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Issue #11: Categorization of mineral and energy resources[1]

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[1] This outcome paper has been prepared by the SEEA Editor. It is based on papers presented to the London Group of Experts on Environmental Accounting and discussions among those experts. Investigation and research for this outcome paper was led by Ole Gravgard of Statistics Denmark.

A. Introduction

1. Mineral and energy resources are a particular focus of the System of Environmental and Economic Accounts (SEEA) from a number of perspectives. The flows of energy resources are of particular interest in the measurement of physical flows of energy and associated efficiency measures. In the asset accounts of the SEEA there is particular interest in understanding the extent of available mineral and energy resources and associated measures of depletion of these resources.

2. In this latter context the SEEA-2003 provides a categorization of mineral and energy resources based on the geological and economic characteristics of mineral and energy resource deposits. This categorization is based on the McKelvey box. In recent years, a new classification for mineral and energy resources - the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources (UNFC) – has been developed and was endorsed by the United Nations Economic and Social Council (ECOSOC) which recommended its application worldwide. The UNFC, in addition to the geological and economic characteristics of the deposits, introduces a third dimension, which is linked to project feasibility.

3. As part of the SEEA Revision process it was recognized that the development of the UNFC should be taken into consideration. The primary question is the extent to which the revised SEEA should adopt a categorization of mineral and energy resources in line with the UNFC. It is noted that the process of categorization of mineral and energy resources is not aimed at classifying the different types of mineral and energy resources. Rather the focus is on defining the resource boundary since there are different degrees to which mineral and energy resources are known.

4. Part I of this paper is focused on explaining the application of the UNFC-2009 including describing links between the UNFC-2009 and other mineral and energy resource categorization systems. Recommendations on the use of the UNFC within SEEA are provided at the end of this explanation.

5. Part II of the paper introduces some suggested classes for the classification of mineral and energy resources by type of resource – for example oil and coal. These suggested classes would need to fit within the broader revised SEEA asset classification. As this broader classification has not yet been finalized no specific recommendation is made on the suggested classes but initial feedback is sought at this stage.

PART I: The categorization of mineral and energy resources

6. In SEEA-2003 the known deposits of mineral and energy resources are categorized into the following three broad classes. This section considers how these classes might be defined according to the UNFC[2] and also considers whether these three classes continue to be the most appropriate for the SEEA.

A. Commercially Recoverable Resources (“Proven”)

B. Potentially Commercially Recoverable Resources (“Probable”)

C. Non commercial and Other Quantities in Place (“Possible”)

7. The United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009)[3] is a generic and flexible scheme for classifying and evaluating quantities of fossil energy and mineral resources. It is designed to allow the incorporation of currently existing terms, definitions and classifications into the framework and thus make them comparable and compatible. The UNFC-2004 was endorsed in February 2004 by the UN Economic Commission for Europe (UNECE) and recommended by the United Nations Economic and Social Council (ECOSOC)

[2] In describing the main ideas of the UNFC-2009 and the UNFC-2009 categories, parts of the text of the UNFC-2009 have been reproduced.

[3] UNFC-2009: United Nations Framework Classification for Fossil Energy and Mineral Reserves and resources 2009 - http://www.unece.org/energy/se/pdfs/UNFC/unfc2009/unfc2009_report_e.pdf

for application worldwide in Resolution 2004/233. In November 2009 the UNECE Committee on Sustainable Energy approved UNFC-2009 as the successor to UNFC-2004.

8. The UNFC-2009 categorizes mineral and energy resources by looking at whether, and to what extent, projects for the extraction or exploration of the resources have been confirmed, developed or planned. Based on the maturity of the projects the underlying natural resources are classified. The UNFC-2009 is based on a breakdown of the resources according to three criteria affecting their extraction:

- Economic and social viability (E)
- Field project status and feasibility (F)
- Geological knowledge (G)

9. The first criteria (E) designates the degree of favourability of economic and social conditions in establishing the commercial viability of the project. The second criteria (F) 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 product. The third (G) criteria designates the level of certainty in the geological knowledge and potential recoverability of the quantities. (see UNFC-2009, Section 3).

10. Each criteria, E, F, and G, is sub-divided into categories characterizing the projects for exploring or extracting the resource. The categories for the economic and social criteria are called E1, E2, E3, and E4, the categories for the project status and feasibility criteria are called F1, F2, F3, F4 and the categories for the geologic knowledge criteria are called G1, G2, G3, and G4. In some cases a sub-categorisation can be applied to the categories. F1 is, for instance, broken down by the sub-categories F2.1, F2.2 and F2.3. Each project is then categorised by a combination of these categories or sub-categories, e.g. (E1,F1,G1). Further, each class is then formed by combining projects with specific combinations of categories or sub-categories.

