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

CSN CARBON STORAGE NEWSLETTER

FEBRUARY 2016

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:

CARBON STORAGE PROGRAM DOCUMENTS and REFERENCE MATERIALS

HIGHLIGHTS

"President's FY 2017 Budget Includes $878 Million for Fossil Energy Programs."

The FY 2017 Budget includes a request for $90.9 million for carbon storage research and development (R&D). The funding request supports: (1) storage field management projects, including the Regional Carbon Sequestration Partnerships (RCSPs), and other field characterization and injection projects; (2) risk and integration tool development; and (3) advanced storage R&D efforts, as part of the U.S. Department of Energy's (DOE) Subsurface crosscut, to develop laboratory- and bench-scale technologies for identifying and obtaining new subsurface signals, ensuring wellbore integrity, and increasing understanding of the stress state and induced seismicity. From *energy.gov* on February 9, 2016.

"NETL Carbon Capture Technologies to be Used in Commercial Biomass-to-Biofuel Conversion Process with Power Generation."

Two patented sorbent technologies that capture carbon dioxide (CO_2) from streams of mixed gases have been granted a license by DOE's National Energy Technology Laboratory (NETL). CogniTek Management Systems will incorporate the technologies into its integrated biomass-to-biofuels conversion process with power generation. The process will have naturally low CO_2 emissions, as the plants used as feedstock consume CO_2 from the atmosphere as part of their growth process. The technologies are expected to result in a "near 100 percent carbon negative" process. To learn more about NETL's role, visit their *Technology Transfer webpage*. From *NETL News Release* on January 20, 2016.

ANNOUNCEMENTS

DOE Co-Sponsors Workshop.

DOE and the UAE Ministry of Energy co-sponsored a CO_2 utilization workshop examining the technological and economic factors for CO_2 utilization to recover oil and water in the Gulf Region. The workshop, which took place at the World Future Energy Summit in Abu Dhabi, brought together government and industry technical experts from the Middle East and the United States to discuss the full lifecycle of carbon capture, utilization, and storage. The workshop furthers ongoing collaboration under the *U.S.-UAE Strategic Energy Dialogue* and in the *Carbon Sequestration Leadership Forum (CSLF)*.

RGGI Auction 31.

The states participating in the Regional Greenhouse Gas Initiative's (RGGI) 2016 auctions released the Auction Notice and application materials for their upcoming quarterly CO_2 allowance auction. The CO_2 Allowance Auction 31 will be held March 9, 2016.

Canada Pledges Funds to Reduce Carbon Emissions.

The Government of Canada announced funding to reduce short-lived climate pollutants (SLCPs), which have a shorter lifespan compared to greenhouse gases (GHGs). A portion of the funding will be used for projects that aim to reduce black carbon emissions to benefit the Arctic.

World Bank to Buy Carbon Credits.

The World Bank announced it has committed to buy carbon credits from the Philippines, potentially purchasing approximately 1.7 million carbon credits until 2020.

GCCSI Introduces CCS Fellowship Program.

The Global CCS Institute (GCCSI) appointed the first legal Fellow to their CCS Fellowship Program. The Institute, whose mission is to accelerate the development, demonstration, and deployment of carbon capture and storage (CCS), introduced the CCS Fellowship Program to recruit international experts to help advance CCS in Asia Pacific.

CARBON STORAGE in the NEWS

"PTRC and EERC Announce $2.5M in Funding."

Funding was awarded to the Petroleum Technology Research Center (PTRC) and the Energy and Environmental Research Center (EERC) at the University of North Dakota to develop an "intelligent monitoring system" (IMS). Utilizing data from PTRC's Aquistore project, the IMS will allow future CO_2 storage site operators to more efficiently manage operations, data management, and monitoring. While current monitoring technologies require various project teams to manually acquire and process data, EERC will develop the IMS to automate the integration of the CO_2 monitoring and simulation data. PTRC will provide access to the data acquired from Aquistore. From *Aquistore News Release* on January 7, 2016.

