



Karin Ask

Statoil

and

Task Force on UNFC-2009 and Injection Projects

Specifications for Application of UNFC-2009 to Injection Projects

WORKSHOP - EGRC 8th Session, Geneva, April 2017



Task Force Members

- Karin Ask, Statoil
- Michelle S. Bentham, BGS
- Simplicio P. Caluyong, CCOP
- Benjamin Court, Global CCS Institute
- Scott Frailey, ISGS
- Eva Halland, NPD
- Wolf Heidug, KAPSARC
- Martin Hubbig, OMV
- Lesley R. Seldon, Shell

Task Force on Application of UNFC-2009 to Injection Projects

Endorsed by the UNECE Committee on Sustainable Energy



Specifications

**for the Application of the United Nations
Classification for Fossil Energy and Mineral
Reserves and Resources 2009 (UNFC-2009)**

**to Injection Projects for the Purpose of Geological
Storage**

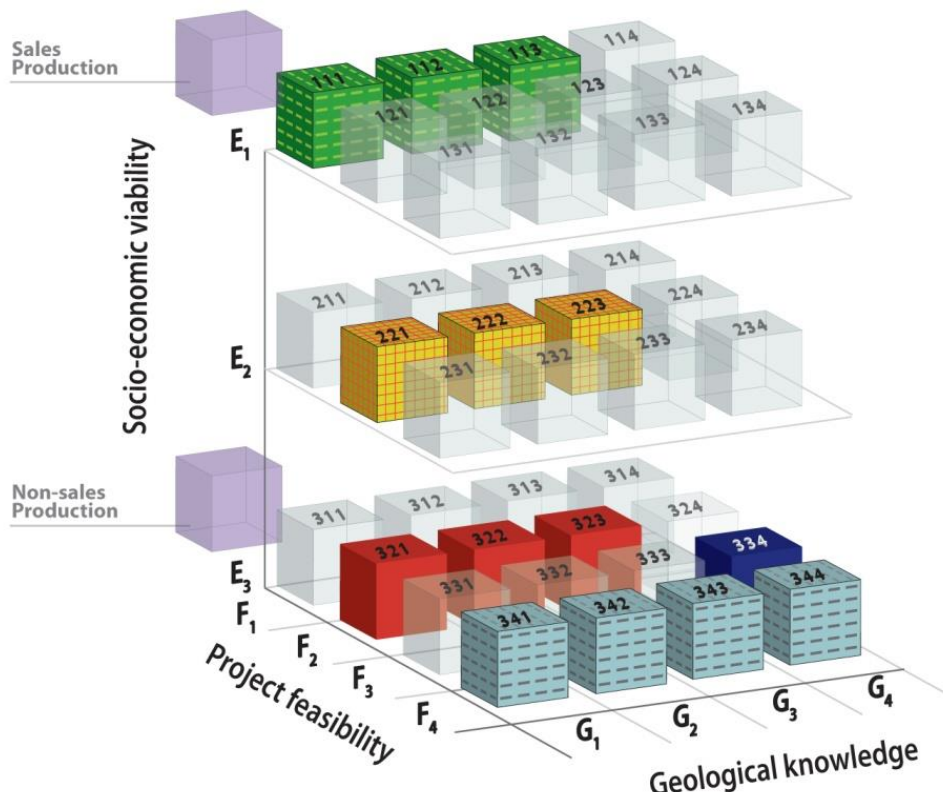
Done in Geneva, 30 September 2016

The Specifications for the application of the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009) to Injection Projects for the Purpose of Geological Storage were endorsed by the UNECE Committee on Sustainable Energy at its twenty-fifth session in Geneva, 30 September 2016.