11. Table 1 gives an overview of how the three classes of resources are defined based on the E, F and G criteria.

Table 1: SEEA categorization of mineral and energy resources based on UNFC-2009

	SEEA Classes	Corresponding UNFC-2009 project categories		
		E **Economic and social viability**	**F** **Field project status and feasibility**	**G** **Geological knowledge**
Known deposits	**A. Commercially Recoverable Resources**[1]	E1. Extraction and sale has been confirmed to be economically viable	F1. Feasibility of extraction by a defined development project or mining operation has been confirmed	Quantities associated with a known deposit that can be estimated with a high (G1) or moderate (G2) level of confidence
	B. Potentially Commercially Recoverable Resources[2]	E2. Extraction and sale is expected to become economically viable in the foreseeable future[3]	F2.1 Project activities are ongoing to justify development in the foreseeable future Or F2.2 Project activities are on hold and/or where justification as a commercial development may be subject to significant delay	Quantities associated with a known deposit that can be estimated with a high (G1) or moderate (G2) level of confidence
	C. Non-Commercial and other known deposits[4]	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	F2.2 Project activities are on hold and/or where justification as a commercial development may be subject to significant delay Or F2.3 There are no current plans to develop or to acquire additional data at the time due to limited potential Or F4. No development project or mining operation has been identified	Quantities associated with a known deposit that can be estimated with a high (G1), moderate (G2) or low (G3) level of confidence
Potential deposits (not included in SEEA)	Exploration projects Additional quantities in place	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	F3. Feasibility of extraction by a defined development project or mining operation cannot be evaluated due to limited technical data Or F4. No development project or mining operation has been identified	Estimated quantities associated with a potential deposit, based primarily on indirect evidence (G4)

Notes

1. Includes on-production projects, projects approved for development and projects justified for development
2. Includes economic and marginal development projects pending and development projects on hold
3. Potential Commercial Projects may also satisfy the requirements for E1.
4. Includes unclarified development projects, non-viable development projects, and additional quantities in place

Source: UNFC-2009, Figures 2 and 3

12. The SEEA-2003 Class A: Commercially Recoverable Resources is formed by combining deposits for those projects that fall in the categories E1and F1. It corresponds to what are called "reserves" in many classification systems. However, the term reserves is not used by the UNFC-2009 since investigation revealed that reserves are defined in different ways in different classifications.

> The category E1 includes projects where extraction and sale is economically viable, i.e. the extraction is assumed to be economic on the basis of current market conditions and realistic assumptions of future market conditions. It includes considerations of prices, costs of the legal and fiscal framework, and various environmental, social and other non-technical factors that could directly impact the viability of a development project. The economic viability is not affected by short-term adverse market conditions provided that longer-term forecasts remain positive.
>
> The category F1 includes projects where extraction is currently taking place (F1.1); or capital funds have been committed and implementation of the development project or mining operation is underway (F1.2); or sufficiently detailed studies have been completed to demonstrate the feasibility of extraction by implementing a defined project or mining operation (F1.3).

13. The SEEA-2003 Class B: Potentially Commercially Recoverable Resources are formed by combining deposits for those projects that fall in the category E2 (or eventually E1) and at the same time in F2.1 or F2.2.

> For projects falling into category E2, 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.
>
> Both F2.1 and F.2.2 includes projects where the feasibility of extraction is subject to further evaluation. For F2.1 project activities are ongoing to justify development in the foreseeable future; and for F2.2 project activities are on hold and/or justification as commercial development may be subject to a significant delay.

14. The SEEA-2003 Class C: Non-Commercial and Other Known Deposits are resources for those projects that fall in E3 and for which the feasibility is categorised as F2.2, F2.3 or F4.

> For 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.
>
> F2.3 indicates that there are no current plans to develop or to acquire additional data at the time due to limited potential. F4 indicates that no development project or mining operation has been identified.

15. In addition to these three classes that exhaust the known deposits of mineral and energy resources, the UNFC also includes so-called potential deposits of resources. These are resources estimated on the basis of very preliminary studies in the exploration phase and where there are currently no development projects or mining operations that have been defined. These quantities are either assumed not to be economically viable, or the information is too sparse to determine the economic viability. The quantification of these resources is subject to a substantial range of uncertainty and there is a major risk that no project or operation may be implemented to extract the estimated quantities.

16. In the SEEA-2003 only the known deposits, i.e. classes A, B and C were included as mineral and energy resources within the asset boundary, while potential and speculative deposits were not included. It is recommended that the same boundary be applied in the revised SEEA – i.e. only known deposits should be included in the asset boundary.

17. It is noted that while the proposed asset boundary extends to all known deposits it may not be possible to value all of these deposits in monetary terms. In particular, the level of geological knowledge about non-commercial projects may not be sufficiently strong for valuation to be

undertaken and thus the implicit monetary boundary is likely to be narrower than the defined physical boundary for mineral and energy resources.

18. Following from this point, the quantification of mineral and energy resources is always based on estimates and cannot be done with certainty. The geological (G) dimension of the UNFC is used to communicate the uncertainty in the geological knowledge and potential recoverability of the quantities.

