Carbon Sequestration Leadership Forum
www.cslforum.org

CSLF-T-2010-11
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TECHNICAL GROUP

Update of
CSLF Project Submission Form

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UPDATE OF CSLF PROJECT SUBMISSION FORM

Note by the Secretariat

Background

The CSLF Project Submission Form was previously updated at the March 2010 CSLF Technical Group Meeting in Pau, France. The major change in that previous update was the addition of a Gaps Analysis Checklist. In the interval since the Pau meeting, the new Technical Group Task Force on Assessing Progress in Closing the Gaps has identified many new gaps and suggested wording changes in many of the existing gaps. In particular, the Storage Technologies section of the Gaps Analysis Checklist has undergone major modifications and has been merged with the Monitoring Technologies section. This paper presents a draft of the updated Project Submission Form, with proposed changes to the Gaps Analysis Checklist highlighted in yellow.

Action Requested

The Technical Group is requested to review and approve the updated CSLF Project Submission Form.

CSLF PROJECT SUBMISSION FORM

PROJECT TITLE:

PROJECT LOCATION:
Please provide the city (or nearest town), the state/province/region, and the country.

PROJECT GOAL:
Please provide a simple and to-the-point explanation in one or two sentences that can be easily understood by someone with no prior knowledge of the project.

PROJECT OBJECTIVES AND ANTICIPATED OUTCOMES:
Please provide a breakdown of the Project Goal into the constituent steps comprising the whole. Use bullet points to separate the steps and indicate key anticipated outcomes. Indicate what the project does to facilitate CCS deployment.

PROJECT DESCRIPTION AND RELEVANCE (non-technical):
Please provide a concise synopsis of the project (who, what, why, where and how) with easily understandable descriptions of the associated science, technology, and goals. This should include an indication of areas of industrial application and relevance. Target audience: policy makers, press, non-scientific community.

PROJECT DESCRIPTION (technical):
Please provide a more detailed technical description of the project with all significant information. Target audience: engineers and scientists.

PROJECT ELEMENTS:
Please check all that apply.
Pre-combustion CO_2 Capture ____
Post-combustion CO_2 Capture ____
Oxyfuel Combustion ____
CO_2 Capture by Other Means (please describe):
CO_2 Transport ____
CO_2 Storage with Enhanced Oil Recovery ____
CO_2 Storage with Enhanced Coal Bed Methane Recovery ____
CO_2 Storage with Enhanced Natural Gas Recovery ____
CO_2 Storage with No Resource Recovery ____
CO_2 Measurement, Monitoring, and Verification of Storage (MMV) ____
Identification of Potential CO_2 Storage Sites ____
Identification of Target CO_2 Sources ____
Economic Evaluation ____
Environmental Evaluation ____
Risk Assessment (HSE) ____
Risk Assessment (Financial) ____

Other (please describe):

PROJECT TIMELINE:

Please provide the project start date, any milestone events (listed chronologically), and the end date. Use most realistic timeline available. Use official (contract signing, etc.) start date. End date should reflect contractual timeline if possible. Use bullet points.

> Please also provide answers to the following questions:
> *Has the project already progressed through the early phases of planning, such as (but not exclusively) documenting the project scope, outputs and outcomes?* _______
>
> *Has the project management identified the magnitude of resource requirements sufficient to achieve the major milestones of the project?* _______
>
> *Has the project management identified funding sources for the project?* _______

INFORMATION AVAILABILITY:

Please provide a description of the types of information that will made available from the project and the outcomes that would be achieved by the project. Please also provide information about the relevance of the project to the overall aims of the CSLF and to carbon capture and storage technology in general.

> Please also provide answers to the following questions:
> *Is the project management willing to share non-proprietary project information with other CSLF Members?* _______
>
> *Will the expected information from the project be sufficient to allow others to make informed estimates of the technology's potential technical performance, costs, and benefits for any future applications?* _______
>
> *Will English-language project summaries be available for posting at the CSLF website?* _______ *(Please also provide details on how, and how often, these summaries and other project information will be made available.)*

RELEVANCE TO CSLF GAPS ANALYSIS:

Please check items that apply in the Attachment.