[LINK to document on UNFC web page](#)



Injection project activities - the simple picture



We need to:

- Understand the geology and dynamic behaviour of the recipient reservoir
- Design a technical concept and evaluate the project feasibility
- Calculate the costs and evaluate the economic and social viability of the project
- Make decisions

These are all activities that we know from oil and gas extraction projects and that are well defined in the UNFC2009

Task Force on Application of UNFC-2009 to Injection Projects

Definition of Categories – E axis

	UNFC-2009	UNFC-2009 applied to Injection Projects for the purpose of Geological Storage	
Category	Definition	Definition	Supporting Explanation
E1	<i>Extraction and sale</i> has been confirmed to be economically viable.	Injection for the purpose of geological storage has been confirmed to be economically viable ^a .	Injection 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 time frame. Economic viability is not affected by short-term adverse market conditions provided that longer term forecasts remain positive.
E2	<i>Extraction and sale</i> is expected to become economically viable in the foreseeable future.	Injection for the purpose of geological storage is expected to become economically viable in the foreseeable future.	Injection has not yet been confirmed to be economic but, on the basis of realistic assumptions of future market conditions, there are reasonable prospects for economic injection and storage in the foreseeable future.
E3	<i>Extraction and sale</i> is not expected to become economically viable in the foreseeable future, or the evaluation is at too early a stage to determine economic viability.	Injection for the purpose of geological storage is not expected to become economically viable in the foreseeable future, or the evaluation is at a too early a stage to determine economic viability.	On the basis of realistic assumptions of future market conditions, it is currently considered that there are not reasonable prospects for economic injection in the foreseeable future; or, economic viability of injection cannot yet be determined due to insufficient information (e.g. during the screening phase).

Task Force on Application of UNFC-2009 to Injection Projects

Definition of Categories – F axis

	UNFC-2009	UNFC-2009 applied to Injection Projects for the purpose of Geological Storage	
Category	Definition	Definition	Supporting Explanation
F1	<i>Feasibility of extraction by a defined development project or mining operation has been confirmed.</i>	Feasibility of an injection project for the purpose of geological storage has been confirmed.	Injection is currently taking place; or, implementation of an injection project is underway; or, sufficiently detailed studies have been completed to demonstrate the feasibility of geological storage by implementing a defined injection project.
F2	<i>Feasibility of extraction by a defined development project or mining operation is subject to further evaluation.</i>	Feasibility of an injection project for the purpose of geological storage is subject to further evaluation.	Preliminary studies demonstrate the existence of a Reservoir in such form, quality and quantity that the feasibility of geological storage by a defined injection project can be evaluated. Further data acquisition and/or studies may be required to confirm the feasibility of injection for the purpose of geological storage.
F3	<i>Feasibility of extraction by a defined development project or mining operation cannot be evaluated due to limited technical data.</i>	Feasibility of an injection project for the purpose of geological storage cannot be evaluated due to limited technical data.	Very preliminary studies (screening phase), which may be based on a defined injection project, indicate the need for further data acquisition and/or further geological studies in order to confirm the existence of a reservoir in such form, quality and quantity that the feasibility of injection for the purpose of geological storage can be evaluated.
F4	<i>No development project or mining operation has been identified.</i>	No injection project for the purpose of geological storage has been identified.	Reservoir which may be suitable for injection for the purpose of geological storage but which will not be utilised by any currently defined injection project.

Definition of Categories – G axis

	UNFC-2009	UNFC-2009 applied to Injection Projects for the purpose of Geological Storage	
Category	Definition	Definition	Supporting Explanation
G1	Quantities associated with a known deposit that can be estimated with a high level of confidence.	Quantities associated with a known reservoir that can be estimated with a high level of confidence.	<p>The G-axis represents the level of confidence in the estimated quantities of a fluid that can be stored in the reservoir through a defined injection project. The quantities are typically categorised discretely, where each discrete estimate reflects the level of geological knowledge and confidence associated with a specific part of the reservoir. The estimates are categorised as G1, G2 and/or G3 as appropriate.</p> <p>The quantities that can be stored 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.</p>
G2	Quantities associated with a known deposit that can be estimated with a moderate level of confidence.	Quantities associated with a known reservoir that can be estimated with a moderate level of confidence.	
G3	Quantities associated with a known deposit that can be estimated with a low level of confidence.	Quantities associated with a known reservoir that can be estimated with a low level of confidence.	
G4	Estimated quantities associated with a potential deposit , based on primary or indirect evidence.	Estimated quantities associated with a potential reservoir , based on primary or indirect evidence.	Undiscovered storage quantities that are estimated during the screening phase. Normally subject to a substantial range of uncertainty as well as a major risk that no injection project may be implemented.

