



Mapping of Ukrainian Mineral Resources Classification for hydrocarbon raw materials to UNFC 2009 at the Category level

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Geneva 2012



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Ukraine was the first among the European community that had implemented UNFC 1997 on the national level following the UNECOSOC resolution No 227/1997, according to which UNFC 1997 was recommended for practical use by UN member-countries.

In this case Ukraine has developed a universal classification, which is adapted to all types of minerals (coal, petroleum, non-metallic raw material, solid minerals and underground waters).



Mapping of Ukrainian Mineral Resources Classification for hydrocarbon raw materials to UNFC 2009 at the Category level

In order to provide the application of National Mineral Resources Classification of State Subsoil Fund to various mineral deposits, the appropriate Instructions (Guidelines) were issued in Ukraine.

For oil and gas fields (hydrocarbon raw materials) there exists an “Instruction on applying Mineral Resources Classification of State Subsoil Fund to geological exploration of the prospective area resources and hydrocarbon field reserves”.

Mapping of Ukrainian Mineral Resources Classification for hydrocarbon raw materials to UNFC 2009 at the Category level



Mapping of UNECE 2009 to Ukrainian Classification in relation to reserves (resources) of hydrocarbon raw materials is based on the unity of approaches to the resources/reserves qualification on the basis of the three fundamental criteria:

1) the degree of geological knowledge (the G axis);

2) the degree of technical-and-economic assessment (project feasibility) (the F axis);

3) the degree of commercial significance (economic and social viability) (the E axis).

UKRAINIAN MINERAL RESOURCES CLASSIFICATION



The Category of commercial significance	The Category of technical-and-economic knowledge		The Category of geological knowledge	Class code	
1. Balance reserves (1..)	GEE-1 (.1) <i>On production and Approved for Development</i>		Explored reserves (..1)	111 (proved)	<i>Commercial</i>
	GEE-2 (.2) <i>Justified for development</i>		Prospected reserves (..2)	121 (probable)	
2. Conditionally balance and outbalance reserves (2..)	<i>Development pending</i>	GEE-1 (.1)		Explored reserves (..1)	211
		GEE-2 (.2)	Prospected reserves (..2)		222
3. Economic value is not defined (3..)	<i>Development unclarified</i>	GEE-3 (.3)	Explored reserves (..1)	331	<i>Non-Commercial</i>
			Prospected reserves (..2)	332	
	<i>No sub-classes defined</i>		Possible resources (..3)	333	<i>Exploration</i>
			Inferred resources (..4)	334	

Comparison of Categories and Sub-Categories definitions, approved by UNFC 2009,
 Ukrainian Classification and Instruction on application of
 Ukrainian Classification to hydrocarbon deposits



Table 1

Category	UNFC-2009	Ukrainian Classification	Ukrainian Instruction for oil and gas fields
E1	Extraction and sale has been confirmed to be economically viable. Extraction and sale is economic on the basis of current market conditions and realistic assumptions of future market conditions.	Reserves that can be cost effectively extracted and used at the time of evaluation according to technical and economic calculations.	Balance reserves (normally economic), which on the moment of calculation and in accordance with technical-economic estimation can be economically-effectively recovered and used under conditions of current technologies of hydrocarbon raw materials production. And that ensures meeting the requirements of rational use and protection of environment and mineral resources.



Category	UNFC-2009	Ukrainian Classification	Ukrainian Instruction for oil and gas fields
E1.1	Extraction and sale is economic on the basis of current market conditions and realistic assumptions of future market conditions	Profitability of production activity, which is performed by mining enterprise, exceeds the refinancing of the National Bank of Ukraine.	
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.	Effective extraction and use of mineral resources by projected mining enterprise according to SCMR definitions is possible subject to the provision of easy terms, donations.	Use of reserves is possible subject to the provision of easy terms for extraction or other state support of investors.



