GSEU

GEOLOGICAL SERVICE FOR EUROPE

GSEU WP2 TRAIN-THE-TRAINER COURSE

Module Introduction

Level 1

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Ljubljana , 15-16 April 2024

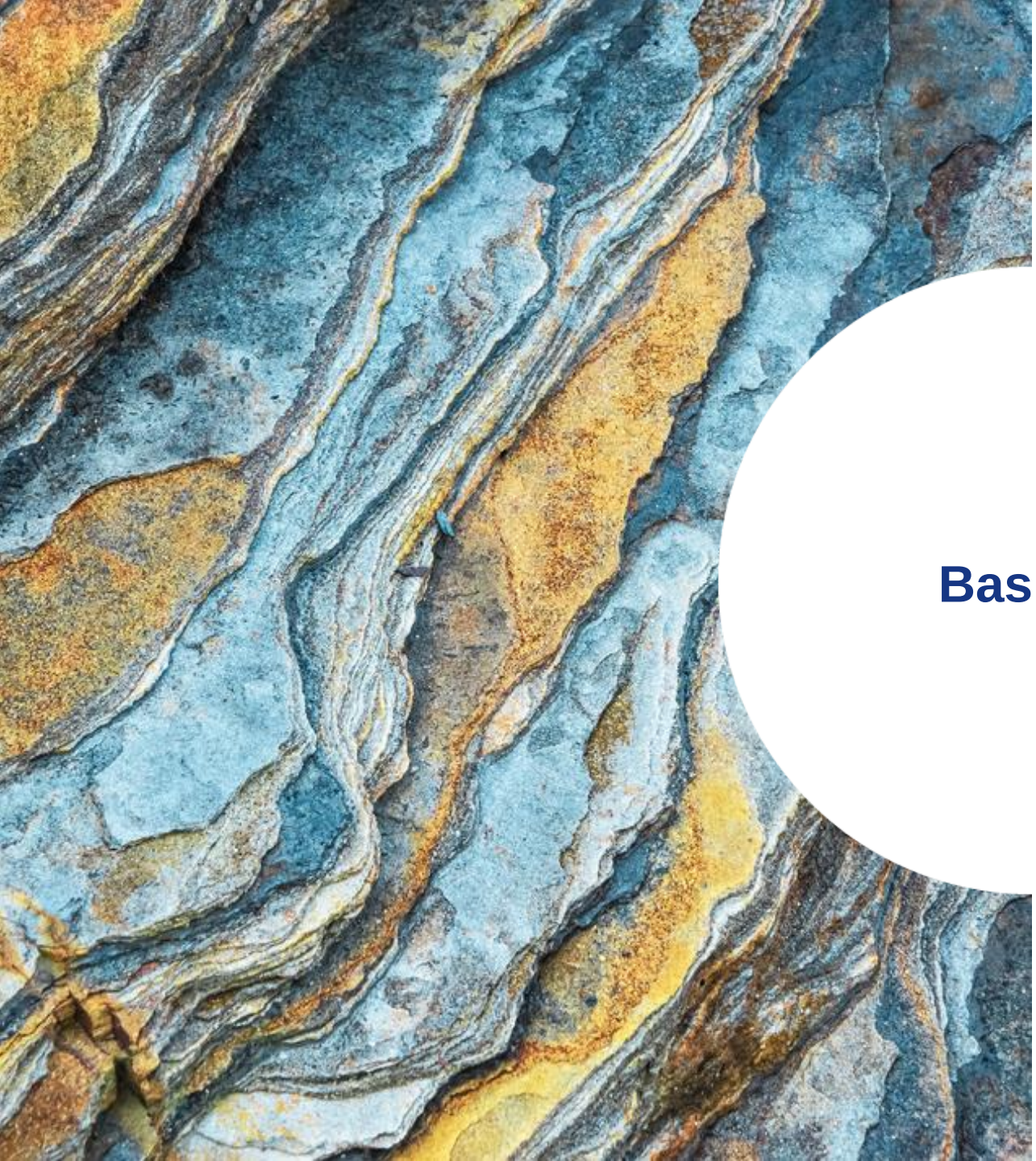
Funded by the European Union

EuroGeoSurveys European Geoscience for Society
The Geological Surveys of Europe

EU ICE SRM

GeoZS Geološki zavod Slovenije

GTK



13h30 – 14h15

Basics on UNFC

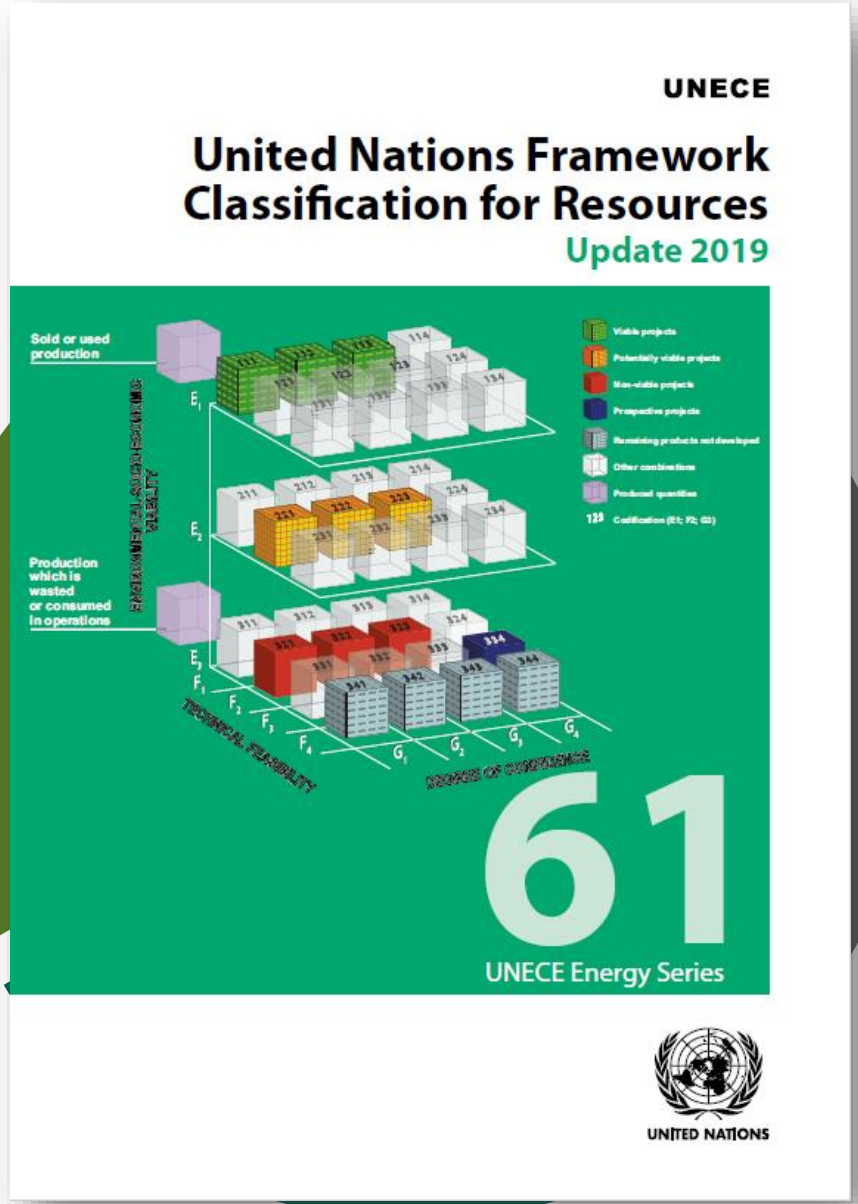
- UNFC principles and category descriptions
- UNFC applied in the Minerals Sector

