

**Karin Ask**

Statoil *and* Task Force on UNFC-2009 and Injection Projects

**Draft Specifications for Application of  
UNFC-2009 to Injection Projects**  
(ECE/ENERGY/GE.3/2015/4)

EGRC 6<sup>th</sup> session 2015, Geneva, 29 April – 1 May 2015



**UNECE**

# Background and Mandate

- **Mandate from 2013**

The Task Force has been asked to investigate how, for example, oil and gas companies classify and evaluate the maturity of their gas injection projects today, and propose a draft bridging document for application of UNFC-2009 to injection projects, in particular to the storage of carbon dioxide.

- **EGRC recommendation from the 5<sup>th</sup> session**

The Expert Group recommended that the Task Force on UNFC and Recipient Reservoirs prepare draft specifications for the use of UNFC-2009 to classify injection projects, in particular for the storage of carbon dioxide, and submit them to the sixth session.

# Task Force Members

- Karin Ask, Statoil
- Michelle S. Bentham, BGS
- Simplicio P. Caluyong, CCOP
- Scott Frailey, ISGS
- Eva Halland, NPD
- Wolf Heidug, KAPSARC
- Martin Hubbig, OMV

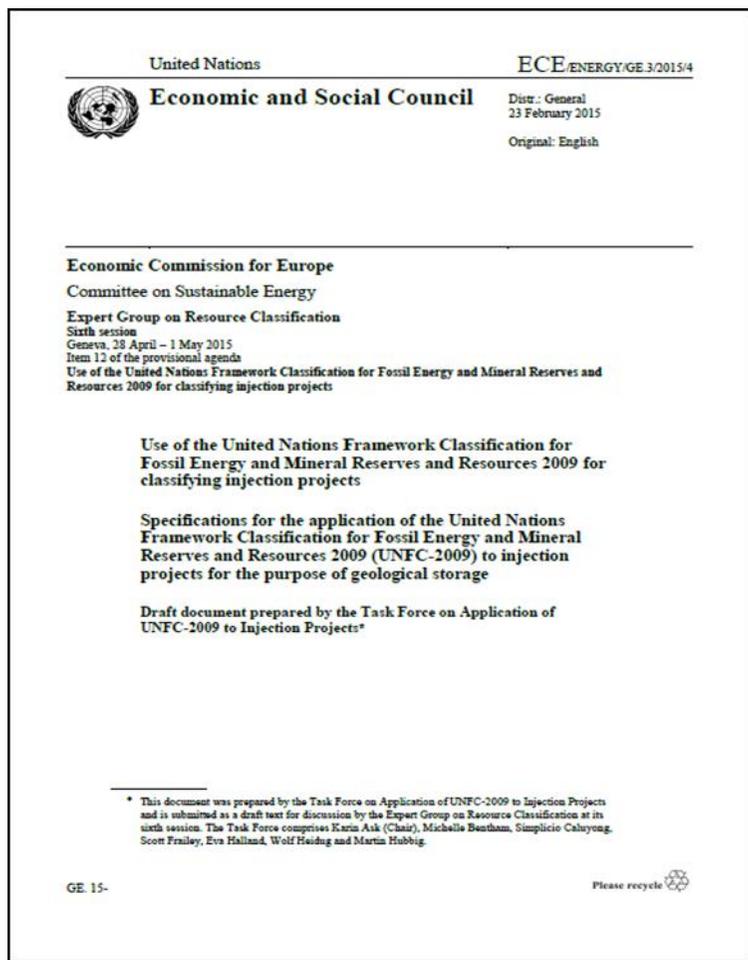
Task Force on Application of UNFC-2009 to Injection Projects

# Summary from EGRC 5th session

At the 5th session in 2014 the Task Force presented:

- Results from a survey on application of resource classification principles to injection projects
- A high level mapping of UNFC-2009 to several other classification systems proposed applied to primarily CO2 storage projects
- An overview of how Carbon Capture and Storage projects listed on the Global CCS Institute's home page could be classified using UNFC-2009
- Proposals for definitions and supporting explanations to the categories and sub-categories in UNFC-2009 as proposed applied to Injection Projects
- A Draft document for discussion on how UNFC-2009 could be applied to Injection Projects based on the high level mapping

# Draft document for discussion at the EGRC 6th session



*Use of the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 for classifying injection projects*

