

EIT HEI Initiative

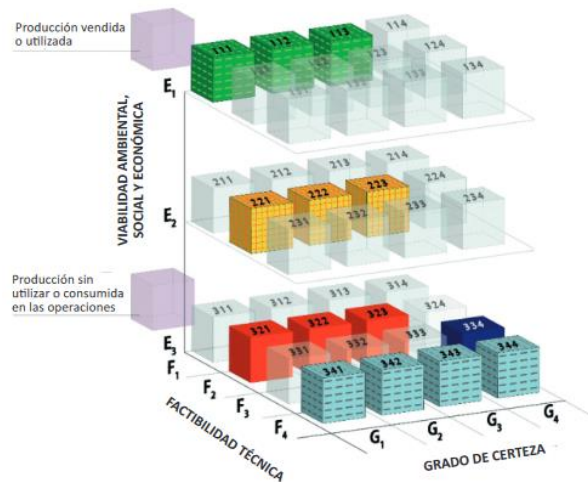
Innovation Capacity Building
for Higher Education



Raw Materials Sustainability and the Circular Economy approach

4 March 2024

United Nations Framework Classification for Resources (UNFC)



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Content:

- Background and classification systems worldwide
- **UNFC classification framework**
- **benefits from UNFC and UNRMS**
- **some bridging doc. (including CRIRSCO)**
- **conclusions**
- **references**

Background

- **United Nations Economic Commission of Europe (UNECE)** is working on a unified Universal Reserves Classification System (UNFC) for evaluating and reporting resources, where all data on reserves and resources will be harmonized and made comparable. The aim is to combine existing national and international classification systems.
- As of the end of 2021, the **Network of Practitioners Europe (NoPE)** has initiated the preparation for transforming existing classification systems in member states. The long-term goal is to implement the UNFC 3-D classification system into national legislative frameworks by preparing '**bridging documents**'.
- Training for national experts (NoPE) has been ongoing since the spring of 2022, led by UNECE in Geneva.
- **CRM Act** (2024) mandates reporting using UNFC codes.

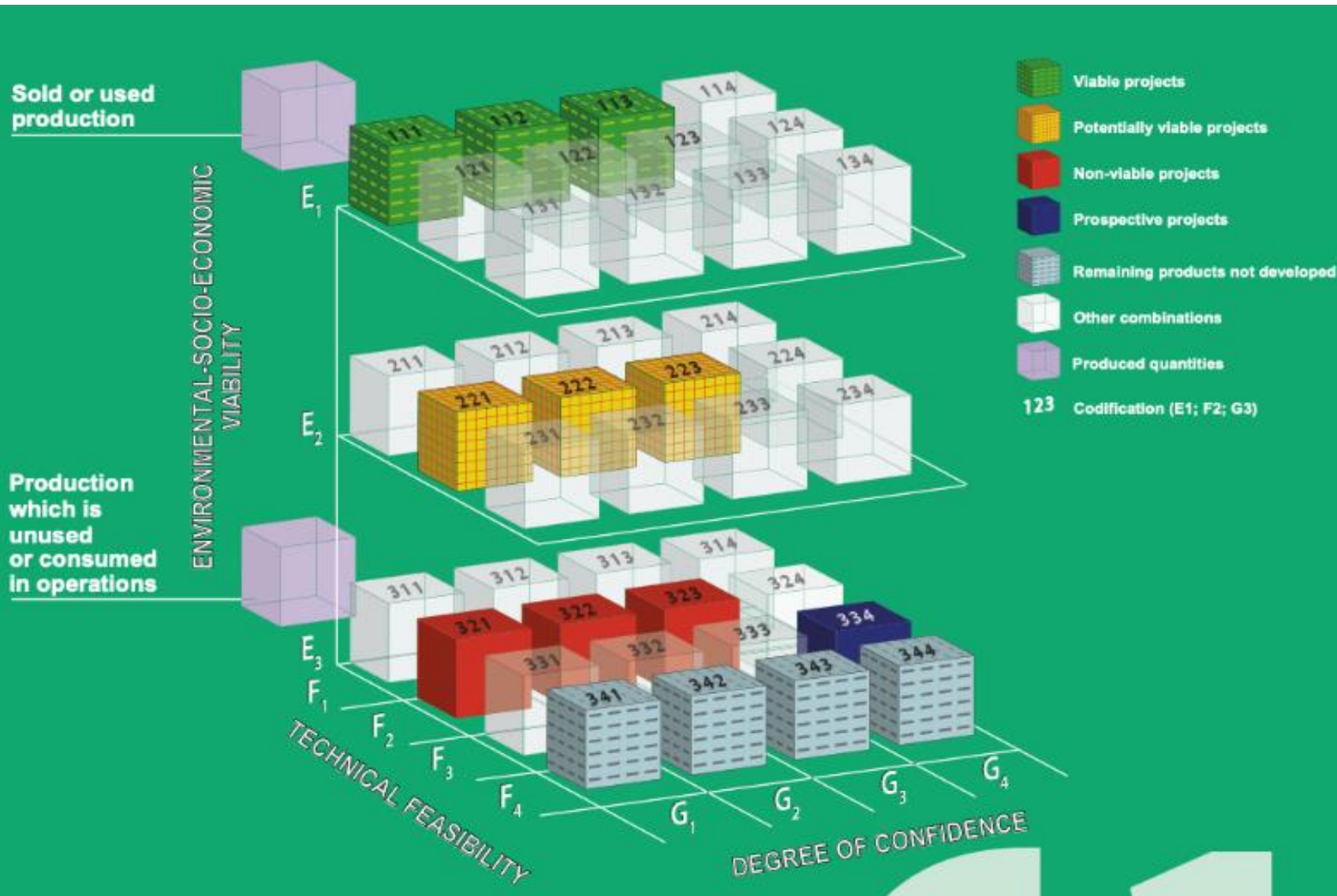
Mineral reserves reporting systems around the world

CRIRSCO (Committee for Mineral Reserves International Reporting Standards)

formed in 1994, is a grouping of representatives of organizations that are responsible for developing mineral reporting codes and guidelines in:

