

PanAfGeo+

Partnerships and Capacity Building

The Pan-African Support to Geological Sciences and Technology

Slavko Solar, Geological Survey of Slovenia/ICE-SRM EU

National AMREC/PARC – UNFC Workshop

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Introduction to UN Framework Classification for Resources (UNFC): How does it work?



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Implemented by:



1. Introduction
2. UN Framework Classification for Resources
 1. Basics
 2. Structure
3. Classifying options
4. Understanding UNFC with Comparison
5. Conclusion

Introduction

Resource classification → systematic grouping based on rules or criteria

Not classification → listing, describing, using, or managing resources without structured categorization

Sentence: Resource classification is the systematic grouping of resources based on their origin, availability, economic value, and level of knowledge to support their management and use.

Introduction

Resource classification is the process of **categorizing natural resources** based on specific criteria such as their origin, availability, stage of development, economic value, or level of geological confidence.

It is widely used in fields like **geoscience, mining, environmental management, and economics** (including systems like UNFC, which you're familiar with).

The Challenge of Classification

How to Classify?

How to
Classify?

By genre

By artist

By composer

By instruments

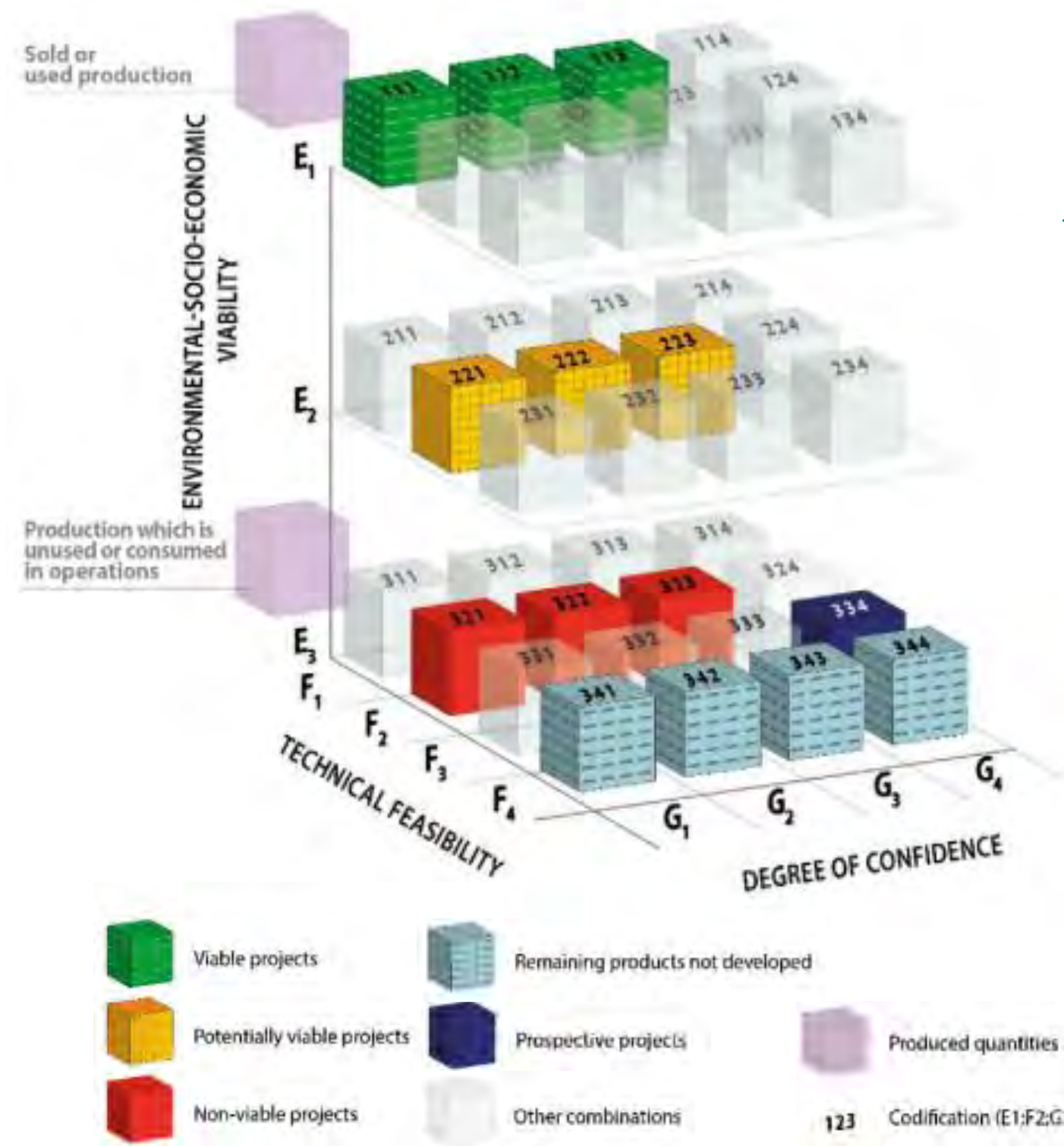
By tempo

By date recorded

By date purchased



UNFC Overview

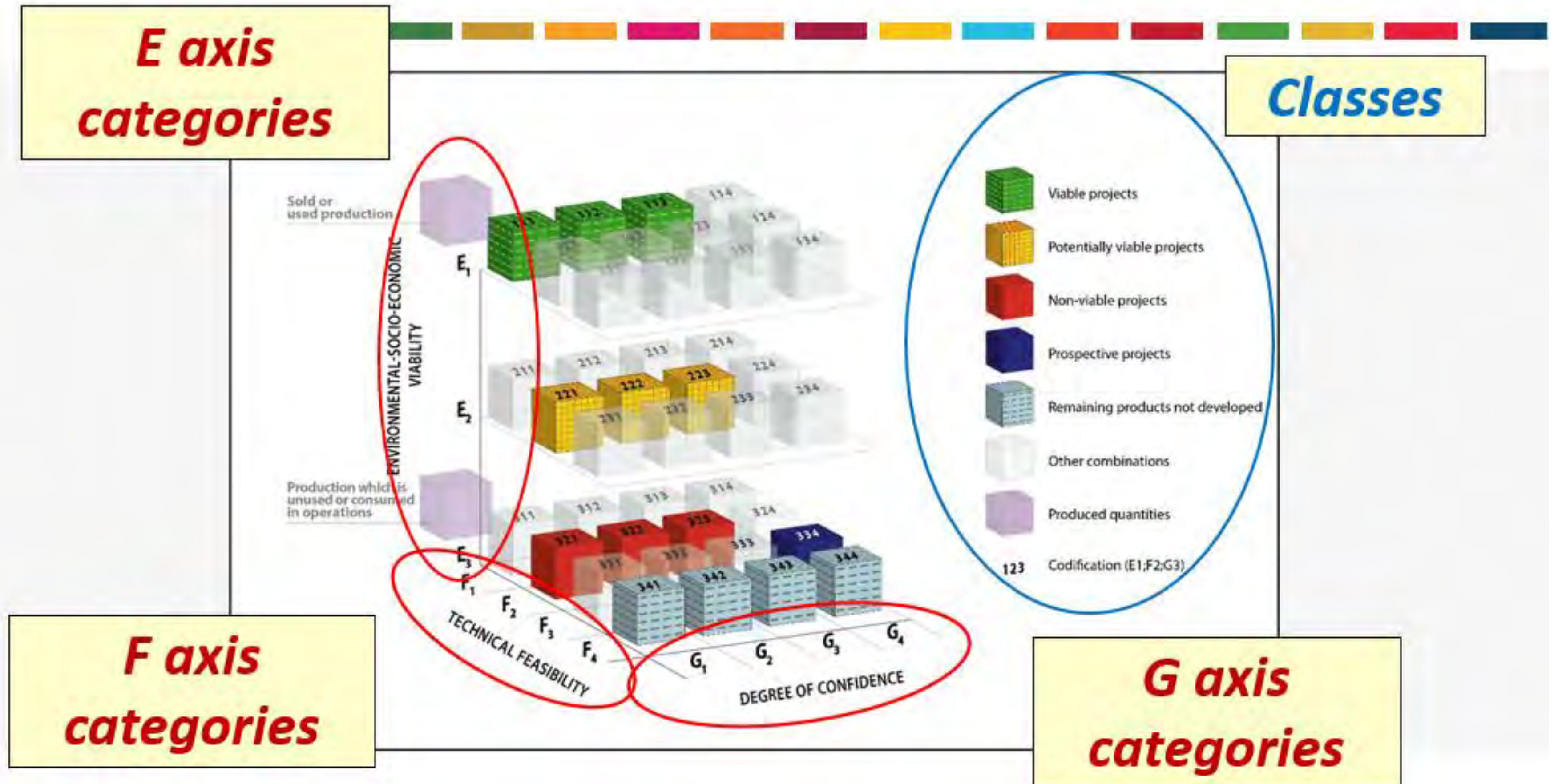


UNFC is an international scheme for the classification, management and reporting of energy and raw material resources

- **UNFC** is based on 3 fundamental criteria
 - **E axis:** Environmental-socio-economic viability
 - **F axis:** Technical Feasibility
 - **G axis:** Degree of Confidence

UNFC

Categories and Classes



UNFC

3 tier Framework

- 1. Definitions: Classification framework
- 2. Specifications: Application rules
- 3. Guidelines: Non-mandatory guidance

