JUPITER OXYGEN CORPORATION

A Sustainable Business Opportunity for West Bengal

Utilizing CO_2 Emissions from Coal-Fired Power Plants for Enhancing Local Coalbed Methane Production

CARBON CAPTURE, UTILIZATION & REUSE CONFERENCE

Indian Institute of Technology Bombay & Carbon Capture Journal

Presented by Mr. U.P. Pani on October 12, 2018

Jupiter Aluminum: Operational Experience since 1992

Dietrich M. Gross

2008 Winner of Prestigious
‘Innovative Star of Efficiency Award’

“In accepting the Alliance to Save Energy’s Innovative Star of Energy Efficiency Award, Jupiter Oxygen’s Chairman and CEO Dietrich Gross emphasized the importance of maximizing our nation's energy efficiency as we address today’s pressing energy issues. Jupiter provides the kind of strong, visionary leadership needed for that task.”

—Kateri Callahan, President of The Alliance To Save Energy

Visionary Approach

→ **What if,** you can develop a technology that cost effectively captures CO_2 from coal-fired power plants, and **puts those emissions to work** for the benefit of a whole region?

→ **What if,** co-benefits of such technology will improve air quality and enables water recovery?

→ **What if,** putting carbon to work – for enhancing local oil recovery or even enhance coalbed methane production substantially?

Delhi, November 15, 2015

How do you get to unlock such business opportunity ?

You get there in three steps

- First: Having a vital CO_2 off-take market available!
- Second: Having affordable carbon capture technologies and Know-How, suitable to region, available.
- Third: Identify sources of CO_2, such as coal-fired boilers or other large industrial CO_2 emitting sources, in close proximity to ‘sinks’ of CO_2 (EOR/CBM operations)

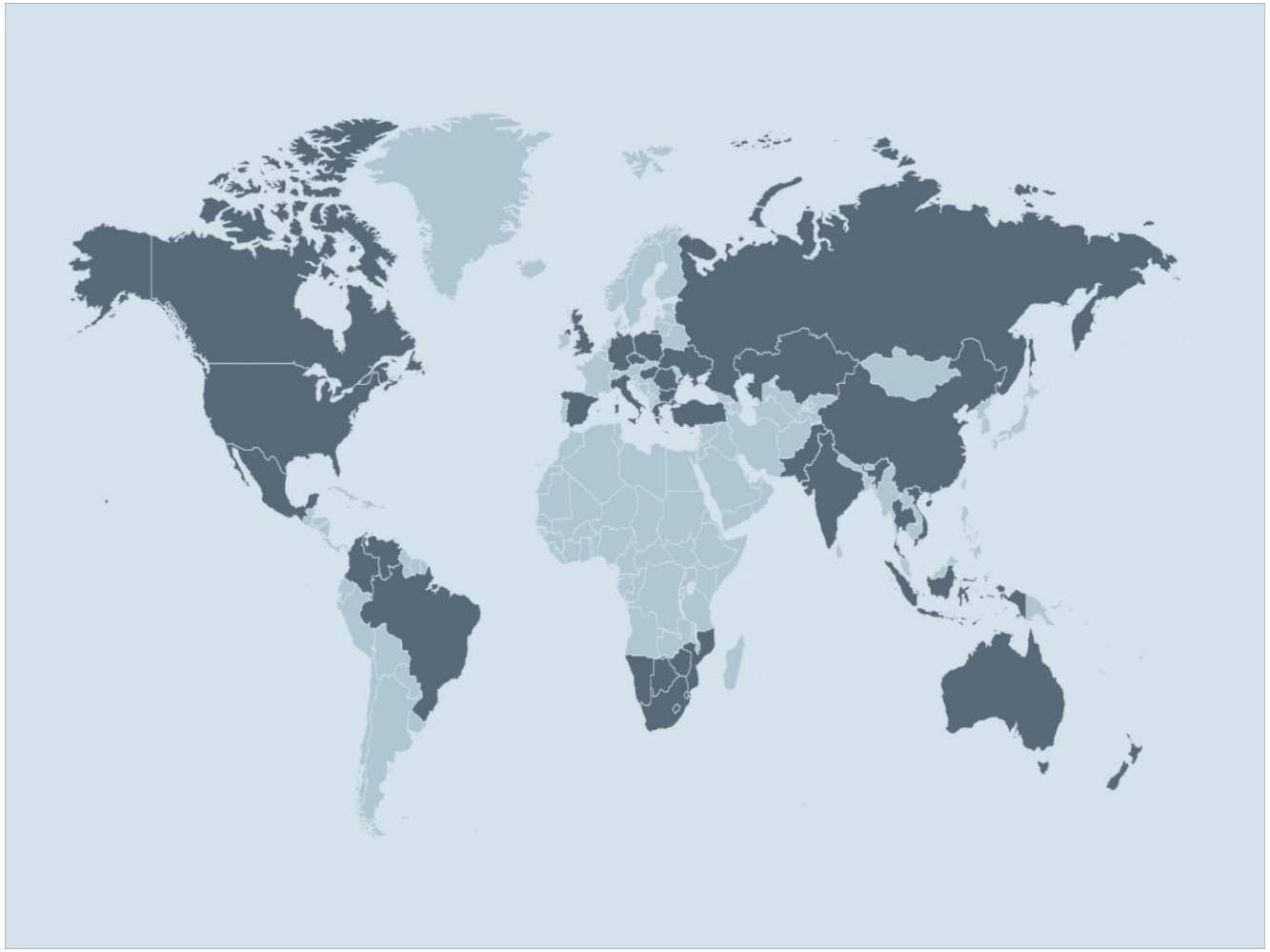
Jupiter Oxygen's motivation to work in India