Tuomas Leskela, GTK
Antje Wittenberg, BGR; Janne Hokka , GTK;

UNFC-2019

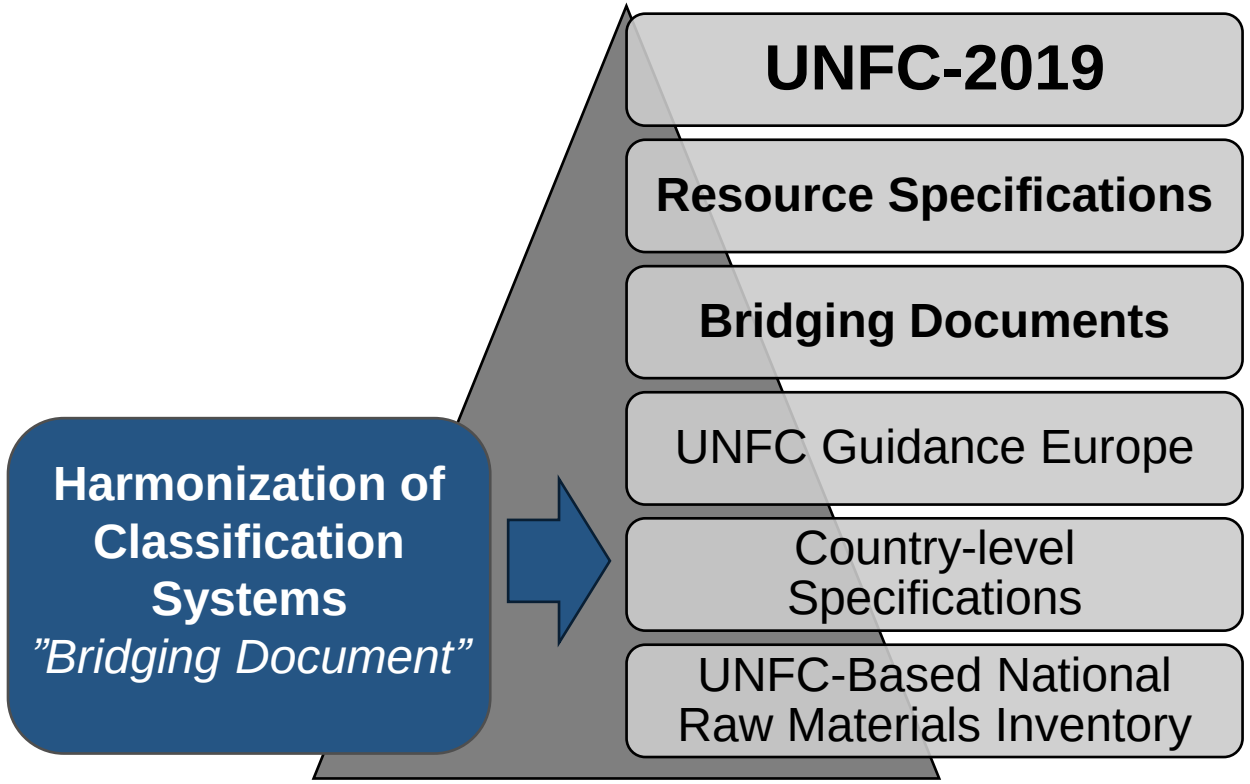
UNFC 2019, ECE ENERGY SERIES No. 61

- United Nations Framework Classification for Resources
- Generic, principles-based system
  - *Applicable to solid minerals, petroleum, renewable energy, injection projects for geologic storage, anthropogenic resources and groundwater*
- Based on three criteria
  - *Environmental-Socio-Economic Viability*
  - *Technical Feasibility*
  - *Degree of Confidence*

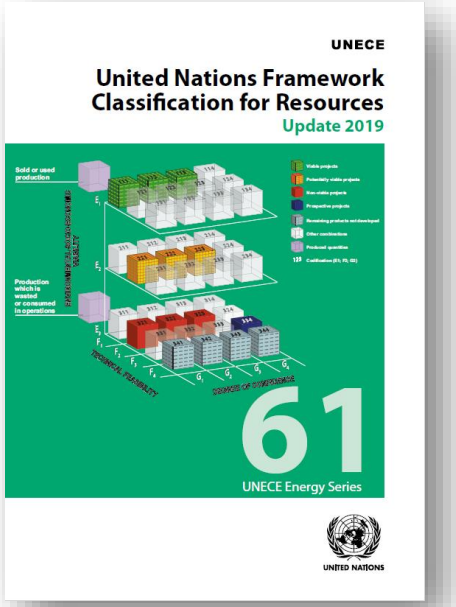


UNFC Document hierarchy

- Within the hierarchy, documents at higher levels consistently **override** those at lower levels.
- Supplemental specifications for **Minerals** provide the guideline to **apply the three axes of the rating matrix to mineral projects**.
- Guidance-level documents are not mandatory UNFC documents; instead, they provide detailed guidance on the use of UNFC and assist users who are applying it.

