

Marshall Miller & Associates, Inc.
Participates in the American Energy Security Summit

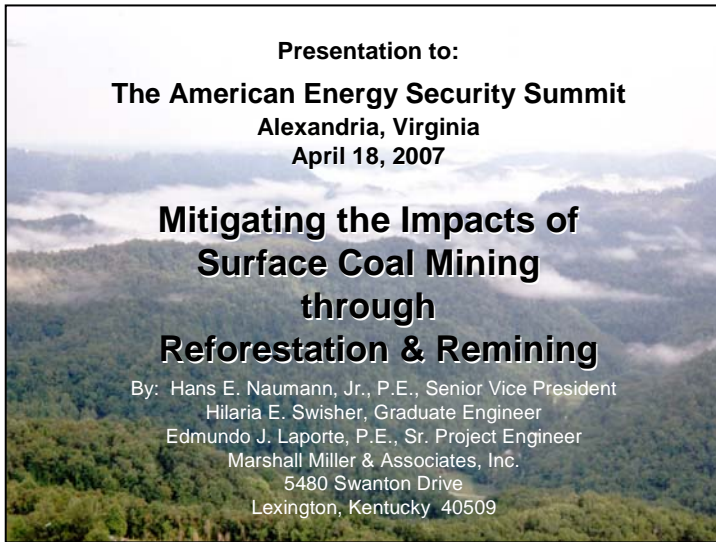
April 16-18, 2007, Alexandria, Virginia

By Hans E. Naumann

On April 18, 2007, Hans Naumann, Jr., P.E., Senior Vice President (Lexington, Kentucky, Office) presented a detailed discussion of the current status of post-mining land treatments associated with surface coal mining. This discussion meshed with the scope of the summit, that is, the development of a liquid transportation fuels production program that eliminates USA's dependence on imported transportations fuels and does so by mitigating many of the current environmental concerns levied against mining, in general, and coal mining/coal consumption, in particular.



SSEB is an interstate compact organization comprised of 16 states and two territories, whose members are governors, state legislators, and a federal representative appointed by the U.S. President.



Edmundo Laporte, P.E., Hilaria Swisher, and Aimee Stoltz, played key roles in the preparation of the presentation. Contributors to the database underlying the presentation included the **University of Kentucky, Virginia Polytechnic Institute & State University (Virginia Tech), Appalachian Fuels, LLC, Engineering Consulting Services, Inc.**, among others. A full copy of the presentation can be accessed through www.mma1.com.

West Virginia Governor Manchin, current chairman of the **Southern States Energy Board (SSEB)**, provided the initiative behind this summit. That event brought together government, business, industry, academia, project development and financial community officials from across the country and reinforced



Governor Manchin (WV), current chairman of the **SSEB**, provided the initiative behind the summit.

an ongoing dialogue on the implementation of a path forward to energy independence.

This path is based on a comprehensive plan for the United States to establish energy security and independence through the production of alternative oil and liquid transportation fuels from its vast domestic resources, including coal, biomass and oil shale. The plan emphasizes the need for improved domestic enhanced oil recovery programs using carbon dioxide capture and storage, increased vehicle fuel efficiency and sensible energy conservation.

Entitled the "*American Energy Security Plan*," it proposes to eliminate imported oil by 2030. The plan calls for initiatives in innovative clean energy technology and conservation efforts, and for creating "Alternative Energy Farms," multi-source energy complexes that produce electricity, liquid fuels, natural gas substitutes, hydrogen, process heat, agricultural fertilizers and petrochemical feedstocks (see: www.AmericanEnergySecurity.org).

SSEB is an interstate compact organization comprised of 16 states and two territories, whose members are governors, state legislators, and a federal representative appointed by the U.S. President. On August 29, 2005, SSEB's Board unanimously approved the *American Energy Security Study*. Member governors and legislators already are introducing policy initiatives and following the recommendations that resulted from the Study.

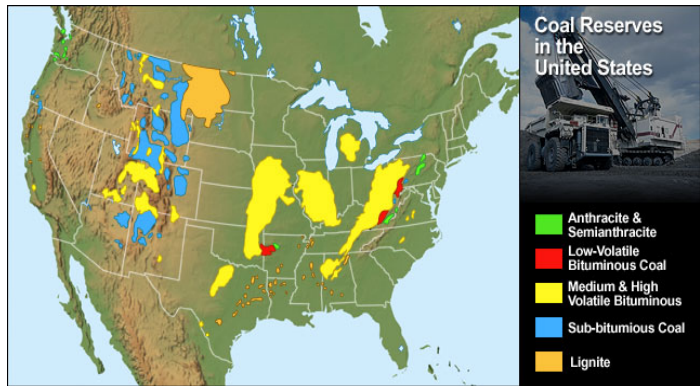
Southern States Energy Board Member States

