



**State Commission of Ukraine  
on Mineral Resources**



**United Nations Framework Classification  
for Fossil Energy and Mineral Resources  
as a Harmonization Tool  
for Global Leading Classifications  
(Ukraine's Example)**

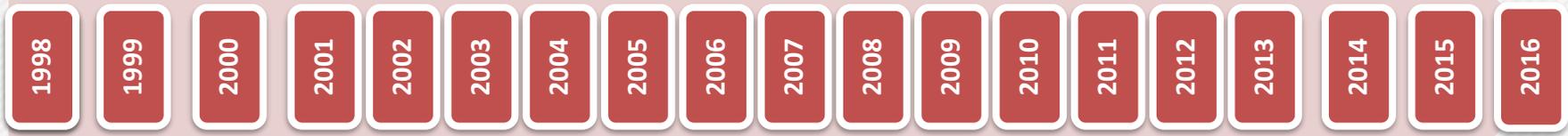
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Since 1997 Ukraine applies the 3-Dimensional International United Nations Framework Classification for Reserves and Resources of Solid Fuels and Mineral Commodities, following the Decision of the United Nations Economic and Social Council and recommended for worldwide application (ECOSOC Decision 226/1997).



In accordance with the United Nations recommendation, Ukrainian Mineral Reserves and Resources Classification of the State Subsoil Fund (hereinafter Ukrainian Classification) was developed and approved by Government on May 5, 1997. It was adapted to the United Nations Framework Classification for Reserves and Resources of Solid Fuels and Mineral Commodities.

# Table 1. UKRAINIAN MINERAL RESOURCES CLASSIFICATION

The Category of Commercial Significance	The Category of technical- and-Economic Study		The Category of Geological Study	Class code	
<b>1. Balance reserves (1..)</b>	EGE-1 (.1.) <i>On production and Approved for Development</i>		Explored reserves (..1)	<b>111 (proved)</b>	<i>Commercial</i>
	EGE-2 (.2.) <i>Substantiated for Development</i>		Prospected reserves (..2)	<b>121 (probable)</b>	
				<b>122 (probable)</b>	
<b>2. Conditionally balance and outbalance reserves (2..)</b>	<i>Pending Development</i>	EGE-1 (.1.)	Explored reserves (..1)	<b>211</b>	<i>Potentially Commercial</i>
		EGE-2 (.2.)		Prospected reserves (..2)	
			<b>222</b>		
<b>3. Economic value is not defined (3..)</b>	<i>Development Unclassified</i>	EGE-3 (.3.)	Explored reserves (..1)	<b>331</b>	<i>Non-Commercial</i>
			Prospected reserves (..2)	<b>332</b>	
	<i>No sub-classes defined</i>		Possible resources (..3)	<b>333</b>	<i>Exploration</i>
			Inferred resources (..4)	<b>334</b>	

The Classification is of general character and has been applied to all types of minerals (coal, oil and gas, non-metallic raw material, solid minerals and groundwaters). The binding documentation such as instructions and guidelines were elaborated in order to apply the Classification to calculation and economic-geological evaluation of various mineral deposits.

Corresponding statistical reporting forms and instructions on their application to various mineral deposits have been elaborated for public reporting on the results of subsoil use.

Along with the development of the **International Framework Classification and elaboration of the UNFC-2009**, as also changes to Ukrainian legislation on mineral resources, Classification of Ukraine took all necessary changes to achieve proper degree of correspondence between them. At the same time Classification of Ukraine constantly was compared with leading international classifications for its further improvement and harmonization of definitions in different Classifications.

General methodological basis for the convergence of taxons definitions in classification systems, which are used for mineral reserves reporting, is existing actually global proximity structure of the exploration process, which is used in different countries for the prospecting, exploration and development of mineral deposits, as well as for disturbed soils recultivation.

Basing on data of case studies and mapping of the Ukrainian Classification to the **SPE (PRMS)** Classifications for hydrocarbon raw material, and to the **CRIRSCO** Template, State Commission published a Monograph “**National and International Classification Systems for Mineral Reserves and Resources: State and Prospects for Harmonization**”, which arose a significant interest of geological society and was translated into **English** and **Chinese** languages.

United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009) and Ukrainian Mineral Reserves and Resources Classification of the State Subsoil Fund were the subject to discuss at China-Ukraine Workshop on Resources Classification: Status, Mapping and Application, which was held in June 2015 in Beijing.

*At the end of 2015 State Commission of Ukraine on Mineral Resources held the Second Scientific-Practical Conference “SUBSOIL USE IN UKRAINE. PROSPECTS FOR INVESTMENT” in the city of Truskavets.*

According to main thematic course of the conference, titled "Classification of reserves and mineral resources, their comparison, use and adaptation to the UNFC-2009“, six reports were presented and considered issues on application of the UNFC-2009 for coal and other minerals, as well as comparison of Ukrainian Mineral Reserves and Resources Classification with the UNFC-2009, the CRIRSCO Template and the SPE Classification.

