U.S. DEPARTMENT OF ENERGY | OFFICE OF FOSSIL ENERGY | NATIONAL ENERGY TECHNOLOGY LABORATORY

# CSN CARBON STORAGE NEWSLETTER

JANUARY 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
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CARBON STORAGE PROGRAM DOCUMENTS and REFERENCE MATERIALS


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


NATIONAL ENERGY TECHNOLOGY LABORATORY

## DOE/NETL HIGHLIGHTS

### *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. The U.S. Department of Energy (DOE) provided funding and the National Energy Technology Laboratory (NETL) provided project management support for the project, which demonstrates how carbon capture technologies can advance 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 carbon dioxide ($CO_2$) per year from an existing coal-fired power plant. From *energy.gov* on January 11, 2017.

*Petra Nova Groundbreaking from September 2014*

### *DOE Offers Conditional Commitment to Facility.*

DOE offered a conditional commitment to guarantee loans up to $2 billion for the construction of a methanol production facility in Lake Charles, Louisiana, USA, that will employ carbon capture technology. The $CO_2$ captured at the facility, which will be constructed by Lake Charles Methanol, LLC, will be transported, via pipeline, to oilfields in Texas, USA, where it will be utilized for enhanced oil recovery (EOR). The project is expected to result in the storage of approximately 4.2 million metric tons of $CO_2$ annually. DOE's loan guarantee was made under the *Advanced Fossil Energy Project* solicitation issued by *DOE's Loan Programs Office (LPO)*. From *energy.gov* on December 21, 2016.

# ANNOUNCEMENTS

### *Final Report on the Task Force on $CO_2$ Utilization.*

The U.S. Secretary of Energy Advisory Board (SEAB) Task Force on $CO_2$ Utilization released a report representing their findings and recommendations. The Task Force set out to describe a framework for a DOE research, development, and demonstration (RD&D) program on $CO_2$ utilization technologies that have the potential to reduce $CO_2$ emissions.

### *DOE Funds $CO_2$ Storage Projects.*

DOE's Office of Fossil Energy (FE) selected 16 carbon storage projects to receive funding as part of DOE's Carbon Storage Assurance Facility Enterprise (CarbonSAFE) initiative. The selected projects will address key research gaps in the deployment of carbon capture and storage (CCS) technologies and will build on lessons learned from the *Regional Carbon Sequestration Partnerships' (RCSPs)* large-scale field projects.

### *MOU Signed for CCS Collaboration.*

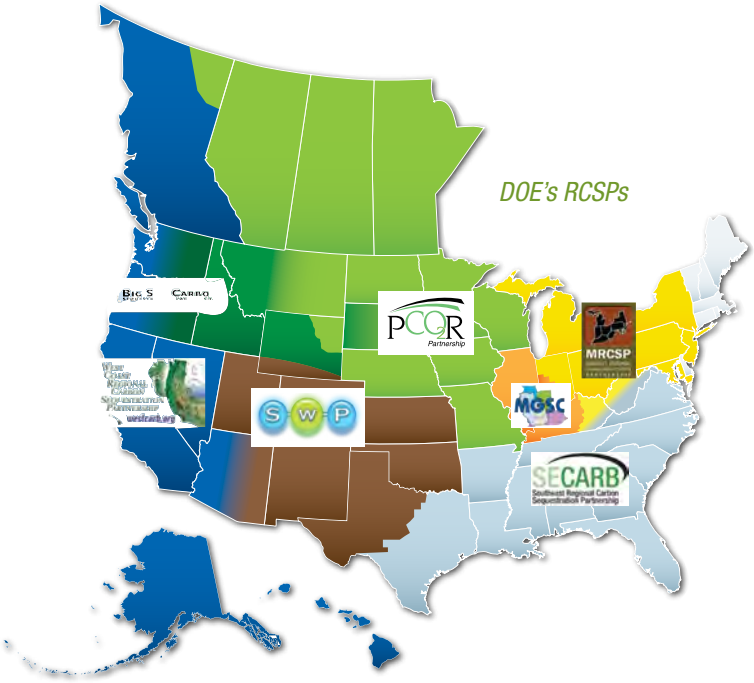
Pale Blue Dot Energy, an energy sector management consultant company based in Aberdeenshire, United Kingdom (UK), signed a Memorandum of Understanding (MOU) with the Guangdong Carbon Capture, Utilization, and Storage (CCUS) Centre in China for collaboration on CCS projects. In addition, the MOU provides for the exchange of capability and learning between UK and Chinese project design and development.

