

— *INSIDE HIGHLIGHTS* —

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Natural gas demand is expected to grow over the next several decades, making the outlook for new nuclear and renewable energy less favorable, according to early conclusions of the U.S. Energy Information Administration’s Annual Energy Outlook 2011. . . . . 5

There may be anywhere from 500 to 5,700 years’ worth of permanent carbon dioxide storage in various geologic formations in the United States and Canada, according to estimates from the most recent edition of the Department of Energy’s Carbon Sequestration Atlas (III). . . . . 5

The Department of Energy is increasingly looking to the Pentagon as a testing ground for new energy technologies and that cooperation is expected to grow even more in the coming years with collaborations of everything from small, modular nuclear reactors to cheaper lithium ion batteries. . . . . 6

**Calendar** . . . . . 6

## CALIFORNIA GIVES FINAL APPROVAL TO CAP-AND-TRADE PROGRAM

The California Air Resources Board approved the state's closely watched cap-and-trade emissions reduction regime last week in resounding fashion, voting 9-1 to endorse the new regulations, which will begin with an initial phase in 2012. "This program is the capstone of our climate policy, and will accelerate California's progress toward a clean energy economy," said ARB Chairman Mary Nichols. "It rewards efficiency and provides companies with the greatest flexibility to find innovative solutions that drive green jobs, clean our environment, increase our energy security and ensure that California stands ready to compete in the booming global market for clean and renewable energy." As California moves to implement the kind of emissions reduction program that has effectively been put on the shelf in Congress, the Board said it hopes the state's program—developed under the state's AB 32 law—can "provide a model for action that can be used at the federal, state and regional levels. As climate policies are being addressed worldwide, California's early actions are positioning its economy to reap the benefits on the world stage and are catalyzing action throughout the country and the world."

The first three years of the program will apply to the electric sector, air emissions from refineries, and large industrial sources. The initial emissions cap will be set at the covered sector's expected emissions, and decline by 2 percent per year until 2015, when the cap-and-trade program will expand to include transportation fuels, natural gas, and propane through fuel distributors, thus capturing most of the state's emissions. From 2015 to 2020 the cap will then be reduced by 3 percent annually. The state will provide "significant" free allowances to industrial sources during the initial phase—which will run from 2012 to 2014—and companies that need additional allowances will be able to purchase them at quarterly auctions conducted by ARB or buy them on the market. Electric utilities will be required to sell their allowances and "dedicate the revenue generated for the benefit of their ratepayers."

## Program Designed to Link With WCI, RGGI

The Board noted that the cap-and-trade regulation is designed "so that California may link up with programs in other states or provinces within the Western Climate Initiative, including New Mexico, British Columbia, Ontario and Quebec. Efforts are also underway to link the WCI with other regional climate programs, such as the Midwest Greenhouse Gas Reduction Accord and the Regional Greenhouse Gas Initiative."

Up to 8 percent of a company's emissions can be covered using credits from compliance-grade offset projects involving forestry management, urban forestry, dairy methane digesters and the destruction of existing banks of ozone-depleting substances in the United States. There are also provisions to develop international offset programs that could include the preservation of international forests. A Memorandum of Understanding has already been signed by the state with Chiapas, Mexico, and Acre, Brazil, to establish the programs.

## \$15-30 Carbon Price by 2020

An economic analysis of the regulations by ARB expects that they will result in a carbon price between \$15-30 by 2020, with a 1-3 percent increase in the price of electricity by that year. But the program, along with companion regulations and laws, is also expected to increase the state's energy efficiency that should reduce fuel and energy demand by between 2 and 4 percent, offsetting the increased electric costs. The prices are well below what many analysts believe would be necessary to support carbon capture and sequestration, though the state does have an integrated gasification closed cycle coal-fired plant proposed to be built where the captured carbon dioxide would go to enhanced oil recovery in nearby oil fields.

