UNFC 2009 – application examples

Presented by

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Acknowledgement

NPD and Statoil project team:
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Karin Ask, Statoil; Øystein Lie, Statoil

Application examples

- **Energy and mineral studies**
  - **EuroGeoSource project**
- **Government resources management functions**
  - **Norway**

What is EuroGeoSource?

General

- Information portal for sustainable use of energy and minerals
- ICT PSP Call, theme 6.2 Geographic information
- budget of 2.5 million EUR
- started April 1, 2010
- ends April 1, 2013

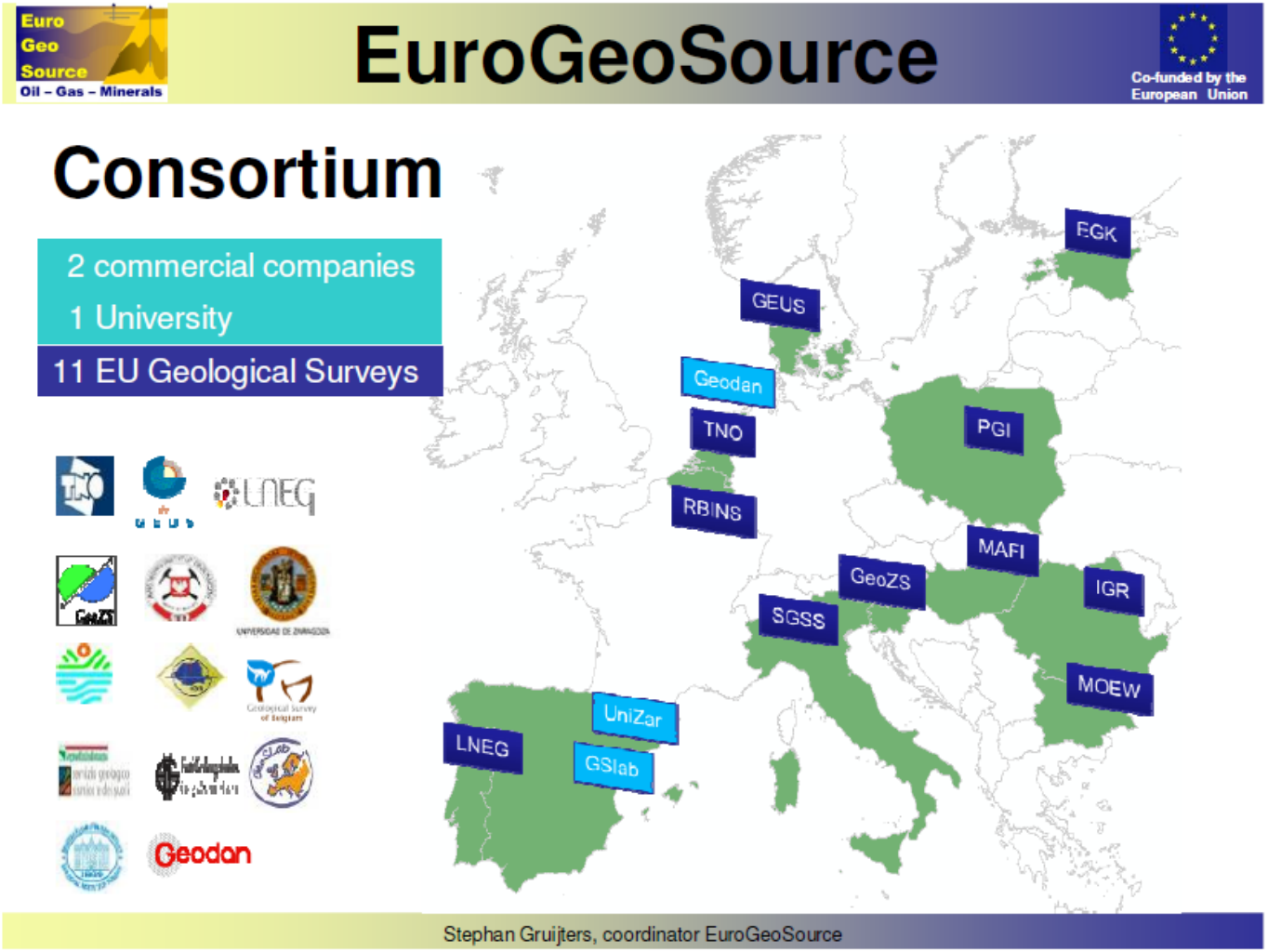
Main data

- Energy (oil and gas) and Minerals (incl. building materials)
- Production and industrial sites
- Geological reserves
- SPBA atlas: Petroleum geology for Northwest and central Europe

Main objectives

- Develop multilingual web GIS system
- Covering at least 10 European countries
- To identify, access and use (geo-) information on energy and mineral resources
- Interactive (user defined) queries

EuroGeoSource project



EuroGeoSource - Goal

- To provide data on energetic and non-energetic mineral resources through an internet portal. By 2012 to have data on-line on occurences of metallic ores,industrial minerals, ornamental stones, oil, gas, etc in at least 10 European countries.

