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Application of the UNFC to Injection Projects

Current status and vision for the future

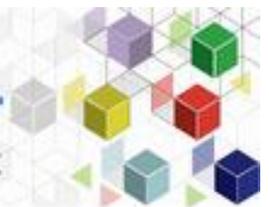
Karin Ask
Equinor

Resource Management Week 2019

RESOURCES FOR SUSTAINABLE DEVELOPMENT

10th Session of the Expert Group on Resource Management

29 April – 3 May 2019, Palais des Nations, Geneva



Application of the UNFC to Injection Projects

Outline



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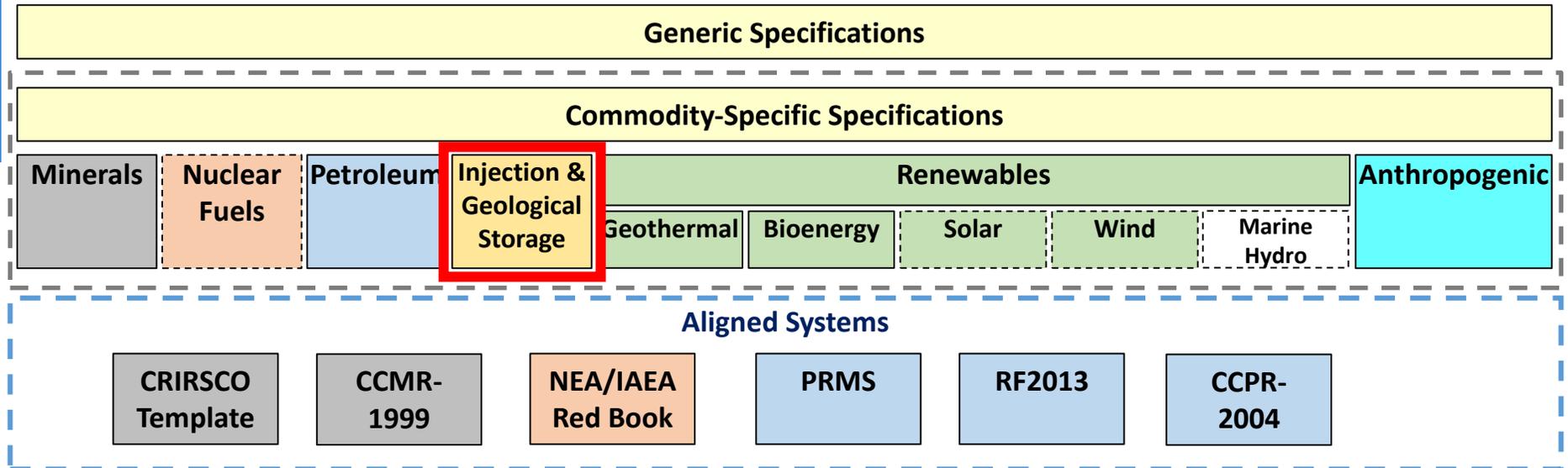
- Introduction
- Working Group membership
- Previously presented examples and case studies
- Current status of application
- What will it take to move us forward?
- Mapping UNFC for Injection Projects to the SPE-SRMS

Application of the UNFC to Injection Projects

Introduction



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- Injection projects related to geological storage of carbon dioxide (CO₂).
- Other injection projects where a fluid is injected into a subsurface geological formation for storage, for example natural gas.