"Research Could Slow Fuel Switching Trend in Electric Generation."

A multi-national team, led by the University of Illinois, was selected to develop a proposal for retrofitting the university's Abbott Power Plant to capture CO_2 emissions. The Phase I award is for detailed engineering and planning and is expected to have a total value of $1.3 million. The retrofit project will also build a value chain and provide workforce training for operators from the coal and mining industries. From *Illinois Sustainable Technology Center* on January 21, 2016.

"Aker Solutions Starts Pioneering CO_2-Capture Project in Norway."

Aker Solutions initiated a five-month test program to capture CO_2 emissions from a waste-to-energy plant in Oslo, Norway. The test will be conducted at the Klemetsrud plant, which emits approximately 300,000 tons of CO_2 per year. The test will be conducted using Aker's mobile test unit for carbon capture. From *Aker Solutions Press Release* on January 25, 2016.

"CO_2 Solutions Receives $15 Million to Advance Transformative Technology."

CO_2 Solutions, Inc., will receive a grant from the Climate Change and Emissions Management Corporation (CCEMC), the company announced. CO_2 Solutions expects to use the grant towards the commercial deployment of their technology to capture CO_2 at an approximately 300 metric ton of CO_2/day scale from an industrial source in Alberta, Canada, with beneficial reuse of the captured CO_2. From *CO_2 Solutions Press Release* on February 1, 2016.

SCIENCE

"Breakthrough in Continuous Monitoring of CO_2 [Releases] from Storage Sites Could Assist CCS."

A new study conducted by a team of Japanese researchers could potentially lead to conducting lower-cost monitoring of underground CO_2 storage sites. By using monitoring techniques more often associated with the study of earthquakes and volcanic eruptions, researchers from the Kyushu University International Institute for Carbon-Neutral Energy Research (I^2CNER) analyzed seismic waves to detect the movement of subterranean fluid and to identify CO_2 releases before they reach the surface. I^2CNER is currently testing the method to further improve its accuracy. The Abstract of the study, titled "Development of surface-wave monitoring system for [released] CO_2 using a continuous and controlled seismic source," is available below. From *Science Codex* on January 22, 2016.

"Development of surface-wave monitoring system for [released] CO_2 using a continuous and controlled seismic source."

The following is the Abstract of this article: "To detect CO_2 [release] from CO_2 geological storage, [the authors] describe a seismic monitoring method using a continuous and controlled seismic source system, the Accurately Controlled Routinely Operated Signal System (ACROSS). The method applies surface-wave analysis to monitor the shallow subsurface from the temporal-variation (time-variation) of surface-wave phase velocity. [The authors'] numerical simulation study for CO_2 [release] through fault zones indicated that the spatial distribution of [released] CO_2 can be estimated from small temporal-variation of local phase velocities (~1–3 [percent]). To demonstrate the method in a field case, [the authors] analyzed continuous seismic records acquired with ACROSS. [The authors] clearly extracted a dispersion curve of surface waves in the frequency range excited by the ACROSS (5.015–15.015 Hz). In particular, [the authors] obtained reliable estimates of phase velocities in 10–15 Hz frequency range, in which the time-variation of phase velocities was better than [one percent] accuracy. This temporal stability was sufficient to allow [the authors] to detect changes in phase velocities associated with CO_2 [release] before [released] CO_2 reached the surface." **Tatsunori Ikeda, Takeshi Tsuji, Toshiki Watanabe, and Koshun Yamaoka**, *International Journal of Greenhouse Gas Control*. (Subscription may be required.)

"Carbon Dioxide Captured from Air Can Be Directly Converted into Methane Fuel."