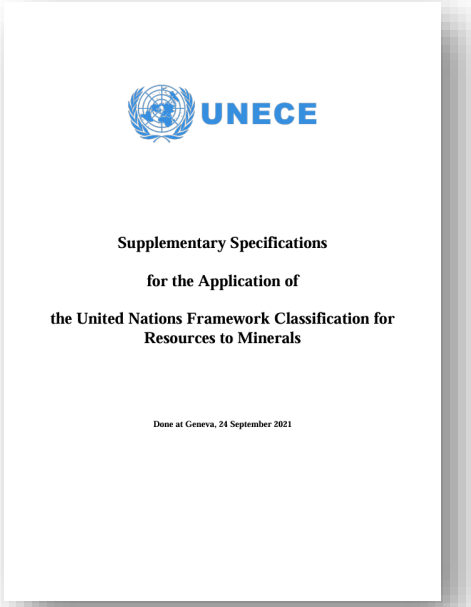


Main Documents



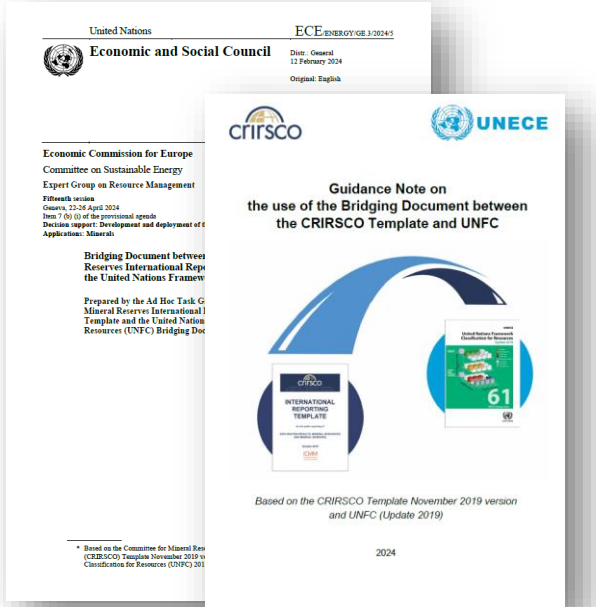
Generic, global standard, UNFC Principles

All



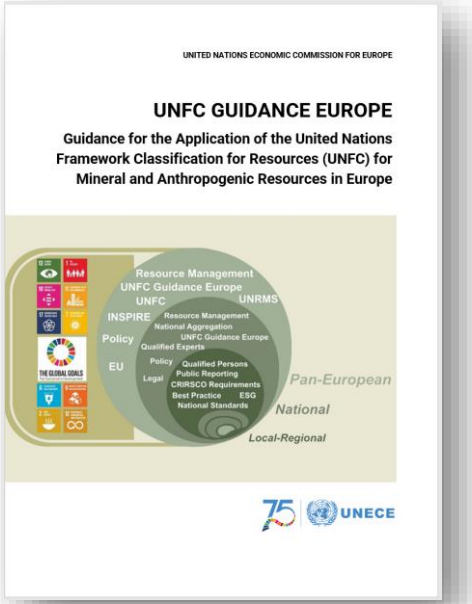
Specifications for mineral projects

Competent Persons
Qualified Experts
Mineral Companies
GeoSurveys



CRIRSCO to UNFC Bridging

Competent Persons
Qualified Experts
Mineral Companies
GeoSurveys



UNFC and INSPIRE

Qualified Experts
GeoSurveys
Authorites (national and EU level)

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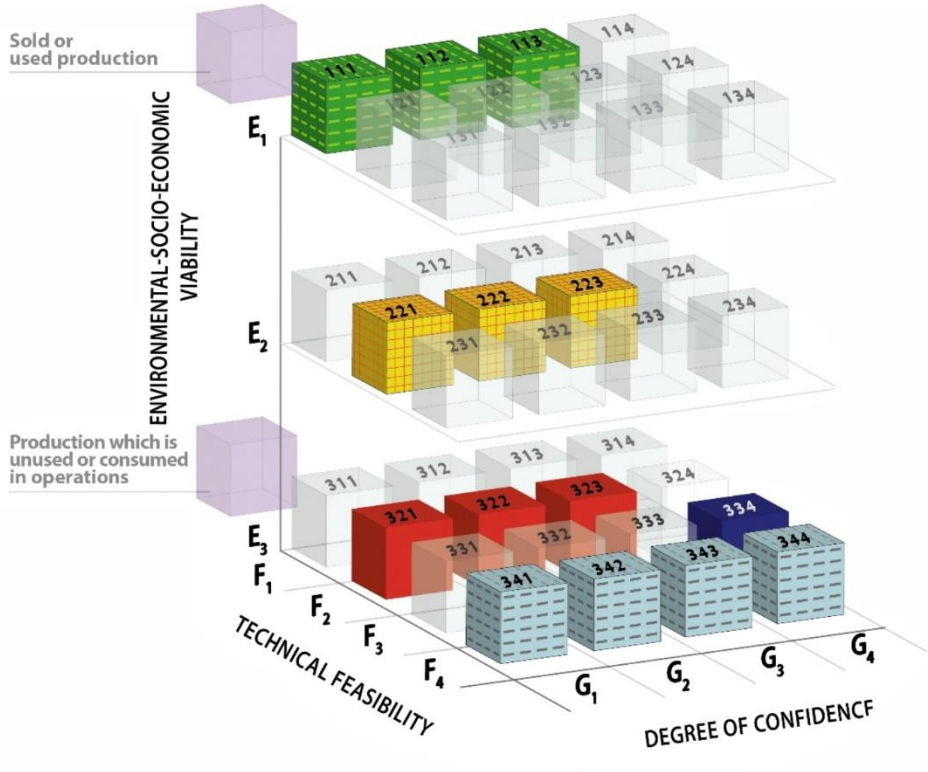
UNFC-2019

UNFC 2019, ECE ENERGY SERIES No. 61

- 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**

Category	Definition
E1	Development and operation are confirmed to be environmentally-socially-economically viable.
F1	Technical feasibility of a development project has been confirmed.
G1	Product quantity associated with a project that can be estimated with a high level of confidence.

