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SEEA classifications of energy resources

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1. Introduction

In this paper a suggestion for classifications related to SEEA energy accounts is presented. The classifications are developed for the purpose of being used in relation to the SEEA[1] and SEEA-E[2] standard tables on energy.

This paper is a follow up of a similar paper presented at the 13th London Group meeting in Brussels 2008. While the basic features of the classifications are the same in the two papers, the presentation of the classification by resource characteristics (Section 3) in this paper is now directly linked to the new abbreviated version of the United Nations Framework Classification for Fossil Energy and Mineral Resources. The basis for the presentation in this paper is the UNFC document *United Nations Framework Classification for Fossil Energy and Mineral Resources 2008 (UNFC-2008)*[3].

At its 6th Session, 25-27 March 2009, the Ad Hoc Group of Experts on Harmonization of Fossil Energy and Mineral Resources Terminology presented a new draft document *United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources (UNFC-2009)*. The differences between UNFC 2008 and the draft UNFC 2009 seems to be of minor importance in relation to the use of the UNFC for SEEA. The differences relate mainly to the terminology used.[4] However, when the UNFC-2009 has been finalized by the Ad Hoc Group of Experts on Harmonization of Fossil Energy and Mineral Resources Terminology any changes should be reflected in the presentation of the SEEA classification .

2. Classification by type of energy resource

Energy resources in SEEA 2003

Energy resources are included in the general classification of natural resources in SEEA. The general SEEA 2003 classification includes the aggregate category EA.11 Mineral and Energy Resources as part of EA.1 Natural Resources.

Suggestion for further disaggregation of energy resources

For the purpose of SEEA, it is suggested that EA.11 is further disaggregated: At the first level, a distinction between petroleum resources; non-metallic minerals and solid fossil energy resources; and metallic minerals is made. Petroleum resources, which cover all liquid and gaseous hydrocarbons found in a natural state, are broken down by natural gas (including NGL and condensate), crude oil and natural bitumen, extra heavy oil, shale oil, etc. Within the non-metallic minerals and solid energy resources, coal and peat are separated. Note that peat are 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.

Energy resources not included

Renewable energy resources, such as wind, solar and wave-energy are not represented in the natural resource classification. Similarly, firewood in forests and other types of biomass are not included explicitly as energy resources. However, both cultivated and non-cultivated timber resources, and other crop and plant resources are included as EA.14 Biological Resources in the classification of natural resources. Further, waste and renewables, as well as heat and electricity produced from renewable energy resources, are included as energy products in the flow accounts.

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[1] System of Environmental-Economic Accounting, cf. UN (2003)

[2] System of Environmental-Economic Accounting for Energy, cf. http://unstats.un.org/unsd/envaccounting/seeae/

[3] http://www.unece.org/energy/unfc/20081204_DraftRevisedUNFC2008.pdf

[4] The differences are presented in: http://www.unece.org/energy/se/pp/unfc/6ahge_March09/25_March09/Ross.pdf

Table 1.   SEEA classification of energy resources within the general SEEA classification of natural resources

EA.1 Natural 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, shale oil , sand oil and others n.e.c.
		EA.112	Non-metallic minerals and solid fossil energy reources	
			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
	EA.12	Soil resources		
	EA.13	Water resources		
	EA.14	Biological resources		

3. Classification by energy resource characteristics

In addition to the classification of energy resources by type, another dimension is needed to further characterize the resources. This second dimension relates to a "quality and knowledge" component of the energy resources and expresses the economic, geological and project feasibility status in relation to the resources.

3.1   SEEA classification based on UNFC

Three classes of energy resources

It is suggested that the SEEA standard classification by resource characteristics includes three broad classes which characterize the known deposits of energy resources:

A.   Commercial Recoverable

B.   Potential Commercial Recoverable

C.   Non Commercial and Other Known Deposits

Reference is made to the United Nations Framework Classification for Fossil Energy and Mineral Resources 2008 (UNFC-2008) in order to more specifically determine the parts of the resources which fall into these three classes.

UNFC is a generic and flexible scheme for classifying and evaluating quantities of 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. In February 2004, the UN Economic Commission for Europe endorsed the UNFC and proposed to the United Nations Economic and Social Council (ECOSOC) that it recommended its application worldwide. ECOSOC issued its recommendation in Resolution 2004/233.

The UNFC categorizes the natural resources by looking at whether, and to what extent, projects for the extraction or exploration of the resources have been

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confirmed, developed or planned. Based on the maturity of the projects the underlying natural resources are classified. The UNFC 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)

Criteria: economy (E), feasibility (F) and geology (G)

The first criteria (E) designates the degree of favourability of economic and social conditions in establishing the commercial viability of the project, including consideration of market prices and relevant legal, regulatory, environmental and contractual conditions. The second critria (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 an energy product. The third (G) criteria designates the level of certainty in the geological knowledge and potential recoverability of the quantities.(UNFC-2008, paragraph 3).

Table 2 gives an overview of how the three classes of energy resources are defined based on the E, F and G criteria. 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 feasibilty critera are called F1, F2, F3, F4 and the categories for the geologic knowledge criteria are called G1, G2, G3, and G4. Each project is then categorised by a combination of these, e.g. (E1,F1,G1). Further, each class is then formed by combining projects with specific combinations of categories.

