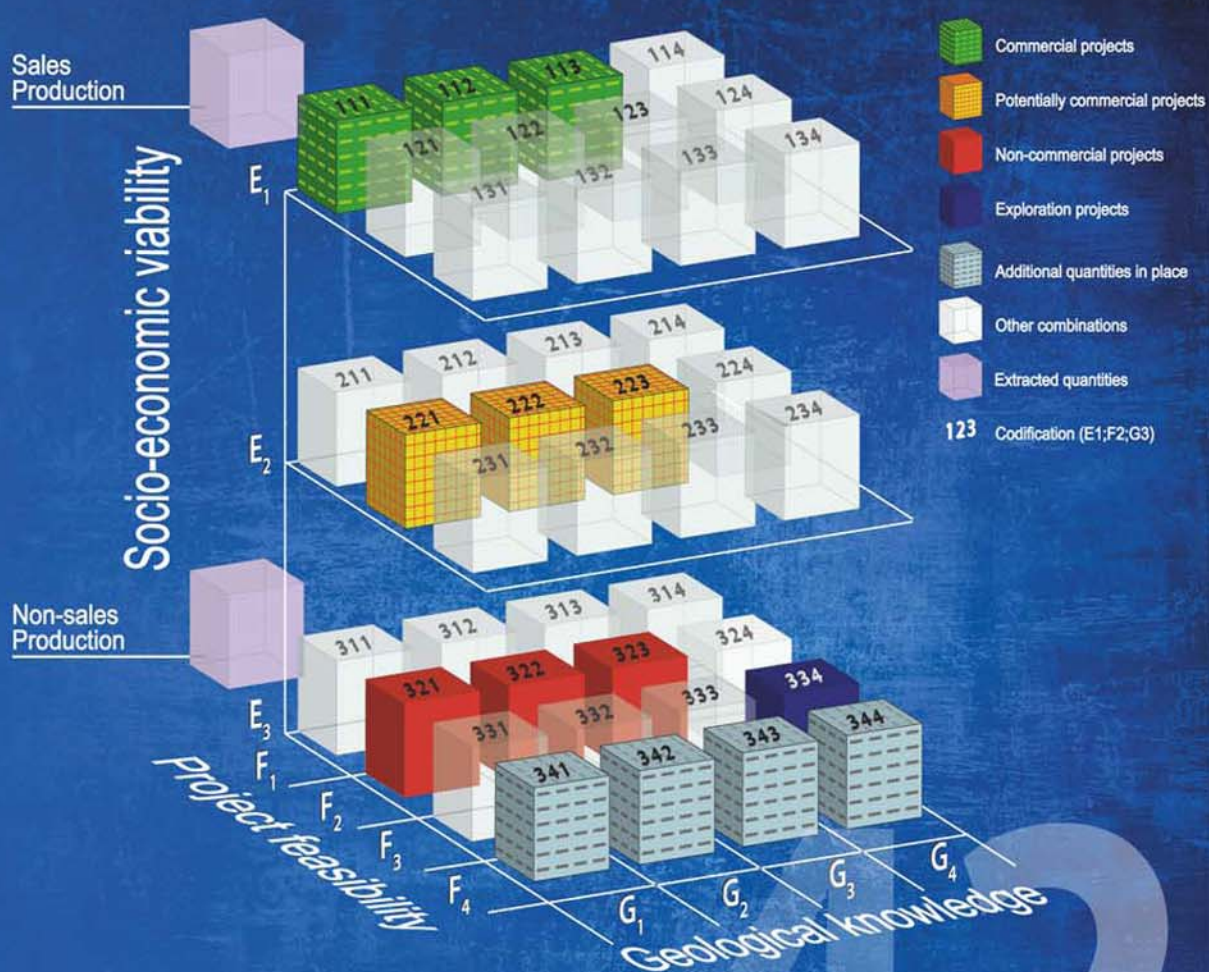


United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 *incorporating Specifications for its Application*



UNECE Energy Series



UNITED NATIONS

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

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FOREWORD

Establishing a complete picture of the current and future supply base of fossil energy and minerals is necessary for effective resource management. Accurate and consistent estimates of fossil energy and mineral reserves and resources, coherent with other scientific and social/ economic information, are the foundation for such assessments. A number of different standards have evolved over time in response to local or industry-specific requirements, but we are now called to serve the needs of a globalized economy. As a result, there has been growing interest in re-expressing earlier work in the form of common and universally-applicable standards.

During the 1990s, ECE took the initiative to develop a simple, user-friendly and uniform system for classifying and reporting reserves and resources of solid fuels and mineral commodities in response to the wishes of member countries to develop a standard reporting system. The result of these efforts was the creation of the United Nations Framework Classification for Reserves and Resources of Solid Fuels and Mineral Commodities (UNFC-1997) that was endorsed by the United Nations Economic and Social Council (ECOSOC) in 1997. In 2004, the Classification was extended to also apply to petroleum (oil and natural gas) and uranium and renamed the UNFC for Fossil Energy and Mineral Resources 2004 (UNFC-2004). In its Decision 2004/33, ECOSOC then invited the Member States of the United Nations, international organizations and the United Nations regional commissions to consider taking appropriate measures for ensuring its worldwide application. This Decision offered an opportunity to harmonize existing reserves and resources classifications, in response to the integration of financial and extractive activities worldwide.

In order to facilitate worldwide application of the Classification, the ECE Committee on Sustainable Energy directed the Ad Hoc Group of Experts on Harmonization of Fossil Energy and Mineral Resources Terminology (now the Expert Group on Resource Classification) to prepare and submit a revised United Nations Framework Classification for Fossil Energy and Mineral Resources (UNFC) for consideration by the Extended Bureau of the Committee. In response to that request a stronger, simpler version of the Classification was prepared. This version is the **United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009)**.

Specifications or rules of application are needed to provide more details on how UNFC-2009 should be applied in practice in order to ensure consistency and comparability. The specifications that allow UNFC-2009 to be fully operational were developed by the Expert Group on Resource Classification between 2010 and April 2013 through an equally inclusive, transparent and robust process as that followed for the development of UNFC-2009. These specifications were agreed upon by the Expert Group and subsequently by the Committee on Sustainable Energy at the end of 2013.

UNFC-2009 and the **Specifications for its Application** were developed by ECE, under the global mandate given by ECOSOC, and through the cooperation and collaboration of both ECE and non-ECE member countries, other United Nations agencies and international organizations, intergovernmental bodies, professional associations, the private sector and many individual experts. The rigorous development process, which included a survey of stakeholders'

requirements and two public consultations, has resulted in a generic, intuitive and user-friendly Framework Classification with specifications for its application as outlined in this publication.

Sustainable energy development is dependent on careful management of the world's non-renewable energy resources *i.e.*, oil, natural gas, coal and uranium. UNFC-2009 has an important role to play in this process. The availability of these non-renewable energy resources over the longer term is of crucial importance to both energy consumers and producers, particularly as a large and growing population is coming out of poverty. UNFC-2009 will significantly facilitate the availability of relevant and reliable information on energy reserves and resources in support of international and national resources management, of industry's management of exploration and production processes, of management of the associated international financial resources and for public awareness. It fills essential needs in our endeavours to build sustainable civilizations. The success of this work for traditional energy sources has led stakeholders to engage in a deep assessment of the applicability of this framework classification to renewable energy sources and to underground storage of carbon dioxide. Our work is not yet done.

It is my pleasure to bring UNFC-2009 incorporating specifications for its application to your attention and to pay tribute to all those who have contributed in the development process.

A handwritten signature in black ink, appearing to read 'Sven Alkalaj', with a stylized, flowing script.

Sven Alkalaj
Executive Secretary

United Nations Economic Commission for Europe

PREFACE

The **United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009)** is a universally acceptable and internationally applicable scheme for the classification and reporting of fossil energy and mineral reserves and resources and is currently the only classification in the world to do so. The **specifications for its application** make UNFC-2009 operational. The specifications set out the basic rules that are considered necessary to ensure an appropriate level of consistency in application. They importantly provide additional instructions on how UNFC-2009 should be applied in specific circumstances.

As with extractive activities, UNFC-2009 reflects conditions in the economic and social domain, including markets and government framework conditions, technological and industrial maturity and the ever present uncertainties. It provides a single framework on which to build international energy and mineral studies, analyze government resource management policies, plan industrial processes and allocate capital efficiently.

UNFC-2009 is a generic principle-based system in which quantities are classified on the basis of the three fundamental criteria of economic and social viability (E), field project status and feasibility (F), and geological knowledge (G), using a numerical and language independent coding scheme. Combinations of these criteria create a three-dimensional system. UNFC-2009, which can either be applied directly or used as a harmonizing tool, is the successor to the UNFC of 2004. The revision process has resulted in a simplified and user-friendly version of the Classification with generic high-level definitions. These are designed to ensure alignment with other widely used systems in the extractive industries – such as the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) Template and the Society of Petroleum Engineers (SPE)/World Petroleum Council (WPC)/American Association of Petroleum Geologists (AAPG)/Society of Petroleum Evaluation Engineers (SPEE) Petroleum Resource Management System (PRMS) – and to facilitate mapping with other classification systems. The definitions of the UNFC-2009 categories and sub-categories have been simplified and the most commonly-used classes are defined using plain language, providing harmonized generic terminology at a level suitable for global communications. The use of commonly-used words that are widely misunderstood by non-experts and which do not have a unique meaning is avoided; most importantly, the word “reserves” is not used other than in a general sense - “reserves” is a concept with different meanings and usage, even within the extractive industries, where the term is carefully defined and applied by technical experts.

Today’s globalized world has resulted in an increasing number of multi-resource companies operating in many different countries and jurisdictions. In addition, the development of new types of resources, such as the mining of bitumen to produce synthetic crude oil, demonstrates that the historic boundaries between the minerals and petroleum sectors, which are reflected in different resource classification systems, public reporting requirements and accounting rules, is no longer sustainable. By covering all extractive activities, UNFC-2009 captures the common principles and provides a tool for consistent reporting for these activities, regardless of the commodity. It is a strong code that paves the way for improved global communications which will aid stability and security of supplies, governed by fewer and more widely understood rules and guidelines. The efficiencies to be gained through the use of UNFC-2009 are substantial.

ACKNOWLEDGEMENTS

UNFC-2009 and the specifications for its application have been developed through the cooperation and collaboration of ECE and non-ECE member countries, other United Nations agencies and international organizations, intergovernmental bodies, professional associations and the private sector.

This document builds on the work of a Task Force that mapped key classifications to one another, the UNFC Mapping Task Force. The Task Force was led by Mucella Ersoy (Turkish Coal Enterprises) and Per Blystad (Norwegian Petroleum Directorate) with Niall Weatherstone (CRIRSCO), Ferdinando Camisani-Calzolari (CRIRSCO), John Etherington (SPE Oil and Gas Reserves Committee), Kirill Kavun (Research Institute for Economics of Mineral Resources and Use of the Subsoil (VIEMS) Russian Federation), James Ross (Ross Petroleum Limited), and Andrej Subelj (Slovenia).

The diligent efforts made in preparing the ground for the revision of the UNFC have been commendable and are greatly appreciated, in particular the work of the UNFC Revision Task Force, which consisted of the Extended Bureau of the Group of Experts, plus selected experts.

The development of the specifications was undertaken by the Specifications Task Force of the Expert Group on Resource Classification, a group of experts led by James Ross (Chair) with Ferdinando Camisani-Calzolari, Daniel DiLuzio, Roger Dixon (supported by Paul Bankes from mid-2012), David Elliott, Timothy Klett, Kjell Reidar Knudsen, Ian Lambert replaced by Leesa Carson in mid-2012 (supported by Yanis Miezitis), David MacDonald, Yuri Podturkin (supported by the Russian Working Group) and Daniel Trotman.