- India recently published its own CCUS Roadmap, which indicated CO_2 off-take options via EOR & ECBM that could be substantial.

- India has potentially large sources of 'man-made' CO_2 available in close proximity to sites, where CO_2 can be used at scale

- Government of India has reached out nationally and internationally to gain CCU & CCUS technology expertise to reuse CO_2 , including for advancing domestic oil and gas production

Countries with ECBM Potential



India with substantial ECBM & CO_2 Utilization Potential

“Screening-Level Assessment of Enhanced Coalbed Methane Opportunities in India” (ARI 2015)

2.0 to 2.6 Tcm resources of methane in place in India

→ 25% recoverable via CBM and additional 20% via ECBM

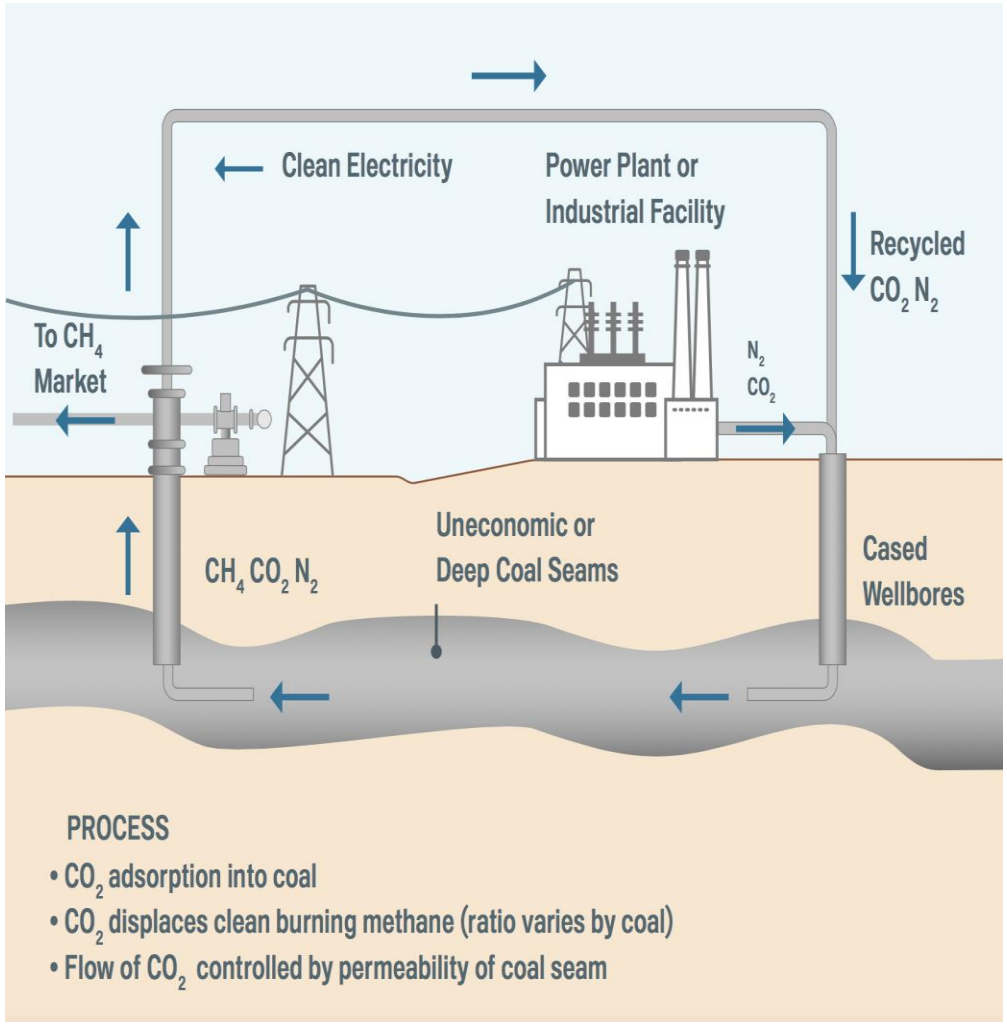
Basins that currently producing CBM or have CBM planned, hold 275 Bcm of methane resources in place

