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NEWSLETTER

Volume 4, Issue 1 - Spring 2008

MONITORING, EVALUATION, AND PROTECTION PROGRAM

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EMEP Gets Updated Multi-Year Research Plan, Expanded Portfolio

EMEP has a new multi-year research plan that includes two new topics of research: "Climate Change in New York State" and "Environmental Effects of Alternative Energy and Other Emerging Energy Options."

According to Mark Watson, NYSERDA's newly minted Program Manager for environmental research, the original EMEP topics reflected the issues of the day when the program was initiated in 1998: *Atmospheric Deposition of Sulfur, Nitrogen, and Mercury, and Ecosystem Response; Air Quality and Related Health Research: Particulates, Ozone and Co-Pollutants;* and *Research Needs Crosscutting the Topics of Air Quality, Health and Ecosystem Response.* In reassessing the program for the third round of System Benefits Charge (SBC) funding, it was found that two important areas of research were missing. One was carbon, carbon dioxide (CO_2), and climate change—a problem, Watson says, that "we realized we weren't going to be able to solve ourselves, but one which we should be able to lead by example." The second addition to the EMEP portfolio was alternative energy. To understand the relative environmental impacts of electricity production from fossil fuels, NYSERDA staff realized they would have to also understand the impacts from alternative generation sources, such as wind and biofuels.

The updated EMEP multi-year research plan, released in August 2007, was a result of a collaborative effort between NYSERDA and the New York Academy of Sciences based on three meetings involving more than 100 stakeholders. Watson noted several reasons for the expansion of EMEP's portfolio. One was a perceived need for environmental research to support policies being proposed under the Regional Greenhouse Gas Initiative (RGGI). A second reason was to make EMEP's research portfolio more comprehensive, so that policy makers would be able to come the relative impacts of different kinds of electricity generation. Finally, EMEP's working group, science advisors, and ogram advisory oup simply felt the program needed updating to "stay current with what's out there."

As with other EMEP research topics, the two additions to the portfolio are broad in scope, encompassing numerous subtopics. *Climate Change in New York State* includes the sub-topics Reducing Greenhouse Gases and Other Climate-Forcing Agents; Understanding and Monitoring Impacts, Managing Risks, and Identifying Adaptation Strategies; and Climate Change Outreach and Education. *Environmental Effects of Alternative Energy and Other Emerging Energy Options* includes the sub-topics Wind, Kinetic Hydro, Biofuels, and Distributed Generation/Combined Heat and Power.

As part of its expanded portfolio, the EMEP program has an updated primary mission statement. Originally tasked to "support research to address environmental issues related to the generation of electricity," EMEP's new mission statement is both more expansive and more precise: "Increase understanding and awareness of the environmental impacts of energy choices and emerging energy options, and provide a scientific, technical foundation for formulating effective, equitable, energy-related environmental policies and resource management practices." Since its inception in 1998, EMEP has funded more than (*continued on next page*)

EMEP Program Advisers

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Climate Change Office
NYS Dept. of Environmental Conservation

Mr. Andrew H. Darrell
Environmental Defense

Ms. Christina Dowd
Bureau of Habitat
NYS Dept. of Environmental Conservation

Dr. Jason Lynch
Clean Air Markets Division
U.S. Environmental Protection Agency

Dr. Daniel Luttinger/Dr. Lloyd Wilson
New York State Department of Health

Dr. Sandra Meier
Environmental Energy Alliance of New York

Ms. Tina Palmero
NYS Department of Public Service

Dr. S. T. Rao
U.S. Environmental Protection Agency and National Oceanic and Atmospheric Administration

Dr. Gopal Sistla
Bureau of Air Research
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50 research projects. Summaries of 40 of these projects, compiled for an external review of the program's effectiveness, may be found on the EMEP website at www.nyserda.org/programs/environment/EMEP/programevaluation.asp. The new multi-year research plan may be found at: www.nyserda.org/environment/emep/emepplan2007.pdf.