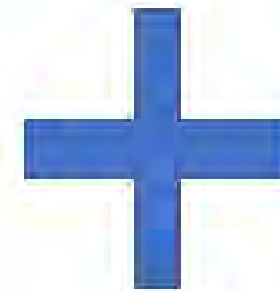
Principles

Rules

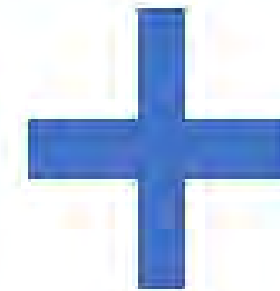
Guidelines

UNFC Documents Sequence

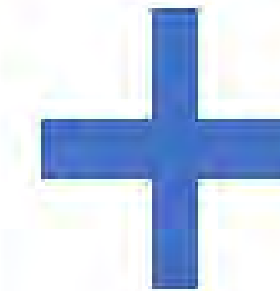
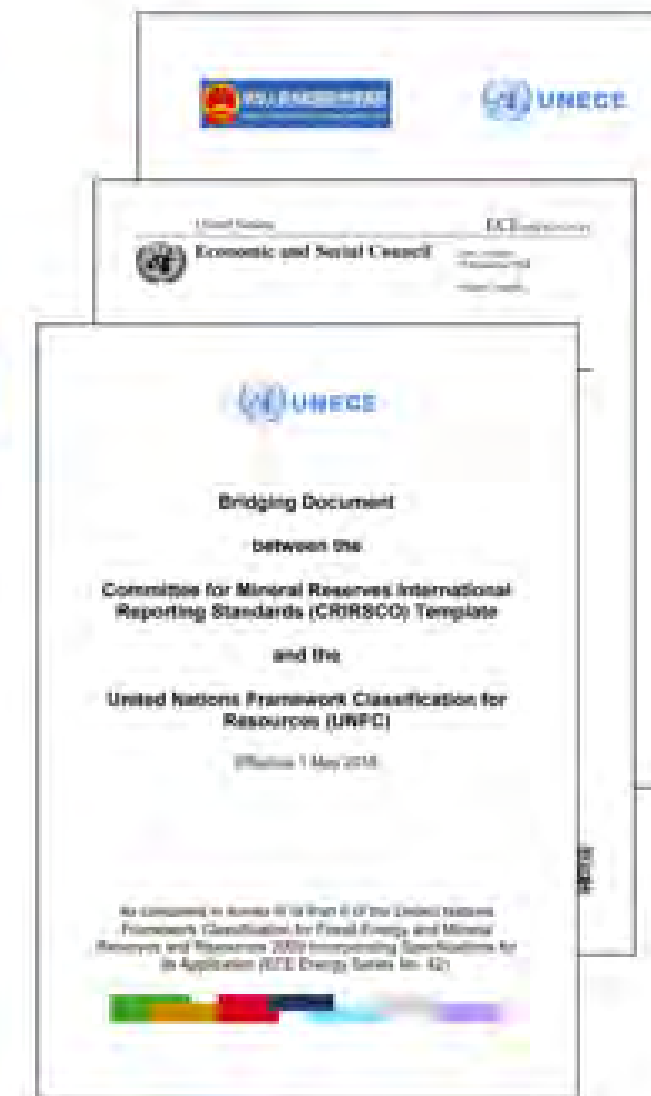
UNFC and Generic Specifications



Supplementary Specifications



Bridging Documents



Guidance



UNFC Specifications Documents

- Generic specifications – Specifications that apply to the classification of products of a resource project using UNFC.
- Generic Specifications ensure clarity and comparability and are complementary to the source-specific requirements
- Additional details (mandatory rules) on how a resource classification system is to be applied, supplementing the framework definitions of that system.

UNFC Specifications Documents

Specifications

- Generic Specifications
- Minerals
- Anthropogenic Resources
- Petroleum
- Renewable energy (generic)
- Geothermal Energy Resources
- Solar Energy Resources
- Wind Energy Resources
- Injection Projects for Geological Storage
- Bioenergy Resources
- Nuclear Projects
- Groundwater

Alignment of Systems Bridging Documents

- 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
- **Aligned System** - A classification system that has been aligned with UNFC as demonstrated by the existence of a Bridging Document that has been endorsed by the Expert Group on Resource Management.

Existing Bridging Documents

- CRIRSCO for minerals
- PRMS for petroleum
- IAEA Red Book – Nuclear
- Russian Federation – petroleum
- China – minerals
- China – petroleum