→ Multi-billion dollar domestic Natural Gas resource

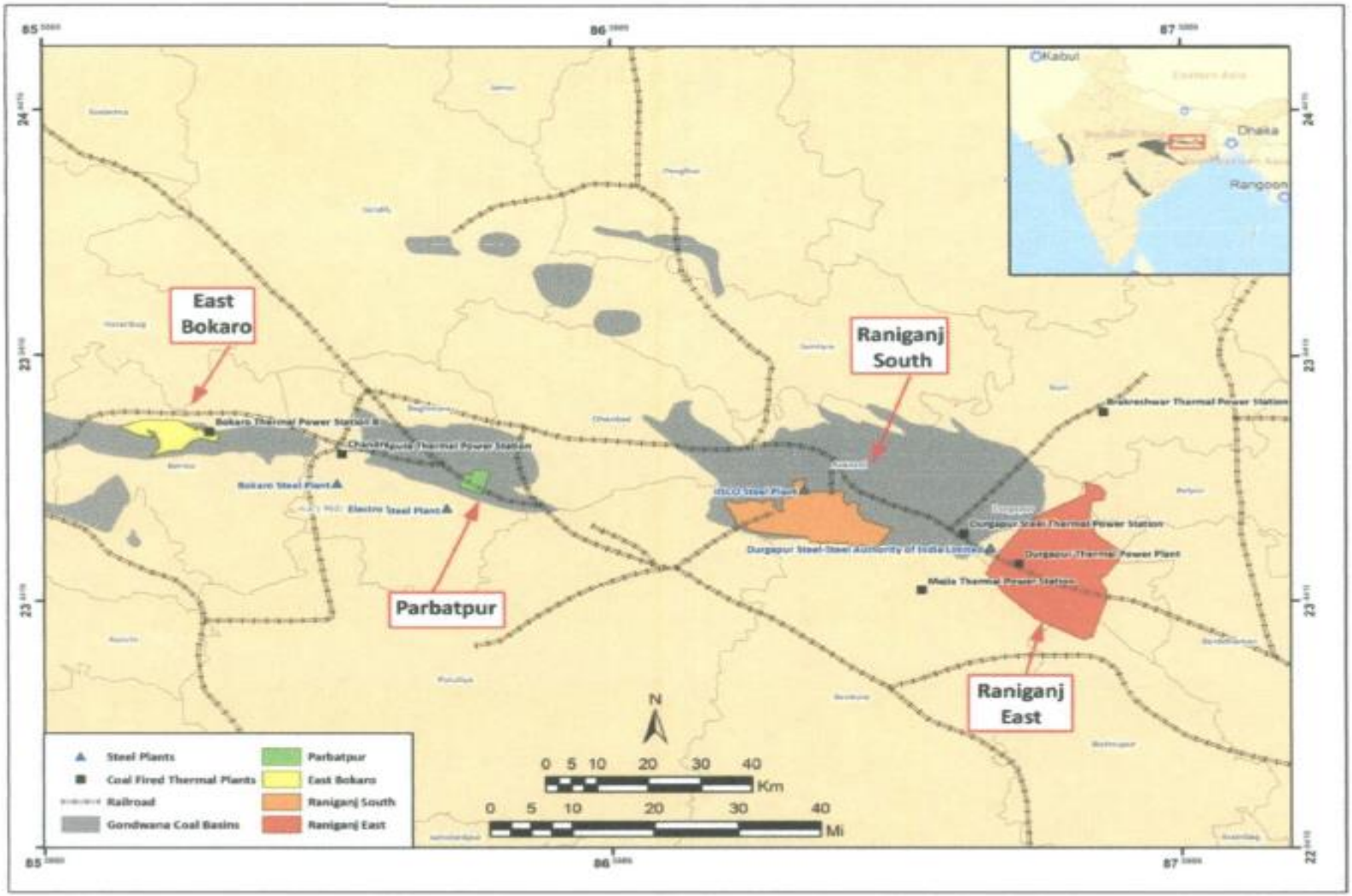
→ Storage Potential: Approx. 824 million tons of CO_2

