MEETING REPORT
Second Meeting of the Heavy Oil Working Group
Monday, August 1, 2011
Bogota, Colombia

Overview

The Heavy Oil Working Group was launched in April 2010 at the Energy and Climate Partnership of the Americas Ministerial in Washington, D.C. This Group brings together regional partners from the Americas to share experiences with heavy oil, update on the current state of technology, and discuss other areas of mutual interest, such as environmental and policy issues involved with heavy oil development.

The second meeting of the Working Group took place on August 1, 2011 in Bogota, Colombia with the participation of delegates from Colombia, Mexico, Canada and the United States. This meeting focused on "Technology for Policymakers", and was composed of three main sessions – a heavy oil outlook and update, a session on next-generation heavy oil technology "game-changers", a final session on the role of the public sector in supporting technology development; as well as a lunch presentation and a brainstorming session. The meeting was moderated by Dr. Jose Luis Bashbush, Mexico RTC Manager at Schlumberger, and involved introductory presentations followed by question and answer periods.

Session 1: Heavy Oil Outlook and Update

In this session, **Robert J. (RJ) Johnston,** Director, Energy and Natural Resources at the Eurasia Group provided an update on the heavy oil supply situation and outlook. He noted the importance of politics in global oil markets, the role of corporate social responsibility (CSR) and increasing focus on environmental issues, and the importance of considering how global events impact the hemisphere.

Mr. Johnston observed that Canada is a strategic oil player, with Alberta forecasted to have one of the most significant sources of oil supply that does not come from a member of the Organization of the Petroleum Exporting Countries (OPEC). Canada does face some challenges, namely with regulation of GHG emissions, with ensuring that the oil sands are being developed responsibly, and market access issues (especially in the context of the Keystone XL pipeline).

Mr. Johnston remarked that the production performances of Mexico and Venezuela have both declined in the last 10-15 years. While it is uncertain whether new Venezuelan supplies will come online in next five years from the Orinoco region, an increase in incremental production in current fields could make a big difference for Venezuela. As well, the completion of planned upgraders by Petróleos de Venezuela (PDVSA) could serve as a boost to upstream production. Mexican exports have recovered a bit in 2010, due to success from PEMEX's ramp-up of the Ku-Maloob-Zaap (KMZ) oil field and enhanced oil recovery (EOR) efforts in mature shallow-water fields. For Mexico in the medium-term, the success of newly awarded contracts will be key.

In terms of new players, Mr. Johnston noted that there is a remarkable upward trend in production experienced by Colombia; a trend which is being driven by heavy oil and advanced oil recovery. In his view, Brazil is the big non-OPEC story for the next generation, with the potential to double their production. The Eurasia Group forecasts that pre-salt production from Brazil will take off around 2014, at the same time that Iraqi light sweet crude will come online.

Regional refining dynamics and traditional trade flows have changed; the Eurasia Group estimates that the market share of "growth" producers in the hemisphere will increase to 10% on the Gulf Coast. Mr. Johnston also spoke to the "decoupling" of WTI and Brent and suggested that the spread is underpinned by structural factors. Brent is driven by growth in emerging markets, unrest in the Middle East and the decline of the North Sea.

To conclude his presentation, Mr. Johnston touched briefly on other global considerations, namely from the Middle East. Mr. Johnston noted that among all of the OPEC countries, Iraq is forecasted to be the biggest "game-changer". Iraqi production is currently pushing towards 3 million bpd, with the potential to produce 6 to 7 million bpd by the end of the decade.

Session 2: Next-Generation Heavy Oil Technology "Game-Changers"

In this session, speakers discussed the application of new technologies in heavy oil extraction, and provided an overview of challenges and opportunities that stem from such technologies.

Marcela Arteaga Cardona, Project Leader of the Alternate Steam Injection (ASI) Project at PEMEX Exploration and Production (PEP) gave an overview of the successful steam injection pilot project at the Neogene Samaria Field. In this project, four vertical, one deviated and three horizontal boreholes were drilled to analyze over 60% of the sand and efficiently use a steam boiler. Mrs. Arteaga noted that the community and the surrounding area were taken into account to determine the optimal design of the project.