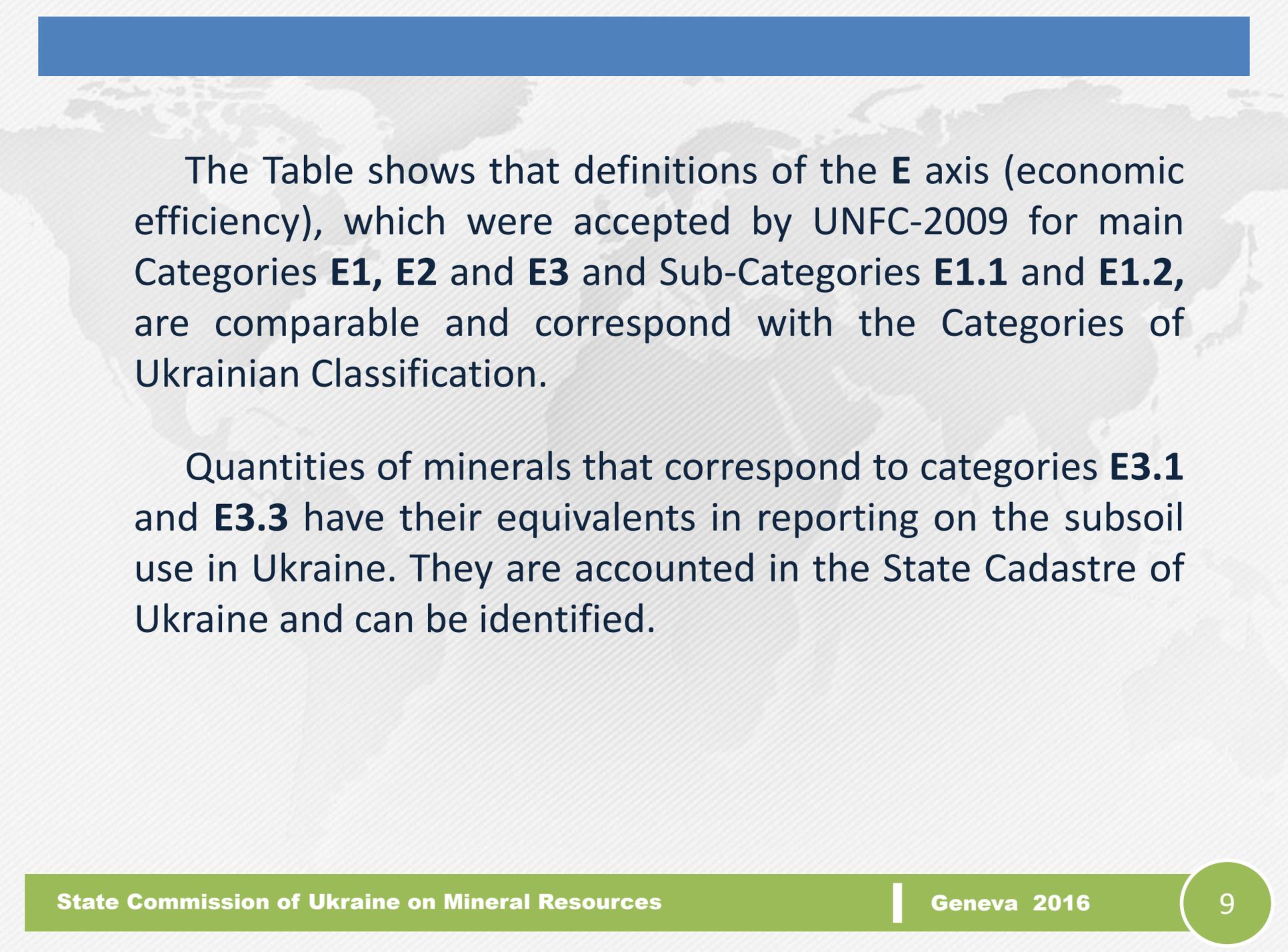
**Main results of conducted research are presented below:**

**COMPARISON OF CATEGORIES AND SUB-CATEGORIES DEFINITIONS, APPROVED BY THE UNFC-2009 AND DRAFT UKRAINIAN CLASSIFICATION. THE E AXIS**

Code of Category and Sub-Category of the UNFC-2009	Definitions of UNFC-2009	Definitions of Draft Ukrainian Classification	Code of Category and Sub-Category for Draft Ukrainian Classification
<b>E1</b>	Extraction and sale has been confirmed to be economically viable. Extraction and sale is profitable on the basis of current market conditions and realistic assumptions of future market conditions.	Reserves that can be cost effectively produced and used in accordance with technical and economic calculations by the time of evaluation	<b>1.x.x</b>
<b>E1.1</b>	Extraction and sale are economic under current market conditions and realistic assumptions of future market conditions.	Producible reserves. The profitability of production activity of a mining enterprise exceeds the refinancing of the National Bank of Ukraine.	<b>1.1.x.x</b>
<b>E1.2</b>	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 or another support.	<b>1.2.x.x</b>
<b>E2</b>	Extraction and sale is expected to become economically viable in the foreseeable future.	Reserves that in the future may become commercial objects (potentially economic).	<b>2.x.x</b>

## COMPARISON OF CATEGORIES AND SUB-CATEGORIES DEFINITIONS, APPROVED BY THE UNFC-2009 AND DRAFT UKRAINIAN CLASSIFICATION. THE E AXIS

Code of Category and Sub-Category of the UNFC-2009	Definitions of UNFC-2009	Definitions of Draft Ukrainian Classification	Code of Category and Sub-Category for Draft Ukrainian Classification
<b>E3</b>	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	<b>3.x.x</b>
<b>E3.1</b>	Quantities that are forecast to be extracted, but which will not be available for sale.	Quantities that will be lost or used in the process of extraction and preparation for sales.	<b>3.1.x.x</b>
<b>E3.2</b>	Economic viability of extraction cannot yet be determined due to insufficient information (e.g. during the exploration phase).	Mineral resources and reserves with non-defined economic value and initial economic-geological evaluation.	<b>3.2.x.x</b>
<b>E3.3</b>	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.	The amount of mineral raw materials that are evaluated as impossible for mining and processing in the foreseeable future, and which are not included into or excluded from the State Balance Record.	<b>3.3.x.x</b>

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The Table shows that definitions of the **E** axis (economic efficiency), which were accepted by UNFC-2009 for main Categories **E1**, **E2** and **E3** and Sub-Categories **E1.1** and **E1.2**, are comparable and correspond with the Categories of Ukrainian Classification.

