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Implications of Sustainability by the Production of Low Carbon Renewable Natural Gas from Geologic Formations

*Zaixing Huang**

Department of Chemical & Petroleum Engineering, University of Wyoming, Laramie, WY 82071, USA

Short Communication

Sustainability is a broad and yet important topic for the well-being of human race and the delicate ecosystems of our planet. Sustainability is a concept that requires interdisciplinary inputs and practiced through every layer of the complicated stratigraphic structure of human society, psychologically and materialized. It has many facets including geography, environmental policies, ethics, ecology, landscape architecture, city and regional planning, economics, natural resources, sociology, anthropology and so forth. World population has grown at an unprecedented rate and is projected to grow even faster over the next couple of decades. It is challenging to meet the needs of the present generation and will not compromise the well-being of future generations. Environmental protection, social responsibility, and economic development are the three core areas for sustainable development. The promise of science and development of new technologies for renewable energy, reducing greenhouse gases emission, protecting environments will make sustainable development realistic. Low carbon renewable natural gas (LCRNG) is a concept newly coined by the author's research group [1] that involves the natural carbon cycle through photosynthesis and production of methane by microorganisms (Figure 1).

Isotopic studies have shown that much of the coalbed natural gas (CBNG) in the world is secondary biogenic in origin and generated by indigenous microorganisms after coalification processes. This has encouraged the research in the field as a potential for gas regeneration through enhanced microbial activities is foreseen. Nonetheless, the generation of biogas through biostimulation (the addition of nutrients to stimulate the native microbial populations) or bioaugmentation (the addition of both nutrients and non-native microbial consortia of microorganisms)is limited to the bioavailability of coal carbons. The biogenic natural gas produced by these approaches are still considered carbon positive. Using plant-derived carbohydrates as alternative substrates for the gas generation by the indigenous coal seam microorganisms is a promising approach to produce renewable natural gas. Coal seams can be envisioned as geobioreactors and engineered for the

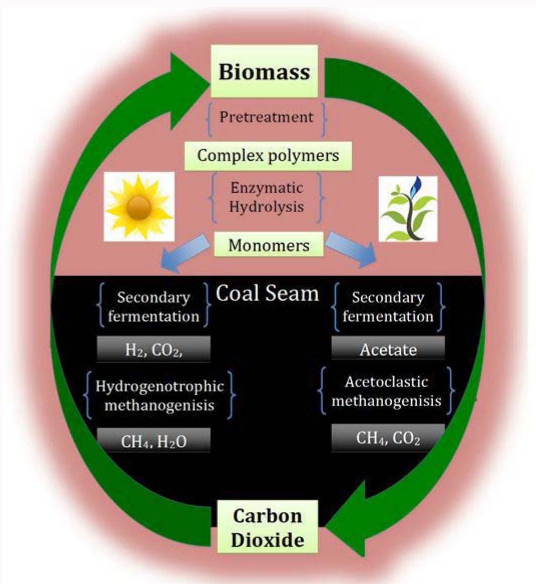

Figure 1: Schematic depicting the concept of low carbon renewable natural gas produced using coal beds as geobioreactors and as sinks for carbon capture and storage.

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Correspondence:
Zaixing Huang, Department of Chemical & Petroleum Engineering, University of Wyoming, Laramie, WY 82071, USA.
E-mail: *zhuang@uwyo.edu*

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enhanced production of biogenic natural gas. The process is similar to the *in situ* biodegradation approach where an alternative carbon source(s) and/or nutrients are added to enhance the degradation and transformation of contaminants of concern (COCs). In this case, an alternative substrate such as simple carbohydrate compounds derived from locally grown perennial forage crops, such as alfalfa, switchgrass, sugar beet, or miscanthus is used to produce large quantities of LCRNG.The benefits of using coal seams as geobioreactors include the use of existing CBNG infrastructure (wells, pipelines, compressors, etc.) which could substantially reduce the cost of producing the gas while achieving a massive scale that is infeasible for the conventional anaerobic digester. The natural gas produced by this approach can be considered carbon neutral or even carbon negative, because carbon not directly converted to methane (i.e., microbial biomass and carbon dioxide) may be sequestered within the coal by adsorption. That is carbon dioxide in the atmosphere is fixed in the plants through photosynthesis. The plant biomass such as sugar beet is processed to produce simple carbohydrates that are readily soluble to be injected into the coal seams. These carbohydrates are subsequently bio-converted to natural gas and stored in the coal seams as coal has a very large surface area and a strong affinity to adsorb gases including methane and carbon dioxide. Since much of the injected carbon remains in the form of microbial biomass and carbon dioxide, the carbon intensity of the LCRNG is further lowered as a result of carbon capture and storage.

In conclusion, production of LCRNG not only could potentially supply unlimited sources of renewable natural gas from added carbon sources within geological formations, but also has implied the reduction of carbon footprint to mitigate the global warming.

References

1. Huang, Zaixing, et al. "Low carbon renewable natural gas production from coal beds and implications for carbon capture and storage." *Nature Communications.* 2017; 8: 568.