In the four vertical boreholes, cold production of 60 to 280 bpd was obtained and initial hot production of 1,000 to 1,700 bpd was obtained. The pilot project found that over 70% of the water injected and energy provided remained in the deposit. As a result, it was established that ASI was an effective process to produce extra-heavy oil from this field, and such technology may be expanded and applied to other similar fields. While developing these deeper, heavier reserves was not a priority in the past, such resources are increasingly becoming more important conventional supplies decrease and markets continue to need oil.

Dr. Craig Fairbridge, Manager, Fuels & Emissions at CanmetENERGY, Natural Resources Canada gave a presentation on heavy oil upgrading, which underlined the importance of downstream operations to the heavy oil industry. Mr. Fairbridge's presentation helped to highlight the importance of commercialization of technology, developing new technologies and reducing greenhouse gases.

Research at the Canmet facility focuses on three areas: air quality – technologies to meet and ensure compliance with air standards; oil sand crude oil conversion – how to reduce air emissions while improving quality and quantity of product converted to final clean transportation fuels; and future fuels for transportation – using new sources and technologies to produce fuels for advanced combustion engines.

The goal of developing these technologies is to reduce the impact on air quality not only of heavy oil production, but also of transportation fuel consumption by researching energy transformation chemistry and advanced combustion for internal combustion engines.

Mr. Fairbridge outlined emerging upgrading technologies, and provided an overview of the key near-term and long-term challenges associated with them, which includes devising standard methods for evaluation and characterization, reducing water use in the production and conversion of petroleum and stabilizing carbon dioxide and criteria air contaminants through the production, conversion and end use of hydrocarbon energy.

Lunch Presentation: The Relationship Between Technology and Policy - Examples from the Oil Sands of Alberta

Mr. Ross Chow, Manager of the Surface Separation Group in the Heavy Oil and Oil Sands Business Unit at Alberta Innovates Technology Futures provided a short lunch session presentation that outlined specific policy requirements that were put into place in the Alberta oil sands which spurred and supported development of more effective, efficient and environmentally- friendly technologies. Policies included a minimum recovery requirement, providing resources on a federal and provincial level to support new technology development, required remediation of tailings, and required recycling of produced water. Mr. Chow outlined the objectives and outcomes of the Alberta Oil Sands Technology and Research Authority (AOSTRA), which later evolved into the Alberta Energy Research Institute in 2000, and in 2010 to the Alberta Innovates- Energy and Environment Solutions (AIEES). Mr. Chow noted that the formation AOSTRA, among other appropriate policy actions, helped to create leaders in the Alberta oil sands industry and served to greatly accelerate development in the oil sands of Alberta.

Session 3: The Role of the Public Sector and the Private Sector to Support Technology Development

This session discussed the role of government, academia and the private sector in supporting technology development.

Dr. Edgar Rangel German, Commissioner of the National Hydrocarbons Commission (CNH) – Mexico spoke about the role of the public sector in supporting technology development in Mexico. Dr. Rangel described Mexico's 2008 energy reform, which aimed to revitalize the exploration and production (E&P) sector through innovative decision-making, new planning tools and new contractual schemes for priority activities.

The presentation outlined the function of the CNH and its part in combating Mexico's production challenges, strengthening the hydrocarbon sector, and enabling R&D in Mexico. He also touched briefly on the importance of EOR techniques, and the uniqueness of the Chicontepec field.

The role of the CNH is to regulate, sanction and supervise the exploration and extraction of hydrocarbons in order to ensure that the best projects are being undertaken with the correct guidelines and supervision. The CNH contributes to hydrocarbon policy by assessing, quantifying and verifying reserves. They have performed an analysis on the national potential of EOR and proposed a methodology to identify technological alternatives in each case. Such technical proposals to increase the recovery factor of hydrocarbon reserves as well as the creation of national research funds serve to foster technology development, transfer and application in Mexico.