*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*

## Task Force on Application of UNFC-2009 to Injection Projects

# Contents of Document

- I. Introduction
- II. UNFC-2009 as applied to injection projects
  - A. Categories and Sub-categories
  - B. Classes and subclasses
- III. Injection project definitions
  - A. Geological Storage
  - B. Defining the Project
  - C. Storage Potential
  - D. Quantities Stored
  - E. Development Plan
  - F. Project Life Time
  - G. Economic Viability
  - H. Storage Permission
- IV. Definition of categories and sub-categories with supporting explanations
- V. Generic specifications
  - A. Use of numerical codes
  - B. Bridging document
  - C. Effective date
  - D. Commodity or product type
  - E. Basis for estimate
  - F. Reference point
  - G. Classification of projects based on level of maturity
  - H. Distinction between E1, E2 and E3
  - I. Confidence levels for G1, G2 and G3
  - J. Distinction between stored quantities and in situ storage potential
  - K. Aggregation of quantities
  - L. Economic assumptions
  - M. Evaluator qualifications
  - N. Units and conversion factors
  - O. Documentation
  - P. Expansion of G4 to account for uncertainty
  - Q. Optional labels for estimates
  - R. Classification of quantities associated with screening projects
  - S. Classification of additional quantities available for storage
  - T. Quantities delivered for injection and storage that may not be stored

# Important definitions and clarifications

## Injection Projects for the Purpose of Geological Storage:

- Refers mainly to permanent containment of CO<sub>2</sub> in deep subsurface geological formations
- Same principles can be applied also to other projects through which a fluid is stored in a geological formation (such as hydrogen storage, natural gas storage)

## What are we classifying?

- The resource is the available reservoir in which a certain quantity of a given fluid can be stored
- It is not the injected and stored fluid
- In the Draft document the resource is referred to as the *Storage Potential*

# Storage Potential definition

*The Storage Potential of a reservoir is the total amount of a given fluid that could be injected and stored in this reservoir, including amounts that could be dissolved in aquifer water, be trapped by chemical reaction or adsorbed onto the carbon in coal beds...*

- Currently not consensus in the TF on using the term **Storage Potential to describe the resource we are trying to classify**
- Other possible terms:
  - Storage Capacity
  - Storage Space
  - Storage Resource
  - Storage Capability
  - Storage
  - Any other proposals from the EGRC?

# UNFC-2009 Main Classes and Categories

UNFC-2009 Classes Defined by Categories as Applied to Injection Projects for the Purpose of Geological Storage					
<b>Total Storage Potential</b>	Injected and Stored Quantities				
		Class	Categories		
			E	F	G
	Future storage by commercial injection projects	Commercial Injection Projects	1	1	1, 2, 3
	Future storage in known reservoirs by commercial 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

Extracted



Injected and Stored

Total Commodity Initially in Place



Total Storage *Potential*

*Potential* future recovery



Future storage

Commercial Projects



Commercial Injection Projects

Additional quantities in place...



Storage Not Feasible

Exploration Projects



Screening Projects

# UNFC-2009 Sub-Classes and Sub-Categories

UNFC Classes Defined by Categories and Sub-Categories as Applied to Injection Projects for the Purpose of Geological Storage					
Total Storage Potential	Injected and Stored Quantities				
	Class	Sub-class	Categories		
			E	F	G
	Known Reservoir	Commercial Injection Projects	Active Injection	1	1.1
Approved for Development			1	1.2	1, 2, 3
Justified for Development			1	1.3	1, 2, 3
Potentially Commercial Injection Projects		Development Pending	2	2.1	1, 2, 3
		Development on Hold	2	2.2	1, 2, 3
Non-Commercial Injection Projects		Development Unclassified	3.2	2.2	1, 2, 3
		Development not Viable	3.3	2.3	1, 2, 3
Storage Not Feasible		3.3	4	1, 2, 3	
Undiscovered Reservoir	Screening Projects	Storage Potential Identified	3.2	3.1	4
		Storage Potential Indicated	3.2	3.2	4
		Storage Potential Inferred	3.2	3.3	4
	Storage Not Feasible		3.3	4	4



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 has been confirmed to be economically viable.</i>	<b>Injection for the purpose of geological storage</b> has been confirmed to be economically viable <sup>a</sup> .	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 is expected to become economically viable in the foreseeable future.</i>	<b>Injection for the purpose of geological storage</b> 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 is not expected to become economically viable in the foreseeable future, or the evaluation is at too early a stage to determine economic viability.</i>	<b>Injection for the purpose of geological storage</b> 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).

