ENVIRONMENTAL MONITORING, EVALUATION, AND PROTECTION: LINKING SCIENCE AND POLICY

OCTOBER 14-15, 2009

SPEAKER ABSTRACTS

NYSERDA

New York State
Energy Research and
Development Authority

Wednesday, October 14th
9:30am – 10:00am

STATE OF THE ENVIRONMENT: MAJOR ENERGY-RELATED ENVIRONMENTAL ISSUES OF THE 21ST CENTURY

R. K. Srivastava
United States Environmental Protection Agency

Climate change poses the most significant environmental problem of global proportions. It has the potential to cause irrevocable and wide-ranging impacts on our environment and it has significant implications for global economy and international trade. Most importantly, it has forced us to consider implementing mitigation strategies now to reduce the potential for large-scale impacts in the future. The speaker will describe the current understanding of climate change, its impact on sustainability, and global actions being taken, or under consideration, to address this environmental problem. The importance of coal-fired power generation as a key source of anthropogenic carbon dioxide (CO_2) emissions will be established and options for mitigating CO_2 emissions from coal-fired power plants will be discussed.

Energy-Related Environmental Science and Policy: Challenges and Strategies
10:30am – 12:00pm

ASSESSMENT OF MARKET-BASED TRADING PROGRAMS

T. Bourgeois
Pace Energy and Climate Center

Market-based trading programs have proliferated in recent years. Trading jurisdictions may, at one extreme, encompass a sub-state area (Emission Reduction Credits [ERCs] in a severe non-attainment area), and, at the other extreme, involve a trading jurisdiction that is international. Markets tend to be balkanized by geography, by certification protocols, and by definition of the commodity/attribute. There is concern that overlapping jurisdictions, lack of clarity regarding definition, ownership, reporting, and lifetimes of these new commodities/attributes could well lead to confusion in the marketplace. Lack of precision and homogeneity in the underlying commodity clearly leads to less efficient markets and works to society's disadvantage by diminishing the ability to attain environmental and energy goals. Market-based environmental policies are those that depend upon financial incentives and/or disincentives to achieve desired environmental goals. The Pace Energy and Climate Center is conducting a systematic review and summary of existing and planned regulatory and voluntary market-based environmental protection mechanisms and their impact on energy production and use in New York State.

NYSERDA'S EXPERIENCE WITH MARKET-BASED ENERGY AND ENVIRONMENTAL PROGRAMS

K. Hale
New York State Energy Research and Development Authority

The New York State Energy Research and Development Authority (NYSERDA) is currently involved with three key market based energy and environmental programs: The NYS Renewable Portfolio Standard, the Regional Greenhouse Gas Initiative, and the Clean Air Interstate Rule. The Renewable Portfolio Standard ("RPS"), New York's cornerstone renewable energy policy, seeks to increase the amount of renewable supply to 25% by 2013. The Regional Greenhouse Gas Initiative ("RGGI") is the first mandatory, market-based effort in the United States to reduce greenhouse gas emissions. Under RGGI, ten Northeastern and Mid-Atlantic states, including New York, have capped and agreed to reduce CO_2 emissions from the power sector 10% by 2018. The Clean Air Interstate Rule ("CAIR") regulates SO_x and NO_x emissions for sources such as power generators having a capacity of 25 MW or greater. As provided for under New York's CAIR regulations, NYSERDA is in the process of selling 10% the state's base NOx allowance budget into the existing cap and trade market. The proceeds from these sales will be used to create the pioneering Battery and Energy Storage Technology Consortium

NEW YORK STATE ENERGY PLAN

K. Michael
New York State Energy Research and Development Authority

The State Energy Plan, its role in developing the State's energy and environmental policies, and the collaborative process by which it was developed will be discussed. The overarching energy planning objectives and the general strategies for achieving those objectives will be addressed. The analytical process on which the Plan is based will be highlighted and some key findings of that process presented. Key actions that will guide the future of New York's energy and environmental policies will be recommended.

Session A: Are New York's Ecosystems Recovering from the Adverse Effects of Mercury and Acid Deposition? An Aquatic Perspective
1:15pm – 2:45pm

ACID DEPOSITION IMPACTS, MONITORING, AND TRENDS IN ADIRONDACK LAKES AND STREAMS

K.M. Roy[1], C.T. Driscoll[2], and G.B. Lawrence[3]
[1] New York State Department of Environmental Conservation;[2] Syracuse University;
[3] U.S. Geological Survey