Class A Commercial Recoverable Resources

Class A Commercial recoverable energy resources and are those resources for which extraction and sale is economic viable, i.e. assumed to be 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. This class of commercially recoverable energy resources corresponds to what is called reserves in many classification systems

Class B Potential commercial recoverable energy resources

Class B Potential commercial recoverable energy resources are resources for which extraction and sale is economic viable or is expected to become so in the foreseeable future based on realistic assumptions on future market conditions. However, the feasibilty of extraction by defined development projects is subject to further evaluation, and has to be justified by further project activities.

Class C Non-commercial and other known deposits

Class C Non-commercial and other known deposits are energy resources for which there are no reasonable prospects for economic extraction and sale based on realistic assumptions of future market conditions. Project activities are on hold, delayed or does not exist.

Potential deposits are excluded

In addition to these three classes which exhaust the known deposits of energy resources, the UNFC also includes so-called potential deposits of energy resources. These are resources estimated on the basis of very preliminary studies in the exploration phase and there currently no development project or mining operation have been defined. These quantities are either assumed not to be economic viable, or the information is to sparse to determine the economic viabilty. The quantification of these resources are 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.

It is suggested to include only the known deposits in SEEA, i.e. classes A, B and C are included as assets, while the potential deposits are not included.

Uncertainty reflected by the geological dimension (G)

The quantification of the subsoil 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 kowledge and potential recoverabilty of the quantities.

Quantities associated with a high level of confidence is classified as G1, quantities associated with a moderate level of confidence is classified as G2 and quantities associated with a low level of confidence as G3. Alternatively, the uncertainty related to the quantities is communicated as *low (G1), moderate (G1+G2) and high* (G1+G2+G3) estimates of the quantities resulting from future extractions.

SEEA should use the moderate (best) estimate

For the SEEA generally the moderate *estimate* (G1 + G2), sometimes also called the *best estimate*, of the energy resources is suggested to be used as standard, but the range of uncertainty can be presented as supplementary information by also presenting the low and high estimate.

Table 2 SEEA mineral and energy classification by resource characteristics

	Classes	UNFC -2008 categories		
		E Economic and social viability	F Field Project Status and Feasibilty	G Geological knowledge
Known Deposit	**A. Commercial Projects [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), moderate (G2) or low (G3) level of confidence.
	B. Potential Commercial Projects [2]	E1. Extraction and sale has been confirmed to be economically viable. or E2. Extraction and sale is expected to become economically viable in the foreseeable future.	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.	
	C. Non-Commercial Projects and Other Known Deposits [3]	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	
Potential deposit (not included in SEEA-E)	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).

[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] Includes unclarified development projects, non-viable development projects, and additional quantities in place

Source: UNFC 2008, Figure 2 and 3.

3.2 Link with other classification systems

Many countries have their own national systems based on the classification systems developed by e.g. the Society of Petroleum Engineers (SPE, 2007)[5] or the Committee for Mineral Reserves International Reporting Standards (CRIRSCO, 2007) for for petroleum energy resources and solid energy resources, respectively. Thus, setting up the SEEA accounts for energy resources might involve a conversion of the national classification system into the overall UNFC used for SEEA . However, since the abbreviated UNFC operates at a very high level of aggregation this conversion will normally be quite straightforward.

CRIRSCO
The CRIRSCO classes called *proved and probable reserves* goes directly into the UNFC class of *Commercial Recoverable* resources. Proved reserves is in UNFC categorized by G1, while the probable reserves are categorized as G2.

Similarly the CRIRSCO class called *Measured Mineral Resources* goes into the *Potential Commercial Recoverable* resources. The uncertainty for these resources is in the CRIRSCO communicated by the terms indicated, inferred and discovered. In the UNFC the corresponding categories are G1, G2 and G3.

SPE-RPMS
The Petroleum Resources Management System (SPE-RPMS) maintained by the SPE includes three classes called Proved, Probable and Possible Reserves. They correspond to the G1, G2 and G3 parts of the UNFC class of *Commercial Recoverable* resources. The SPE class called Contingent Resources covers resources which falls partly into the UNFC class of Potential Recoverable resources and partly into Non-Commercial and Other Known Deposits.

Proved and probable reserves
It follows that, generally, the moderate (*best) estimate of Commercial Recoverable resources* can be obtained from the CRIRSCO and SPE-RPMS classification by selecting the proved and probable reserves.

More information on how to make the conversion from e.g. the CRIRSCO and SPE-RPMS classifications to the UNFC can be obtained by consulting the mapping schemes worked out by the UN-ECE Ad Hoc Group of Experts on Harmonization of Fossil Energy and Mineral Resources Terminology, the custodian of of the UNFC[6] .

4. Questions to the London Group

1) Do you agree with the classification of energy resources within the classification of natural resources presented in table 1?

2) Do you agree in principle with the SEEA classification by resource characteristics presented in table 2 (subject to the finalisation of UNFC 2009).

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[5] http://www.spe.org/spe-app/spe/industry/reserves/prms.htm

[6] http://www.unece.org/energy/se/pdfs/UNFC/apr08/UNFC_MTF_Report_16May08.pdf