EuroGeoSource

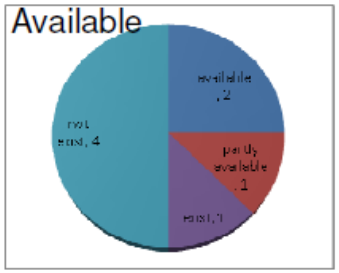
WP4: Key Attributes

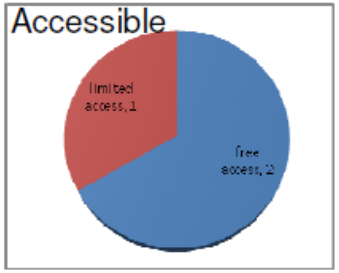
Co-funded by the European Union

Economic data: Classification

Definition	Mineral reserves/resources according to United Nation Framework Classification
Type	Code list
Code list	111, 112, 113, …, …, 342, 343, 344
Mapping to EarthResourceML	NO
Mapping to INSPIRE MR	NO
Mapping to INSPIRE ER	5.3.1.1.5. EnergyResourceDeposit → Attribute: unitedNationsClassificationCode

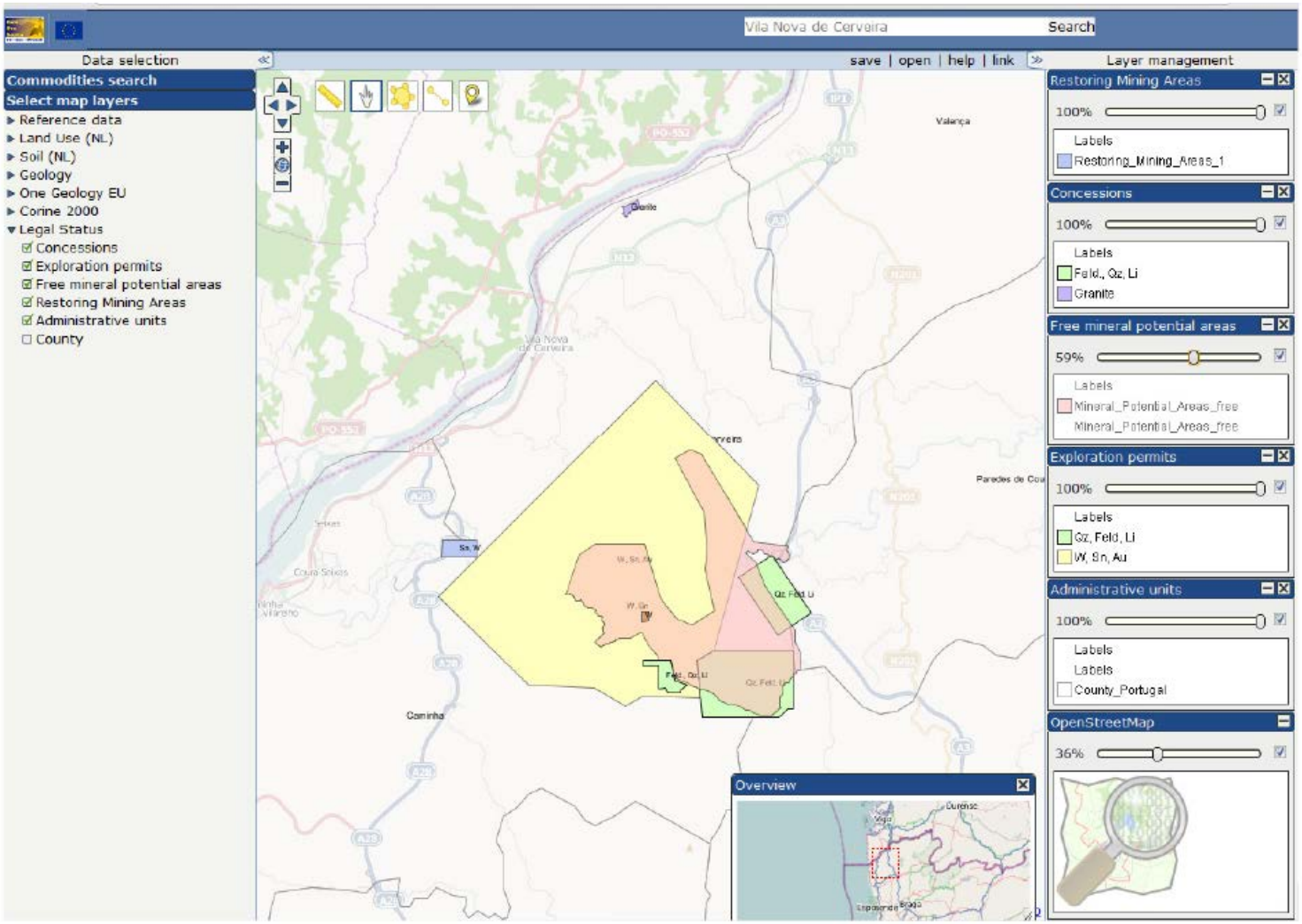
UNFC





Stephan Gruijters, coordinator EuroGeoSource

EuorGeoSource



UNFC: The Umbrella classification system

- 11 European countries cooperate on establishing a common platform to share information
- Each country have their own classification system
- By use of a common code, the UNFC, it is possible to display and compare reserves and resources of minerals and energy resources on equal basis.