Category	UNFC-2009	Ukrainian Classification	Ukrainian Instruction for oil and gas fields
E2	Extraction and sale is expected to become economically viable in the foreseeable future.	Reserves, which extraction and use at the time of assessment is not economically efficient, but in future they may become commercial objects.	Outbalance reserves (potentially economic), extraction and use of which is economically inexpedient on the moment of estimation, but in the future they can be commercial objects. <i>P.S. This category includes the resources that are not recovered by applied development technologies and are classified by UNFC 2009 as F4 (Classes 341, 342, 343, 344).</i>



Category	UNFC-2009	Ukrainian Classification	Ukrainian Instruction for oil and gas fields
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.	Mineral resources and reserves with non-defined economic value and initial economic-geological evaluation that determines them as possible for extraction and processing in current technical and economic conditions.	Reserves with non-defined economic value and which have only initial economic-geological evaluation.
E3.1	Quantities that are forecast to be extracted, but which will not be available for sale.	Relate to losses in the process of extraction and processing and are included into the extracted quantity of raw material.	

Continuation of Table 1



Category	UNFC-2009	Ukrainian Classification	Ukrainian Instruction for oil and gas fields
E3.2	Economic viability of extraction cannot yet be determined due to insufficient information (e.g. during the exploration E3 phase).	Initial economic-geological evaluation is performed for reserves and resources with non-defined economic value and that are potential for production and processing in modern economic-technical conditions.	Reserves with non-defined economic value and which have only initial economic-geological evaluation.
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.	Ukrainian Classification does not include the amount of mineral raw materials that are evaluated as impossible for mining and processing in the foreseeable future.	

SUMMARY ON THE E AXIS



- 1.** The definitions of the economic efficiency axis, which were accepted by UNFC-2009 for main Categories **E1**, **E2**, **E3**, and Sub-Categories **E1.1**, **E1.2** have a close meaning with those, used in Ukrainian Classification, and may be comparable.
- 2.** Sub-Category **E3.2** of the Ukrainian Classification is brought under the formulation of corresponding Category **E3** and is not individually separated.
- 3.** Mineral resources that are extracted not for the purpose of commercial sale (**E3.1** Sub-Category), belong to different types of losses in the Ukrainian Classification, and are included into the volumes of deleted deposits. The volume of extracted minerals, which are used for production activity, are considered to be for sale on a general basis.
- 4.** The quantity of natural substances, which in the foreseeable future will not have a potential (technology) of profitable mining (**E3.3** Sub-Category). They are not considered mineral resources. These are non-traditional sources that are not comprised by the Ukrainian Classification.

Comparison of Categories and Sub-Categories definitions, approved by UNFC 2009,
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Table 2

Category	UNFC-2009	Ukrainian Classification	Ukrainian Instruction for oil and gas fields
F1	Feasibility of extraction by a defined development project or mining operation has been confirmed.	Explored mineral resources on the basis of which a detailed economic-geological assessment of their industrial development was made. Its materials, including feasibility study for constant conditions of mineral raw materials, are approved by SCMR.	Explored mineral resources on the basis of which a detailed economic-geological assessment (GEO-1) of their industrial development was made. GEO-1 materials, which are positively valued by SCMR, present the main document that substantiates the economic feasibility of financing of oil and gas companies (industries) construction.
F1.1	Extraction is currently taking place.	Are brought under the Class definition. Are not individually separated because they refer to industrial planning.	
F1.2	Capital funds have been committed and implementation of the development project or mining operation is underway.		

Continuation of Table 2



Category	UNFC-2009	Ukrainian Classification	Ukrainian Instruction for oil and gas fields
F1.3	Sufficiently detailed studies have been completed to demonstrate the feasibility of extraction by implementing a defined development project or mining operation.	Are brought under the Class definition. Are not individually separated because they refer to industrial planning.	
F2	Feasibility of extraction by a defined development project or mining operation is subject to further evaluation.	Explored and prospected mineral reserves and resources on the basis of which the initial economic-geological assessment was made. TEC materials are approved by SCMR or by the customer of further geological exploration works.	Explored and prospected mineral reserves and resources on the basis of which the preliminary economic-geological assessment (GEO-2) of their commercial value was made. GEO-2 materials in the form of technical-and-economic considerations (TEC) have to be approved by SCMR or customer (investor) of further geological exploration works.

Continuation of Table 2



Category	UNFC-2009	Ukrainian Classification	Ukrainian Instruction for oil and gas fields
F2.1	Project activities are ongoing to justify development in the foreseeable future.	<p>Are brought under the Class definition. Are not individually separated in the form of single Sub-Category. Are determined at the stage of industrial planning.</p>	
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.		