CONTENTS

FOREWORD	iii
PREFACE	v
ACKNOWLEDGEMENTS	vi
ACRONYMS AND ABBREVIATIONS	x

PART I

United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009)

INTRODUCTION	3
I. APPLICATION	3
II. CATEGORIES AND SUB-CATEGORIES	3
III. CLASSES	4
IV. SUB-CLASSES	7
V. HARMONIZATION OF RESOURCE INVENTORIES	7
VI. ADAPTING TO NATIONAL OR LOCAL NEEDS	7

ANNEX I

DEFINITION OF CATEGORIES AND SUPPORTING EXPLANATIONS	9
--	---

ANNEX II

DEFINITION OF SUB-CATEGORIES	12
------------------------------------	----

PART II

Specifications for the Application of the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009)

I. INTRODUCTION	15
II. ENVIRONMENTAL AND SOCIAL CONSIDERATIONS	16
III. COMMODITY-SPECIFIC SPECIFICATIONS AND THE RELATIONSHIP WITH OTHER RESOURCE CLASSIFICATION SYSTEMS	17
IV. NATIONAL RESOURCE REPORTING	19
V. DISCLOSURE	19
VI. GENERIC SPECIFICATIONS	19
A. Use of numerical codes	20
B. Bridging document	20
C. Effective date	20
D. Commodity or product type	20
E. Basis for estimate	21
F. Reference point	21
G. Classification of projects based on level of maturity	21
H. Distinction between E1, E2 and E3	21
I. Confidence levels for G1, G2 and G3	22
J. Distinction between recoverable quantities and in situ (in-place) quantities	22
K. Aggregation of quantities	23

L. Economic assumptions	23
M. Evaluator qualifications	23
N. Units and conversion factors	24
O. Documentation	24
P. Expansion of G4 to account for uncertainty	24
Q. Optional labels for estimates	24
R. Classification of quantities associated with Exploration Projects	25
S. Classification of additional quantities in place	25
T. Extracted quantities that may be saleable in the future	25
ANNEX I	
GLOSSARY OF TERMS	27
ANNEX II	
GUIDELINES ON THE APPLICATION OF KEY INSTRUCTIONS IN UNFC-2009	30
ANNEX III	
BRIDGING DOCUMENT BETWEEN THE CRIRSCO TEMPLATE AND UNFC-2009	31
I. INTRODUCTION	31
II. OVERVIEW OF THE CRIRSCO TEMPLATE (2006)	31
III. DIRECT MAPPING OF CATEGORIES AND SUB-CATEGORIES	32
A. Application of the G-axis	32
B. Detailed mapping of the E and F axes	33
C. Exploration results	36
ANNEX IV	
BRIDGING DOCUMENT BETWEEN PRMS AND UNFC-2009	37
I. INTRODUCTION	37
II. OVERVIEW OF PRMS	37
III. DIRECT MAPPING OF CATEGORIES AND SUB-CATEGORIES	38
A. Application of the G-axis	38
B. Detailed mapping of the E and F axes	39
C. Exploration prospects	41
D. Additional Quantities in Place	41
IV. SUB-DIVISION OF PRMS PROJECT MATURITY CLASSES TO MULTIPLE UNFC-2009 SUB-CATEGORIES	42
A. Commercial projects sub-categorization	42
B. Potentially commercial and non-commercial project sub-categorization	43
V. IDENTIFICATION OF QUANTITIES DEFINED BUT NOT CLASSIFIED IN PRMS	45
VI. DESCRIPTION OF RESERVES STATUS IN PRMS	45
ANNEX V	
GUIDELINES ON THE USE OF PROJECT MATURITY TO SUB-CLASSIFY PROJECTS USING UNFC-2009	46
(a) Commercial Projects	47
(b) Potentially Commercial Projects	47
(c) Non-commercial Projects	48
(d) Additional Quantities in Place	48

PART III

Explanatory Note to the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009)

INTRODUCTION	51
I. RELATIONSHIP TO OTHER CLASSIFICATIONS	51
II. MAINTENANCE OF THE CLASSIFICATION	52
III. NORMATIVE REFERENCES	52
IV. COMMENTS TO UNFC-2009	53
To Section I (UNFC-2009)	53
To Section II (UNFC-2009)	53
To Section III (UNFC-2009)	53
To Sections IV and V (UNFC-2009)	55
To Section VI (UNFC-2009)	55
BIBLIOGRAPHY	56

Table of Figures

Figure 1

UNFC-2009 Categories and Examples of Classes	4
--	---

Figure 2

Abbreviated Version of UNFC-2009, showing Primary Classes	5
---	---

Figure 3

UNFC-2009 Classes and Sub-classes defined by Sub-categories	8
---	---

Figure III.1

General Relationship between Exploration Results, Mineral Resources and Mineral Reserves, as set out in the CRIRSCO Template	32
--	----

Figure III.2

Mapping of CRIRSCO Template to UNFC-2009 Classes and Categories	33
---	----

Figure III.3

Mapping of CRIRSCO Template to E-F Axes of UNFC-2009	35
--	----

Figure IV.1

Mapping of PRMS Range of Uncertainty Categories to UNFC-2009 G Axis	38
---	----

Figure IV.2

Mapping of PRMS and UNFC-2009 Classes and Categories	39
--	----

Figure IV.3

Mapping of the E-F Matrix to the PRMS Project Maturity Sub-classes	40
--	----

Figure IV.4

Mapping of UNFC-2009 Exploration Projects to PRMS Prospective Resources	41
---	----

Figure IV.5

Mapping of UNFC-2009 Additional Quantities in Place to PRMS Unrecoverable Quantities	42
--	----

Figure IV.6

Mapping of PRMS Contingent Resource Sub-classes to UNFC-2009 Sub-classes using E and F Axis Categories and Sub-categories	43
---	----

ACRONYMS AND ABBREVIATIONS

AAPG	American Association of Petroleum Geologists
Ad Hoc Group of Experts	ECE Ad Hoc Group of Experts on the Harmonization of Fossil Energy and Mineral Resources Terminology
CMMI	Council of Mining and Metallurgical Institutions
CRIRSCO	Committee for Mineral Reserves International Reporting Standards
ECE	United Nations Economic Commission for Europe
Expert Group	ECE Expert Group on Resource Classification
IAEA	International Atomic Energy Agency
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
NEA	Nuclear Energy Agency of OECD
OECD	Organisation for Economic Co-operation and Development
PRMS	SPE/WPC/AAPG/SPEE Petroleum Resources Management System of 2007 which has been endorsed by SPE, WPC, AAPG, SPEE and SEG
SEG	Society of Exploration Geophysicists
SPE	Society of Petroleum Engineers
SPEE	Society of Petroleum Evaluation Engineers
UNFC	United Nations Framework Classification for Fossil Energy and Mineral Resources
UNFC-2009	United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009
VIEMS	Institute for Economics of Mineral Resources and the use of the Subsoil, Russian Federation
WPC	World Petroleum Council

PART I

United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009)*

*

The text of UNFC-2009 is as contained in the publication ECE Energy Series No. 39 and ECE/ENERGY/85 issued in 2010.

INTRODUCTION

At its sixteenth session in November 2007, the Committee on Sustainable Energy of the Economic Commission for Europe directed the Ad Hoc Group of Experts on Harmonization of Fossil Energy and Mineral Resources Terminology (now the Expert Group on Resource Classification) to submit any revised United Nations Framework Classification for Fossil Energy and Mineral Resources (UNFC) for consideration by the Extended Bureau of the Committee on Sustainable Energy in 2008 in order to facilitate worldwide application of the UNFC. In response to that request a simplified revised version of the Classification (United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009)) was prepared by the UNFC Revision Task Force, which consisted of the Extended Bureau of the Ad Hoc Group of Experts, plus selected experts. The Explanatory Note to UNFC-2009 (as contained in Part III) explains in some detail the issues contained in the revised Classification, but does not form part of the Classification itself.

The programme of work for 2009/10 of the Ad Hoc Group of Experts (ECE/ENERGY/GE.3/2009/2), as agreed at its sixth session, notes that the text of the revised draft UNFC-2009 should be prepared for its seventh session.

I. APPLICATION

UNFC-2009 applies to fossil energy and mineral reserves and resources located on or below the Earth's surface. It has been designed to meet, to the extent possible, the needs of applications pertaining to energy and mineral studies, resources management functions, corporate business processes and financial reporting standards.

II. CATEGORIES AND SUB-CATEGORIES

UNFC-2009 is a generic principle-based system in which quantities are classified on the basis of the three fundamental criteria of economic and social viability (E), field project status and feasibility (F), and geological knowledge (G), using a numerical coding system. Combinations of these criteria create a three-dimensional system. Categories (e.g. E1, E2, E3) and, in some cases, sub-categories (e.g. E1.1) are defined for each of the three criteria as set out and defined in Annexes I and II.

The first set of categories (the E axis) designates the degree of favourability of social and economic conditions in establishing the commercial viability of the project, including consideration of market prices and relevant legal, regulatory, environmental and contractual conditions. The second set (the F axis) designates the maturity of studies and commitments necessary to implement mining plans or development projects. These extend from early exploration efforts before a deposit or accumulation has been confirmed to exist through to a project that is extracting and selling a commodity, and reflect standard value chain management principles. The third set of categories

(the G axis) designates the level of confidence in the geological knowledge and potential recoverability of the quantities.

The categories and sub-categories are the building blocks of the system, and are combined in the form of “classes”. UNFC-2009 can be visualized in three dimensions, as shown in Figure 1, or represented in a practical two-dimensional abbreviated version as shown in Figure 2.

III. CLASSES

A class is uniquely defined by selecting from each of the three criteria a particular combination of a category or a sub-category (or groups of categories/sub-categories). Since the codes are always quoted in the same sequence (i.e. E; F; G), the letters may be dropped and just the numbers retained. The numerical code defining a class is then identical in all languages using Arabic numerals.

Figure 1

UNFC-2009 Categories and Examples of Classes

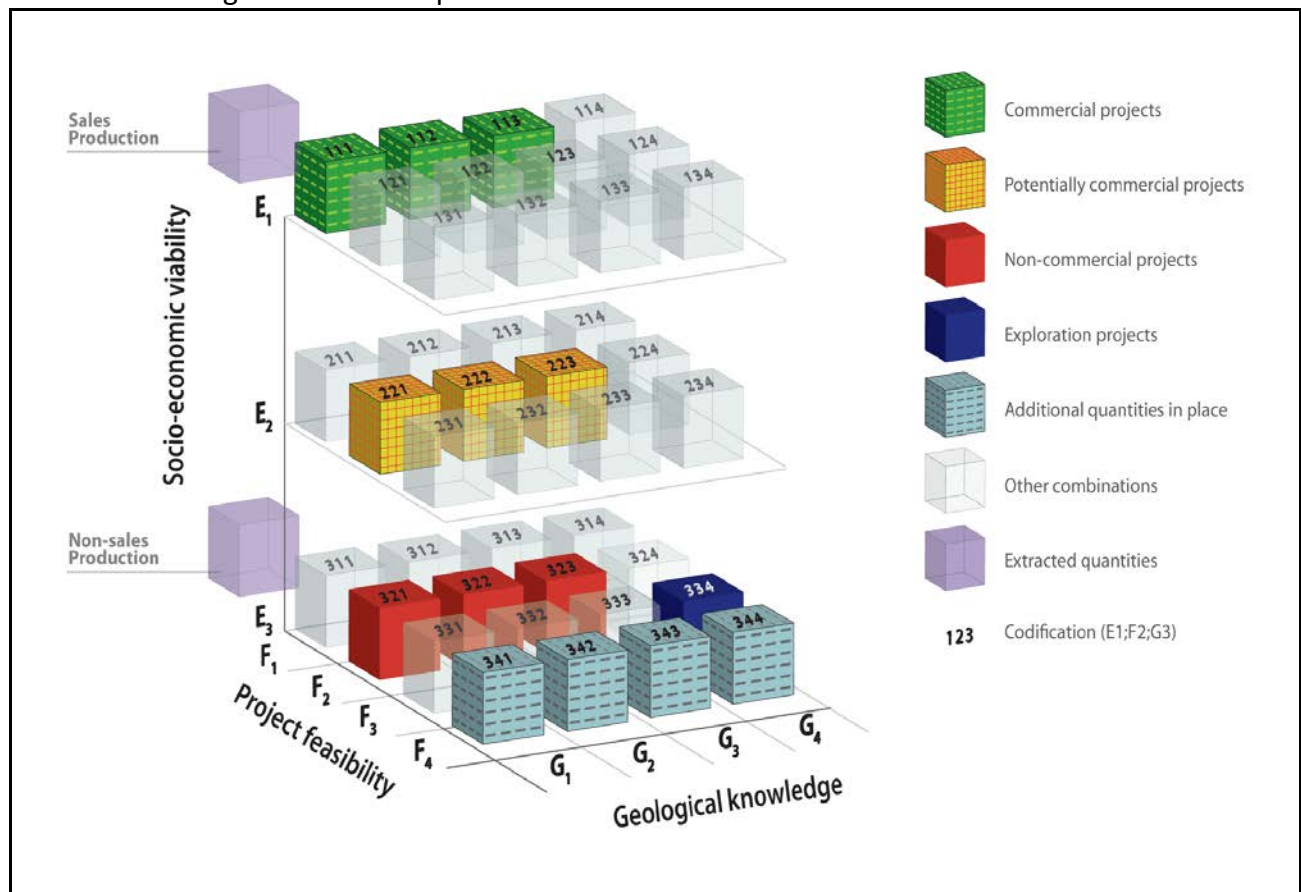


Figure 2

Abbreviated Version of UNFC-2009, showing Primary Classes

Total Commodity Initially in Place	Extracted	Sales Production			
		Non-Sales Production ^a			
		Class	Categories		
			E	F	G ^b
	Future recovery by commercial development projects or mining operations	Commercial Projects ^c	1	1	1, 2, 3
	Potential future recovery by contingent development projects or mining operations	Potentially Commercial Projects ^d	2 ^e	2	1, 2, 3
		Non-Commercial Projects ^f	3	2	1, 2, 3
	Additional quantities in place associated with known deposits ^g		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 ^g		3	4	4

^a Future non-sales production is categorized as E3.1. Resources that will be extracted but not sold can exist for all classes of recoverable quantities. They are not shown in the figure.

^b G categories may be used discretely, particularly when classifying solid minerals and quantities in place, or in cumulative form (e.g. G1+G2), as is commonly applied for recoverable fluids.

^c Commercial Projects have been confirmed to be technically, economically and socially feasible. Recoverable quantities associated with Commercial Projects are defined in many classification systems as Reserves, but there are some material differences between the specific definitions that are applied within the extractive industries and hence the term is not used here.

^d Potentially Commercial Projects are expected to be developed in the foreseeable future, in that the quantities are assessed to have reasonable prospects for eventual economic extraction, but technical and/or commercial feasibility has not yet been confirmed. Consequently, not all Potentially Commercial Projects may be developed.

^e Potentially Commercial Projects may satisfy the requirements for E1.

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

^g A portion of these quantities may become recoverable in the future as technological developments occur. Depending on the commodity type and recovery technology (if any) that has already been applied, some or all of these quantities may never be recovered due to physical and/or chemical constraints.

While there are no explicit restrictions on the possible combinations of E, F and G categories or sub-categories, only a limited number will generally be applicable. For the more important combinations (classes and sub-classes), specific labels are provided as a support to the numerical code, as illustrated in Figure 2.