Mr. William Flórez Villamizar, Executive Director of the Professional Council of Petroleum Engineers (Colombia), gave a presentation on the importance of strengthening higher education in Colombia and the role that human resources management plays in developing the oil industry. The presentation outlined the guidelines for higher education in Colombia and emphasized the need for more resources, the need to strengthen research labs in educational institutions and the need to foster interaction with the productive sector, the public sector and the wider community. In Colombia, the amount of new petroleum engineers is set to double in the next few years; properly managing and encouraging this young work force will be essential to the growth of Colombia's hydrocarbons sector.

Mr. Jaime Jiménez Viacobo, Deputy Director, National Council of Science and Technology (Conacyt) (Mexico) presented on the Hydrocarbon Industry Fund. His presentation outlined how Mexico has been working to strengthen the hydrocarbons industry in accordance with the driving forces of the industry by creating a fund for R&D activities and applied research.

The objective of the Hydrocarbon Industry Fund is to encourage applied technology and scientific research, encourage technological development and to support the creation of specialized human resources in the oil industry in order to complement the technological development, assimilation, innovation and adoption that will is the driving force behind this fund. This fund has disbursed $175 million USD on applied technology and scientific research projects and to various institutions that have focused on preventing pollution related to oil industry activities, refining heavy crude oil and exploration activities with the aim of increasing the recovery rates of reserves. The requirements to receive support from this fund are quite open and foreign companies are able to participate. However, on all projects, consortiums must be led by a Mexican institution (such as the Mexican Petroleum Institute).

This fund aims to create international synergies by examining the situation in different countries, working collaboratively and encouraging contributions to technology development.

Brainstorming Discussion

In the final session and the evaluation forms from the meeting, participants provided suggestions for the next meeting. In terms of format, participants expressed that it would be valuable to allow more time for discussions and break-out sessions to discuss a specific problem and exchange ideas. Participants also noted that it would be useful to have representatives from Brazil and Venezuela in attendance, as well as more exploration and production companies. This varied audience would help to broaden the discussion.

Potential areas of discussion at future meetings which were suggested include the following:

General

- Identifying common problems for heavy oil development in Latin America
- How to get to field – what are the barriers? Funds? Regulation? Access to Resources?
- Regional stock markets and the Latin American hydrocarbon sector
- Price Realization/Differentials
- Western Hemisphere Heavy Oil – Evaluating the Vulnerability to External Shocks
- The potential effects of US environmental regulations on the heavy oil industry
- "Next-Generation" Heavy Oil – Trinidad and Tobago, Alaska, Ecuador, Peru
- Heavy Oil Infrastructure
- Estimates of reserve simulation vs. success in heavy oil fields
- Auditing Heavy Oil Reserves
- Crude Oil Quality
- Human resources shortages and how they should be handled

Technology

- Moving from lab-pilot-commercialization: what is the process?
- Commercialization of technology - shared approaches – this session could outline time frames, successful examples, etc.
- Pilot Projects - Case studies to share results (also including failures)
- How to encourage knowledge sharing of experiences on big heavy oil projects
- How to get the right cooperation along the chain – moving technology from discovery to scale-up
- Best Practice Success stories for public sector R&D
- Technology Collaboration schemes
- Evaluation of Heavy Oil Technologies/Criteria for selecting the best technology
- Off-shore heavy oil

Legal and Regulatory Frameworks

- Incentives to develop heavy oil (tax incentives or other)
- Tax regimes to develop heavy oil

Environmental Issues

- Reducing GHG emissions
- Update on funding programs
- Control of thermal production methods
- Co-generation

Conclusion

As a potential deliverable for the 2012 ECPA Ministerial meeting, it was suggested that the creation of a common database of pilot projects (past and present) would help to share experiences as to why certain projects were successful (or not), and would be a very useful reference for the sector.

With respect to the next meeting of the group, the majority of participants agreed that a meeting in the first quarter of 2012 would be useful. It was suggested that a meeting scheduled around the Latin American and Caribbean Petroleum Engineering Conference (LACPEC) which is taking place April 16-18, 2012 in Mexico City would potentially be a good option.