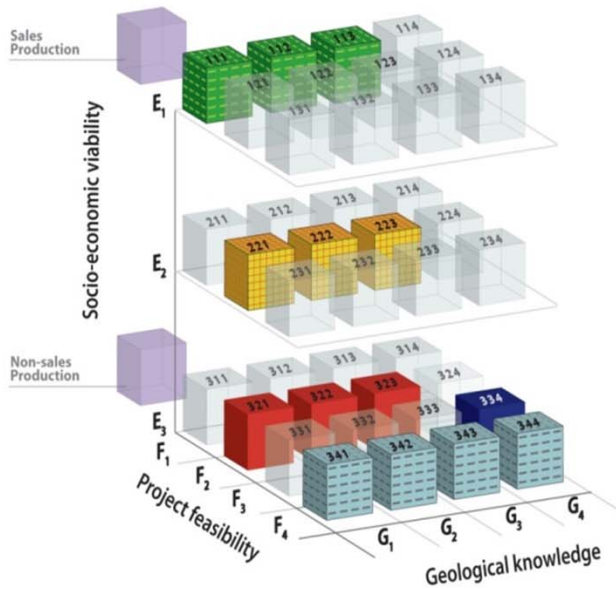
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What are specifications?

Definitions

Classification
Framework

Specifications

Application
Rules

Guidelines

Non-
Mandatory
Guidance



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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**

Generic specifications

20 generic specifications, covering:

- **Mandatory disclosure issues**
- **Project maturity**
- **Distinction between categories**
- **Aggregation**
- **General obligations**
- **Optional additional sub-categories and labels**
- **Extracted quantities that may be saleable in the future**

Specification S: Classification of additional quantities in place

- In some situations, it may be helpful to sub-classify Additional Quantities in Place on the basis of the current state of technological developments. In such cases, the following specification shall apply:
 - (a) F4.1:** the technology necessary to recover some or all of the these quantities is currently under active development, following successful pilot studies on other deposits, but has yet to be demonstrated to be technically feasible for the style and nature of deposit in which that commodity or product type is located;
 - (b) F4.2:** the technology necessary to recover some or all of the these quantities is currently being researched, but no successful pilot studies have yet been completed;
 - (c) F4.3:** the technology necessary to recover some or all of these quantities is not currently under research or development.

Bridging documents

“A document that explains the relationship between UNFC-2009 and another classification system, including instructions and guidelines on how to classify estimates generated by application of that system using the UNFC-2009 Numerical Codes.”

- **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**

Bridging documents

Aligned systems – commodity-specific basis

- **Solid minerals**
 - **CRIRSCO Template of 2006 developed by the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) and the reporting codes and standards that are based on it**
- **Petroleum**
 - **Petroleum Resources Management System of 2007 (PRMS) which has been endorsed by SPE, WPC, AAPG, SPEE and SEG**
- **Uranium**
 - **OECD NEA/IAEA uranium classification (“Red Book”)**
- **Further bridging documents are being developed for other classification systems**
 - **Must be aligned with UNFC and lead to results that are comparable to those based on CRIRSCO Template/PRMS**



Bridging documents – CRIRSCO Template

	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			
E3.1	12	12	12	12	12	12		
E3.2			6	6	6		8	
E3.3			7	7	7	7		11

Using Sub-categories

		UNFC-2009 Sub-Classes
Mineral Reserve		1
		2
		3
Mineral Resource		4
		5
Inventory (not defined in Template)		6
		7
		11
Exploration Results		8
Special Cases	Classification not in Template	12
	Less Common Mappings	