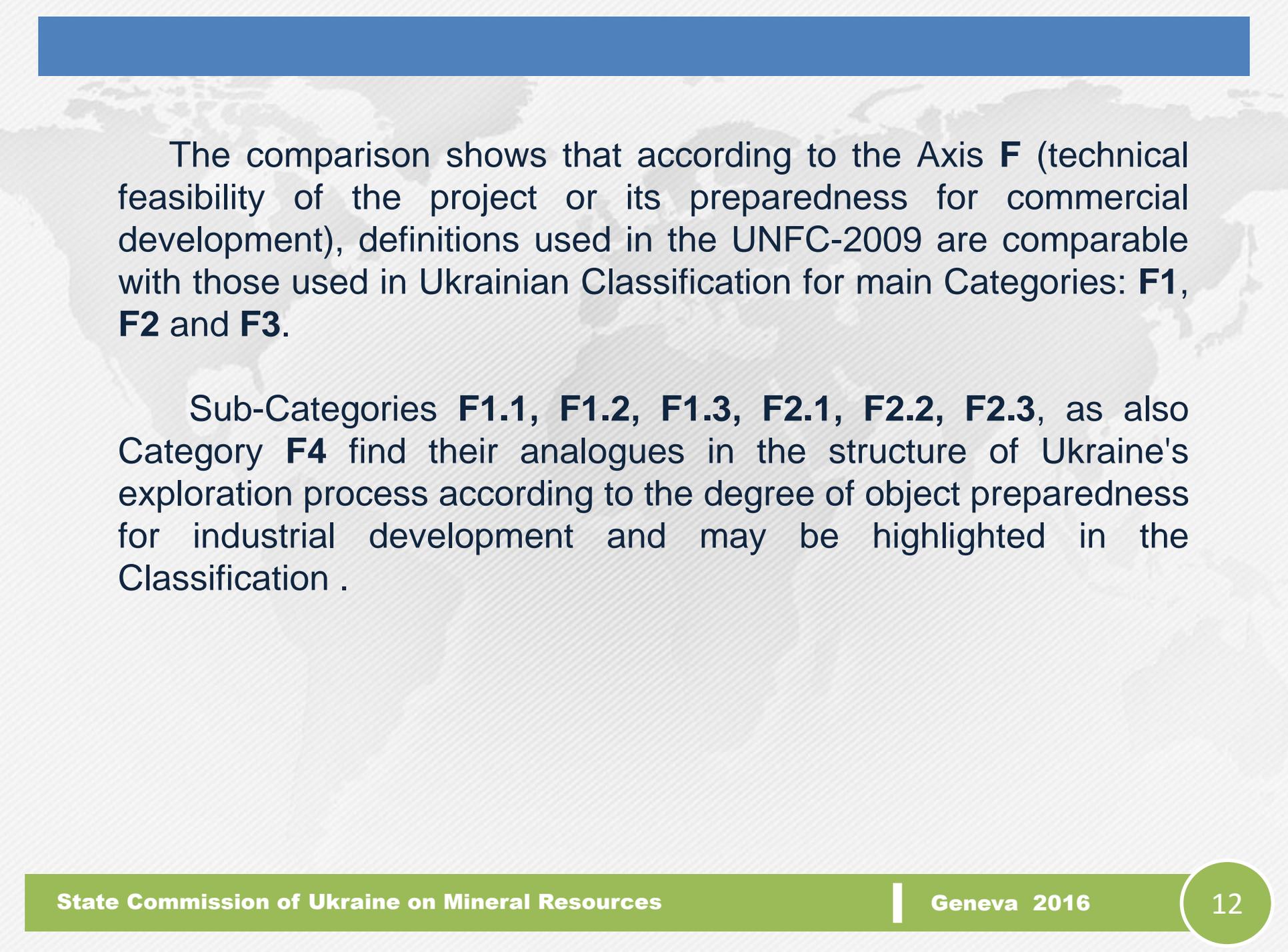
Quantities of minerals that correspond to categories **E3.1** and **E3.3** have their equivalents in reporting on the subsoil use in Ukraine. They are accounted in the State Cadastre of Ukraine and can be identified.

## COMPARISON OF CATEGORIES AND SUB-CATEGORIES DEFINITIONS, APPROVED BY THE UNFC-2009 AND DRAFT UKRAINIAN CLASSIFICATION. THE F AXIS

Code of Category and Sub-Category of the UNFC-2009	Definitions of UNFC-2009	Definitions of Draft Ukrainian Classification	Code of Category and Sub-Category for Draft Ukrainian Classification
<b>F1</b>	Feasibility of extraction by a defined development project or mining operation has been confirmed.	Detailed economic-geological evaluation of industrial development of mineral resources was carried out. Its materials, including feasibility study for constant conditions of mineral raw materials, are approved by SCMR.	<b>x.1.x</b>
<b>F1.1</b>	Extraction is currently taking place.	Reserves involved into the commercial development	<b>x.1.1.x</b>
<b>F1.2</b>	Capital funds have been committed and implementation of the development project or mining operation is underway.	Reserves involved into the pilot commercial development, reserves of construction companies.	<b>x.1.2.x</b>
<b>F1.3</b>	Sufficiently detailed studies have been completed to demonstrate the feasibility of extraction by implementing a definite development project or mining operation	Detailed geological exploration works were completed in order to determine the feasibility of definite development project.	<b>x.1.3.x</b>
<b>F2</b>	Feasibility of extraction by a defined development project or mining operation is subject to further evaluation.	The initial economic-geological evaluation of commercial value was carried out. TEC materials are approved by SCMR or by the customer of further geological exploration works.	<b>x.2.x</b>

## COMPARISON OF CATEGORIES AND SUB-CATEGORIES DEFINITIONS, APPROVED BY THE UNFC-2009 AND DRAFT UKRAINIAN CLASSIFICATION. THE F AXIS