Continuation of Table 2



Category	UNFC-2009	Ukrainian Classification	Ukrainian Instruction for oil and gas fields
F3	Feasibility of extraction by a defined development project or mining operation cannot be evaluated due to limited technical data.	Mineral reserves and re-sources on the basis of which the initial economic-geological assessment was made according to the potential commercial value of prospective subsoil. TEC materials are approved by the customer of further geological exploration works.	Mineral reserves and re-sources on the basis of which the initial economic-geological assessment (GEO-3) was made according to the potential commercial value of prospective subsoil. GEO-3 materials in the form of technical-and-economic considerations (TEC) have to be approved by the customer (investor) of further geological exploration works.
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.	Belong to E2 Class as off-balance reserves, extraction and use of which are not economically efficient, but in the future they may be an object of commercial significance.	

SUMMARY ON THE F AXIS



1. Thus, due to the F axis that presents the degree of technical-and-economic assessment (project feasibility), the definitions that are used by UNFC 2009 are relatively comparable with those used in the Ukrainian Classification only for of main Categories: **F1**, **F2**, **F3**.
2. Sub-Categories **F1.1**, **F1.2**, **F1.3**, **F2.1**, **F2.2**, **F2.3** are brought under formulations of **F1** and **F2** Categories and are not specified as separate objects of calculation and registration.
3. Mineral reserves of **F4** Category refer to “unrecoverable”, “residue” off-balance reserves of **E2** Category according to the Ukrainian Classification.

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Table 3

Category	UNFC-2009	Ukrainian Classification	Ukrainian Instruction for oil and gas fields
<p>G1</p>	<p>Quantities associated with a known deposit that can be estimated with a high level of confidence. Quantities of fluid mineral resources are estimated by G1 Category.</p>	<p>Explored reserves – such mineral resources, quantity, quality, technological properties, mining-geological and other conditions of which are studied with completeness, sufficient for development of projects on extractive objects construction.</p>	<p>Explored reserves are calculated on the explored and developing fields (deposits) under the condition of examining type, shape, deposit size, effective hydrocarbon saturation thickness, type of collector, the variability of reservoir properties, hydrocarbon saturation of reservoir, composition and properties of hydrocarbons, as well as the conditions of deposit position, which determine the conditions of its development, environmental and other parameters, sufficient for the industrial project development.</p>
		<p>Total quantities of mineral reserves (in situ), except the renewable ones, are geometrized and calculated. Recoverable quantities are defined according to the development technologies within the geometrical limits of total reserves. Quantities are estimated by the G1 Category of I11 Class.</p>	

Continuation of Table 3



Category	UNFC-2009	Ukrainian Classification	Ukrainian Instruction for oil and gas fields
<p>G2</p>	<p>Quantities associated with a known deposit that can be estimated with a moderate level of confidence. Quantities of fluid mineral resources are estimated by G1+G2 Categories.</p>	<p>Prospected reserves – such mineral resources, quantity, quality, technological properties, mining-geological and other conditions of which are studied with completeness, sufficient for definition of deposit’s industrial significance.</p>	<p>Prospected oil and gas reserves are calculated within the discovered deposits under condition of obtaining of oil or gas inflows as well as positive results of geophysical studies within the non-tested wells.</p>
		<p>Total quantities of mineral reserves (in situ) are geometrized, recoverable ones are determined within a general volume and are classified by Categories G1+G2 of 121+122 Classes.</p>	

Continuation of Table 3



Category	UNFC-2009	Ukrainian Classification	Ukrainian Instruction for oil and gas fields
<p>G3</p>	<p>Quantities associated with a known deposit that can be estimated with a low level of confidence. 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 categorized on the basis of three scenarios or outcomes that are equivalent to G1, G1+G2 and G1+G2+G3.</p>	<p>Possible resources consider the possibility to discover new mineral deposits of definite geological-industrial type, existence of which is substantiated by a positive estimation of mineral occurrences, geophysical and other anomalies, which nature and perceptiveness are proved.</p>	<p>Possible oil and gas resources – minerals that are prepared for deep drilling within the known oil-and-gas bearing area and layers that are not exposed by drilling, if their productivity is established for one or another deposit.</p>
		<p>Total quantities of mineral resources are estimated using the volumetric method and relate to G3 Category. Recoverable amounts are not included, although they can be determined statistically. Resources fall into G3 Category of 333 Class.</p>	