As shown in Figure 2, the total commodity initially in place is classified at a given date in terms of the following:

- (a) Extracted quantities that have been sold – Sales Production.
- (b) Extracted quantities that have not been sold – Non-sales Production.
- (c) Quantities associated with a known deposit that may be recovered in the future by extractive activities. Technical and commercial evaluation studies based on defined development projects or mining operations constitute the basis for the classification.
- (d) Additional quantities in place associated with a known deposit that will not be recovered by any currently defined development project or mining operation.
- (e) Quantities associated with a potential deposit that may be recovered in the future provided that the deposit is confirmed.
- (f) Additional quantities in place associated with a potential deposit that would not be expected to be recovered even if the deposit is confirmed.

Material balance of total quantities can be maintained by full application of the classification. For this purpose a reference point shall be established where the quantity, quality and sales (or transfer¹) price of recovered quantities are determined.

With the exception of past production that may be measured, quantities are always estimated. There will be a degree of uncertainty associated with the estimates. The uncertainty is communicated either by quoting discrete quantities of decreasing levels of confidence (high, moderate, low) or by generating three specific scenarios or outcomes (low, best and high estimates). The former approach is typically applied for solid minerals, while the latter method is commonly used in petroleum. A low estimate scenario is directly equivalent to a high confidence estimate (i.e. G1), whereas a best estimate scenario is equivalent to the combination of the high confidence and moderate confidence estimates (G1+G2). A high estimate scenario is equivalent to the combination of high, moderate and low confidence estimates (G1+G2+G3). Quantities may be estimated using deterministic or probabilistic methods.

Where relevant, discovered quantities that may be recovered in the future are subdivided into quantities that are forecast to be sold and quantities that are forecast to be extracted but not sold.

¹ In large integrated projects, it may be necessary to determine an internal “transfer” price between “upstream” operations and “midstream” or “downstream” operations based on a netback calculation.

Potentially recoverable quantities may be recovered in the future through projects that are contingent on one or more conditions yet to be fulfilled. Contingent projects are classified into projects for which the social and economic conditions are expected to be acceptable for implementation and those where they are not. In the former case, contingency is caused by the recovery project not being sufficiently matured to confirm technical and/or commercial feasibility, which can then provide the basis for a commitment to extract and sell the commodity at a commercial scale. In the latter case, neither the project nor the economic and social conditions are sufficiently matured to indicate a reasonable potential for commercial recovery and sale in the foreseeable future. A deposit or an accumulation may give rise to several projects with different status.

IV. SUB-CLASSES

For further clarity in global communications, additional generic UNFC-2009 sub-classes are defined based on the full granularity provided by the sub-categories included in Annex II. These are illustrated in Figure 3.

V. HARMONIZATION OF RESOURCE INVENTORIES

Classifications other than the one shown in Figure 2 can be generated by choosing appropriate combinations of categories, or by grouping or further subdividing the categories. This permits the harmonization of resource inventories that are developed on the basis of different classification systems.

Conversely, when the unabbreviated UNFC-2009 is used to build a resource inventory, this can be converted to inventories developed on other harmonized classifications without going back to the basic resource information.

VI. ADAPTING TO NATIONAL OR LOCAL NEEDS

Classifications often need to be adapted to national or local needs. Modifications of this nature should be checked for consistency with the unabbreviated UNFC-2009 and other applications in use.

Figure 3

UNFC-2009 Classes and Sub-classes defined by Sub-categories^a

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 ^b	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	1, 2, 3
	Potential Deposit	Exploration Projects	[No sub-classes defined] ^c	3.2	3	4
		Additional Quantities in Place		3.3	4	4

^a Refer also to the notes for Figure 2.

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

^c Generic sub-classes have not been defined here, but it is noted that in petroleum the terms Prospect, Lead and Play are commonly adopted.

ANNEX I^a

DEFINITION OF CATEGORIES AND SUPPORTING EXPLANATIONS

Category	Definition ^b	Supporting Explanation ^c
E1	Extraction and sale has been confirmed to be economically viable. ^d	Extraction and sale is economic on the basis of current market conditions and realistic assumptions of future market conditions. All necessary approvals/contracts have been confirmed or there are reasonable expectations that all such approvals/contracts will be obtained within a reasonable timeframe. Economic viability is not affected by short-term adverse market conditions provided that longer-term forecasts remain positive.
E2	Extraction and sale is expected to become economically viable in the foreseeable future. ^d	Extraction and sale has not yet been confirmed to be economic but, on the basis of realistic assumptions of future market conditions, there are reasonable prospects for economic extraction and sale 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. ^d	On the basis of realistic assumptions of future market conditions, it is currently considered that there are not reasonable prospects for economic extraction and sale in the foreseeable future; or, economic viability of extraction cannot yet be determined due to insufficient information (e.g. during the exploration phase). Also included are quantities that are forecast to be extracted, but which will not be available for sale.

^a Annex I forms an integral part of UNFC-2009.

^b The term “extraction” is equivalent to “production” when applied to petroleum.

^c The term “deposit” is equivalent to “accumulation” or “pool” when applied to petroleum.

^d The phrase “economically viable” encompasses economic (in the narrow sense) plus other relevant “market conditions”, and includes consideration of prices, costs, legal/fiscal framework, environmental, social and all other non-technical factors that could directly impact the viability of a development project.

Category	Definition	Supporting Explanation
F1	Feasibility of extraction by a defined development project or mining operation has been confirmed.	Extraction is currently taking place; or, implementation of the development project or mining operation is underway; or, sufficiently detailed studies have been completed to demonstrate the feasibility of extraction by implementing a defined development project or mining operation.
F2	Feasibility of extraction by a defined development project or mining operation is subject to further evaluation.	Preliminary studies demonstrate the existence of a deposit in such form, quality and quantity that the feasibility of extraction by a defined (at least in broad terms) development project or mining operation can be evaluated. Further data acquisition and/or studies may be required to confirm the feasibility of extraction.
F3	Feasibility of extraction by a defined development project or mining operation cannot be evaluated due to limited technical data.	Very preliminary studies (e.g. during the exploration phase), which may be based on a defined (at least in conceptual terms) development project or mining operation, indicate the need for further data acquisition in order to confirm the existence of a deposit in such form, quality and quantity that the feasibility of extraction can be evaluated.
F4	No development project or mining operation has been identified.	In situ (in-place) quantities that will not be extracted by any currently defined development project or mining operation.
G1	Quantities associated with a known deposit that can be estimated with a high level of confidence.	For in situ (in-place) quantities, and for recoverable estimates of fossil energy and mineral resources that are extracted as solids, quantities are typically categorised discretely, where each discrete estimate reflects the level of geological knowledge and confidence associated with a specific part of the deposit. The estimates are categorised as G1, G2 and/or G3 as appropriate. For recoverable estimates of fossil energy and mineral resources that are extracted as fluids, their mobile nature generally precludes assigning recoverable quantities to discrete parts of an accumulation. Recoverable quantities should be evaluated on the basis of the impact of the development scheme on the accumulation as a whole and are usually categorised on the basis of three scenarios or outcomes that are equivalent to G1, G1+G2 and G1+G2+G3.
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.	

Category	Definition	Supporting Explanation
G4	Estimated quantities associated with a potential deposit, based primarily on indirect evidence.	Quantities that are estimated during the exploration phase are subject to a substantial range of uncertainty as well as a major risk that no development project or mining operation may subsequently be implemented to extract the estimated quantities. Where a single estimate is provided, it should be the expected outcome but, where possible, a full range of uncertainty in the size of the potential deposit should be documented (e.g. in the form of a probability distribution). In addition, it is recommended that the chance (probability) that the potential deposit will become a deposit of any commercial significance is also documented.

ANNEX II^a

DEFINITION OF SUB-CATEGORIES

Category	Sub-Category	Sub-Category Definition
E1	E1.1	Extraction and sale is economic on the basis of current market conditions and realistic assumptions of future market conditions.
	E1.2	Extraction and sale is not economic on the basis of current market conditions and realistic assumptions of future market conditions, but is made viable through government subsidies and/or other considerations.
E2	No sub-categories defined	
E3	E3.1	Quantities that are forecast to be extracted, but which will not be available for sale.
	E3.2	Economic viability of extraction cannot yet be determined due to insufficient information (e.g. during the exploration phase).
	E3.3	On the basis of realistic assumptions of future market conditions, it is currently considered that there are not reasonable prospects for economic extraction and sale in the foreseeable future.
F1	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.
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 commercial development may be subject to significant delay.
	F2.3	There are no current plans to develop or to acquire additional data at the time due to limited potential.

^a Annex II forms an integral part of UNFC-2009.

PART II^{*}

Specifications for the Application of the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009)

^{*}

Unless otherwise indicated, all the Sections and Annexes listed and referenced in Part II relate to Part II only.

I. INTRODUCTION

At its eighteenth session in November 2009, the Committee on Sustainable Energy approved the final text of the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009). The text of UNFC-2009 (as contained in Parts I and III) was previously published in 2010 as a United Nations Economic Commission for Europe (ECE) publication, ECE/ENERGY/85 and ECE Energy Series No. 39 in the six languages of the United Nations (Arabic, Chinese, English, French, Russian and Spanish).

The principal objective of UNFC-2009 is to enhance international communication by providing a generic classification framework for the reporting of fossil energy and mineral reserves and resources, even though such estimates may have been generated using classification or reporting systems that: (i) may use different terminology for comparable estimates, or the same terminology with different meanings; (ii) incorporate application guidelines that are commodity-specific; and, (iii) may reflect the extraction of solids by mining or the production of fluids through wells. UNFC-2009 has been developed to meet, to the extent possible, the needs of applications pertaining to international energy and mineral studies, government resource management functions, corporate business processes and financial reporting standards.

A key benefit of UNFC-2009 is the potential to provide a common basis for the minerals and petroleum sectors, whose classification systems have been developed primarily for the mining of solids and the production of fluids respectively, but which now must address the increasing overlap between the two extractive industries. Examples of this overlap include the mining of natural bitumen or coal for processing into synthetic oil or gas, and the production of minerals as fluids, such as the in-situ leaching of uranium and production of salt/potash from sub-surface brines in salt lakes.

The importance of environmental and social issues in the context of resource extraction is appropriately recognized in UNFC-2009, as discussed in Section II.

At the first session of the Expert Group on Resource Classification in April 2010, it was agreed that generic specifications would be developed for UNFC-2009, but only to the extent considered necessary to achieve an appropriate level of consistency in the reporting of reserve and resource estimates under UNFC-2009. Specifications that were considered necessary for particular commodities would not be addressed, as these were agreed to be more appropriately incorporated in existing commodity-specific classification systems. Consequently, in addition to the provision of generic specifications, there was also a need to establish a linkage between UNFC-2009 and such commodity-specific systems so that the appropriate specifications are applied at a commodity level for the purpose of reserve and resource assessments. The agreed framework for this linkage is discussed in Section III.

It is recognized that there may be differences between reporting at a corporate level and reporting by government entities at a national level, where estimates have been aggregated and/or derived using different information and procedures. This issue is discussed further in Section IV.

In Section V, the issue of disclosure is addressed, noting that UNFC-2009 is a voluntary system that does not mandate specific Categories of reserves or resources to be disclosed.¹ Generic specifications are provided in Section VI. These are considered necessary to ensure that reserve/resource quantities (for any commodity) that are reported as UNFC-2009 compliant are sufficiently comparable to provide meaningful information to users of such data.

Governance of UNFC-2009 and its specifications is the responsibility of the Expert Group on Resource Classification.

A Glossary of Terms is included (in Annex I), but is limited to those terms that are specific to UNFC-2009 for which definitions are not already adequately provided in Aligned Systems. In addition, guidelines on the application of key instructions in UNFC-2009 are provided in Annex II.

II. ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

UNFC-2009 is designed to take account of the importance of environmental and social issues in the context of resource extraction. In classifying estimated quantities that may be extracted in the future from a development project or mining operation, the E-axis Categories are explicitly defined to include both environmental and social issues that may be relevant to the commercial viability of such a venture, in addition to economic, legal and other non-technical factors.²

In particular, the identification and consideration at the time of the estimate of all known environmental or social impediments or barriers to the project during its entire life cycle is recognized as an integral part of the project assessment. The presence of environmental or social impediments can prevent a project from proceeding or it can lead to the suspension or termination of activities in an existing operation. Refer to Generic Specification H for further details.

¹ The terms “reserves” and “resources” are not defined in UNFC-2009, because they both have specific, but different, definitions in the solid minerals and petroleum sectors. The terms are used here purely in a generic sense to encompass all possible Classes and Sub-classes that are valid in UNFC-2009.

² Refer to Annex I of UNFC-2009 (see Part I).

III. COMMODITY-SPECIFIC SPECIFICATIONS AND THE RELATIONSHIP WITH OTHER RESOURCE CLASSIFICATION SYSTEMS

UNFC-2009 has been aligned with two other classification systems, which facilitates the reporting of the same resource quantities under either UNFC-2009 or the aligned system. The two systems are the CRIRSCO Template of 2006³ developed by the Committee for Mineral Reserves International Reporting Standards (CRIRSCO), and the reporting codes and standards that are based on it, and the Society of Petroleum Engineers (SPE)/World Petroleum Council (WPC)/American Association of Petroleum Geologists (AAPG)/Society of Petroleum Evaluation Engineers (SPEE) Petroleum Resources Management System of 2007 (PRMS⁴) which has been endorsed by SPE, WPC, AAPG, SPEE and the Society of Exploration Geophysicists (SEG).

Long-standing agreements are in place for CRIRSCO and SPE to provide the commodity-specific specifications for solid minerals and petroleum. In accordance with those agreements, they have provided commodity-specific specifications via the CRIRSCO Template and PRMS respectively. Along with the generic specifications, the two systems, together with a Bridging Document for each, provide the foundation and keystones for consistent application of UNFC-2009. It is recognized that these systems will continue to be developed in response to stakeholder needs and changes in technology, and hence additional commodity-specific specifications may be incorporated in the future, subject to endorsement by the Expert Group on Resource Classification.