Application of the UNFC to Injection Projects

Working Group members 2018/2019



UNEP

Karin Ask, Equinor

Michelle S. Bentham, BGS

Maren Bjørheim, NPD

Simplicio P. Caluyong, CCOP

Scott Frailey, ISGS

Wolf Heidug, KAPSARC

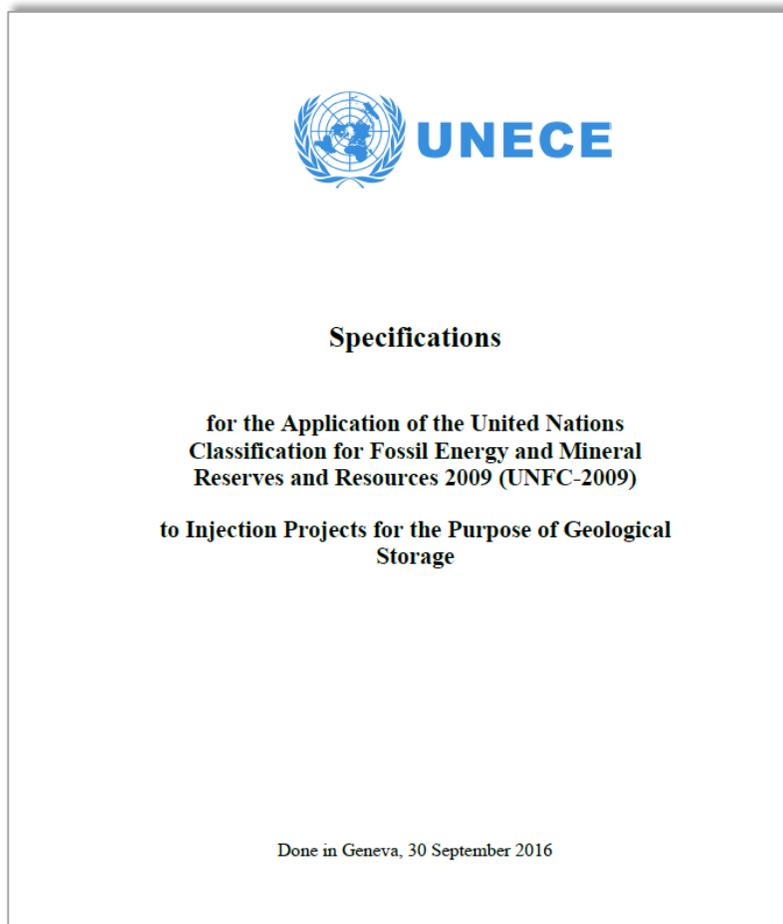
Martin Hubbig, OMV

Kris Piessens, Royal Belgian Institute of Natural Sciences

Lesley R. Seldon, Shell

Application of the UNFC to Injection Projects

Specifications document



- 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* has been available on the UNECE web site since 2016

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

- No new activity in the working group since last year

Application of the UNFC to Injection Projects

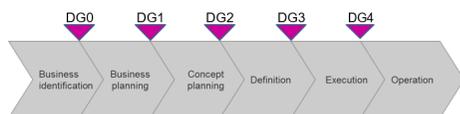
Examples of possible application presented before



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Application of UNFC to Injection Projects - Example 1

Classifying the *Snøhvit* long term CO₂ solution project

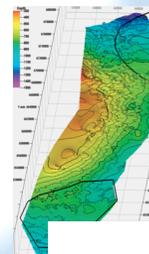


Year	Reporting	Norwegian classification / Statoil CVP			UNFC as applied to injection projects			
		Decision gate	Decision stage	Resource class	Sub-class	E	F	G
2011	RNB2012	DG1	Concept planning	C4A	On hold	2	2.2	1, 2, 3
2012	RNB2013	DG2	Definition	C4A	Pending	2	2.1	1, 2, 3
2013	RNB2014	DG3	Execution	C3A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

Application of UNFC to Injection Projects - Example 2

The *Utsira* Formation - Norwegian North Sea

- Statoil and our partners are currently injecting and storing CO₂ at the Sleipner field in the southern North Sea
- Feasibility study of full scale CO₂ storage offshore Norway performed in 2016 where a structure in the Utsira Formation was one possible storage site evaluated
- NPD Storage Atlas
- Various studies and publications exist
- *Is all of the Utsira Formation a discovered storage resource?*



Project or activity	UNFC as applied to injection projects				
	Sub-class	E	F	G	Estimated quantity
Sleipner CO ₂ storage	Active Injection	1	1.1	1+2	~1Mt pa
Feasibility Study – Sæter structure	Development On hold	2	2.2	1	15-18 Mt
NPD Storage Atlas	Geological Storage Identified	3.2	3	4	0,5-1,5 Gt
Various studies and publications	Storage not feasible	3.3	4	4	16-170 Gt