EMEP's Promotions and Newest Staff

Janet Joseph, former Program Manager for Environmental Research at NYSERDA, was recently promoted to the position of Program Director for Clean Energy Research and Market Development, a position vacated by Joseph Visalli when he retired in 2007. She has been with NYSERDA since 1991 and took over as Program Manager of the Environmental Program in 1997.

Mark Watson, formerly a Senior Project Manager, has become the Program Manager for Environmental Research. He started at NYSERDA in 1995 with the Energy Efficiency Group, and moved to the Environmental Program in 2000.

Gregory Lampman comes to the EMEP program from the Energy Efficiency Services side of NYSERDA. Greg has been with NYSERDA for more than seven years working predominantly on Technical Assistance programs and focusing on municipal water and wastewater systems, K-12 schools and geothermal heat pumps. Prior to coming to NYSERDA, he spent a number of years working at the Institute of Ecosystems Studies on a variety of aquatic biogeochemistry projects. Greg holds an Associates Degree in Environmental Science, a Bachelors Degree in Biology with a minor in Chemistry and a Masters Degree in Biology from SUNY Brockport with a focus on aquatic ecology and water chemistry.

Amanda Stevens has been promoted to Assistant Project Manager in the EMEP Program. Amanda began at NYSERDA in May of 2006 as Project Coordinator in Environmental R&D. Prior to NYSERDA, she was an intern in the Environmental Bureau of the New York State Office of the Attorney General. Amanda holds a Bachelors Degree in Geology with minors in Math and Physics from Hartwick College, and is currently working on her Master's degree in geophysics from SUNY Binghamton.

Final Reports Funded through the EMEP Program

The following table lists EMEP-funded final reports published since 2006.

Final Report Title	Project Number	Publication Date
Ambient Air Quality Monitoring of Ultrafine Particles in Rochester, NY	6820	Jan 06
Atmospheric Transport and Fate of Mercury and its Impact on New York State	6488	May 06
Mitigating New York City's Heat Island	6681	Jan 07
Mercury Matters	--	Jan 07
Clinical Studies of Exposure to Ultrafine Particles	4913	Feb 07
Workshop on Receptor Models	7607	Feb 07
A Study of Ambient Air Contaminants and Asthma	6484	Mar 07
Guidebook for Small CHP	7615	May 07
Emissions Allowance Market Opportunities for CHP	7615	May 07
Assessment of the Extent to which Intensively Studied Lakes are Representative of the Adirondack Region	7605	May 07
Changes in Stream Chemistry and Aquatic Biota	7606	Jul 07

2007 EMEP Conference is the Most Successful to Date

More than 340 Attend the Meeting Held at the Marriott in Albany, New York

Peter Iwanowicz, Director of the newly created Climate Change Office at the New York State Department of Environmental Conservation (NYSDEC), speaking to an overflow crowd. This year's fifth biennial conference broke attendance records for EMEP.

The fifth biennial EMEP conference, held in Albany on November 15-16, 2007, was an unqualified success. The conference featured 46 speakers, 32 presentations, and 86 posters, and attracted 341 attendees—a respectable 28% increase from the 267 who attended the previous conference in 2005.

An opening presentation by Paul Tonko, then-President and CEO of NYSERDA, included a summary of the state's clean-energy plan. One key to the clean-energy economy is the state's "15 x 15" plan, which aims to reduce statewide electricity use by 15% from forecasted levels by the year 2015. This plan, Tonko said, will reduce both energy costs and pollution while addressing global climate change, primarily through new efficiency measures. But, he added, reducing energy use is not enough. Renewable energy sources must also be developed. "It is important to recognize that there is no single silver bullet technology to substitute for fossil fuels," Tonko stated. "We must stimulate and support a diverse collection of renewable energy sources and technologies. We must continue to deploy current applications, which include wind, hydro, and solar generation. In the transportation sector, breakthroughs in hydrogen technology, fuel cells, bio-diesel, and cellulosic ethanol are significant pieces of the solution that should be supported. We must dramatically grow NYSERDA's research and development and deployment programs."