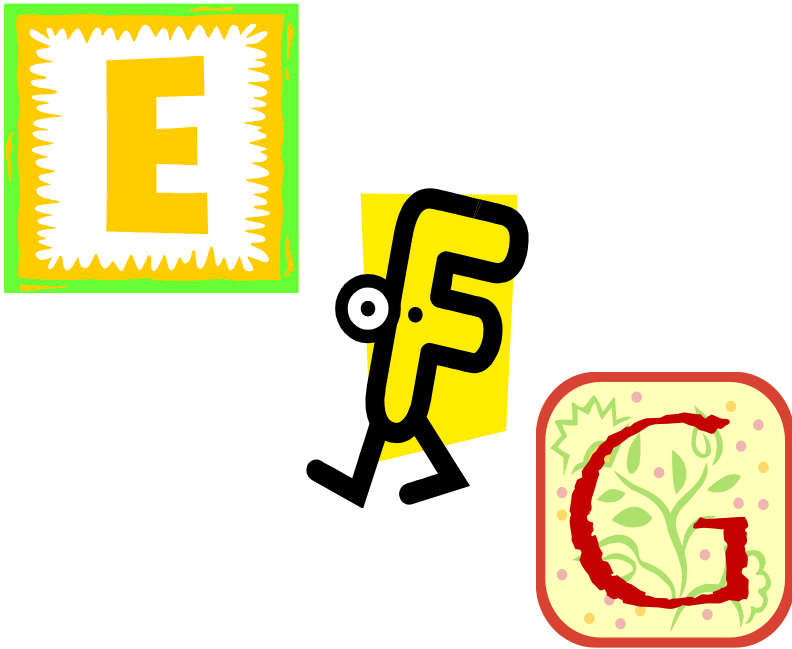
- Australia (JORC),
- Canada (CIM),
- Europe (PERC),
- Russia (NAEN),
- South Africa (SAMREC),
- USA (SME),
- etc.

United Nations Framework Classification for Resources (UNFC)



- Applicable across resources and countries
- Includes environmental, social, and economic dimensions

UNFC Classification Framework



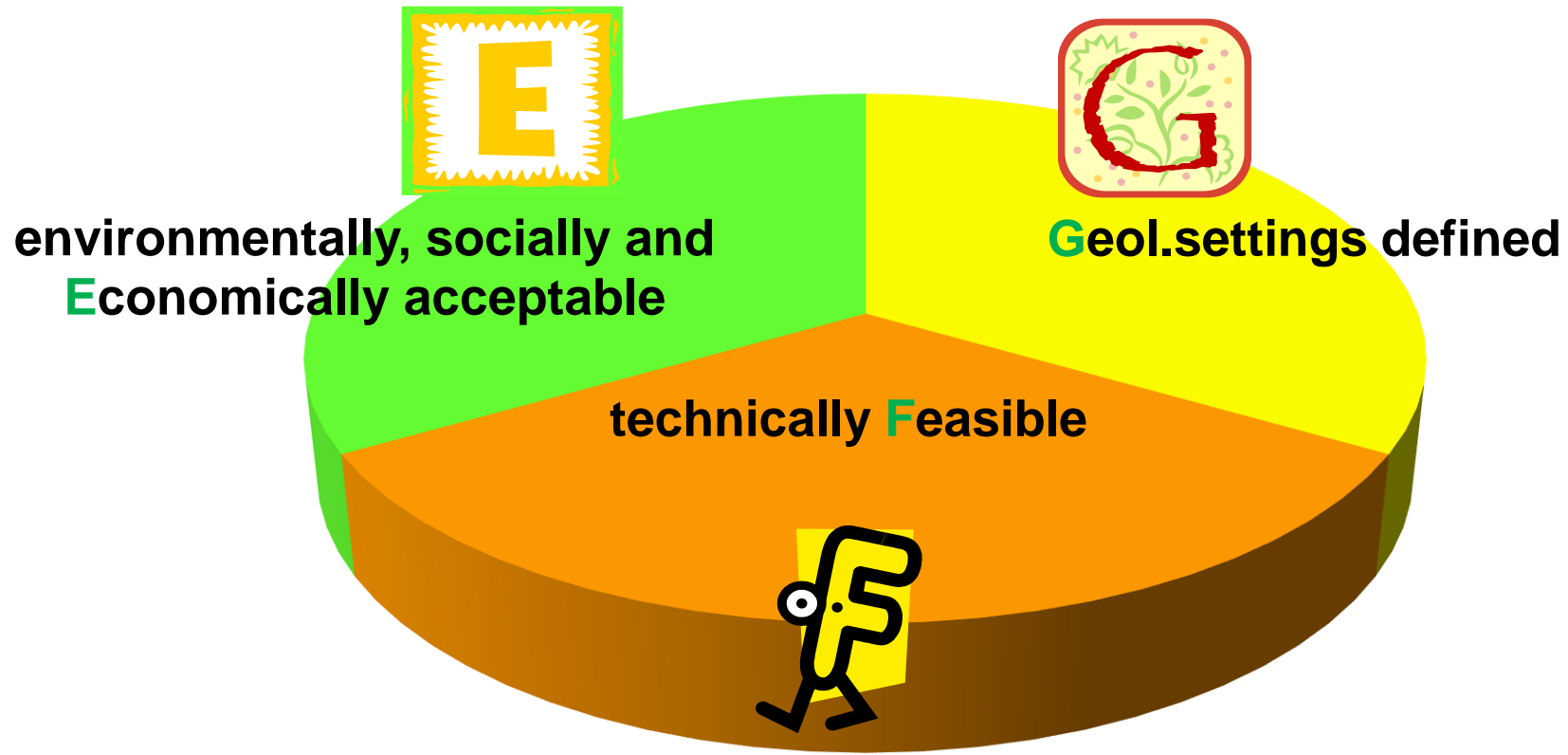
- Based on 3 fundamental criteria:
 - Environmental-Socio-**E**conomic viability
 - Technical **F**easibility
 - Degree of confidence (**G**eology)



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Why 3 criteria?

To be viable a project must be ...