Alabama	Maryland	South Carolina	Georgia	North Carolina	Virginia
Arkansas	Mississippi	Tennessee	Kentucky	Oklahoma	U.S. Virgin Islands
Florida	Missouri	Texas	Louisiana	Puerto Rico	West Virginia

By producing environmentally superior transportation fuels from near-zero emissions plants (which can recycle, utilize, and/or safely sequester CO₂), the United States is expected to set an example for the world. Liquid fuels produced from coal, oil shale, and some biomass processes have very low to zero sulfur, low particulate and NO_x emissions, and higher performance characteristics than their conventional distillate counterparts. In addition, the plants that produce the liquids can be carbon-capture capable. (See: [MM&A's participation in the SeCarb project. www.mma1.com](#))

The focus of the energy security plan is primarily on the rapid development of coal/oil shale/biomass-to-liquid fuels production, though other elements of a comprehensive energy security program also were examined Improving transportation fuel efficiency, especially in vehicles, sensible conservation, renewable resources, and initiatives to increase conventional and non-conventional domestic oil production must all play a part.

Commercial enhanced oil recovery successes using CO₂ flooding suggest that American oil and gas production can be dramatically increased by this method. Miscible CO₂ flooding can revitalize certain mature oil fields. In addition, CO₂ injection into coal and oil shale



North America holds an abundance of coal. The map shown here excludes the sizeable coal fields of Alaska. Ten of the states shown on this map are home to some 561 billion tons of coal reserves; enough coal to supply the energy needs of the USA for more than two centuries.



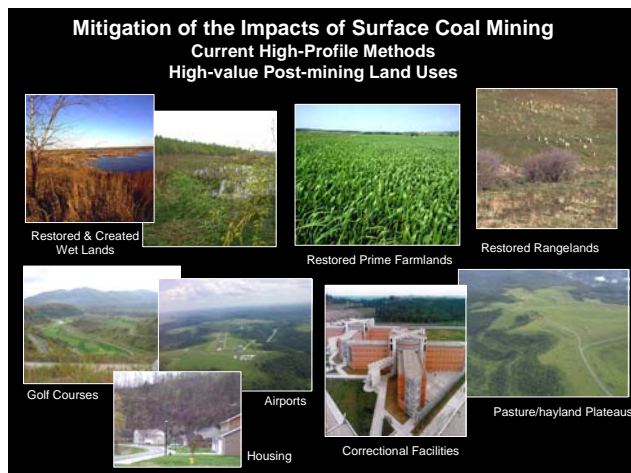
MM&A's Naumann presented a detailed paper on current reforestation techniques and its place in mitigating the impacts of mining.

deposits is an emerging technology that can increase natural gas production from these sources. At present, limited availability of CO₂ supplies severely constrains this production enhancing technique. However, coal, oil shale, and biomass-to-liquids plants will produce and capture large quantities of CO₂, which can be sold to oil and gas producers for such productive uses. Thus, the CO₂ generated by these plants can be put to a positive use, while at the same time permanently and safely sequestering the gas in reservoirs deep beneath the surface. In addition, the petroleum residuals generated by oil and gas producers can be upgraded to liquid fuels in the new carbon-to liquids plants.

The principal points of MM&A's presentation to the members of the Summit are summarized below.

Current High-Profile Methods High-Value Post-Mining Land Uses

- High Schools
- Elementary Schools
- Flea Markets
- Athletic Complexes
- Hospitals
- Housing Developments
- Church, Daycare
- Mobile Home Sales
- Shopping Centers
- Car/Truck/Equipment Sales
- Motel/Hotel
- Office Complex
- Storage Rental Facility
- Off Track Betting
- Telecommunications Call Center



Common sense, entrepreneurship, and the desire to "do good," have resulted in a variety of post-mining land uses that have clearly demonstrated sustainable positive benefits on society.

Reforestation: A Mitigation Option for Mining-Related Surface Disturbance

Environmental Benefits

- Minimization of soil erosion

Recreational Value

- Hiking, biking, skiing
- Seasonal hunting
- Outdoor activities which support regional tourism and benefit area residents

Other Economic and Social Benefits

- Job Creation
- Local Tax Revenue
- Tax incentives for landowners to choose forestry land use




Thoughtful attention to habitat diversity, as shown here with an approved post-mining pond along a mixed use forest/rangeland, also provides an opportunity to collect and store carbon dioxide.

Carbon Sequestration Potential of Trees


- The benefits of reclamation with trees include reducing the negative effects of global warming by storing carbon in trees.
- A tree can absorb up to a ton of carbon dioxide over its lifetime.

Carbon Sequestration Potential of Trees

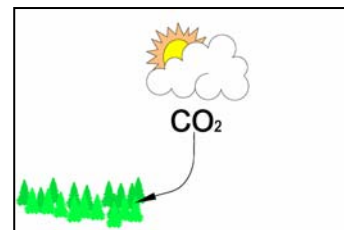
- The benefits of reclamation with trees include reducing the negative effects of global warming by storing carbon in trees.