The relationship between UNFC-2009 and the CRIRSCO Template, and between UNFC-2009 and PRMS, is explained in Bridging Documents contained in Annex III and Annex IV, respectively.

Other classification systems may be mapped to UNFC-2009 through the CRIRSCO Template/PRMS, or directly to UNFC-2009. In either case, the mapping must comply with all UNFC-2009 definitions and generic specifications. In particular, the relationship between mapped systems must be documented in a Bridging Document that shall be subject to evaluation by the Technical Advisory Group, which will then recommend endorsement by the Expert Group on Resource Classification only where the resultant estimates reported using UNFC-2009 are considered to be comparable with no significant difference to those that would result from the application of classification systems for which Bridging Documents have already been endorsed by the Expert Group on Resource Classification (i.e. Aligned Systems).

In certain jurisdictions, corporate reporting (either publically or to government) is mandated and/or constrained by regulation. Such regulations may explicitly preclude the public reporting of estimates using alternative systems or additional resource categories, and nothing in this UNFC-2009 specifications document shall be construed as a basis for deviating from the relevant regulations.

³ Available at: www.crirSCO.com/crirSCO_template_v2.pdf.

⁴ Available at: www.spe.org/industry/docs/Petroleum_Resources_Management_System_2007.pdf.

Unless constrained by regulation, the application of commodity-specific specifications of mapped systems shall not limit in any way the use of the full granularity of UNFC-2009 (refer to the Bridging Documents in Annexes III and IV).

Application of UNFC-2009 to classify quantities based on an Aligned System can be performed either by first generating estimates using the Aligned System and then assigning those estimates to the appropriate UNFC-2009 Class or Sub-class, or by generating the estimates directly in UNFC-2009 by applying the relevant specifications from the Aligned System. However, in both cases, this still requires adherence to both the Definitions and Generic Specifications of UNFC-2009, and the commodity-specific requirements that are included in the Aligned System.

The CRIRSCO Template (and the codes/standards based on it) and PRMS are independent from UNFC-2009 and may be mandatory for reporting purposes in some jurisdictions or in particular circumstances. This UNFC-2009 specifications document has no bearing whatsoever on such mandatory reporting requirements or on the independent application of these other systems/codes/standards.

There are major differences between the intended scope and application of the CRIRSCO Template (for solid minerals) and PRMS (for petroleum). Consequently, there are issues that may be addressed in one system but not in the other, or which are addressed differently in the two systems. In order that UNFC-2009 can provide a common basis for reporting of solid minerals and petroleum reserves and resources, appropriate for all its stakeholders, it is necessary to incorporate generic specifications that are mandatory whenever UNFC-2009 is applied. While these requirements do not impact in any way the independent application of the CRIRSCO Template and PRMS (as highlighted in the preceding paragraph), it should also be recognized that any reporting under UNFC-2009 must comply with the generic specifications documented herein.

UNFC-2009 does not distinguish between “conventional” and “unconventional” resources. When applying UNFC-2009, it should be noted that the G axis Definitions and Supporting Explanations are based on a distinction between commodities that are extracted as a solid and those extracted as a fluid.

IV. NATIONAL RESOURCE REPORTING

At a government level, national inventory estimates may be based on an aggregation of reported or published corporate estimates for individual development projects or mining operations.⁵ However, such estimates may not cover all known or potential fossil energy and mineral deposits in the country. Further, where government organizations have a responsibility for developing reserve/resource estimates at a regional or national level, the estimates may be different from corporate estimates on an individual project basis, regardless of the classification system being used. In such cases, regional or national inventory estimates using UNFC-2009 shall be derived using an appropriate methodology based on the nature and extent of available data. In accordance with Generic Specification K, the aggregation methodology shall be disclosed.

When reporting aggregated estimates using UNFC-2009, it is mandatory that the relevant Numerical Codes for the individual Classes are disclosed. For example, it may be useful at a national level to determine the sum of estimated quantities for Commercial Projects and Potentially Commercial Projects at a “best estimate” level, though it is preferred that the breakdown by Class is also provided.

V. DISCLOSURE

UNFC-2009 is a voluntary system and does not impose any rules regarding which Categories of resources (Classes or Sub-classes) that should be disclosed. Unless mandated or restricted by a government or other regulatory body, the disclosure of resource quantities under UNFC-2009 is entirely at the discretion of the reporter. However, in order to ensure that those quantities that are disclosed will provide meaningful information to users of resource information, certain generic specifications are included below for the purpose of ensuring clarity and comparability. In some cases, these specifications can be appropriately addressed through the use of footnotes to the resource report.

VI. 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.

Where a generic specification is defined below, this sets a minimum standard for reporting under UNFC-2009. However, where a specification for the same issue exists in the Aligned System, and it fully meets the requirements of the generic specification defined below, that specification may be adopted.

⁵ Note that regulatory bodies may explicitly preclude such aggregation in corporate reporting under any circumstances.

A. Use of numerical codes

While the defined Classes and Sub-classes shown in Figures 2 and 3 of UNFC-2009 may be used as supplementary terminology, the relevant Numerical Code(s) shall always be reported in conjunction with the estimated quantity. For example, these may be documented in the form 111, 111+112, or 1.1;1.2;1, as appropriate.

Note that some Sub-categories are defined below that are in addition to those provided in Annex II of UNFC-2009. These optional Sub-categories have been identified as potentially useful in certain situations and have been defined herein in order to ensure consistency in their application. Nothing in this document shall preclude the possible use of additional Sub-classes in the future that may be deemed to be useful in particular cases, especially where such Sub-classes facilitate the linkage to other systems and which may be defined in Bridging Documents.

B. Bridging document

Application of UNFC-2009 requires reference to a Bridging Document for the relevant commodity-specific specifications. The Bridging Document that was used as the basis for the evaluation shall be disclosed in conjunction with the reported quantities.

C. Effective date

Reported quantities are estimates of remaining quantities as at the Effective Date of the evaluation. The Effective Date shall be clearly stated in conjunction with the reported quantities. The evaluation should take into account all data and information available to the evaluator prior to the Effective Date. If information becomes available subsequent to the Effective Date, but prior to reporting, that could have significantly changed the estimated quantities as at the Effective Date, the likely effect of this information shall be disclosed.

D. Commodity or product type

Estimated quantities should be reported separately for each commodity or significant product type that will be sold, used, transferred or disposed of separately. Where estimates for different commodities or product types have been aggregated for reporting purposes, and separate estimates are not provided, the aggregated estimates shall be accompanied by a statement clarifying which commodities or product types have been aggregated and the conversion factor(s) used to render them equivalent for the purposes of aggregation⁶.

⁶ For example, crude oil volumes may be reported inclusive of condensate and natural gas liquids, in which case this fact shall be disclosed. Further, if gas volumes are converted to “oil equivalent” volumes and aggregated with crude oil estimates, this shall be disclosed. In addition, where resource estimates (e.g. oil, gas, coal and uranium) are converted into a measure of energy equivalency, the relevant conversion factors shall be disclosed.

E. Basis for estimate

Reported quantities may be those quantities attributable to the mine/development project as a whole, or may reflect the proportion of those quantities that is attributable to the reporting entity's economic interest in the mining operation or development project.⁷ The reporting basis shall be clearly stated in conjunction with the reported quantities. Government royalty obligations are often treated as a tax to be paid in cash and are therefore generally classified as a cost of operations. In such cases, the reported quantities may include the proportion attributable to the royalty obligation. Where the reported quantities exclude the proportion attributable to the royalty obligation, this shall be disclosed.

F. Reference point

The Reference Point is a defined location within an extraction and processing operation at which the reported quantities are measured or estimated. The Reference Point may be the commodity sales point from the extraction and processing operation or it may be an intermediate stage, such as pre-processing (if required), in which case the reported quantities would not take into account processing losses. The Reference Point shall be disclosed in conjunction with the reported quantities. Where the Reference Point is not the point of sale to third parties (or where custody is transferred to the entity's downstream operations), and such quantities are classified as E1, the information necessary to derive estimated sales quantities shall also be provided.

G. Classification of projects based on level of maturity

Where it is considered appropriate or helpful to sub-classify projects to reflect different levels of project maturity, based on the current status of the project, the optional Sub-classes shown in Figure 3 of UNFC-2009 (see Part I) may be adopted for reporting purposes. Additional guidance on the distinction between the Sub-classes of UNFC-2009 is provided in Annex V.

H. Distinction between E1, E2 and E3

The distinction between quantities that are classified on the Economic axis as E1, E2 or E3 is based on the phrase "reasonable prospects for economic extraction and sale in the foreseeable future". The definition of "foreseeable future" can vary depending on the commodity and hence more detailed specifications can be found in relevant commodity-specific systems that have been aligned with UNFC-2009.

The Economic axis Categories encompass all non-technical issues that could directly impact the viability of a project, including commodity prices, operating costs, legal/fiscal framework, environmental regulations and known environmental or social impediments or barriers. Any one of these issues could prevent a new project from proceeding (and hence quantities would be classified as E2 or E3, as appropriate), or it could lead to the suspension or termination of extractive activities in an existing operation. Where extractive activities are suspended, but there

⁷ The proportion of gross quantities attributable to a company will depend on the specific contractual arrangements governing development and extraction operations, and may be defined by regulation. For corporate reporting, the general principles used to determine net quantities shall be documented.

are “reasonable prospects for economic extraction and sale in the foreseeable future”, remaining technically recoverable quantities shall be reclassified from E1 to E2. Where “reasonable prospects for economic extraction and sale in the foreseeable future” cannot be demonstrated, remaining quantities shall be reclassified from E1 to E3.

I. Confidence levels for G1, G2 and G3

The level of confidence for quantities that are classified on the Geological axis as G1, G2 and G3 is defined as “high”, “medium” and “low”, respectively. These are not specified more precisely at a generic level because there are fundamental differences between the approaches that are appropriate for commodities extracted as solids and those extracted as fluids, as discussed in the Supporting Explanation to the definitions of these Categories in UNFC-2009. More detailed specifications can therefore be found in relevant commodity-specific systems that have been aligned with UNFC-2009.

J. Distinction between recoverable quantities and *in situ* (in-place) quantities

38. Other than quantities that are classified on the Feasibility axis as F4, all reported quantities shall be limited to those quantities that are potentially recoverable on the basis of existing technology or technology currently under development, and are associated with actual or possible future exploration/development projects or mining operations. For solid minerals projects where the ultimate extraction methodology has yet to be confirmed (E2F2), *in situ* quantities may be reported, provided that there are “reasonable prospects for economic extraction and sale” of all such quantities in the foreseeable future. If *in situ* quantities are reported and it is expected that the extraction methodology will lead to significant losses and/or grade dilution, this shall be disclosed, e.g. in a footnote. In the absence of any consideration of potential economic recoverability, all reported quantities shall be classified as F4. For commodities extracted as fluids, the recovery factor is usually a major uncertainty and hence this should always be taken into account for such projects (F2 and F3) and shall be accommodated using the G-axis Categories.⁸

⁸ As discussed in Annex I of UNFC-2009 (G1/G2/G3 Supporting Explanation).

K. Aggregation of quantities

Estimated quantities associated with mining operations or development projects that are classified in different Categories on the Economic or Feasibility axis shall not be aggregated with each other without proper justification and disclosure of the methodology adopted.⁹ In all cases, the specific Classes that have been aggregated shall be disclosed in conjunction with the reported quantity (e.g. 111+112+221+222) and a footnote added to highlight the fact that there is a risk that projects that are not classified as E1F1 (Commercial Projects) may not eventually achieve commercial operation.

Where estimated quantities have been aggregated from multiple projects, consideration should be given to sub-dividing the aggregated totals by deposit type and by location (e.g. offshore vs. onshore).

L. Economic assumptions

In accordance with the definitions of E1, E2 and E3, economic assumptions shall be based on current market conditions and realistic assumptions of future market conditions. Except where constrained by regulation, assumptions of future market conditions should reflect the view of either:

- (a) The organization responsible for the evaluation;
- (b) The view of a competent person¹⁰ or independent evaluator; or,
- (c) An externally published independent view, which is considered to be a reasonable forecast of future market conditions.

The basis for the assumptions (as opposed to the actual forecast) shall be disclosed.

M. Evaluator qualifications

Evaluators must possess an appropriate level of expertise and relevant experience in the estimation of quantities associated with the type of deposit under evaluation. More detailed specifications can be found in relevant commodity-specific systems that have been aligned with UNFC-2009.¹¹

⁹ Note that regulatory bodies may explicitly preclude such aggregation in corporate reporting under any circumstances.

¹⁰ Note that "competent person" may be defined by regulation.

¹¹ In addition, regulatory bodies may explicitly mandate the use of a "competent person", as defined by regulation, with respect to corporate reporting.

N. Units and conversion factors

In order to facilitate global comparability of resource estimates, it is recommended that the *Système International d'Unités* (SI units) is used for reporting of resource quantities. However, it is recognized that there are traditional measurement units that are widely used and accepted for certain commodities; where such units are used for reporting purposes, conversion factors to SI units shall be provided. Similarly, where quantities are converted from volume or mass to energy equivalents, or other conversions are applied, the conversion factors shall be disclosed.

O. 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.¹²

P. Expansion of G4 to account for uncertainty

In some situations, it may be helpful to express a range of uncertainty for quantities that are classified on the Geological axis as G4, e.g. Exploration Projects. In such cases, the following specification shall apply:

- (a) G4.1: low estimate of the quantities;
- (b) G4.2: incremental amount to G4.1 such that G4.1+G4.2 equates to a best estimate of the quantities;
- (c) 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.

