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CARBON STORAGE NEWSLETTER

MARCH 2017

This newsletter is compiled by the National Energy Technology Laboratory to provide information on recent activities and publications related to carbon storage. It covers domestic, international, public sector, and private sector news in the following areas:

- ▷ DOE/NETL HIGHLIGHTS
- ▷ ANNOUNCEMENTS
- ▷ PROJECT and BUSINESS DEVELOPMENTS
- ▷ LEGISLATION and POLICY
- ▷ EMISSIONS TRADING
- ▷ CLIMATE and SCIENCE NEWS
- ▷ JOURNAL ARTICLES
- ▷ REPORTS and OTHER PUBLICATIONS

CARBON STORAGE PROGRAM DOCUMENTS and REFERENCE MATERIALS

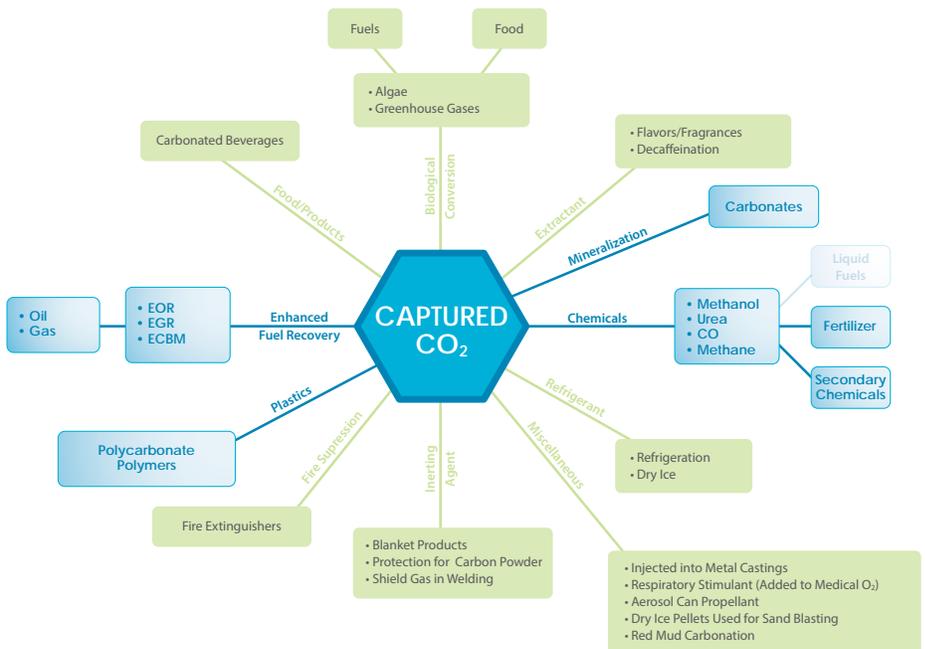
- ▷ Carbon Storage Educational Resources
- ▷ Program Reports, Plans, and Roadmaps
- ▷ Conference Proceedings
- ▷ Carbon Storage Portfolio
- ▷ Systems Analysis
- ▷ Peer Review
- ▷ Best Practices Manuals
- ▷ Fossil Energy Techlines



DOE/NETL HIGHLIGHTS

Department of Energy Invests in Projects to Advance Novel CO₂ Utilization Strategies.

The U.S. Department of Energy's (DOE) Office of Fossil Energy (FE) selected seven projects to receive funding to focus on novel ways to use carbon dioxide (CO₂) captured from coal-fired power plants. The selected research projects, which directly support the National Energy Technology Laboratory's (NETL) *Carbon Storage Program's Carbon Use and Reuse* research and development (R&D) portfolio, fall under three technical areas of interest: (1) biological-based concepts for beneficial use of CO₂, (2) mineralization concepts utilizing CO₂ with industrial wastes, and (3) novel physical and chemical processes for beneficial use of CO₂. The portfolio will develop and test novel approaches that convert the captured CO₂ to useable products, as well as explore ways to use the captured CO₂ in areas where high-volume uses may not be optimal, such as enhanced oil recovery (EOR). Each project will also include non-federal cost share of at least 20 percent. From *energy.gov* on February 22, 2017.



This figure illustrates opportunities for carbon use and reuse with NETL-supported research highlighted in blue.