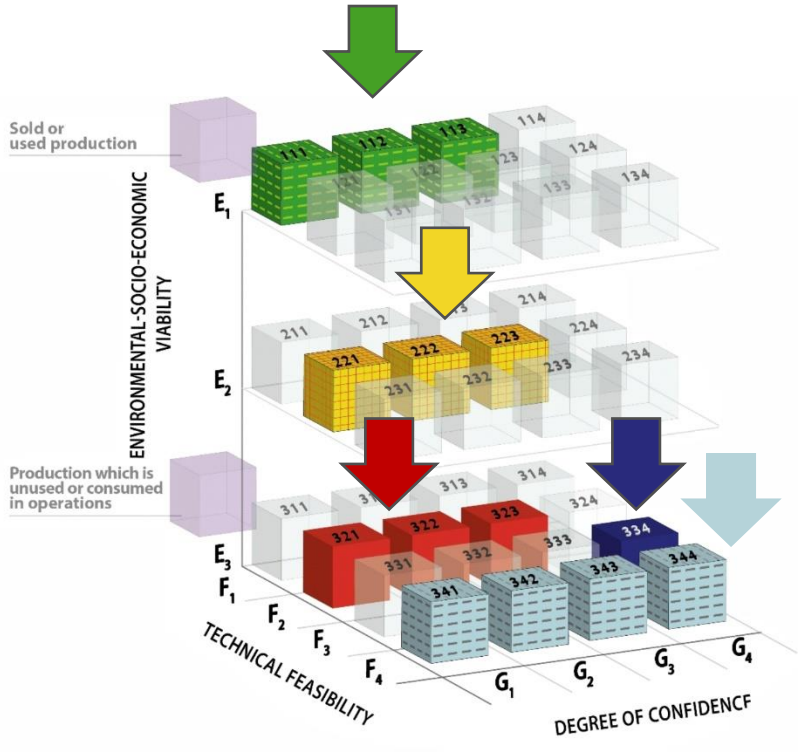


- There are no constraints on combinations, but not all will be meaningful

Primary Classes of UNFC-2019

UNFC 2019, ECE ENERGY SERIES No. 61, FIGURE 2

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



a. Future production that is either unused or consumed in the project operations is categorized as E3.1. These can exist for all classes of recoverable quantities.

b. G categories may be used discretely, or in cumulative scenario form (e.g. G1+G2).

c. Estimates associated with Viable Projects are defined in many classification systems as Reserves, but there are some material differences between the specific definitions that are applied within different industries and hence the term is not used here.

d. Not all Potentially Viable Projects will be developed.

e. Potentially Viable Projects may satisfy the requirements for E1.

f. Non-Viable Projects include those that are at an early stage of evaluation in addition to those that are considered unlikely to become viable developments within the foreseeable future.

g. Remaining products not developed from identified projects or prospective projects may become developable in the future as technological or environmental-socio-economic conditions change. Some or all of these estimates may never be developed due to physical and/or environmental-socio-economic constraints. This classification may be of less value to renewable resource projects but can still be used to indicate the amount of unrealized potential. It is emphasised that the remaining products are quantities which, if produced, could be bought, sold or used (i.e. electricity, heat, etc., not wind, solar irradiation, etc.).

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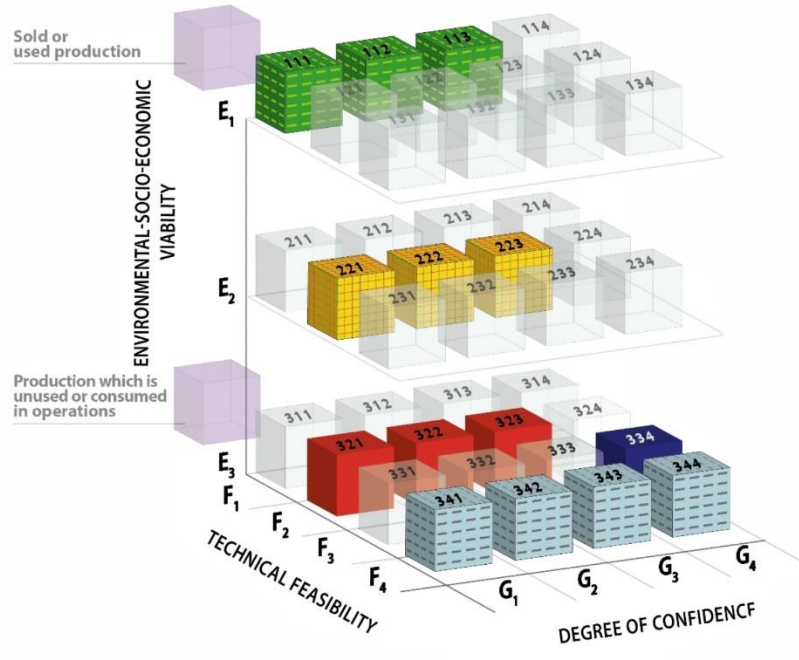
Primary Classes of UNFC-2019

UNFC 2019, ECE ENERGY SERIES No. 61, FIGURE 3 & Annex III

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 Unclarified	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



For further clarity in global communications, additional UNFC Sub-classes are defined based on the full granularity provided by the Sub-categories.

E axis sub-categories of UNFC-2019

UNFC 2019, ECE ENERGY SERIES No. 61, Annex I

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.

Category	Sub-Category	Sub-Category Definition
E1	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.
E2	No Sub-categories defined	
E3	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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F axis sub-categories of UNFC-2019

UNFC 2019, ECE ENERGY SERIES No. 61, FIGURE 3 & Annex III

F Axis – Technical Feasibility and Maturity

Category	Definition	Supporting Explanation
F1	Technical feasibility of a development project has been confirmed.	Development or operation is currently taking place or, sufficiently detailed studies have been completed to demonstrate the technical feasibility of development and operation. A commitment to develop should have been or will be forthcoming from all parties associated with the project, including governments.
F2	Technical feasibility of a development project is subject to further evaluation.	Preliminary studies of a defined project provide sufficient evidence of the potential for development and that further study is warranted. Further data acquisition and/or studies may be required to confirm the feasibility of development.
F3	Technical feasibility of a development project cannot be evaluated due to limited data.	Very preliminary studies of a project, indicate the need for further data acquisition or study in order to evaluate the potential feasibility of development.
F4	No development project has been identified.	Remaining quantities of product not developed by any project. These are quantities which, if produced, could be bought, sold or used (i.e. electricity, heat, etc., not wind, solar irradiation, etc.).

Category	Sub-Category	Sub-Category Definition
F1	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	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.