→ Will require ~10,000 MWe ‘clean coal’ to produce required CO_2

What is Enhanced Coalbed Methane (ECBM)?



Damodar Valley CBM Fields and Industrial Infrastructure (ARI 2015)



NEXT STEPS FOR WEST BENGAL

GETTING THE UTILITY, OIL, GAS & COAL INDUSTRY INVOLVED

► West Bengal has significant CO_2 ECBM utilization potential

► Many CO_2 sources (utility size- / industrial boilers) are in proximity to potential CO_2 ECBM sites

► The oil and gas industry is well prepared to provide the necessary infrastructure for CO_2 ECBM operation & can play a leading role

► Secure funding from Multilateral Development Banks for Feasibility Study

► Identify ideal site for commercial scale CCUS demonstration plant

Business Opportunity for India
Carbon Capture, CO_2 Utilization & Storage

Country Opportunity – Enhanced Coal Bed Methane (ECBM)

→ Increase indigenous gas supply through ECBM

→ Addresses environmental concerns

Create 10 GW Clean Coal Power initially, potentially 100 GW serving CO_2 Utilization Market in conjunction with ECBM, and prevent billions of tons of CO_2 to enter the atmosphere!

Business Opportunity for India
Carbon Capture & CO_2 Utilization

Diversified power companies - supplying more than power

→ MW with improved efficiency

→ Water recovery for plant use

→ CO_2 for delivery to ECBM fields

→ Near zero emissions

TIFAC REPORT RECOMMENDATIONS [MAY 2018]

Chapter 19.2: 'CO_2 to ECBM'

"Utilization of captured CO_2 to increase production of declining ECBM reservoirs by approximately 30 – 50% is a dual-benefit model of the CCUS strategy. IIT Bombay has conducted pioneering research over the past decade on technical feasibility of ECBMR and found the following prospective basins to initiate CO_2 – ECBMR activities…:

→ Raniganj CBM blocks West Bengal

→ Bokaro CBM blocks, Jharkhand

→ Sohagpur CBM blocks, Madhya Pradesh"

TIFAC REPORT RECOMMENDATIONS [MAY 2018]

Chapter 19.2: 'CO_2 to ECBM'

"It is important to identify nearby large point sources from thermal power plants for CO_2 capture and supply. Technologies providing CO_2 and N_2 may be preferred to successfully implement these projects. The committee recommends that CBM operators in these coalfields in collaboration with power producers should take forward the feasibility study in this field with technical assistance from IIT Bombay"

CCUS – ECBM demonstration progress in India to date

- West Bengal government sent a CCUS – ECBM Green Energy project proposal report (PPR) to Department of Economic Affairs (GOI) in February 2017, referring to potential support from CCS Trust Fund, administered by Asian Development Bank

- Goal was to conduct techno-economic feasibility study for retrofit of boiler units at either WBPDCL's Bandel Power Station or DPL units near Durgapur with oxy-combustion based carbon capture technology and ECBM recovery at CBM fields at Raniganj area

- The same has been examined by Ministry of Power , Ministry of Coal, Ministry of Environment and Forest and Climate Change, NITI Aayog.

CCUS – ECBM demonstration progress in India to date

- During screening committee meeting held at Department of Economic Affairs during October 2017, it was felt that NITI Aayog to examine carbon capture technology road map in India first.

- Subsequently, during the meeting of NITI Aayog (Nov 2017), it was known that TIFAC (Under Ministry of Science and Technology) is already engaged in making a road map for carbon capture and storage, utilization in India.

- The CCUS Roadmap for India is publically available since July 2018.

- Anticipating a re-examination by NITI Aayog for PPR submitted by West Bengal government in line with TIFAC recommendation.

More Information at WWW.JUPITEROXYGEN.COM

U.S. based clean energy technology company offers:

→ High flame temperature oxy-combustion process Know-How

→ Patents and Licensing

→ Consulting Services

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