# 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 <b>injection project for the purpose of geological storage</b> 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 <b>injection project for the purpose of geological storage</b> 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 <b>injection project for the purpose of geological storage</b> 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 <b>injection project for the purpose of geological storage</b> 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.

Task Force on Application of UNFC-2009 to Injection Projects

# 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	<i>Quantities associated with a <b>known deposit</b> that can be estimated with a high level of confidence.</i>	Quantities associated with a <b>known reservoir</b> 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	<i>Quantities associated with a <b>known deposit</b> that can be estimated with a moderate level of confidence.</i>	Quantities associated with a <b>known reservoir</b> that can be estimated with a moderate level of confidence.	
G3	<i>Quantities associated with a <b>known deposit</b> that can be estimated with a low level of confidence.</i>	Quantities associated with a <b>known reservoir</b> that can be estimated with a low level of confidence.	
G4	<i>Estimated quantities associated with a <b>potential deposit</b>, based on primary or indirect evidence.</i>	Estimated quantities associated with a <b>potential reservoir</b> , 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.

# Generic specifications - Example

- **F. Reference point**

*The Reference Point is a defined location within an injection operation at which the reported quantities are measured or estimated. The Reference Point may be the custody transfer point from a pipeline operator to a storage site operator, or the last metered quantity prior to injection. The Reference Point shall be disclosed in conjunction with the reported quantities. Where the Reference Point is not the point where custody is transferred to the storage site (or the entity's downstream operations), and such quantities are classified as E1, the information necessary to derive estimated quantities shall also be provided.*

Text in *italics* is identical to original UNFC-2009 specifications

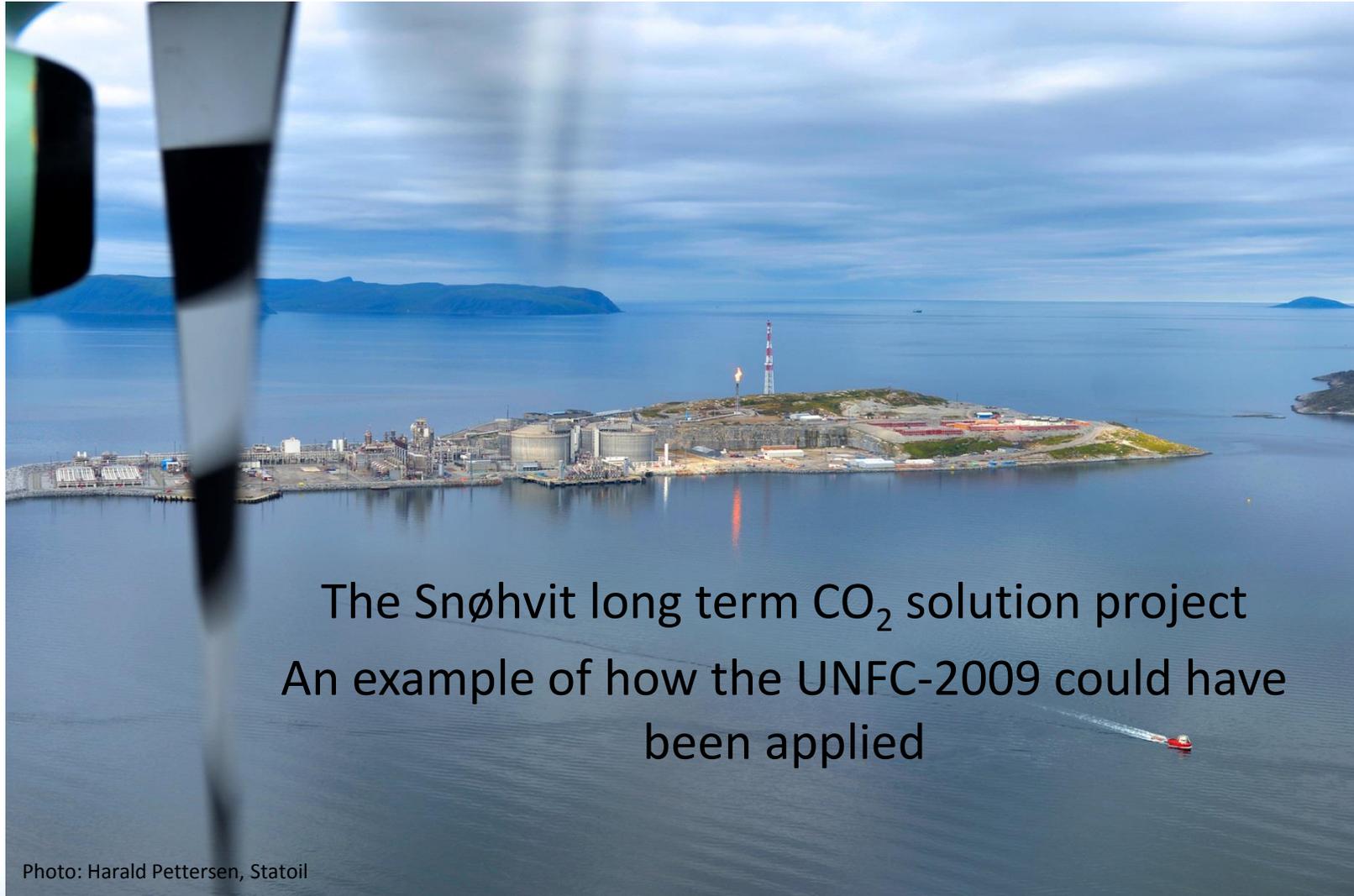
Underlined text has been modified to facilitate application to injection projects