Researchers from the University of Southern California have demonstrated that CO_2 captured from the air can be directly converted into methanol using a homogeneous catalyst. The conversion of CO_2 to methanol requires high temperatures, which can cause the catalysts to decompose. However, in the new study, published in the "Journal of the American Chemical Society," the researchers developed a stable catalyst that does not decompose in such conditions; the stability of the catalyst allows it to be reused numerous times for the continuous production of methanol, which can be used as an alternative fuel. According to the researchers, the new catalyst, along with additional compounds, allows for up to 79 percent of the CO_2 captured from the air to be converted into methanol. The Abstract of this study, titled "Conversion of CO_2 from Air into Methanol Using a Polyamine and a Homogeneous Ruthenium Catalyst," is available below. From *Phys.org* on January 27, 2016.

"Conversion of CO_2 from Air into Methanol Using a Polyamine and a Homogeneous Ruthenium Catalyst."

The following is the Abstract of this article: "A highly efficient homogeneous catalyst system for the production of CH_3OH from CO_2 using pentaethylenehexamine and Ru-Macho-BH (1) at 125–165°C in an ethereal solvent has been developed (initial turnover frequency = 70 h^{-1} at 145°C). Ease of separation of CH_3OH is demonstrated by simple distillation from the reaction mixture. The robustness of the catalytic system was shown by recycling the catalyst over five runs without significant loss of activity (turnover number > 2000). Various sources of CO_2 can be used for this reaction including air, despite its low CO_2 concentration (400 ppm). For the first time, [the authors] have demonstrated that CO_2 captured from air can be directly converted to CH_3OH in 79 [percent] yield using a homogeneous catalytic system." **Jotheeswari Kothandaraman, Alain Goeppert, Miklos Czaun, George A. Olah, and G.K. Surya Prakash**, *J. Am. Chem. Soc.* (Subscription may be required.)

POLICY

"Historic Paris Agreement on Climate Change."

An agreement was reached by 195 nations at the annual Conference of Parties (COP21) in Paris, France, to combat potential climate change by driving efforts to limit global temperature increase and invest in a low-carbon future. In addition to setting long-term direction, the Paris Agreement lays the foundation for countries to peak their GHG emissions as soon as possible while continuing to submit national climate action plans. Under the agreement, countries will submit their updated climate plans, called nationally determined contributions (NDCs), every five years. Following adoption of the Paris Agreement by the COP, it will be opened for one year for signature on April 22, 2016, and will become effective after 55 countries, accounting for at least 55 percent of global emissions, ratify the agreement. From *United Nations Press Release* on December 12, 2015.

"Canada to Consider CO_2 Emissions in Approving New Pipelines."

Canada announced a new framework for approving the construction of pipelines that requires the consideration of the direct and upstream GHG emissions linked to the projects. The new requirements will be added to Canada's existing environmental assessment process and will apply to projects currently being analyzed by the national energy regulator. From *Phys.org* on January 28, 2016.

"Carbon strategies and management practices in an uncertain carbonomic environment – lessons learned from the coal-face."

The following is the Abstract of this article: "For many businesses, carbon strategies are undertaken within a backdrop of an uncertain national carbon policy. Such was the case in Australia with the major political parties having radically different policies as to tackle the issue of climate change. However, despite such uncertainty, forward-thinking early movers have incorporated carbon awareness into their business decisions. This research investigates the carbon strategies and carbon management practices that were adopted by two firms operating at different levels of the Australian national energy market – one operates in energy transmission and distribution, and the other is an energy generator and retailer. The metaphor of 'the coal-face' is used to [analogize] the business practitioners from the studied firms who understand and are directly involved in day-to-day practices to handle carbon emissions issues in their [organizations]. The research findings highlight that while operating in the same industry, the firms employ different carbon strategies and carbon management practices to manage their compliance liabilities. Applying the lens of contingent resource-based view, the factors that explain their different carbon practices include the extent of carbon exposures, the sector-specific regulatory setting and the in-house capabilities to deal with carbon issues. In addition, this study [synthesizes] a general template of corporate carbon management framework, based on the real practices of studied firms, to provide practical guidelines for effectively developing carbon management strategies in an uncertain environment." **Dina Wahyuni and Janek Ratnatunda**, *Journal of Cleaner Production*. (Subscription may be required.)