Category	Sub-Category	Sub-Category Definition
F3	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	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.

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G axis sub-categories of UNFC-2019

UNFC 2019, ECE ENERGY SERIES No. 61, FIGURE 3 & Annex III

Category	Definition	Supporting Explanation
G1	Product quantity associated with a project that can be estimated with a high level of confidence.	Product quantity estimates may be categorized discretely as G1, G2 and/or G3 (along with the appropriate E and F Categories), based on the degree of confidence in the estimates (high, moderate and low confidence, respectively) based on direct evidence. Alternatively, product quantity estimates may be categorized as a range of uncertainty as reflected by either (i) three specific deterministic scenarios (low, best and high cases) or (ii) a probabilistic analysis from which three outcomes (P90, P50 and P10)[3] are selected. In both methodologies (the "scenario" and "probabilistic" approaches), the estimates are then classified on the G Axis as G1, G1+G2 and G1+G2+G3 respectively. In all cases, the product quantity estimates are those associated with a project. Additional Comments: The G axis Categories are intended to reflect all significant uncertainties (e.g. source uncertainty, geologic uncertainty, facility efficiency uncertainty, etc.) impacting the estimate forecast for the project. Uncertainties include variability, intermittency and the efficiency of the development and operation (where relevant). Typically, the various uncertainties will combine to provide a full range of outcomes. In such cases, categorization should reflect three scenarios or outcomes that are equivalent to G1, G1+G2 and G1+G2+G3.
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.	A Prospective Project is one where the existence of a developable product is based primarily on indirect evidence and has not yet been confirmed. Further data acquisition and evaluation would be required for confirmation. Where a single estimate is provided, it should be the expected outcome but, where possible, a full range of uncertainty should be calculated for the prospective project. In addition, it is recommended that the chance of success (probability) that the prospective project will progress to a Viable Project is assessed and documented.

G – Degree of Confidence

Category	Sub-Category	Sub-Category Definition
G4	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.

Where **P90 means that there is a 90 per cent probability that the actual outcome will equal or exceed this estimate**. Similarly, P50 and P10 reflect 50 per cent and 10 per cent probability respectively that the actual outcome will equal or exceed the estimate.

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UNFC applied in Minerals Sector

Minerals Specification 2021

The purpose of this document is to **specify the use** of the United Nations Framework Classification for Resources (UNFC) **to classify mineral projects**, including metal ores, technical minerals, evaporites, aggregates and solid energy minerals such as coal and others in alignment with the Sustainable Development Goals (SDGs).

This document is intended for a broad audience including

(i) policymakers,

(ii) those responsible for government resource management may also be of interest to

(iii) those responsible for company internal resource management, and

(iv) financial reporting, in particular in relation to the mineral potential that falls outside existing classification and reporting standards, especially for users that wish to ensure realisation of the SDGs.

chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://unece.org/sites/default/files/2022-01/UNFC%20Mineral%20Specifications%202021.pdf

UNFC applied in Minerals Sector

Minerals Specification 2021, 3-17

- A **Minerals Project** produces mineral products from a mineral source with defined frame conditions, which provide the basis for environmental-socio-economic evaluation and decision-making.
- A mineral project is comprised of a defined activity or set of activities, which provide the basis for estimating environmental-socio-economic viability including costs and potential revenues associated with its implementation.
- **In the context of this course, a project is defined as a broad-scale initiative encompassing activities from early exploration to a fully operational mine.** Such a project may involve one or several deposits and commodities.
- **An Identified Project is a project associated with a known source, indicating that a mineral estimation has been conducted**.

UNFC applied in Minerals Sector

Minerals Specification 2021, 31

- **Project Lifetime** is the remaining period of time that a project is expected to operate, constrained by technical, economic, regulatory or other permit/licence cut-offs.
- Minerals project lifetime is normally constrained by the period for which prospecting, exploration or mining licence may apply for the project. The mining licence may include beneficiation, processing, decommissioning and remediation stages of the mineral life cycle.

E Axis

reflects both the economic assessment of the project as well as the environmental or social aspects within a project's life cycle balanced against the SDGs.

F Axis

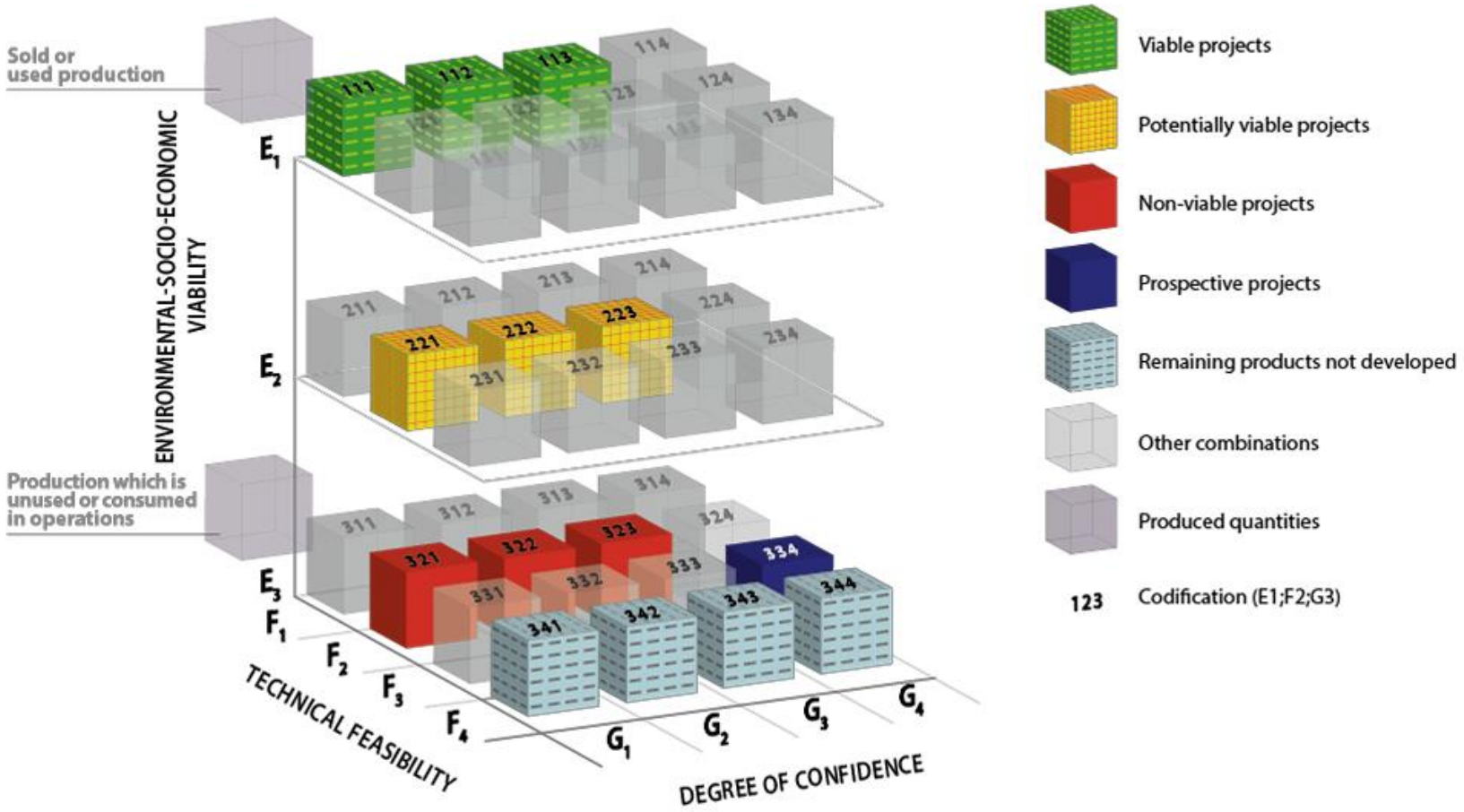
represents the stage of Project Feasibility. The F Axis designates the maturity of studies and commitments necessary to implement mineral projects.