Code of Category and Sub-Category of the UNFC-2009	Definitions of UNFC-2009	Definitions of Draft Ukrainian Classification	Code of Category and Sub-Category for Draft Ukrainian Classification
<b>F2.1</b>	Project activities are ongoing to justify development in the foreseeable future	Preliminary assessment continues to validate the commercial value of the deposit.	<b>x.2.1.x</b>
<b>F2.2</b>	Project activities are on hold and/or where justification as a commercial development may be subject to significant delay	Implementation of the project under stoppage and/or substantiation as commercial development may be subject to significant delay.	<b>x.2.2.x</b>
<b>F2.3</b>	There are no current plans to develop or to acquire additional data at the time due to limited potential.	At the time of assessment there are no current plans to develop or collect additional data due to limited opportunities.	<b>x.2.3.x</b>
<b>F3</b>	Project evaluation is at too early stage to determine technical and commercial feasibility.	A primary economic-geological evaluation of the long-term commercial value of subsurface area and TPP materials are approved by the customer for further exploration.	<b>x.3.x</b>
<b>F4</b>	Remaining in-place quantities that are currently considered to be technically unrecoverable.	The remaining raw materials in-situ, which can not be extracted by any of currently existing methods of development or mining operations	<b>x.4.x</b>



The comparison shows that according to the Axis **F** (technical feasibility of the project or its preparedness for commercial development), definitions used in the UNFC-2009 are comparable with those used in Ukrainian Classification for main Categories: **F1**, **F2** and **F3**.

Sub-Categories **F1.1**, **F1.2**, **F1.3**, **F2.1**, **F2.2**, **F2.3**, as also Category **F4** find their analogues in the structure of Ukraine's exploration process according to the degree of object preparedness for industrial development and may be highlighted in the Classification .

## COMPARISON OF CATEGORIES AND SUB-CATEGORIES DEFINITIONS, APPROVED BY THE UNFC-2009 AND DRAFT UKRAINIAN CLASSIFICATION. THE G AXIS

Code of Category and Sub-Category of the UNFC-2009	Definitions of UNFC-2009	Definitions of Draft Ukrainian Classification	Code of Category and Sub-Category for Draft Ukrainian Classification
<b>G1</b>	<p>Quantities associated with a known deposit that can be estimated with a high level of confidence.</p> <p>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>	<b>x.x.1</b>
<b>G2</b>	<p>Quantities associated with a known deposit that can be estimated with a moderate level of confidence</p> <p>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>	<b>x.x.2</b>

## COMPARISON OF CATEGORIES AND SUB-CATEGORIES DEFINITIONS, APPROVED BY THE UNFC-2009 AND DRAFT UKRAINIAN CLASSIFICATION. THE G AXIS

<p><b>G3</b></p>	<p>Quantities associated with a known deposit that can be estimated with a low level of confidence.</p> <p>For recoverable estimates of fossil energy and mineral resources that are extracted as fluids, mobile nature generally precludes assigning recoverable quantities to discrete parts of accumulation.</p> <p>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+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><b>x.x.3</b></p>
<p><b>G4</b></p>	<p>Estimated quantities associated with a potential deposit, based primarily on indirect evidence.</p> <p>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.</p>	<p>Inferred resources – the amount of minerals that take into account the potential for deposits formation of certain geological and commercial types, based on positive stratigraphic, lithological, tectonic and other preconditions within the prospective areas</p>	<p><b>x.x.4</b></p>

## CONCLUSIONS:

Mapping shows that definitions of **G1** and **G4** Categories coincide in both Classifications.

Due to the Ukrainian Classification, mineral resource quantities for **G2** may be determined as a sum of **G1** and **G2** Categories; and **G3** Category – as a sum of **G1+G2+G3**, according to the accepted methodology of calculation and accounting for mineral reserves and resources.

On the basis of completed mappings the extended version of Ukrainian Mineral Resources Classification was developed. It is fully comparable to Categories and Sub-Categories of the **UNFC-2009**.