Category G4, when used alone, shall reflect the best estimate and is equal to G4.1+G4.2.

Q. Optional labels for estimates

Where it is considered appropriate or helpful to use labels in addition to the numerical codes for a range of estimates for a specific development project or mining operation, the terms “Low Estimate”, “Best Estimate” and “High Estimate” may be used to correspond to quantities that are classified on the Geological axis as G1, G1+G2 and G1+G2+G3 respectively.

¹² Note that this is an obligation for ensuring that appropriate internal documentation is generated and kept, and is not an obligation for external disclosure of such information.

R. Classification of quantities associated with Exploration Projects

In some situations, it may be helpful to sub-classify Exploration Projects on the basis of their level of maturity. In such cases, the following specification shall apply:

- (a) F3.1: where site-specific geological studies and exploration activities have identified the potential for an individual deposit with sufficient confidence to warrant drilling or testing that is designed to confirm the existence of that deposit in such form, quality and quantity that the feasibility of extraction can be evaluated;
- (b) F3.2: where local geological studies and exploration activities indicate the potential for one or more deposits in a specific part of a geological province, but requires more data acquisition and/or evaluation in order to have sufficient confidence to warrant drilling or testing that is designed to confirm the existence of a deposit in such form, quality and quantity that the feasibility of extraction can be evaluated;
- (c) F3.3: at the earliest stage of exploration activities, where favourable conditions for the potential discovery of deposits in a geological province may be inferred from regional geological studies.

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.

T. Extracted quantities that may be saleable in the future

The Sub-categories of E3 permit a distinction to be made between those quantities that may be forecast to be extracted, but which will not be available for sale (E3.1) and those for which there are currently no reasonable prospects for economic extraction and sale in the foreseeable future (E3.3). In the former case, the quantities are those that will be used, lost, destroyed or otherwise disposed of during the extraction process, and hence will not be made available for sale, such as natural gas that is produced in association with oil and is then flared into the atmosphere or used on-site for operational purposes.

In some situations, however, quantities may be extracted to the surface and then stored in some way for possible economic sale in the future and these may be assigned to E3.3 (and subsequently moved to E2 and E1 as appropriate).¹³

¹³ One example is natural gas that has been produced to surface, but then injected back underground into the same or a different rock formation in such a way that it remains available for possible extraction and sale in the future. Another example would be thorium that has been extracted along with other, commercially saleable, commodities, but where there is no current market for the commodity. Provided that it is then stored in a manner in which it remains available for future commercial sale, it may be assigned to E3.3.

ANNEX I

GLOSSARY OF TERMS

Term	Definition
Aligned System	A classification system that has been aligned with UNFC-2009 as demonstrated by the existence of a Bridging Document that has been endorsed by the Expert Group on Resource Classification.
Bridging Document	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.
Category	Primary basis for classification using each of the three fundamental Criteria of economic and social viability (related Categories being E1, E2, and E3), field project status and feasibility (related Categories being F1, F2, F3 and F4), and geological knowledge (related Categories being G1, G2, G3 and G4). Definitions of Categories are provided in Annex I to UNFC-2009.
Class(es)	Primary level of resource classification resulting from the combination of a Category from each of the three Criteria (axes).
Complementary Texts	Additional texts to provide mandatory requirements (i.e. Specifications) and further guidance regarding the application of UNFC-2009. (This Specifications Document is an example of a complementary text.)
CRIRSCO Template	The CRIRSCO Template of 2006 is the system developed by the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) for solid minerals and, for the purposes of this Specifications Document, includes the reporting codes and standards that are aligned with it.
Criteria	UNFC-2009 utilises three fundamental Criteria for reserve and resource classification: economic and social viability; field project status and feasibility; and, geological knowledge. These Criteria are each subdivided into Categories and Sub-categories, which are then combined in the form of Classes or Sub-classes.
Evaluator	Person, or persons, performing resource estimation and/or classification.

Term	Definition
Exploration Project	A Project that is associated with one or more Potential Deposits (as defined below).
Generic Specifications	Specifications (as documented in this Specifications Document) that apply to the classification of quantities of any commodity using UNFC-2009.
Known Deposit	A deposit that has been demonstrated to exist by direct evidence. More detailed specifications can be found in relevant commodity-specific Aligned Systems.
Mapping Document	The output of a comparison between another resource classification system and UNFC-2009, or between that system and existing Aligned Systems, which highlights the similarities and differences between the systems. A Mapping Document can provide the basis for assessing the potential for the other system to become an Aligned System through the development of a Bridging Document.
Numerical Code	Numerical designation of each Class or Sub-class of resource quantity as defined by UNFC-2009. Numerical Codes are always quoted in the same sequence (i.e. E;F;G).
Potential Deposit	A deposit that has not yet been demonstrated to exist by direct evidence (e.g. drilling and/or sampling), but is assessed as potentially existing based primarily on indirect evidence (e.g. surface or airborne geophysical measurements). More detailed specifications can be found in relevant commodity-specific Aligned Systems.
Project	A Project is a defined development or mining operation which provides the basis for economic evaluation and decision-making. In the early stages of evaluation, including exploration, the Project might be defined only in conceptual terms, whereas more mature Projects will be defined in significant detail. Where no development or mining operation can currently be defined for all or part of a deposit, based on existing technology or technology currently under development, all quantities associated with that deposit (or part thereof) are classified in Category F4.

Term	Definition
Specifications	Additional details (mandatory rules) as to how a resource classification system is to be applied, supplementing the framework definitions of that system. Generic Specifications provided for the UNFC-2009 in this Specifications Document ensure clarity and comparability and are complementary to the commodity-specific requirements included in Aligned Systems, as set out in the relevant Bridging Document.
Specifications Document	Specifications for the application of the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009).
PRMS	Petroleum Resources Management System of 2007 (PRMS), which was approved by the Society of Petroleum Engineers (SPE) Board in March 2007 and endorsed by the World Petroleum Council (WPC), the American Association of Petroleum Geologists (AAPG), the Society of Petroleum Evaluation Engineers (SPEE) and the Society of Exploration Geophysicists (SEG).
Sub-categories	Optional subdivision of Categories for each of the fundamental Criteria of economic and social viability, field project status and feasibility, and geological knowledge. Definitions of Sub-categories are provided in Annex II to UNFC-2009.
Sub-classes	Optional subdivision of resource classification based on project maturity principles resulting from the combination of Sub-categories. Project maturity Sub-classes are discussed further in Annex V of this Specifications Document.
Système International d'Unités	Internationally recognized system of measurement and the modern form of the metric system. Prefixes and units are created and unit definitions are modified through international agreement as the technology of measurement progresses, and as the precision of measurements improves. Abbreviated to SI.
UNFC-2009	United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009.

ANNEX II

GUIDELINES ON THE APPLICATION OF KEY INSTRUCTIONS IN UNFC-2009

Classify (according to UNFC-2009)	To assign estimated quantities to a specific Class (or Sub-class) of UNFC-2009 by reference to the definitions of Categories or Sub-categories for each of the three Criteria and taking into account both the Generic Specifications and the commodity-specific requirements that are included in the Aligned System, as set out in the relevant Bridging Document.
Harmonization of Classification Systems	To identify significant differences between systems, if any, by mapping and then, if necessary, to adjust definitions and/or specifications of one system so that they lead to comparable results. A system that is harmonized with UNFC-2009 can become an Aligned System through the development and endorsement (by the Expert Group on Resource Classification) of a Bridging Document.
Mapping between Classification Systems	To generate a Mapping Document by comparing the definitions and specifications of each Category/Class of one classification system to the definitions and specification of each of the Categories/Classes in another system in order to identify the similarities and differences between them.
Mapping through the CRIRSCO Template and PRMS	To perform the mapping of a third classification system to UNFC-2009 by first mapping it to the CRIRSCO Template or PRMS, which are already mapped to, and aligned with, UNFC-2009.
Align Systems	See Harmonization of Classification Systems.
Apply UNFC-2009 Directly	To classify quantities without first generating estimates in an Aligned System. This still requires adherence to both the Generic Specifications and the commodity-specific requirements that are included in the Aligned System, as set out in the relevant Bridging Document.
Use UNFC-2009 as a Harmonizing Tool	See Harmonization of Classification Systems.

ANNEX III

BRIDGING DOCUMENT BETWEEN THE CRIRSCO TEMPLATE AND UNFC-2009

I. INTRODUCTION

Bridging Documents explain the relationship between UNFC-2009 and another classification system that has been endorsed by the Expert Group on Resource Classification as an Aligned System. They incorporate instructions and guidelines on how to classify estimates generated by application of that Aligned System using the UNFC-2009 Numerical Codes. The relevant Bridging Document shall be identified when reporting estimates using the UNFC-2009 Numerical Codes.

A long-standing agreement is in place for CRIRSCO to provide the commodity-specific specifications for solid minerals. In accordance with this agreement, CRIRSCO has provided commodity-specific specifications via the CRIRSCO Template of 2006 (hereinafter referred to as the “Template”).¹⁴ Along with the Generic Specifications, these provide the foundation and keystones for consistent application of UNFC-2009 for solid minerals.

The Template (and the codes/standards aligned with it) is independent from UNFC-2009 and may be mandatory for reporting purposes in some jurisdictions or in particular circumstances. This Bridging Document has no bearing whatsoever on such mandatory reporting requirements or on the independent application of the Template (and the codes/standards aligned with it).

Unless constrained by regulation, the application of commodity-specific specifications shall not limit in any way the use of the full granularity of UNFC-2009.

II. OVERVIEW OF THE CRIRSCO TEMPLATE (2006)

The CRIRSCO Template is the most recently developed international standard for the reporting of Exploration results, Mineral Resources and Mineral Reserves. It is in turn based on a number of national or regional reporting standards that are compatible and consistent with each other and the Template, and whose authors contributed to the development of the Template that represents current international best practice for Public Reports by companies.¹⁵ The basic framework on which the Template and the standards aligned to it are based is shown in Figure III.1.

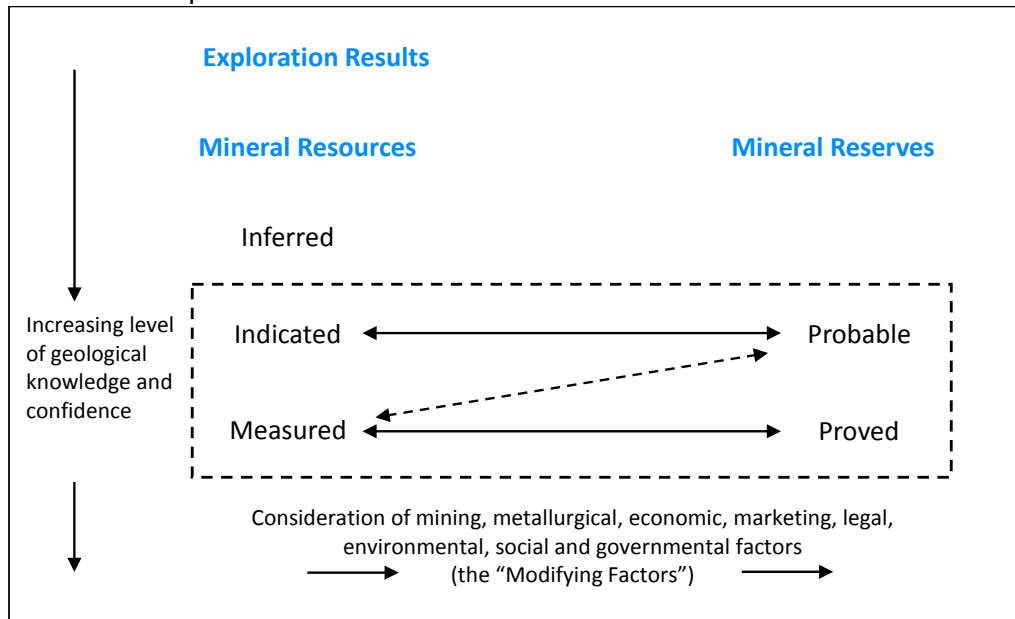
¹⁴ Available at: www.crirSCO.com/crirSCO_template_v2.pdf.

¹⁵ In the Template, a Public Report “refers to any report on Exploration Results, Mineral Resources or Mineral Reserves, prepared for the purpose of informing investors or potential investors and their advisers, or to satisfy regulatory requirements”.

The Template is focussed on establishing and maintaining consistent and appropriate standards for Public Reports (as defined by CRIRSCO) and hence does not address all mineralisation that may be relevant for other purposes, such as national inventories or internal use. Consequently, full application of UNFC-2009 for solid minerals can extend beyond the classes explicitly defined in the Template.

Figure III.1

General Relationship between Exploration Results, Mineral Resources and Mineral Reserves, as set out in the CRIRSCO Template



III. DIRECT MAPPING OF CATEGORIES AND SUB-CATEGORIES

A. Application of the G-axis

Where geological studies have been carried out and an estimate of the quantity of mineralization is possible (volume, tonnes, grade/quality etc.) then classification takes place on the vertical geological axis of the Template on the basis of the level of detail of the studies and the degree of confidence in the geological model. Mineral Resources are defined as Inferred, Indicated or Measured, reflecting an increasing level of geological knowledge and confidence.

The Geological Knowledge (G) axis has a direct mapping to the Template as shown in Figure III.2, which also shows the mapping of the E and F axes at the Category level. Note that the E and F Categories set minimum standards for the UNFC-2009 Classes. For example, a Potentially Commercial Project must be at least E2 and F2, but it could also be E1F2 or E2F1.

Figure III.2

Mapping of CRIRSCO Template to UNFC-2009 Classes and Categories. See preceding paragraph (second paragraph in Section III.A.) for explanation of “minimum”.