ANNOUNCEMENTS

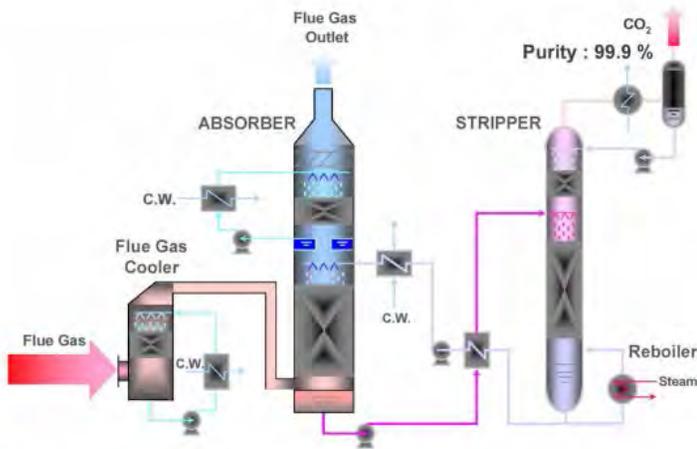
11th IEAGHG Monitoring Network Meeting.

The International Energy Agency Greenhouse Gas R&D Program (IEAGHG) will be hosting their 11th Monitoring Network Meeting in Traverse City, Michigan, USA, on June 13-15, 2017. The theme of the meeting will be "The Cost and Value-Effectiveness of Monitoring: what key drivers are required to deliver an optimum outcome?" A sub-theme will be the leveraging of oil and gas industry experience for CO₂ storage. The full agenda of the meeting can be found on the [IEAGHG website](#).

ANNOUNCEMENTS *(cont.)*

Post-Combustion Carbon Capture Project Begins Commercial Operation.

The post-combustion carbon capture *Petra Nova* project began commercial operation at the W.A. Parish Plant in Thompsons, Texas, USA, officials announced. DOE provided funding and NETL provided project management support for the project, which demonstrates how carbon capture technologies can support the flexibility and sustainability of fossil fuels at a commercial scale. The Petra Nova project has the potential to capture 1.6 million tons of CO₂ per year from an existing coal-fired power plant.



Process flow for amine absorption.

NETL Signs MOU to Advance Fossil Energy Technologies.

Representatives from NETL and FE signed a memorandum of understanding (MOU) with Dubai Electricity and Water Authority (DEWA) to collaborate on the advancement of fossil energy technologies and to foster assessments of technology options and economics.

RGGI Releases Reports.

The states participating in the Regional Greenhouse Gas Initiative (RGGI) released the "*Report on the Secondary Market for RGGI CO₂ Allowances: Fourth Quarter 2016.*" Prepared by the independent market monitor Potomac Economics, the report addresses the period from October through December 2016 and contains information on the secondary market for RGGI CO₂ allowances, such as future prices, market activity, and allowance holdings. In addition, RGGI released the "*2016 Interim Compliance Summary Report.*" which contains data regarding CO₂ allowances provided by CO₂ budget sources to meet their 2016 interim control period compliance.

New Report Backs CCS in Australia.

An independent report on carbon capture and storage (CCS) in Australia, commissioned by government, industry, and research organizations, has been released. Titled "A Roadmap for Carbon Capture and Storage," the report states, among other findings, that CCS could play a vital role in decarbonizing energy-intensive industries in Australia.

PROJECT and BUSINESS DEVELOPMENTS

Pale Blue Dot Energy to Review CO₂ Transport and Storage Business Models.

Pale Blue Dot Energy, energy transition management consultants, were awarded a contract to review business models for CO₂ transport and storage. The project will examine models that have been successfully used overseas and for other types of infrastructure, as well as those that have been proposed for the delivery and operation of CO₂ infrastructure in the United Kingdom (UK). Pale Blue Dot Energy, which provides support in CCS, oil and gas transition, and emerging energy systems, was awarded the contract from HMG Department for Business, Energy, and Industrial Strategy (BEIS). From *Pale Blue Dot* on February 8, 2017.

CCS Facility Captures More than 63,000 Metric Tons of CO₂.