### *RGGI $CO_2$ Allowance Auction 35.*

The states participating in the Regional Greenhouse Gas Initiative (RGGI) released the Auction Notice and application materials for their 35th quarterly $CO_2$ allowance auction, scheduled for March 8, 2017. The released materials provide potential participants with information needed to indicate their intent to bid. A total of 14,371,300 $CO_2$ allowances will be offered for sale at a reserve price of $2.15.

### *EU Adds to Emissions Trading Scheme.*

The European Parliament's Environment Committee voted to include maritime transport in the European Union (EU) Emissions Trading Scheme (ETS) by 2023.




# PROJECT and BUSINESS DEVELOPMENTS

### *Indian Firm Advances Carbon Capture and Utilization Processes.*

An industrial plant in India is capturing $CO_2$ for carbon capture and utilization (CCU) processes. The $CO_2$ captured from the plant, located at the industrial port of Tuticorin, India, is being used to make baking soda. According to plant officials, approximately 60,000 metric tons of $CO_2$ per year will be captured at the plant with the use of Carbonclean's technology. From *The Guardian* on January 3, 2017.

### *Elk Petroleum Acquires Gas Field and Plant.*

Elk Petroleum entered an agreement to acquire interest in a gas field and plant located in Wyoming, USA, approximately 60 miles from Elk's Grieve $CO_2$-EOR plant. The Madden Gas Field and Lost Cabin Gas Plant is the second largest supplier of $CO_2$ into the Northern Rockies $CO_2$ Gas Transmission and Supply Pipeline Network. The amount of the currently available supply of $CO_2$ from the Lost Cabin Gas Plant, according to an *Elk Petroleum Media Release*, is capable of supporting the development of a $CO_2$-EOR project similar in size to that of *Elk's Grieve project*. From *Proactive Investors* on January 4, 2017.

# LEGISLATION and POLICY

### *Canada Agrees on National Carbon Price.*

The Canadian government reached a deal with 8 of the 10 Canadian provinces to introduce a national carbon price. Part of a framework to help Canada reach its goal of reducing $CO_2$ emissions by 30 percent from 2005 levels by 2030, the carbon price is accompanied by measures that also include increasing the use of renewable energy and investing in clean technologies. Under the plan, $CO_2$ emissions would cost $7.60 per metric ton in 2018, increasing by $7.60 a year until it reaches approximately $30 per metric ton in 2022. The provinces can either implement a carbon tax or a cap-and-trade market. From *Reuters* on December 9, 2016.

# EMISSIONS TRADING

### *EU Lawmakers Adopt Draft Reform of Carbon Market.*

European Parliament Environment Committee lawmakers adopted a draft proposal to reform the carbon market after 2020. The draft includes a higher rate at which permits should be removed from the market; an additional draft proposal was endorsed, which will double the rate the Market Stability Reserve (MSR) absorbs excess allowances. From *Euro News* on December 15, 2016.

# CLIMATE and SCIENCE NEWS

### *Scientists Measure Pulse of $CO_2$ Emissions During Spring Thaw in the Arctic.*

In collaboration with a team of researchers, scientists from *DOE's Lawrence Berkeley National Laboratory (LBNL)* have quantified the scale of $CO_2$ release from soil in the frozen arctic tundra once it begins to melt. The study, which used measurements from both the field and the lab, was based on a 2014 spring pulse in northern Alaska, USA, that included $CO_2$ emissions equivalent to 46 percent of the net $CO_2$ absorbed in the summer months. The study was a project of *DOE's Next-Generation Ecosystem Experiment (NGEE-Arctic)*, which seeks to gain a predictive understanding of the Arctic terrestrial ecosystem's feedback to climate. Findings of the study were published in a paper, titled *"Large $CO_2$ and $CH_4$ emissions from polygonal tundra during spring thaw in northern Alaska,"* in the online journal Geophysics Research Letters. From *Lawrence Berkeley National Laboratory* on December 14, 2016.