The Adirondack Long Term Monitoring (ALTM) program was established to monitor acid deposition effects. Since 1992, changes in the chemistry of wet deposition and 48 ALTM lakes showed that mounded seepage and thin till drainage lakes were the most responsive to decreases in deposition. Lake water declined in sulfate (47 lakes), nitrate (26) and inorganic aluminum (35) and increased in acid neutralizing capacity (34), pH (28), and dissolved organic carbon (20). Rates of response are greater between 1993 and 2000 than in 2001 to 2008. Comparison of recent (1994-2005) fisheries resurveys of 45 ALTM lakes with 1984-87 surveys found fish community changes to be modest and mixed. Fish change comparisons with chemistry showed the strongest patterns between fish gain and ANC increases and nitrate decreases. Total fish populations increased from 147 to 176 in the 45 lakes. Median number of species increased from 3 to 4 per lake. Ten lakes had no fish in either survey. Adirondack stream chemistry trends broaden our understanding of regional ecosystem responses. Recent (2001-2008) chemistry patterns at Buck Creek and Bald Mountain Brook show improvements have diminished or stayed unchanged since the previous (1991-2001) trend analysis. Findings from a 200-stream intensive survey in 2003-2005 demonstrate the value of hydrologic benchmark streams in the region.

CRITICAL LOADS OF NITROGEN AND SULFUR FOR ALUMINUM MOBILIZATION IN ADIRONDACK SOILS

G.B. Lawrence[1], K. C. Weathers[2], A. M. Elliot[2], and T.J. Sullivan[3]
[1]U.S. Geological Survey; [2]Cary Institute of Ecosystem Studies; [3]E&S Environmental Chemistry

The term critical load refers to the level of air pollution above which an ecosystem is damaged in some way. Damage is quantified by ecological indicators and the most commonly used indicators are specific to either aquatic or terrestrial ecosystems. The recently developed base-cation surplus (BCS) provides a new indicator that is based on the threshold of toxic aluminum (Al) mobilization in soil. Mobilization of this form of Al is an unambiguous indication of acidic deposition and is harmful to both terrestrial and aquatic ecosystems. Stream and soil chemistry data collected in 2003-2005 in the Western Adirondack Stream Survey (WASS) and a high resolution atmospheric deposition model developed for complex terrain were used to estimate the critical load at which Al mobilization occurs. Results did not show a relationship between atmospheric deposition and the BCS in stream water because variation in deposition across the study region was small and the acid sensitivity of the study watersheds varied greatly. Significant relationships were observed between the BCS and base saturation of the soil. The lowest deposition levels measured in the study region were not sufficient to prevent substantial Al mobilization in some watersheds.

LONG-TERM IMPACTS OF ACIDIC DEPOSITION ON BROOK TROUT IN HONNEDAGA LAKE, NEW YORK

D. Josephson, J. Chiotti, K. Jirka, J. Robinson, and C. Kraft
Cornell University, Department of Natural Resources, Adirondack Fishery Research Program

Honnedaga Lake, located in the southwestern Adirondacks, supports one of seven remaining heritage strains of brook trout designated in the State of New York. During the past century long-term acidic deposition has altered water chemistry and fish populations within the Honnedaga Lake watershed. Brook trout were the only fish species known to inhabit Honnedaga Lake prior to European settlement. Stocking in the late 1890s resulted in the establishment of reproducing populations of lake trout, round whitefish, creek chub, and white sucker, but all of these species – with the exception of brook trout – disappeared from the lake between 1930 and 1955. By 1980, surface waters were chronically acidified (pH<5) with inorganic monomeric aluminum at lethal levels (>200 µg/L) for brook trout. Yet during this period of chronic acidification brook trout were able to sustain populations in several small groundwater tributaries to Honnedaga Lake with pH>5. Amendments to the Clean Air Act in 1990 lead to decreased SO_4, increased pH (>5), and decreased inorganic monomeric aluminum (>50µeq/L) in lake surface waters with a coincident modest recovery of the brook trout population in the lake. The continued chronic acidification of numerous tributaries likely limits young-of-year survival and recruitment and, consequently, adult brook trout abundance in Honnedaga Lake.

MERCURY CYCLING AND BIOACCUMULATION IN A CENTRAL ADIRONDACK STREAM ECOSYSTEM

K. R. Murray and D. A. Burns
United States Geological Survey

Concentrations of mercury (Hg) in fish are elevated in relation to human-health and wildlife-health guidelines across much of the Adirondacks, where atmospheric deposition is the principal source of Hg. The Adirondacks are particularly sensitive to Hg deposition because of environmental characteristics that promote conversion of inorganic Hg to methylmercury (MeHg), the toxic and bioavailable form of Hg. Since 2007, the U.S. Geological Survey has been studying the factors that control Hg cycling and bioaccumulation in Fishing Brook, an upper Hudson River tributary that drains an area of about 67 km^2. Water, bed sediment, macroinvertebrates (shredder, scraper, and predator taxa), and fish (omnivore and predator taxa) have been sampled seasonally at sites with a range of environmental characteristics that are believed to affect MeHg production and bioavailability. Results of analyses to date indicate that Hg concentrations in biota (within particular feeding groups) vary widely across the study area. These spatial patterns are related to stream water concentrations of MeHg and dissolved organic carbon and to landscape characteristics that include catchment slope, proximity, and hydrologic connectivity of wetlands, and the presence of open water. This study highlights the importance of local- and landscape-scale controls on mercury cycling and bioaccumulation in Adirondack streams.