The Boundary Dam Power Station's CCS facility located in Saskatchewan, Canada, captured more than 63,000 metric tons of CO₂ during January 2017, according to a release from SaskPower. The amount captured was 63 percent of the capacity; the 12-month average for the facility was 64 percent. Since start-up, the CCS facility has captured more than 1.3 million metric tons of CO₂. From *Estevan Mercury* on February 10, 2017.

LEGISLATION and POLICY

St. Paul Launches Climate Action Plan Effort to Become Carbon Neutral.

Government officials in St. Paul, Minnesota, USA, are launching an effort to draft a Climate Action Plan with a goal of becoming carbon neutral by 2050. Officials aim to have a finalized Climate Action Plan by the end of 2017. In the coming months, a series of meetings will be held to gather input and suggestions from the public. From *Star Tribune* on February 25, 2017.

Australia State Passes Bill to Reduce Emissions.

A bill was passed by legislature in Victoria, Australia, that commits the state to reduce its emissions by 2050. *The Victoria bill* presents options for the state to reduce emissions, such as participating in an emissions trading scheme or adopting carbon capture measures. Once they receive feedback from experts, the Victoria government will provide opportunities to work toward the 2050 goal. From *Ammonia21* on February 24, 2017.

EMISSIONS TRADING

European Parliament Adopts Carbon Market Draft Reform.

The European Parliament supported draft reforms of the carbon market post-2020, aligning with the European Commission's proposal for the emissions cap to decrease by 2.2 percent per year. The assembly's environmental committee's lawmakers will begin discussions with the European Union (EU) member states to finalize the legislation. From *Reuters* on February 15, 2017.

China to Launch Carbon Market.

China is expected to launch its emissions trading system (ETS) later this year. The country has launched seven pilot regional carbon trading markets since 2013 (in Beijing, Tianjin, Shanghai, Guangdong, Shenzhen, Hubei, and Chongqing), covering a range of industrial sectors. According to a report by the China

Beijing Environment Exchange and the Beijing Emission Trading Association, the cumulative trading volume of the seven pilot markets (as of December 31, 2016) was 160 million tons. From *China Daily* on February 16, 2017.

Singapore to Implement Carbon Tax.

Singapore's government announced plans to implement a carbon tax from 2019 as part of efforts reduce greenhouse gases (GHGs). The tax is expected to be in the range of \$10 to \$20 per metric ton of GHG emissions, and revenue generated will be used to fund measures by industries to reduce emissions, as well as potential opportunities in industries such as clean energy. From *The Straits Times* on February 20, 2017.

CLIMATE and SCIENCE NEWS

Researcher Receives DOE Grant to Produce Alcohols from CO₂ Flue Gas.

A researcher from the University of Delaware received a grant from DOE through NETL to investigate the use of CO₂ as a cheap feedstock to produce fuels and chemicals. The proposed technology is an integrated electrolyzer system that takes flue gas from the power plant and produces multi-carbon alcohols through a two-stage electrolysis process. The grant, titled "Electrochemical Conversion of Carbon Dioxide to Alcohols," will help fund the effort, which involves electrocatalyst development, system design and evaluation, and investigation of compatibility with simulated flue gas from coal-fired power plants. From *The University of Delaware News Release* on February 23, 2017.

Warming Ponds Could Accelerate Potential Climate Change.

According to a study conducted by the University of Exeter and Queen Mary University of London, rising temperatures may reduce the amount of CO₂ stored in ponds. The study was conducted by warming an array of ponds by

4°C to 5°C for seven years. In studying the impacts on GHG emission rates, scientists observed that after the first year, changes became "amplified" over a longer period. After seven years, the pond's ability to absorb CO₂ was reduced by almost half. The results of the study were published in a paper, titled "*Long-term warming amplifies shifts in the carbon cycle of experimental ponds*," in the journal *Nature Climate Change*. From *phys.org* on February 20, 2017.

Alberta Invests in CarbonCure.

CarbonCure will receive up to \$3 million from Emissions Reduction Alberta (ERA) to further optimize and accelerate the adoption of its CO₂ utilization technology in Alberta, Canada. CarbonCure's technology, which reduces GHGs while providing economic benefit to concrete producers, is installed in more than 40 concrete plants across North America. The retrofit technology will source CO₂ emissions from local industrial emitters and convert it to nano-sized minerals, making concrete stronger and greener. CarbonCure will be competing with three other recipients of the ERA Grand Challenge for the final \$10 million grant in 2019. From *Carbon Capture Journal* on March 2, 2017.