"Climate policy modeling: An online SCI-E and SSCI based literature review."

The following is the Abstract of this article: "This study utilizes the bibliometric method on climate policy modeling based on the online version of SCI-E from 1981 to 2013 and SSCI from 2002 to 2013, and summarizes several important research topics and methodologies in the field. Publications referring to climate policy modeling are assessed with respect to quantities, disciplines, most productive authors and institutes, and citations. Synthetic analysis of keyword frequency reveals six important research topics in climate policy modeling which are summarized and analyzed. The six topics include integrated assessment of climate policies, uncertainty in climate change, equity across time and space, endogeneity of technological change, greenhouse gases abatement mechanism, and enterprise risk in climate policy models. Additionally, twelve types of models employed in climate policy modeling are discussed. The most widely utilized climate policy models are optimization models, computable general equilibrium (CGE) models, and simulation models." **Yi-Ming Wei, Zhi-Fu Mi, and Zhimin Huang**, *Omega*. (Subscription may be required.)

GEOLOGY

"Impact of pressure and temperature on CO_2–brine–mica contact angles and CO_2–brine interfacial tension: Implications for carbon geo-[storage]."

The following is the Abstract of this article: "Precise characterization of wettability of CO_2–brine–rock system and CO_2–brine interfacial tension at reservoir conditions is essential as they influence capillary sealing efficiency of caprocks, which in turn, impacts the structural and residual trapping during CO_2 geo-[storage]. In this context, [the authors] have experimentally measured advancing and receding contact angles for brine–CO_2–mica system (surface roughness ~12 nm) at different pressures (0.1 MPa, 5 MPa, 7 MPa, 10 MPa, 15 MPa, 20 MPa), temperatures (308 K, 323 K, and 343 K), and salinities (0 wt%, 5 wt%, 10 wt%, 20 wt% and 30 wt% NaCl). For the same experimental matrix, CO_2–brine interfacial tensions have also been measured using the pendant drop technique. The results indicate that both advancing and receding contact angles increase with pressure and salinity, but decrease with temperature. On the contrary, CO_2–brine interfacial tension decrease with pressure and increase with temperature. At 20 MPa and 308 K, the advancing angle is measured to be ~110°, indicating CO_2-wetting. The results have been compared with various published literature data and probable factors responsible for deviations have been highlighted. Finally, [the authors] demonstrate the implications of measured data by evaluating CO_2 storage heights under various operating conditions. [The authors] conclude that for a given storage depth, reservoirs with lower pressures and high temperatures can store larger volumes and thus exhibit better sealing efficiency." **Muhammad Arif, Ahmed Z. Al-Yaseri, Ahmed Barifcani, Maxim Lebedev, and Stefan Iglauer**, *Journal of Colloid and Interface Science*. (Subscription may be required.)

"Analysis of a time dependent injection strategy to accelerate the residual trapping of [stored] CO_2 in the geologic subsurface."

The following is the Abstract of this article: "A time dependent injection strategy for greatly accelerating the immobilization of geologically [stored] CO_2 is proposed and analyzed. The injection of high density CO_2 into a brine [formation] is followed by brine flooding facilitating residual trapping and dissolution of the CO_2 on time scales much shorter than those that would occur by natural processes. One-dimensional kinematic wave equations are derived for the two-phase flow of brine and CO_2 and for the transport of dissolved CO_2. A solution of these equations using the method of characteristics reveals that brine flooding is most effective when the kinematic wave speed of CO_2 saturation is higher than the propagation velocity of a shock wave separating the two-phase flow from the native brine. Finite volume simulation using the reservoir simulator TOUGH2 with PetraSIM interface are generally in good agreement with the one-dimensional model, but show that gravitational overriding of the CO_2 can become important if the duration of the injection process is too long. Both methods show that brine flooding is able to reduce the mass fraction of mobile CO_2 to less than 10 [percent] using a volume ratio brine: CO_2 of less than 2.75 on time scales comparable to that of the CO_2 injection." **Erik J. Huber, Abraham D. Stroock, and Donald L. Kock**, *International Journal of Greenhouse Gas Control*. (Subscription may be required.)