# Summary of work to date and the way forward

- Draft specifications document presented
  - Comments from the EGRC will be most welcome
  - Will be made available for public commenting
- Simple example from Statoil's Snøhvit field used to demonstrate how UNFC-2009 can be applied to a CO<sub>2</sub> storage project
- Document will be updated and improved based on comments received to prepare a Final Draft for approval
- Guide Lines to complement the specifications may be necessary
  - Different kinds of injection and storage projects



## Task Force on Application of UNFC-2009 to Injection Projects



The Snøhvit long term CO<sub>2</sub> solution project  
An example of how the UNFC-2009 could have  
been applied

Photo: Harald Pettersen, Statoil

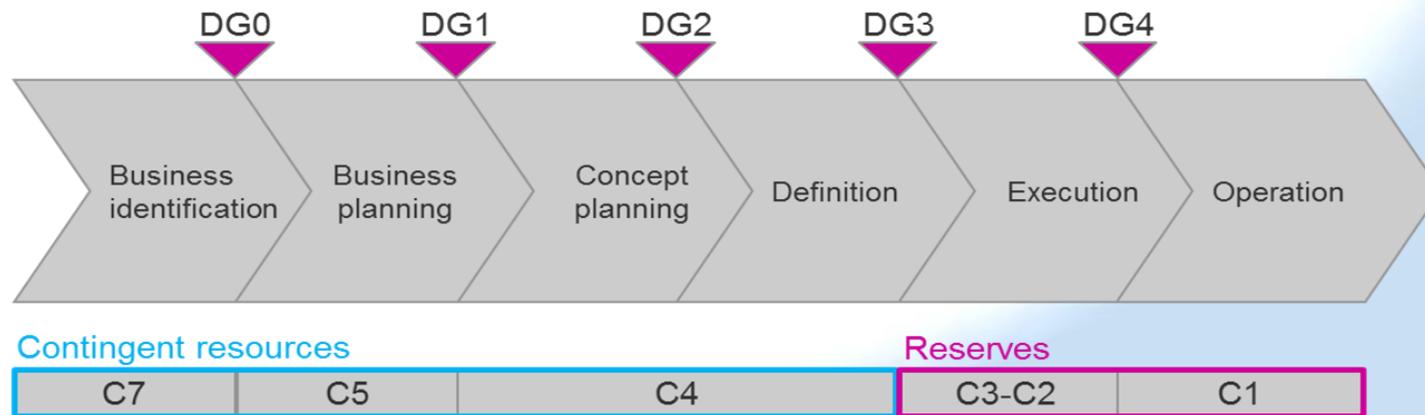


## Example: Classifying the *Snøhvit long term CO<sub>2</sub> solution* project

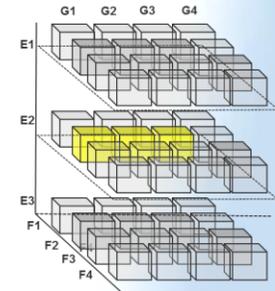
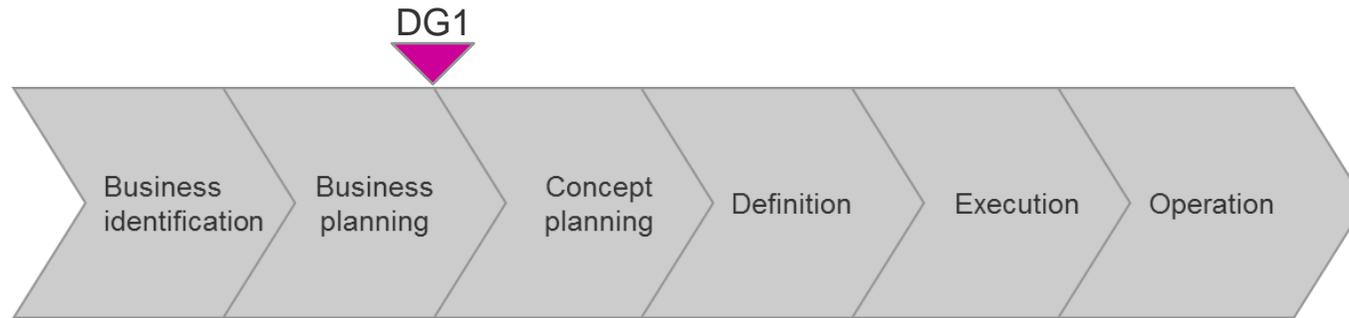
- Snøhvit was the first field development in the Barents Sea offshore Norway
- The Snøhvit Area includes three fields; Snøhvit, Albatross and Askeladd
- All offshore installations are subsea