"Every one of these initiatives work toward smart use of energy, good environmental stewardship and reducing our carbon footprint." Paul Tonko

"Every one of these initiatives works toward smart use of energy, good environmental stewardship, and reducing our carbon footprint," Tonko concluded. "Our collective success depends heavily upon research and development of efficient and clean energy solutions, which is what makes your participation here today so important."

Following the welcome and opening remarks by Paul Tonko and Pete Grannis, Commissioner of the New York State Department of Environmental Conservation (NYSDEC), Thursday's presentations began with a session devoted to climate change and related policy, chaired by Peter Iwanowicz, Director of the Climate Change Office at the NYSDEC. Topics ranged from the global—"Intergovernmental Panel on Climate Change: State of the Science"—to the local—"Sequestration Opportunities in New York State." Following lunch, NYSERDA Program Manager Jeff Peterson initiated a series of presentations on environmental issues related to alternative energy and emerging technologies. These presentations, which included updates on wind, tidal, and clean coal technologies, continued on Friday with discussions of biomass, biogas, biopower, and liquid biofuels.

Friday morning brought a hard choice, as participants had to choose between two concurrent programs. One session on air quality and related health research featured presentations on carbonaceous particulates and aerosols, human exposure, health impacts, and emission-control technologies. The other session began with sulfur and nitrogen deposition and ecosystem response, addressed trends in deposition to lakes, streams, soils, and forests, as well as trends in biotic health, and wrapped up with a discussion on the use of trends data to inform environmental protection strategies. A session on science and policy issues related to mercury in the environment brought updates on state- and regional-level initiatives, a presentation on the implications of mercury "hot spots," and a discussion of mercury in food webs.

After the sessions, many attendees took the opportunity to comment on the conference. Responses included suggestions that future conferences be filmed for use in schools, to connect not only science and policy, but also science and education; and several compliments on the keynote address, delivered by Peter Lehner, Executive Director of the Natural Resources Defence Council. An overwhelming majority of respondents indicated they would attend a longer, two-and-a-half- to three-day conference, to better accommodate the large number of targeted research topics and the speakers required to address those topics.

Pete Grannis, Commissioner of the NYSDEC, presents a welcome speech for EMEP's 2007 conference.

Lists of the conference speakers, presentations, and posters, along with biographies of the speakers and abstracts of posters and presentations, are available at the EMEP website: www.nyserda.org/programs/Environment/EMEP/conference_2007/index.asp.

PROFILE: Praveen Amar, EMEP Science Adviser

Translating Science into Effective Environmental Policy

Dr. Praveen Amar is the Director of Science and Policy at Northeast States for Coordinated Air Use Management (NESCAUM), where he "translates" the implications of scientific findings and technological developments into workable and cost-effective policy options for air-quality management. Dr. Amar has been a science advisor to EMEP since 1999, and he has found this to be a challenging and satisfying part of his job. He received his Ph.D. in engineering from UCLA in 1977, where he developed one of the first generations of photochemical smog pollution models for the Los Angeles Basin as his doctoral dissertation. He is also a licensed mechanical engineer. "I have, to this day, dabbled in both areas," he says. "I still work very much in the atmospheric sciences of air pollution and also in the evaluation of control technologies. So one-third of my head is in atmospheric sciences, one-third in engineering, the remaining third is in how to use that knowledge in designing effective public policy."

Dr. Amar enjoys reading and travel. He has taught graduate science and policy classes part-time at three universities, and goes out of his way to give lectures at other local universities to inspire the next generation of scientists and policy makers. He and his wife have three grown children, of whom they are very proud. "Our great mission in life has been to raise three kids. Years ago, when I put them to bed, I used to tell them, 'Just remember that you're having a great childhood, so when you get older and mess it up, don't blame your parents'."

We asked Dr. Amar several questions. Those questions are followed by his responses below.

How good is our understanding of the behavior of air and atmospheric pollutants?