## Schwarzenegger Heralds Approval

The approval from the Air Resources Board comes a month-and-a-half after voters in California overwhelmingly rejected a ballot initiative that would have suspended AB 32 until unemployment fell to historical lows for a year

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(GHG, Vol. 5 No. 43). Gov. Arnold Schwarzenegger pointed to the backing of the state's voters in his comments to the Board at its Nov. 16 meeting. "One thing we know for sure is that AB 32 was challenged, you know, by outside oil companies and by industries, coal mines and different companies that challenged it, put millions of dollars behind it in the last election. And Proposition 23, which was meant to take out AB 32, was defeated overwhelmingly—not by 5 percent, not by 10 percent but by 22 percent.

So that just shows to you, a huge majority of Californians are big believers in AB 32." ■

## **UPTON NAMES SUBCOMMITTEE CHAIRMAN, SHUFFLES JURISDICTION**

Incoming House Energy and Commerce Committee Chairman Fred Upton (R-Mich.) tapped the leaders of the panel's six subcommittees last week, moving both to reward those who backed him in a bitter campaign for the gavel and mend fences with current Ranking Member Joe Barton (R-Texas) and others who opposed him. Barton, who was Upton's main opponent in the fight for the chairmanship but failed to receive a necessary term-limit waiver from House Republican leaders, will be given the title of 'Chairman Emeritus' and will have a seat on each of the subcommittees as well as additional staff. "We could not have a more talented, accomplished group of members, from top to bottom, with such diverse backgrounds necessary to deliver the change the American people expect and demand," Upton said in a statement. "I am also pleased that Joe Barton will continue his distinguished service on the Committee as Chairman Emeritus."

The big winner initially appears to be Rep. Ed Whitfield (R-Ky.), an early supporter of Upton who will take the helm of the newly formed Energy and Power Subcommittee. That panel appears to be the more significant of the two that emerged from Upton's decision to break up the Energy and Environment Subcommittee into two subcommittees. Whitfield's subcommittee will have jurisdiction over energy and Clean Air Act issues—a plus for Whitfield as Republicans look to take on the Environmental Protection Agency—while the Environment and Economy Subcommittee will be chaired by Rep. John Shimkus (R-Ill.), who led his own campaign for chairman against Upton. Rep. Cliff Stearns (R-Fla.), another opponent of Upton in the chairmanship battle, will take over the Oversight and Investigations Subcommittee. "Our challenges are many, and it will be all hands on deck for the Energy and Commerce Committee as we repeal Obamacare, cut spending, roll back job-killing regulations,

unleash technological innovation, and fortify our nation's energy security," Upton said. "Every member and every subcommittee will be on the frontlines as we take on federal agencies—EPA, HHS, DOE, FCC, you name it—to identify wasteful programs and target areas to immediately cut spending."

## **Vice Chairs Appointed**

Upton has also decided to name vice chairmen on the full committee and most of the subcommittees. Rep. Sue Myrick (R-N.C.) will serve as the full committee's vice chair, while John Sullivan (R-Okla.) will hold that spot on Energy and Power and Tim Murphy (R-Pa.) on Environment and Economy. No vice chair has been named for Oversight and Investigations. ■

## **NEW SHORT-TERM CR APPEARS LIKELY FOR FUNDING DOE COAL PROGRAMS**

As the clock ticked down late last week on the stop-gap measure currently funding the Department of Energy at current levels, lawmakers appeared set to move forward with passing another short-term Continuing Resolution (CR) that would extend into early February. The likelihood of such a move became apparent late last week, after the Senate failed to take up a proposed omnibus appropriations bill to provide funding for the remainder of Fiscal Year 2011 that would have boosted funds for DOE's carbon capture and sequestration programs. While the House earlier this month passed a year-long CR that would continue to fund government agencies at their current levels for the remainder of the fiscal year, Senate Majority Leader Harry Reid (D-Nev.) reportedly believed that there was not enough votes in the Senate to pass that measure.