### *NASA Reveals 3-D Visualization of Earth's $CO_2$ Levels.*

The National Aeronautics and Space Administration (NASA) *released a video* representing a 3-D view of Earth's $CO_2$ levels. The data was gathered by the Orbiting Carbon Observatory satellite (OCO-2), which collected worldwide $CO_2$ levels from September 1, 2014, through August 31, 2015. The data was used along with a high-resolution weather model to reveal the movements of $CO_2$ across the world. Scientists then developed a model of the atmospheric $CO_2$ behavior from the timeframe the data was collected. From *International Business Times* on December 14, 2016.

### *China Launches $CO_2$ Monitoring Satellite.*

China launched a $CO_2$ monitoring satellite to contribute to global research on potential climate change. Launched from the Jiuquan Satellite Launch Center in Northwest China' Gansu Province, the TanSat satellite was sent into orbit approximately 430 miles above Earth and will monitor the concentration, distribution, and flow of atmospheric $CO_2$. TanSat will observe global $CO_2$ levels every 16 days during its 3-year mission. From *Global Times* on December 22, 2016.

# JOURNAL ARTICLES

### *Effectiveness of greenhouse-gas Emissions Trading Schemes implementation: a review on legislations.*

The following is the Abstract of this article: "Due to the severe problems caused by global warming, controlling [GHG] emissions has become an emerging topic around the world. This situation has led to the implementation of legislations, forcing companies to implement innovations and strategies to prevent and reduce carbon emissions. Nevertheless, the effectiveness of implementing these strategies and the estimation to fulfill Kyoto Protocol's 2020 target [ETS] needs to be further analysed and discussed. This paper reviews the existing [GHG]-emission legislations, as well as carbon offset programs worldwide. A detailed analysis on carbon emissions trends related to emissions penalties is shown for six major countries. The optimal penalty for emissions trading schemes is also analyzed and discussed in this paper. Future changes that could be made to the existing programs for enhancing their effectiveness are also suggested. It was found that carbon emissions decreased around 1.58% per year since [ETS] implementation. Around 23.43% of $CO_2$ reduction can be reached after 10 years of [ETS] implementation, compared to the trend when [ETS] was not implemented. Despite [ETS] implementation is extremely recent, based on the existing data a first estimation of the optimal penalty in achieving the maximum carbon reduction it was found around US$90.22 per tonne. However, as the implementation period of [ETS] is still limited for most countries, it is necessary to explore similar analysis as future work." **Paola Villoria-Sáez, Vivian W.Y. Tam, Mercedes del Rio Merino, Carmen Viñas Arrebola, and Xiangyu Wang**, *Journal of Cleaner Production*. (Subscription may be required.)

### *Limited trading of emissions permits as a climate cooperation mechanism? US-China and EU-China examples.*

The following is the Abstract of this article: "Recent multilateral climate negotiations have underlined the importance of international cooperation and the need for support from developed to developing countries to address climate change. This raises the question of whether carbon market linkages could be used as a cooperation mechanism. Policy discussions surrounding such linkages have indicated that, should they operate, a limit would be set on the amount of carbon permits that could be imported by developed regions from developing countries. This paper analyzes the impact of limited carbon trading between an ETS in the EU or the US and a carbon market covering Chinese electricity and energy intensive sectors using a global economy-wide model. [The authors] find that the limit results in different carbon prices between China and Europe or the US. Although the impact on low-carbon technologies in China is moderate, global emission reductions are deeper than in the absence of international trading due to reduced carbon leakage. If China captures the rents associated with limited permit trading, [the authors] show that it is possible to find a limit threshold that makes both regions better off relative to carbon markets operating in isolation." **Claire Gavard, Niven Winchester, and Sergey Paltsev,** *Energy Economics*. (Subscription may be required.)

### *Time-lapse downhole electrical resistivity monitoring of subsurface $CO_2$ storage at the Maguelone shallow experimental site (Languedoc, France).*