UNFC-2009 Main Classes and Categories

UNFC as Applied to Extractive Industries					
Total Commodity Initially in Place	Extracted	Sales Production			
		Non-sales Production			
		Class	Categories		
			E	F	G
	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 activites	Explration Projects	3	3	4
	Additional quantities in place associated with potential projects		3	4	4

UNFC as Proposed Applied to Injection Projects					
Total Geological Storage	Injected and Stored Quantities				
	Lost Quantities				
		Class	Categories		
			E	F	G
	Future storage by commercial injection projects	Commercial Injection Projects	1	1	1, 2, 3
	Potential future storage in known reservoirs by injection projects	Potentially Commercial Injection Projects	2	2	1, 2, 3
		Non-Commercial Injection Projects	3	2	1, 2, 3
	Storage Not Feasible		3	4	1, 2, 3
	Potential future storage in undiscovered reservoirs by injection projects	Screening Projects	3	3	4
Storage Not Feasible		3	4	4	

Application of UNFC-2009 to Injection Projects

How it could be applied



The Snøhvit long term CO₂ solution project
An example of how the UNFC-2009 could
have been applied as seen by the
presenter

Application of UNFC-2009 to Injection Projects - Example

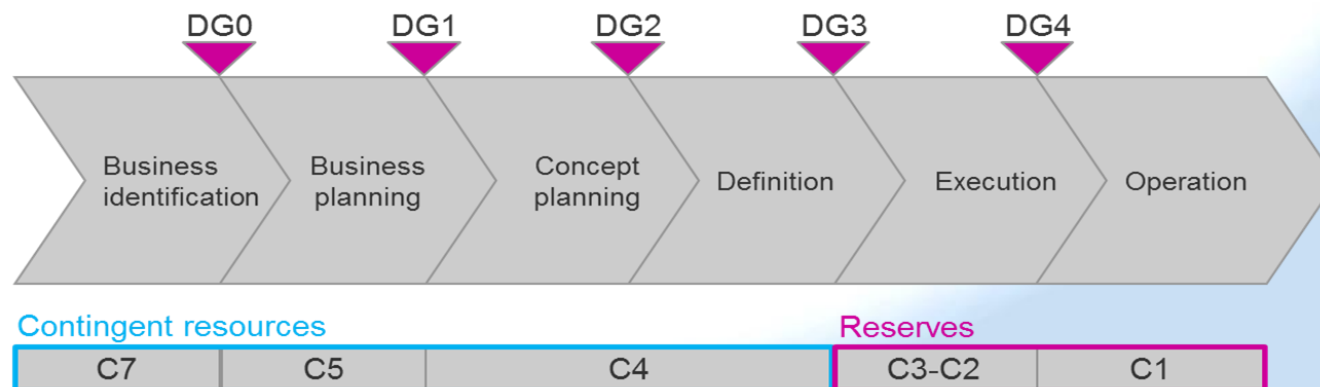
Classifying the *Snøhvit long term CO₂ solution* project

- Snøhvit was the first field development in the Barents Sea offshore Norway
- The Snøhvit Area includes three fields; Snøhvit, Albatross and Askeladd
- All offshore installations are subsea
- The natural gas is transported to shore through a 143 km long pipeline and processed in an LNG plant at Melkøya
- The CO₂ in the feed gas is removed due to freezing constraints in the process system
- To reduce carbon emissions to the air the removed CO₂ is liquefied, transported through a pipeline and injected into a storage reservoir in Snøhvit
- The CO₂ injection started in 2008

