



## OFFICERS PRESIDENT

P. Thakur  
ESMS LLC  
[pramodthakur@frontier.com](mailto:pramodthakur@frontier.com)

## SECRETARY

I Havryluk  
Havryluk & Associates  
[havryluk@zoominternet.net](mailto:havryluk@zoominternet.net)

## COORDINATOR

K. Aminian  
West Virginia University  
[kaminian@wvu.edu](mailto:kaminian@wvu.edu)

## BOARD OF DIRECTORS

C.W. Byrner  
Arthur Henry, LLC  
[charliebyrner@gmail.com](mailto:charliebyrner@gmail.com)

J. D'Amico  
DTC  
[Damico.corp@verizon.net](mailto:Damico.corp@verizon.net)

B De Maagd  
De Maagd Consulting  
[demaagdconsulting@gmail.com](mailto:demaagdconsulting@gmail.com)

J. Duda  
U.S.DOE/NETL  
[john.duda@netl.doe.gov](mailto:john.duda@netl.doe.gov)

G. DuBois  
[gary.dubois@frontier.com](mailto:gary.dubois@frontier.com)

C. Eckert  
EQT  
[eckertc@eqt.com](mailto:eckertc@eqt.com)

G. Kozera  
Learned Leadership LLC  
[gkozera@aol.com](mailto:gkozera@aol.com)

M. Mosser  
Mosser Resources  
[mmosser72@comcast.net](mailto:mmosser72@comcast.net)

J. Reilly  
Consultant  
[reillyjoanne@hotmail.com](mailto:reillyjoanne@hotmail.com)

G. Rodvelt  
Halliburton  
[gary.rodvelt@halliburton.com](mailto:gary.rodvelt@halliburton.com)

F. Ruiz  
US EPA  
[Ruiz.felicia@epa.gov](mailto:Ruiz.felicia@epa.gov)

S. Schatzel  
NIOSH  
[Zia6@cdc.gov](mailto:Zia6@cdc.gov)

D. Uhrin  
CBM Consulting  
412-828-3454

K. White  
Steptoe & Johnson  
[Kristian.white@steptoe-johnson.com](mailto:Kristian.white@steptoe-johnson.com)

Earlier this month, the Forum successfully delivered a day-long CBM engineering seminar and its annual spring technical session. There may be no better way to complement these timely and informative events than to dedicate the theme of this quarter's newsletter to research. To wit -- articles covering current research and analysis on the topics of mine ventilation, life cycle assessment, and enhanced methane production are provided to spur the interest of readers. Information about internship opportunities is also presented to assist those who wish to advance the knowledge base that underpins energy resources development. First, a recap of April's events.

John R. Duda  
Managing Editor  
[John.duda@netl.doe.gov](mailto:John.duda@netl.doe.gov)

## NACBM FORUM HOLDS ITS 57<sup>TH</sup> SESSION

The Forum held its annual session on Wednesday April 12, 2017 at the Hilton Garden Inn at Southpointe, Canonsburg PA. The session included the following presentations:

1. Post-election energy outlook
2. International CBM/CMM developments
3. Marcellus shale energy and environment lab
4. Deep coal gas potential
5. A profitable coal to liquids project
6. Water management and recovery of rare earth elements
7. Dissolvable technology for down hole completion
8. Nora CBM field update
9. Longwall instrumented aerodynamic model

The luncheon keynote speaker was Mr. Christian Palich, President, Ohio Coal Association

## FORUM PRESENTS FUNDAMENTALS OF CBM ENGINEERING SEMINAR

On Tuesday, April 11, 2017 the Forum held a one day CBM engineering seminar at the Hilton Garden Inn. The seminar provided a comprehensive treatise of:

1. CBM reserves and reservoir properties
2. Vertical Drilling and hydraulic fracturing
3. Horizontal drilling for CBM production and mine degasification
4. CBM processing and marketing

The short course was well received and attended by over forty participants. The participants included students from several universities as well as representatives from the coalbed methane industry. A reception followed the seminar. The Board thanks Consol Energy and EnerVest Operating, LLC for their financial support of the forum. Also, we would like to acknowledge Halliburton for their continued support as well as YPE and the Washington County Chamber of Commerce for informing their members about our educational seminar.