Session B: Air Quality and Health Effects from Energy Use
1:15pm – 2:45pm

PM SUPERSITE REVISITED: QUEENS COLLEGE 2009 SUMMER FIELD INTENSIVE STUDY

K. L. Demerjian
Atmospheric Sciences Research Center, University of Albany

The accountability of the air quality management process entails maintaining measurement programs (over decades) to track changes in air quality in urban and regional environments in response to regulatory actions. Tracking the effectiveness of regulatory actions requires routine monitoring of relevant chemical parameters and performing periodic field intensive studies utilizing more advanced measurement systems. The New York State Energy Research and Development Authority (NYSERDA)/United States Environmental Protection Agency (U.S. EPA) sponsored (particulate matter) PM Supersite program has pursued both of these approaches, providing a foundation for "accountability" research as well as detailed findings on the characterization of particulate matter in urban and regional environments. The main focus of the presentation is on preliminary results from Queens College Summer 2009 Field Intensive Study, a revisit to

the EPA PM Supersite (PMTACS-NY) on the campus of Queens College that was first monitored in the summer of 2001. Results of the recent AMS (spell out) analyses were compared to those performed during the 2001 campaign, when a substantial bimodal distribution in organic particle matter was observed. Analyses of the AMS spectra also indicated that the principal source of the small mode (70nm) organic particles was condensed lube oil and, to a lesser extent, unburned diesel fuel. These findings are important as the 70nm mean particle size mode can effectively and deeply penetrate the lung and have sufficient size to contribute significant mass dosage. The toxicity of diesel exhaust may well be tied directly to this particle population, thus suggesting the need for further study. The advanced High-Resolution Time-of-Flight Aerosol Mass Spectrometer (HR-ToF-AMS) system used during the 2009 study provided characterized the chemical composition of organic aerosol as a function of particle size in far greater detail than past low resolution AMS results. Using a combination of measurements of particle sizing data from a Fast Mobility Particle Sizer (FMPS), black carbon from a photo-acoustic soot spectrometer (PASS) and a HR-ToF-AMS analyses provided additional insight into the attribution of primary and secondary organic aerosols (and their oxidized components, oxidized organic aerosol - OOA-1 and OOA-2) as a function of particle size. In addition evidence that the size distribution of organic aerosol has been altered as result of the introduction of low sulfur (15ppm) diesel fuel in 2007 was reported.

APPLYING THE NORTHEAST REGIONAL MULTI-POLLUTANT POLICY ANALYSIS FRAMEWORK TO NEW YORK

J. Graham
Northeast States for Coordinated Air Use Management

Northeast States for Coordinated Air Use Management (NESCAUM) and New York State Department of Conservation (NYS DEC) are working collaboratively to develop and apply analytical tools that enable air quality planners to simultaneously analyze multiple climate and air quality concerns. The project uses NESCAUM's Multi-pollutant Analysis Framework (MPAF), which integrates a suite of models, encompassing the energy system (Northeast Market Allocation Model: NE-MARKAL), economic impacts (Regional Economic Models, Inc.: REMI), environmental impacts (Community Multi-scale Air Quality Modeling System: CMAQ) and public health (Benefits Mapping and Analysis Program: BENMAP). A number of stepwise tasks comprise this effort, beginning with a review of the State's goals for air quality and climate. The project team identified strategies that help to achieve these goals and translated the policies as inputs for NE-MARKAL. A reference scenario was developed to represent a business-as-usual case, against which the policy scenarios were compared. Subsequent analysis provided an understanding of potential tradeoffs and cross-sector interactions resulting from the least-cost model solutions. Careful consideration has been given to assure a reasonable and realistic model response. Output from NE-MARKAL included air quality emissions for each of ten three-year time-steps covering the years 2002-2029. These emissions will be mapped to source classification codes used in air quality modeling. The Community Multiscale Air Quality (CMAQ) model will assess the effectiveness of policy scenarios in achieving New York State's ozone and $PM_{2.5}$ goals. The project will compare the modeled pollution levels from policy cases to the reference case at two points in time, 2017 and 2029, which will provide recommendations for both short and long term air quality improvements that might be realized through different policy choices. Differences in modeled air quality will then be used in BENMAP to generate potential health benefits. This presentation will focus on the model framework and the iterative decision-making process used to refine NE-MARKAL for development of the final policy scenarios.