Application of UNFC-2009 to Injection Projects - Example

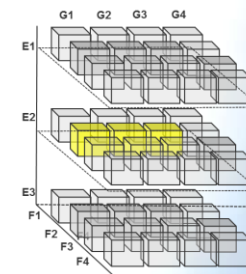
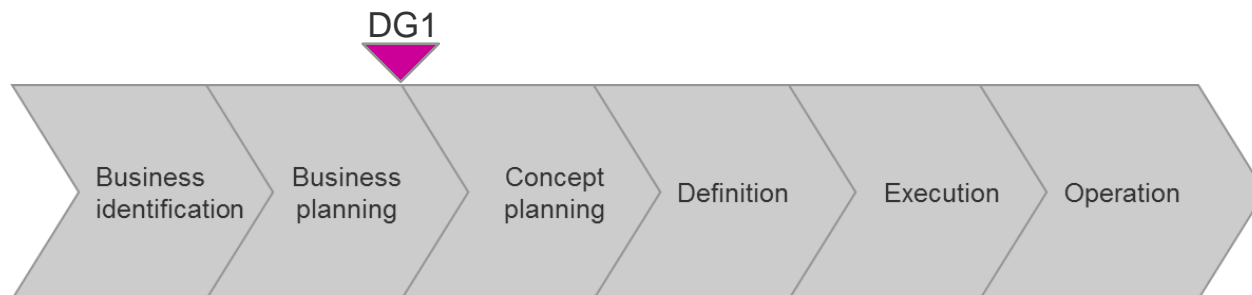
Classifying the *Snøhvit long term CO₂ solution* project

- In 2011 a project was initiated to increase the CO₂ storage capacity at Snøhvit through a second CO₂ injection well, including subsea and pipeline facilities: *Snøhvit long term CO₂ solution*
- The project was decided by the partners in 2013 and approved by the Norwegian authorities in 2014
- The project was run according to Statoil's Capital Value Process (CVP)
- Forecasts of injected volumes are reported to the authorities every year based on the Norwegian classification system



Application of UNFC-2009 to Injection Projects - Example

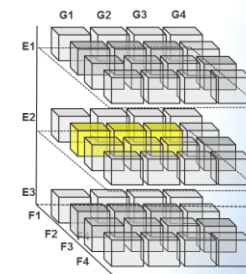
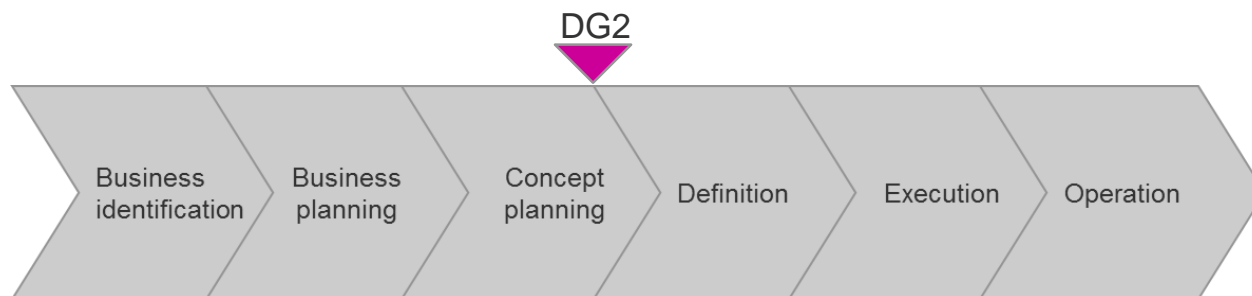
Classifying the *Snøhvit long term CO₂ solution* project



		Norwegian classification			UNFC-2009 as applied to injection projects			
Year	Reporting	Decision gate	Decision stage	Resource class	Sub-class	E	F	G
2011	RNB2012	DG1	Concept planning	C4A	On hold	2	2.2	1, 2, 3