G Axis

reflects the degree of geological knowledge regarding quantities and qualities (a funtion of exploration measures).

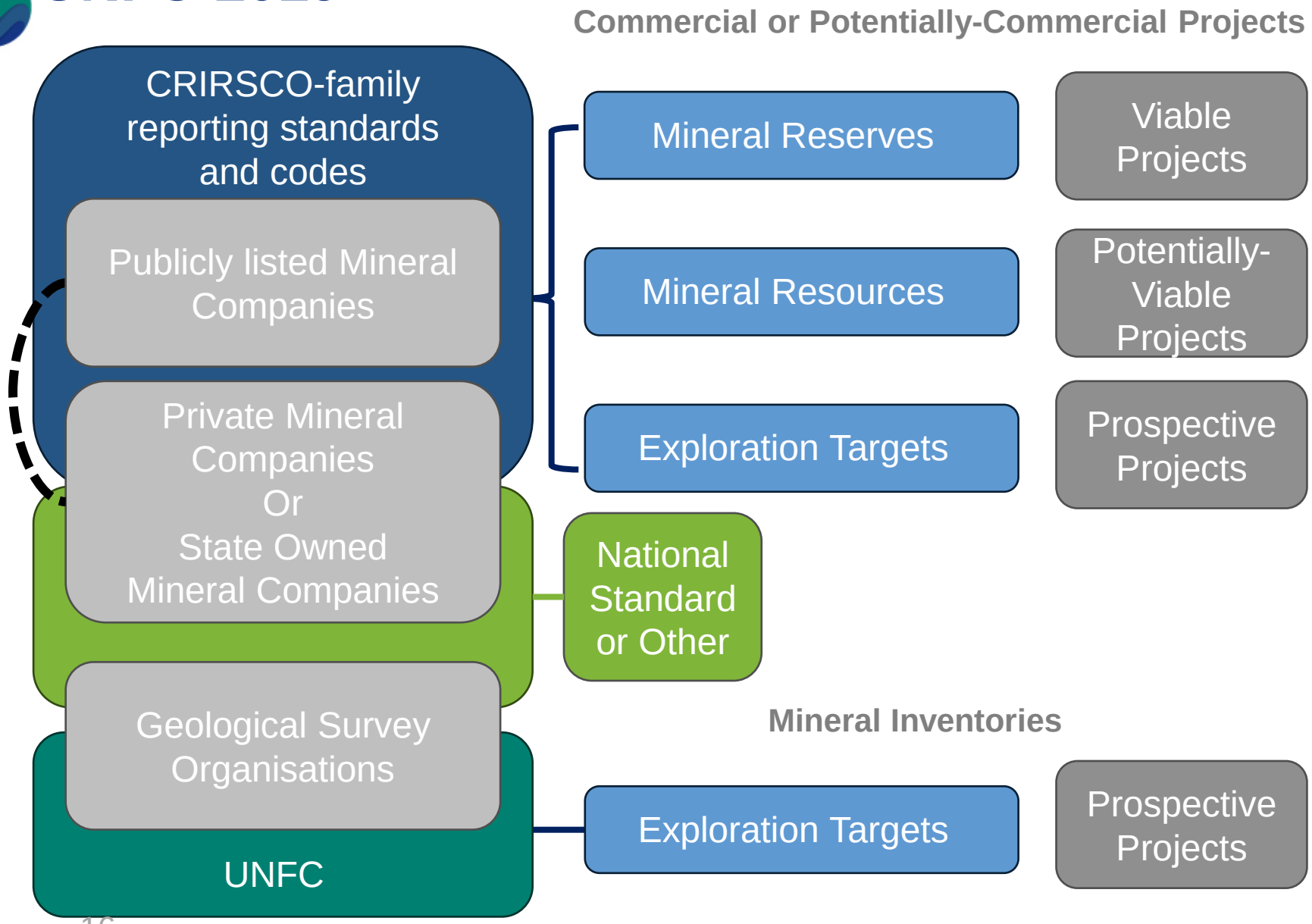
UNFC Categories and Example of Classes

Minerals Specification 2021

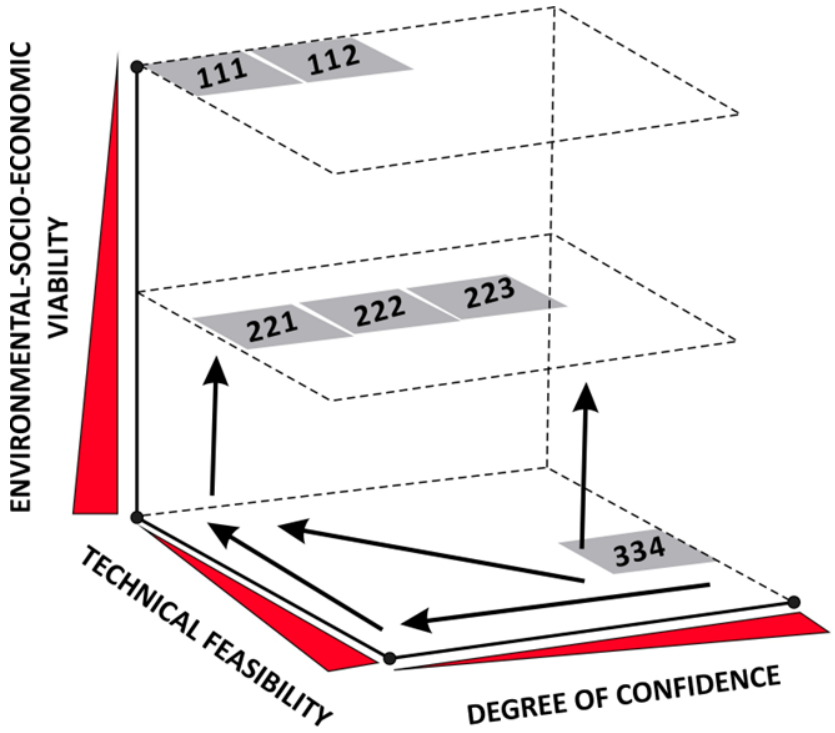


- There are no constraints on combinations, but not all will be meaningful. Colored blocks showcase the most common combinations in the Minerals sector.

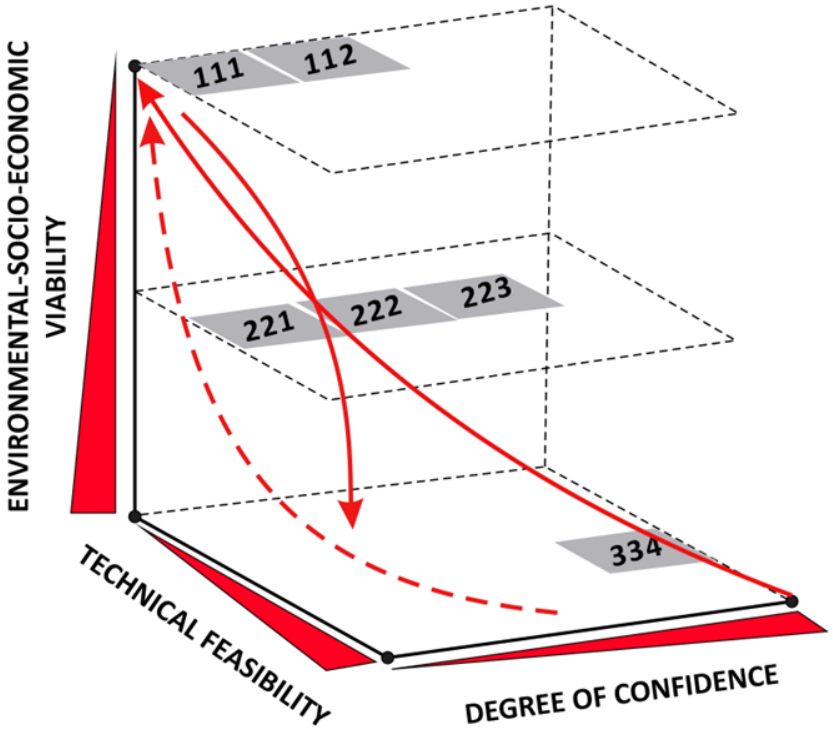
UNFC-2019


Commercial or Potentially-Commercial Projects