Continuation of Table 3



Category	UNFC-2009	Ukrainian Classification	Ukrainian Instruction for oil and gas fields
<p>G4</p>	<p>Estimated quantities associated with a potential deposit, based primarily on indirect evidence. 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 be-come a deposit of any commercial significance is also documented.</p>	<p>Inferred resources – the amount of minerals that take into account the potential for the formation of deposits of certain geological and commercial types, based on positive stratigraphic, lithological, tectonic and other preconditions within the prospective areas.</p>	<p>Inferred oil and gas resources take into account a potential productivity of definite lithologic-stratigraphical complexes within large regional structures that have proved and unproved oil-and-gas bearing capacity.</p>
		<p>The quantitative estimation of inferred resources is carried out by possible parameters that were collected on the basis of general geologic ideas and statistical analogy with other regional structures and known deposits. Inferred resources fall into G4 Category of 334 Class.</p>	

SUMMARY ON THE G AXIS



1. Mapping shows that definitions of **G1** and **G4** coincide in both Classifications.
2. Difference between Categories **G2** and **G3** is that UNFC determines mineral re-source quantity for **G2** as a sum of **G1** and **G2** Categories, and **G3** quantity – as a sum **G1+G2+G3**, while due to the Ukrainian Classification, mineral resources quantities for **G2** and **G3** are determined separately.