ULTRAFINE PARTICLES AND CARDIAC RESPONSES

M.J. Utell[1], P.K. Hopke[2], D. Oakes[1], M.W. Frampton[1], and W. Zareba[1].
[1]University of Rochester Medical Center; [2]Clarkson University, Potsdam, NY

Increases in levels of airborne particulate matter are associated with hospitalization for myocardial infarctions and cardiac arrhythmias. The objective of our study was to examine effects of ultrafine particles in exercising patients with a recent acute cardiovascular event, such as MI or unstable angina. Seventy-six patients were enrolled in a health study in the Cardiac Rehabilitation Program offered within the University of Rochester Medical Center. Ultrafine particles (10 to 500 nm) were measured continuously indoors and outdoors at the rehabilitation center as well as outdoors at the reference New York State Department of Environmental Conservation (NYSDEC) site. The exercise program involved supervised and graded twice weekly exercise sessions for 10 weeks. Subjects underwent continuous Holter electrocardiogram (ECG)

recordings allowing evaluation of ECG parameters at rest, during exercise, and post-exercise. Blood samples were collected weekly for acute phase reactants. The analysis is modeling ultrafine and fine particle levels with ECG parameters including heart rate variability, ischemia, and repolarization; exercise performance; symptoms; and blood data. Study recruitment is completed but data analyses are ongoing. The study group included 51 men and 26 women with a mean age = 60±10 (SD) years. Approximately 90% of the patients will complete the entire 20 exercise studies. An analysis of cardiac findings in a subset of study patients and variability in ultrafine particle numbers will be presented.

Session A: Are New York's Ecosystems Recovering from the Adverse Effects of Mercury and Acid Deposition? A Terrestrial Perspective

3:15pm – 5:00pm

MERCURY BIOACCUMULATION IN TERRESTRIAL FOOD WEBS

D. Evers,
BioDiversity Research Institute

It is apparent that atmospheric deposition of mercury (Hg) has potential widespread and profound ramifications on environmental health. While the negative effects of Hg through the biomagnification of biologically-active methylmercury (MeHg) are relatively well documented for aquatic ecosystems, such impacts are less described for terrestrial ecosystems. Recent findings that high trophic level avian invertivores (e.g., songbirds) carry Hg body burdens that can well exceed those of associated avian piscivores (e.g., kingfishers) underlie a paradigm shift in scientific assessments of ecological harm. Thus, understanding the underlying mechanisms for MeHg exposure in high trophic level terrestrial invertivores has gained considerable purpose. The transfer of MeHg into the terrestrial foodweb may happen through multiple paths. Similar to aquatic ecosystems, the biomagnification of MeHg is a function of moving through multiple trophic levels. In both uplands and wetlands, foodweb pathways of MeHg for invertivorous wildlife often include arachnids, particularly certain families of spiders. Because wetlands have a greater ability to generate MeHg than upland habitats, wildlife inhabiting wetlands and foraging on arachnids typically are at greatest risk to MeHg toxicity. Mercury monitoring networks now include songbirds and bats to document spatial gradients, measure temporal changes, and assess risk.

CLIMATIC IMPACTS ON WATERSHED BIOGEOCHEMISTRY: NITROGEN, SULFUR, AND MERCURY DYNAMICS

M. J. Mitchell
SUNY College of Environmental Science and Forestry

Climate change is predicted to have marked effects on the temperature and hydrological regimes of the northeastern United States and southeastern Canada. The importance of these changes will be highlighted and placed in the context of impacts on watershed biogeochemistry. Examples of the effects on forested watersheds will be provided using both case studies and synoptic comparisons of watersheds within the region. Climatic changes in the winter, including increased temperature and the frequency of rain on snow events, will be especially important in affecting the spatial and temporal patterns of snow pack dynamics and the resultant transport of nitrate from upland forests to surface waters. In contrast, watershed droughts and rewetting during the summer have a major influence on the mobilization of sulfur, especially from wetlands. The mobilization of sulfur causes episodic acidification and the release of toxic aluminum to soil and surface waters. The overall linkage between watershed hydrology and sulfate drainage losses will be described. The formation of methyl mercury, which can be accumulated along food chains and is toxic to the biota, is closely linked with sulfur dynamics through reduction processes. The mobilization of methyl mercury shows strong seasonal variation and these losses are linked with hydrological events. The importance of integrating studies that evaluate the concomitant effects of climatic changes and decreases in the atmospheric deposition of pollutants will be emphasized.

ACID DEPOSITION EFFECTS ON ADIRONDACK ECOSYSTEMS: LINKAGES AMONG STREAMS, SOILS, AND SUGAR MAPLE HEALTH

S. Bailey
United States Forest Service

Sugar maple decline disease was first documented in 1913. Outbreaks have occurred range-wide, particularly since the 1960's. This disease fits the model of a multiple stress syndrome, with nutrient imbalances as a predisposing factor and stress, including defoliation and extreme climatic events, as an inciting factor. Imbalanced nutrition, low calcium and magnesium coupled with high manganese and aluminum availability is common to many outbreaks. Soil changes inferred from watershed mass balance studies, and documented by repeated soil monitoring, are consistent with recent widespread outbreaks in areas with a history of high levels of acid deposition. Tree ring analysis shows that even in areas without decline, growth has moderated, or decreased on calcium/magnesium poor sites since about 1970. In contrast, species co-occurring with sugar maple, such as American beech and black cherry, have not responded to these soil changes or may have benefitted. Despite popular press that a warming climate is responsible for decline and a northward shift of suitable habitat, it may be that nutrient imbalances and soil changes have had the most measureable effects on the range of sugar maple.