Application of UNFC to Injection Projects - Example 3
EIA Storage Plan – Possible application of the UNFC

From EIA Storage Plan		Possible UNFC Classification			
Project Name	Development Status	E	F	Total Capacity (G1+G2) (Bcf)	Working Capacity (G1+G2) (Bcf)
Bobcat Gas Storage Cavern 3	Terminated	F3.3	F2.3	12	10
Crowville Salt Dome Project Cavern 2	Operational	E1.1	F1.1	4	-
East Cheyenne Phase 2: Lewis Creek Field	Construction	E1.1	F1.2	12	7
Golden Triangle Storage Cavern 3	Planned	E2	F2.1	11	7
Golden Triangle Storage Cavern 4	Planned	E2	F2.1	11	7
Aliso Canyon Expansion	On Hold	E2	F2.2	-	-
D'Lo Gas Storage Cavern 1	On Hold	E2	F2.2	-	8
D'Lo Gas Storage Cavern 1	On Hold	E2	F2.2	-	8
D'Lo Gas Storage Cavern 2	On Hold	E2	F2.2	-	8
D'Lo Gas Storage Cavern 2	On Hold	E2	F2.2	-	8
D'Lo Gas Storage Cavern 3	Planned	E2	F2.1	-	8
Magnum Gas Storage Project 1	Planned	E2	F2.1	3	-
Magnum Gas Storage Project 2	On Hold	E2	F2.2	3	-
Magnum Gas Storage Project 3	On Hold	E2	F2.2	3	-
Magnum Gas Storage Project 4	On Hold	E2	F2.2	3	-
Mist Storage Expansion Project	Construction	E1.1	F1.2	0	4
Beneca Lake Gallery 2 Expansion	Terminated	F3.3	F2.3	0	1

Note that this is one possible outcome as seen by the presenter and based on very limited information. The intention is simply to illustrate how the UNFC can be applied.



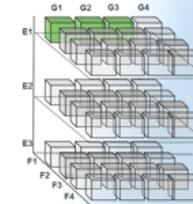
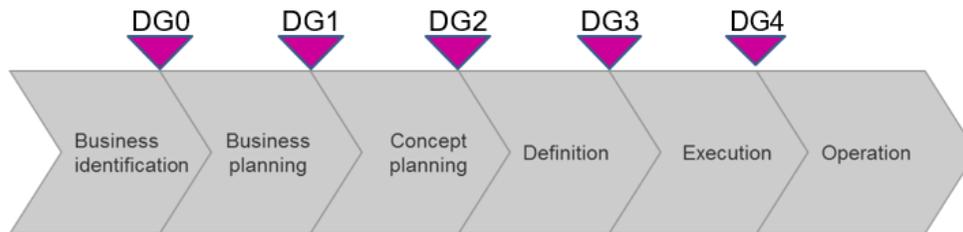
Application of the UNFC to Injection Projects

Examples of possible application presented before



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Application of UNFC to Injection Projects - Example 1 Classifying the *Snøhvit* long term CO₂ solution project



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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

Project maturation ↓

Injection Projects - Example 3
Possible application of the UNFC

Possible UNFC Classification			
E	F	Total Capacity (Gt+G2 (Bt))	Working Capacity (G1+G2 (Bt))
F3.3	F2.3	12	10
E1.1	F1.1	4	-
E1.1	F1.2	12	7
E2	F2.1	11	7
E2	F2.1	11	7
E2	F2.2	-	-
E2	F2.2	-	8
E2	F2.2	-	8
E2	F2.2	-	8
E2	F2.2	-	8
E2	F2.1	-	8
E2	F2.1	3	-
E2	F2.2	3	-
E2	F2.2	3	-
E2	F2.2	3	-
E1.1	F1.2	0	4
F3.3	F2.3	0	1



Prepared and based on very limited information. UNFC can be applied.



