INNOVATION IN ENERGY: NEW ENGINE OF GROWTH FOR EMERGING ECONOMIES

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The UN estimates that global population will grow more than 20% in this century, mainly in Asia and Africa. These growing populations will increase global demand for food, water, and energy – especially electricity – with concurrent growth in coal consumption. At the same time, the recent Paris Agreement commits 195 governments to decarbonize national economies, and to work at their national level to limit future warming to 2°C or less.

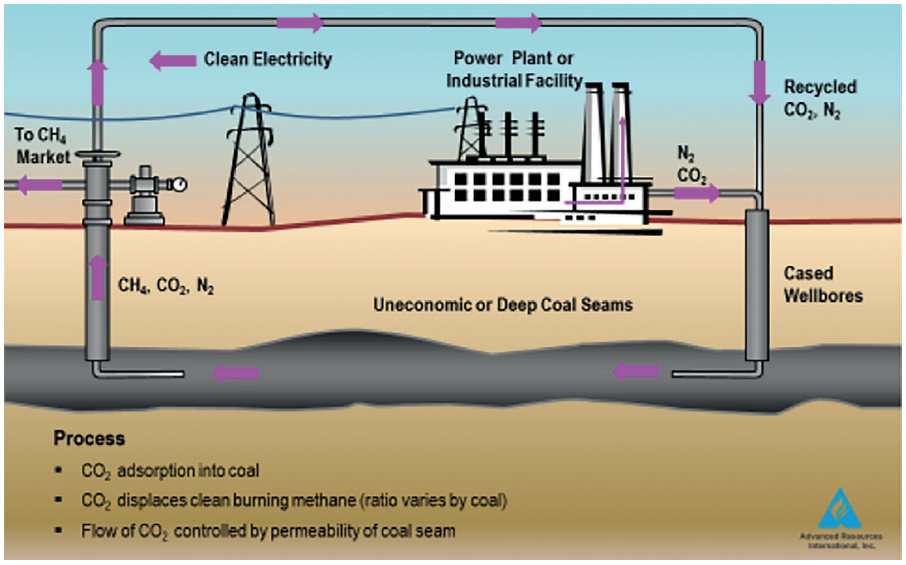
China is a key indicator of what can be achieved with the Paris Agreement, recognizing their continuing dependence on coal on the one hand, and the inclusion of clean coal technologies in their climate plan on the other. China announced that it will ratify the Agreement in 2016 in order to accelerate the Agreement's entry into force.

Full ratification of the Paris Agreement is only the beginning of the process: tangible action on high-impact carbon mitigation strategies must follow worldwide.

Innovative energy technologies, including technologies for carbon capture, utilization, and storage (CCUS), will be essential to achieving the targets of the Paris Agreement. By moving now to promote commercial-scale demonstrations of innovative CCUS technologies, the G20 can play a critical role in accelerating investment in sustainable infrastructure, and growing the global economy.

Coal Drives Growth

According to the INDC Scenario of the International Energy Agency's Special Report on Energy and Climate Change[1], economic growth continues to be fueled by fossil energy, especially coal. Global



How does Enhanced Coal-Bed Methane Recovery work?

coal consumption reaches a plateau around 2020, with usage declining in the OECD but increasing in developing countries. India, China, and Indonesia account for most of this growth in coal use, with associated increases in local air pollution and consumptive water use for energy production.

The IEA's INDC Scenario envisions the world on a path to a long-term warming of 2.6ºC. Using this scenario, the IPCC[2] estimate of the amount of fossil fuel that can be burned and still limit future global warming to 2ºC is fully exhausted by 2040. Additional combustion of high-carbon fossil fuels will lead the world further down the path toward dangerous interference in the global climate system.

How Innovative CCUS Technology can Help Meet the Challenge

Cleaner fossil energy technologies can help facilitate the development of intermittent renewable energy technologies and minimize the negative environmental impacts of conventional fossil energy supply and use. One CCUS strategy, in particular, seems likely to create near-term, win-win opportunities that are highly relevant for developing countries.

Key for Sustainable Development:
Innovative Clean Energy Technology Solutions

The application of oxy-combustion (i.e., the burning of fossil fuels in a boiler with nearly pure oxygen) in existing and new power plants enables cost-effective capture of highly concentrated CO_2.

Co-benefits from applying oxy-combustion carbon-capture technologies include air pollutant control and making CO_2 available as a useful and marketable product. These ancillary benefits help offset the cost of cleaning up coal-fired power plants.

Using the CO2 for ECBM

Local Oil & Gas Companies or other entities are potential buyers and off-takers for CO_2 for use in energy production. The captured CO_2 from coal fired power plants in conjunction with nitrogen (available from an air separation unit as part of the oxy-combustion technology), can be injected into deep, unmineable coal seams to release trapped methane. In this application, the process is referred to as Enhanced Coal-Bed Methane (ECBM) recovery. This domestically produced cleaner methane substitutes for coal in electricity production or for expensive natural gas imports in developing countries. There have been promising ECBM pilot projects in the U.S., Canada and China.

The cost of ECBM recovery is sensitive to both the geology of the local coal seam and the distance between the unmineable coal seam and the CO_2 "source" facility.

The volumes of clean-burning domestic natural gas that can be produced from unmineable coal seams can be significant.

For example, Advanced Resources International estimates that 70 to 90 trillion cubic feet (TCF) of coal-bed methane are present in India[4]. Of this resource, only 20 TCF are recoverable with conventional methods. An additional 15 to 18 TCF are potentially recoverable with ECBM, which would also store billions of tons of CO_2 safely and securely underground. Natural gas, including methane, will be an important bridge fuel for decades.

Financing the Transition to a Green Economy

As G20 leaders work on their pledge to end fossil fuel subsidies, new opportunities emerge for financing the transition to a Clean Energy Future. Multilateral investment funds, including the Green Climate Fund, the Clean Technology Fund, and the Trust Funds of multilateral development banks should finance the commercialization of CCUS technology with ECBM. In so doing, these institutions will be instrumental in financing the transition to a Green Economy. Under Article 4 of the UNFCCC[3], industrialized countries are committed to underwrite the incremental costs for CCUS and other low-carbon technologies in emerging economies. Financing the development of carbon capture, utilization, and storage with enhanced coal-bed methane production provides win-win options for emerging economies, fuels economic growth, and strengthens energy security.

Jupiter Oxygen Corporation (JOC) has commenced an initial commercial ECBM project in western China, which will include retrofitting coal fired power plants with JOC's high flame temperature oxy-combustion and CO_2 capture technologies. This will be the first commercial full scale ECBM project in the world. The recovered methane will provide cleaner energy for China.

Implementing these technologies at scale will facilitate achieving the INDCs, support national efforts to protect local environments, and contribute to the stability of our shared global atmosphere. ■

REFRENCES
1. IEA: World Energy Outlook 2015: INDC Scenario that takes into account all Intended Nationally Determined Contribution (INDC) pledges
2. IPCC: Intergovernmental Panel on Climate Change
3. UNFCCC: United Nations Framework Convention on Climate Change
4. Advanced Resources International, 2015. "Screening-Level Assessment of CO2-Enhanced Oil Recovery and Enhanced Coal-Bed Methane Recovery Opportunities in India,"