JOURNAL ARTICLES

Modeling changes in pressure due to migration of fluids into the Above Zone Monitoring Interval of a geologic carbon storage site.

The following is the Abstract of this article: "An increasing emphasis on the industrial-scale implementation of CO₂ storage in geological formations has led to the development of whole-system models to evaluate performance of candidate geologic storage sites and the environmental risk associated with them. Components of that engineered geologic system include the storage reservoir, overlying aquitards (primary caprock and secondary seals) and aquifers (including the above zone monitoring interval, or AZMI, directly overlying the primary seal), and potential leakage pathways including wells, fractures, and faults. Leakage of CO₂ and brine through the primary seal to the overlying porous and permeable formations (AZMI) may occur due to the seal's intrinsic permeability and/or the presence of natural fractures or induced perforations or fractures in the caprock. AZMI monitoring may provide a potentially useful source of information about seal performance and subsurface pressure response to potential CO₂ and/or brine leakage from the reservoir. Unfortunately, full complexity simulations of the geologic storage system are not computationally affordable, especially given the need to develop many realizations to evaluate uncertainties in system performance. Thus, the goal of the current work is to present a novel reduced order model (ROM) for AZMI that simulates fluid (i.e., CO₂ and brine) flow above the seal, and verify performance of the ROM. The AZMI model predicts spatial changes in pressure over time in the zone above the primary seal due to migration of fluids from the reservoir. A case is examined wherein CO₂ is injected into a storage reservoir for 30 years and a heterogeneous primary seal exists above the reservoir with some permeable zones. The model results are verified against those of a numerical simulator. The new AZMI model provides an improvement in computation time

by a factor of approximately 2000 times to that of the numerical simulator and provides predictions that approximate those of the comparable numerical simulation." **Argha Namhata, Liwei Zhang, Robert M. Dillmore, Sergey Oladyshkin, and David V. Nakles**, *International Journal of Greenhouse Gas Control*. (Subscription may be required.)

Production and transportation outsourcing decisions in the supply chain under single and multiple carbon prices.

The following is the Abstract of this article: "Cap-and-trade and carbon tax are the two main policies to reduce carbon emissions. Different from the previous literature and practice, this paper examines the production and transportation outsourcing problems of a two-echelon supply chain under the cap-and-trade policy and joint cap-and-trade and carbon tax policy. Enterprise operations are divided into the order stage and transportation outsourcing decision stage. In the order stage, the retailer sets his order schedule for the manufacturing plant for fulfillment, and in the transportation outsourcing decision stage, the manufacturer decides the optimal freight volume based on energy consumption. Furthermore, [the authors] construct a basic model without a carbon policy and two extended models with carbon policies and the optimal solutions of the models are solved. Numerical examples are provided, and the three models are compared. The results indicate that the extended model with carbon policies is more beneficial for emissions reduction, and the effect of emissions reduction gradually becomes smooth as the carbon price increases; the joint cap-and-trade and carbon tax policy is more effective for emissions reduction, especially when the carbon price is lower. These findings will be helpful to policy makers and managers." **Jian Li, Qin Su, and Li Ma**, *Journal of Cleaner Production*. (Subscription may be required.)

JOURNAL ARTICLES (cont.)

Response comment: Carbon sequestration on Mars.

The following is the Abstract of this article: "Martian atmospheric pressure has important implications for the past and present habitability of the planet, including the timing and causes of environmental change. The ancient Martian surface is strewn with evidence for early water bound in minerals and recorded in surface features such as large catastrophically created outflow channels, valley networks, and crater lakes. Using orbital spectral data sets coupled with geologic maps and a set of numerical spectral analysis models, [the authors] constrained the amount of atmospheric sequestration in early Martian rocks and found that the majority of this sequestration occurred prior to the formation of the early Hesperian/late Noachian valley networks, thus implying the atmosphere was already thin by the time these surface-water-related features were formed." **Christopher Edwards and Bethany L. Ehlmann**, *Geological Society of America*. (Subscription may be required.)