Application examples

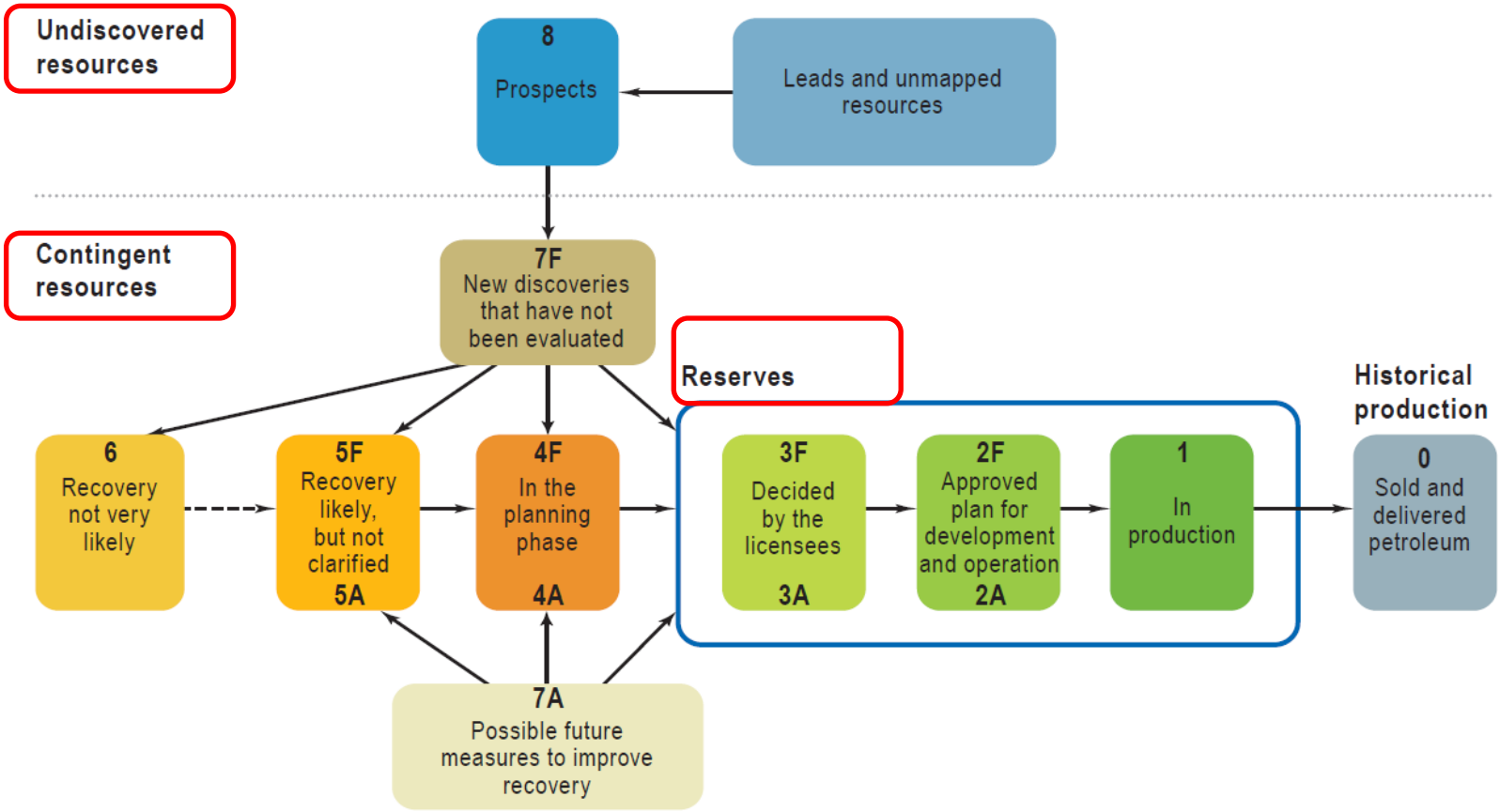
- Energy and mineral studies
  - EuroGeoSource project
- Government resources management functions
  - Norway

Norway

Mapping

NPD classification and UNFC at high level

The NPD's resource classification



UNFC 2009 and SPE-PRMS

<table>
<tr><th></th><th colspan="2">UNFC-2009</th><th colspan="2">SPE-PRMS (petroleum)</th></tr>
<tr><td rowspan="8">Known Deposit</td><td rowspan="3">Commercial Projects</td><td>On Production</td><td rowspan="3">Reserves</td><td>On Production</td></tr>
<tr><td>Approved for Development</td><td>Approved for Development</td></tr>
<tr><td>Justified for Development</td><td>Justified for Development</td></tr>
<tr><td rowspan="2">Potentially Commercial Projects</td><td>Development Pending</td><td rowspan="3">Contingent Resources</td><td>Development Pending</td></tr>
<tr><td>Development On Hold</td><td rowspan="2">Development Unclarified or On Hold</td></tr>
<tr><td rowspan="2">Non-Commercial Projects</td><td>Development Unclarified</td></tr>
<tr><td>Development Not Viable</td><td>Development Not Viable</td></tr>
<tr><td colspan="2">Additional quantities in place</td><td colspan="2">Unrecoverable</td></tr>
<tr><td rowspan="3">Potential Deposit</td><td colspan="2" rowspan="3">Exploration Projects</td><td rowspan="3">Prospective Resources</td><td>Prospect</td></tr>
<tr><td>Lead</td></tr>
<tr><td>Play</td></tr>
<tr><td colspan="2">Additional quantities in place</td><td colspan="2">Unrecoverable</td></tr>
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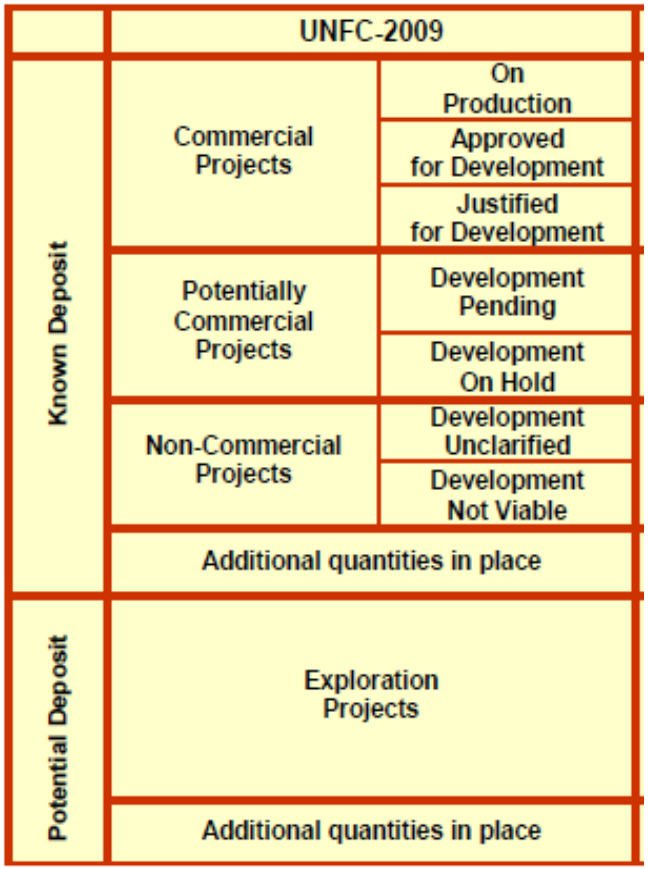
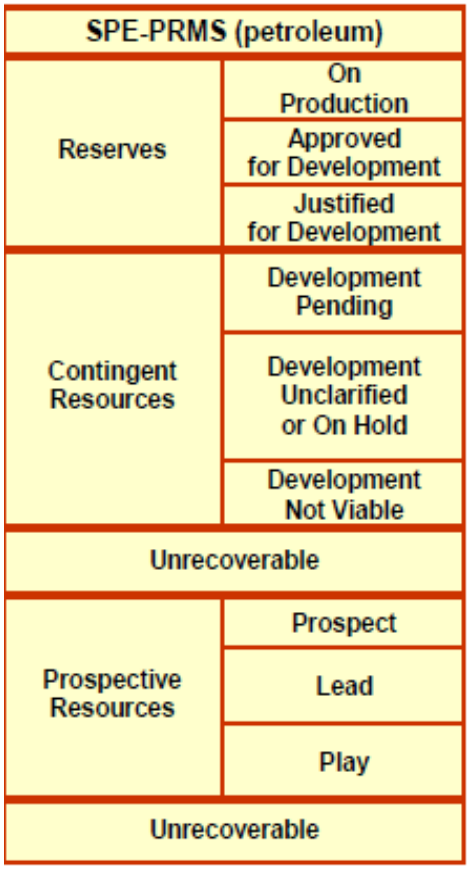
Alignment between UNFC 2009 and SPE PRMS is documented through mapping .