TECHNOLOGY

"Impact of wettability alteration on 3D nonwetting phase trapping and transport."

The following is the Abstract of this article: "[The authors] investigate capillary trapping and fluid migration via x-ray computed microtomography (x-ray CMT) of nonwetting phase (air) and wetting phase (brine) in Bentheimer sandstone cores which have been treated to exhibit different degrees of uniform wettability. x-Ray CMT scans were acquired at multiple steps during drainage and imbibition processes, as well as at the endpoints; allowing for assessment of the impact of wettability on nonwetting phase saturation and cluster size distribution, connectivity, topology and efficiency of trapping. Compared with untreated (water-wet) Bentheimer sandstone, cores treated with tetramethoxylsilane (TMS) were rendered weakly water-wet, and cores treated with octadecyltrichlorosilane (OTS) demonstrate intermediate-wet characteristics. As apparent contact angle increases, drainage flow patterns deviate from those derived for water-wet systems, total residual trapping and trapping efficiency decrease, and buoyancy plays a larger role during nonwetting phase mobilization; this has significant implications for CO_2 migration and trapping during CO_2 [storage] operations." **Anna L. Herring, Adrian Sheppard, Linnéa Andersson, and Dorthe Wildenschild**, *International Journal of Greenhouse Gas Control.* (Subscription may be required.)

TERRESTRIAL

"Economic value of carbon storage in U.S. National Wildlife Refuge wetland ecosystems."

The following is the Abstract of this article: "*The Third National Climate Assessment* released in 2014 provides further evidence of global warming and mitigation options [including carbon storage]. In this paper, [the authors] report on the quantity and economic value of carbon stored in wetlands ecosystems found in four U.S. National Wildlife Refuges. [The authors'] results suggest that wetlands in National Wildlife Refuges provide substantial carbon storage benefits to the [United States] and world." **Douglas Patton, John C. Bergstrom, Rebecca Moore, and Alan P. Covich**, *Ecosystem Services.* (Subscription may be required.)

"Land use, land use change and soil carbon [storage] in the St. Johns River Basin, Florida, USA."

The following is the Abstract of this article: "Land use change is widely recognized as a net source of [GHG] emissions at the global scale. Most of these emissions are attributed to losses from aboveground terrestrial pools such as deforestation. However, much less is known about the effects of land use change on soil carbon pools at regional scales. To address this problem, relationships between soil organic carbon (SOC), land use/land cover (LULC) classes, and LULC change were investigated at the regional scale. A legacy soil survey was used in conjunction with a new, contemporary sampling campaign to determine SOC change through time. Together, the two datasets cover an approximate 40-year time period (1965 to 2009). The greatest densities of SOC were documented in wetland classes. Specifically, soils of Hardwood Swamp, Cypress Swamp, and Mixed Urban consisted of both residential Wetland Forest contained 9.8, 9.5, and 7.8 g C m^{-2}. In regard to absolute storage, or SOC stocks, Hardwood Swamp, Pineland, and Urban ranked highest and contained 14.4, 13.3, and 9.9 Tg C, respectively. The effect of LULC change was mixed, and resulted in both gains and losses of SOC at the field scale. At the regional scale, median SOC increased by 16.9 g C m^{-2} yr^{-1}. Urbanization of natural landscapes resulted in the largest rate of [storage], which increased SOC by 37.1 g C m^{-2} yr^{-1}. The largest losses were documented in LULC classes converted from Improved Pasture to Rangeland, which decreased SOC by 8.5 g m^{-2} yr^{-1}." **C. Wade Ross, Sabine Grunwald, David Brenton Myers, and Xiong Xiong**, *Geoderma Regional.* (Subscription may be required.)