Application of the UNFC to Injection Projects

Examples of possible application presented before



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Application of UNFC to Injection Projects - Example 2

The Utsira Formation - Norwegian North Sea

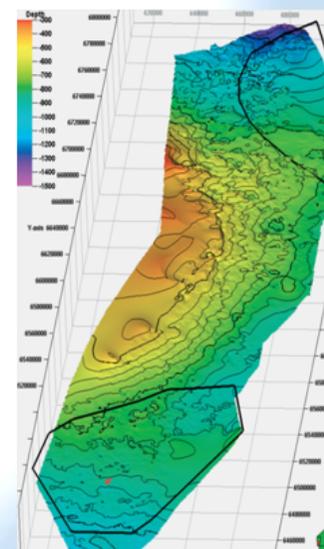
Apj
Classifyin

DG

Business
identification

Year	Reporting
2011	RNB2012
2012	RNB2013
2013	RNB2014
2014	RNB2015
2015	RNB2016

- Statoil and our partners are currently injecting and storing CO₂ at the Sleipner field in the southern North Sea
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Feasibility Study – <u>Sæter</u> structure	Development On hold	2	2.2	1	15-18 Mt
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Various studies and publications	Storage not feasible	3.3	4	4	16-170 Gt



Example 3
of the UNFC

Working Capacity Gt+G2 (Bd)
10
-
7
7
7
-
8
8
8
8
-
-
4
1

Note that this is one possible outcome as seen by the presenter and based on very limited information. The intention is simply to illustrate how the UNFC can be applied.



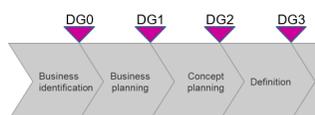
Application of the UNFC to Injection Projects

Examples of possible application presented before



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Application of UNFC to Injection
Classifying the *Snøhvit long term*



Year	Reporting	Norwegian classification / Statoil CVP		
		Decision gate	Decision stage	Resource class
2011	RNB2012	DG1	Concept planning	C4A
2012	RNB2013	DG2	Definition	C4A
2013	RNB2014	DG3	Execution	C3A
2014	RNB2015	DG3	Execution	C1
2015	RNB2016	DG4	Operation	C1

Application of UNFC to Injection Projects - Example 3 EIA Storage Plan – Possible application of the UNFC

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Project Name	Development Status	E	F	Total Capacity G1+G2 (Bcf)	Working Capacity G1+G2 (Bcf)
Bobcat Gas Storage Cavern 3	Terminated	F3.3	F2.3	12	10
Crowville Salt Dome Project Cavern 2	Operational	E1.1	F1.1	4	-
East Cheyenne Phase 2: Lewis Creek Field	Construction	E1.1	F1.2	12	7
Golden Triangle Storage Cavern 3	Planned	E2	F2.1	11	7
Golden Triangle Storage Cavern 4	Planned	E2	F2.1	11	7
Aliso Canyon Expansion	On Hold	E2	F2.2	-	-
D'Lo Gas Storage Cavern 1	On Hold	E2	F2.2	-	8
D'Lo Gas Storage Cavern 1	On Hold	E2	F2.2	-	8
D'Lo Gas Storage Cavern 2	On Hold	E2	F2.2	-	8
D'Lo Gas Storage Cavern 2	On Hold	E2	F2.2	-	8
D'Lo Gas Storage Cavern 3	Planned	E2	F2.1	-	8
Magnum Gas Storage Project 1	Planned	E2	F2.1	3	-
Magnum Gas Storage Project 2	On Hold	E2	F2.2	3	-
Magnum Gas Storage Project 3	On Hold	E2	F2.2	3	-
Magnum Gas Storage Project 4	On Hold	E2	F2.2	3	-
Mist Storage Expansion Project	Construction	E1.1	F1.2	0	4
Seneca Lake Gallery 2 Expansion	Terminated	F3.3	F2.3	0	1

Note that this is one possible outcome as seen by the presenter and based on very limited information. The intention is simply to illustrate how the UNFC can be applied.