MERCURY AND ACID DEPOSITION RESEARCH – A RECAP OF CURRENT EFFORTS AND KNOWLEDGE

C. T. Driscoll[1], K. M. Driscoll[1], K. Roy[2], Q. Zhao[1]
A. Pourmokhtarian[1], T. Sullivan[3] and M. Mitchell[4]
[1] Syracuse University, Department of Civil and Environmental Engineering; [2] New York State Department of Environmental Conservation, Division of Air; [3] E&S Environmental Chemistry; [4] SUNY ESF, Department of Environmental and Forest Biology

Forest and aquatic ecosystems of the Adirondack region in New York State experience important interactions among air pollution stresses, including acidic and mercury deposition and changing climate. Long-term decreases in acidic deposition have produced some recovery of surface waters and their biota. However, under current levels of deposition, soils are continuing to acidify, which may limit the long-term recovery of ecosystems. Surface waters respond to decreases in acidic deposition with long-term increases in dissolved organic matter (DOC), which will likely influence acid-base chemistry, the attenuation of light and thermal stratification of lakes, and mercury transport and bioaccumulation. Other linkages between acidic deposition and mercury accumulation in biota include the methylation of ionic mercury by sulfate reducing bacteria and increases in concentrations of methyl mercury in aquatic biota with decreases in pH. Changing climate has the potential to influence ecosystem recovery from both acidic and mercury deposition through altered quantity and distribution of runoff, increased rates of soil mineralization and enhanced nitrate and DOC leaching and associated acidification. Monitoring and assessment programs for these air pollution disturbances should be integrated in the near future.

Session B: Improving Emissions Estimates in New York State
3:15pm – 5:00pm

RECOMMENDATIONS FROM THE REGIONAL WORKSHOP ON EMISSIONS ESTIMATES

S. Wierman
Mid-Atlantic Regional Air Management Association (MARAMA)

What are the most important ways to improve our understanding of air pollutant emissions in this region? Experts met to identify issues and suggest approaches. Topics addressed included agricultural ammonia emissions, fuel oil combustion emissions, emissions from biomass burning, emissions on days with high electricity demand, and vehicle emissions both on- and off-roadways. This presentation summarizes recommendations from the conference.

ESTIMATING EMISSIONS ON HIGH ELECTRIC DEMAND DAYS: A WORKSHOP SUMMARY

R. G. Sliwinski and J. Barnes
New York State Department Environmental Conservation

Peak electricity demand generally corresponds to days when the potential for poor air quality is greatest. Typically, these are hazy, hot, and humid summer days. Peak demand often requires the electricity generating sector to call upon all available resources to maintain a reliable electricity system: load following generators and peaking units that typically have minimal or no pollution control. As a result, the Ozone Transport Commission has developed a memorandum of understanding to incorporate high electricity demand day emission reduction efforts into its air quality plans. However, emission inventory techniques currently in use do not accurately reflect the operation of these peak demand resources. To better account for the operation of these units in air quality planning, a workshop was held to discuss issues related to high electricity demand days, including the dispatch of generation assets, emissions from peaking units and demand response units, and the available emissions estimating tools. This presentation summarizes what was discussed and learned at the workshop and the subsequent efforts to incorporate the results into air quality planning (including modeling).

WOOD SMOKE IN UPSTATE NEW YORK: A NEW TECHNIQUE FOR IMPROVED SPATIAL MODELING

M. Brauer[1], J. G. Su[2], P. J. Miller[3], G. Allen[3], and L. Rector[3]
[1]School of Environmental Health, The University of British Columbia;
[2]Department of Environmental Health Sciences, University of California; [3]Northeast States for Coordinated Air Use Management (NESCAUM)

Wood smoke can be an important contributor to elevated levels of fine particulate matter ($PM_{2.5}$) during the heating season. Exposure to wood smoke has been associated with a number of adverse cardiopulmonary health impacts. Improvements to the assessment of exposure to wood smoke $PM_{2.5}$ were based on the evaluation of the effect of wood combustion on local air quality in the Adirondacks of New York. Topography, U.S. census data, property assessments, and other relevant publicly accessible databases were used as inputs into a geographic model of predicted wood smoke $PM_{2.5}$ spatial variability across the largely rural study region. The predicted spatial pattern of wood smoke $PM_{2.5}$ was then compared to observed ambient levels from fixed monitoring sites and from a mobile monitoring campaign. These monitoring results indicated that most of the $PM_{2.5}$ measured in the Adirondacks during the study period was linked to wood combustion. The model and monitoring campaign demonstrated the ability to combine census information with additional survey and property assessment data to provide a broadly applicable estimate of wood smoke spatial patterns and population exposure in the Adirondacks. This approach is a promising method for screening potential wood smoke problem areas in complex terrains across the Northeast and elsewhere in the U.S.