In remarks on the Senate floor Dec. 16, Minority Leader Mitch McConnell (R-Ky.) attacked the omnibus spending bill and pushed instead for a new CR that would run through Feb. 18. "They want us to ram this gigantic, trillion dollar bill through Congress—and they're using the Christmas break as a inducement to get us to vote for it. This is no way to legislate," he said. "Once the new Congress is sworn in, we'll have a chance to pass a less expensive bill free of wasteful spending. Until then, we should take a step back and respect the clear will of the voters. Americans don't want massive, trillion dollar bills rushed through Congress on our way out the door—they want us to be careful and responsible with their money."

After the Senate failed to take up the omnibus bill, Reid lashed out at Republicans, a number of which pulled their support for the bill, leading to its collapse. "The hypocrisy

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of my Republican colleagues caught up with them tonight. While publicly posturing for months against Congressionally-directed spending, many of them worked in private to secure funding for priorities in their states. And when they were exposed for trying to have it both ways, they pressured their colleagues who had previously supported this critical bill to pull their support at the last minute,” Reid said in a statement. “It is critical we do everything in our power to make sure that we keep our government operating. That is why I decided to move forward with a short-term Continuing Resolution. I will work with the Republican leader to finalize it in the coming days.”

### **CRs Keep EM at Approx. \$6 Billion Total**

Since the start of FY 2011 on Oct. 1, the DOE and other federal agencies have been funded at their FY 2010 levels through a set of CRs, the last of which expired Dec. 18. The series of stop-gap funding measures has been necessary due to lawmakers’ failure to complete the appropriations bills that specify funding levels for various federal agencies. In the Senate’s omnibus appropriations bill, the DOE’s Fossil Energy R&D programs would receive \$672 million, an increase of \$85 million over the request, but largely matching the funding level from FY 2010 that would be included in a year-long CR. Specifically, the omnibus includes \$155 million for carbon sequestration R&D, an increase of \$12 million over the request. The increase would go toward “an initiative focused on innovative concepts for the beneficial use of carbon dioxide for non-geological activities,” according to an explanatory statement accompanying the bill. ■

### **EPRI RAMPING UP WORK TO STUDY COST OF CCS RETROFITS**

Bringing down the cost of retrofitting older coal plants with carbon capture and sequestration technology and guarding against groundwater contamination once CO<sub>2</sub> has been injected for storage will be two key research areas for the Electric Power Research Institute over the next year, EPRI officials said at a briefing with utility executives last week. EPRI is currently conducting an engineering analysis of five coal-fired plants to gauge how much it would cost to retrofit the plants with CCS. “From that we will get a sense of what the complexities are, what the challenges are, what the costs are and what the energy penalties are,” George Offen, manager of EPRI’s CCS research and development program, said during a discussion hosted by EPRI last week. “Each of these power plants is a very different fuel or configuration, and that’s why we’re going to five of them.”

Retrofit has emerged as one of the key issues facing utilities as they weigh the benefits of CCS technology, though the industry has yet to reach agreement on reasonable guidelines for retrofitting existing coal plants with carbon capture and sequestration technology, specifically when to do away with existing plants and start anew. At the Ninth Annual Conference on Carbon Capture and Sequestration last May, Peter Radgen, technology area manager for CCS at E.ON, argued in his presentation that only power plants operating at more than 40 percent efficiency are worth retrofitting—anything operating at a lower efficiency, he said, should be replaced. “We see that there are reasons for post-combustion technology, but it doesn’t make sense to have very old, low-efficient power plant stations say, ‘well, let’s reduce emissions by CCS,’” he said. “You need to have an integrated approach.” John Thompson, director of the Clean Air Task Force’s Coal Transition Program, said at the May meeting that he believes fleets with above 35 percent efficiency should be retrofitted. In the end, he said, he predicts that somewhere between 100 and 150 gigawatts will be left to retrofit. “I think we’re going to have a lot of these plants that will not be able to retrofit for very practical reasons about space, and there are others that are not able to retrofit simply because they are small and they’re old,” he said. “So when you start subtracting that out, you’re going to see a significant chunk that is going to fall out.”