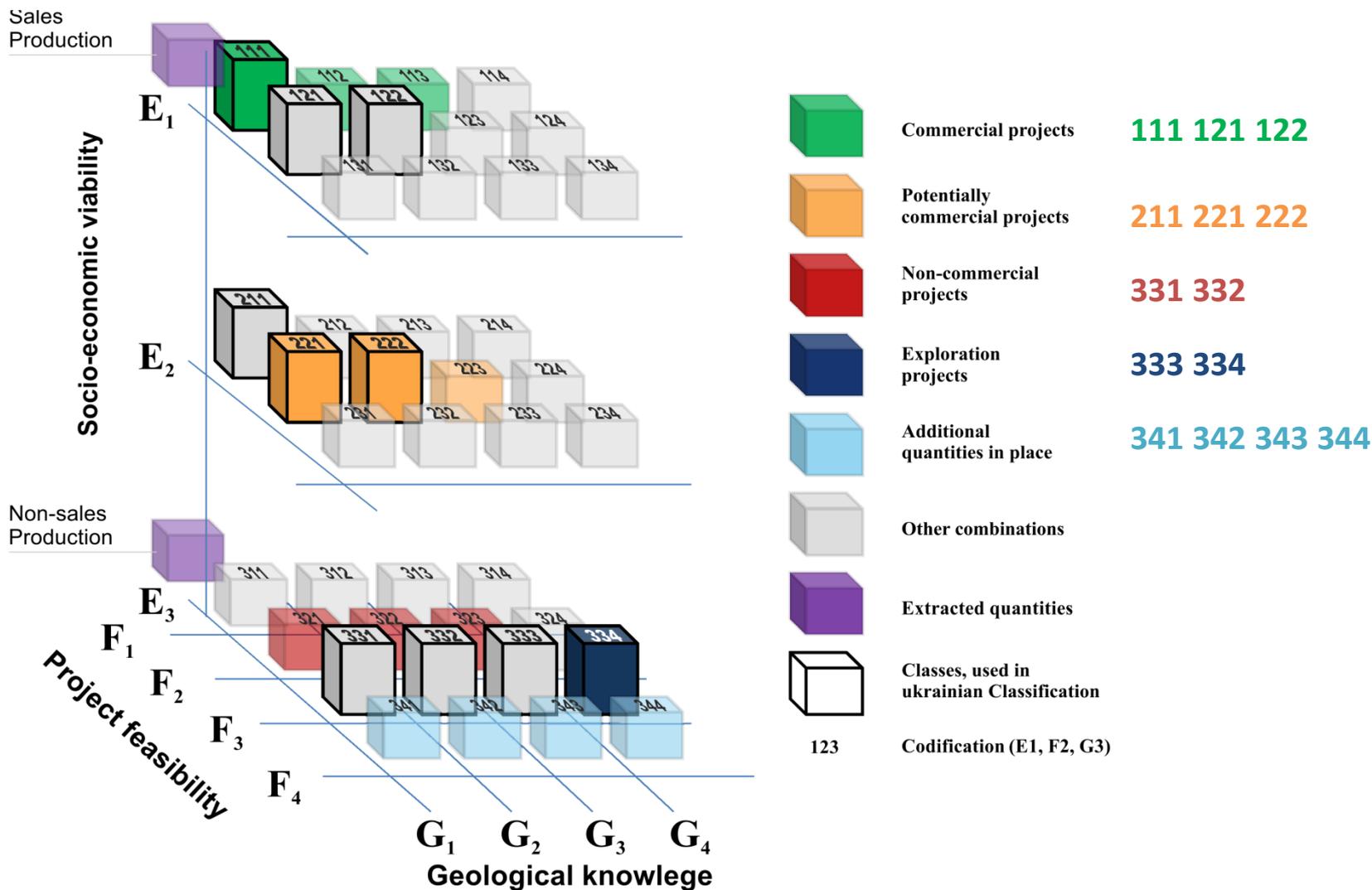
# EXTENDED VERSION OF UKRAINIAN CLASSIFICATION OF MINERAL RESERVES AND RESOURCES

<u>Socio-economic viability (E)</u>	<u>Project feasibility (F)</u>		<u>Geological knowledge (G)</u>	<u>Class code</u>	
1. Balance reserves (1..) E1 E1.1; E1.2	Producible and approved for development	EGE-1(.1.) F1 (F1.1; F1.2; F1.3)	Explored reserves (..1) G1	111 (Proved)	Commercial
	Proved for development	EGE-2(.2.) F2 (F2.1; F2.2)	Explored reserves (..1) G1	121 (Probable)	
			Prospected reserves (..2) G2	122 (Probable)	
2. Conditionally balance and off-balance reserves (2..) E2	Pending development	EGE-1(.1.) F1; F1.3	Explored reserves (..1) G1	211	Potentially Commercial
				221	
	EGE-2 (.2.) F2 (F2.1; F2.2;)	Prospected reserves (..2) G2	222		

# EXTENDED VERSION OF UKRAINIAN CLASSIFICATION OF MINERAL RESERVES AND RESOURCES

<p><b>Commercial value is not defined (3.)</b>  <b>E3; E3.1; E3.2; E3 (E3.3)</b></p>	<p><b>Development is not clarified</b></p>	<p><b>EGE-3 (.3.)</b></p>	<p>Explored reserves (..1) G1</p>	<p><b>331</b></p>	<p>Non- Commercial</p>
			<p>Prospected reserves (..2) G2</p>	<p><b>332</b></p>	
			<p>Possible resources (..3) G3</p>	<p><b>333</b></p>	<p>Geologically explored</p>
			<p>Inferred resources (..4) G4</p>	<p><b>334</b></p>	
		<p><b>EGE-4 (.4.)</b></p>	<p>Explored reserves (..1) G1</p>	<p><b>341</b></p>	<p>Residual quantities (additional)</p>
			<p>Prospected reserves (..2) G2</p>	<p><b>342</b></p>	
			<p>Possible resources (..3) G3</p>	<p><b>343</b></p>	
			<p>Inferred resources (..4) G4</p>	<p><b>344</b></p>	