Thursday, October 15th

Climate Change in New York State
8:30am – 10:00am

CLIMATE CHANGE IN NEW YORK STATE

C. Rosenzweig, W.D. Solecki, and A. DeGaetano
Columbia University, Hunter College, Cornell University

New York State Energy Research and Development Authority's (NYSERDA) Climate Change Adaptation Assessment for New York State ClimAID project aims to identify issues related to climate change risks, vulnerability, and adaptation facing New York State, to describe actions already underway to address these issues, and to suggest areas for future study and action. The assessment is focused on eight sectors: agriculture, ocean coastal zones, communication, ecosystems, energy, public health, transportation, and water resources. In addition to an overview of climate change adaptation issues within each sector, case studies highlight particular areas of interest from which broader applications can be drawn. Three cross-cutting elements are analyzed throughout the assessment: equity and environmental justice, economics, and science-policy linkages. The ClimAID Assessment will provide an inventory and analysis of a wide range of climate change adaptation strategies in New York State, contributing to robust and resilient risk management.

NEW YORK STATE GREENHOUSE GAS ABATEMENT COST CURVES

R. Strait
Center for Climate Strategies

For the past year New York State Energy Research and Development Authority (NYSERDA) has been supporting research using a bottom-up approach to develop sector-specific greenhouse gas (GHG) abatement cost curves for individual technologies and best practices (TBPs) or sets of technologies and best practices. Abatement cost curves for approximately 100 TBPs covering three geographic regions (upstate New York, New York City, and the entire state of New York) for three target years (2010, 2020 and 2030) were identified and developed. Near-term costs and emission reductions (for 2010 and 2020) based on technical potential to support development of policy scenarios for 2020 and 2030 were analyzed. The information developed for each (spell out) TBD or TBP set will serve as the building blocks for constructing GHG abatement cost curves for a wide range of potential policy actions or mechanisms for mitigating statewide GHG emissions. A progress report on the research covering the project approach, TBP selection, quantification methods and assumptions, and indications from other states of the GHG reduction and costs, or cost savings potential of similar TBPs, will be presented.

Carbon Capture and Sequestration: An Emerging Technology for Mitigation
10:00am – 10:30am

CHARACTERIZATION OF POTENTIAL CARBON SEQUESTRATION TARGETS IN NEW YORK STATE

B. Slater, A. Stolorow, and T. Smith
New York State Museum

Geologic sequestration of carbon dioxide has emerged as one of the leading methods for reducing the emission of greenhouse gases. As part of the Midwest Region Carbon Sequestration Partnership (MRCSP) geologists at the New York State Museum have been given the task of identifying formations that may possess the characteristics needed to be an efficient CO_2 sequestration reservoir. These formations must be at least 2500 feet deep with pressures greater than 73 bars so that the CO_2 will be stored in a supercritical state. Potential targets include the Cambrian sandstones of the Galway and Potsdam formations, hydrothermal dolomite reservoirs in the Middle Ordovician Trenton – Black River

group, and the Late Ordovician Queenston sandstone. Wireline logs are used as a first order tool to identify both porous zones and cap rocks for each of the potential targets. Rock cores and well cuttings are used to support log readings and determine a more precise lithology. Samples taken from the cores are measured for porosity and permeability. Thin sections made from these samples help determine the type of porosity. Seismic surveys allow cap rocks to be examined for faulting and possible leakage pathways, while software like Petra is used to calculate storage capacity.

CARBON DIOXIDE CAPTURE AND SEQUESTRATION: DEVELOPING A REGULATORY STRATEGY FOR NEW YORK STATE

R. Singer, G. Rusk, J. Whitken, R. Morse, and I. Miller
Ecology and Environment, Inc.

The reduction of CO_2 emissions through the development of CO_2 capture and sequestration (CCS) technology is a critical component of the international effort to battle global climate change. New York State has assumed a leadership role in this effort. This report summarizes the legal, permitting, and policy challenges that New York must address as it develops one of the first comprehensive CCS regulatory programs in the country; identifies evolving legal and regulatory precedents in other jurisdictions; transportation, injection and long-term storage activities; and outlines available options and strategies for developing a CCS regulatory program that addresses key implementation issues involving property rights, financial impacts, and regulatory oversight.