### **Asking the ‘What Ifs’**

Joining EPRI in the discussion was American Electric Power executive Gary Spitznogle, director of the company’s office of new technology development and policy support, who detailed AEP’s plans for the 1,300 MWe Mountaineer Plant in New Haven, W. Va. Spitznogle, who estimates that the plant will be fully functional within the next five years, said one of AEP’s biggest challenges there is navigating the large amount of unexplored geology in the area as it looks for places to sequester the captured carbon dioxide. “We’re looking for porous, permeable rock that is suitable for storing the CO<sub>2</sub>, and we’re also looking for high-integrity cap rock. In other words, very thick layers of rock that do not exhibit porosity, permeability, any kind of fissures or faults or anything that would allow for the transmission of CO<sub>2</sub>,” he said.

This fear of weak rock in CCS storage sites has researchers taking extra precautions during their testing process. Offen said one of his biggest concerns is buried CO<sub>2</sub> leaking into and subsequently contaminating nearby groundwater. EPRI is addressing just that in a current a controlled release study by injecting CO<sub>2</sub> into an underground saline reservoir of water that borders an aquifer. “We know that CO<sub>2</sub> can be stored underground. It’s been done in enhanced oil recovery, it exists naturally in underground

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# TENTH ANNUAL CARBON CAPTURE & SEQUESTRATION CONFERENCE

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## CALL FOR PAPERS

The 2011 Conference follows in the footsteps of the past nine events, maintaining the objectives to:

- Focus on carbon capture, separation and sequestration technologies that are being or could be deployed in the U.S. and North America;
- Provide a forum for the exchange of experience among U.S. and international scientific and engineering communities working on such technologies and systems;
- Facilitate the necessary dialogue between technology developers/purveyors, industry and the public on the development and deployment of viable technologies; and
- Share experience on developing the necessary capacity within the public and private sector to move the technology base forward.

Conference Advisors... (as of 11/18/2010)

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<b>Douglas W. Duncan</b> <i>U.S. Geological Survey</i>	<b>Edward Rubin</b> <i>Carnegie Mellon Univ.</i>
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**The Ninth Annual Carbon Capture and Sequestration Conference attracted a record crowd of nearly 900 participants, representing about two dozen countries.** Kicked off by U.S. DOE Assistant Secretary for Fossil Energy James Markowsky, plenary session speakers included: Global Carbon Capture & Storage Institute CEO Nick Otter, Minnesota Public Utility Commission Chairman David Boyd and Duke Energy Chief Technology Officer David Mohler. Papers were presented on the full range of issues facing CCS, from regulatory and transportation issues to public outreach and financing. More than 300 technical papers were presented on the latest in CCS research and technology development. **The Annual May CCS Conferences have become the place to be if you have anything to do with CCS.**

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# An Invitation to Present a Paper or Poster

Individuals seeking to present a paper in the concurrent sessions or as a poster must submit a **350-word abstract** for peer review. Following is a list of topic areas. **'HOT TOPICS' FOR 2011 ARE IN GREEN**. Acceptance for presentation in a concurrent session or for a poster presentation will depend on the decision of reviewers. ***For 2011 'poster only' presentations are being sought in some topic/sub-topic areas. These are designated in italics.*** \*Added Topic.

## THE NECESSITY OF CCS TO MEET DEVELOPMENT NEEDS IN A DE-CARBONIZED ECONOMY

### THE U.S.-CANADIAN CCS COLLABORATION

### US-CHINA COOPERATION TO SUPPORT CCS TECHNOLOGY RDD&D

### CCS SYSTEMS FOR VARIED FOSSIL FUELS

- Coal by Rank
- *Petcoke (posters only)*
- **Biomass**
- **Biomass/Coal Mixed Feed**  
– **Achieving Negative Emissions**
- **Natural Gas**