Energy system impacts and policy implications of the European Intended Nationally Determined Contribution and low-carbon pathway to 2050.

The following is the Abstract of this article: "In March 2015 the European Union (EU) submitted to the United Nations Framework Convention on Climate Change (UNFCCC) the Intended Nationally Determined Contribution (INDC) in view of the Paris Conference of Parties (COP21). The binding target of lowering domestic [GHGs] emissions by at least 40% by 2030 compared to 1990 levels, coupled with long-term decarbonization goals, will have profound energy system, macroeconomic and policy implications. EU targets are qualitatively discussed and quantitatively assessed with the simulation of a Reference and an alternative decarbonization scenario to 2050. Simulations are carried out with the technology-rich PRIMES energy-system model and the GEM-E3 Computable General Equilibrium model. Restructuring of the EU energy system induces changes in the energy mix and production with small effects on the EU GDP, 0.4% in 2030 and 1% in 2050 compared to the Reference scenario. Energy efficiency improvements, increasing penetration of renewables, fuel switching towards natural gas, and technical progress in process related to emissions abatement are identified as essential options to the EU INDC implementation. The electrification of final energy demand, particularly transport electrification, complemented with decarbonized power supply is found to play a critical role in the successful transition towards a low-carbon economy by 2050." **Panagiotis Fragkos, Nikos Tasios, Leonidas Paroussos, Pantelis Capros, and Stella Tsani**, *Energy Policy*. (Subscription may be required.)

Lessons learned from using expert elicitation to identify, assess and rank the potential leakage scenarios at the Heletz pilot CO₂ injection site.

The following is the Abstract of this article: "Expert elicitation is a useful approach to synthesis expert knowledge, experience and insight when the input data and analysis is limited. During the early stages of the EU FP7 MUSTANG pilot CO₂ injection experiment at Heletz, Israel there was very little input data available, yet decisions had to be made regarding data collection, drilling, operation and monitoring strategies. An expert elicitation study was undertaken to identify, assess and rank potential CO₂ leakage scenarios at Heletz to provide guidance to support the decision making processes. This paper presents a critique of the expert elicitation process undertaken, presenting the methodology and a discussion of the results. [The authors] present the lessons learned during the expert elicitation process, highlighting its advantages and limitations and provide suggestions on ways to overcome these limitations. [The authors'] findings show that prudent expert elicitation can make a valuable contribution to decision making, however if done improperly it can equally lead to invalid or misleading results and wrong decisions." **K. Edlmann, J. Bensabat, A. Niemi, R.S. Haszeldine, and C.I. McDermott**, *International Journal of Greenhouse Gas Control*. (Subscription may be required.)

Enhancing residual trapping of supercritical CO₂ via cyclic injections.

The following is the Abstract of this article: "[The authors] utilize synchrotron X-ray tomographic imaging to investigate the pore-scale characteristics and residual trapping of supercritical CO₂ (scCO₂) over the course of multiple drainage-imbibition (D-I) cycles in Bentheimer sandstone cores. Capillary pressure measurements are paired with X-ray image-derived saturation and connectivity metrics which describe the extent of drainage and subsequent residual (end of imbibition) scCO₂ trapping. For the first D-I cycle, residual scCO₂ trapping is suppressed due to high imbibition capillary number ($Ca \approx 10-6$); however, residual scCO₂ trapping dramatically increases for subsequent D-I cycles carried out at the same Ca value. This behavior is not predicted by conventional multiphase trapping theory. The magnitude of scCO₂ trapping increase is hysteretic and depends on the relative extent of the sequential drainage processes. The hysteretic pore-scale behavior of the scCO₂-brine-sandstone system observed in this study suggests that cyclic multiphase flow could potentially be used to increase scCO₂ trapping for sequestration applications." **Anna L. Herring, Linnea Anderson, and Dorthe Wildenschild**, *Geophysical Research Letters*. (Subscription may be required.)

Assessing the design of three carbon trading pilot programs in China.