TRADING

"Beijing Carbon Market to Extend Pilot Trading."

Beijing's carbon market will continue to trade local CO_2 permits after their three-year pilot phase expires in June 2016, according to a statement released by the Beijing market regulator. In addition, the Beijing Development and Reform Commission has submitted plans to convert local permits into ones tradable on the nationwide exchange. To date, Beijing has traded approximately 5.7 million permits. From *Reuters* on January 27, 2016.

"EU and Switzerland Set to Link Carbon Markets…"

The European Union (EU) and Switzerland announced plans to link their respective emissions trading schemes, allowing covered entities in both systems to trade emissions permits. The Swiss scheme was set up in 2008, includes approximately 55 companies, and covered 5.5 million metric tons of carbon emissions in 2015. EU's Emission Trading Scheme (ETS) was initiated in 2005 and regulates approximately 11,000 power stations and manufacturing plants representing approximately 2 billion metric tons of carbon emissions. From *International Center for Trade and Sustainable Development* on January 26, 2016.

"Adjusting the CO_2 cap to subsidized RES generation: Can CO_2 prices be decoupled from renewable policy?"

The following is the Abstract of this article: "The low prices in the EU ETS have triggered discussions of various possible reforms. One option is to decouple the CO_2 prices from renewable energy policy by adjusting the emission cap to renewable energy investment overshoots. [The authors] introduce two ways of reducing the CO_2 cap in response to overshoots of renewable policy investment over previously announced targets. [The authors] investigate these options with the agent-based model EMLab-generation. [The authors] find that both policy implementations are successful in restoring prices. They also ensure that making public investments that exceed policy targets contribute to carbon emission reduction, and that renewable policy does not benefit the most emission-intensive power plants. However, neither policy is suitable for achieving [specific] levels of prices or price volatility." **Jörn C. Richstein, Émile J.L. Chappin, and Laurens J. de Vries**, *Applied Energy.* (Subscription may be required.)

RECENT PUBLICATIONS

"No-Impact Threshold Values for Groundwater Reduced-Order Models."

The following is from the Executive Summary of this National Risk Assessment Partnership (NRAP; an initiative within DOE/NETL) document: "The purpose of this study was to examine methodologies for establishing baseline data sets and statistical protocols for determining statistically significant changes between background concentrations and predicted concentrations that would be used to represent a contamination plume from geologic storage of CO_2 in the second-generation hydrologic models being developed by the National Risk Assessment Partnership's (NRAP) Groundwater Protection Working Group. This could then be used to help quantitatively evaluate the impact of [releasing] fluids on a groundwater system. The initial effort examined selected portions of two [formation] systems: the urban shallow-unconfined [formation] system of the Edwards-Trinity [Formation] System (being used to develop the reduced-order model for carbonate-rock [formations]), and a portion of the High Plains [Formation] (an unconsolidated and semi-consolidated sand and gravel [formation] being used to develop the reduced-order model for sandstone [formations]). No-impact threshold values were determined for cadmium, lead, arsenic, pH, and total dissolved solids that could be used to identify potential areas of contamination in overlying [formations] predicted by numerical models of [CO_2] storage reservoirs. No-impact threshold values were later determined for chromium specifically to support the reduced-order model being developed by Lawrence Livermore National Laboratory (LLNL) for the High Plains [Formation]. These threshold values are based on an interwell approach for determining background groundwater concentrations as recommended in the U.S. Environmental Protection Agency's Unified Guidance for Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities…"

"Roadmap for carbon capture and storage demonstration and deployment in the People's Republic of China."