### CARBON CAPTURE/SEPARATION TECHNOLOGIES

- Chemical Solvents
- Chemical Looping
- **Membranes/Ionic Liquids**
- Sorbents
- **Oxycombustion**
- *Potential of Reducing Need for CO<sub>2</sub> Separation from Flue Gases*
- *Advanced Gasification*
- New Advanced Concepts

### CAPTURE AND SYSTEMS ANALYSIS

- Industrial Efforts/Case Studies
- Power System Concepts
- Environmental Aspects
- Cost and Efficiency

### ADVANCED CONVERSION/CAPTURE CONCEPTS

- **Carbonates**
- Biological/Chemical Processes  
– **ALGAL Biomass Systems**
- Methane Conversion
- **Beneficial Use of CO<sub>2</sub>**

### POST-COMBUSTION CAPTURE

- Industrial Efforts/Case Studies
- Technology Advancement
- Technology Feasibility and Economics
- **Economics of Pre- vs Post-Combustion Technologies**

### SEQUESTRATION OF CO<sub>2</sub> IN GEOLOGIC FORMATIONS

- Depleted Oil/Gas Fields
- Enhanced Coal Bed Methane
- *Saline Reservoirs*
- *Environmental Assessments*
- *Site Selection and Characterization Protocols*
- Unmineable Coal Seams
- **Basalts and Organic Shales**
- Co-Sequestration
- **Off Shore Sites in North America**

### CO<sub>2</sub> COMPRESSION TECHNOLOGIES \*

### CARBON SEQUESTRATION VIA EOR

- Field Experience of Ongoing Projects
- **Long-Term Containment**

- **EOR/CCS Systems to Handle CO<sub>2</sub> Emission from Electric Generating Facilities**
- Potential Regulation Beyond Current Framework

### REGIONAL CARBON SEQUESTRATION PARTNERSHIPS—LARGE SCALE FIELD TESTING

### EVALUATIONS OF TERRESTRIAL SEQUESTRATION

- Potential Contribution of Terrestrial Sequestration to Mitigation of Atmospheric Emission of CO<sub>2</sub>/CH<sub>4</sub>
- Enhancing Natural Sinks for Sequestration
- Utilizing Terrestrial-Based CCS by Large-Scale Industrial Facilities

### KNOWLEDGE GAINED (OR EXPECTED TO BE OBTAINED) FROM LARGE-SCALE CCS DEMONSTRATIONS

### SIMULATION AND RISK ASSESSMENT

- *Geologic Modeling Efforts*
- Groundwater Impacts
- Case Studies
- *Results from Field Tests*
- *Modeling Development*
- Approaches, Methodologies and Code
- **Opportunities for Accelerating CCS Deployment**

### CCS IMPACT ON WATER RESOURCES

- Potential Groundwater Impacts from Sequestration
- Water Resource Demands for Capture Systems
- Management of Extracted Water

### MONITORING, VERIFICATION AND ACCOUNTING TECHNOLOGIES

- *Field Application Studies*
- *Tools/Technology Advancement*
- *Results and Analysis*
- *Time-Lapse Monitoring*

### ECONOMICS OF CCS SYSTEMS FOR ELECTRIC GENERATING FACILITIES

- **Comparison with other Alternatives to Reduce CO<sub>2</sub> Emissions**  
– **Timeframe for CCS Commercial Deployment in Order for it to be a Viable Option**
- Rebuild vs Retrofit of Existing Plants

### CO<sub>2</sub> TRANSPORTATION

- Overall Pipeline Need to Support CCS Proposed to be Deployed in Regions Lacking Suitable Sequestration Sites
- Pipeline Infrastructure
- Risk and Health Concerns
- Related Policies/Regulations
- Safety Issues

### ELECTRIC GENERATION FACILITY DECISIONMAKERS EVALUATION OF FOSSIL-FIRED PLANTS WITH CCS

- Post-Combustion CCS Systems for the Existing Fleet of Fossil-Fired Plants

- **Consideration of Natural Gas-Fired Plants With/Without CCS**
- **Comparative Assessments by PUCs, Public Power Entities of CCS for Fossil-Fired Plants Versus Other Options for Electricity Generation**
- **PUCs, Public Power Entities' Consideration of Liability for Sequestration at Remote Sites**
- **Viability of Deployment of CCS in a Regulated vs. Unregulated Framework for Electricity Generation**