## **NACBM FORUM HOLDS ITS ANNUAL MEETING**

The Forum held its annual meeting on Wednesday, April 12, 2017 at the Hilton Garden Inn. The meeting heard reports from the president, Dr. Pramod Thakur and vice-president/treasurer, Dr. Kashi Aminian. Subsequently, the annual meeting elected its Board of Directors and corporate officers. Elected to the Board were: C. Byrer C. Eckert, J. D'Amico, B. De Maagd, J. Duda, G. DuBois, G. Kozera. M. Mosser, J. Reilly, G. Rodvelt, F. Ruiz, S. Schatzel, D. Uhrin and K. White. Re-elected as officers of the corporation were Dr. Pramod Thakur – president; Dr. Kashi Aminian – vice-president/treasurer and Mr. Ihor Havryluk – secretary.

## **SPRING 2017 CLOSING REMARKS**

My name is Ihor Havryluk and I am the Forum's secretary and one of the founding fathers of the Forum. As an exploration geologist, I have been in the business since the mid-1960's and last year I said that the current difficult times in oil, coal and natural gas shall pass having lived through a few of the ups and downs in these industries. The current down shall also pass. Back in early 1956, a prominent Shell Oil geologist by the name of M. King Hubbert predicted that US oil production would peak within 10 to 15 years, and yes, fifteen years later US oil output did begin to decline and American reliance on foreign oil began to increase. In the mid-2000s, as global oil production appeared to have peaked, Mr. Hubbert became an idol of those who dreamed of the end of oil/fossil fuels era. Fast forward to spring 2017. The price of natural gas is about \$3.30 per mmbtu as compared to \$2.50 in 2016. Northern Appalachian coal is selling at about \$45.00 per short ton and Central Appalachian coal is at \$50.00 per short ton. According to my colleague, Dr. Thakur, these prices can sustain the US coal industry. But even more important than the increase in commodity prices is the cautious optimism that is taking place throughout the energy industry due to the change of Administration in Washington DC.

Now, regarding the future of coal and natural gas, according to energy experts with the American Association of Petroleum Geologists, coal is a remarkable fuel. Coal is available worldwide, it is affordable, and it is reliable. Coal remains the cheapest energy source to generate electricity at 4 cents per kilowatt hour! Now, coal is lifting developing countries in Asia and Africa from poverty and helping to raise the standard of living all over the world. And, let me remind you, wherever you have coal you have coalbed methane/coal seam gas. In the future, the world will [continue to] need energy that is affordable, available, reliable, and sustainable. Currently, the bulk of this energy is provided by coal and natural gas, including shale gas. Down the road, I can see where coal and coal seam gas (with an estimated resource of over 30,000 TCF) can continue to provide this type of energy in the world!

## **MINE SAFETY REMAINS FOREMOST**

A mine experiment using tracer gas was conducted at a western US coal mine as part of the National Institute for Occupational Safety and Health's (NIOSH) ongoing study on longwall face ventilation. The study was conducted to evaluate the movement of longwall face air exchanges between the face and worked-out area, and to document the presence or absence of face airflow pathways between these locations. Maintaining adequate ventilation air on longwall faces is important for worker safety and for the dilution of methane emitted from the face and caved gob. In addition to the main face ventilation airflow movement from head to tail, the study documented transport of ventilation air at the back of the shields with movement in the same general direction. Other less prominent pathways may be present and exchanges between the airflow pathway at the back of the shields and gas in the mined-out gob were suggested. Citation -- *Schatzel SJ, Gangrade V, Hollerich CA, Addis JD, Chasko LL, [2017]. Tracer gas study to determine face ventilation air and gob gas movement patterns on a bleederless longwall panel. 2017 SME Annual Meeting and Exhibit, Denver, CO, February 19-22, 2017, Pre-print 17-137.*