# Mapping of the UNFC-2009 with Ukrainian Mineral Resources and Reserves Classification

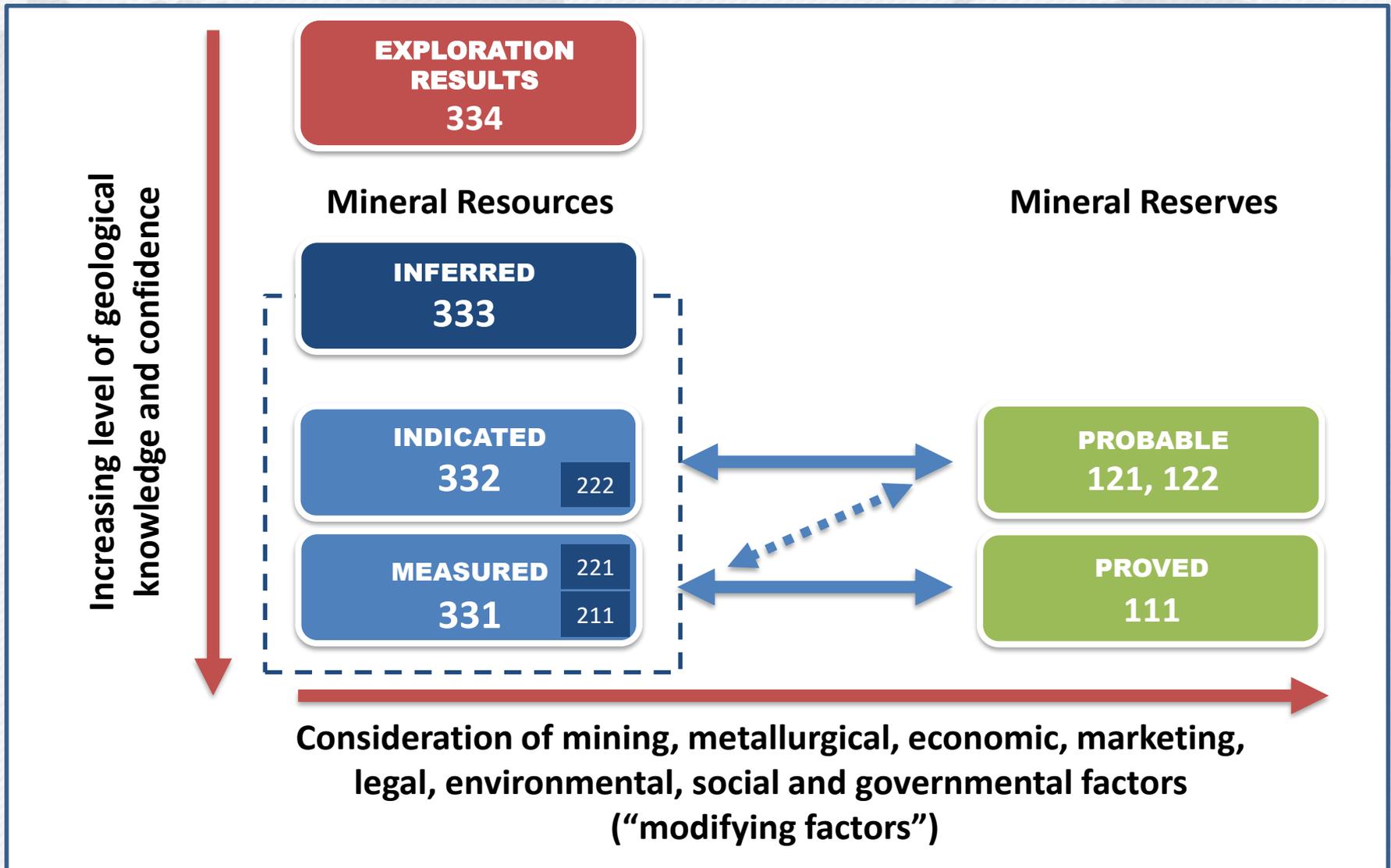


Summing up comparison between the UNFC-2009 definitions at level of Classes and Sub-Classes of the UNFC-2009 and the definitions of Ukrainian Classification, we can conclude the following:

- ❑ **All Categories of mineral reserves and resources, which are used in the UNFC-2009, find their analogues in Ukrainian Classification.**
- ❑ **All Sub-Categories, outlined in UNFC-2009 may be included in Ukrainian Classification.**
- ❑ **All classes of Ukrainian Classification have analogues in the UNFC-2009.**

UNFC-2009 can be an "umbrella" for Ukrainian Classification and statistical reporting at level of Classes and Sub-Classes can be comparable according to both classifications.

# Mapping of the Ukrainian Classification with the CRIRSCO Template



## Mapping of Ukrainian Mineral Resources and Reserves Classification with the CRIRSCO Template

Comparison of National Classification of mineral reserves and resources of Ukraine with the **CRIRSCO** Template at Class level, shown at the previous scheme, allows to make following conclusions:

Class of **PROVED** reserves according to the **CRIRSCO** Template corresponds with Class **111** of Ukrainian Classification. Reserves of this Class are formed as a result of detailed economic-geological evaluation (EGE-1) of explored reserves with an unidentified industrial value of Class **331**, which corresponds with the Class of Measured mineral resources of the **CRIRSCO** Template.

The Class of **PROBABLE** mineral reserves of the **CRIRSCO** Template corresponds with reserves of Classes **121** and **122** of Ukrainian Classification. These reserves may be formed in the result of the preliminary economic-geological evaluation (EGE-2) of **MEASURED** mineral resources of Class **331**, and also as a result of the preliminary economic-geological evaluation (EGE-2) of **INDICATED** minerals of Class **332** in the **CRIRSCO** Template.

The Class of **MEASURED** mineral resources of the **CRIRSCO** Template corresponds with Class **331** of prospected reserves with uncertain commercial value in Ukrainian Classification.

The Class of **INDICATED** mineral resources of the **CRIRSCO** Template corresponds with Class **332** of previously explored reserves with an uncertain industrial value in Ukrainian Classification.

Class of **POSSIBLE** resources of the **CRIRSCO** Template corresponds to Class **333** of prospective resources in Ukrainian Classification.

Class **334** of prospective mineral resources of Ukrainian Classification goes with related mineral resources identified as the **EXPLORATION RESULTS** according to the **CRIRSCO** Template.