### CCS FOR NATURAL GAS-FIRED ELECTRIC GENERATING PLANTS

### DECISIONMAKING TOOLS/CRITERIA

- Gaps in the Current Knowledge Base That Need to Be Addressed
- **Decisionmaking Tools for PUCs/Public Power Entities to Evaluate CCS Systems**
- **Criteria Used by Decisionmakers in Selecting Electric Generation Options**
- Case Studies
- **Economics**
- Environmental Aspects
- Benefits Analysis

### CCS SYSTEMS FOR NON-ELECTRIC GENERATING OPERATIONS

- Natural Gas/Oil Production
- **Cement Operations**
- **Steel Manufacturing**
- **Refineries**

### EXPECTED RESULTS/ASSESSMENT OF U.S. GOVERNMENT \$3.2 BILLION INVESTMENT IN CCS UNDER THE RECOVERY ACT

### POLICY ISSUES

- **Government Drivers vs. Market Forces**
- **Cap & Trade vs. Carbon Tax**

### REGULATORY ISSUES

- **Proposed EPA Regulations for CO<sub>2</sub> Emissions from Electric Generating Facilities**
- **Federal/State/Local Regulations for CO<sub>2</sub> Sequestration**
- *Methods for Reporting CO<sub>2</sub> Emissions*
- *Certification (1605b)*

### CARBON STORAGE/SEQUESTRATION PUBLIC OUTREACH/EDUCATION

- Education and Outreach
- Risk Communication
- Lessons Learned
- **Benefit/Revenue Sharing Between Sequestration Service Provider and Host Community**
- **Assessment of Public Attitudes**

### GLOBAL INITIATIVES, PROGRAMS AND PROJECTS

- Case Studies
- **Large Scale CO<sub>2</sub> Injection Projects**
- Policy Issues and Roadmaps
- Opportunities for CCS in Emerging Economies

**350-Word Abstract Due: Feb. 18, 2011; Acceptance Notification: March 7, 2011; Submit via: [www.carbonsq.com](http://www.carbonsq.com)**

**Please indicate topic/sub-topic area. Full Papers Due: April 18.** Oral presentation time limited to 20 minutes, including 5 min. for Q&A. Poster Sessions 5:30-7:00pm May 3-4. **PDF files of PP presentations will be accepted in lieu of a technical paper.**

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 U.S. Carbon Sequestration Council  
 U.S. China Energy and Environmental  
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 U.S. Department of Energy:  
 National Energy Technology Lab  
 Office of Basic Energy Sciences  
 Office of Sequestration, Hydrogen  
 and Clean Fuels  
 Fossil Energy  
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 U.S. Energy Association  
 U.S. Environmental Protection Agency  
 U.S. Geological Survey  
 U.S. House Natural Resource Comm.  
 UAB

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 UC Davis  
 UK Dept of Energy & Climate Change  
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# TENTH ANNUAL CCS CONFERENCE

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## SITE LOCATION

The conference will be held at the **David L. Lawrence Convention Center (DLLCC)** 1000 Ft. Duquesne Boulevard, Pittsburgh, PA 15222. Phone: 412-565-6000. The Center and our conference hotels are located downtown Pittsburgh, which is approximately 20 minutes from the Pittsburgh International Airport.

Taxi service and Super Shuttle are available from the airport. Super Shuttle will give attendees who make advance reservations by calling 800-258-3826 a discount.

## ACCOMMODATIONS

Hotel rooms at a conference rate have been reserved at three nearby hotels. **The Conference rate is available prior to April 11, 2011** and will apply two days prior and two days following the conference dates. The rates do not include a daily hotel services fee, along with applicable city and state taxes (which are currently 14%). When making a reservation, identify yourself as a *CCS Conference participant*.

