



NORWEGIAN PETROLEUM  
DIRECTORATE



# Application of UNFC to Petroleum

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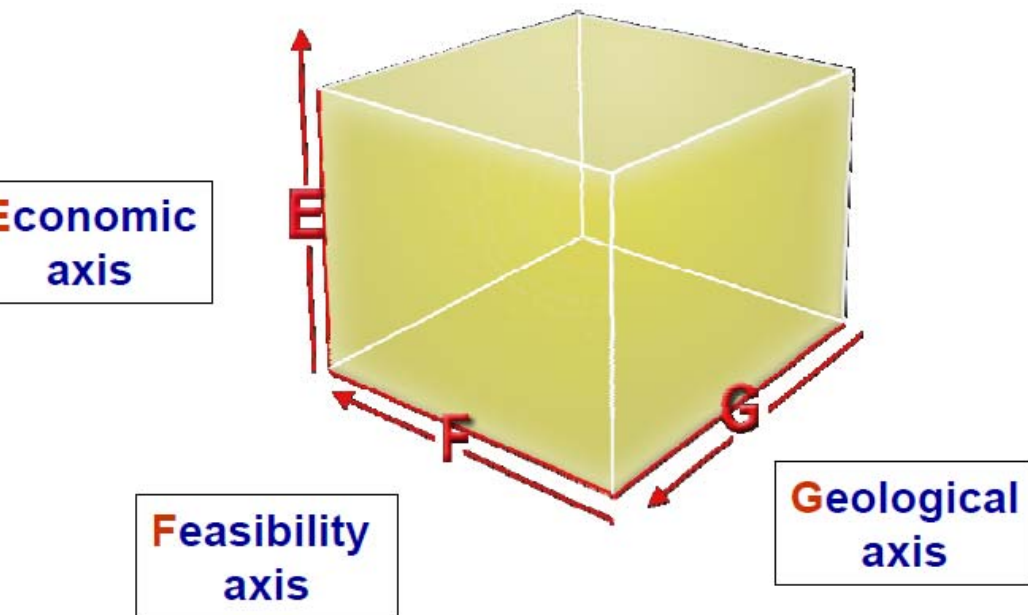
Norwegian Petroleum Directorate

Stavanger, Norway

Workshop on UNFC, Warsaw, Poland, 21 - 22 June 2010

# Basic principles of the UNFC -2009

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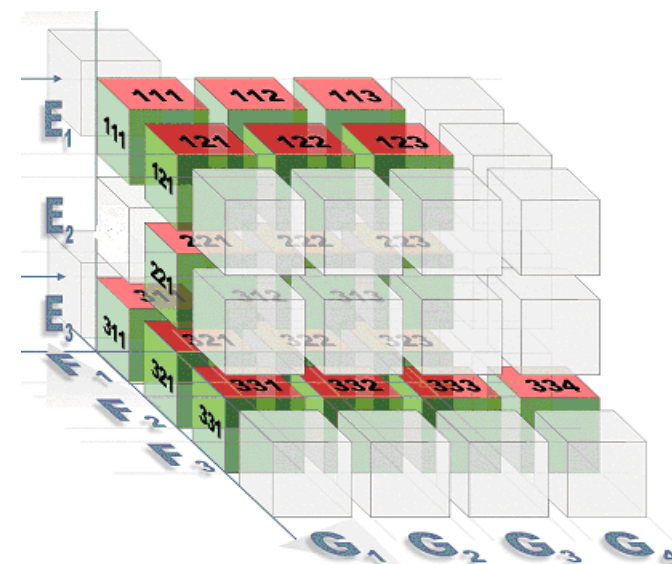


- **Three dimensional system**

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

# UNFC- 2009 - Categories and sub-categories

Axis	Criteria	Categories	Sub-categories
E-axis	Economic and social viability	E1	E1.1, E1.2
		E2	
		E3	E3.1, E3.2, E3.3
F-axis	Field project status and feasibility	F1	F1.1, F1.2, F1.3
		F2	F2.1, F2.2, F2.3
		F3	
		F4	
G-axis	Geological knowledge	G1	
		G2	
		G3	
		G4	



Sub-Category	Definition
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.