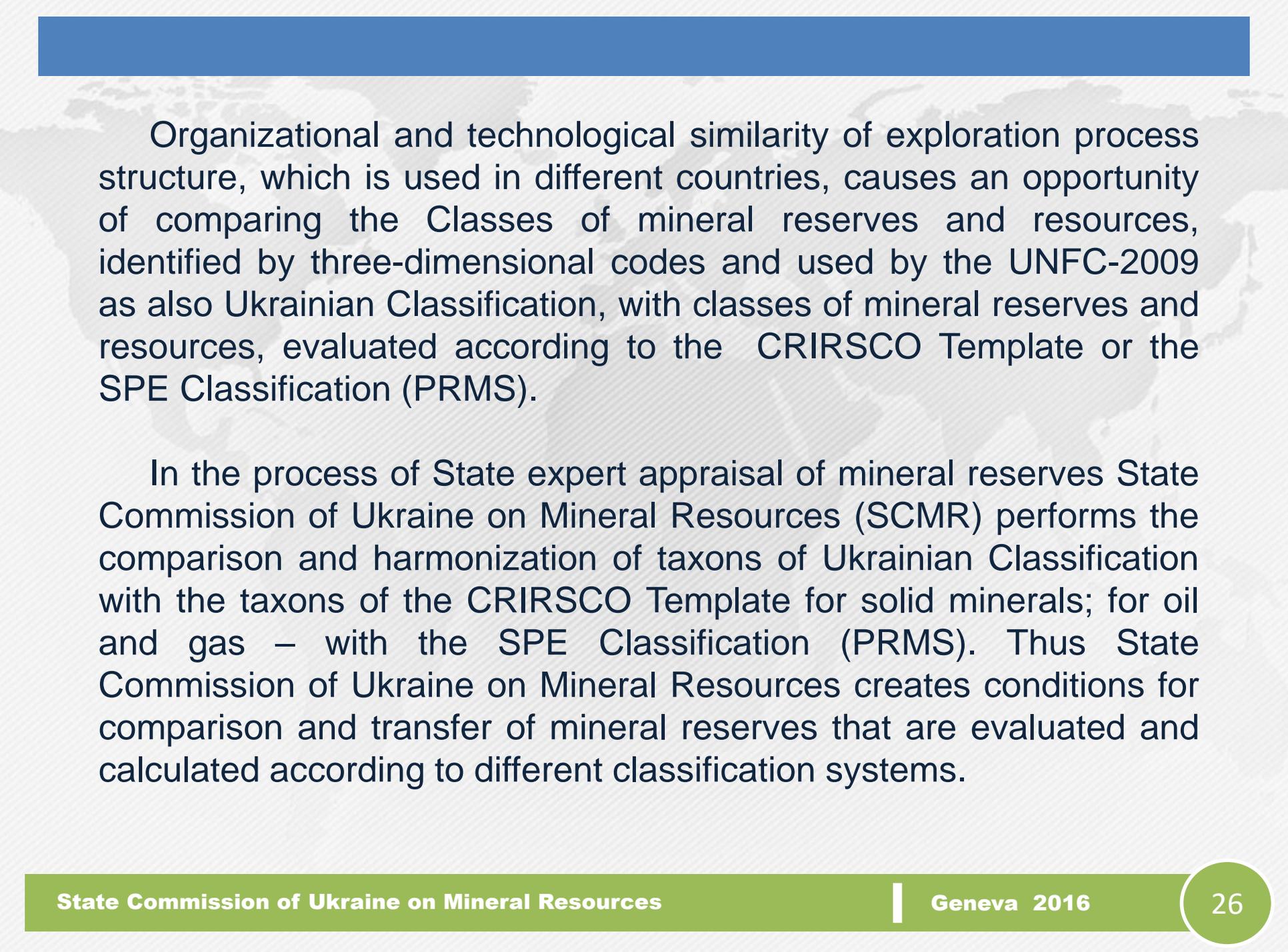
Summarizing the results of the comparison it should be noted that all six classes of reserves and mineral resources, which are specified by the **CRIRSCO** Template, find their analogues in Ukrainian Classification and for this reason they may be considered comparable.

The **CRIRSCO Template** is used by industrial-financial groups, whose shares are traded on international stock exchanges, and by companies that plan to distribute securities. That is why the main requirement for data comparability of these classifications is to provide the possibility of transfer from Ukrainian Classification to the **CRIRSCO Template**. To fulfill this condition the **CRIRSCO Template** and Classification of Ukraine can be considered completely comparable.

Balance and conditionally balance reserves of Classes **211**, **221** and **222** in Ukrainian Classification do not have analogues in the **CRIRSCO Template**, but they are absorbed respectively by the Classes of **MEASURED** and **INDICATED** mineral resources of the **CRIRSCO Template**.

# Main separation principles of hydrocarbon reserves and resources within the PRMS and SCMR systems

<b>Total Petroleum Initially in Place</b>	<b>Discovered</b>	<b>Commercial</b>	<b>Production</b>			<b>Increasing Chance of Commerciality</b>	<b>In comparison with the SCMR</b>				
			<b>Reserves</b>					<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">1P</td> <td style="width: 33%; text-align: center;">2P</td> <td style="width: 33%; text-align: center;">3P</td> </tr> <tr> <td style="text-align: center;">Proved</td> <td style="text-align: center;">Probable</td> <td style="text-align: center;">Possible</td> </tr> </table>	1P	2P	3P
	1P	2P	3P								
	Proved	Probable	Possible								
	<b>Sub-Commercial</b>	<b>Contingent Resources</b>			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">1C</td> <td style="width: 33%; text-align: center;">2C</td> <td style="width: 33%; text-align: center;">3C</td> </tr> </table>		1C	2C	3C	<b>EGE-1 (2P)</b>	
1C		2C	3C								
<b>Unrecoverable</b>			<b>EGE-2 (2C)</b>								
<b>Undiscovered</b>	<b>Prospective Resources</b>			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">Low Estimate</td> <td style="width: 33%; text-align: center;">Best Estimate</td> <td style="width: 33%; text-align: center;">High Estimate</td> </tr> </table>	Low Estimate	Best Estimate	High Estimate	<b>Unrecoverable</b>			
	Low Estimate	Best Estimate	High Estimate								
<b>Unrecoverable</b>			<b>EGE-3 (Best Estimate)</b>								
<b>Range of Uncertainty</b>						<b>Unrecoverable</b>					