Application of the UNFC to Injection Projects

Current status of application



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- The Specifications have been available for some time
- Case studies are so far limited to what has been presented in this forum
- To our knowledge there are no other examples of actual application to injection projects
 - Is UNFC sufficiently known to stakeholders?
 - Limited number of applications also for other commodities
 - If an entity or state is not using UNFC for other commodities, why use it for CCS or Natural Gas Storage?
 - Or is it simply too early?
 - Few examples of portfolios with several storage projects – with one or just a few projects the need for any classification may be limited (at least for CCS)
 - Few or no regulators or regulatory requirements for reporting

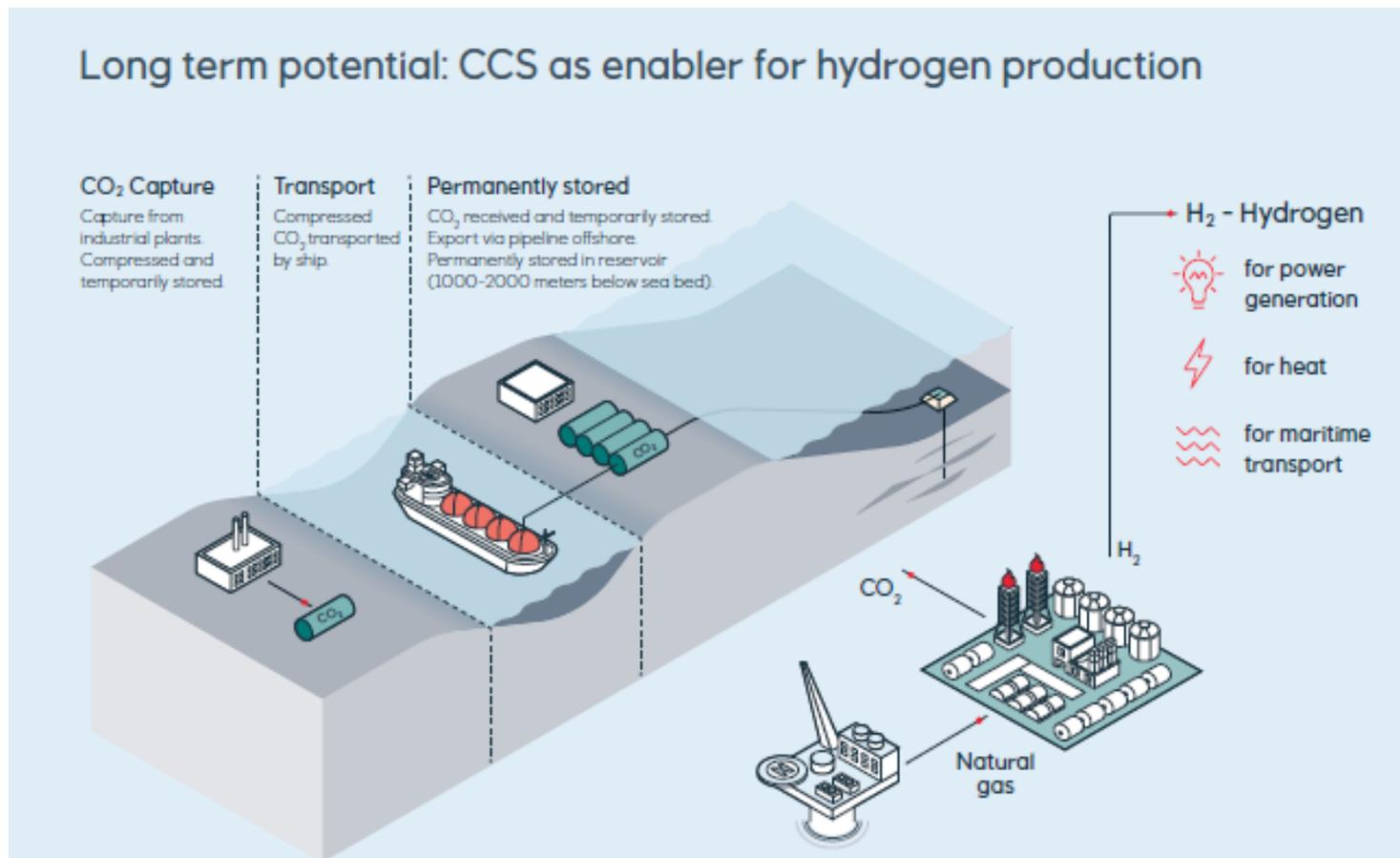
Application of the UNFC to Injection Projects