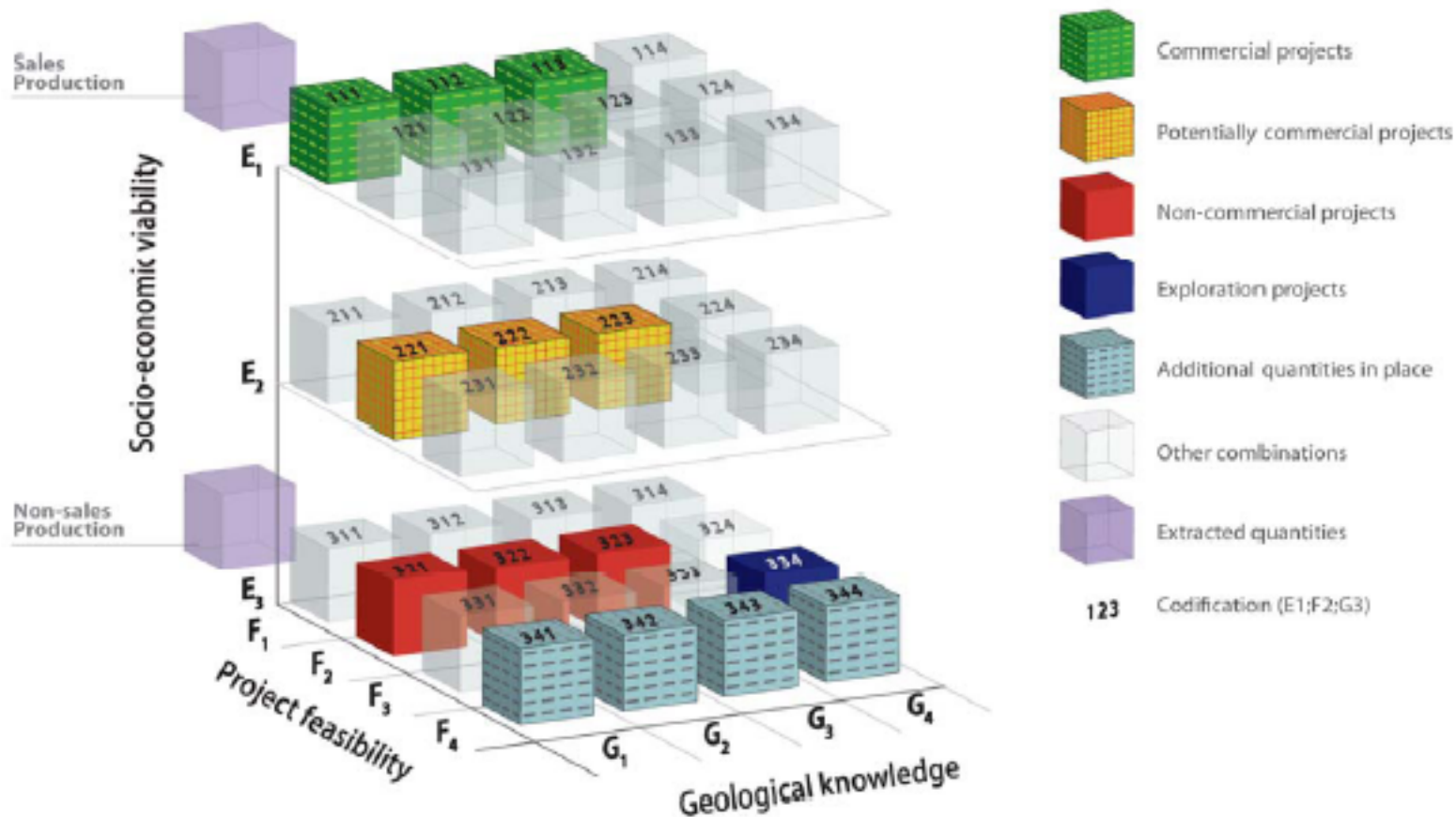
# Most used classes in petroleum

	Extracted	Sales Production			
		Non-sales Production			
	Class	Categories			
		E	F	G	
Total commodity initially in place	Future recovery by commercial development projects or mining operations	Commercial Projects	1	1	1, 2, 3
	Potential future recovery by contingent development projects or mining operations	Potentially Commercial Projects	2	2	1, 2, 3
		Non-Commercial Projects	3	2	1, 2, 3
	Additional quantities in place associated with known deposits		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		3	4	4

”Class” = grouping of categories or sub-categories

# Most used UNFC-2009 classes in petroleum

## UNFC-2009 categories and examples of classes



”Class” = aggregation(grouping) of categories or sub-categories

# Supporting Explanation provided

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## E Axis Category and Sub-category Definitions

Category	Definition	Supporting Explanation
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. 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.