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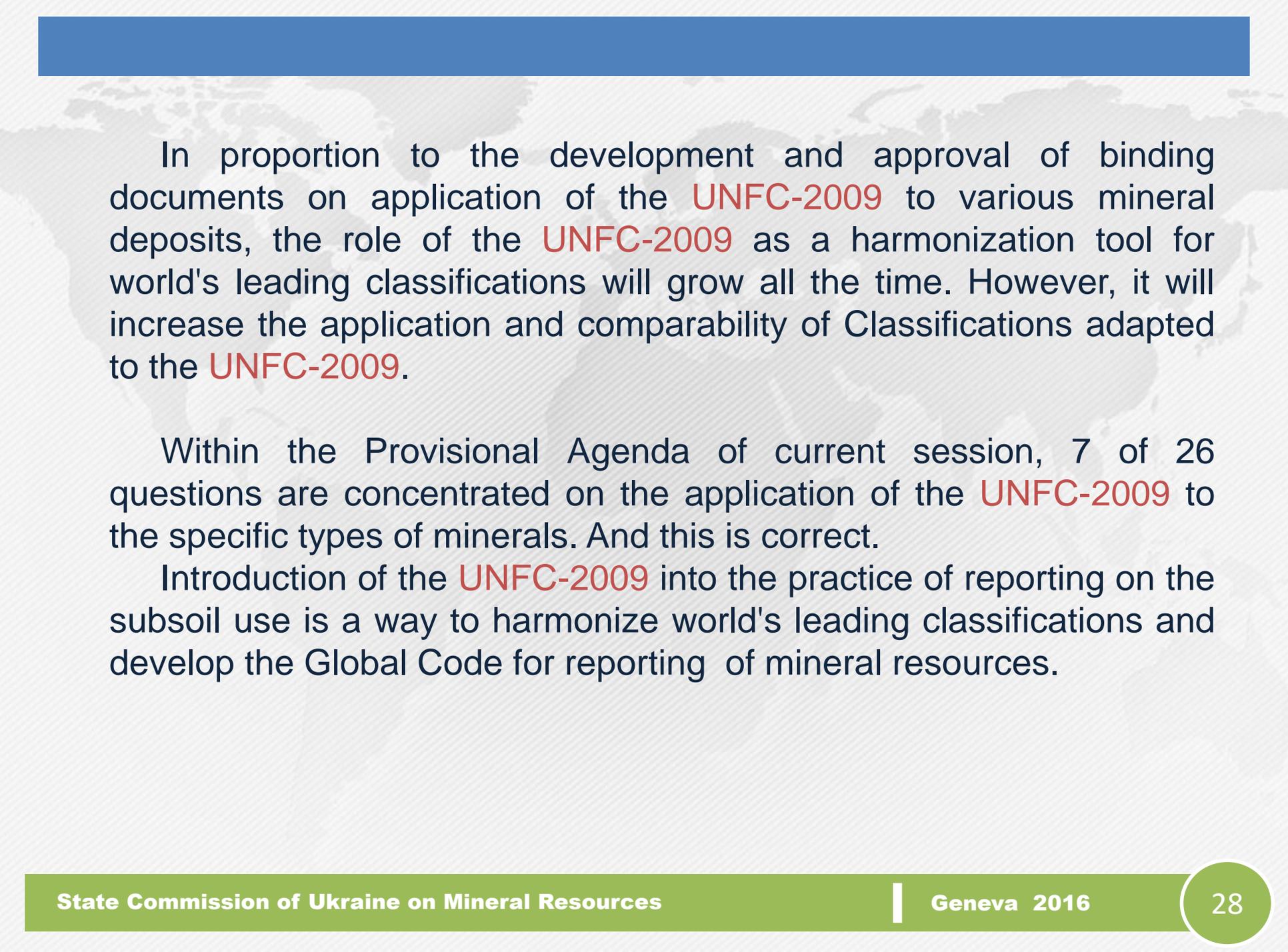
Organizational and technological similarity of exploration process structure, which is used in different countries, causes an opportunity of comparing the Classes of mineral reserves and resources, identified by three-dimensional codes and used by the UNFC-2009 as also Ukrainian Classification, with classes of mineral reserves and resources, evaluated according to the CRIRSCO Template or the SPE Classification (PRMS).

In the process of State expert appraisal of mineral reserves State Commission of Ukraine on Mineral Resources (SCMR) performs the comparison and harmonization of taxons of Ukrainian Classification with the taxons of the CRIRSCO Template for solid minerals; for oil and gas – with the SPE Classification (PRMS). Thus State Commission of Ukraine on Mineral Resources creates conditions for comparison and transfer of mineral reserves that are evaluated and calculated according to different classification systems.

State Commission of Ukraine on Mineral Resources developed working versions of Mineral Reserves and Resources Classifications of the State Subsoil Fund using all Classes and Sub-Classes of the **UNFC-2009**, which were considered at previous sessions of the **UN Experts Group**.

Consistent harmonization of Ukrainian Classification with the **UNFC-2009**, as well as comparison of its Classes and Categories with taxons of the **CRIRSCO** Template and the **SPE (PRMS)** Classification, which was purposefully carried out during several years in accordance with work program of the **UNECE Expert Group**, may lead to following conclusions:

On account of work of State Commission of Ukraine on Mineral Resources as a part of the **UNECE Expert Group**, it can be stated the Ukrainian Classification of Mineral Resources is adapted to the **UNFC-2009** and is comparable with Classifications of the **CRIRSCO Template** for solid minerals and with Petroleum Resources Management System of the Society of Petroleum Engineers **SPE (PRMS)** for oil and gas reserves.

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In proportion to the development and approval of binding documents on application of the **UNFC-2009** to various mineral deposits, the role of the **UNFC-2009** as a harmonization tool for world's leading classifications will grow all the time. However, it will increase the application and comparability of Classifications adapted to the **UNFC-2009**.

Within the Provisional Agenda of current session, 7 of 26 questions are concentrated on the application of the **UNFC-2009** to the specific types of minerals. And this is correct.

Introduction of the **UNFC-2009** into the practice of reporting on the subsoil use is a way to harmonize world's leading classifications and develop the Global Code for reporting of mineral resources.

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***Thank you  
for your attention!***