PROJECT CONTACTS:

Please provide name and contact information (including telephone and e-mail) for the project manager or coordinator. If relevant, please also provide name and contact information (including telephone and e-mail) for the person who will handle any requests for site visits.

> Please also provide an answer to the following question:
> *What restrictions, issues, or costs will be assumed by any visitors to the project site?*

OTHER PROJECT PARTICIPANTS:

Please provide a listing of all entities who are participating in this project. If available, please also include a management structure diagram or otherwise indicate the role of each participating entity.

PROJECT WEBSITES:

Please provide the web address of the main project website, if one exists. If available, please also provide the web addresses of other project-related websites such as workshops, project presentations, etc.

PROJECT NOMINATORS:

In order to formalize and document the relationship with the CSLF, the project representative and at least two CSLF Members nominating the project must sign the Project Submission Form specifying that relationship before the project can be considered.

____

Project Representative
(Affiliation)

______________________________	______________________________
CSLF Delegate	CSLF Delegate
(CSLF Member)	(CSLF Member)

CSLF Gaps Analysis Checklist

(Please check all of the following technology areas that your project will address.)

CAPTURE TECHNOLOGIES

Post-Combustion Capture	
Optimise capture systems	
Improved solvent systems	
Power plant concepts to integrate CO_2 capture	
CO_2 capture pilot plant	
Fully integrated demonstration plant	
Develop better solvents	
Optimise capture process systems to reduce power stations energy loss and environmental impact	
Advance organic / inorganic non-precipitation absorption systems	
Identify advantages and limitations of precipitating systems (e.g., carbonates)	
Develop better understanding of the assessment of environmental impacts of capture technologies	
Pre-Combustion Capture	
Hydrogen-rich turbines	
Improved air separation processes	
Improved water-gas shift	
Improved H_2/CO_2 separation	
Power plant concepts to integrate CO_2 capture	
Polygeneration optimization	
Advance integration and optimization of components for power station applications	
Coal and liquid petroleum gasification, natural gas reformer, syngas cooler	
Improve CO_2 separation and capture technologies	
Develop high efficiency and low emission H2 gas turbines	
Fully integrated demonstration plant	
Oxyfuel Combustion	
Boiler design	
Improved air separation processes	
Oxy-fuel gas turbines	
Combustion science	
Power plant concepts to integrate CO_2 capture	
CO_2 capture pilot plant	
Fully integrated demonstration plant	
High temperature turbines	
CO_2/N_2 separation technology for industrial processes	
Research into material selections	
Cryogenic air separation	

CSLF Gaps Analysis Checklist

(Please check all of the following technology areas that your project will address.)

CAPTURE TECHNOLOGIES

Industrial Applications	
Capture from non-power industrial processes	
Emerging and New Concepts for CO_2 capture	
Research into Post-combustion carbonate looping cycles	
Research into Gas separation membranes and adsorption processes for CO_2	
Research into Ion-transport membranes for O_2 separation	
Research into Chemical looping	
Generation Efficiency	
Support initiatives to improve efficiency of electricity generation plant	
Develop high efficiency gas turbines and support new cycle concepts	
Develop alternative power generation processes that have the potential to produce improved economics when paired with absorption capture	

CSLF Gaps Analysis Checklist

(Please check all of the following technology areas that your project will address.)

STORAGE AND MONITORING TECHNOLOGIES

The following abbreviations are used in the Storage Technologies section:

- DSF: deep saline formations
- DOGR: depleted oil and gas reservoirs
- EOR, EGR, ECBM: enhanced oil recovery, enhanced gas recovery and enhanced coalbed methane recovery, respectively
- UCS: unmineable coal seams
- OGF: other geological formations
- MC: mineral carbonation

If no abbreviation is used to specify the type of storage unit, it means that the respective gap applies to all categories.