# Alignment of Systems

	UNFC-2009	SPE-PRMS (petroleum)
<b>Known Deposit</b>	<b>Commercial Projects</b>	<b>Reserves</b>
	<b>Potentially Commercial Projects</b>	<b>Contingent Resources</b>
	<b>Non-Commercial Projects</b>	
	<b>Additional quantities in place</b>	<b>Unrecoverable</b>
<b>Potential Deposit</b>	<b>Exploration Projects</b>	<b>Prospective Resources</b>
	<b>Additional quantities in place</b>	<b>Unrecoverable</b>

# More detailed classes used in petroleum

## UNFC-2009

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	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]	3.2	3	4
	Additional quantities in place		3.3	4	4



# Alignment with SPE-PRMS



	UNFC-2009		SPE-PRMS (petroleum)	
Known Deposit	Commercial Projects	On Production	Reserves	On Production
		Approved for Development		Approved for Development
		Justified for Development		Justified for Development
	Potentially Commercial Projects	Development Pending	Contingent Resources	Development Pending
		Development On Hold		Development Unclassified or On Hold
	Non-Commercial Projects	Development Unclassified		Development Not Viable
Development Not Viable				
Additional quantities in place		Unrecoverable		
Potential Deposit	Exploration Projects		Prospective Resources	Prospect
				Lead
				Play
	Additional quantities in place		Unrecoverable	

# Need for specifications

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- ◆ Experience has shown different numbers with same generic definitions due to commodity specific circumstances
- ◆ Recent recommendation from a task force of stakeholders for the UNFC representing the use of the system for
  - ◆ International Energy and Mineral Studies
  - ◆ Government Resources Management
  - ◆ Industry business Processes
  - ◆ Financial Reporting
- ◆ SPE specification will cater for the petroleum need with a few high level specification in the UNFC itself

# G-axis.....

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- ◆ UNFC : ”G-axis designates the level of confidence in the geological knowledge and potential recoverability of the quantities”
- ◆ The uncertainty associated with the quantities estimated is communicated either by
  - ◆ Quoting discrete quantities of decreasing level of confidence (high ,moderate, low)
  - ◆ Generating three specific scenarios or outcomes (low, best and high)

# G-axis.....

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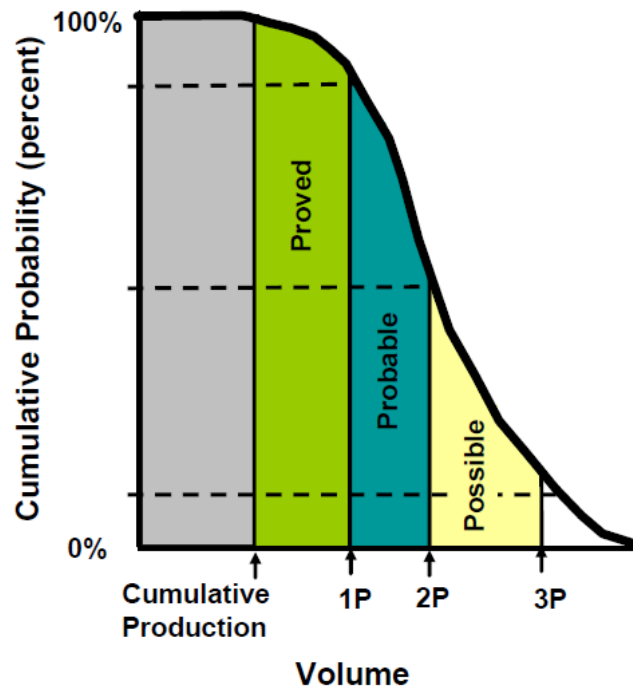
- ◆ Definitions of the G-categories are the same for both extraction of solids and fluids.
- ◆ The supporting explanation, however, describe the differences on how to apply these to solid resources and fluids:
  - ◆ For resources extracted as solids, each estimated project recovery comes from a specific part of the deposit.
  - ◆ For resources extracted as fluids, the project recovery comes from draining the accumulation as a whole.