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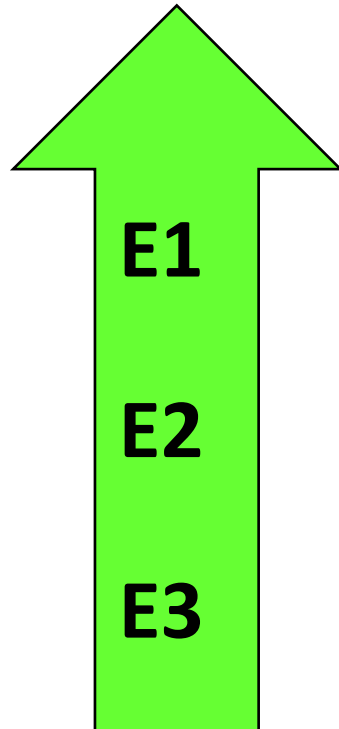


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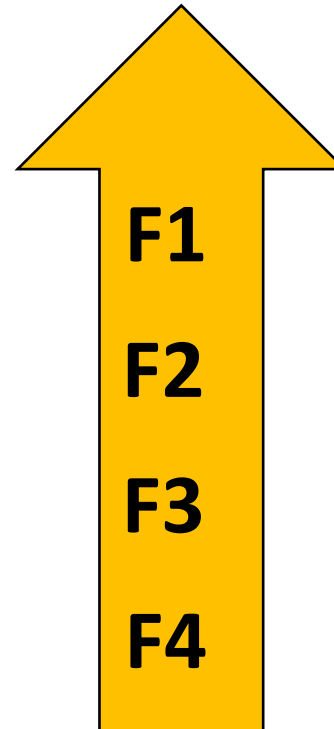
Criteria and Categories

Numerical coding system based on the 3 criteria, sub-divided by categories

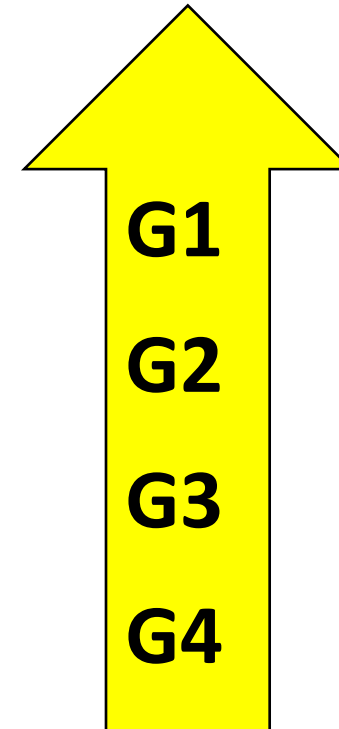
Environmental-socio-economic feasibility



Technical feasibility

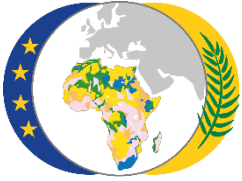


Degree of confidence



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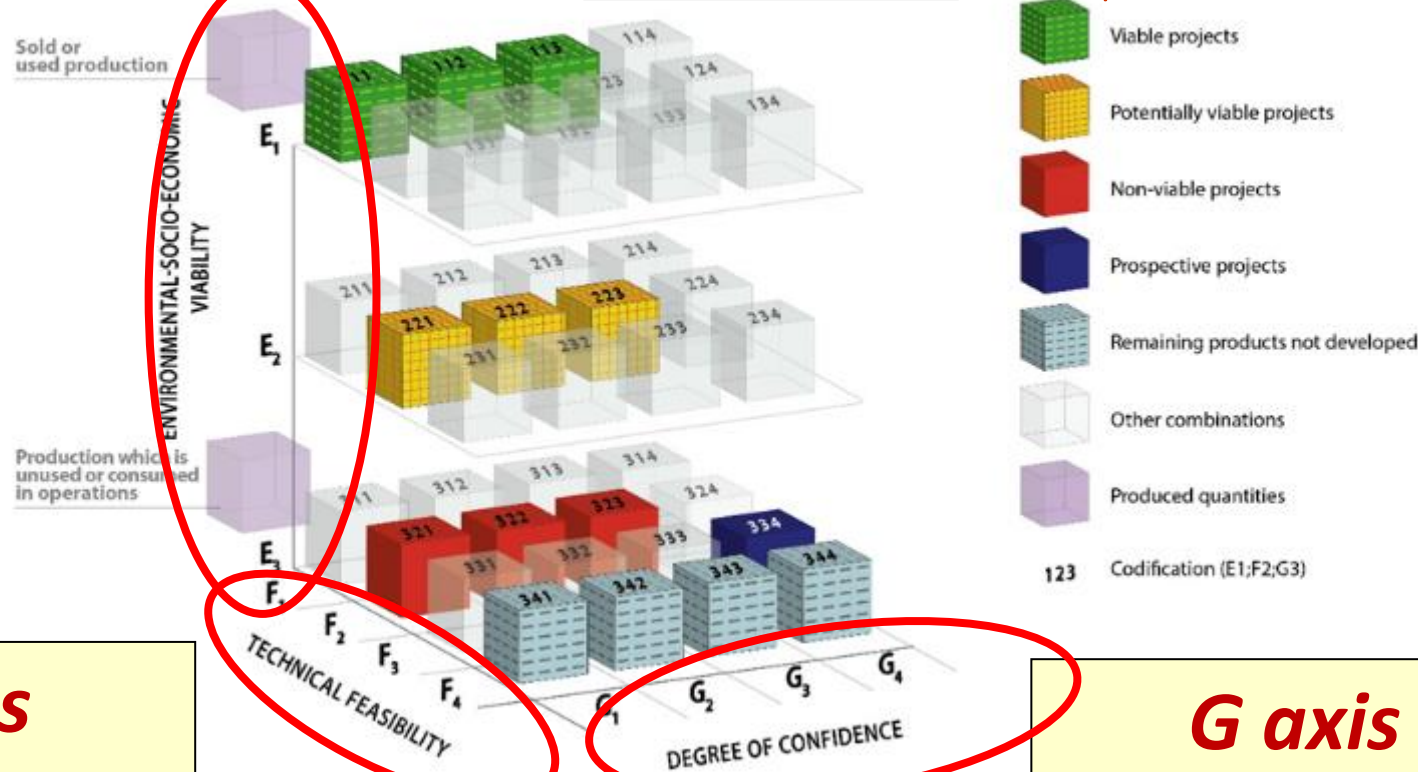
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Categories and Classes