ECE Energy Series No. 33

UNFC 2009 and SPE-PRMS

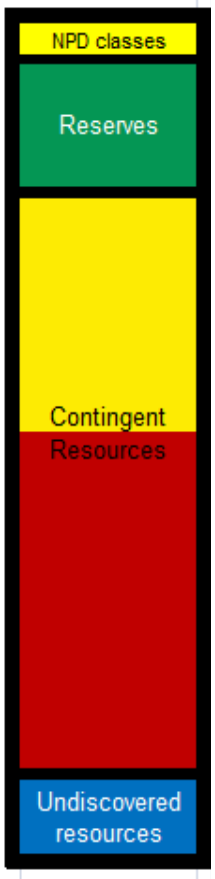


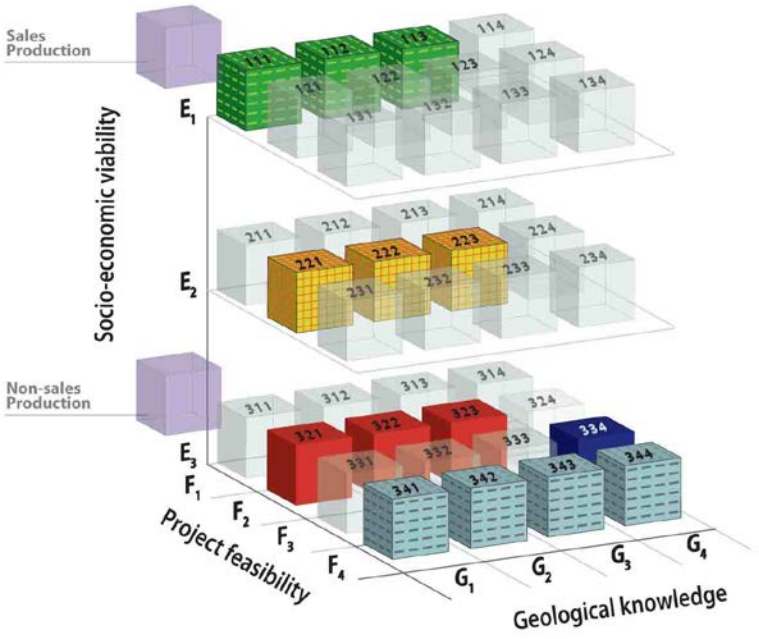


NPD-2001 , UNFC 2009 and SPE-PRMS

	UNFC-2009		NPD		SPE-PRMS (petroleum)	
Known Deposit	Commercial Projects	On Production	Reserves	In production	Reserves	On Production
		Approved for Development		Approved for development		Approved for Development
		Justified for Development		Decided for development		Justified for Development
	Potentially Commercial Projects	Development Pending	Contingent Resources	In planning phase	Contingent Resources	Development Pending
		Development On Hold		Recovery likely, but undecided		Development Unclarified or On Hold
	Non-Commercial Projects	Development Unclarified		Not evaluated / Improved rec. pot.		
		Development Not Viable		Recovery not very likely		Development Not Viable
	Additional quantities in place		Not applicable		Unrecoverable	
Potential Deposit	Exploration Projects		Undiscovered Resources	Prospect	Prospective Resources	Prospect
				Lead and play		Lead
						Play
	Additional quantities in place		Not applicable		Unrecoverable	