The following is the Abstract of this article: "To help overcome the challenge of growing CO₂ emissions, China is experimenting with market-based instruments, including pilot CO₂ emissions trading systems (ETSs) in seven regions that serve as precursors of a national CO₂ ETS. Implementing an ETS in a rapidly growing economy in which government authorities exercise significant control over markets poses many challenges. This study assesses how well three of the most developed pilot ETSs, in Guangdong, Shanghai, and Shenzhen, have adapted carbon emissions trading to China's economic and political context. [The authors] base [their] study on new information gathered through interviews with local pilot ETS regulators and experts, analysis of recent trading data, and extensive legal and literature reviews. [The authors] point out instances in which pilot regulators have deftly tailored carbon emissions trading to China's unique context and instances in which designs are insufficient to ensure smooth operation. [The authors] also indicate areas in which broader institutional reforms of China's political economy may be required for carbon emissions trading to operate successfully. [The authors] make nine recommendations to improve the design and operation of the pilot programs and to inform the construction of a national CO₂ ETS." **Clayton Munnings, Richard D. Morgenstern, Zhongmin Wang, and Xu Liu**, *Energy Policy*. (Subscription may be required.)

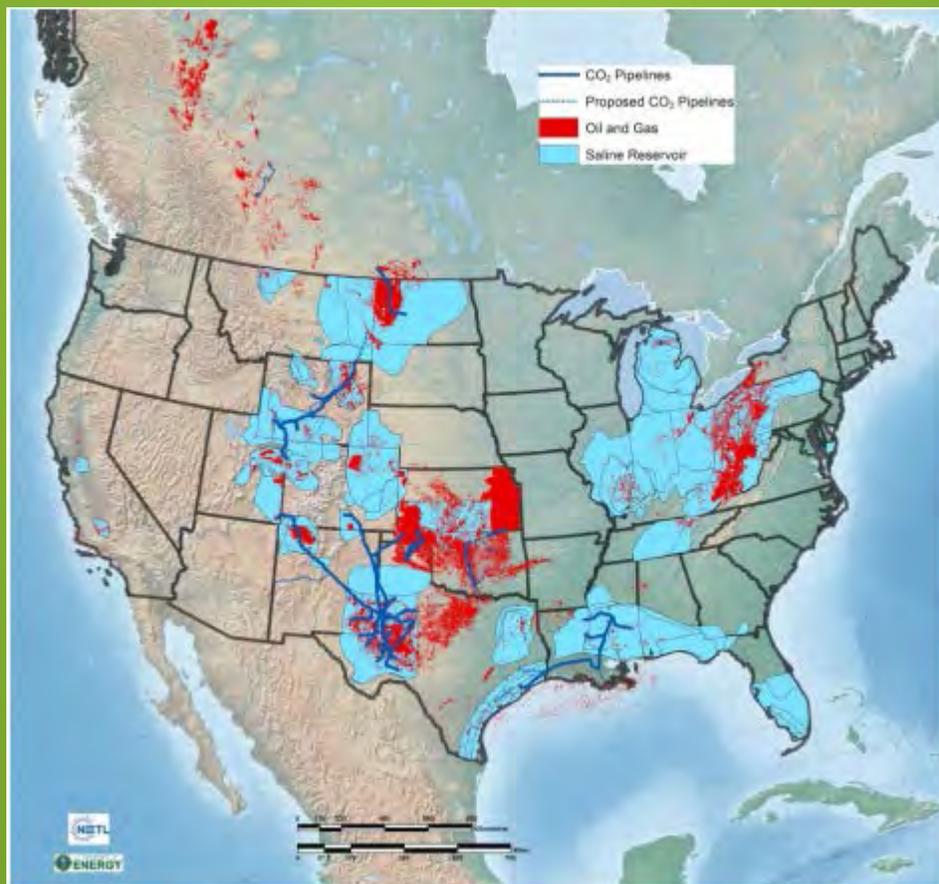
Convective mixing fingers and chemistry interaction in carbon storage.