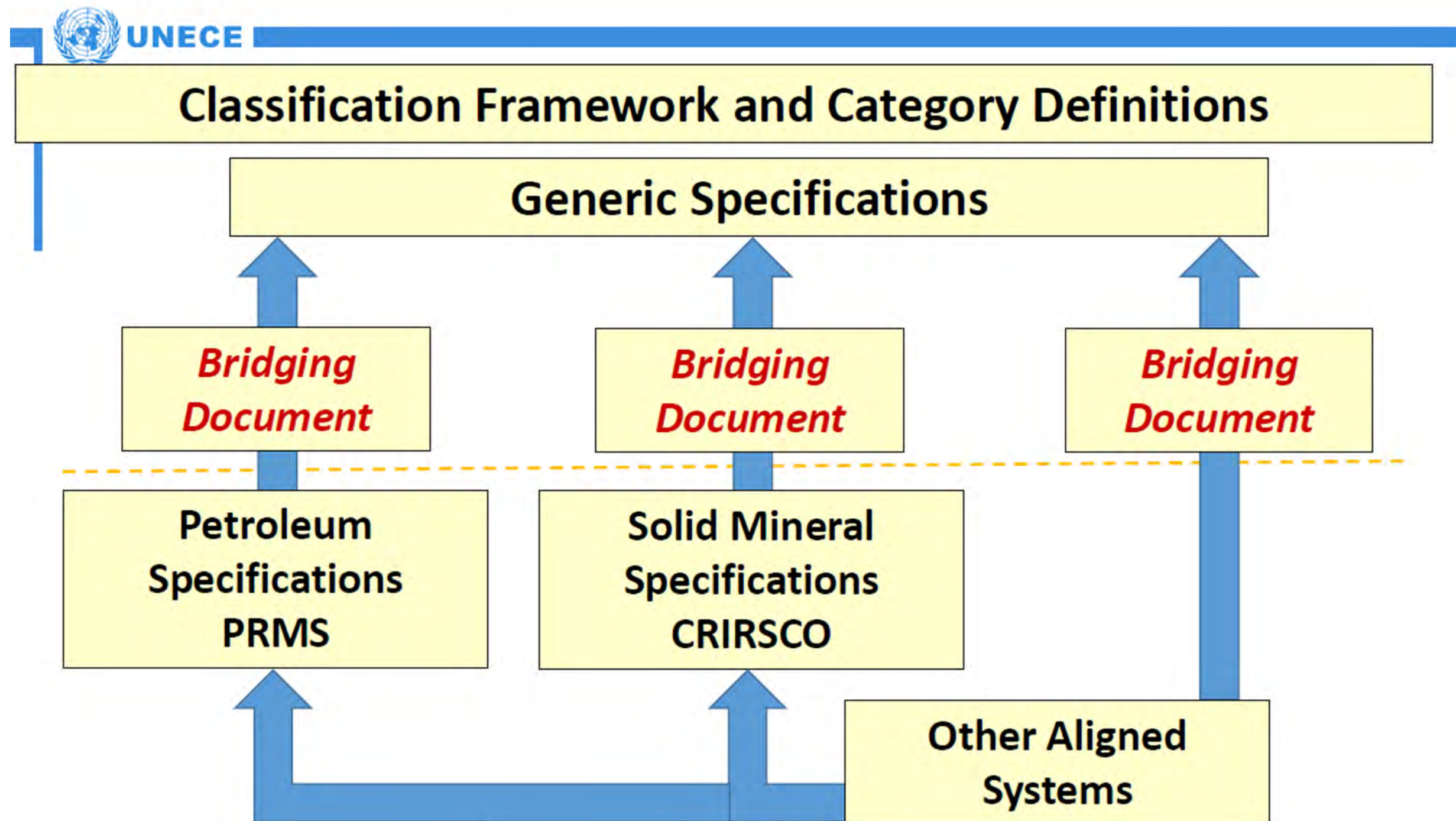
CRIRSCO Template		UNFC-2009 "minimum" Categories			UNFC-2009 Class	
Mineral Reserve	Proved	E1	F1	G1	Commercial Projects	
	Probable			G2		
Mineral Resource	Measured	E2	F2	G1	Potentially Commercial Projects	
	Indicated			G2		
	Inferred			G3		
Exploration Results		E3	F3	G4	Exploration Projects	

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

Law (2015) and Proposed New Book of Regulations for Solid Mineral Raw Materials	Results of Geological Exploration	Mineral Resources			Mineral Reserves	
		Inferred	Indicated	Measured	Probable	Proved
Official Book of Regulations for Solid Mineral Raw Materials (1979)	Potential	Mineral Reserves			Exploitation (inclusive of dilutions and losses during mining)	
		Potential	Established (in situ – Geological: Out-of-Balance and Balance)			
	D ₂ , D ₁	C ₂	C ₁	B ₂ , A	C ₁	B ₂ , A
UNFC	Mineral Resources			Mineral Reserves		
	334	223	222	221	112	111