The rate for Conference attendees at the **Westin is \$209.00** for single and double occupancy. The Westin (A Starwood Hotel) is located at 1000 Penn Avenue and is attached to the David L. Lawrence Convention Center by a covered walkway. To make a reservation, visit [www.starwoodhotels.com/Westin](http://www.starwoodhotels.com/Westin) or call 412-281-3700.

The rate for Conference attendees at the **Omni William Penn Hotel is \$199.00** for single and double occupancy. The Omni William Penn Hotel is located at 530 William Penn Place. The hotel is located 4 blocks from the convention center. To make a reservation, visit [www.omnihotels.com](http://www.omnihotels.com) or call 412-281-7100.

The rate for Conference attendees at the **Pittsburgh Marriott City Center is \$175**. The Pittsburgh Marriott City Center is located at 112 Washington Place. The Hotel is located 7 blocks from the convention center. To make a reservation, visit [www.marriott.com](http://www.marriott.com) or call 412-471-4000.

*Shuttle service will be provided from these hotels to and from the convention center.*

**Registration opens at 3:00 p.m. Monday, May 2, followed by a Reception/Dinner beginning at 6:00 p.m. The opening Plenary is at 8:00 a.m., Tuesday, May 3. The Forum ends at 1:00pm Thursday, May 5.**

### Registration Fees:

Federal, State and Local Government Employees (non-speakers) .....	\$595.00
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**Payment/Cancellation Policy:** Anyone who registers and cancels after **April 4** is subject to a \$200.00 service fee. Fees paid will be forfeited for non-attendance or cancellation after **April 18**. Substitutions welcome.

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reservoirs. So, the challenge for the industry, and what we're trying to help the industry with, is to demonstrate as conclusively as possible on something as new as this technology that it can be done safely," Offen said. "So out of an abundance of caution, we're asking ourselves all the questions that we can ask about what ifs." ■

## **EIA: NATURAL GAS INCREASINGLY ATTRACTIVE**

Natural gas demand is expected to grow over the next several decades, making the outlook for new nuclear and renewable energy less favorable, according to early conclusions of the U.S. Energy Information Administration's Annual Energy Outlook 2011. Overall the economy is expected to become less "carbon intensive," the report says, with emissions growing slowly over the next two decades. Recoverable shale gas resources more than doubled from the report's 2010 estimates, to 827 trillion cubic feet, while the increase in supply and improvements in gas extraction technologies are expected to lessen the impact of oil prices on natural gas prices. "The larger resource leads to about double the shale gas production and over 20 percent higher total lower 48 natural gas production in 2035," according to the report, which predicts future energy markets up to 2035, assuming that current regulations affecting the energy sector remain unchanged. The share of natural gas generation is projected to increase from 23 percent in 2009 to 25 percent in 2035.

Reversing the "recent downward trend," demand for natural gas is predicted to grow from 7.3 trillion cubic feet in 2009 to 9.4 trillion cubic feet in 2020. The report predicts 6.3 gigawatts of new nuclear capacity by 2035 from five new plants, with an increase of 3.7 additional gigawatts from uprates. Noting that "new natural gas-fired plants are also much cheaper to build than new renewable or nuclear plants," the 2011 report predicts higher construction costs for new nuclear than last year's report, making new nuclear slightly less attractive than predicted earlier. "Coal remains the dominant energy source for electricity generation because of continued reliance on existing coal-fired plants," according to the outlook, which does not predict any new central station coal-fired plants other than those under construction or backed by clean coal programs. The predicted share of coal in total electricity generation is lower in 2010 than the 2011 report, though domestic coal production is expected to increase an average of 0.7 percent per year.