When we started in the 1970s, we couldn't even model ozone over two days' time because we didn't understand the overnight chemistry. Now we can model ozone and even fine particles over a year's time and over areas larger than the entire United States, so our understanding has become much better.

The problem now is that, despite our ability to model the behavior of fine particles, we still don't fully understand their complex chemical and physical processes in the air. On a scale of 1 to 100, where 100 signifies perfect understanding, our understanding of ozone behavior is at about 80, whereas our understanding of fine particles is under 50, but we are making rapid progress. Another challenging area of research is the effect of global climate change on regional air pollution for both ozone and fine particles.

Atmospheric modeling is no more than our collective understanding of a subject. It's only as good as the collective knowledge at a given time. People in policy often don't see that— they think you can model anything. I always emphasize "numeracy" or mathematical literacy in policy making, and remind policy makers that the purpose of modeling is not numbers but insights on how complex systems behave under different conditions. It is also good to remind ourselves that the main purpose of science is not to predict the future, but to help us understand the present.

What are the top three challenges facing the northeastern states in terms of air quality?

First, climate change, and its long-term policy implications, and, frankly, convincing policy people that it is of utmost urgency.

Second, we need to make new connections between energy and the environment. Serious coordination hasn't happened. For example, even now we're building new coal plants the same way we did 40-50 years ago. It makes no sense to build new coal-fired power plants without the ability to capture and sequester carbon now, not in 10-20 years.

Third, we need to do much better cost-benefit analyses for environmental regulations and policy. The costs—such as the price of a flue-gas scrubber for a power plant—are easy to calculate, but benefits cannot be quantified in as straightforward a manner. For example, studies show that when pregnant women have less mercury in their bodies, their children tend to have higher IQs. But how do you translate that into dollars and cents? Economists translate IQ into lifetime earnings, but there are also many intangible benefits. Now we have also found evidence that mercury contributes to heart attacks among adults, which makes a huge difference in the benefit value of controlling mercury emissions. Simply put, heart attacks are "worth" more than low IQ.

I will add a fourth challenge, which is to recognize that all the great innovations in technology have come after environmental regulations were put in place. For example, auto companies always say they cannot comply with new emissions standards, but once the new standards have been put in place, advances in technology have followed. Hybrid cars wouldn't be here if the State of California had not required a certain percentage of cars to be electric in the early 2000s. So technology moves in ways we can't predict. We need to set "stretch goals," acknowledging that yes, we don't know how to do it, but if we don't set a goal, we'll never know how to do it, because there'll be (*continued on next page*)

no reason to do it. Set goals, and trust the creativity of the mind.

And this comes back to climate change. In this case, the task is so massive that you have to do much more than what is currently being done. My fear is that we're all happily turning off the lights and wearing sweaters and feeling good about our contribution, but we're not doing nearly enough. We need leadership at the federal level. Certain things have to be addressed nationally.

At NESCAUM, you specialize in translating scientific findings and technological developments into workable public policy options. What do scientists need to learn to be better able to communicate their ideas to policy makers?

Scientists should read the *New York Times* Science Section every Tuesday. As scientists, we seem to underestimate people's intelligence, but we tend to overestimate their knowledge. We have to remind ourselves that most people are not as knowledgeable as we are about matters of science, but they're smart. Scientists tend to assume just the opposite. Our job is to explain complex ideas in a clear and simplified manner, without dumbing it down.

What question are you trying to answer now?

I am just starting an exciting new EPA-funded project with Harvard Center for Risk Analysis, studying the role uncertainty plays in complex environmental decision making. It is a rather timely issue. Our case study deals with mercury emissions, but the results may also shed light on decision making around more complex issues, such as global climate change.

You are in a position to lend an international perspective on air-quality issues and policies. What are some opportunities for us to both learn from and inform other nations addressing air-quality issues?