Alternative Ways to Understand and Assess the Impacts of Atmospheric Pollutants
10:50am – 12:00pm

USE OF CRITICAL DEPOSITION LOADS TO INFORM ENVIRONMENTAL PROTECTION STRATEGIES

T.J. Sullivan[1], B.J. Cosby[2] C.T. Driscoll[3], T.C. McDonnell[1], Q. Zhou[3], and D.A. Burns[4]
[1] E&S Environmental Chemistry; [2] Department of Environmental Sciences, University of Virginia; [3] Department of Civil and Environmental Engineering, Syracuse University; [4] U.S. Geological Survey

As levels of atmospheric sulfur and nitrogen deposition decrease throughout the northeastern United States, some damaged resources are showing signs of recovery from past acidification. However, model simulations suggest that the base cation supply in acid-sensitive soils continues to decline, with possible consequent future effects on recovery rates. Key issues now facing scientists and policy makers include determination of the extent to which emissions and deposition might need to be further reduced to allow full ecosystem recovery and prevent further damage. To aid in addressing such issues, model-based critical loads can be calculated for acid-sensitive resources, assuming chemical/biological dose-response relationships. The critical load is defined as the deposition load below which harmful effects do not occur to sensitive elements of the environment according to present knowledge. Because different species respond at varying chemical levels, multiple critical loads can be calculated or applied to a given sensitive region. The concept of target loads can include a time component, specifying that damaged resources recover within a designated period of time. Land managers are now beginning to use model-based critical and target load calculations for setting resource protection and restoration goals on public lands. Approaches for calculating critical and target loads using steady state and dynamic models will be explored. Ongoing research on critical loads for sensitive aquatic and terrestrial resources in the Adirondack Mountains will be highlighted. Ways in which these results can help to bridge the gap between science and policy will be discussed.

CAPTURING THE VALUE OF ECOSYSTEM SERVICES

Jon D. Erickson
Rubenstein School of Environment and Natural Resources and Gund Institute for Ecological Economics, University of Vermont

Forest and aquatic ecosystems in the Adirondack region of New York State (NYS) provide a broad range of ecosystem services that benefit local, state, and even national and international constituencies. Ecosystem services are the ecological functions that generate benefits for society and support economic, cultural, and physical well-being. Ecosystem services provided by the Adirondack region include the provisioning of forest products (timber and non-timber), fisheries, game, and water; the regulation of water quantity and quality, soils, climate, and nutrient cycles; the cultural value of recreation, wildlife viewing, and natural amenities; and, as a large regional biodiversity refuge, support for all ecosystem services. Strict land protections in the Adirondacks seek to sustain these services for local, regional, and global beneficiaries, due to broad recognition of their economic and cultural importance and their role in supporting human health and well-being. Despite these conservation measures, provision of these ecosystem services remains strongly influenced by both the legacies of past human activities and the ongoing impacts of acidic deposition. Acidification of Adirondack forests and aquatic ecosystems threatens the sustainability of ecosystem services by altering nutrient cycles, degrading overall productivity and diversity, and eroding ecological resilience to other stressors and larger-scale drivers of change, such as climate. These tangible impacts have been much discussed and debated, but they remain poorly understood, especially in terms of the quantitative and spatial information needed for management and policy-making.

ACHIEVING RISK- AND RESULTS-BASED MULTIPOLLUTANT AIR QUALITY MANAGEMENT

W. T. Pennell
North American Research Strategy for Tropospheric Ozone

North American Research Strategy for Tropospheric Ozone (NARSTO) has recently completed an assessment of the technical challenges of implementing a an approach to air quality management that coordinates air quality management actions for multiple pollutants and sources, considers overall risk reduction as a principal decision metric, and uses retrospective analysis (i.e., accountability) as a tool for assessing and improving air quality management. This presentation briefly summarizes the principal recommendations of the assessment that indicates there are theoretical advantages to the multipollutant air quality management approach, but achieving it will be an evolutionary process. It will require improvements in exposure/dose assessment and changes in monitoring approaches to support these assessments, significant advances in our understanding of the risks of exposure to multiple pollutants, considerable advance planning in order to select appropriate accountability metrics and provide information needed to evaluate these metrics.

Bioenergy: Opportunities and Challenges in New York
1:15pm – 2:50pm

TOTAL FUEL CYCLE ANALYSIS FOR BIOFUELS IN THE STATE OF NEW YORK

J. J. Winebrake
Rochester Institute of Technology

This presentation will provide the results of a total fuel cycle analysis of biofuels for transportation based on scenarios developed for the Renewable Fuels Roadmap and Sustainable Feedstock Supply for New York State. The total fuel cycle analysis accounts for energy use and emissions across the entire fuel cycle — from feedstock harvesting, to fuel production and distribution, and ultimately to consumption.