UNFC is a Process

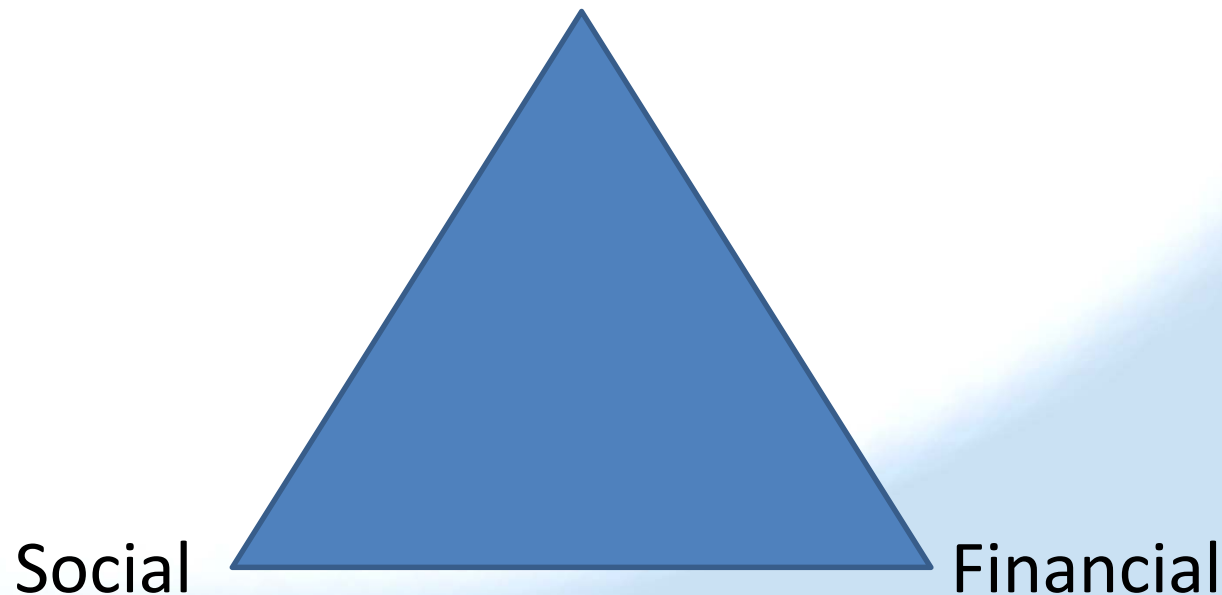
- Understand the deposit
- Develop the project
- Test the social/economic impacts

What is the goal?

- Of businesses
- Of governments
- Of stakeholder groups
- Of communities

Corporate Responsibility and the Triple Bottom Line

- John Elkington, California Business Review 1994
- Three components in equilibrium for optimum enterprise or organisational performance:
Environmental



Sustainable Development Fundamentals



Key Performance Indicators

- De-risked financials/ ROI (protects lender/ investor)
- Stable, equitable, long-term partnerships with stakeholders
- Reduced risk of project-related social conflicts/ conflict-free supply chain/ compliance with EITI objectives
- Reduced impact health, culture and heritage
- Equitable balance of economic and environmental interest



Uptake of Comprehensive Extraction

- Conceptual roots in Russia and China during 1990s
- Initial focus on unconventional U resources
 - by-product U - mainly Phosphates
- Now seen to be generally applicable
 - copper, coal, oil shale
- Applies to primary and secondary resources
 - 70% of mine tailings presently seen as a resource for other commodities
 - increasing attention to residues, effluents and slags
- A chance to rethink
 - The balance sheet
 - The flowsheet

Comprehensive Extraction Methodology

- Whole life-cycle, addressing all available resources from a given site/ deposit
- Multi-target resource management, eg energy basin management models
- Primary and secondary resources seen as single, complex resource
- Reuse and recycling – leading to zero waste
- Develop new product development as strategic alternative to waste disposal (eg from recycling tailings or residues)
- Net positive contribution to Food Energy and

Resource assessment for comprehensive extraction (CX)