CCS as an integrated part of an energy generation project



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- Ongoing and future development and promotion of the UNFC and development of a UNRMS is a step in the right direction



Application of the UNFC to Injection Projects

So what will it take?



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- Ongoing and future development and promotion of the UNFC and development of a UNRMS is a step in the right direction
 - Consolidate current developments, making UNFC more suitable for all resources to which it applies
 - Continue to develop and publish case studies including studies across commodities to show the advantage of one integrated system
 - Ensure alignment with other systems. For Injection Projects, possible alignment with the SPE Storage Resource Management System (SPE-SRMS) is an important next step

Application of the UNFC to Injection Projects

Mapping the UNFC to the SPE-SRMS



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- SPE-SRMS: Storage Resource Management System

- Published in 2017, work on guidelines for its application is ongoing
 - Only applicable to CO₂ storage in saline aquifers and abandoned oil and gas reservoirs
- Both working groups are interested in mapping the two systems
- Illustration below is from an ongoing attempt by the presenter to evaluate similarities and differences

UNFC Classes Defined by Categories and Sub-Categories as Applied to Injection Projects for the Purpose of Geological Storage						SPE-SRMS												
Injection and Stored Quantities																		
Class	Sub-Class	Sub-Categories			Sub-Categories	Sub-Categories	Sub-Categories	Sub-Categories	Sub-Categories	Sub-Categories	Sub-Categories	Sub-Categories	Sub-Categories	Sub-Categories	Sub-Categories	Sub-Categories	Sub-Categories	Sub-Categories
		A	B	C														
Commercial Injection Projects	Approved for Development	1	1.1	1.1.1	1.1.1.1	1.1.1.1.1	1.1.1.1.1.1	1.1.1.1.1.1.1	1.1.1.1.1.1.1.1	1.1.1.1.1.1.1.1.1	1.1.1.1.1.1.1.1.1.1	1.1.1.1.1.1.1.1.1.1.1	1.1.1.1.1.1.1.1.1.1.1.1	1.1.1.1.1.1.1.1.1.1.1.1.1	1.1.1.1.1.1.1.1.1.1.1.1.1.1	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1	
	Justified for Development	1	1.1	1.1.2	1.1.2.1	1.1.2.1.1	1.1.2.1.1.1	1.1.2.1.1.1.1	1.1.2.1.1.1.1.1	1.1.2.1.1.1.1.1.1	1.1.2.1.1.1.1.1.1.1	1.1.2.1.1.1.1.1.1.1.1	1.1.2.1.1.1.1.1.1.1.1.1	1.1.2.1.1.1.1.1.1.1.1.1.1	1.1.2.1.1.1.1.1.1.1.1.1.1.1	1.1.2.1.1.1.1.1.1.1.1.1.1.1.1		