Bridging Documents Basics For Mineral Deposits

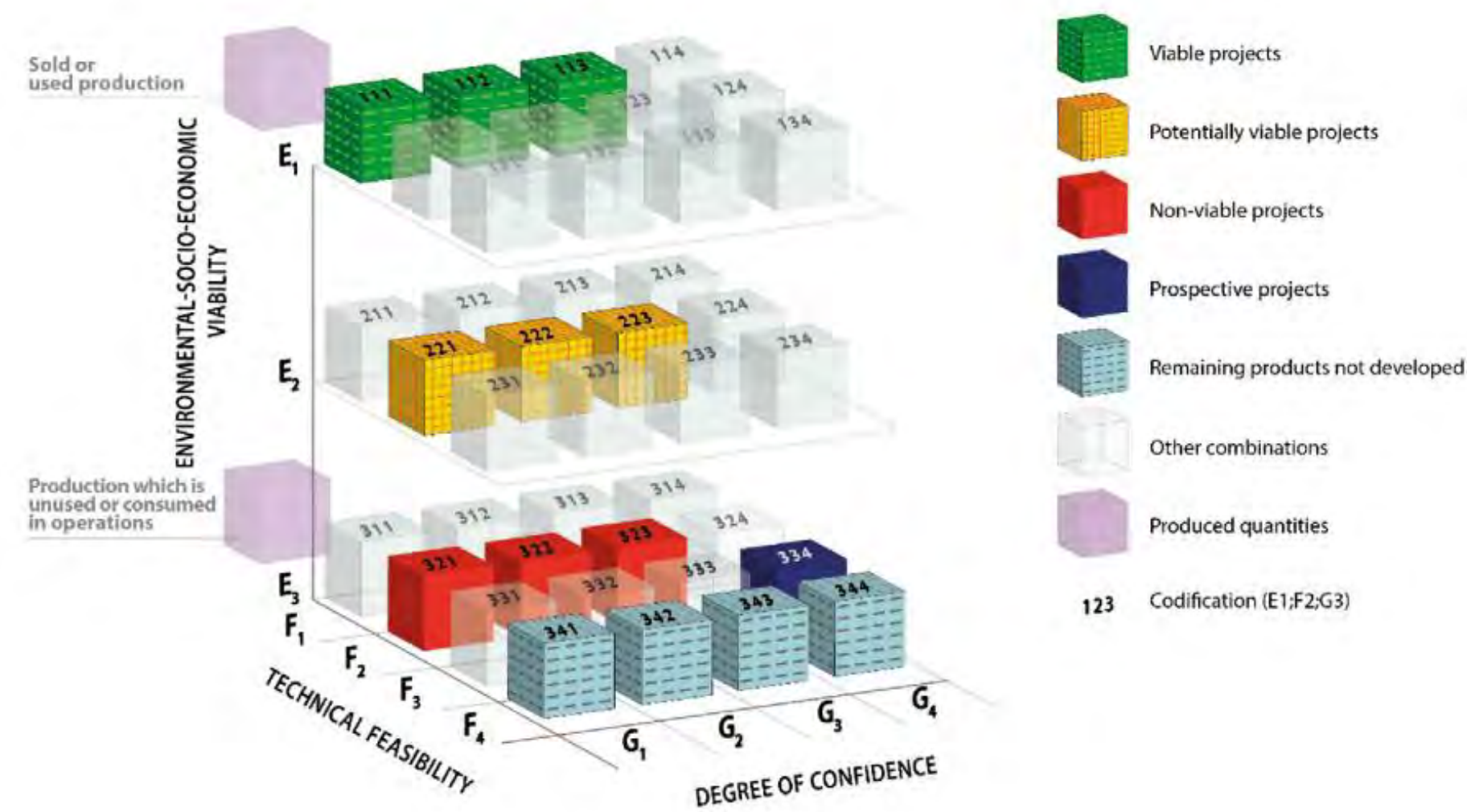
Bridging and Aligned Systems



H. Falck Z. Horváth 2023
UNFC Workshop Georgia

Conclusion

UNFC Categories and Examples of Classes



UNFC Classes and Sub-classes defined by Sub-categories^a

UNFC Classes Defined by Categories and Sub-categories						
Total Products	Produced	Sold or used production				
		Production which is unused or consumed in operations				
	Known Sources	Class	Sub-class	Categories		
				E	F	G
		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
	Potential Sources	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
		Prospective Projects	[No sub-classes defined]	3.2	3	4
		Remaining products not developed from prospective projects		3.3	4	4

a. Refer also to the notes for Figure 2.

b. Development Pending Projects may satisfy the requirements for E1.

UNFC Categories Definition

E axis



- 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

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.

UNFC Categories Definition

E axis

+ Sub-Category Definition



- Degree of viability in established
- Includes social, economic
- E1, E2 and E3
- E1 is “baseline”
- Definition of E1 can be read in supporting information

Sub-Category	Sub-Category Definition
E1.1	Development is environmentally-socially-economically viable on the basis of current conditions and realistic assumptions of future conditions.
E1.2	Development is not environmentally-socially-economically viable on the basis of current conditions and realistic assumptions of future conditions, but is made viable through government subsidies and/or other considerations.
No Sub-categories defined	
E3.1	Estimate of product that is forecast to be developed, but which will be unused or consumed in operations.
E3.2	Environmental-socio-economic viability cannot yet be determined due to insufficient information.
E3.3	On the basis of realistic assumptions of future conditions, it is currently considered that there are not reasonable prospects for environmental-socio-economic viability in the foreseeable future.

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UNFC Categories Definition

F axis



- **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**

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.

UNFC Categories Definition

F axis

+ Sub-Category Definition

Sub-Category	Sub-Category Definition
F1.1	Production is currently taking place.
F1.2	Capital funds have been committed and implementation of the development is underway.
F1.3	Studies have been completed to demonstrate the technical feasibility of development and operation. There shall be a reasonable expectation that all necessary approvals/contracts for the project to proceed to development will be forthcoming
F2.1	Project activities are ongoing to justify development in the foreseeable future.
F2.2	Project activities are on hold and/or where justification as a development may be subject to significant delay.
F2.3	There are no plans to develop or to acquire additional data at the current time due to limited potential.