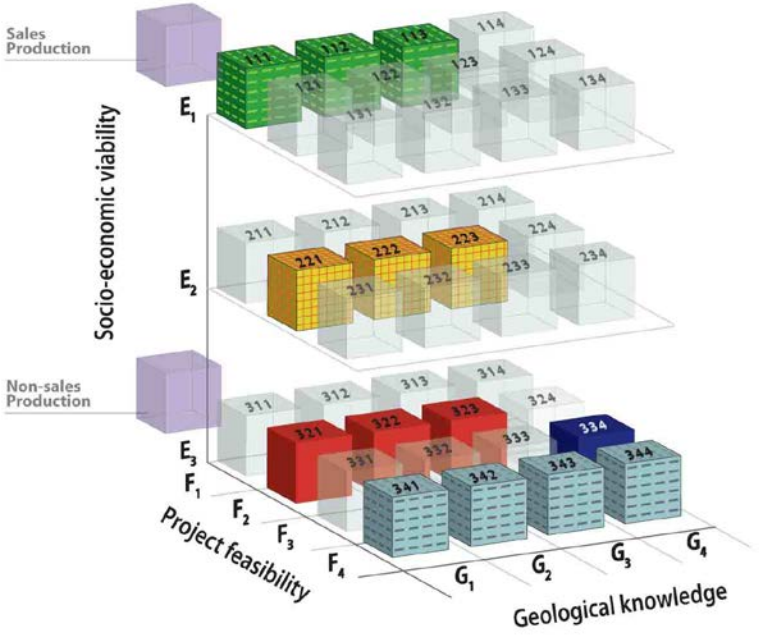
High level mapping of classes





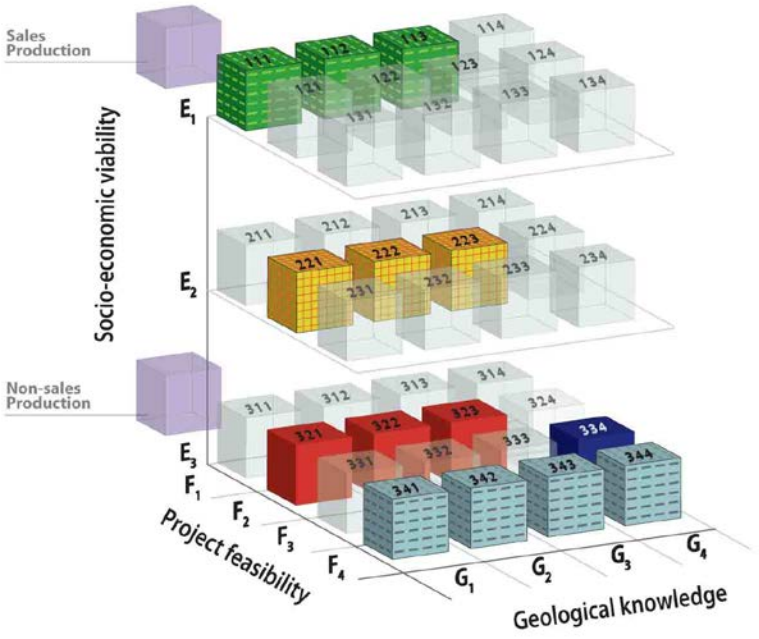
Coarse mapping of one to one classes

NPD classes	NPD Categories
Reserves	0+1
	2 A & 2F
	3 A & 2F
Contingent Resources	4 A & 4 F
	5 A & 5 F
	6
	7 A & 7 F
Undiscovered resources	8
	9



Coarse mapping of one to one classes

NPD classes	NPD Categories	UNFC classes
Reserves	0+1	E1.1F1.1
	2 A & 2F	E1.1F1.2
	3 A & 2F	E1.1F1.3
Contingent Resources	4 A & 4 F	E1.1F2.2
		E2F2.1
		E2F2.2
	5 A & 5 F	E1.1F2.1
	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
		E3.2F2.2
Undiscovered resources	8	E3F3G4
	9	E3.2F3



Norwegian Resource figures

UNFC - 2009					31.12.2003	31.12.2004	31.12.2005	31.12.2006	31.12.2007	NPD per 31.12.2008	NPD as of 31.12.2009	NPD as of 31.12.2010	NPD 2001		
					MSm³ o.e.	MSm³ o.e.	MSm³ o.e.	MSm³ o.e.	MSm³ o.e.	MSm³ o.e.	MSm³ o.e.	MSm³ o.e.			
Sales Production					3 779	4 044	4 324	4 573	4811	5055	5287	5521			Sales Production
Non-sales production															
Class	Sub-class	E	F	G									Category		Class
Commercial Projects	On production	1	1,1	1, 2, 3	2837	2781	2796	2497	2812	2634	2604	2506	In production	1	Reserves
	Approved for Development	1	1,2	1, 2, 3	422	788	757	781	549	490	236	221	Approved PDO	2 F/A	
	Justified for Development	1	1,3	1, 2, 3	814	361	344	381	250	283	329	396	Licencees decided to recover	3 F/A	
Potentially Commercial Projects	Development pending	2	2,1	1, 2, 3	620	654	498	534	440	561	538	654	In the planning phase	4 F/A	Contingent Resources
	Development on hold	2	2,2	1, 2, 3	576	621	676	687	640	590	624	570	Recovery likely but undecided	5 F/A	
Non-Commercial Projects	Development unclarified	3,2	2,2	1, 2, 3	469	235	293	287	293	418	454	397	Not yet evaluated	7 F/A	
	Development not Viable	3,3	2,3	1, 2, 3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Recovery not very likely	6	
Additional quantities in place		3,3	4	1, 2, 3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Exploration Projects	No sub-classes defined	3,2	3	4	3400	3400	3400	3400	3400	3400	3280	2570	Prospect	8	Undiscovered resources
													Lead and Play	9	
Additional quantities in place		3,3	4	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			

Conclusion from high level (aggregated) mapping

- Alignment between NPD and UNFC based on classes and sub-classes is fairly straightforward
- Likely that some projects within a sub-class may better be aligned with a different sub-class in UNFC than assumed in high level mapping
- Mapping on a project level is necessary to fully test the alignment between the two systems.

