

Carbon Capture & Sequestration: The Business Summit
Pre-Summit Technology Showcase
Washington, DC—July 13, 2010

Tuesday, July 13, 2010

This year's Technology Showcase will feature presentations discussing the current research directions, progresses made in developing solutions to carbon capture and sequestration for power, as well as industrial and oil extraction applications.

7:00 – 8:00 Networking Breakfast and Registration

8:00 – 8:15 Welcoming Comments

Advanced Oxy-Combustion Technologies

8:15 – 8:45 **Future Carbon Management Technologies**

Praxair will present a variety of innovative technologies that are designed to respond to future demands for competitive carbon management systems. The technologies are designed to meet industrial demands for CO₂ capture, CO₂ purification, preservation of marketable byproducts and hybrid oxy-fuel power generation. Praxair has been working with the Dept. of Energy, Power Generators and a variety of industrial customers who are proactively developing response plans in anticipation of carbon management legislation. Praxair, Inc. has been developing carbon management technologies for the past 10 years and has received several awards for the development and demonstration of innovative technologies.

Chris Guild, *North American Business Development*, PRAXAIR INC.

8:45 – 9:15 **MHI's KM-CDR™ CO₂ Recovery Technology Commercialization Status**

Mitsubishi Heavy Industries (MHI) currently has the largest fleet of large-scale commercially operating CO₂ capture plants recovering CO₂ from natural gas fired applications. The company is now focusing on providing its KM-CDR™ post-combustion CO₂ capture process for commercial scale solutions for coal fired applications. MHI has already completed demonstration testing of its capture process, and is involved in constructing a full-scale demonstration project, as well as working on a number of heat and process integration improvements to reduce operating costs and energy penalty of CO₂ capture. These wide-ranging initiatives, designed to move this technology forward to facilitate commercial deployment for coal-fired applications, are the topic of this paper.

Steve Holton, *Director of Business Development*,
MITSUBISHI HEAVY INDUSTRIES, AMERICA, INC.

9:15 – 9:45 **Status of CO₂ Capture Commercialization - the Alstom Program**

Alstom is moving forward with multiple demonstration and validation plants for the Chilled Ammonia Process, Advanced Amine, and Oxy-fired Combustion. A summary of the total program will be presented with highlights and timing for each major project.

Robert G. Hilton, *Vice President, Power Technologies for Government Affairs*, ALSTOM

9:45 – 10:15 **Oxyfuel CO₂ Capture from an Industrial Gas Perspective**

The complete system of oxyfuel combustion for power with CO₂ capture and purification involves four primary elements: air separation unit (ASU) for oxygen supply, steam boiler equipped for oxy-firing, CO₂ purification/compression, and CO₂ transport and storage. Two of these four elements are based on the fundamentals of advanced gas separation. This presentation will focus on the status of CO₂ purification technology specifically applied to oxyfuel combustion for the power industry, including novel technology developments in removal of SO_x, NO_x and mercury in the CO₂ purification unit. This presentation will also discuss how the industrial gas sector can respond to the oxygen needs of oxyfuel coal combustion as has been done in the past for the needs of the steel sector, the refining sector, the chemicals sector and IGCC, among others.

Dave Taylor, *Vice President, Energy Businesses*, AIR PRODUCTS AND CHEMICALS INC.

10:15 – 11:00 Networking Break

Amine Capture and Sorbents Technologies

11:00 – 11:30 **Low-Cost Carbon Capture Using Enzyme Catalysis**

CO₂ Solution Inc. and Codexis Inc. are validating a patented enzyme-based technology to enable the economical capture of carbon dioxide in aqueous solvents, which are normally kinetically limited, but have low energies of regeneration. The presentation will provide the basis of the technology and the opportunity for its deployment as a breakthrough solution for economic carbon capture.

Jonathan A. Carley, *Business Development Director*, CO₂ SOLUTION INC.

James Lalonde, *Vice-President, Biochemistry and Engineering R&D*, CODEXIS, INC.