We have the know-how and technology in the United States that we can export, but we have to be careful. We can't simply export our way of doing business. We have to understand how things work in other countries. It's not just the technology, but the place-based policy instruments. For example, in Mexico, the governmental sector is a much larger part of the economy than in the United States, and the free market is less advanced. Technology solutions there have to be tailored to the local conditions.

As another example, recently I had a visitor from a province in China—a high-level provincial government official. I gave him some reports on how to control emissions from coal-burning power plants. He took the reports on nitrogen oxides, sulfur dioxide, and other emissions, but he wouldn't take the report on mercury emissions. He said, "No, we're not working on that yet." I thought he would at least have wanted to read it on his long flight home, but he wouldn't even take it. If you want to be helpful you have to tell them what you know, but don't think that what you know is applicable to them one-to-one. It just isn't.

What is the urgency "to do AB 32" for the whole United States and the planet? (Note: AB 32 is the California Global Warming Solutions Act of 2006, or Assembly Bill 32 [AB 32], California's landmark legislation that establishes mandatory greenhouse gas [GHG] reduction targets to be achieved through regulatory and market mechanisms.)

Well, carbon dioxide (CO_2) is going up and up and has never gone down in the last 50 years.

This is the message of the famous Keeling curve. Professor Keeling of Scripps Institution, a great California entity, decided almost 50 years ago (in 1959) to measure CO_2 year after year at 11,000 feet, at Mauna Loa, Hawaii. This picture of the

Praveen standing with the original Keeling Curve plaque dedicated to Professor Keeling. This plaque shows how CO_2 measurements have been consistently increasing for 50 years.

plaque honoring him was taken by my wife in 2005 (shown above). I had the opportunity to spend three days with Dr. Jim Hansen (Director of NASA Goddard Institute for Space Studies and Adjunct Professor of Earth and Environmental Studies at Columbia University) and his many colleagues from around the world who are conducting scientific investigations of global warming.

Since 2005, CO_2 has gone up by 3 to 4 ppm. Even if we were to halt or reverse our GHG emissions today, the process of global warming would continue for decades, because climate change doesn't turn on a dime. So it is very important that we do everything we can to stop contributing to climate change immediately. And we can do quite a bit more than we are doing.

EMEP's Newest Funded Projects

Among EMEP's newest crop of funded projects, four are different. This year, for the first time ever, EMEP is funding student research. Four fellowships have been awarded for graduate and doctoral level research in EMEP program areas. The projects and institutions that received funding are:

- **Cornell University:** *Investigating Interactions Between Carbon, Nitrogen, and Calcium in the Adirondack Forest*
- **Cornell University:** *Improving Microscopic Particulate Emission Inventories—Modeling Sources of Variability, High-Emitting Events, and Size Distribution of PM*
- **Syracuse University:** *The Production and Transfer of Methylmercury within Terrestrial Foodwebs across the Northeastern Landscape*
- **Clarkson University:** *Urban Airshed Monitoring: New Tools for Aerosol Characterization*

By supporting pertinent, high-level student research, EMEP supports New York State students and institutions of higher learning, while further expanding and enriching the EMEP portfolio. For a complete list of funded projects from the current Program Opportunity Notices (PONs), see page 6.

New Projects for 2008

Funded Projects from Current Program Opportunity Notices (PONs)