19. Quantities associated with a high level of confidence are classified as G1, quantities associated with a moderate level of confidence are classified as G2 and quantities associated with a low level of confidence as G3. Alternatively, the level of uncertainty related to the estimates of the quantities from future extraction can be communicated as low (G1), moderate (G1+G2) or high (G1+G2+G3).

20. For the SEEA generally the moderate estimate (G1 + G2), sometimes also called the best estimate, of the resources should be used as a standard, but the range of uncertainty could be presented as supplementary information by presenting the low and high estimates for an individual resource.

21. In practice it is recognised that there are a range of national and other classification systems that are used for categorizing mineral and energy resources. It has therefore been considered important that the UNFC can be linked to other classification systems. Annex 1 notes some relevant work in the area of converting between classification systems.

22. One important and common linkage is to the terminology of proven, probable and possible which have been a widespread set of categories to distinguish between different degrees of confidence in the extraction of mineral and energy resources. Annex 1 explains that, in general, the terms proven, probable and possible relate most closely to the categories G1, G2 and G3. That is, the link is to the relative certainty of geological knowledge.

23. Annex 1 shows however, that the terms proven, probable and possible are used in slightly different ways in different categorization approaches and hence these terms are not incorporated in the proposals for the revised SEEA.

Recommendation 11.1: That in the revised SEEA the categorization of mineral and energy resources should be based on the UNFC-2009 with particular focus on the criteria concerning economic and social viability (E) and geological knowledge (G).

Recommendation 11.2: That the scope of mineral and energy resources included in the asset boundary of the revised SEEA should be Known deposits, consisting of Commercially Recoverable Resources (Class A) or Potentially Commercially Recoverable Resources (Class B) and Non-commercial projects (Class C).

Recommendation 11.3: That deposits classed as Commercially Recoverable Resources (Class A) or Potentially Commercially Recoverable Resources (Class B) must have a geological knowledge rating of G1 or G2.

PART II – Suggested classes for the classification of mineral and energy resources by type of resource

24. In addition to categorization following the UNFC-2009, mineral and energy resources are classified within the broader SEEA asset classification by type of resource (e.g. natural gas, crude oil, coal, etc.). In SEEA-2003 mineral and energy resources (EA.11) are included within the broader category of natural resources (EA.1).

25. For the purpose of the revised SEEA, it is suggested that EA.11 retain the title of Mineral and Energy Resources but be further disaggregated. At the first level, a distinction between petroleum resources; non-metallic minerals and solid energy resources; and metallic minerals could be made. Petroleum resources, which cover all liquid and gaseous hydrocarbons found in a natural state, could be broken down by natural gas (including NGL and condensate), crude oil and natural bitumen, extra

heavy oil, shale oil, etc. Within the category non-metallic minerals and solid energy resources, coal and peat are separated. Note that peat is included as part of the EA.11 Mineral and Energy Resources and not as part of EA.14 Biological resources. Uranium ores are shown as a sub-category of metallic minerals.

26. The proposals as presented in Table 2 are preliminary suggestions only. The final naming and content of the categories of mineral and energy resources will be dependent on:

- outcomes of discussion on the broader asset classification for the revised SEEA
- deliberations on the classification of physical flows which encompasses a classification of natural resources flowing from the environment to the economy and a classification of products.
- the conclusions regarding the classification of energy products that is being developed in the context of the International Recommendations for Energy Statistics.
- further work to expand the classes to better cover those minerals that are not energy resources – for example gold and copper.

27. Given these various dependencies no recommendation on the classification of mineral and energy resources by type of resource is made at this stage. However the following question is posed aimed at seeking feedback from experts in this area.

Question 11.4: Do you have any comments or feedback in relation to the suggested classes for the classification of mineral and energy resource by type of resource as presented in Table 2 of the outcome paper?

Table 2: Suggested SEEA classes for selected* mineral and energy resources

EA.11	Mineral and energy resources		
	EA.111	Petroleum resources	
		EA.111.1	Natural gas (including NGL and condensate)
		EA.111.2	Crude Oil
		EA.111.3	Natural bitumen, extra heavy oil, oil shale, sand oil and others n.e.c.
	EA.112	Non-metallic minerals and solid energy resources	
		EA.112.1	Non-metallic minerals except coal and peat
		EA.112.2	Coal
		EA.112.3	Peat
	EA.113	Metallic minerals	
		EA.113.1	Uranium ores
		EA.113.2	Other metallic minerals

* The suggested classes cover only energy resources at a detailed level and additional classes will be required for mineral resources.

References

Integrated System of Environmental and Economic Accounting (SEEA-2003) – Final draft, United Nations, et al.

UNFC-2009: United Nations Framework Classification for Fossil Energy and Mineral Reserves and resources 2009 , United Nations. - http://www.unece.org/energy/se/pdfs/UNFC/unfc2009/unfc2009_report_e.pdf