Codification

***E axis
categories***

Classes

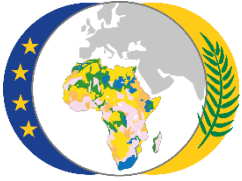


***F axis
categories***

***G axis
categories***



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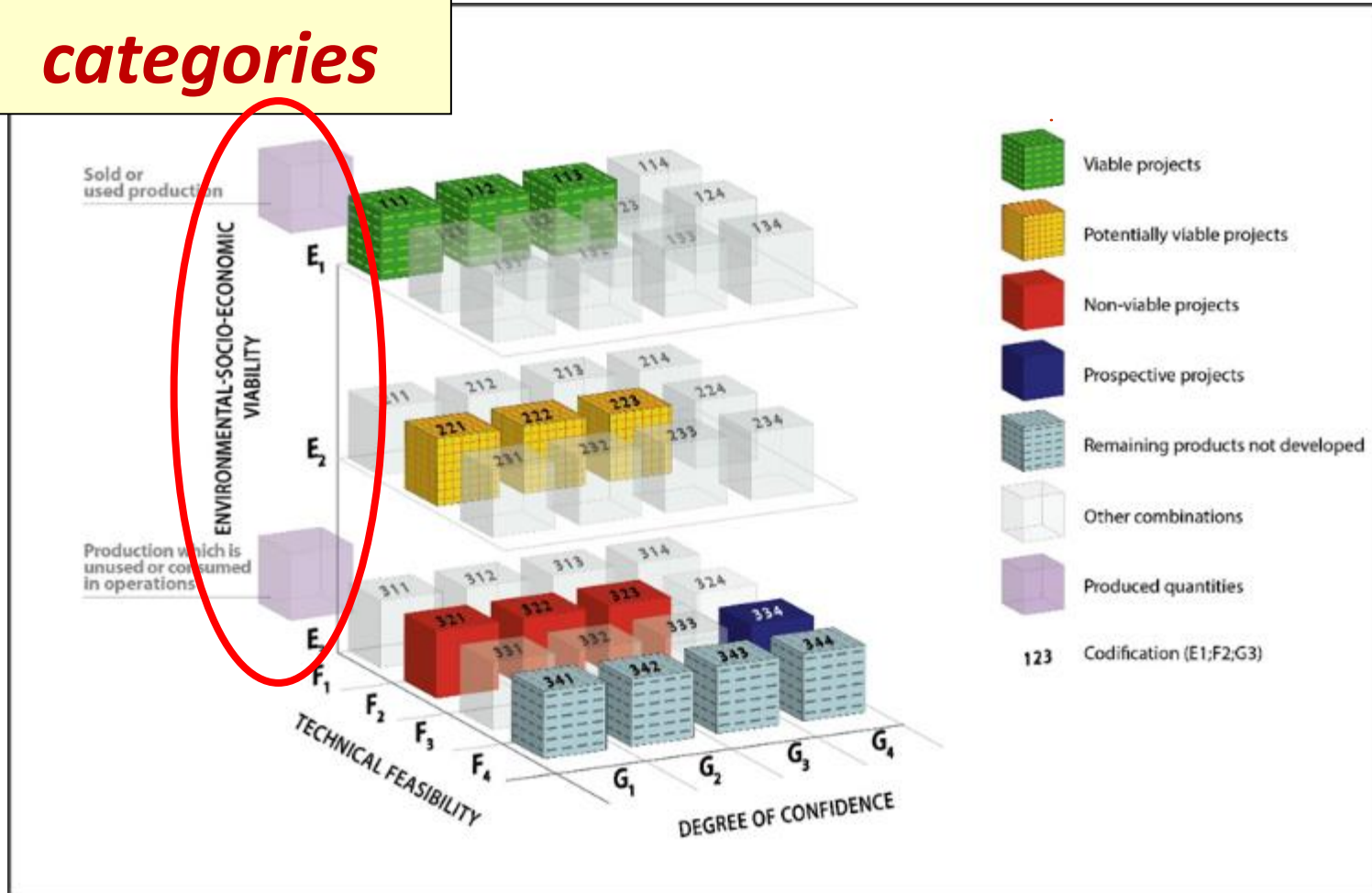


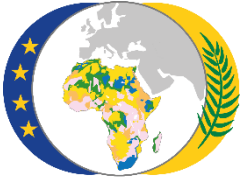
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E axis categories

Category definitions

E axis





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Category definitions

E axis (Environmental-Socio-Economic)

- Degree of favourability of environmental social and economic conditions in establishing the viability of the project
- Includes consideration of market prices and relevant legal, regulatory, social, environmental and contractual conditions
- E1, E2 and E3 categories
- E1 is “best”
- Definitions should always be read in conjunction with supporting explanation



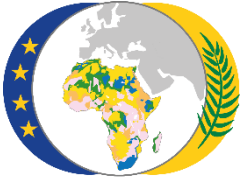
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Category definitions

E axis (Environmental-Socio-Economic)