The following is from the Introduction of this Global CCS Institute document: "Carbon dioxide (CO_2) emissions from fossil fuel combustion account for the largest share of [GHG] emissions by far. In the People's Republic of China (PRC), CO_2 emissions have risen in tandem with its rapid economic growth for the past three decades due to its carbon-intensive coal dominated energy mix. Accelerated efforts to reign in growing CO_2 emissions in the PRC, the world's largest energy consumer and largest emitter of CO_2, are of paramount importance to global climate change mitigation efforts. Consistent with its aim to peak out CO_2 emissions by 2030, the Government of the PRC is implementing strong measures to transform its energy to a lowcarbon mix. But coal is expected to remain a pillar of its energy security even in the long-term, with a large share in the energy mix. As a result, for the PRC to move from its current CO_2 emission reduction trajectory to a more ambitious one, CO_2 abatement from coal-based industrial production and power generation is crucial. CCS is the only currently available technology that can cut up to 90 [percent] of CO_2 emissions from coal-fired power plants and industries. Many studies have highlighted CCS as an essential part of a portfolio of technologies that are required to achieve cost-effective long-term CO_2 mitigation. Yet, many perceived and real risks and barriers are delaying CCS demonstration and deployment, risking the attainment of CO_2 mitigation objectives…"

"Scottish CO_2 Hub – A unique opportunity for the United Kingdom."

The following is from this Scottish Carbon Capture & Storage (SCCS) document: "The unique importance of a Scottish CO_2 Hub is as the 'downstream' component of a Europe-wide CO_2 capture, transport and storage system, complementing the 'upstream' collection and dispatch hubs envisaged for mainland Europe, Scandinavia and England by providing access to low risk, high capacity and cost-effective CO_2 storage. This can be achieved economically and rapidly by re-use of existing on- and offshore transport and storage infrastructure to reduce costs, and potentially through value generation from CO_2 [utilization] in CO_2-EOR. A flexible shipping solution can transport CO_2 from eastern England and Europe with low initial capital investment and allow sequential, project-by-project expansion of the system. A CO_2 capture cluster in central and eastern Scotland involving both power and industrial emitters can be established using existing transport and storage infrastructure allowing rapid deployment of the whole-chain CCS system for sequential expansion as import volumes from European and other UK CO_2 hubs become available. Although small by European standards, this capture cluster would be significant for Scottish emissions, realistically able to halve Scottish industrial emissions and reduce total Scottish emissions from all sources by c.20 [percent]."

LEGISLATIVE ACTIVITY

"[CO_2 Capture Technology Amendment Included in Energy Bill]."

The U.S. Senate passed the clean air technology amendment (*S.A. 3017*) to the *Energy Policy Modernization Act*. The program, established by a Federal commission under DOE, will award public and private entities that design technology to remove CO_2 from the atmosphere and permanently store CO_2. Once the technology is developed, the intellectual property rights would be shared by the United States and the inventor. From *U.S. Senator John Barrasso News Release* on January 28, 2016.

"Climate Change Package Passes Massachusetts Senate."

The Massachusetts State Senate passed legislation requiring the state to develop a climate change mitigation plan and to meet long-term carbon emissions reduction benchmarks. The bill, *S. 2092*, would set new targets between the goal of reducing Massachusetts' emissions 25 percent below 1990 levels by 2020, and reducing it to 80 percent below 1990 levels in 2050. In addition, the bill, which was sent to the Massachusetts House for consideration, would establish benchmarks of 35 to 40 percent below 1990 levels in 2030, and 55 to 65 percent below 1990 levels in 2040. From *NewBostonPost* on January 28, 2016.

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

The *National Energy Technology Laboratory (NETL)*, part of DOE's national laboratory system, is owned and operated by the U.S. Department of Energy (DOE). NETL supports DOE's mission to advance the national, economic, and energy security of the United States.

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

Get Social with Us

There are several ways to join the conversation and connect with NETL's Carbon Storage Program:

Facebook
Twitter
Instagram
YouTube
LinkedIn
RSS Feed
Flickr

Disclaimer