Norway

Mapping NPD classification and UNFC at detailed (project) level

Detailed mapping project UNFC and NPD

- The main goal is to classify each individual project in Norway, by applying the
  - UNFC
    - Definitions and Supporting explanations
    - UNFC Mapping document
    - Proposed Generic Specifications
    - Existing Commodity specific specifications (PRMS-specifications)
  - NPD Classification
    - Definitions
    - Guideline for reporting to NPD
- Secondary goal to identify areas for improvements in existing NPD classification
- Third goal to consider UNFC as preferred classification for NPD

Cooperation with Statoil

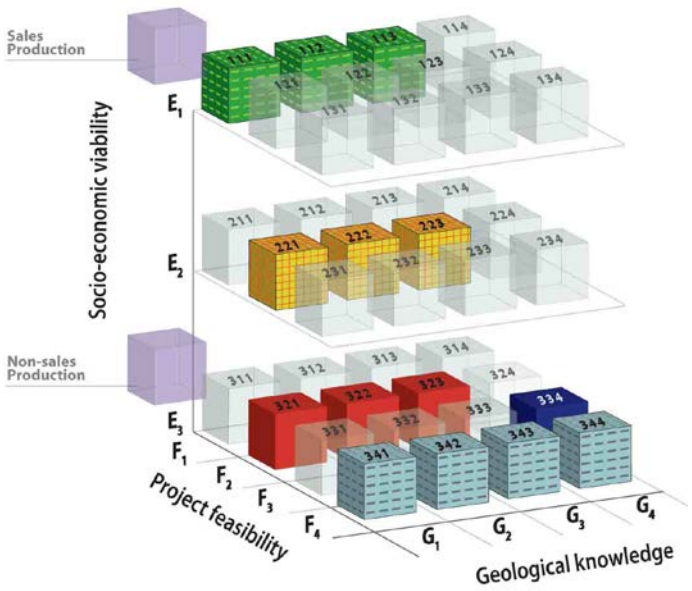
- Select a representative group of Statoil operated fields and discoveries (projects)
- Allocate a UNFC-class to each project
  - *Combined by E and F categories*
- Use the detailed information from the annual company reporting
- Use additional information of each project prepared by the operator (e.g. Economic calculations, NPV) if necessary

Total number of projects more than 700!

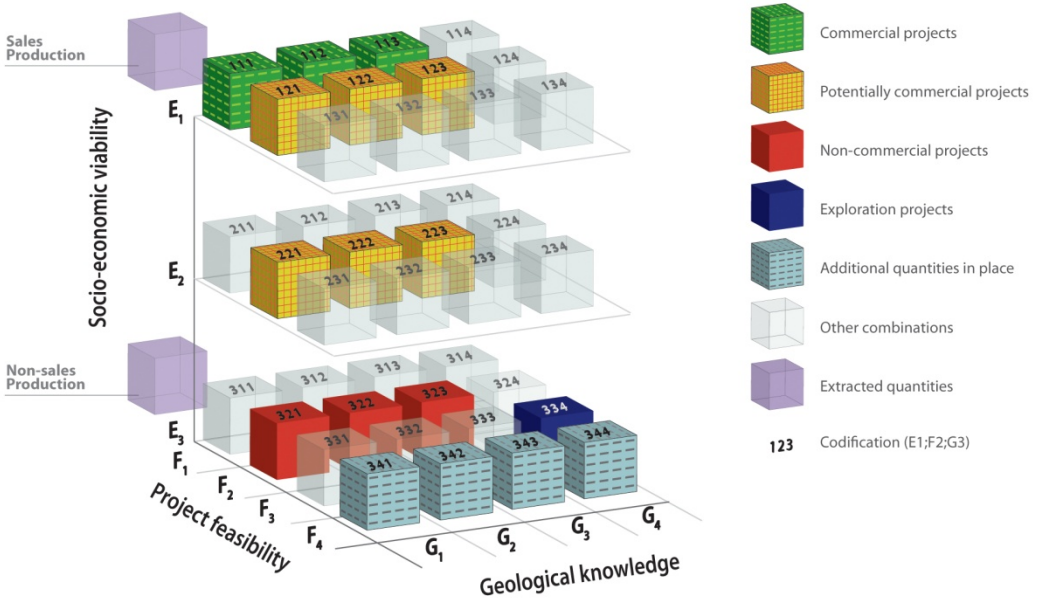
Number of projects		NPD Project Status Categories	UNFC classes (combinations of categories)	NPD Project Status Categories
		0		Sold and delivered petroleum
167	231	1	E1.1F1.1	Reserves
22		2 F	E1.1F1.2	
18		2 A	E1.1F1.2	
9		3 F	E1.1F1.3	
15		3 A	E1.1F1.3	
46	437	4F	E1.1F2.1	Contingent resources
68		4A	E1.1F2.1	
46		5F	E2F2.1	
74		5A	E2F2.1	
		6	E3.3F2.3	
44		7F	E3.2F2.1	
159	Reported	7A	E2,F2.2	
71	Plays	8	E3F3G4	Prospective resources
		9	E3.2F3	
739				