Quantities associated with known and potential resources

Contained in Ore concentrates/Phosphoric acid/other intermediate products

Not extracted; available in Wastes/PG process water

Available in raffinate and slags

Available in tailings and clays

Not Commercial for current extraction

Potential for Commercial extraction

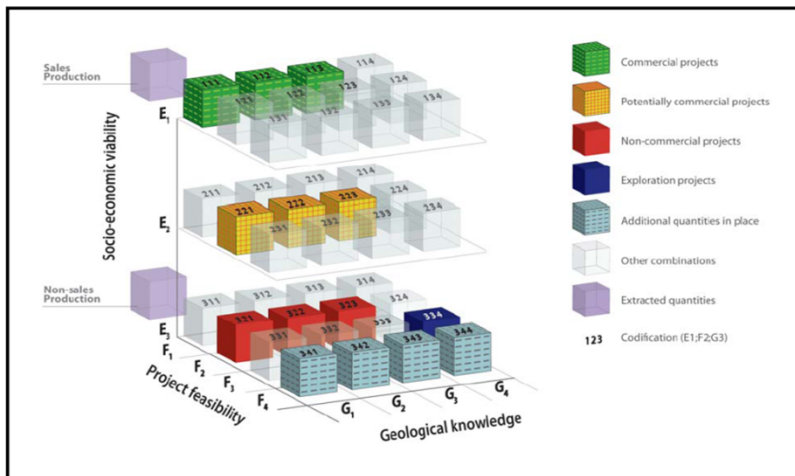
Commercially Extracted quantities

Dissipated in products, wastes, environment

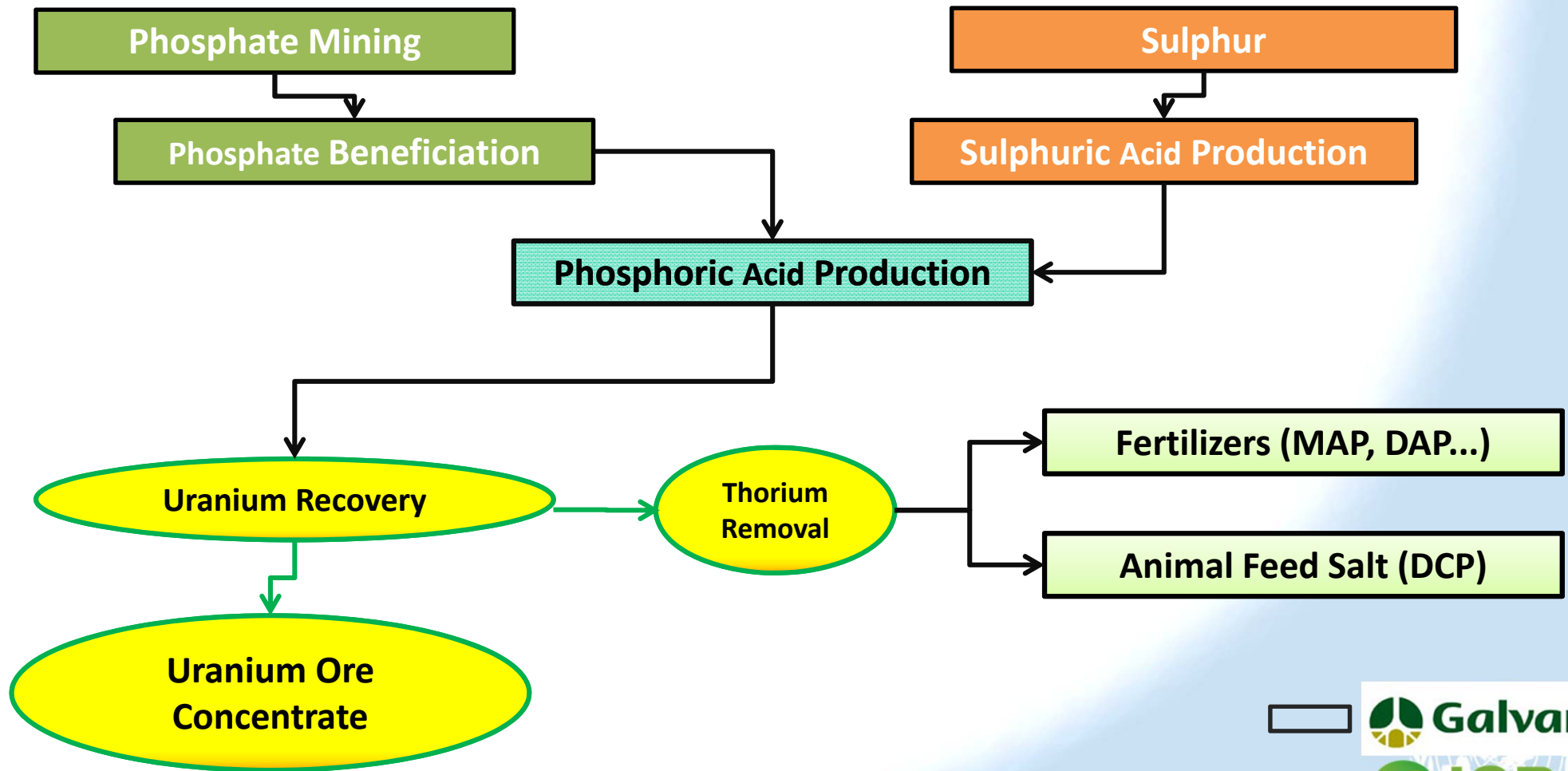
Accurate and transparent management of essential materials