Definitions should always be read in conjunction with supporting explanation

Commitments necessary to implement the conceptual studies through to a fully developed

Sub-Category	Sub-Category Definition
F3.1	Site-specific studies have identified a potential development with sufficient confidence to warrant further testing.
F3.2	Local studies indicate the potential for development in a specific area but requires more data acquisition and/or evaluation in order to have sufficient confidence to warrant further testing.
F3.3	At the earliest stage of studies, where favourable conditions for the potential development in an area may be inferred from regional studies.
F4.1	The technology necessary is under active development, following successful pilot studies, but has yet to be demonstrated to be technically feasible for this project.
F4.2	The technology necessary is being researched, but no successful pilot studies have yet been completed.
F4.3	The technology is not currently under research or development.

UNFC Categories Definition

G axis



- 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

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.

UNFC Categories Definition

G axis



- Degree of confidence in the estimate of the quantities of products from the project

- General defined

- G1, G2,

- G1 is “h

- Definition

be read in conjunction with supporting explanation

Sub-Category	Sub-Category Definition
G4.1	Low estimate of the quantities.
G4.2	Incremental amount to G4.1 such that G4.1+G4.2 equates to a best estimate of the quantities.
G4.3	Incremental amount to G4.1+G4.2 such that G4.1+G4.2+G4.3 equates to a high estimate of the quantities.

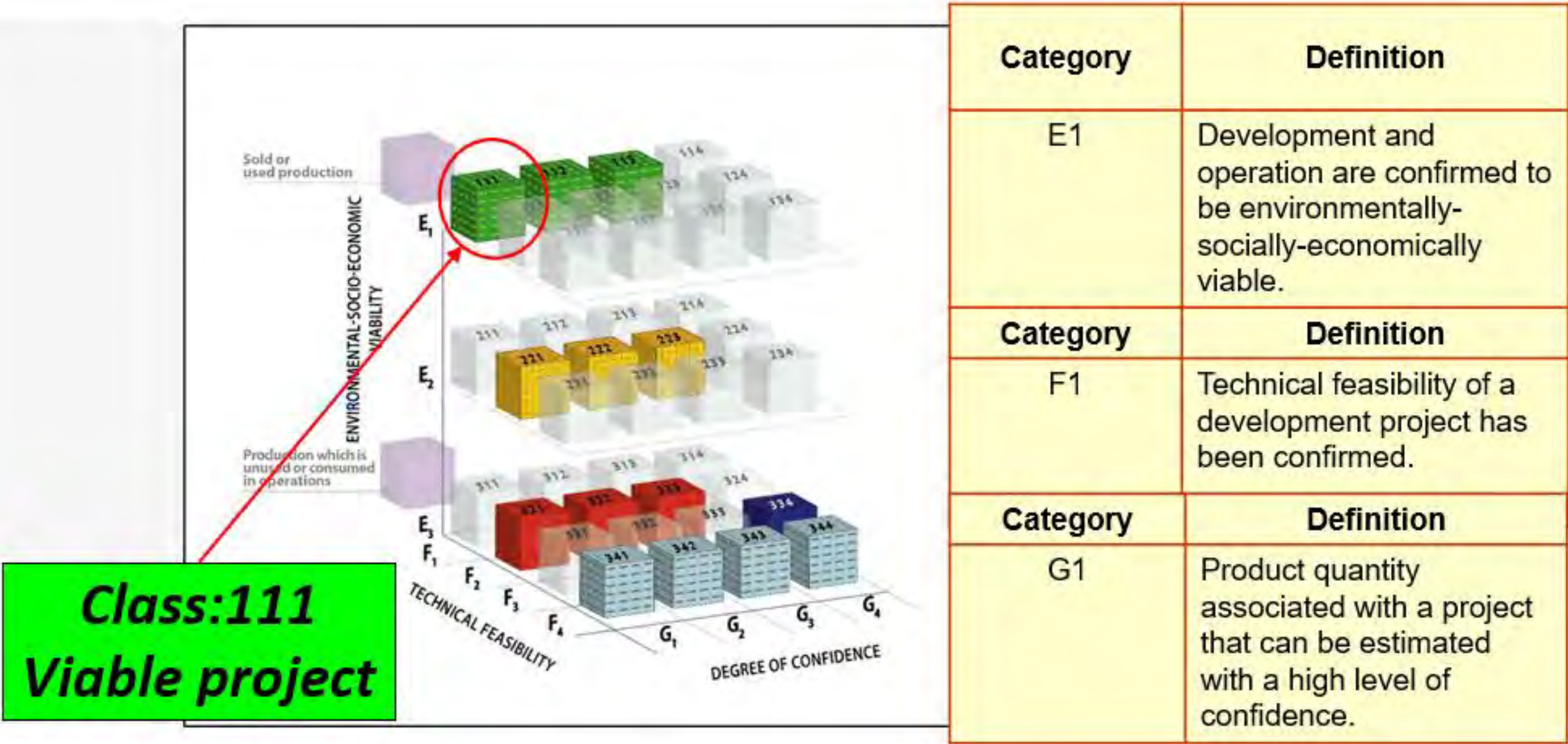
	be estimated with a moderate level of confidence.
G3	Product quantity associated with a project that can be estimated with a low level of confidence.
G4	Product quantity associated with a Prospective Project, estimated primarily on indirect evidence.

can

can

UNFC

How it works?