Application of UNFC-2009 to Injection Projects - Example

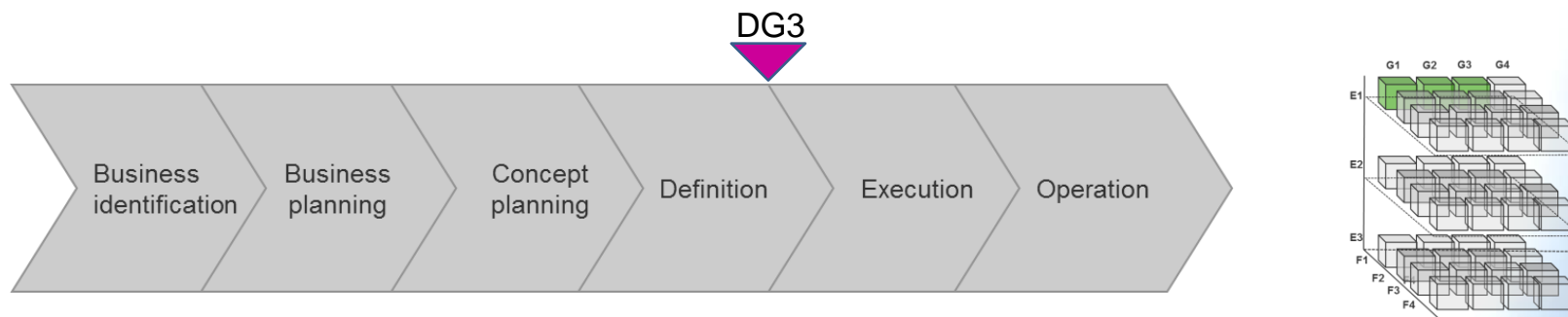
Classifying the *Snøhvit long term CO₂ solution* project



		Norwegian classification			UNFC-2009 as applied to injection projects			
Year	Reporting	Decision gate	Decision stage	Resource class	Sub-class	E	F	G
2011	RNB2012	DG1	Concept planning	C4A	On hold	2	2.2	1, 2, 3
2012	RNB2013	DG2	Definition	C4A	Pending	2	2.1	1, 2, 3

Application of UNFC-2009 to Injection Projects - Example

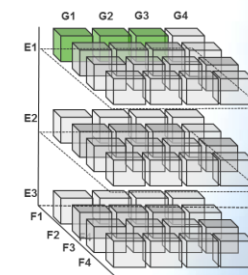
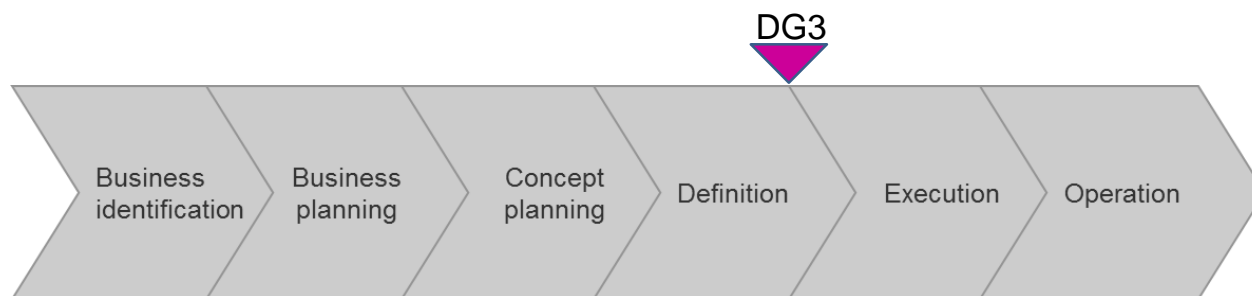
Classifying the *Snøhvit long term CO₂ solution* project



Year	Reporting	Norwegian classification			UNFC-2009 as applied to injection projects			
		Decision gate	Decision stage	Resource class	Sub-class	E	F	G
2011	RNB2012	DG1	Concept planning	C4A	On hold	2	2.2	1, 2, 3
2012	RNB2013	DG2	Definition	C4A	Pending	2	2.1	1, 2, 3
2013	RNB2014	DG3	Execution	C3A	Justified	1	1.3	1, 2, 3