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

B. Detailed mapping of the E and F axes

Mineral Resources are in situ estimates of mineralization prior to conversion to Mineral Reserves (i.e. with no adjustments for mining dilution or losses), although preliminary consideration is given to mining, metallurgical, economic, marketing, legal, infrastructure, environmental, social and governmental factors (the Modifying Factors). Furthermore, portions of a mineral deposit that do not have reasonable prospects for eventual economic extraction must not be included in a Mineral Resource. In UNFC-2009, a Mineral Resource estimate will generally be classified as E2F2. Optionally, it may be further sub-classified on the F axis into F2.1 or F2.2 (refer to Figure III.3 and Annex V of this Specifications Document, which provides specific guidance in the differentiation between the project maturity Sub-classes). In some cases, a Mineral Resource estimate could correspond to E1F2, where there is no doubt regarding economic viability, or E2F1 where there is no doubt concerning technical viability (Sub-category F1.3). (Note that these combinations do not change the UNFC-2009 Class, which remains as Potentially Commercial Projects, as shown in Figure III.2.)

Where adequate geological studies have been carried out but preliminary assessment of the Modifying Factors indicates that the project is not viable in the foreseeable future (i.e. it does not have “reasonable prospects for eventual economic extraction”), the mineralization is classified as “inventory” and is not converted to a Mineral Resource.¹⁶ “Inventory” is not a defined term in the Template, and such quantities may not be disclosed in a Public Report (as defined above), but for other purposes would generally be classified in UNFC-2009 as either E3F2 where the quantities are technically recoverable but are not expected to become economically viable in the foreseeable

¹⁶ For more discussion regarding what constitutes “reasonable prospects for eventual economic extraction” in the context of different solid mineral commodities, refer to the discussion on Mineral Resources in the Template.

future (Sub-categories E3.3, F2.3) or where economically viability cannot yet be determined due to insufficient information (Sub-categories E3.2, F2.2), or E3F4 where no technically viable development project or mining operation can be identified (Sub-category E3.3). The inventory will be reviewed in future should conditions change.

In the Template, Mineral Resources may be reported inclusive of, or additional to, Mineral Reserves. Note that in UNFC-2009, classes such as 221 are always exclusive of other classes, such as 111. Where classes are aggregated, they must be documented explicitly (e.g. 111+221).¹⁷

Mineral Reserves are generally quoted as the product of mining activities (tonnage and grade or quality), i.e. the quantities delivered to the process plant. For some commodities, e.g. coal, Mineral Reserves are quoted as saleable product (tonnage and quality). Otherwise, where processing is required to produce a saleable product, recovery or yield factors shall be provided. A Mineral Reserve will always correspond to E1F1. Optionally, it may be further sub-classified on the E axis into E1.1 or E1.2 and on the F axis into F1.1, F1.2 or F1.3.

Conversion of Mineral Resources to Mineral Reserves requires technical studies of at least pre-feasibility level to demonstrate that mining, metallurgical, economic, marketing, legal, infrastructure, environmental, social and governmental factors (the Modifying Factors) have been adequately addressed and the project yields a positive financial return. In UNFC-2009, this requirement is also reflected in the definitions of the E1 and F1 Categories.

Provided that the Modifying Factors are satisfied, Indicated Resources can be converted to Probable Reserves. Similarly, Measured Resources may usually be converted to Proved Reserves, but can only be converted to Probable Reserves if the confidence in the Modifying Factors is less than the geological confidence. Inferred Resources shall not be converted to a Mineral Reserve (see Figure III.1).

Figure III.3 shows a mapping of the E-F Sub-category matrix to the Template with a colour coded and numeric key. Note that colours and numbers are aligned with the PRMS mapping (see Annex IV) and hence not all numbers are used here.

UNFC-2009 is a project-based system. Where a mining operation has both Mineral Reserves and Mineral Resources (excluding Mineral Reserves), these correspond to two separate projects in UNFC-2009. Referring to Figure III.2, the Mineral Reserves are associated with a Commercial Project whereas the Mineral Resources are associated with a Potentially Commercial Project. These may be further subdivided using the UNFC-2009 Sub-classes (Figure III.3) if desired.

¹⁷ For Public Reporting purposes, certain aggregations are not permitted.

In rare cases, a project that is actively extracting a commodity may, under the Template, be assigned zero Mineral Reserves due to inadequate confidence in the estimation of any future recoverable quantities. In such cases, a meaningful economic evaluation cannot be completed and hence the project would be classified as E2F1.1 on the basis that economic viability was “expected”. The project would be documented as a Potentially Commercial Project and should be explicitly identified and explained, e.g. in a footnote.

Figure III.3

Mapping of CRIRSCO Template to E-F Axes of UNFC-2009. Note that “Inventory” is not a defined term in the Template. The relationship between the Template and UNFC-2009 G axis Categories is shown in Figure III.2. Colours and numbers are aligned with the PRMS mapping (see Annex IV) and hence not all numbers are used here.

	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 Results		8
Special Cases	Classification not in Template	12
	Less Common Mappings	

C. Exploration results

Where exploration activities have taken place but are insufficiently advanced to estimate a Mineral Resource quantity, the generic term of Exploration Results is applied. Exploration Results are insufficient (in the context of Public Reports, as defined above) to determine the volume, tonnes, grade or quality of mineralization and should not be stated as Mineral Resources.

However, when UNFC-2009 is used for other purposes, estimated quantities would be classified as E3F3 where the quantities are technically recoverable (Sub-categories E3.2, F3), or as E3F4 where no technically viable development project or mining operation can be identified (Sub-category E3.3).

The Template does not have Sub-categories of Exploration Results.

ANNEX IV

BRIDGING DOCUMENT BETWEEN PRMS AND UNFC-2009

I. INTRODUCTION

Bridging Documents explain the relationship between UNFC-2009 and another classification system that has been endorsed by the Expert Group on Resource Classification as an Aligned System. They incorporate instructions and guidelines on how to classify estimates generated by application of that Aligned System using the UNFC-2009 Numerical Codes. The relevant Bridging Document shall be identified when reporting estimates using the UNFC-2009 Numerical Codes.

A long-standing agreement is in place for the Society of Petroleum Engineers (SPE) to provide the commodity-specific specifications for petroleum. In accordance with this agreement, SPE has provided commodity-specific specifications via the Petroleum Resources Management System of 2007 (hereinafter referred to as “PRMS”).¹⁸ Along with the Generic Specifications, these provide the foundation and keystones for consistent application of UNFC-2009 for petroleum.

PRMS is independent from UNFC-2009 and may be mandatory for reporting purposes in some jurisdictions or in particular circumstances. This Bridging Document has no bearing whatsoever on such mandatory reporting requirements or on the independent application of PRMS.

Unless constrained by regulation, the application of commodity-specific specifications shall not limit in any way the use of the full granularity of UNFC-2009.

II. OVERVIEW OF PRMS

The definitions and guidelines of PRMS are designed to provide a common reference for the international petroleum industry, including national reporting and regulatory disclosure agencies, and to support petroleum project and portfolio management requirements. They are intended to improve clarity in global communications regarding petroleum resources. It is expected that PRMS will be supplemented with industry education programmes and application guides addressing their implementation in a wide spectrum of technical and/or commercial settings. It is understood that the definitions and guidelines of PRMS allow flexibility for users and agencies to tailor application for their particular needs; however, any modifications to the guidance contained in PRMS should be clearly identified. The definitions and guidelines contained in PRMS must not be construed as modifying the interpretation or application of any existing regulatory reporting requirements.

Approved by the SPE Board in March 2007, the PRMS for defining reserves and resources was developed by an international group of reserves evaluation experts led by SPE and co-sponsored by the World Petroleum Council (WPC), the American Association of Petroleum Geologists (AAPG)

¹⁸ See also second paragraph in Section II ‘Overview of PRMS’ for further details. Available at: www.spe.org/industry/docs/Petroleum_Resources_Management_System_2007.pdf.

and the Society of Petroleum Evaluation Engineers (SPEE), and was subsequently endorsed by the Society of Exploration Geophysicists (SEG).

In November 2011, the sponsors of PRMS published the “Guidelines for Application of the Petroleum Resources Management System” to improve its application and use.¹⁹

III. DIRECT MAPPING OF CATEGORIES AND SUB-CATEGORIES

A. Application of the G-axis

The Geological Knowledge (G) axis has a direct mapping to the PRMS Range of Uncertainty as shown in Figure IV.1.

As described in the Generic Specifications, if a quantity is expressed for the G4 Category without Sub-category refinement, then the sum of the G4.1 and G4.2 Sub-categories shall be stated. This equates to the Best Estimate for Prospective Resources under PRMS.

Figure IV.1

Mapping of PRMS Range of Uncertainty Categories to UNFC-2009 G Axis.²⁰ Note: the scenario method may also be referred to as the cumulative method.

PRMS Categories		UNFC-2009 Categories
Reserves (Incremental)	Proved	G1
	Probable	G2
	Possible	G3
Reserves (Scenario)	Proved (1P)	G1
	Proved plus Probable (2P)	G1+G2
	Proved plus Probable plus Possible (3P)	G1+G2+G3
Contingent Resources	Low Estimate (1C)	G1
	Best Estimate (2C)	G1+G2
	High Estimate (3C)	G1+G2+G3
Prospective Resources	Low Estimate	G4.1
	Best Estimate	G4.1+G4.2 (=G4)
	High Estimate	G4.1+G4.2+G4.3

¹⁹ Available at: http://www.spe.org/industry/docs/PRMS_Guidelines_Nov2011.pdf.

²⁰ Combinations of G axis Categories (or Sub-categories), such as G1+G2, are shown here for illustrative purposes only. In practice, they will always be associated with E and F axis Categories (or Sub-categories) and documented as Classes in the form: 111+112, for example.

B. Detailed mapping of the E and F axes

The direct and unique mapping of PRMS uncertainty categories to the G axis allows the mapping of PRMS Project Maturity Sub-classes to a matrix formed from the Economic and Social Viability (E) and Field Project Status and Feasibility (F) axes. Figure IV.2 shows the mapping where optional Sub-classes have not been used, while Figure IV.3 shows a mapping of the E-F Sub-category matrix to the PRMS Project Maturity Sub-classes with a colour coded and numeric key. Note that the E and F Categories set minimum standards for the UNFC-2009 Classes. For example, a Potentially Commercial Project must be at least E2 and F2, but it could also be E1F2 or E2F1.

Figure IV.2

Mapping of PRMS and UNFC-2009 Classes and Categories. See preceding paragraph for explanation of “minimum”. PRMS Contingent Resources are always subdivided in UNFC-2009 between Potentially Commercial Projects and Non-commercial Projects based on the distinction between E2 and E3 Categories. Non-sales quantities are always classified as E3 in UNFC-2009. See text for further details.

PRMS Class		UNFC-2009 “minimum” Categories			UNFC-2009 Class
Discovered	Reserves	E1	F1	G1,G2,G3	Commercial Projects
	Contingent Resources	E2	F2	G1,G2,G3	Potentially Commercial Projects
		E3	F2	G1,G2,G3	Non-Commercial Projects
	Unrecoverable	E3	F4	G1,G2,G3	Additional in Place ^a
Undiscovered	Prospective Resources	E3	F3	G4	Exploration Projects
	Unrecoverable	E3	F4	G4	Additional in Place ^a

^a Additional quantities in place associated with known deposits (discovered) and with potential deposits (undiscovered).

As shown in Figure IV.3, there are a large number of cells within the E-F matrix that are labelled as Less Common Mappings. These are cells which result from mappings where the E-F combination would not generally be expected to occur, but could still be possible, or where there is a logical inconsistency with the level of project and socio-economic maturity. Classifying the cells as less common in this document does not preclude their use in UNFC-2009, but the quantities would need to be mapped to PRMS on a case by case basis to ensure that they were fully consistent with the definitions. In general, a project cannot be declared as meeting social and economic criteria until it has progressed to a sufficiently defined level of technical maturity.

Figure IV.3

Mapping of the E-F Matrix to the PRMS Project Maturity Sub-classes with a Colour Coded and Numeric Key. Relationship between PRMS and UNFC-2009 G axis Categories is shown in Figure IV.1. Note 12: in PRMS, where permitted by regulation, lease fuel (but not any other E3.1 non-sales quantities) can be included in Reserves, but should be reported separately from sales quantities. See Section IV.A of this Bridging Document for details.

	F1.1	F1.2	F1.3	F2.1	F2.2	F2.3	F3.1	F3.2	F3.3	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	9	10	
E3.3			7	7	7	7				11

Discovered	Reserves	On Production		1
		Approved for Development		2
		Justified for Development		3
	Contingent Resources	Development Pending		4
		Development Unclassified or On Hold	On Hold	5
			Unclassified	6
		Development Not Viable		7
	Unrecoverable			11
Undiscovered	Prospective Resources	Prospect		8
		Lead		9
		Play		10
	Unrecoverable			11
Special Cases		Defined but not classified in PRMS		12
		Less Common Mappings		

However, in certain circumstances, a project may be seen to be unequivocally commercially viable (E1.1), e.g. a very large oil discovery in a mature hydrocarbon province, even though appraisal activities are still on-going in order to optimize the development plan (F2.1). Such a project would be still be classified as a Potentially Commercial Project under UNFC-2009 and a Contingent Resource under PRMS.

Most PRMS Project Maturity Sub-classes map to more than one location in the E-F matrix, as shown in Figure IV.3. Section IV of this Bridging Document describes how the quantities within these PRMS Sub-classes shall be assigned to the correct Sub-classes within UNFC-2009. There are also some quantities described in UNFC-2009 that are not specifically included within PRMS resources description, although they are part of the total commodity initially in place. This issue is discussed in Section V of this Bridging Document.