Bridging Documents

Basics For Mineral Deposits

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
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		Potentially Viable Projects	Development Pending	2*	2.1	1, 2, 3
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		Non-Viable Projects	Development Unclassified	3.2	2.2	1, 2, 3
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		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	

*Potentially Viable Projects may satisfy the requirements for E1

UNFC Competency Requirements

6 key features

- Is **sector neutral**;
- Uses **Qualified Expert** (instead of Competent Person) and **Qualified Assessments**
- Points out four key aspects that **reinforce trust on estimations**:
 1. **Qualified Experts must be objective and independent,**
 2. **Have adequate and relevant professional qualifications and experience,**
 3. **Endorse their reports,** and
 4. **Provide sufficient transparent and material supporting detail** to allow users of their reports to understand the inherent uncertainties involved.

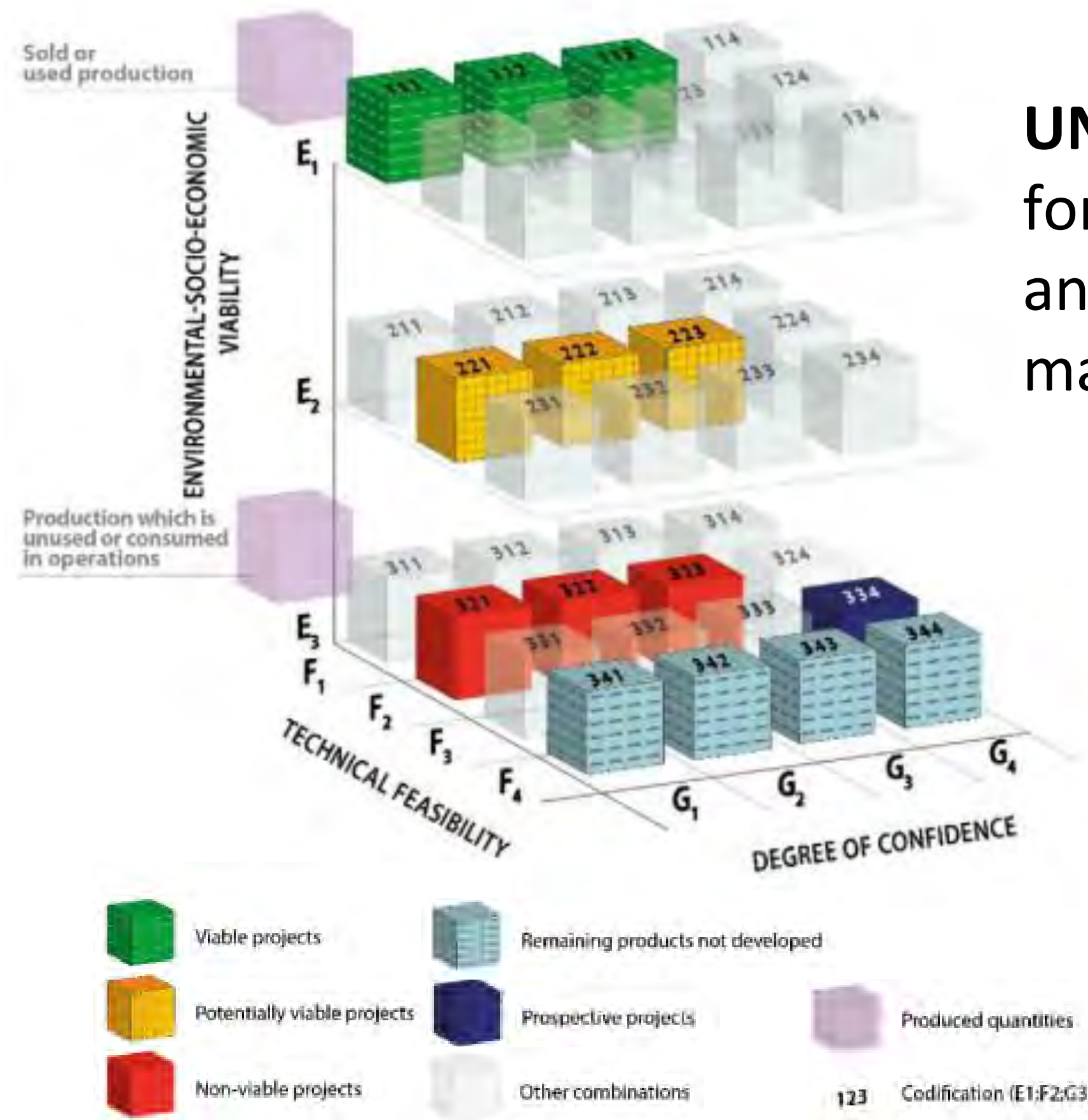
Resource Classification Stakeholders



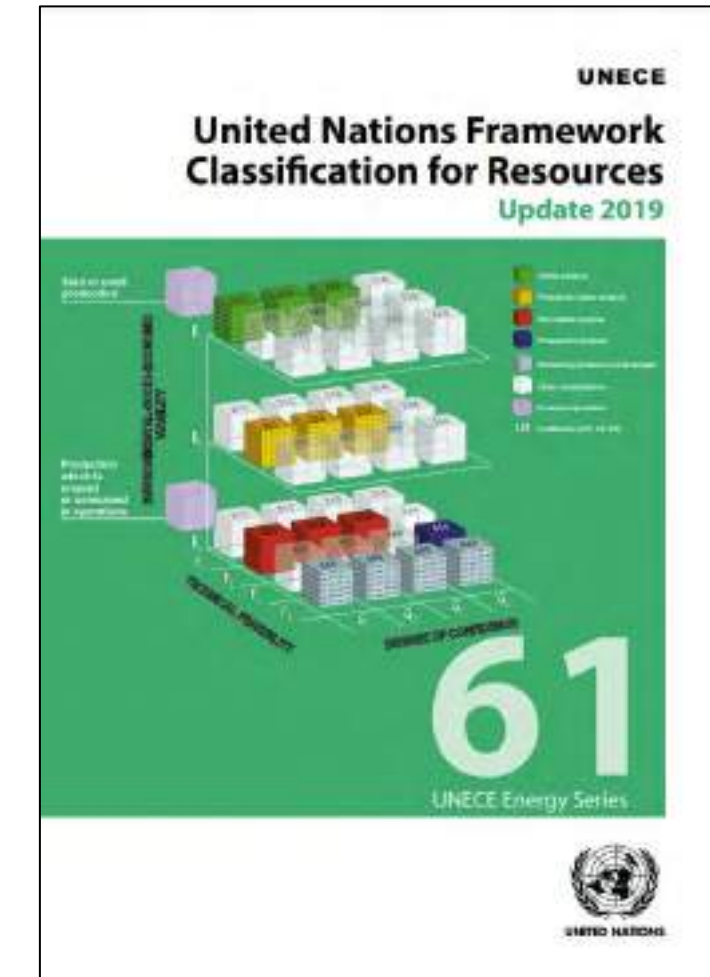
Key takeaways - UNFC-2019

- **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**
 - **Numerical category or sub-category for E, for F and for G**
 - **Axis letters can be dropped: e.g. Class 221**
- **Consistent classification depends on careful application of category definitions**
 - **Definitions should always be read in conjunction with supporting explanation**

Conclusion on UNFC



UNFC is an international scheme for the classification, management and reporting of energy, raw materials and other resources.



- 1. Definitions: Classification framework
- 2. Specifications: Application rules
- 3. Guidelines: Non-mandatory guidance

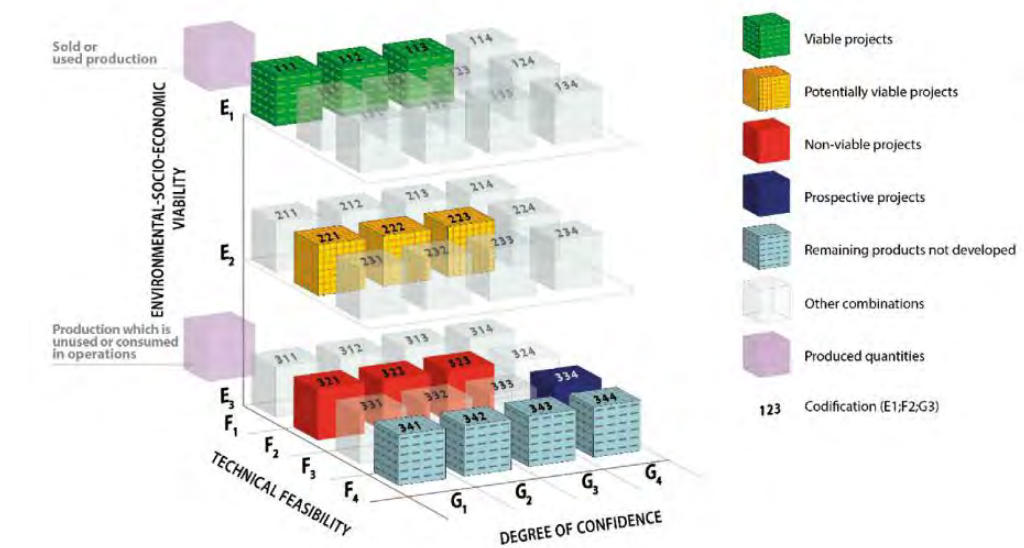
Principles

Rules

Guidelines

Questions? Comments ?

UNFC Categories and Examples of Classes



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Thank you
Merci
Obrigado