The following is the Abstract of this article: "A shallow field experimental site for $CO_2$ injection was established at Maguelone (Languedoc, France), in order to test in an integrated manner a suite of surface and downhole hydrogeophysical monitoring methods. The objective is to improve monitoring of gas transport in the shallow subsurface and to determine the sensitivity of $CO_2$ monitoring systems for leakage detection. The site offers a natural laboratory to study the processes associated with $CO_2$ injection in a clastic and clay-rich context saturated with saline fluids. Prior to $CO_2$ injection, three nitrogen ($N_2$) injections were undertaken in 2012 to measure the site response to neutral gas injection. In 2013, a volume of 111 $m^3$ (mass of 220 kg) of $CO_2$ was injected during 3.5 h at 15 m depth. During each experiment, the gas plumes were successfully detected from pressure monitoring, time-lapse induction logging and downhole resistivity monitoring with dipole–dipole array. Increases in resistivity are attributed to free gas propagation (either $N_2$ or $CO_2$) whereas decreases in resistivity correlate with $CO_2$ dissolution in the pore fluid. Chemical analyses confirm this hypothesis with a decrease in pH and an increase in the concentration of dissolved species in the latter case." **Philippe A. Pezard, Nataliya Denchik, Johanna Lofi, Hervé Perroud, Gilles Henry, Denis Neyens, Linda Luquot, and Arnaud Levannier**, *International Journal of Greenhouse Gas Control*. (Subscription may be required.)

# JOURNAL ARTICLES *(cont.)*

### *Lessons learned from using expert elicitation to identify, assess and rank the potential leakage scenarios at the Heletz pilot $CO_2$ 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 $CO_2$ 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 $CO_2$ 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.)

### *Flow visualization of $CO_2$ in tight shale formations at reservoir conditions.*

The following is the Abstract of this article: "The flow of $CO_2$ in porous media is fundamental to many engineering applications and geophysical processes. Yet detailed $CO_2$ flow visualization remains challenging. [The authors] address this problem via positron emission tomography using $^{11}C$ nuclides and apply it to tight formations—a difficult but relevant rock type to investigate. The results represent an important technical advancement for visualization and quantification of flow properties in ultratight rocks and allowed [the authors] to observe that local rock structure in a layered, reservoir shale ($K = 0.74$ μdarcy) sample dictated the $CO_2$ flow path by the presence of high-density layers. Diffusive transport of $CO_2$ in a fractured sample (high-permeable sandstone) was also visualized, and an effective diffusion coefficient ($D_t = 2.2 \bullet 10^{-8}$ m$^2$/s) was derived directly from the dynamic distribution of $CO_2$. During $CO_2$ injection tests for oil recovery from a reservoir shale sample [the authors] observed a recovery factor of RF = 55% of oil in place without fracturing the sample." **M.A. Fernø, L.P. Hauge, A. Uno Rognmo, J. Gauteplass, and A. Graue**, *Geophysical Research Letters*. (Subscription may be required.)

### *Experimental study of gas–oil relative permeability curves at immiscible/near miscible gas injection in highly naturally fractured reservoir.*

The following is the Abstract of this article: "The main aim of this work is to investigate gas–oil relative permeability curves as the main flow function in different gas injection scenarios, immiscible and near miscible in case of highly fractured reservoirs. In this research, some experiments have been done on the reservoir core sample selected from sandstone formation in one of the Iranian naturally fractured oil reservoirs. The core is saturated with oil sample and $CO_2$ is injected into oil saturated core sample. Experiments have been performed on both of the sandstone and artificial fractured sandstone, represented as no fractured and highly fractured reservoirs, based on incremental pressure algorithm approaching into near miscible condition. Inverse modeling method has been used to calculate relative permeability curves. By comparing the relative permeability curves in immiscible and near-miscible conditions, the results show that in sandstone core type this change is considerable, but in highly artificial fractured sandstone with a high ratio of artificial fractured to sandstone absolute permeability ($K_{ef}/K_s$) is not substantial. Moreover the results show that in the described case of artificial fractured core type so simple conventional relative permeability methods have the same results compared to a sophisticated inverse modeling method. The other main result is the lack of miscibility activation in near miscible injection through the highly fractured reservoirs leading to viscose dominant flow rather than capillary. Finally by considering this changing behavior, a better knowledge of gas front movement through highly fractured reservoirs in low [interfacial tension (IFT)] regions can be obtained." **Mohammad Parvazdavani, Saeed Abbasi, and Mohammad-Reza Zare-Reisabadi**, *Egyptian Journal of Petroleum*. (Subscription may be required.)