The following is the Abstract of this article: "Dissolution of [CO₂] into formation fluids during CCS can generate an instability with a denser CO₂-rich fluid located above the less dense native aquifer fluid. This instability promotes convective mixing, enhancing CO₂ dissolution and favoring the storage safety. Convective mixing has been extensively analyzed in the context of CCS over the last decade, however the interaction between convective mixing and geochemistry has been insufficiently addressed. This relation is explored using a fully coupled model taking into account the porosity and permeability variations due to dissolution-precipitation reactions in a realistic geochemical system based on the Hontomin (Spain) potential CCS site project. This system, located in a calcite, dolomite, and gypsum bearing host rock, has been analyzed for a variety of Rayleigh and Damköhler values. Results show that chemical reactions tend to enhance CO₂ dissolution. The model illustrates the first stages of porosity channel development, demonstrating the significance of fluid mixing in the development of porosity patterns. The influence of non-carbon species on CO₂ dissolution shown in this study demonstrates the needs for realistic chemical and kinetic models to ensure the precision of physical models to accurately represent the [CO₂] injection process." **Alvaro Sainz-Garcia, Elena Abarca, Albert Nardi, Fidel Grandia, and Eric H. Oelkers**, *International Journal of Greenhouse Gas Control*. (Subscription may be required.)

REPORTS and OTHER PUBLICATIONS

Siting and Regulating Carbon Capture, Utilization and Storage Infrastructure.

The following is the Background of this DOE Workshop Report: “[DOE’s] first Quadrennial Energy Review (QER) identified CO₂ pipelines as ‘an important enabling infrastructure for GHG emissions in the future.’ Carbon dioxide capture, utilization, and storage (CCUS) may involve moving CO₂ significant distances from power plants and other industrial sources to storage sites, including saline geologic formations and oil fields (where CO₂ is stored during and potentially after EOR operations), as well as to entities that employ other technologies to utilize captured CO₂, such as photosynthesis, chemosynthesis, or mineralization. The regulation of CO₂ pipelines and other CCUS infrastructure is a joint responsibility of Federal and State governments. However, states typically play a primary role in establishing the requirements for siting, construction, and operations of CO₂ pipelines. The first QER found that the development of a national CO₂ pipeline infrastructure should ‘build on state experiences, including lessons learned from the effectiveness of different regulatory structures, incentives, and processes that foster interagency coordination and regular stakeholder engagement.’ DOE sponsored a technical workshop in April 2016 in Washington, D.C., to identify and promote best practices for siting and regulating CO₂ infrastructure (pipelines, EOR, and other geologic CO₂ storage sites). The purpose of the workshop was to foster communication, coordination, and sharing of lessons learned and best practices among states and entities that are involved in siting and regulating CO₂ infrastructure, or that may have CO₂ infrastructure projects within their borders in the future. The scope of the technical workshop also encompassed issues being addressed in the second installment of the QER, including discussions around regulation and management of CO₂ storage sites, which serve as critical infrastructure for entities capturing CO₂.”



CO₂ pipeline network showing oil and gas fields.

REPORTS and OTHER PUBLICATIONS (cont.)*Probabilistic approach to CO₂ plume mapping for prospective storage sites: The CarbonNet experience.*

The following is from the Executive Summary of this Global CCS Institute document: “In CO₂ storage, there is a requirement to predict the range of possible plume extents and travel paths and associate a probability with this range. This requirement is in the context that subsurface uncertainty is a given, and that no single plume prediction can be 100% precise. The probabilistic expectation of the plume at future times is used for project purposes and for regulatory assurance that the plume will remain within the defined storage boundaries (both geographical and stratigraphic) for the required period of time with an appropriate high level of confidence. In particular, Australian GHG storage regulations call for a prediction of all plume paths with more than 10% probability of occurrence (i.e. plume paths at P90 confidence level). Here [the authors] outline a probabilistic approach based on reservoir modelling sensitivity and uncertainty analysis, adapted from the petroleum industry and suitable for high-mobility CO₂ plumes in thick and well-defined reservoirs. The method can also be extended to other basins and geological circumstances. In the petroleum industry, it is commonplace to evaluate resources in probabilistic terms with some objective parameter such as oil in place, recoverable reserves, or nett present value. This methodology can be adapted easily to objective measures such as vertical ascent of a plume relative to a caprock or lateral approach of the plume to a boundary or other geographic feature to be avoided (e.g. a mapped fault). What is novel in [the authors’] approach is to analyze plume paths (extents) in a statistical manner to generate probabilistic maps and cross-sections of plume extents to inform on containment risks and areas with key monitoring requirements. In [the authors’] approach, the reservoir layering must first be analyzed and the principal hydrodynamic flow units (HFU’s) and the intervening seals identified. In the Gippsland Basin, multiple reservoir layers of 100-150m of multi-darcy, clean quartz-dominated sands form the main reservoir units and are proven by over 1,500 hydrocarbon exploration and development wells and are mappable on extensive 3D marine seismic data. The reservoirs are supported by an ideal, almost infinite aquifer which buffers pressure effectively and dissipates it regionally over short timescales (100 km in decades). In these reservoirs, CO₂ plumes are highly mobile and must be controlled by either structural trapping, or by careful mapping and use of non-structural (saline aquifer) storage. The CarbonNet Project aims to store a nominal 125 million tonnes of CO₂ over 25 years in the same basin still in use for hydrocarbon extraction, and adjacent to an important onshore aquifer. Plume management and containment is therefore vital and high confidence must be placed on plume path modelling, including the analysis of rare statistical outliers.”