Low estimate = High confidence estimate = G1  
Best estimate = Moderate confidence estimate = G1+G2  
High estimate = Low confidence estimate = G1+G2+G3

# Methods of estimation

- ◆ Quantities may be estimated using deterministic or probabilistic methods .... or combinations

## Volumetric Uncertainty



Scenario approach to recovery factors based on discrete premises

Quantitative levels of confidence is not accurate.

# How to use UNFC for petroleum

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- ◆ Classify each project by the most detailed UNFC sub-categories and thereafter aggregate all projects for each sub-category
- ◆ Map existing resource account classification system to classes of the UNFC
- ◆ Compare own numbers to others at the same level (classes of categories)

# Example

UNFC - 2009					NPD as of 2008	NPD 2001		
Sales Production					M <sup>3</sup>			Sales Production
					o.e.			
Non-sales production					5055			
Class		E	F	G		Category		Class
Commercial Projects		1	1	1, 2, 3	3407		1,2,3	Reserves
Potentially Commercial Projects		2	2	1, 2, 3	1151		4,5	Contingent resources
Non-Commercial Projects		3	2	1, 2, 3	418		6,7	
Additional quantities in place		3,3	4	1, 2, 3	N/A			
Exploration Projects		3	3	4	3400		8,9	Undiscovered resources
Additional quantities in place		3,3	4	4	N/A			

Base numbers, uncertainty not shown

# Example

UNFC - 2009					NPD as of 2008	NPD 2001		
Sales Production Non-sales production					M <sup>3</sup> o.e.			Sales Production
					5055			
Class	Sub-class	E	F	G		Category		Class
Commercial Projects	On production	1	1,1	1, 2, 3	2634	In production	1	Reserves
	Approved for Development	1	1,2	1, 2, 3	490	Approved PDO	2 F/A	
	Justified for Development	1	1,3	1, 2, 3	283	Licencees decided to recover	3 F/A	
Potentially Commercial Projects	Development pending	2	2,1	1, 2, 3	561	In the planning phase	4 F/A	Contingent resources
	Development on hold	2	2,2	1, 2, 3	590	Recovery likely but undecided	5 F/A	
Non-Commercial Projects	Development unclarified	3,2	2,2	1, 2, 3	418	Not yet evaluated	7 F/A	
	Development not Viable	3,3	2,3	1, 2, 3	N/A	Recovery not very likely	6	
Additional quantities in place		3,3	4	1, 2, 3	N/A			
Exploration Projects	No sub-classes defined	3,2	3	4	3400	Prospect	8	Undiscovered resources
						Lead and Play	9	
Additional quantities in place		3,3	4	4	N/A			

Base numbers, uncertainty not shown



# Comments to mapping total accounts

NPD Class	UNFC classes
0+1	E1.1F1.1
2 A & 2F	E1.1F1.2
3 A & 2F	E1.1F1.3
4 A & 4 F	E1.1F2.1
	E1.1F2.2
	E2F2.1
	E2F2.2
5 A & 5 F	E1.1F2.1
	E2F2.1
6	E3.3F2.3
7 A & 7 F	E1.1F2.1
	E1.1F2.3
	E1.1F3
	E1.2F2.1
	E1.2F2.3
	E2F2.1
	E2F2.3
	E3.2F3
8	E3F3G4
9	E3.2F3

Some projects may be put in other categories due to special circumstances i.e. relative to specifications

# Conclusions

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- ◆ UNFC provides for a common language for classification and reporting
- ◆ Three dimensions seems more complicated, but ensure good flexibility
- ◆ A common system make comparison easier and statistics more reliable
- ◆ UNFC is a framework system
  - ◆ Specifications and guidelines need to be worked out to make UNFC suitable for use under different conditions
  - ◆ The system needs to be used and tested, and then improved based on experience