### *Investigation of uncertainty in $CO_2$ reservoir models: A sensitivity analysis of relative permeability parameter values.*

The following is the Abstract of this article: "Numerical reservoir models of $CO_2$ injection in saline formations rely on parameterization of laboratory-measured pore-scale processes. [The authors] performed a parameter sensitivity study and Monte Carlo simulations to determine the normalized change in total $CO_2$ injected using the finite element heat and mass-transfer code (FEHM) numerical reservoir simulator. Experimentally measured relative permeability parameter values were used to generate distribution functions for parameter sampling. The parameter sensitivity study analyzed five different levels for each of the relative permeability model parameters. All but one of the parameters changed the $CO_2$ injectivity by <10%, less than the geostatistical uncertainty that applies to all large subsurface systems due to natural geophysical variability and inherently small sample sizes. The exception was the end-point $CO_2$ relative permeability, $k^0_{r,CO2}$, the maximum attainable effective $CO_2$ permeability during $CO_2$ invasion, which changed $CO_2$ injectivity by as much as 80%. Similarly, Monte Carlo simulation using 1000 realizations of relative permeability parameters showed no relationship between $CO_2$ injectivity and any of the parameters but $k^0_{r,CO2}$, which had a very strong ($R^2 = 0.9685$) power law relationship with total $CO_2$ injected. Model sensitivity to $k^0_{r,CO2}$ source points to the importance of accurate core flood and wettability measurements." **Nozomu Yoshida, Jonathon S. Levine, and Philip H. Stauffer**, *International Journal of Greenhouse Gas Control*. (Subscription may be required.)

### *Rapid method to estimate the minimum miscibility pressure (MMP) in live reservoir oil systems during $CO_2$ flooding.*

The following is the Abstract of this article: "Flooding fuel-generated $CO_2$ into oil reservoirs will lead to two advantages in both EOR and reduction in atmospheric emission of [$CO_2$]. The main factor for determination of the possibilities to EOR by *e.g.* $CO_2$ injection, in particular miscible case, into a specific oil reservoir is the $CO_2$–oil minimum miscibility pressure (MMP). In this communication, [the authors] present the utilization of a soft-computing technique – gene expression programming (GEP) – for developing a new symbolic equation to pursue [the authors'] objective. In other words, this work presents a new approach to predict both pure and impure $CO_2$–oil MMP in live reservoir oil systems. The parameters of the new model involve the molecular weight of $C_{5+}$ fraction in crude oil, reservoir temperature, the mole percentage ratio of volatile to intermediate components of oil and critical temperature. A comprehensive error investigation is done to discuss accuracy of the recently proposed MMP model. Additionally, the results obtained by the new GEP-based model are compared with most widely-used empirically derived correlations available in the literature to show the superiority of the model. The results obtained in this study are encouraging and can propose accurate and efficient solutions for the case of $CO_2$–oil MMP of pure and impure components in live oil systems." **Arash Kamari, Milad Arabloo, Amin Shokrollahi, Farhad Gharagheizi, and Amir H. Mohammadi**, *Fuel*. (Subscription may be required.)

## REPORTS and OTHER PUBLICATIONS

*Carbon Capture and Storage (CCS) Market Analysis: By Technology (Post combustion, Pre Combustion, Oxy Fuel Technology); By Storage (Geological, Ocean and Mineral); By End User (Chemical, Fertilizer, Iron and Steel, Oil & Gas) – Forecast (2016 - 2021).*

The following is from a description of this report: "CCS technology has emerged as critical technical component in the combined efforts of various nations to combat climate change. [CCS] refers to the capturing of [$CO_2$] from different sources of emission, separating it from other gases and transporting to a suitable location for storage. Considering the cumulative commitment of disparate industrial stakeholders in curbing $CO_2$ emissions coupled with ongoing dominant role of fossil fuels in energy generation, the [CCS] technology is being adopted and employed across the globe...The [CCS] market report analyses the applications in disparate end user industries coupled with market demand from across the regions. The growth in [CCS] market is driven from Non Organization for Economic Corporation and Development (OECD) countries with a strong economic growth and industrialization. The increase of energy consumption is projected from renewable energy and nuclear power, presently contributing 2.5% growth to the market per year. Policies and regulations governing usage of fossil fuels and [$CO_2$] emissions fuel are set to increase the market growth. The increase in usage of biofuels resulted in the increase of energy consumption."