United Nations Framework Classification

- 3D framework
 - Socio-economic
 - Project Feasibility
 - Uncertainty
- Multiple commodities
- International cooperation across diverse stakeholder groups
- Uniquely placed to aid in comprehensive extraction



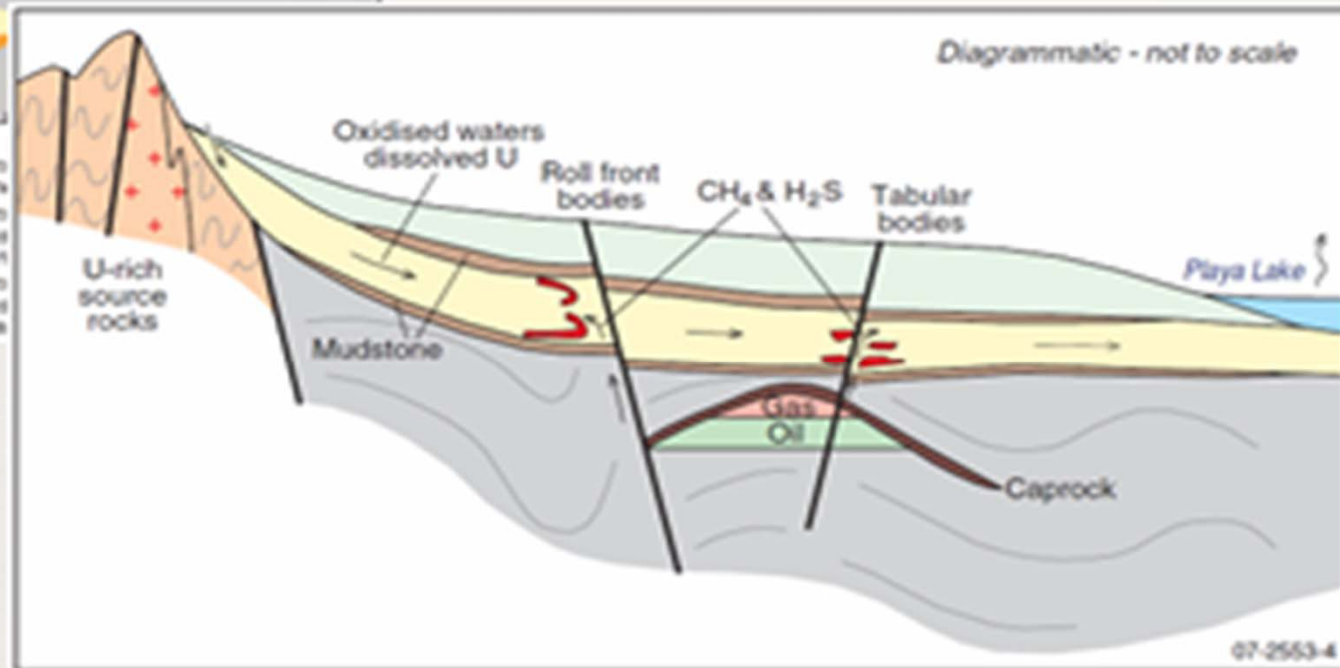
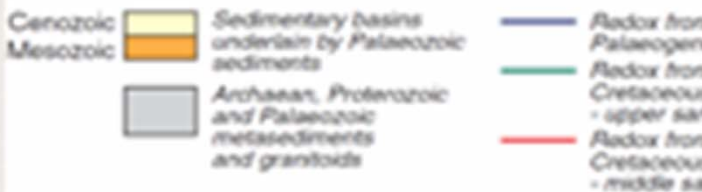
3G EXAMPLE: SANTA QUITERIA, BRAZIL, U AND P PROJECT FLOWSHEET (2017 START)