CRIRSCO-family reporting standards and codes
Publicly listed Mineral Companies
Private Mineral Companies Or State Owned Mineral Companies
Mineral Reserves
Mineral Resources
Exploration Targets
Viable Projects
Potentially-Viable Projects
Prospective Projects
National Standard or Other
Mineral Inventories
Geological Survey Organisations
UNFC
Exploration Targets
Prospective Projects

UNFC in mining related projects



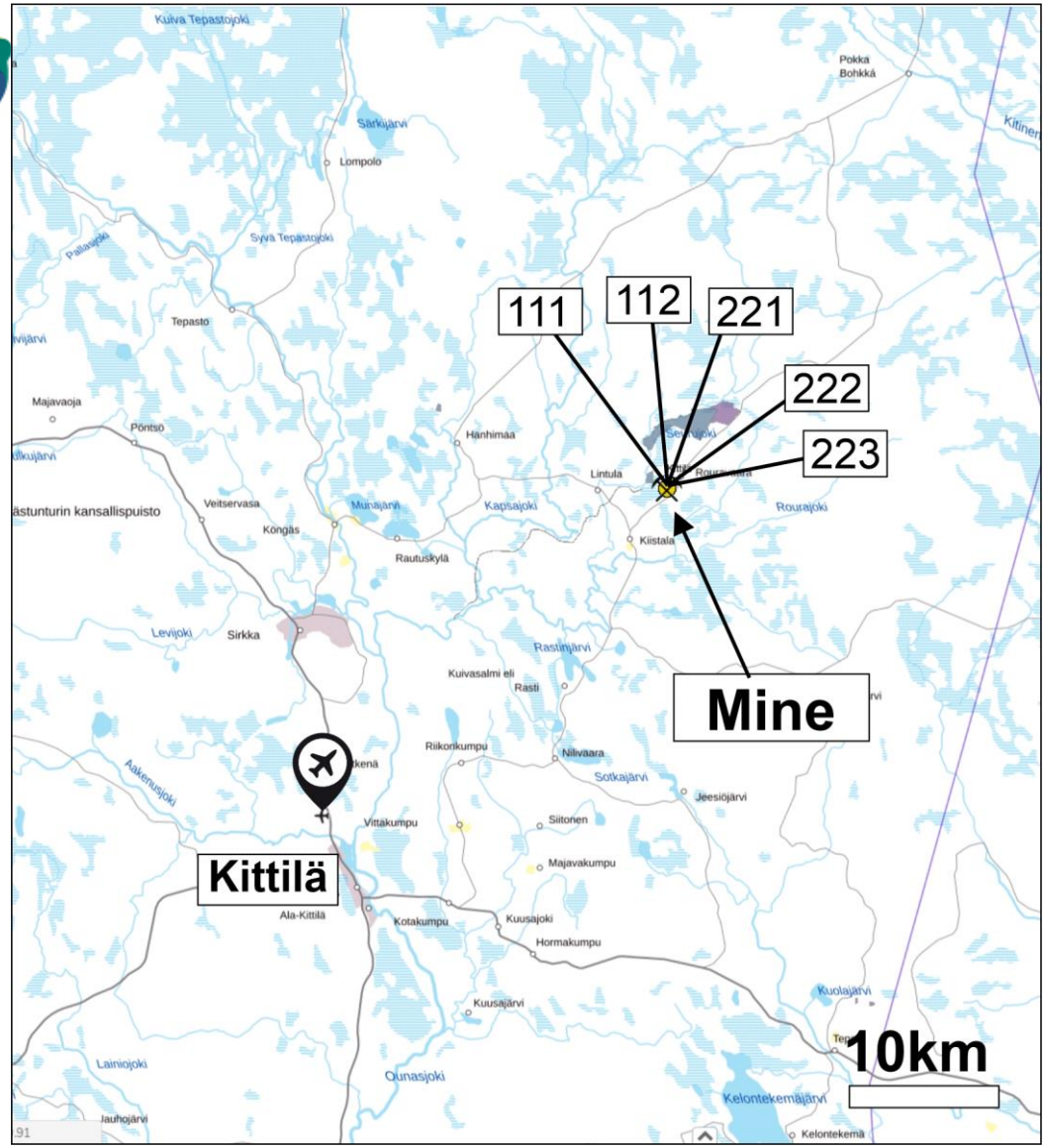
Mineral project are not moving forward independently in respect to different UNFC axes.



