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Extracting Energy from Petroleum Reservoirs at Large Scale without CO_2 Emissions –Is it possible? Is The Attempt Desirable?

Steve Larter, Marc Strous, and Steven Bryant
The University of Calgary, Calgary, Canada.

One of our greatest challenges is the rapid transition to a carbon-neutral energy future. Alberta, with vast petroleum resources and a key role in Canada's current economy, embodies this global challenge of balancing environmental, economic and energy security goals – the "energy trilemma." The proposition that limiting future global warming requires holding atmospheric CO_2 concentrations below a target value leads inexorably to the conclusion that the carbon in most of the world's fossil fuels, has to remain underground. Most fossil fuel resources would be stranded, as so would the economic wealth associated with those resources – unless resource development can be accomplished by maintaining a fossil fuel industry with a reduced and eventually eliminated environmental footprint. If achievable, there are potential political and economic benefits evident, that could greatly accelerate broader, desirable energy system changes.

In this alternate paradigm, petroleum reservoirs might play a transitional role as storehouses of chemical energy, but instead of utilizing that energy by surface combustion, an alternative is to convert it into other forms of chemical or electrical energy. By carrying out this conversion in situ, CO_2 can be left in the reservoir. By choosing energy forms such as hydrogen, hydrogen rich fuels or electricity, that emit no CO_2 when used to power our machines and devices, we can in principle, continue to derive value from fossil fuel resources and provide economic drivers for a complete and rapid transformation of our energy supply systems and economies. We examine the technical and political aspects of this route emphasizing the need for safeguards against emergent issues that might slow a rapid transition towards dominant renewable energy sources in the medium and long terms.

Technologies such as conventional carbon capture and storage can only have a small effect on oil related emissions, as downstream emissions dominate. So, dramatic technological change is needed, yet few alternatives have been proposed. To resolve this crisis, a focused, multi-sector collaborative approach is needed that both provides a transitional technical fix and a basis for a transition to stable diverse renewables powered economies. The experience of other successful focused mega projects, often called "moonshots" in homage to the Apollo program, suggests several ingredients are essential.

• Leadership: A long term ambition and vision with sustained political and institutional leadership, focused at a single achievable goal with an aggressive timeline of achievement.
• Partnership: A coherent, organised and sustained interaction between industry, academic and government R&D communities.
• Science and technology: A strong foundation in key areas of science, engineering and social science from which the necessary development can be built.
• Funding: Sustained investment in research and development over extended periods of time (5-10 years) with funding at an appropriate scale to succeed within the given timeline

We examine Zero Emission Energy Recovery And Use(ZEERAU), from oil reservoirs, for technical and societal viability in the context of such a moonshot project.