ANALYZING THE POTENTIAL FOR SUSTAINABLE BIOENERGY FEEDSTOCK PRODUCTION IN NEW YORK STATE

P. Woodbury
Cornell University

To increase our use of bioenergy and biofuels, we need to increase the supply of sustainably-produced biomass (plant material) required as feedstocks. As part of a project to develop a renewable fuels "roadmap" for New York State, a multi-disciplinary, multi-institutional research team is examining the potential for production of different types of biomass from agricultural and forest lands throughout the state. A combination of geospatial modeling, statistical analysis, and process-based modeling is being used to estimate the expected yields of grasses, short-rotation woody crops, mixed-species forests, and both agricultural and forest residues. In addition, data on land use, crop yield trends, and livestock production efficiency are being used to determine how much land might actually be available for bioenergy feedstocks once competing uses are considered. Finally, key aspects of sustainability, such as greenhouse gas emissions, soil quality, water quality, and land use change are currently being analyzed.
An overview of the steps in the analysis, along with some preliminary results on land use and biomass production potential, will be reported.

TRANSFORMATION OF THE AUSTRIAN HIGH-EFFICIENCY BIOMASS HEATING MARKET

C. Egger
O.Oe. Energiesparverband

Upper Austria, one of nine Austrian federal states, is located in the northern part of the country. It is highly industrialized, with significant heavy industry (steel, machinery) and has 1.4 million inhabitants. It is also home to the majority of the leading European biomass boiler companies. They cooperate in the OEC (Oekoenergie-Cluster), the network of renewable energy and energy efficiency companies. Renewable energy sources provide 33 % of the primary energy (of which 14 % is biomass) and more than 45 % of all heating. The use of wood in clean high-efficiency biomass boilers contributes significantly to the share of renewable energy sources: currently 35,000 automatic biomass boilers are in operation in homes as well as public and commercial buildings (half are fuelled with pellets, half with wood chips) and more that 270 biomass district heating systems have been built. Stringent emission standards and innovative boilers which offer high user convenience have contributed to the positive market development. The state government has adopted the target of 100% heat and electricity from renewable energy by 2030. To achieve this ambitious goal, a comprehensive action plan is being implemented which includes legal measures, financial incentives, user obligations, training programmes, information campaigns, and an R&D program.

BIOGAS DIGESTER POTENTIAL

T. Fiesinger
New York State Energy Research and Development Authority

The presentation will describe the status of anaerobic digester use in New York State and opportunities for producing more biogas and electricity through this technology. Potential benefits from applying this technology will be projected, with the emphasis on New York's large dairy farm sector. Costs and other barriers to more widespread implementation will be described. The presentation will also discuss potential funding sources and initiatives for increased application of digester energy projects.

OFFSHORE WIND POWER: ENVIRONMENTAL IMPACTS, TRADE-OFFS, AND PROGRESS

J.Firestone
University of Delaware

Offshore wind development in the United States has been hampered primarily as the result of three factors: (1) the lack, until very recently, of a regulatory regime; (2) concern over environmental impacts. and (3) reluctance by the industry to invest in offshore wind power because of concerns over public opposition. Progress made in the offshore wind sector will be discussed, including an update on regulatory measures, and a view of a re-conceptualized NEPA process will be presented. This process places more emphasis on consideration of trade-offs and alternatives to wind power than alternative locations for offshore wind. Research results suggest that while developers need to be sensitive to communities' attachment to place, the US public is ready to embrace offshore wind power and is willing to lead a transformation in the generation of electricity with wind power at its center.

MARCELLUS SHALE NATURAL GAS: THE RESOURCE, ENVIRONMENTAL IMPACTS, AND PROPOSED REGULATORY REQUIREMENTS

J. Dahl[1] and J. P. Martin[2]
[1]Division of Mineral Resources; New York State Department of Environmental Conservation; [2]Energy Resources R&D, New York State Energy Research and Development Authority

New York's Devonian and Ordovician shale formations may hold significant untapped reserves of natural gas. Previous estimates of the state's shale gas resource range from 163 to 313 trillion cubic feet (Tcf). The New York State Energy Research and Development Authority (NYSERDA) has been investigating New York's shale resource for more than two decades. This presentation will review the characteristics of shale gas exploration and production. The environmental impacts of wells drilled horizontally and those wells which will utilize high volume hydraulic fracturing (HVHF) techniques for Marcellus Shale exploration and development in New York will be reviewed. The Draft Supplemental Generic Environmental Impact Statement (dSGEIS) and the supplementary permit conditions proposed for HVHF operations will be summarized.

PLUG-IN VEHICLES: A NEW WAY OF THINKING ABOUT THE ELECTRIC GRID

J. Halliwell
Electric Power Research Institute

The future of plug-in vehicles is now. With the near term deployment of many different plug-in vehicle technologies, including battery electric vehicles, range extended battery electric vehicles and plug-in hybrid vehicles, many new opportunities exist for utilities. Along with these opportunities come the challenges that any new technology brings. Plug-in vehicle deployment, opportunities and challenges for utilities, and vehicle/grid infrastructure readiness will be discussed. Brief coverage of some of the Electric Power Research Institute's current Electric Transportation projects will be presented.