- The natural gas is transported to shore through a 143 km long pipeline and processed in an LNG plant at Melkøya
- The CO<sub>2</sub> in the feed gas is removed due to freezing constraints in the process system
- To reduce carbon emissions to the air the removed CO<sub>2</sub> is liquified, transported through a pipeline and injected into a storage reservoir in Snøhvit
- The CO<sub>2</sub> injection started in 2008

## Example: Classifying the *Snøhvit long term CO<sub>2</sub> solution* project

- In 2011 a project was initiated to increase the CO<sub>2</sub> storage capacity at Snøhvit through a second CO<sub>2</sub> injection well, including subsea and pipeline facilities: Snøhvit long term CO<sub>2</sub> 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)



# Example: Classifying the *Snøhvit long term CO<sub>2</sub> solution* project

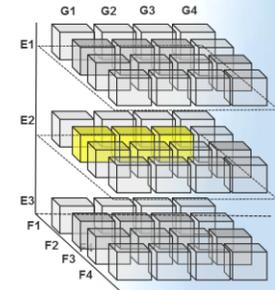
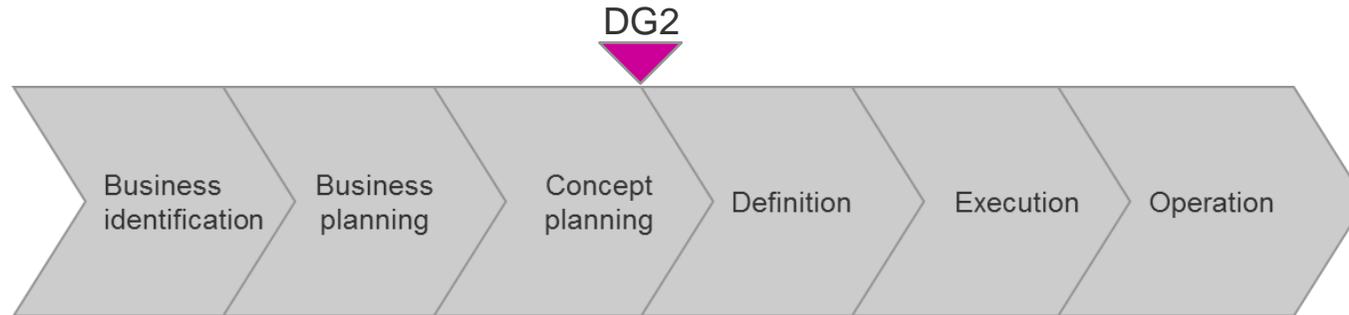


		Norwegian classification			UNFC-2009 as applied to injection projects			
Year	Reporting	Decision gate	Decision stage	Reported in Category	Sub-class	E	F	G
2011	RNB2012	DG1	Concept planning	C4A	On hold	2	2.2	1, 2, 3

Snøhvit base project (for comparison)