## **Emissions Grow Slowly**

Carbon dioxide emissions fell in 2008 and 2009, linked to reduced demand from the economic downturn, and are not expected to rise to 2005 levels until 2027, and will rise 5 percent from 2027 to 2035. "With modest electricity demand growth and increased use of renewables for electricity generation influenced by RPS laws in many States, electricity-related CO<sub>2</sub> emissions grow by 18 percent from 2009 to 2035," according to the report. "Emissions per capita fall by an average of 0.8 percent per year from 2005 to 2035, as growth in demand for electricity and transportation fuels is moderated by higher energy prices, efficiency standards, State RPS requirements, and Federal CAFE standards." Overall, the economy is expected to become "less carbon-intensive, as energy-related CO<sub>2</sub> emissions per dollar of GDP decline by 42 percent" up to 2035. ■

## **DOE ISSUES NEW VERSION OF ITS CARBON SEQUESTRATION ATLAS**

There may be anywhere from 500 to 5,700 years' worth of permanent carbon dioxide storage in various geologic formations in the United States and Canada, according to estimates from the most recent edition of the Department of Energy's Carbon Sequestration Atlas (III). The updated preliminary estimate, based on current emission rates, documents 1,800 billion to more than 20,000 billion metric tons of CO<sub>2</sub> storage potential in saline formations, oil and gas reservoirs, and unmineable coal areas. The third edition also presents updated information on the location of CO<sub>2</sub> stationary source emissions, as well as the locations and geologic storage potential of various formations and it provides details about the commercialization opportunities for CCS technologies from each RCSP. The CO<sub>2</sub> geologic storage resource calculation methodology of Atlas III was refined to better reflect uncertainties in geologic formation properties, DOE said. "The sequestration community has come to rely on the carbon sequestration atlas," acting Assistant Secretary for Fossil Energy Victor Der said in a statement. "The third edition will continue to guide and inform our efforts to mitigate climate change with the environmentally sound, cost-effective storage of carbon dioxide from fossil fuels." ■

## **DOE INCREASINGLY LOOKING TO DEFENSE DEPT. AS TESTING GROUND**

The Department of Energy is increasingly looking to the Pentagon as a testing ground for new energy technologies and that cooperation is expected to grow even more in the

coming years with collaborations of everything from small, modular nuclear reactors to cheaper lithium ion batteries, DOE and DoD officials said last week during an energy innovation conference in Washington, D.C., hosted by the Breakthrough Institute. Jeffrey Marqusee, executive director of the strategic environmental R&D program and environmental security technology certification program at DoD, emphasized his agency's historical role as a testing ground for new DOE-sponsored technologies. "The role for DoD, we see, particularly for the class of technology that overlaps with the civil sector, is to be a test bed for them. To be a place in which we can take the high risk to try out these technologies and partner with DOE and directly with the private sector to bring on technology which hasn't been used or widely deployed yet, get the lessons learned and find the winners and losers," he said. He said DoD is especially eager to test small modular nu-

clear reactors, which are currently used on naval ships. But in the meantime he said there are some "practical local political issues" to get through first. Acting Under Secretary of Energy Cathy Zoi said the DOE is similarly interested. "We're really excited about the possible contribution it can make," she said.

In his comments at the conference, Arun Majumdar, director of DOE's Advanced Research Projects Agency-Energy, said the biggest challenge DOE faces is quickly developing and testing new technologies that can compete with the pace set by countries like India and China. He also stressed the need to look beyond current technology like lithium ion and look for new projects to invest in at early stages. "We are trying to find those game-changing innovations," he said. "[Even] if it makes the lithium ion batteries obsolete." ■

## Calendar

### December

24-02 EM PUBLS CLOSED FOR HOLIDAYS

### January 2011

17 EM PUBLS CLOSED FOR MLK JR. HOLIDAY

### February

1 Call for Abstracts: Air Quality VIII: *An International Conference on Carbon Management, Mercury, Trace Substances, SO<sub>x</sub>, NO<sub>x</sub>, and Particulate Matter*; Organizer and Sponsor: EERC; Additional Sponsors: EPRI, NETL, DOE; Information: [www.undeerc.com/AQ8](http://www.undeerc.com/AQ8).

15-18

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*(Changes from previous Calendar in Bold)*



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