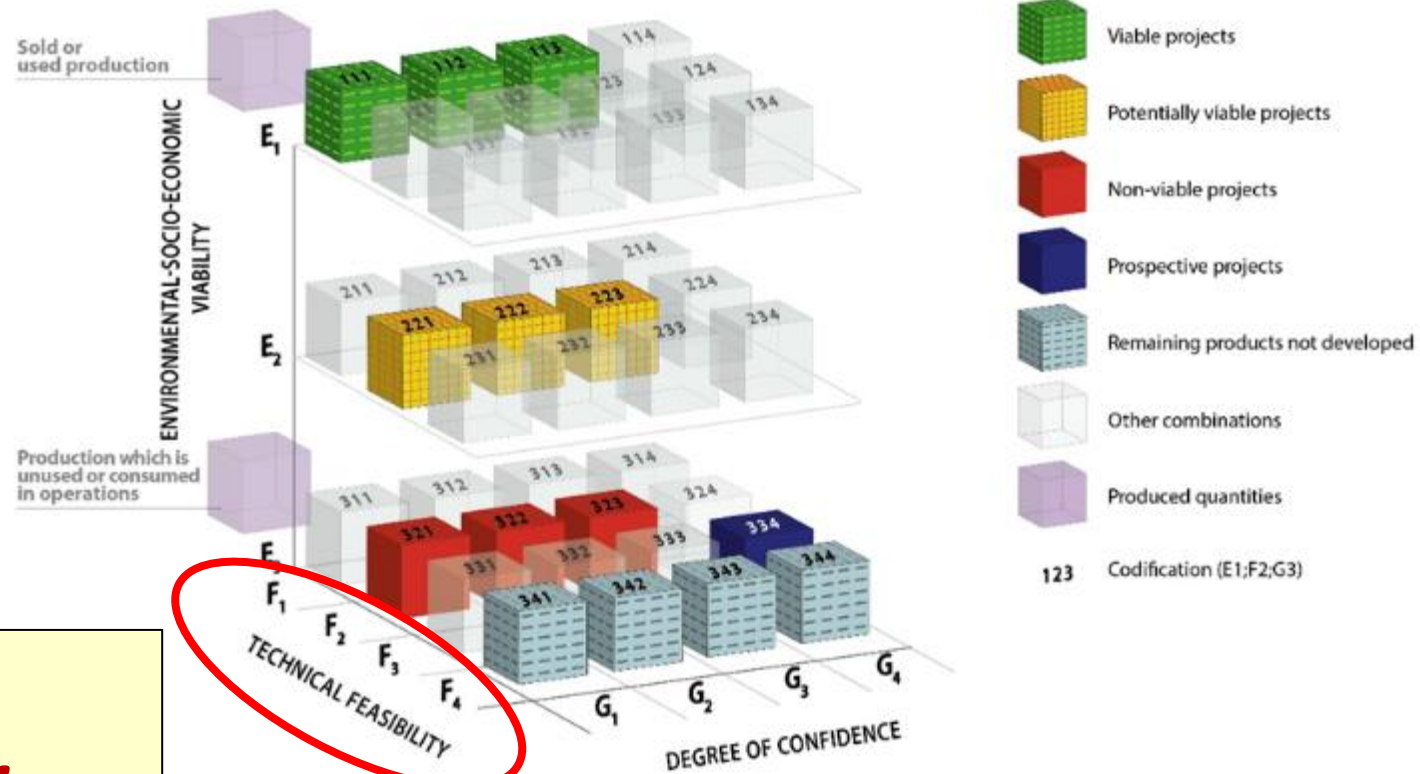
Category	Definition
E1	Development and operation are confirmed to be environmentally-socially-economically viable.
E2	Development and operation are expected to become environmentally-socially-economically viable in the foreseeable future.
E3	Development and operation are not expected to become environmentally-socially-economically viable in the foreseeable future or evaluation is at too early a stage to determine environmental-socio-economic viability.



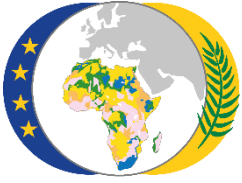
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Category definitions

F axis



***F axis
categories***



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Category definitions

F axis (Feasibility)

- Maturity of technology, studies and commitments necessary to implement the project
- These projects range from early conceptual studies through to a fully developed project that is producing
- F1, F2 and F3 and F4 categories
- F1 is “best”
- Definitions should always be read in conjunction with supporting explanation



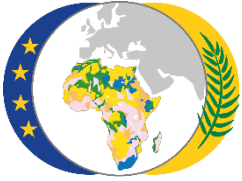
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Category definitions

F axis (Feasibility)

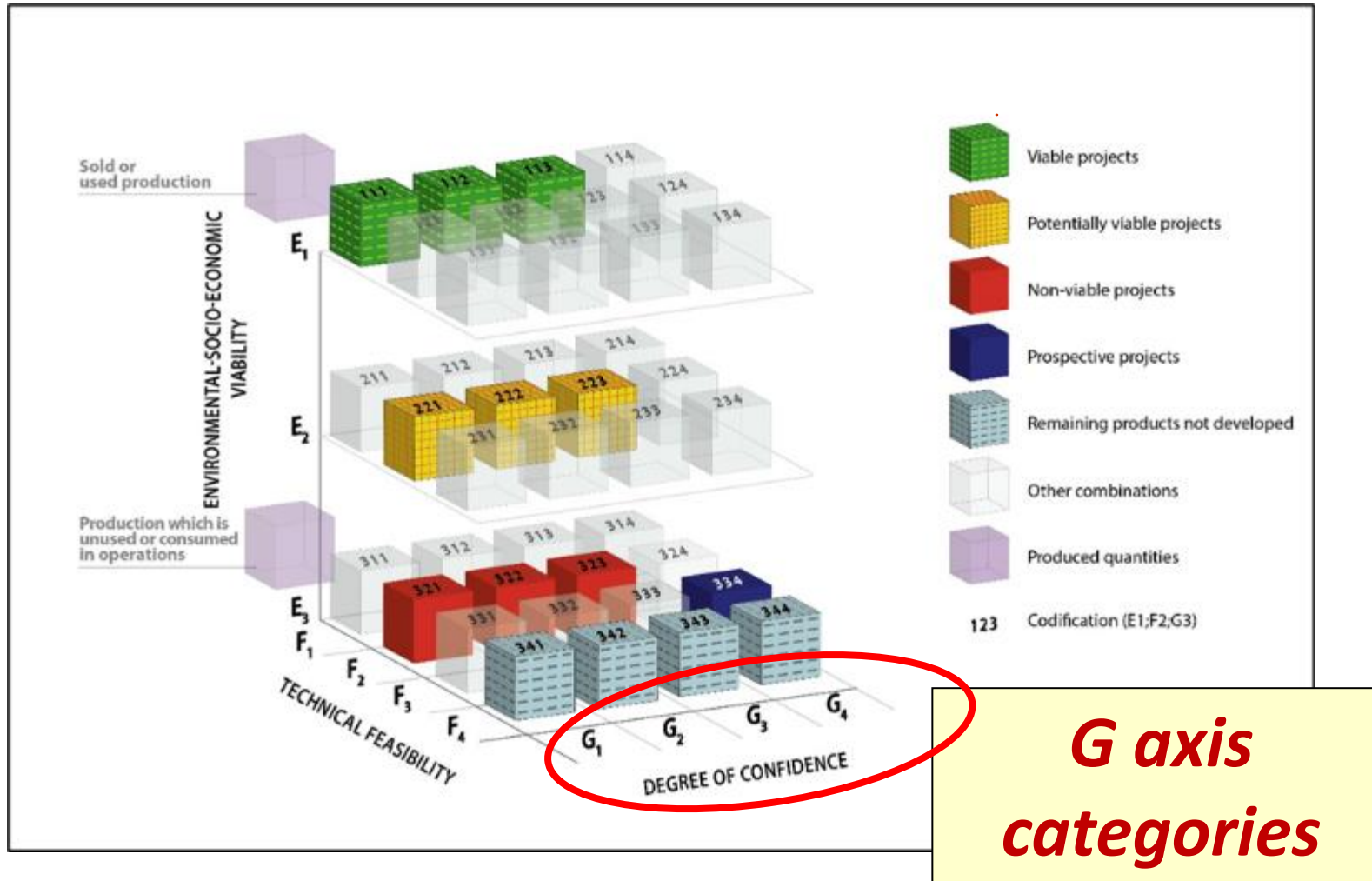
Category	Definition
F1	Technical feasibility of a development project has been confirmed .
F2	Technical feasibility of a development project is subject to further evaluation .
F3	Technical feasibility of a development project cannot be evaluated due to limited technical data .
F4	No development project has been identified.