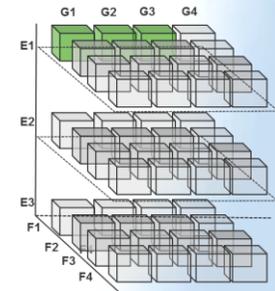
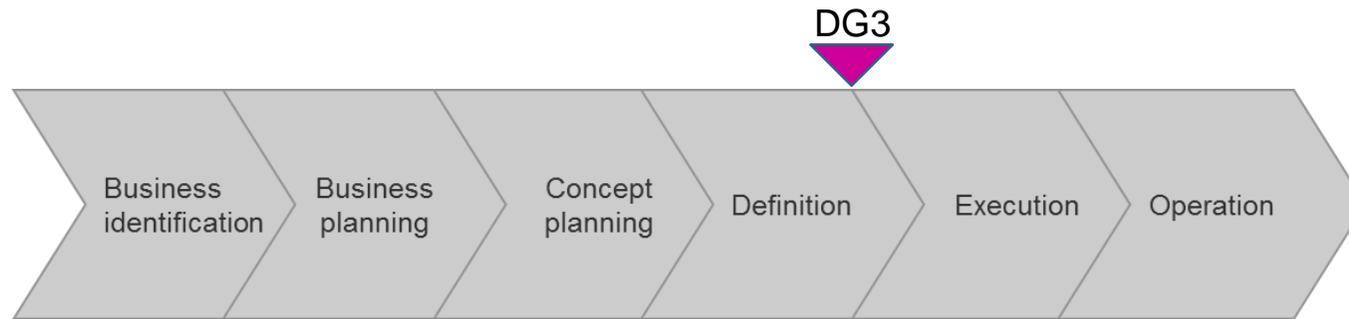
2011	RNB2012	DG4	Operation	C0+1	On production	1	1.1	1, 2, 3
------	---------	-----	-----------	------	---------------	---	-----	---------

# Example: Classifying the *Snøhvit long term CO<sub>2</sub> solution* project



Year	Reporting	Norwegian classification			UNFC-2009 as applied to injection projects			
		Decision gate	Decision stage	Reported in Category	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

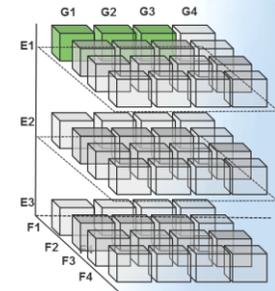
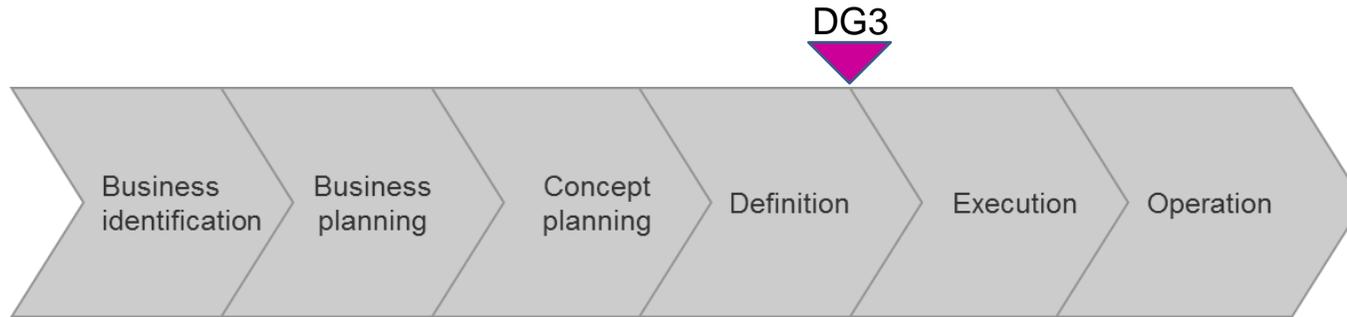
# Example: Classifying the *Snøhvit long term CO<sub>2</sub> solution* project



Year	Reporting	Norwegian classification			UNFC-2009 as applied to injection projects			
		Decision gate	Decision stage	Reported in Category	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

Task Force on Application of UNFC-2009 to Injection Projects

# Example: Classifying the *Snøhvit long term CO<sub>2</sub> solution* project



Year	Reporting	Norwegian classification			UNFC-2009 as applied to injection projects			
		Decision gate	Decision stage	Reported in Category	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	C0+1	Approved	1	1.2	1, 2, 3

## Task Force on Application of UNFC-2009 to Injection Projects

Thank you for your attention!