A tree can store up to one ton of carbon dioxide over its lifetime.



Harvesting and using the wood for permanent/semi-permanent uses (furniture, buildings, etc.), extend the sequestering period.



The Challenge: Making Valuable Tree Species Grow on Reclaimed Mine Lands

- Without extraordinary effort only 20 - 22% of tree seedlings planted for reforestation purposes survive.
- Those that survive are often small and weak.

Problems with Current Reclamation Practices

- Excessive compaction of the rooting (growth) medium (soil or approved soil substitute)
- Selection of inappropriate rooting medium
- Excessive competition from the herbaceous ground-cover species established to control erosion



Environmental activists rail against the vast plains created by current (and regulatory agency approved) mining techniques. The area shown here will take centuries to return to its former forested self.

Reforestation Research Projects

University of Kentucky

- Starfire Mine
- Bent Mountain Mine

West Virginia University

- Ohio Mine Study
- Mountain Top Mined Areas
- AML Sites

Virginia Tech

- Powell River Project



Proving reforestation technique options is an exasperating long process. Astonishing and well-documented successes in quick-growth reforestation have now caught government, miners, and landowner's attention.

Commonwealth of Kentucky Reclamation Advisory Memorandum (RAM) No. 124 – March 1997

- The Commonwealth of Kentucky Issued Forestry Reclamation Practices RAM 124 based on the advice of a panel of experts and administrators
- RAM 124 comprised the following items:
 1. Selection of a growth medium
 2. Grading
 - a) Area/Mountaintop
 - b) Dragline
 - c) Steep Slope
 - d) Final Surface
 - e) Tree-compatible ground cover
 - f) Fertilizer requirements*
 - g) Tree species selection
 - h) Tree planting



Remarkable tree growth has been consistently documented when the final layer of reclaimed “mined-over” land is loosely dumped and gently treated prior to planting seedlings. The trees shown here are barely seven years old.

Reforestation of Previously Reclaimed Sites

Challenge: Preparation of a loose rooting zone

- Excavator “Pockets”
- Deep ripping



Stable, but highly compacted, reclaimed areas support grasses and shrubs, and often little else. Preparing the surfaces for trees requires excavating rooting zones with a backhoe (*left*) or ripping the surface (*right*). Both methods loosen the rooting zone for better seedling survivability and tree growth.

State Regulatory Agencies that have Adopted New Mined Land Reforestation Guidelines

- The Virginia Department of Mines, Minerals, and Energy (*DMME*) – 1996
- The Kentucky Department of Surface Mining and Reclamation Enforcement (*DSMRE*) – 1997
- The West Virginia Department of Environmental Quality – 1998
- The Missouri Department of Natural Resources – 1998
- The Tennessee Federal Program – 1999
- The Indiana Division of Reclamation – 1999

Re-mining – A Reforestation Opportunity

- Both surface and underground mines are increasingly “reworking” previously mined over areas
- Re-mining by surface mines provides an opportunity to restore/reclaim/and reforest

Sequestering Carbon in Forests Planted on Abandoned Mine Land

- 367,000 acres (148,500 hectares) of abandoned (unreclaimed) mine land (*AML*) in the Appalachian coal region
- Provide little or no economic value
- Afforestation and forest management can provide two major benefits
- Financial
- Environmental

About the Authors:

Hans Naumann is a Senior Vice President stationed in Lexington, Kentucky. His first mining experience in his home country, Haiti, left him with a lasting impression of the damaging effects of acidic mine drainage on the surrounding environment. Since then, he has participated in a variety of mining related environmental mitigation efforts and sat on West Virginia’s Acid Mine Drainage Technical Advisory Committee. His mining engineering practice continues to-date with an interest in mine site rehabilitation and this latest reforestation initiative sits well with his views.

Edmundo Laporte is a registered engineer and hails from Venezuela, where he left his mark on both surface coal mines and limestone quarries. His engineering practice with MM&A includes estimation of post mining reclamation costs and appraising mineral estates. He is particularly sensitive about the heritage of a site and works his designs to accommodate that sensitivity.

Hilaria Swisher is a graduate mining engineer from West Virginia University. Her forte has been the assembly of coal mining surface disturbance permits. In the course of that work, she is frequently exposed to the dilemma of choosing an appropriate post mining land use. She found participation as principal researcher for the preparation of this paper on reforestation both educational and refreshing.

Special Acknowledgements:

The entire presentation, complete with detailed notes pages can be downloaded from the MM&A web site (www.mma1.com). This presentation was made possible in part by the unselfish contributions from the following individuals and entities:

- **Virginia Tech**, Sustainable Development of Mineral and Energy Resources, Lecture #13, Rehabilitation and Post-Mining Land Use
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