There are four cells within the E-F matrix that map directly and uniquely to corresponding PRMS Project Maturity Classes. These cells relate to exploration projects (Prospective Resources in PRMS) and additional quantities in place (Unrecoverable in PRMS).

C. Exploration prospects

The Generic Specifications of UNFC-2009 define Sub-categories for the F axis that map directly to the PRMS Project Maturity Sub-classes for Prospective Resources. UNFC-2009 enforces the use of the E3.2 and G4 Sub-categories for classification of Exploration Projects. Figure IV.4 shows the full mapping of UNFC-2009 to PRMS for Exploration Projects and Prospective Resources.

Figure IV.4

Mapping of UNFC-2009 Exploration Projects to PRMS Prospective Resources

		Low Estimate	Best Estimate	High Estimate
Prospective Resources	Prospect	E3.2,F3.1,G4.1	E3.2,F3.1,G4.1+G4.2	E3.2,F3.1,G4.1+G4.2+G4.3
	Lead	E3.2,F3.2,G4.1	E3.2,F3.2,G4.1+G4.2	E3.2,F3.2,G4.1+G4.2+G4.3
	Play	E3.2,F3.3,G4.1	E3.2,F3.3,G4.1+G4.2	E3.2,F3.3,G4.1+G4.2+G4.3

D. Additional Quantities in Place

In the context of petroleum, additional quantities in place under UNFC-2009 correspond to those quantities that are currently classified as unrecoverable within discovered and undiscovered resources. Within the E-F matrix, additional quantities in place are found at the intersection of the E3.3 and F4 Categories. These are mapped to the Unrecoverable class in PRMS.

PRMS has two Unrecoverable classes, one representing unrecoverable quantities associated with discovered resources and a second representing the unrecoverable quantities associated with undiscovered resources. Within UNFC-2009, the geologic uncertainty for discovered quantities is described using Categories G1 to G3, while the geologic uncertainty for undiscovered quantities is described using Category G4, thus it is possible to have a unique mapping between the systems as shown in Figure IV.5.

Figure IV.5

Mapping of UNFC-2009 Additional Quantities in Place to PRMS Unrecoverable Quantities.

		Low Estimate	Best Estimate	High Estimate
Unrecoverable	Discovered	E3.3,F4,G1	E3.3,F4,G1+G2	E3.3,F4,G1+G2+G3
	Undiscovered	E3.3,F4,G4.1	E3.3,F4,G4.1+G4.2	E3.3,F4,G4.1+G4.2+G4.3

IV. SUB-DIVISION OF PRMS PROJECT MATURITY CLASSES TO MULTIPLE UNFC-2009 SUB-CATEGORIES

As UNFC-2009 contains more granularity than PRMS, it is to be expected that there will be many instances where a single PRMS project maturity Sub-class could reflect multiple combinations of UNFC-2009 Sub-categories. This is evident in Figure IV.3. In addition, one of the PRMS Sub-classes is subdivided into two UNFC-2009 Sub-classes. The criteria to be used to subdivide PRMS Sub-classes to utilize the full breadth of UNFC-2009 are described in the next two sections for Commercial Projects (equivalent to projects with Reserves), and Potentially Commercial and Non-Commercial Projects (equivalent to projects with Contingent Resources).

A. Commercial projects sub-categorization

PRMS project maturity Sub-classes for Reserves map directly to the UNFC-2009 Sub-categories F1.1 to F1.3 on the F axis, but can also be mapped to the E1.1, E1.2 or E3.1 Sub-categories on the E axis.

The subdivision of quantities between E1.1 and E1.2 for PRMS Reserves categories is completed by following the definitions of the Sub-categories. Quantities where extraction and sale is economic on the basis of current market conditions and realistic assumptions of future market conditions are categorized as E1.1. Quantities for which extraction and sale is not economic on the basis of current market conditions and realistic assumptions of future market conditions, but is made viable through government subsidies and/or other considerations are categorised as E1.2.

PRMS recommends that “lease fuel should be treated as shrinkage and is not included in sales quantities or resource estimates”. However, PRMS then states that if lease fuel is reported as Reserves (which is permitted under some regulations), it should be reported separately from sales quantities. PRMS also notes that all non-sales quantities (lease fuel, flare, and losses) may be separately identified and documented in addition to sales quantities.

UNFC-2009 does not fully represent the total commodity initially in place, but does not recognize lease fuel as part of Commercial Projects: under UNFC-2009, lease fuel (plus flaring and other losses) is always reported separately from sales quantities. All such quantities (lease fuel, flare or other losses) are categorized within the E3.1 Sub-category as non-sales. The project Sub-category (F axis) will be the same as that associated with the quantities being extracted and sold from that project. The level of geologic uncertainty will similarly reflect the project uncertainty. When mapping a volume from the UNFC-2009 E3.1 Sub-category to PRMS, care must be taken to exclude such quantities from Reserves or, if appropriate, to assign only the lease fuel to the Reserves Category and, in such cases, to document them separately from sales quantities. Flare gas and other losses are defined by PRMS but not explicitly categorized, but good practice would be to maintain a record of the quantities outside of the categorization.

B. Potentially commercial and non-commercial project sub-categorization

The mapping of Potentially Commercial and Non-Commercial Projects with PRMS Contingent Resources is slightly more complex with each project needing to be reviewed for the level of socio-economic and technical maturity.

There is a close link between PRMS project maturity Sub-classes and the UNFC-2009 Sub-classes, as shown in Figure IV.6. Note that the Sub-categories set minimum standards for the UNFC-2009 Sub-classes. For example, Development Pending must be at least E2 and F2.1, and cannot be equated to E3 or to F2.2 (or lower). On the other hand, it could also be E1F2.1 or it could be E2F1.3.

Figure IV.6

Mapping of PRMS Contingent Resource Sub-classes to UNFC-2009 Sub-classes using E and F Axis Categories and Sub-categories. See preceding paragraph, for explanation of “minimum”.

PRMS Sub-class		E axis “minimum” Category or Sub-Category	F axis “minimum” Sub-Category	UNFC-2009 Sub-class
Contingent Resources	Development Pending	E2	F2.1	Development Pending
	Development Unclarified or on Hold	E2	F2.2	Development on Hold
		E3.2	F2.2	Development Unclarified
	Development not Viable	E3.3	F2.3	Development not Viable

Mapping of the three PRMS Sub-classes to the UNFC-2009 Categories and Sub-categories shall be based on the following guidelines.

Development Pending projects must, as a minimum, satisfy the definitions of both F2.1 and E2, but could fall in either the F1.3 or F2.1 Sub-category based on the level of technical feasibility. A project that meets all technical requirements but does not meet current economic thresholds is sub-categorized as F1.3. Further, a project with remaining technical feasibility issues to be resolved is sub-categorized as F2.1 but, if there is no doubt about commercial viability, it could satisfy the definition of E1.1.

Sub-category E1.2 would not normally be expected to be associated with a project that is classified as Development Pending in PRMS. The reason for this is that there has to be no doubt about commercial viability (as mentioned in the preceding paragraph) and this is unlikely to be the case at that point in time (when the project is still under evaluation) if it requires a subsidy.²¹

PRMS has a single Sub-class of “Development Unclassified or on Hold”, which corresponds to two separate Sub-classes in UNFC-2009, as illustrated in Figure IV.5. Therefore, particular care is required to ensure that the appropriate distinction is made based on the UNFC-2009 Sub-category definitions so that projects are assigned to the correct UNFC-2009 Sub-class.

Projects On Hold are similar to Development Pending projects, but their progression towards commerciality is constrained by activities which may or may not be outside the control of the evaluator. Projects on Hold are classified as E2F2.2 to reflect the chance of commerciality but taking into account the current lack of activity progress.

Development Unclassified projects are those where there is currently an insufficient basis for concluding that there are reasonable prospects for eventual economic extraction. This is generally due to a lack of data to make the assessment, or where the evaluation is still at an early stage. The projects are sub-categorized as E3.2 and as F1.3, F2.1 or F2.2 based on the level of technical maturity. A project that meets all technical requirements but does not meet current commercial thresholds is sub-categorized as F1.3. A project with remaining technical and commercial issues to be resolved is sub-categorized as F2.1. If activities are on hold, or evaluation is still to be completed, the project is sub-categorized as F2.2.

Development not Viable projects are technically feasible projects (based on existing technology or technology currently under development), but they have been assessed as being of insufficient potential to warrant any further data acquisition activities or any direct efforts to remove commercial contingencies at this point in time. In such cases, it can be helpful to identify and record these quantities as part of a portfolio so that the potential for a commercial development opportunity will be recognized in the event of a major change in commercial conditions. The projects are not considered to have the potential for eventual commercial development as at the Effective Date, and are therefore always aligned with Sub-category E3.3 in UNFC-2009. Typically, the project will not have been matured technically due to the lack of potential and would be sub-categorized as F2.3. However, there could be circumstances where, for example, the project has been matured to F1.3 and then commercial circumstances have changed significantly.

²¹ Although such a combination of E and F Sub-categories is considered unlikely, it is not precluded, and each case needs to be reviewed in the light of the relevant circumstances.

V. IDENTIFICATION OF QUANTITIES DEFINED BUT NOT CLASSIFIED IN PRMS

As noted above, PRMS states that all non-sales quantities (lease fuel, flare and losses) may be separately identified and documented in addition to sales quantities. Where there is a need to differentiate between lease fuel, flare and losses within UNFC-2009, quantities of each non-sales type should be treated as a different product type (see Generic Specification D) and reported separately.

VI. DESCRIPTION OF RESERVES STATUS IN PRMS

Under PRMS, quantities classified as Reserves may be allocated to the following subdivisions based on the funding and operational status of wells and associated facilities within the reservoir development plan:

- Developed Reserves are expected quantities to be recovered from existing wells and facilities.
 - Developed Producing Reserves are expected to be recovered from completion intervals that are open and producing at the time of the estimate.
 - Developed Non-Producing Reserves include shut-in and behind-pipe Reserves.
- Undeveloped Reserves are quantities expected to be recovered through future investments.

As a generic system, UNFC-2009 does not provide additional sub-categories that correspond to these PRMS Reserves subdivisions. In addition, UNFC-2009 does not use the term Reserves.

Nevertheless, it is recognized that it may be useful at the generic level to reflect the funding and operational status of wells and associated facilities when reporting petroleum quantities using UNFC-2009. In such cases, the quantities associated with each relevant UNFC-2009 Class (or Sub-class, if used) may be reported in accordance with these subdivisions provided that in every case the aggregated quantities are also reported together with the appropriate UNFC-2009 Numerical Code for the Class or Sub-class.

Each of the Reserves status subdivisions may be abbreviated as indicated below, but the full name (excluding the word Reserves) shall always be provided (e.g. as a footnote) in association with the reported quantities. The accepted full names and their abbreviations are:

- DP: Developed Producing
- DNP: Developed Non-Producing
- U: Undeveloped

The names of these subdivisions and their abbreviations do not form part of the UNFC-2009 Numerical Code and should be incorporated either by placing them in parentheses after the Numerical Code or by including them in a separate column immediately adjacent to the Numerical Code.

ANNEX V

GUIDELINES ON THE USE OF PROJECT MATURITY TO SUB-CLASSIFY PROJECTS USING UNFC-2009²²

UNFC-2009 provides scope to sub-classify projects by applying the full range of Sub-category definitions.²³ The application of this level of granularity of the system is optional, though it is becoming widely recognised as a powerful tool for portfolio management purposes, both corporately and at a national level. The Sub-classes reflect the concept of classification on the basis of project maturity, which broadly corresponds to the probability that the project will eventually achieve commercial operation and commodity sales.

The Category and Sub-category definitions, as well as all generic specifications and relevant commodity-specific specifications necessary for the high level classification into Commercial Projects, Potentially Commercial Projects and Non-commercial Projects, must be satisfied before consideration is given to assignment to the appropriate Sub-class.

The project maturity Sub-classes are based on the associated actions (business decisions) required to move a project towards commercial production/extraction. The boundaries between different levels of project maturity are designed to align with internal (corporate) project “decision gates”, thus providing a direct link between decision-making and the capital value process within a company, and the characterization of its portfolio of assets through resource classification.

It is important to note that while the goal of the developer is always to move projects “up the ladder” toward higher levels of maturity, and eventually to commercial production/extraction, a change in circumstances (e.g. a change to local environmental, social or market considerations, or to the applicable fiscal regime, or disappointing results from further data acquisition) can lead to projects being “downgraded” to a lower Sub-class.

If the Sub-classes in Figure 3 of UNFC-2009 (see Part I) are adopted, the following guidelines should be applied.

²² PRMS provides for the optional use of very similar project maturity Sub-classes. Where these PRMS sub-classes have been adopted, they may be mapped to equivalent UNFC-2009 Sub-classes, as discussed in Annex IV. In all other cases, the guidelines presented in this Annex V shall be used to facilitate consistent application of the optional UNFC-2009 Sub-classes.

²³ See Figure 3 of UNFC-2009 (see Part I).

(a) Commercial Projects

On Production is used where the project is actually producing/extracting and selling one or more commodities to market as at the Effective Date of the evaluation. Although implementation of the project may not be 100% complete at that date, the full project must have all necessary approvals and contracts in place, and capital funds committed.²⁴ If a part of the project development plan is still subject to separate approval and/or commitment of capital funds such that it is not currently certain to proceed, that part should be classified as a separate project in the appropriate Sub-class.

Approved for Development requires that all approvals/contracts are in place, and capital funds have been committed. Construction and installation of project facilities should be underway or due to start imminently. Only a completely unforeseeable change in circumstances that is beyond the control of the developers would be an acceptable reason for failure of the project to be developed within a reasonable time frame.

Justified for Development requires that the project has been demonstrated to be technically feasible and commercially viable, and there must be a reasonable expectation that all necessary approvals/contracts for the project to proceed to development will be forthcoming.