*20 years of carbon capture and storage – Accelerating future deployment.*

The following is a description of this International Energy Agency (IEA) publication: "CCS technologies are expected to play a significant part in the global climate response. Following the ratification of the Paris Agreement, the ability of CCS to reduce emissions from fossil fuel use in power generation and industrial processes – including from existing facilities – will be crucial to limiting future temperature increases to 'well below 2°C,' as laid out in the Agreement. CCS technology will also be needed to deliver 'negative emissions' in the second half of the century if these ambitious goals are to be achieved. CCS technologies are not new. This year is the 20$^{th}$ year of operation of the Sleipner CCS Project in Norway, which has captured almost 17 million tonnes of $CO_2$ from an offshore natural gas production facility and permanently stored them in a sandstone formation deep under the seabed. Individual applications of CCS have been used in industrial processes for decades, and projects injecting $CO_2$ for EOR have been operating in the United States since the early 1970s. This publication reviews progress with CCS technologies over the past 20 years and examines their role in achieving 2°C and well below 2°C targets. Based on the International Energy Agency's 2°C scenario, it also considers the implications for climate change if CCS was not a part of the response. And it examines opportunities to accelerate future deployment of CCS to meet the climate goals set in the Paris Agreement."

*Combining $CO_2$ Enhanced Oil Recovery with Permanent Storage in Mexico.*

The following is from the Executive Summary of this Battelle Memorial Institute document: "The goal of the current project is to review state-of-the-art practices related to combining $CO_2$ EOR with geologic storage for CCUS in Mexico. This was accomplished by an assessment of the requirements a $CO_2$-EOR project must satisfy in order to qualify as a permanent storage project to earn carbon credits. The material presented is based on review of latest literature, discussions with relevant experts, as well as Battelle's direct experiences from multiple in-house geologic $CO_2$ storage projects. The report focuses on the key technical and practical considerations and provides an overview of related technologies for economic and efficient $CO_2$-EOR storage. The technology and operational practices for CCUS have been developed over decades of $CO_2$-EOR experience established in the oil and gas industry. Hence, the key barriers and uncertainties in accounting for associated $CO_2$ storage during $CO_2$-EOR operations are not technical but economic and policy-related. While economic favorability can be improved by investing in improvements to the current $CO_2$ infrastructure, strong constructive policy measures for geologic $CO_2$ storage are also important. $CO_2$-EOR projects demonstrating storage of anthropogenic $CO_2$ in Mexico may be eligible to provide carbon credits. The minimum requirements to gain storage credits according to protocols stated in the United Nations Framework Convention on Climate Change Clean Development Mechanism (CDM), California Cap-and-Trade Regulation Instructional Guidance, American Carbon Registry, and U.S. Environmental Protection Agency regulatory guidance were compared and contrasted. The protocols typically outline requirements as performance measures without prescribing technologies to meet these requirements. Accordingly, there is significant flexibility for the project proponent to fashion the project details and submit for approval plans that describe how requirements will be met."

*Scotland's Energy Strategy: The role of carbon dioxide capture and permanent storage.*

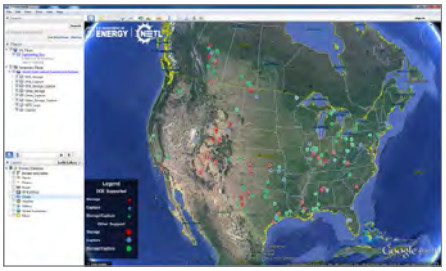
The following is from this Scottish Carbon Capture & Storage document: "This briefing from Scottish Carbon Capture & Storage (SCCS) sets out reasons for Scottish Government continuing to provide positive support for technologies and infrastructure that capture $CO_2$ from emissions and permanently store it in geological formations. Such technologies, collectively known as CCS, are complementary to several options being pursued for decarbonisation of the energy system. Including CCS in Scotland's whole energy-system strategy can make other options more effective and will be needed to extend the 2032 targets to an ambition of a net zero carbon Scotland in 2050."

# 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 $CO_2$. 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 $CO_2$ in the subsurface and identifying the geologic reservoirs appropriate for $CO_2$ 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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626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880

13131 Dairy Ashford Road, Suite 225
Sugar Land, TX 77478

420 L Street, Suite 305
Anchorage, AK 99501

1450 Queen Avenue SW
Albany, OR 97321-2198

## Contacts

Traci Rodosta
304-285-1345
*traci.rodosta@netl.doe.gov*

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