CATEGORIES AND SUB-CATEGORIES OF UNFC 2009 THAT COMPLETELY FALL INTO CLASSES OF UKRAINIAN CLASSIFICATION



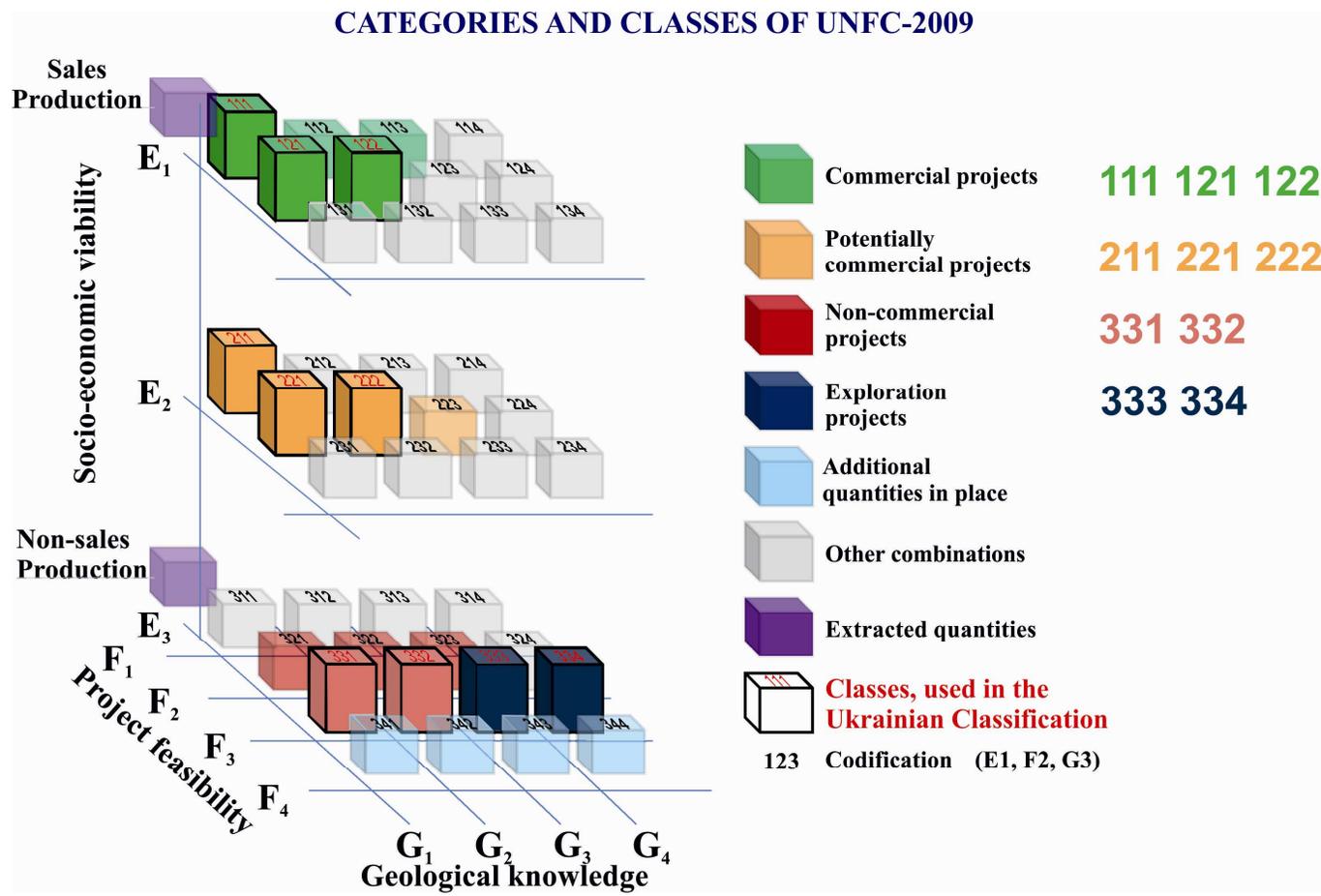
Ukrainian Classification (classes)	Categories and Sub-Categories of UNFC 2009		
111	E1 (E1.1, E1.2)	F1 (F1.1, F1.2, F1.3)	G1
121	E1 (E1.1, E1.2)	F2 (F2.1, F2.2, F2.3)	G1
122	E1 (E1.1, E1.2)	F2 (F2.1, F2.2, F2.3)	G2
211	E2	F1 (F1.1, F1.2, F1.3)	G1
221	E2	F2 (F2.1, F2.2, F2.3)	G1
222	E2	F2 (F2.1, F2.2, F2.3)	G2
331	E3 (E3.1, E3.2, E3.3)	F3	G1
332	E3 (E3.1, E3.2, E3.3)	F3	G2
333	E3 (E3.1, E3.2, E3.3)	F3	G3
334	E3 (E3.1, E3.2, E3.3)	F3 (F4)	G4

F2.3 – Sub-Categories, which do not coincide with terminological definition of Class in the Ukrainian Classification (do not fall into).



Categories and Classes of UNFC-2009

UNFC-2009 categories of reserves/resources have corresponding analogues in the Ukrainian Classification and are applied to hydrocarbon reserves (resources): **10** classes that are determined by the Ukrainian Classification completely fall into the model of UNFC 2009, which specifies **40** classes.



CONCLUSION



Summing up comparison of the UNFC-2009 Classification with the Ukrainian National Mineral Resources Classification of State Subsoil Fund for hydrocarbon raw materials, we can conclude the following:

- 1. All Categories of mineral resources/reserves, which are used in Ukrainian Classification, find their analogues in the UNFC-2009.**
- 2. All classes of Ukrainian Classification have analogues in the UNFC-2009.**
- 3. The vast majority of Sub-Categories in the UNFC-2009 are included into Categories of the Ukrainian Classification. Only two UNFC-2009 Sub-Categories **E3.1** and **E3.3** are not compatible with the Category **E3** of the Ukrainian Classification.**

CONCLUSION



4. Three UNFC-2009 Sub-Categories: F1.1, F1.2 and F2.3 are also not compatible with separate Classes of the Ukrainian Classification: F1.1 and F1.2 – with 211 Class; F2.3 – with 121, 122 and 221 Classes.

5. Thus, UNFC-2009 may be an “umbrella” for the Ukrainian Classification, and statistical reporting at the Class level can be comparable in both Classifications.

6. If it is necessary, the separation of Sub-Categories in the Ukrainian Classification may be accomplished after adoption of the Global Code on mineral resources reporting.



**THANK YOU
FOR YOUR ATTENTION!**