Application of UNFC-2009 to Injection Projects - Example

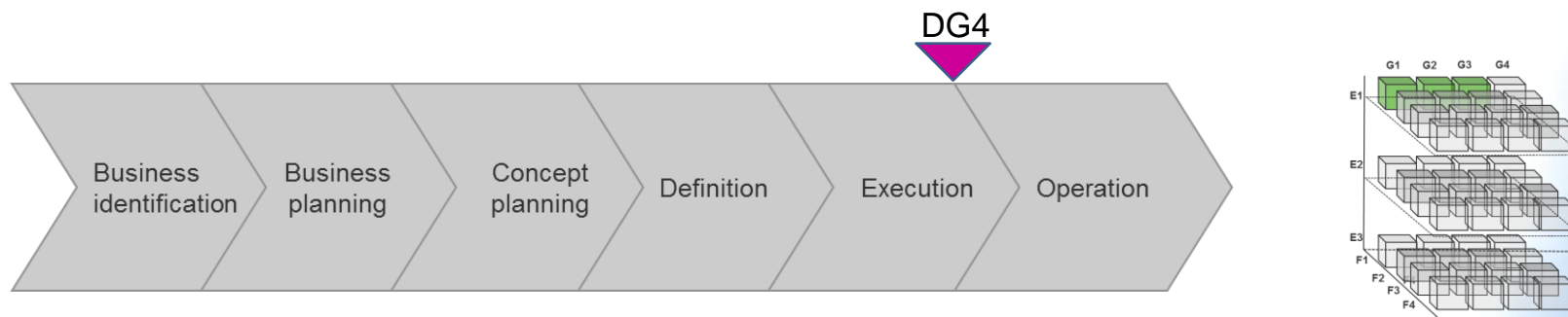
Classifying the *Snøhvit long term CO₂ solution* project



Year	Reporting	Norwegian classification			UNFC-2009 as applied to injection projects			
		Decision gate	Decision stage	Resource class	Sub-class	E	F	G
2011	RNB2012	DG1	Concept planning	C4A	On hold	2	2.2	1, 2, 3
2012	RNB2013	DG2	Definition	C4A	Pending	2	2.1	1, 2, 3
2013	RNB2014	DG3	Execution	C3A	Justified	1	1.3	1, 2, 3
2014	RNB2015	DG3	Execution	C1	Approved	1	1.2	1, 2, 3

Application of UNFC-2009 to Injection Projects - Example

Classifying the *Snøhvit long term CO₂ solution* project



Year	Reporting	Norwegian classification			UNFC-2009 as applied to injection projects			
		Decision gate	Decision stage	Resource class	Sub-class	E	F	G
2011	RNB2012	DG1	Concept planning	C4A	On hold	2	2.2	1, 2, 3
2012	RNB2013	DG2	Definition	C4A	Pending	2	2.1	1, 2, 3
2013	RNB2014	DG3	Execution	C3A	Justified	1	1.3	1, 2, 3
2014	RNB2015	DG3	Execution	C1	Approved	1	1.2	1, 2, 3
2015	RNB2016	DG4	Operation	C1	Active injection	1	1.1	1, 2, 3

What's next?

- Specifications are now endorsed by the Committee on Sustainable Energy and available at the UNFC web site
- Case studies needed to test this further on real projects
- Guide lines yet to be developed
- Ongoing SPE initiative to establish a Storage Resource Managament System (SRMS) based on the PRMS
 - Intention that this system shall be sufficiently aligned with the UNFC-2009 for a bridging document to be possible
 - Currently available fur public comments at the SPE web site (April-May)

Task Force on Application of UNFC-2009 to Injection Projects

Thank you for your attention!

Karin Ask

Statoil

and

Task Force on UNFC-2009 and Injection Projects