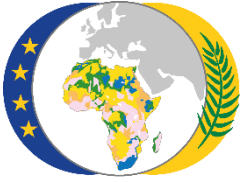


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Category definitions

G axis





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Category definitions

G axis (Geology)

- Degree of confidence in the estimate of the quantities of products from the project
- Generally defined as discrete increments for solids (G1, G2, G3), but often defined as scenarios for fluids (G1, G1+G2, G1+G2+G3)
- G1, G2, G3 and G4 categories
- G1 is “highest confidence”
- Definitions should always be read in conjunction with supporting explanation



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Category definitions

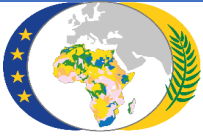
G axis (Geology)

Category	Definition
G1	Product quantity associated with a project that can be estimated with a high level of confidence.
G2	Product quantity associated with a project that can be estimated with a moderate level of confidence.
G3	Product quantity associated with a project that can be estimated with a low level of confidence.
G4	Product quantity associated with a Prospective Project, estimated primarily on indirect evidence.



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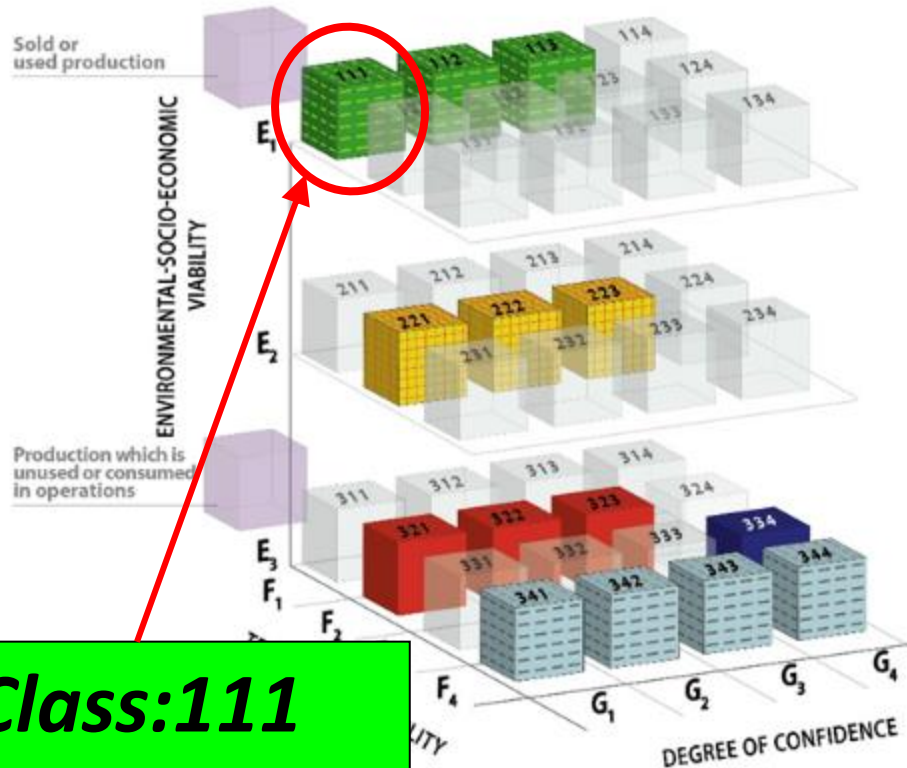




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UNFC

How it works



Category	Definition
E1	Development and operation are confirmed to be environmentally-socially-economically viable.

Category	Definition
F1	Technical feasibility of a development project has been confirmed.

Category	Definition
G1	Product quantity associated with a project that can be estimated with a high level of confidence.



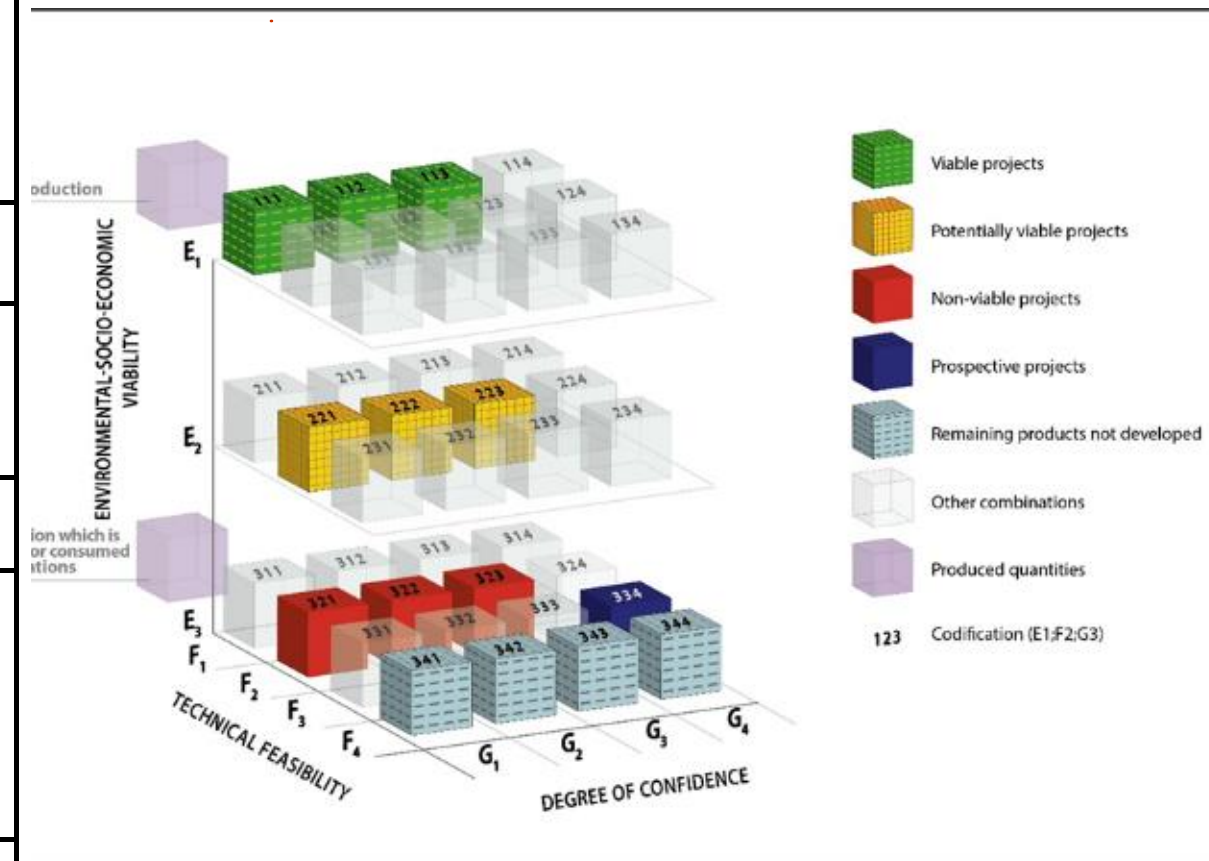
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3D representation