In practice, geological confidence is increasing during technical studies. And, project viability is a consideration of processing technological aspect together with ESG assumptions and permitting.

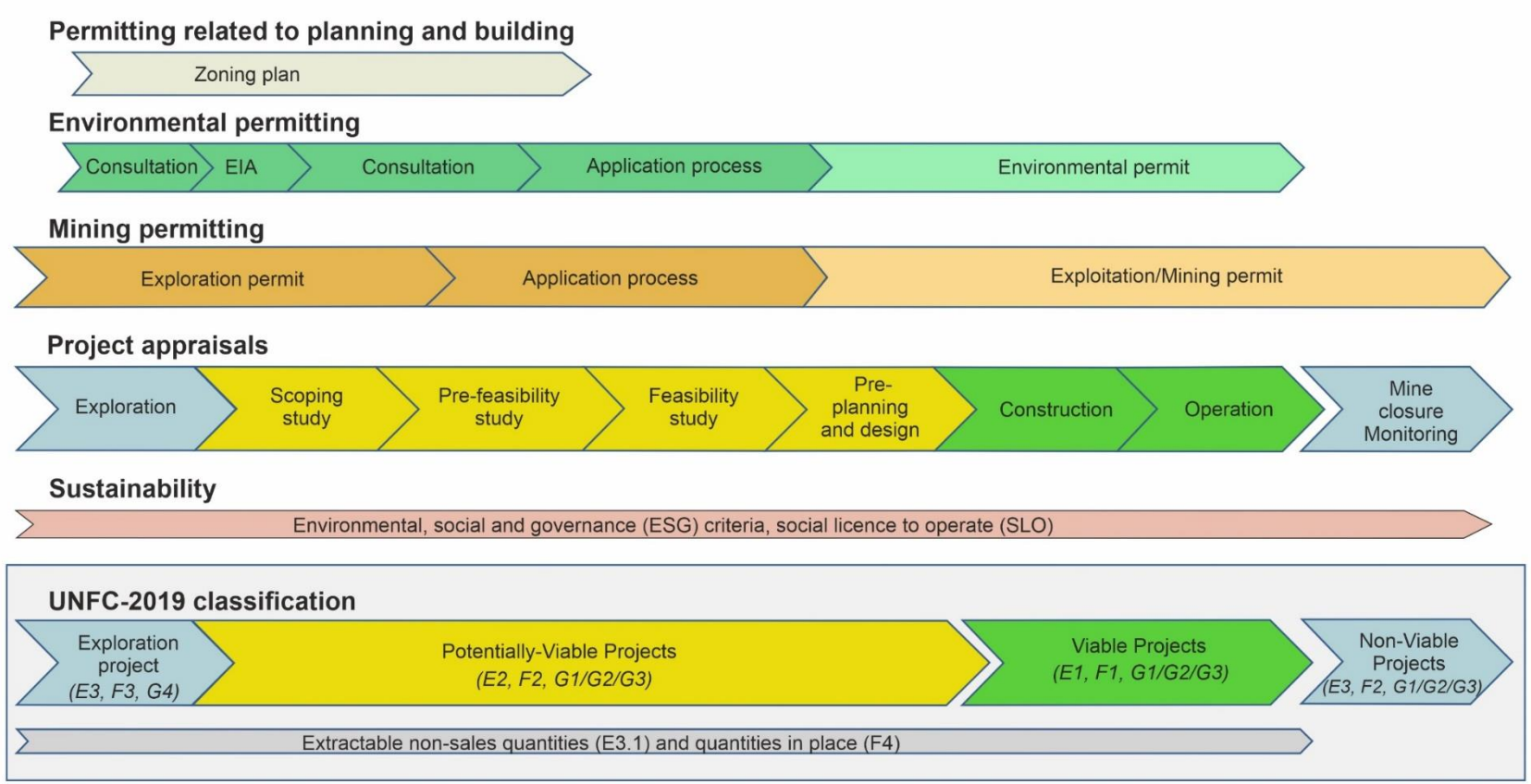
Project viability and, therefore, resource definitions may also be downgraded. This could mean that commercial projects becomes non-commerical despite of having minerals ”in the ground”.

Scale of Investigation



- Permitting status provides an informative source for assessing project maturity.
- An active mine always operates at a local scale (UNFC: E1-E2;F1-F2;G1-G3), whereas exploration is conducted at a regional scale (UNFC: E3;F3;G3-G4).

Project progression



*Modified after Lax et al. 2017

- Schematic mining-related project life cycles* in governmental and industry processes with some E-Axis controlling factors

- Schematic mining-related project life cycles* in governmental and industry processes with some E-Axis controlling factors

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Thank you for your attention

Tuomas Leskelä, GTK

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The Geological Surveys of Europe

EU ICE SRM

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