Storage Site Characterization and Capacity Assessment	
Improve coefficients for storage capacity efficiency considering the wide range of in-situ conditions likely to be encountered in various geological settings, using knowledge gained from existing projects and from numerical simulations, including probabilistic methods	
Develop a robust storage capacity classification system and consistent methodology for storage capacity estimation that will inform industry, policymakers and the tenure and permitting/regulatory authorities	
Produce digitally-based national, regional and worldwide atlases of CO_2 storage capacity, including both quantitative and qualitative assessments of storage potential, and covering separately DSF, DOGR and UCS	
Improve estimates of storage capacity potential in EOR and EGR	
Improve methodologies and standards to determine practical and matched storage capacity for all types of geological media under current consideration	
Summarize data needs for storage capacity estimation and site characterization	
Understand better the effects of variability in rock properties and characteristics on injectivity	
Understand better the effects of caprock variability and properties on containment and storage capacity	
Improved recognition and interpretation of the nature and characteristics of faults and fractures	
Improved functionality and resolution of available logging tools for characterization	
Improved interpretation of cased hole logs for characterization	
OGF: prove the concept of storing CO_2 in basalts, organic-rich shales, unconventional hydrocarbon reservoirs (heavy oil, tar sands, tight sands)	
DSF: improve data availability	
UCS: understand the effects of coal rank, quality and other properties on storage potential and capacity	
ECBM: prove feasibility on large scale	
MC: enhance trapping and reduce costs to improve viability	
Demonstrate viability of storage in the shallow subsea bed (low temperature, high pressure conducive to hydrate formation)	
Define criteria for the definition of lateral and vertical extent of the reservoir and the storage complex (with respect to legal and liability issues)	

CSLF Gaps Analysis Checklist

(Please check all of the following technology areas that your project will address.)

STORAGE AND MONITORING TECHNOLOGIES

Modeling the Storage Complex	
DSF: Understanding/determination and documentation of residual gas trapping (relative permeability effects) at laboratory and field scales	
DSF: Predicting and modeling spatial reservoir and cap rock characteristics with uncertainties	
DSF: Understanding CO_2/water/rock interactions and effects on CO_2 trapping and migration	
DSF: Evaluation of basin-wide pressure build-up as a result of CO_2 storage at multiple sites, including assessing sustainability of high injection rates in open and closed systems	
DSF: Evaluation of petroleum field development impact on aquifer hydrodynamic regime and storage capacity (this refers to decreased pressure, hence higher storage capacity)	
DSF: Impact of the quality of CO_2 (composition of the CO_2 injection stream) on interactions with the aquifer water, rocks and caprock, including impact on storage capacity and containment	
DSF: Development of coupled HTMC (hydro-thermo-mechanical-chemical) models for CO_2 injection, migration and leakage for a wide range of in-situ conditions (pressure, temperature, water salinity, rock mineralogy), including the feedback loop	
DSF: Improvement of databases of parameters needed for modeling geochemical effects	
DSF: Improvement in models and software for basin wide geological, reservoir engineering and hydrodynamic modeling, including the behavior of the displaced formation fluid	
UCS: Effects of depth, pressure and stress on coal permeability/injectivity	
UCS: Effects of CO_2-coal interactions, particularly for supercritical CO_2 (swelling, plasticization) and methane displacement	
MC: Thermodynamics and kinetics of chemical and microbiological reactions, and impact on injectivity, geomechanics and fluid flow	
Improvement in understanding and modeling the effect of CO_2-rich environments on well materials, leakage, and fate and effects of leaked CO_2	
Understanding the role of CO_2 as a solvent, particularly in supercritical state, and the effects of impurities	
Monitoring the Storage Complex at Depth	
Improvement of simulation models and their accuracy through (automated) history matching and reduction of discrepancies between observed filed data and simulation results	
Detection of leakage pathways in confining zones at depth before progressing further	
Monitoring frequency, resolution, methods and costs	
Use of seismic and non-seismic geophysical techniques	
Evaluation of permanent or semi-permanent sampling points in an observation well	
Improved integration of monitoring techniques	
Improved wellbore monitoring techniques	
Development of low cost and sensitive CO_2 monitoring technologies	
Development of monitoring techniques and methodologies that allow for quantification of subsurface leakage	

CSLF Gaps Analysis Checklist

(Please check all of the following technology areas that your project will address.)