Total Products

Produced	Sold or used production			
	Production which is unused or consumed in operations ^a			
	Class	Minimum Categories		
		E	F	G ^b
The project's environmental-socio-economic viability and technical feasibility has been confirmed	Viable Projects ^c	1	1	1, 2, 3
The project's environmental-socio-economic viability and/or technical feasibility has yet to be confirmed	Potentially Viable Projects ^d	2 ^e	2	1, 2, 3
	Non-Viable Projects ^f	3	2	1, 2, 3
Remaining products not developed from identified projects ^g		3	4	1, 2, 3
There is insufficient information on the source to assess the project's environmental-socio-economic viability and technical feasibility	Prospective Projects	3	3	4
Remaining products not developed from prospective projects ^g		3	4	4



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UNFC Classes Defined by Categories and Sub-categories

Total Products	Produced	Sold or used production				
		Production which is unused or consumed in operations				
	Class		Sub-class	Categories		
				E	F	G
	Known Sources	Viable 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 Viable Projects	Development Pending	2 ^b	2.1	1, 2, 3
			Development On Hold	2	2.2	1, 2, 3
		Non-Viable Projects	Development Unclassified	3.2	2.2	1, 2, 3
Development Not Viable			3.3	2.3	1, 2, 3	
Remaining products not developed from identified projects			3.3	4	1, 2, 3	
Potential Sources	Prospective Projects	[No sub-classes defined]	3.2	3	4	
	Remaining products not developed from prospective projects		3.3	4	4	

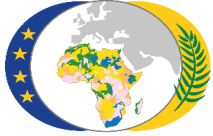
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Sub-categories and classes provide more resolution



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Summary

- **UNFC-2019 is a generic, principles-based system**
 - Applicable to solid minerals, anthropogenic resources, and a wide range of renewable and non-renewable resources
- **Based on three fundamental criteria**
 - Environmental-socio-economic viability
 - Technical feasibility
 - Degree of confidence
- **Each criterion is sub-divided into 3 or 4 defined categories**
 - Optional use of sub-categories for more granularity
- **Classes are defined by a combination of a single category or sub-category for each of the three criteria**
 - Numerical category or sub-category for E, for F and for G
 - Always quoted in same sequence: E – F – G
 - Axis letters can be dropped: e.g. Class 221



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Specifications

- Minerals
- Petroleum
- Anthropogenic Resources
- Geothermal Energy Resources
- Solar Energy Resources
- Wind Energy Resources
- Injection Projects for Geological Storage
- Bioenergy Resources
- Nuclear Projects
- Groundwater

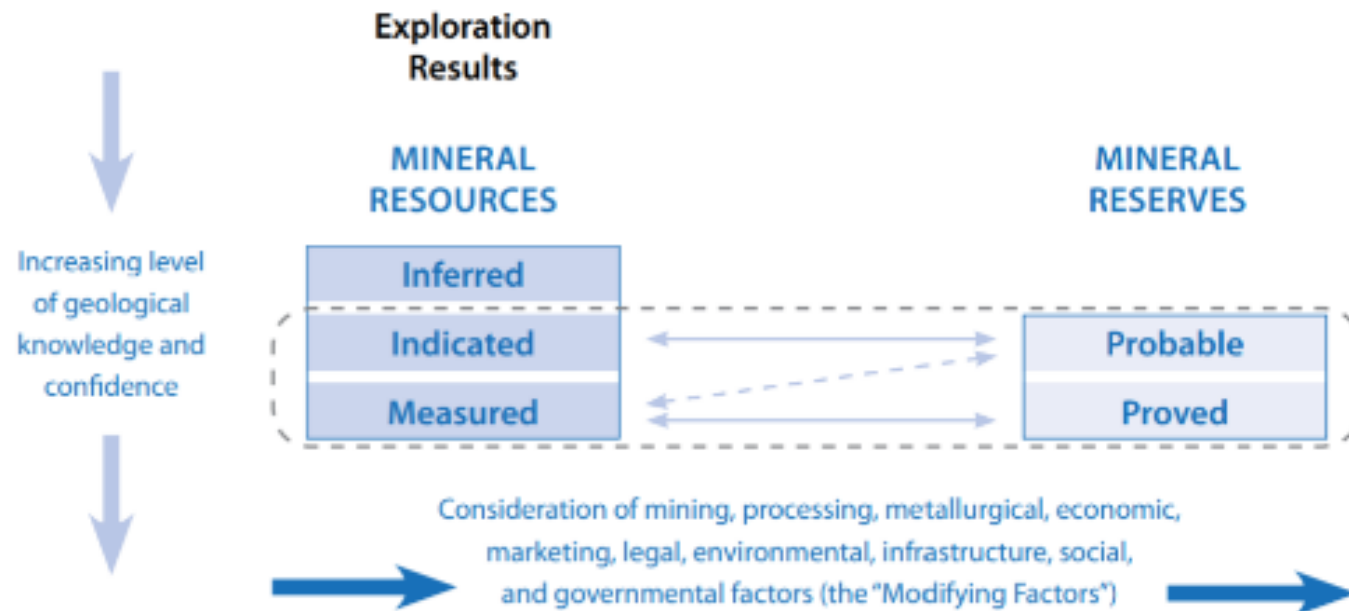
Bridging documents

-
- Aligned System - **A classification system** that has been aligned with UNFC as demonstrated by the existence of a **Bridging Documents** are being prepared by proj. **GSEU** (WP-2).
 - A document that explains the relationship between UNFC and another classification system, including instructions and guidelines on how to classify estimates generated by application of that system using the UNFC Numerical Codes.
-