Ecosystem Response to Mercury, Nitrogen, and Sulfur

E&S Environmental Chemistry, Inc.	Critical Loads of Sulfur and Nitrogen Deposition to Protect and Restore Acid-Sensitive Resources in the Adirondack Mountains
USGS, New York Water Science Center	Mercury Deposition in the Biscuit Brook Watershed
Institute of Ecosystem Studies	Empirical Estimation of the Critical Load for Inorganic Aluminum Mobilization in the Western Adirondack Region
Syracuse University	Land-Atmosphere Dynamics of Mercury and Ecological Implications for Adirondack Forest Ecosystems
E&S Environmental Chemistry, Inc., USGS, and USDA Forest Service	Acid Deposition Effects on Adirondack Ecosystems: Linkages among Streams, Soils and Sugar Maple Health
SUNY College of Environmental Science & Forestry	Evaluation and Protection of Adirondack Ecosystems: Impacts of Acid and Mercury Deposition on Watersheds
Adirondack Loon Conservation Program	Assessing the Impact of Long-Term Mercury Contamination on Wildlife Health in New York, Using the Common Loon as a Sentinel Species
Cornell University	Deacidification, Dissolved Organic Carbon, and Nitrate Export: Identifying the Connections
NYS DEC	Mercury and Selenium in Fish in Important Recreational Waters of New York
Fellowships	
Cornell University	Investigating Interactions Between Carbon, Nitrogen, and Calcium Cycles in an Adirondack Forest
Syracuse University	The Production and Transfer of Methylmercury within Terrestrial Foodwebs across the Northeastern Landscape

Air Quality and Health Effects

Proposer	Proposal Title
SUNY Albany	Improving Air Quality Forecasting and Management in New York State through Ensemble and High-Resolution Modeling with Diagnostic Analysis
NESCAUM	Applying the Northeast Regional Multi-Pollutant Policy Analysis Framework to New York
Cornell University	Modeling Microenvironment Air Quality in Rochester, New York
SUNY Albany	Research Measurements of Chemical Constituents and Related Processes Affecting New York State's Regional and Urban Ozone and Particulate Matter Air Quality
Rutgers University	Combustion-Derived and Secondary Organic Compounds in New York State Ambient Fine Particles
Clarkson University	Atmospheric Species—Improved Monitoring, Characterization, and Understanding of Processes
SUNY Albany	Beyond Organic Carbon (OC): A Method to Extract and Interpret Additional Aerosol OC Fractions from Thermal Optical Analysis of Filter-Based and Continuous Data
Fellowships	
Cornell University	Improving Microscopic Particulate Emission Inventories—Modeling Sources of Variability, High-Emitting Events, and Size Distribution of Particulate Matter
Clarkson University	Urban Airshed Monitoring: New Tools for Aerosol Characterization

EMEP Sponsors Carbon Sequestration Studies

As part of its climate change portfolio, EMEP is launching a number of new projects to investigate the potential for carbon dioxide (CO_2) capture and sequestration in New York State. This technology could help reduce the contribution to global warming of New York's coal-fired power plants, which supply about 18% of the state's electricity.

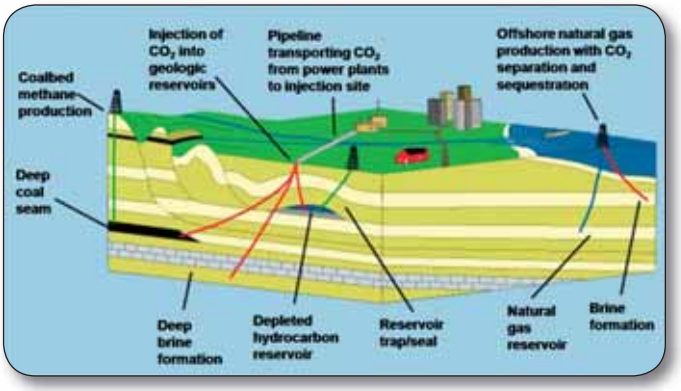

Figure 1. Carbon Capture and Storage (CCS). Source: U.S. Geological Survey.

Carbon capture and sequestration (CCS) is considered a fundamental component of efforts to design low-emissions coal plants. CCS involves capturing CO_2 emissions at a power plant or other source, compressing the gas, transporting it by pipeline to an appropriate site (see Figure 1), and injecting it into geological formations deep underground. Once injected, the CO_2 remains trapped and will not contribute to climate change. This process uses technologies similar to those employed in oil and natural gas exploration.

In New York State, the rock formations with the most potential for CO_2 storage are saline formations—deep, porous rocks containing very salty water, often six times saltier than seawater. The New York State Museum has produced a preliminary map of sequestration potential in New York State (see Figure 2). These formations are deep enough and are the correct type for CO_2 storage, but much more detailed research is needed before it can be determined whether such a project is feasible.