## **CBM PRODUCTION AND GREEN HOUSE GAS EMISSIONS**

The National Energy Technology Laboratory's (NETL) life cycle natural gas model accounts for the variability in 31 combinations of different extraction technologies and geographies (<https://www.netl.doe.gov/research/energy-analysis/search-publications/vuedetails?id=1830>). For coal bed methane (CBM) extraction, four regions are modeled: Appalachian, Black Warrior, Central, and Rocky Mountains. CBM extraction from these four regions accounts for approximately 6% of the U.S. natural gas supply. The life cycle greenhouse gas (GHG) emissions for these scenarios are highly variable, with expected values ranging from 12.1 to 19.7 of grams of carbon dioxide equivalents (CO<sub>2</sub>e) per megajoule (MJ) of natural gas distributed to consumers (with CO<sub>2</sub>e expressed in terms of IPCC's 100-yr, AR-5 global warming potentials). The national average for all natural gas delivered in 2012 is 14.8 g CO<sub>2</sub>e/MJ, on a life cycle basis. Natural gas from Rocky Mountain CBM has the highest life cycle CO<sub>2</sub>e of the four scenarios, with liquids unloading being the key source of methane (CH<sub>4</sub>) emissions. Based on NETL's life cycle natural gas model, Rocky Mountain CBM emits 0.23 grams of CH<sub>4</sub> per MJ of distributed natural gas, which translates to a life cycle CH<sub>4</sub> emission rate of 1.3% from liquids unloading alone. Liquids unloading emissions are not as pronounced for the other three CBM scenarios, but given that Rocky Mountain CBM accounts for the majority (78%) of total CBM extraction, it represents an opportunity for CBM methane mitigation. This year NETL will be evaluating the life cycle emissions from CO<sub>2</sub>-enhanced coalbed methane recovery. This new work represents an integrated system that uses CO<sub>2</sub> captured from fossil power plants to displace CH<sub>4</sub> in unminable coalbeds. Integrated systems such as this could result in lower life cycle emissions than the current pathways for natural gas and electricity production. Additional information can be found at [www.netl.doe.gov/LCA](http://www.netl.doe.gov/LCA).

## **MICROBIAL METHANE PROCESSES**

Research at the National Energy Technology Laboratory (NETL) is focused on advancing the understanding of natural microbial methane producing processes in different coalbed methane fields, with the goal of maximizing the natural gas produced. Thanks to collaborations with industry, geologic surveys, and universities, researchers have studied the microbial composition of coal and water samples from major coalbed methane fields across the US to gain an understanding of the diversity of microorganisms available in coal seams. Relatively large proportions of methane producing microorganisms have been identified as well as large proportions of microorganisms that could be responsible for breaking down coal into smaller hydrocarbons. Despite differences between locations, this information suggests that there is significant microbial capability to convert coal to methane. These data, along with chemical composition, are being used to devise and test different nutrients that could be injected into depleted wells in efforts to increase recoverable gas volumes from developed areas where infrastructure exists. Related information is available at <https://www.netl.doe.gov/File%20Library/Events/2015/gas-ccbtl-proceedings/Biogasification-panel-discussion-slides.pdf>.

## **RESEARCH OPPORTUNITIES**

Many internships and fellowships opportunities are available to those who wish to pursue energy-related research. These competitive programs not only support individuals in their interests and passion, but also help to fill the pipeline of scientists and engineers to meet the nation's future science and technology needs. These programs include: Oak Ridge Institute for Science and Education (ORISE) (undergraduate through faculty participants), Mickey Leland Fellowship (ten-week summer program), Office of Science Graduate Student Research (part of a graduate thesis research at a US Department of Energy National Laboratory), Computational Sciences Graduate Fellowship (doctoral degrees in fields using high performance computing), and National Research Council Research Associateship Program (competitive awards to pursue select research projects). These opportunities are obviously just a sampling of programs available nationwide. Additional information is available at [www.netl.doe.gov/internship](http://www.netl.doe.gov/internship).