3G Model – Kazakhstan: “Smart Mining” (URAM 2014) and multi-target energetic basin management



► Possible link between oil & gas and uranium, with associated migration of gas along faults, tectonic control of the localisation of roll fronts...



Jaireth et al. 2008

4G Extraction

- 4G Whole basin =
 - Oil
 - Gas
 - Coal
 - Phosphates
 - Uranium
 - Rare Earths...

An integrated management and extraction process



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 CRIRSCO Template and PRMS**
 - 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 using bridging documents
 - Bridging document finalized for NEA/IAEA “Red Book” system
 - Bridging documents currently in preparation for new Russian Federation petroleum classification and for application to renewable energy sources and CCS projects

Observations

- **UNFC-2009 suitable for application to seabed mineral resources**
 - Ability to distinguish between E and F
 - Sub-divisions of F4 relevant (Specification S)
- **Until the economics of the deposits can be evaluated should be classified as E3.2**
 - *economic viability of extraction cannot yet be determined due to insufficient information (e.g. during the exploration phase)*
 - no inferred resources
- **Classify with UNFC and disclose with CRIRSCO Template once resources become more “mature” eg commercial extraction agreements in place. Governments well placed to continue with UNFC for national reporting purposes**

Delivering on Sustainable Energy for All

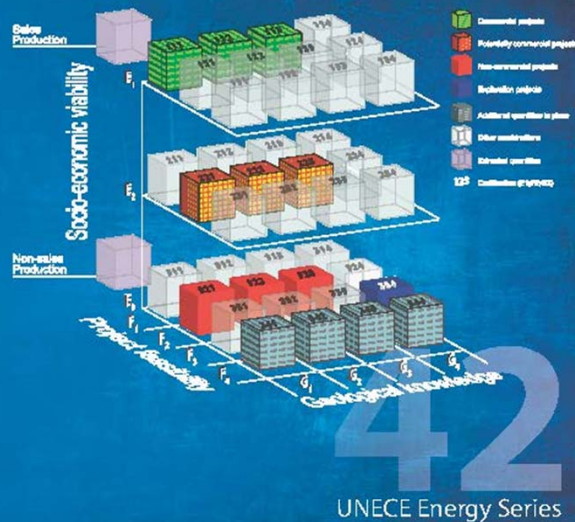
- **Securing affordable and sustainable energy for the future requires a common standard for:**
 - **Global communications about energy**
 - **Recognition of environmental and social considerations**
 - **Developing long-sighted policies for global markets**
 - **Government resources management for security and efficiency**
 - **Cost effective allocation of financial resources**
 - **Industry processes to ensure common understanding of impact of new technologies and optimization of project management decisions**



For more information on UNFC and the Expert Group

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

United Nations Framework Classification
for Fossil Energy and Mineral Reserves and Resources 2009
incorporating Specifications for its Application



UNITED NATIONS

- www.unece.org/energy/se/reserves.html
- E-mail: reserves.energy@unece.org
charlotte.griffiths@unece.org
- Sixth EGRC Meeting, Geneva, 29 April – 1 May 2015 incl. UNFC Workshop on 28 April



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