Potentially commercial projects may also satisfy E1 criteria

Basis for high level mapping



Detailed (project) level mapping



”Bulk” mapping after re-interpretation of RC 4

UNFC - 2009					NPD per 31.12.2008	NPD as of 31.12.2009	NPD as of 31.12.2010	NPD 31.12.2011	NPD 2001		
					MSm³ o.e.	MSm³ o.e.	MSm³ o.e.	MSm³ o.e.			
Sales Production					5055	5287	5521	5740			Sales Production
Non-sales production											
Class	Sub-class	E	F	G					Category		Class
Commercial Projects	On production	1.1	1.1	1, 2, 3	2634	2604	2506	2347	In production	1	Reserves
	Approved for Development	1.1	1.2	1, 2, 3	490	236	221	433	Approved PDO	2 F/A	
	Justified for Development	1.1	1.3	1, 2, 3	283	329	396	384	Licencees decided to recover	3 F/A	
Potentially Commercial Projects		1.1	2,1	1, 2, 3	561	538	648	593	In the planning phase	4 F/A	Contingent Resources
	Development pending	2	2.1	1, 2, 3	590	624	570	798	Recovery likely but undecided	5 F/A	
	Development on hold	2	2.2	1, 2, 3			210	190		7 A	
Non-Commercial Projects		3.2	2.1	1, 2, 3	418	454	193	182	Not yet evaluated	7 F	
	Development unclarified	3,3	2,3	1, 2, 3	N/A	N/A	N/A	N/A	Recovery not very likely	6	
Additional	Development	3,3	4	1, 2, 3	N/A	N/A	N/A	N/A			
Exploration Projects	No sub-classes defined	3,2	3	4	3400	3280	2570	2455	Prospect	8	Undiscovered resources
									Lead and Play	9	
Additional		3,3	4	4	N/A	N/A		N/A			

NPD Mapping Matrix
Reserves (1,2 and 3 categories): No problems

NPD Class	UNFC classes	Details project	NPD Category Name	NPD Definition
1	E1.1F1.1	All projects that are part of existing production at the effective date	Reserves in Production	Remaining, recoverable, marketable and deliverable quantities of petroleum which the licensees have decided to recover, and which are covered by plans for development and operation (PDO) which the authorities have approved or granted exemption from. Should production be temporarily shut down, the reserves must, nevertheless, be added to this category. The reserves in this category are shown by subtracting the sold and delivered petroleum quantities from the originally recoverable reserves.
2 A	E1.1F1.2	All development projects approved by authorities that will produce additional oil from (oil in place) deposits that have other projects that have allready been approved and may be producing	Additional Reserves with an approved plan for development and operation	Additional (or deducted) reserves that are in categories 1 or 2F, which are a consequence of projects to improve production, and which have the same status as regards decisions as reserves in category 2F.
2 F	E1.1F1.2	All development projects approved by authorities that has not started producing	Reserves with an approved plan for development and operation	Recoverable quantities of petroleum described under category 1, but which have not been put into production.
3 A	E1.1F1.3	All development projects approved by all licencees but not authorities that will produce additional oil from (oil in place) deposits that have other projects that have allready been approved and may be producing	Additional Reserves which the licensees have decided to recover	Additional (or deducted) quantities of petroleum in categories 1, 2 or 3F, which are a consequence of projects to improve production and which the licensees have decided to recover, but for which the authorities have not yet approved a PDO or granted exemption therefrom.
3 F	E1.1F1.3	All development projects approved by all licencees but not authorities (and have not started producing)	Reserves which the licensees have decided to recover	3.5 Category 4 Resources in the planning phase

NPD Mapping Matrix
Contingent resources: several options to be tested

NPD Class	UNFC classes	Details project	NPD Category Name	NPD Definition
4 A	E1.1F2.1	All additional active projects confirmed economic and where approval by licecee is expected within 4 years	Additional Recoverable Resources in the planning phase	Additional (or deducted) quantities of petroleum in categories 1, 2, 3 or 4F, which are a consequence of projects to improve production and which have the same status as regards decisions as resources in category 4F.
	E1.1F2.2	All additional projects confirmed economic and where approval by licecee is **not** expected within 4 years (Can not be in RK4, unless the gas outlet is the problem making it "on hold")		
	E2F2.1	All additional active projects **not** confirmed to be economic but where approval by licecees is expected within 4 years		
	E2F2.2	All additional active projects **not** confirmed to be economic and where approval by licecee is **not** expected within 4 years (Can not be in RK4, unless the gas outlet is the problem making it "on hold")		
4 F	E1.1F2.1	All (first) development projects confirmed economic where approval by licecee is expected withis 4 years	Recoverable Resources in the planning phase	Discovered, recoverable, petroleum resources that are expected to be covered by a PDO or granted exemption therefrom, and where specific activity is taking place with a view to clarifying whether a development will be implemented. Development is expected to be decided by the licensees within about 4 years. This category also contains supplementary resources which can be connected to existing fields that have reserves in categories 1 and 2, and discoveries that have reserves in category 3.
	E2F2.1	All (first) development projects where approval by licecee is expected withis 4 years but technical qualifications (to verify investment estimates) are missing (Bad reservoir quality?)		
	E1.1F2.2	All (first) development projects confirmed economic where approval by licecee is **not** expected withis 4 years (Why does it not come sooner if it is confirmed economic?)(Can not be		