(b) Potentially Commercial Projects

Development Pending is limited to those projects that are actively subject to project-specific technical activities, such as acquisition of additional data (e.g. appraisal drilling) or the completion of project feasibility studies and associated economic analyses designed to confirm project commerciality and/or to determine the optimum development scenario or mine plan. In addition, it may include projects that have non-technical contingencies, provided these contingencies are currently being actively pursued by the developers and are expected to be resolved positively within a reasonable time frame. Such projects would be expected to have a high probability of achieving commerciality.

Development On Hold is used where a project is considered to have at least a reasonable chance of achieving commerciality (i.e. there are reasonable prospects for eventual economic extraction), but where there are currently major non-technical contingencies (e.g. environmental or social issues) that need to be resolved before the project can move towards development.²⁵ The primary difference between Development Pending and On Hold is that in the former case the only significant contingencies are ones that can be, and are being, directly influenced by the developers (e.g. through negotiations), whereas in the latter case the primary contingencies are subject to the decisions of others over which the developers have little or no direct influence and both the outcome and the timing of those decisions is subject to significant uncertainty.

²⁴ In some cases, a project may be able to initiate operations and commodity sales even though parts of the approved development plan are not yet complete (e.g. some production wells remain to be drilled and/or connected). However, care is required to distinguish this situation from a phased development where implementation of the later phases is subject to a separate approval process which may even be contingent on the results of the first phase.

²⁵ Lack of sufficient demand in an existing and accessible economically viable market could be another reason for a project being classified as Development On Hold, but care is required to distinguish this situation from one where no economically viable market currently exists (Development not Viable).

(c) Non-commercial Projects

Development Unclassified is appropriate for projects that are still in the early stages of technical and commercial evaluation (e.g. a recent new discovery), and/or where significant further data acquisition will be required, in order to make a meaningful assessment of the potential for a commercial development, i.e. there is currently insufficient basis for concluding that there are reasonable prospects for eventual economic extraction.

Development not Viable is used where a technically feasible project can be identified, but it has been assessed as being of insufficient potential to warrant any further data acquisition activities or any direct efforts to remove commercial contingencies. In such cases, it can be helpful to identify and record these quantities so that the potential for a commercial development opportunity will be recognized in the event of a major change in technology or commercial conditions.

(d) Additional Quantities in Place

Quantities should only be classified as Additional Quantities in Place where no technically feasible projects have been identified that could lead to the extraction of any of these quantities. Some of these quantities may subsequently become recoverable in the future due to the development of new technology.

PART III

Explanatory Note to the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009)*

*

Explanatory Note accompanies, but does not form part of, UNFC-2009.

INTRODUCTION

By 2004, the Economic Commission for Europe (ECE)¹ had developed the United Nations Framework Classification for Fossil Energy and Mineral Resources (UNFC) and submitted it to the United Nations Economic and Social Council for its consideration.

At its 42nd Plenary Meeting, on 16 July 2004, the Economic and Social Council², recalling its decision 1997/226 of 18 July 1997, welcomed the endorsement by ECE of the United Nations Framework Classification for Fossil Energy and Mineral Resources and decided to invite the Member States of the United Nations, international organizations and the regional commissions to consider taking appropriate measures for ensuring worldwide application of the Framework Classification. The Council noted that the new classification for fossil energy and mineral resources, which now included energy commodities (for example, natural gas, oil and uranium), was an extension of the earlier framework developed for solid fuels and mineral commodities, on which the Council had taken similar action in 1997 upon endorsement and recommendation by ECE.

The ECE Committee on Sustainable Energy has been assisted by the Ad Hoc Group of Experts on the Harmonization of Fossil Energy and Mineral Resources Terminology (Ad Hoc Group of Experts) in dealing with this matter.

At its sixteenth session in November 2007, the Committee on Sustainable Energy directed the Ad Hoc Group of Experts to submit any revised UNFC for consideration by the Extended Bureau of the Committee on Sustainable Energy in 2008 in order to facilitate worldwide application of the UNFC. A simplified revised version of the classification (UNFC-2009) was prepared in response to that request. This Explanatory Note explains in some detail the issues contained in the revised classification, but does not form part of the classification itself.

The UNFC Revision Task Force that prepared the UNFC-2009 proposal consisted of the Extended Bureau of the Ad Hoc Group of Experts, plus selected experts.

I. RELATIONSHIP TO OTHER CLASSIFICATIONS

Throughout the twentieth century, many different systems were developed for resource classification, reflecting the different physical characteristics of the resources as well the geographic and socio-economic diversity of the producing areas. Although there was always a

¹ ECE is one of the five regional commissions of the United Nations. It represents Europe, Central Asia, North America, Turkey and Israel.

² Resolution 2004/233 of the United Nations Economic and Social Council pertaining to the United Nations Framework Classification for Fossil Energy and Mineral Resources.

certain desire and will, there was no particular requirement to harmonize terminology or to agree to common classification systems. More recently, as the globalization of commodity trading and financial markets has become firmly established, a view developed that a harmonized framework classification system would be extremely beneficial. Development work on the UNFC began in 1992 and led to a three dimensional classification system to which most other solid minerals systems were able to relate.

By 2004, the UNFC had been further developed in order to address all fossil energy and mineral resources. Since then, other important classifications have been developed or significantly updated. These include the New Russian Classification of 2005, the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) Template of 2006 and the Society of Petroleum Engineers (SPE)/World Petroleum Council (WPC)/American Association of Petroleum Geologists (AAPG)/Society of Petroleum Evaluation Engineers (SPEE) Petroleum Resource Management System (PRMS) of 2007. In 2007 and 2008, the Ad Hoc Group of Experts, in cooperation with experts representing these professional bodies, undertook an extensive mapping exercise, under the UNFC Mapping Task Force. The work showed that the CRIRSCO Template and PRMS could be aligned with the UNFC. The Report of the Mapping Task Force (ECE ENERGY SERIES No. 33 and ECE/ENERGY/71) recommended making some modifications to the UNFC to facilitate this.

UNFC-2009 reflects the recommendations of the Mapping Task Force by providing a high-level framework classification under which commodity-specific guidelines, such as reflected in the CRIRSCO Template and PRMS, can coexist. The generic high-level definitions have been developed to ensure maximum potential for alignment with other systems and to facilitate mapping with them. The definitions of the UNFC categories and sub-categories have been simplified and the most commonly-used classes are defined using plain language, providing harmonized generic terminology at a level suitable for global communications.

II. MAINTENANCE OF THE CLASSIFICATION

The resulting classification(s) will need to meet requirements of relevance, materiality, reliability and comparability with respect to the principal needs they aim to serve. This may require complementary texts to be developed in dialogue with all the stakeholders.

III. NORMATIVE REFERENCES

The International Organization for Standardization (ISO) normative reference document ISO 1000:1992, SI Units (Système International d'Unités) and recommendations for the use of their multiples and certain other units, contains provisions which, through reference in this text, constitute provisions for this document. For dated references, subsequent amendments to or revisions of the publication do not apply. However, Parties to agreements based on this document are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated previously. For undated references, the latest edition of the normative document referred to applies. The members of ISO and the International Electrotechnical Commission (IEC) maintain registers of currently valid International Standards.

IV. COMMENTS TO UNFC-2009

The following comments refer to specific sections of the Classification. They are appended to the Classification for ease of reference.

To Section I (UNFC-2009)

This section states that the UNFC-2009 is an inclusive classification with respect to fossil energy and mineral resources. However, it does not make reference to energy resources contained in physical fields (of pressure and temperature). It also does not make reference to groundwater resources, although it is applicable to projects that are extracting non-renewable groundwater.

Application of the UNFC-2009 to recipient reservoirs for permanent storage or for temporary inventory is not addressed in the classification.

The classification aims to serve the four principal needs mentioned in Section I.

To Section II (UNFC-2009)

The text establishes how conditions in the economic and social domain, the industrial domain (project/mine feasibility) and the geological domain are reflected in the categories used to define classes of in-place and recoverable quantities.

To Section III (UNFC-2009)

Classes of in-place and recoverable quantities are here defined in terms of the categories of Section II.

The recoverable quantities are those that are estimated to eventually be produced. An important aspect of the classification is the definition of a reference point for produced quantities where production is measured directly or estimated from indirect measurements, whether it is sales production or non-sales production. This allows quantities, qualities and values to be defined.

Simple language is used throughout, avoiding the use of key words that do not have a unique meaning. Most importantly, the word “reserves” is not used other than in a general sense.

In existing classifications, the term “reserves” is for the most part used to describe the quantities that commercial recovery projects are forecast to produce. Classifications relating to the recovery of solid minerals often add the additional restriction that the quantity is known with a high level of confidence where used in the context of “proved” or “proven” [mineral] reserves. Recovery projects producing or using fluids will typically have a much broader range of uncertainty with respect to recoverable quantities that result from a given recovery effort. Here, the term “proved” or “proven” reserves is applied to the outcome that has a high probability of being exceeded. UNFC-2009 is fully compatible with both these practices.

However, “reserves” is a concept with different meanings and usage. Even within the extractive industries, where the term is carefully defined and applied, there are some material differences between the specific definitions that are used in different sectors. In the public domain, many will

use it to describe quantities that are recoverable from discovered deposits or accumulations, regardless of whether they are recoverable by commercial projects or by projects that are not (yet) commercial, or where they are thought to be technically recoverable without any consideration of possible recovery projects that would be required to actually recover the quantities. Others use expressions like “recoverable reserves” implying that for them, some reserves are not recoverable, and also phrases such as “undiscovered reserves” and even “in-place reserves”. While all of these usages are clearly incorrect when considered in the light of certain widely-used definitions, such as those of CRIRSCO and SPE, the fact that the term has materially different meanings within the extractive industries indicates that it is not ideal as a basis for global communication of such an important quantity. This is the situation also in languages other than English.

This view is further supported by the observation that other common uses of the word “reserves” in English actually have a diametrically opposed meaning to the one most frequently used in the extractive activities. It is not used to describe quantities that are ready to be produced, but rather quantities of soldiers, wines etc. that are being kept “in reserve” – that is, not to be produced until later, or perhaps not at all.

“Commercial” is a key concept in the classification. It is used in its original sense to reflect what is prepared for buying and selling at scale.

Uncertainty is communicated in three complementary ways:

- (a) The oldest, emanating from best practices in geologic analysis, is to communicate what has been “observed” or “measured”, what has been estimated with, or is indicated by, reasonably good geological control, and what has been extrapolated or inferred from observations, but with less or lacking geological control. This method of discrete estimates is well-suited to the characterization of quantities in place in a deposit/accumulation and is also appropriate where estimated potentially recoverable quantities are based directly on those discrete in place estimates, as in the case of solid minerals;
- (b) The later industrial and commercial approach is to communicate the quantities that may be recovered by a given project. This may be dependent on a number of factors in addition to the quantities in place in the deposit/accumulation. The tradition in this scenario-based method is to communicate a probability that a project will produce at least the estimated quantity;
- (c) Except in the case of commercial projects, there may be a chance that development and production projects will not be realized. This is clearly the case in the exploration phase, where best practice is to communicate a probability that a discovery will be made of sufficient size to have the potential to lead to a commercial project, and then the probability distribution of the forecast recoverable quantities from that commercial project. The probability that potentially commercial projects associated with known deposits will actually be undertaken in the foreseeable future can likewise be communicated if the information is available. Alternatively, the information may be communicated by assigning the quantities to subclasses. For any single exploration prospect or development project, it may be constructive to communicate both the

chance that it will lead to a commercial project and the range of quantities that may be produced from the project. When working with portfolios these quantities are generally discounted for the probability that they will materialize.

UNFC-2009 is consistent with these three best practices of communicating uncertainty.

[To Sections IV and V \(UNFC-2009\)](#)

While the UNFC is a classification in its own right, its generic category definitions make it very suitable for comparing with other classifications through mapping modules, and thus it can be used to facilitate their harmonization through highlighting changes that could be implemented to remove material differences between them. Both the application of the UNFC as a classification and the use of it for comparing to other classifications are facilitated by the subdivision or aggregation of categories to define classes which reflect the primary quantities that are generally and most usefully reported.

[To Section VI \(UNFC-2009\)](#)

The same procedure of either subdividing or aggregating categories may be applied at the national or local level to meet specific needs arising for instance from national legislation, corporate decision procedures or needs not foreseen when issuing the classification initially. In order to ensure that problems of this nature are solved in a consistent way by different users of the classification, it is important to check the different adaptations for consistency with the basic UNFC and other national or local adaptations.

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

This publication contains the text of the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009) and the specifications for its application. UNFC-2009 is a universally acceptable and internationally applicable scheme for the classification and reporting of fossil energy and mineral reserves and resources and is currently the only classification in the world to do so. As with extractive activities, UNFC-2009 reflects conditions in the economic and social domain, including markets and government framework conditions, technological and industrial maturity and the ever present uncertainties. It provides a single framework on which to build international energy and mineral studies, analyze government resource management policies, plan industrial processes and allocate capital efficiently.

UNFC-2009 is a generic principle-based system in which quantities are classified on the basis of the three fundamental criteria of economic and social viability (E), field project status and feasibility (F), and geological knowledge (G), using a numerical coding system. Combinations of these criteria create a three-dimensional system.

The specifications for its application make UNFC-2009 operational. The 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 UNFC-2009 should be applied in specific circumstances.

By covering all extractive activities, UNFC-2009 captures the common principles and provides a tool for consistent reporting for these activities, regardless of the commodity. It is a strong code that paves the way for improved global communications which will aid stability and security of supplies, governed by fewer and more widely understood rules and guidelines. The efficiencies to be gained through the use of UNFC-2009 and its specifications are substantial.