A Business Case for a UK Industrial CCS Support Mechanism.

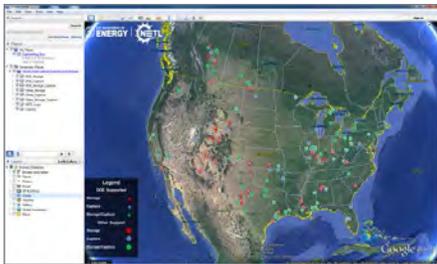
The following is the Introduction of this Teesside Collective document: “Large manufacturing industry is a major contributor to the British economy: in 2015, for example, nationally it accounted for 2.6 million jobs, [\$195] billion Gross Value Added and contributed around half of UK exports. However, it also has around 70 million tonnes (mt) annual direct CO₂ emissions. As the UK Government formulates its industrial strategy, it is inevitable that the impact of legally binding carbon budgets form part of that consideration – including the provision of necessary infrastructure to reduce industrial emissions. Beyond further energy efficiency, deep emissions reduction for many industries is only possible through CCS technology. During the most recent UK competition for CCS on power, modest funding was provided by Government to scope CCS for industry, as represented by Teesside Collective. Following the cancellation of the CCS Commercialization Program in 2015, and an evident need to gain industry confidence after a number of failed competitions, there is a need to revitalize this effort in a more structured approach. This report proposes a business model that could make cost-effective, near-term investment in CCS attractive to the Government and to Energy Intensive Industries (EIs) and so form a basis to enable the Government and industry to jointly to take forward delivery of Industrial CCS.”

ABOUT DOE'S CARBON STORAGE PROGRAM

The **Carbon Storage Program** advances the development and validation of technologies that enable safe, cost-effective, permanent geologic storage of CO₂. The Carbon Storage Program also supports the development of best practices for CCS that will benefit projects implementing CCS at a commercial scale, such as those being performed under NETL's Clean Coal Power Initiative and Industrial Carbon Capture and Storage Programs. The technologies being developed and the small- and large-scale injection projects conducted through this program will be used to benefit the existing and future fleet of fossil fuel power-generating facilities by developing tools to increase our understanding of the behavior of CO₂ in the subsurface and identifying the geologic reservoirs appropriate for CO₂ storage.

The [Carbon Storage Program Overview](#) webpage provides detailed information of the program's structure, as well as links to the webpages that summarize the program's key elements.

Carbon Storage Program Resources



The [National Energy Technology Laboratory's CCS Database](#) includes active, proposed, and terminated CCS projects worldwide. The information is taken from publically available sources to provide convenient access to information regarding efforts by various industries, public groups, and governments towards development and eventual deployment of CCS technology. NETL's CCS Database is available as a Microsoft Excel spreadsheet and also as a customizable layer in Google Earth.

Newsletters, program fact sheets, best practices manuals, roadmaps, educational resources, presentations, and more are available via the [Carbon Storage Program Publications webpage](#).

Get answers to your carbon capture and storage questions at NETL's [Frequently Asked Questions webpage](#).

ABOUT NETL'S CARBON STORAGE NEWSLETTER

Compiled by the National Energy Technology Laboratory, this newsletter is a monthly summary of public and private sector carbon storage news from around the world. The article titles are links to the full text for those who would like to read more.



National Energy Technology Laboratory

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