Pre-Combustion Capture/IGCC

11:30 – 12:00 **Overview of Technology Readiness for Pre-combustion Capture of CO₂**

Previous studies have demonstrated the advantages of utilizing IGCC based systems for power generation. Carbon management for these systems is based on pre-combustion capture of CO₂ from syngas. The separation process is significantly different from that encountered in post-combustion capture. In fact, process conditions (e.g. pressure, temperature and feed composition) could make pre-combustion capture more economically feasible than post combustion capture. A variety of technologies are being evaluated and developed in order to capitalize on the significantly different conditions encountered during pre-combustion capture. This presentation will review technologies under development, identify their strengths and weaknesses, and rate their level of technology readiness for deployment.

Kevin C OBrien, Ph.D., *CEO / President*, ENERGY COMMERCIALIZATION, LLC

12:00 – 12:30 **GE Infra Gasification Technology—Status and Update**

GE is the IGCC technology provider for Duke Energy's plant in Edwardport, Indiana that is expected to be the world's largest IGCC facility when it enters commercial operation in 2012. With proven pre-combustion capture, IGCC is well suited to respond now to the uncertainty in carbon regulation. This presentation will discuss how GE has applied its broad experience in gasification-based industrial carbon capture to IGCC, for up to 90% CO₂ capture. It will also discuss GE's Carbon Island™ as either a Greenfield or retrofit option for achieving a carbon footprint identical to natural gas combined cycle, and the importance of integration and consideration of interoperability of all steps in the CCS train.

Norm Shilling, *Carbon Technology Leader*, GE ENERGY

12:30 – 2:00 Group Luncheon

Mineralization

2:00 – 2:30 **Carbon Sequestration, Steam-Methane Reformation and Mineralization**

Whenever fossil fuel is used for production of energy, we produce carbon emission. This presentation will take a critical look at the ways the industry is producing CO₂ and what can be done to minimize the emission. Besides the analysis of the sequestration problem, the presentation will focus on a novel method to sequester carbon emission in the steam-methane reformation/coal-gasification process.

Surendra Saxena, *Professor of Mechanical and Materials Engineering*, FLORIDA INTERNATIONAL UNIVERSITY

2:30 – 3:15 Networking Break

3:15 – 3:45 **A Recipe for Carbon Mineralization with a Pinch of Salt**

Combining efficient chemical production with processes that beneficially reuse or capture CO₂ and other contaminants from the flue gas of power, cement and steel plants can lead to significant reductions in emissions and generate profit. Specifically, co-locating the production of hydrogen, chlorine and sodium hydroxide at a plant with CO₂ emissions can yield significant carbonomic and economic benefits. The SkyMine® process relies on well-understood chemical reactions and unit operations to capture and mineralize CO₂ at a competitive energy penalty. The chemistry, thermodynamics, material balance, carbonomics and financials for this synergistic approach are presented and the field results from a pilot demonstration plant are reviewed.

David St. Angelo, *Vice President of Engineering*, SKYONIC CORPORATION

CO₂ Storage and EOR

3:45 – 4:15 **Catalytic Transformation of CO₂ for Polymer and EOR Applications**

The presentation will describe Novomer's advances in the area of polymerization of CO₂ and epoxides, which results in the permanent sequestration of CO₂ into valuable polymeric materials. This presentation will briefly cover the foundational technology, current state-of-the-art process economics, Life Cycle Analysis, and end-use applications.

Jim Mahoney, CEO, NOVOMER INC.

4:15 – 4:45 **A Fresh Look at the Oil and Gas Technologies We Could Use for CO₂ Storage**

As is recognized by many individuals and organizations, the oil field services sector has many applicable, proven and existing technologies that can meet the needs of CCS sub-surface activity—this is in addition to new, emerging technologies that will provide even further advantages. This presentation aims to highlight the large diversity in oil and gas technologies, from high-end deepwater environments to shallow, onshore wells—and the potential crossover of lower cost services to analogous CCS wells.

Paul Williams, *Global CCS Projects Director*, BAKER HUGHES INTEGRATED OPERATIONS

4:45 – 5:00 Closing Remarks – Pre-Summit Adjourns