NPD Mapping Matrix
Contingent resources: several options to be tested

5 A	E1.1F2.1	All additional unclarified projects confirmed economic and where approval by licecee is not expected within 4 years		
	E2F2.1	All additional unclarified projects not confirmed economic and where approval by licecee is not expected within 4 years	Additional Resources whose recovery is likely, but not clarified	Additional (or deducted) quantities of petroleum that are in categories 1, 2, 3, 4 or 5F, which are a consequence of projects to improve production, and which have the same status as regards decisions as resources in category 5F.
	E1.1F2.2	All additional unclarified projects confirmed economic and where approval by licecee is not expected within 4 years		
	E2F2.2	All additional unclarified projects not confirmed economic and where approval by licecee is not expected within 4 years		
5 F	E1.1F2.1	All unclarified (first) projects confirmed economic and where approval by licecee is not expected within 4 years, but project activities for justification are ongoing		
	E2F2.1	All unclarified (first) projects not confirmed economic and where approval by licecee is not expected within 4 years but project activities for justification are ongoing	Resources whose recovery is likely, but not clarified	Discovered, recoverable petroleum resources whose recovery is likely, but not clarified. This category contains discovered, recoverable petroleum resources which are not being considered for development at the moment, but which can be developed in due course. It also contains supplementary resources from new deposits which can be tied in to fields and discoveries with resources in categories 1, 2, 3 and 4, but where matters regarding recovery have still not been clarified.
	E1.1F2.2	All unclarified (first) projects confirmed economic and where approval by licecee is not expected within 4 years but project activities for justification are on hold or significant delayed		
	E2F2.2	All unclarified (first) projects not confirmed economic and where approval by licecee is not expected within 4 years but project activities for justification are on hold or significant delayed		
	E3F2.2	All unclarified (first) projects not confirmed economic and where approval by licecee is not expected within 4 years and technology is missing, uncertain reservoir quality,uncertain resservoir volume and commercial deal is missing.		

UNFC G-axis and NPD – no problems

Cat	UNFC Definitions	UNFC Supporting Explanation		NPD Definition	NPD supporting documentation (Reporting Guidelines)
G1	Quantities associated with a known deposit that can be estimated with a high level of confidence.	For in situ (in-place) quantities, and for recoverable estimates of fossil energy and mineral resources that are extracted as solids, quantities are typically categorised discretely, where each discrete estimate reflects the level of geological knowledge and confidence associated with a specific part of the deposit. The estimates are categorised as G1, G2 and/or G3 as appropriate. 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 categorised on the basis of three scenarios or outcomes that are equivalent to G1, G1+G2 and G1+G2+G3.	Low estimate	The Low estiomate must be lower than the best estimate. The probability of being able to recover the stated estimate or more must be stated (e.g. P90 or P80). Unlike the base estimate, the low estimate should be an expression of possible negative changes with respect to the mapping of the reservoir, reservoir parameters, or the recovery factor.	The petroleum resources shall be classified in accordance with the resource classification system of the Norwegian Petroleum Directorate. The originally recoverable petroleum resources shall be classified according to their position in the development chain from a discovery is made, or a new effort to increase the recoverable resources of a field is identified, and up to the point when the resources have been produced. **A discovery or a field may have resources of several classes. All petroleum resources shall to the extent possible be designated by P10 - P expected - P90.**
G2	Quantities associated with a known deposit that can be estimated with a moderate level of confidence.		Basis estimate	The base estimate must reflect the current understanding of the exstention, characteristics and recovery factor of the reservoir. The base estimate will be calculated deterministically or stochastically. If the estimate is calculated by a stocastic method, it should correspond to the mean value.	
G3	Quantities associated with a known deposit that can be estimated with a low level of confidence.		High estimate	The High estiomate must be higher than the best estimate. The probability of being able to recover the stated estimate or more must be stated (e.g. P10 or P20). Unlike the base estimate, the low estimate should be an expression of possible positive changes with respect to the mapping of the reservoir, reservoir parameters, or the recovery factor	
G4	Estimated quantities associated with a potential deposit, based primarily on indirect evidence. Quantities	Quantities that are estimated during the exploration phase are subject to a substantial range of uncertainty as well as a major risk that no development project or mining operation may subsequently be implemented to extract the estimated quantities. 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.			Reporting of RC 8: Estimates shall be given for recoverable resources in prospects in separate production licences/unitized fields that, given discovery, will very likely be tied in to the field/discovery they are reported in. Prospects that extend into adjacent production licences are to be reported with the total volumes. It must be ensured that the prospect is not reported simultaneously by other fields/discoveries. **The resource estimate must be risk-weighted and should reflect the estimated volumes multiplied by the probability of making a discovery.**. Information must also be provided regarding exploration drilling and resource growth for the past year, as well as plans for use of mobile facilities.

Detailed mapping - examples of issues to be checked out

- Break-even price for project (high – low)
- No Commercial agreement
- Lack of gas solution (flaring not allowed)
- Lack of infrastructure
- Infrastructure exist but lack of transport capacity
- Lack of proper technology
- High reservoir uncertainty (complexity)
- Low recoverable volume

Preliminary conclusions Detailed mapping

- Commercial projects (reserves) are robust. No changes from high level mapping
- Potentially commercial projects (contingent resources) are more diversified than anticipated in the high level mapping
- Additional information on economy (NPV) and project stoppers are being used when assigning the UNFC class for the project
- UNFC allows for more granularity in classifying projects than in current NPD classification

Deliverables
Detailed Mapping Project

- Results to be presentated at the Third Session, Expert Group on Resource Classification, 2 – 4 May 2012, Geneva, Switserland.

- Report documenting the mapping.

Mapping and Testing UNFC for Nuclear Fuel Resources

Higher level mapping

UNFC	CRIRSCO	IAEA-NEA	E	F	G
Commercial Projects	Mineral Reserves	Identified Resources <$ 80/KgU	1	1	1,2,3
Potentially commercial projects	Mineral Resources		2	2	1,2,3
Non-commercial projects	Discovered not economical	Identified Resources $80 – 130; >$130/KgU	3	2	1,2,3
Exploration projects	Exploration results	Undiscovered Resources	3	3	4

IAEA

Conclusion

- The number of Mapping and Case Studies of UNFC to National and International Classification systems are growing
- Single project/single field mapping are useful for screening and testing
- High level mapping often show good alignment between UNFC and mapped system
- Portfolio mapping will reveal more of the tricky details and help improve UNFC
- The flexibility of UNFC makes it a strong tool for all stakeholders

UNFC 2009 – application examples

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