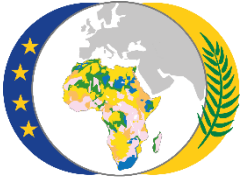


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CRIRSCO Bridging 1/2



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 Target		E3	F3	G4	Exploration Projects



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CRIRSCO Bridging 2/2

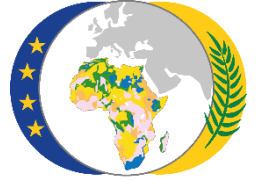
	F1.1	F1.2	F1.3	F2.1	F2.2	F2.3	F3	F4
E1.1	1	2	3	4				
E1.2	1	2	3					
E2			4	4	5			
E3.1	12	12	12	12	12	12		
E3.2			6	6	6		8	
E3.3			7	7	7	7		11

		UNFC-2009 Sub-Classes	
Mineral Reserve	1	On Production	
	2	Approved for Development	
	3	Justified for Development	
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 Target		8	
Special Cases	Classification not in Template	12	
	Less Common Mappings		

3 Way Bridging

UNFC-2009 Classification					CRIRSCO Template		NEA/IAEA Classification		
UNFC Classes and Sub-classes		UNFC Categories			CRIRSCO Classes and Sub-classes				
Class	Sub-Class	E	F	G	Class	Sub-Class	IAEA-NEA Categories		Status
Commercial Projects	On Production	1	1.1	1	Mineral Reserves	Proved	Reasonably Assured Resources (RAR)		Existing
				2		Probable			
	Approved for Development	1	1.2	1		Proved			Committed
				2		Probable			
	Justified for Development	1	1.3	1		Proved			Planned
				2		Probable			
Potentially Commercial Projects	Development Pending	2	2.1	1	Mineral Resources	Measured	Identified Resources	RAR	Prospective
				2		Indicated		IR*	
				3		Inferred		RAR	
	Development On Hold	2	2.2	1		Measured		IR*	
				2		Indicated			
				3		Inferred			
Non-commercial Projects	Development Unclassified	3.2	2.2	1,2,3	Inventory (not defined in Template)	Development Unclassified (not defined in Template)	Identified Resources RAR IR*		Unclassified
	Development Not Viable	3.3	2.3	1,2,3		Not Viable (not defined in Template)			Not Viable
Exploration Projects		3.2	3.1	4	Exploration Target		Undiscovered Resources	Prognosticated Resources	
		3.2	3.2, 3.3	4				Speculative Resources	

Benefits from the unified classification system / UNRMS (UN Resources Management System) value drivers:



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Social Resource Contract (SLO+)

- **Governance, transparency, stakeholder engagement**
- **Mitigate / Eliminate Moral Hazard & Negative Externalities**
 - Zero waste – includes pre-approved End of Lifecycle management plan for issuance of operating permit
 - Zero harm
- **Reliability of Key Data**
 - Capability, credibility and Independence of Experts

Circularity from commodity to resources as a service and Public Good
Continuous whole lifecycle resource management

Provenance, traceability and trackability of resources funds

Secure supply chains for critical materials and stressed resources
Innovation – transformative technologies and business models
Blockchain (all resources tokenized)
Smart Contracts

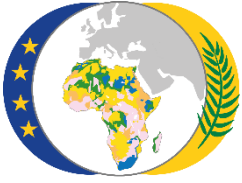
ESG Scores (Environmental, Social and Governance) - how products and services contribute to sustainable development.

Climate Action – Carbon Tariffs
Energy Efficiency
Water Use Efficiency
Resource Use Efficiency



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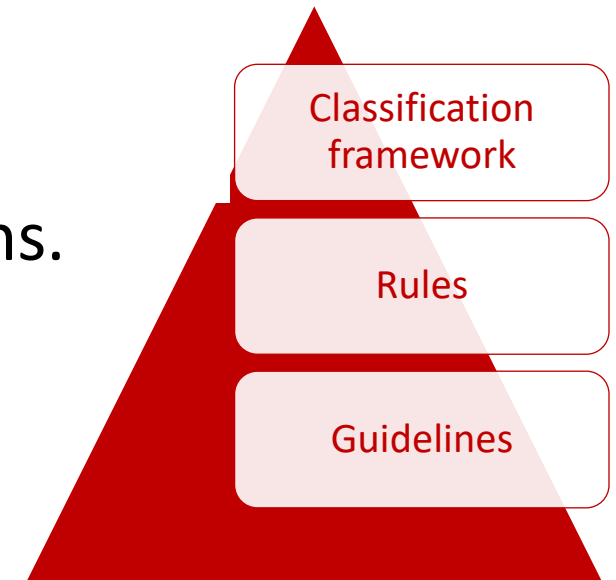




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to conclude

- Principles provide the **classification framework**.
- Specifications are **application rules-mandatory** (how a resource classification system is to be applied, supplementing the framework definitions of that system.).
- **Bridging Documents** relates UNFC with other systems.
- **Guidelines** provide **non-mandatory** instructions.



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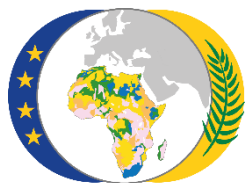
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References

- ✓ United nations international framework classification for reserves/resources – Solid fuels and mineral commodities, United nations economic and social council, ECE, Committee on sustainable energy, Geneva, 1996
- ✓ United nations framework classification for fossil energy and mineral reserves and resources 2009 incorporating specifications for its application, UNECE, New York and Geneva, 2013
- ✓ ***United nations framework classification for resources -update 2019***«, providing key rules and parameters for UNFC classification, translated into several member states languages
- ✓ ***UNFC GUIDANCE EUROPE, Guidance for the Application of the United Nations Framework Classification for Resources (UNFC) for Mineral and Anthropogenic Resources in Europe***, Geneva, 2022



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Thank you!



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