Carbon dioxide could also be stored in mature natural gas and oil fields that are reaching or have reached the end of their productive life. Injecting CO_2 into these reservoirs could push out more gas or oil that would otherwise remain underground. This process is called enhanced oil (or gas) recovery (EOR/EGR). In addition to storing CO_2, EOR and EGR can result in an economic gain because the process extends the productivity of otherwise depleted oil and gas fields. The southwestern portion of New York State contains numerous gas fields where EGR could be practical.

A third type of underground sequestration is shale sequestration. Sometimes natural gas is produced from organic shale. Injecting CO_2 into these rocks may enhance any existing gas production (another form of EGR), while also storing CO_2. This process is still in the early stages of research; however, if proven successful, a large area of New York State could be opened up to CO_2 storage in shales.

It is difficult to estimate the amount of CO_2 that could be stored in various geological formations in New York State. Capacity estimates require research and modeling, and the State is only beginning to study the problem. However, preliminary measurements of some New York formations are promising.

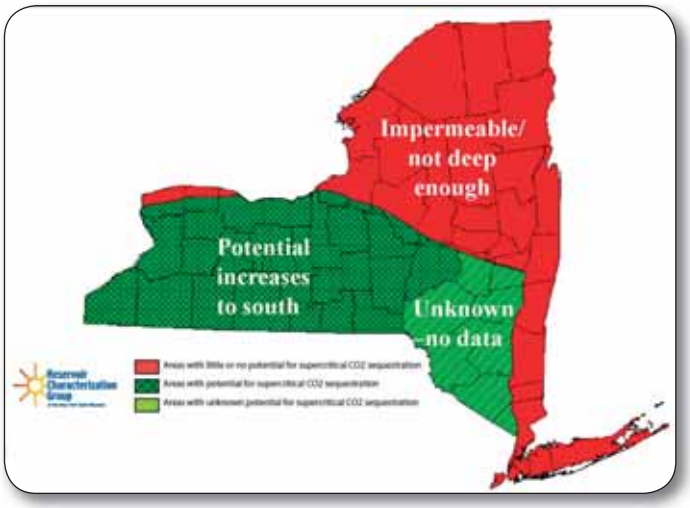

Figure 2. Potential for supercritical CO_2 storage. Preliminary assessment based on data collected and analyzed to date. Source: Reservoir Characterization Group at the New York State Museum.

Underground sequestration may not be the only way to indefinitely store captured CO_2. NYSERDA currently manages several projects investigating alternative methods of sequestration. These include CO_2 capture by algae, which could then be processed to create a liquid biofuel; converting CO_2 to a solid, stable mineral using wollastonite; and storing CO_2 beneath the ocean floor. In the near future, the potential for terrestrial sequestration (increasing the amount of carbon naturally stored by plants and soils) will be studied as well.

A number of EMEP projects under contract or approved for contracting will evaluate the potential for underground storage in various locations around New York State. Under a current project, geologists at the New York State Museum are performing a statewide assessment of New York's geological sequestration potential, including shale formations. An upcoming EMEP project will build on this study and evaluate gas shale formations for CO_2 sequestration and EGR potential throughout the state. Two other projects will characterize the geology of two sections of western New York to determine if sequestration is possible there. Another project will assess the potential for long-term CO_2 storage in central New York, where there are already a number of coal-fired generation facilities. This project also will evaluate the potential for EGR in the area's deep sandstone gas reservoirs. Because chemically stripping CO_2 from other flue gases is costly, new technologies for more easily capturing CO_2 from power plants are being investigated in another EMEP project.

These CCS studies are part of a larger EMEP climate change research program begun in 2006. New York State is committed to pursuing several strategies to reduce greenhouse gas emissions. Carbon capture and storage is one; others include the Regional Greenhouse Gas Initiative and the State's "15 x 15" plan to reduce electricity consumption 15% by the year 2015.

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