STORAGE AND MONITORING TECHNOLOGIES

Monitoring the Storage Site near and at the Surface	
Identification of measurement thresholds for natural and anthropogenic (leaked) CO_2	
Estimation of leakage flux rates of anthropogenic and natural systems, including use of improved remote sensing	
Detection and monitoring of CO_2 seeps into subaqueous settings	
Use of vegetation changes in hyperspectral surveys changes to identify gas levels in the vadose zone	
Compilation of required baseline surveys for measurement, monitoring and verification (MMV) activities including site-specific information on CO_2 background concentration and seismic activity	
Development of instruments capable of measuring CO_2 levels close to background and to distinguish between CO_2 from natural processes and that from storage	
Monitoring impacts (if any) on the environment, including sub-aquatic and aquatic	
Identification and development of monitoring techniques that meet the requirements of emission credits and trade system	
Managing the Storage Site	
Determination of optimum well spacing and patterns, and optimum injection parameters	
DSF: Development for pressure build-up management, including production and disposal of brine	
EOR: Optimization of CO_2 storage and conversion from CO_2-EOR to CCS – lessons to be applied to other storage reservoirs	
EGR: Validation of enhanced gas recovery (EGR), including coalbed methane (ECBM)	
Development of improved well abandonment practices for CO_2-rich environments	
Development of risk mitigation strategies in case leckage occurs	
Risk Assessment, Impact Evaluation, Remediation Techniques	
Understanding of the effect of oil and/or gas production from shales (which normally constitute caprocks) on storage integrity (confinement) and capacity	
Detection of initiation of, and sealing of leakage flowpaths in confining zones	
Understand the effects of CO_2 and associated impurities on well materials and integrity	
Understanding of how geochemical buffering limits pH decrease by carbonic acid, thus avoiding the need for expensive materials in new well construction and old wells remediation	
Remediation of existing wells	
Quantification and modeling of potential subsurface and surface leakage impacts	
Development of appropriate risk assessment models to understand likelihood and consequences of CO_2 leaks, and including induced seismicity and ground movement	
Development of risk minimization/mitigation methods and strategies, including leakage	
Assessment of long-term site security post-injection including verified mathematical models of storage	
Evaluation of competing interests or synergies between different uses of the subsurface and potential sterilisation of existing resources	
Costs Evaluation	
Address costs associated with storage, including compression, drilling and establishing wells, and monitoring	
MC: Assess the techno-economic viability of mineral storage of CO_2	

CSLF Gaps Analysis Checklist

(Please check all of the following technology areas that your project will address.)

STORAGE AND MONITORING TECHNOLOGIES

Guidelines Development	
Development of best practice guidelines for site selection, characterization, operation and closure, including monitoring and risk assessment	
Development of guidelines for responding to, and remediating CO_2 leaks	
Outreach and Public Concern	
Development of procedures and approaches for communicating the impacts of geological storage to the general public	

CSLF Gaps Analysis Checklist

(Please check all of the following technology areas that your project will address.)

TRANSPORT

General	
Cost benefit analysis and modeling of CO_2 pipeline and transport systems	
Tanker transport of liquid CO_2	
Specifications for impurities from various processes	
Dispersion modeling and safety analysis for incidental release of large quantities of CO_2	
Safety and mitigation of pipelines through urban areas	
Safety protocols to protect CO_2 pipelines, including response and remediation	
Identify regulations and standards for CO_2 transport	
Acquire experimental thermodynamic data for CO_2 with impurities	
Understand effects of impurities on compression, transport, corrosion	
Understand the effects of supercritical CO_2 on sealing materials	
Develop flow models for dense CO_2 streams in pipelines	
Understand effects and impacts of pipeline leaks	
Integration	
Identify reliable sources of information and data related to the design, cost, and space requirements, operation, and integration of CCS with energy facilities	
Conduct periodic technical reviews of all aspects of recognized large-scale CCS demonstration projects and report on the "lessons learned"	
On a periodic basis, update the Technology Roadmap to include technology gaps identified during the technical assessment of demonstration projects	
Integrate with existing infrastructure	
Cross-Cutting Issues	
Energy price issues would encourage the take-up of CCS	