	Development Pending	2	2.1	2.1.1	2.1.1.1	2.1.1.1.1	2.1.1.1.1.1	2.1.1.1.1.1.1	2.1.1.1.1.1.1.1	2.1.1.1.1.1.1.1.1	2.1.1.1.1.1.1.1.1.1	2.1.1.1.1.1.1.1.1.1.1	2.1.1.1.1.1.1.1.1.1.1.1	2.1.1.1.1.1.1.1.1.1.1.1.1	2.1.1.1.1.1.1.1.1.1.1.1.1.1	2.1.1.1.1.1.1.1.1.1.1.1.1.1.1		
	Development on Hold	3	3.1	3.1.1	3.1.1.1	3.1.1.1.1	3.1.1.1.1.1	3.1.1.1.1.1.1	3.1.1.1.1.1.1.1	3.1.1.1.1.1.1.1.1	3.1.1.1.1.1.1.1.1.1	3.1.1.1.1.1.1.1.1.1.1	3.1.1.1.1.1.1.1.1.1.1.1	3.1.1.1.1.1.1.1.1.1.1.1.1	3.1.1.1.1.1.1.1.1.1.1.1.1.1	3.1.1.1.1.1.1.1.1.1.1.1.1.1.1		
Non-Commercial Injection Projects	Development not Viable	3	3.1	3.1.2	3.1.2.1	3.1.2.1.1	3.1.2.1.1.1	3.1.2.1.1.1.1	3.1.2.1.1.1.1.1	3.1.2.1.1.1.1.1.1	3.1.2.1.1.1.1.1.1.1	3.1.2.1.1.1.1.1.1.1.1	3.1.2.1.1.1.1.1.1.1.1.1	3.1.2.1.1.1.1.1.1.1.1.1.1	3.1.2.1.1.1.1.1.1.1.1.1.1.1	3.1.2.1.1.1.1.1.1.1.1.1.1.1.1		
	Storage Not Feasible	3	3	4	4.1	4.1.1	4.1.1.1	4.1.1.1.1	4.1.1.1.1.1	4.1.1.1.1.1.1	4.1.1.1.1.1.1.1	4.1.1.1.1.1.1.1.1	4.1.1.1.1.1.1.1.1.1	4.1.1.1.1.1.1.1.1.1.1	4.1.1.1.1.1.1.1.1.1.1.1	4.1.1.1.1.1.1.1.1.1.1.1.1		
Screening Projects	Geological Storage Identified	3	3.1	3.1	3.1.1	3.1.1.1	3.1.1.1.1	3.1.1.1.1.1	3.1.1.1.1.1.1	3.1.1.1.1.1.1.1	3.1.1.1.1.1.1.1.1	3.1.1.1.1.1.1.1.1.1	3.1.1.1.1.1.1.1.1.1.1	3.1.1.1.1.1.1.1.1.1.1.1	3.1.1.1.1.1.1.1.1.1.1.1.1	3.1.1.1.1.1.1.1.1.1.1.1.1.1		
	Geological Storage Informal	3	3.1	3.1	3.1.2	3.1.2.1	3.1.2.1.1	3.1.2.1.1.1	3.1.2.1.1.1.1	3.1.2.1.1.1.1.1	3.1.2.1.1.1.1.1.1	3.1.2.1.1.1.1.1.1.1	3.1.2.1.1.1.1.1.1.1.1	3.1.2.1.1.1.1.1.1.1.1.1	3.1.2.1.1.1.1.1.1.1.1.1.1	3.1.2.1.1.1.1.1.1.1.1.1.1.1		
Storage Not Feasible	Geological Storage Informal	3	3	4	4.1	4.1.1	4.1.1.1	4.1.1.1.1	4.1.1.1.1.1	4.1.1.1.1.1.1	4.1.1.1.1.1.1.1	4.1.1.1.1.1.1.1.1	4.1.1.1.1.1.1.1.1.1	4.1.1.1.1.1.1.1.1.1.1	4.1.1.1.1.1.1.1.1.1.1.1	4.1.1.1.1.1.1.1.1.1.1.1.1		
	Geological Storage Identified	3	3	4	4.2	4.2.1	4.2.1.1	4.2.1.1.1	4.2.1.1.1.1	4.2.1.1.1.1.1	4.2.1.1.1.1.1.1	4.2.1.1.1.1.1.1.1	4.2.1.1.1.1.1.1.1.1	4.2.1.1.1.1.1.1.1.1.1	4.2.1.1.1.1.1.1.1.1.1.1	4.2.1.1.1.1.1.1.1.1.1.1.1		



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Thank you

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Resource Management Week 2019

RESOURCES FOR SUSTAINABLE DEVELOPMENT

10th Session of the Expert Group on Resource Management

29 April – 3 May 2019, Palais des Nations, Geneva

