Petroleum and Coal

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Petroleum and Coal: Are they not renewable and sustainable?

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Abstract

The role of petroleum and coal as fossil fuels is seen as a curse and it is blamed to be sole cause for the enhancement in extreme rainfall events and extreme temperature conditions. Also, there is no clear evidence on the enhancement in CO_2 levels with that of fossil fuel usage. In this article, it is highlighted that both petroleum and coal are natural renewable resources similar to solar energy and wind power. The only difference is that it takes a geological time period for its replenishment. However, the cycle continues and the fossil fuels get replenished at various other locations as per the encountering of favorable pressure and temperature. It can be clearly noted that there is no cessation of oil and gas resources as on date, but, there is a serious cessation of oil and gas exploration and production activities due to the introduction of carbon tax. Even if we assume fossil fuel to be the only reason, still, the world does not seem to stop using fossil fuels as the CO_2 levels keep increasing, while most of the mainstream experts keep continuing using their crude-oil or natural-gas powered four-wheelers. This article highlights some of the critical issues associated with petroleum and coal as natural renewable energy sources. This study critically suggests that petroleum and coal along with other natural renewable energy sources (including solar energy and wind power) can make wonders towards growing global energy demand by making sustainable contribution.

Keywords: *Petroleum; Coal; Fossil fuel; Renewable energy; CO_2 level; Solar energy; Wind power.*

1. Introduction

Energy remains to be the bottleneck for a sustainable global economy. Energy remains to be the basis for the present society, however, unlike water resources, oil and gas resources cannot be recycled within a human cycle; and it takes not only geological time levels but also the location of the replenishment remains to be completely different. On the other hand, the challenge of sustainable energy is intensified by the continuous growth in world energy demand due to increased population and enhanced life style. Meeting energy demands by ignoring fossil fuels seems to be a tedious task. In this context, world would require sustainable fossil fuel. So far, only the extraction of easy oil is nearing an end, while, we still have a lot of resources of fossil fuel which require advanced technology to get it exploited and produced. Thus, there is no oil or gas depletion with reference to human cycle. However, environmental concerns relating the use of fossil fuels with the enhancement in CO_2 levels deserve a special attention.

A sustainable hydrocarbon resource can be defined as a flux of oil and/or gas that is managed with the objective of maintaining the availability and quantity of oil and gas in the absence of influencing any significant change in environment (such as the so called climate-change). In fact, a sustainable oil and gas resource is a flux of hydrocarbons that reflects the natural rate of replenishment of the oil and gas resources through the earth's carbon cycle. A sustainable oil and gas resource does not represent the stored volume (original oil in place or original gas in place) of oil and gas underground. The point is the value of any petroleum reservoir as an oil or gas resource does not remain to be directly proportional to the rate of recharge to the reservoir within the human cycle. Here, the carbon cycle of the petroleum reservoir as an oil or gas reservoir is indeed more relevant than the geologic or geophysical

concept of the reservoir as an oil or gas holding formation. Similarly, the addition of new oil and gas reservoir fields is the important variable to consider in evaluating the corresponding sustainable oil and gas resources. Further, sustainability of oil and gas resources is largely a function of how we manage it. On the other hand, we cannot come to an immediate conclusion that oil and gas resources are no more sustainable just because the oil and/or gas stored in any petroleum reservoir does not correspond to the rate of replenishment of oil and/or gas resources; and it can be noted that as the natural processing time increases, the energy content of the natural fuels would also increase as evident from wood (18 MJ/kg) to natural-gas (52 MJ/kg). This is because the rate of replenishment takes a larger time period, while, the location of replenishment also need not remain to be the same; and thereby, ensuring that there is no actual boundary between renewable and the so called non-renewable energy sources. And, this is what is happening with oil and gas resources over a geological time scale and there is no question of cessation of oil and gas resources in earth's crust as on date. In addition, there is no direct relationship between sustainability of oil and gas resources and the climate. The so called climate change is not going to change the global distribution of oil and gas resources within human cycle.

For more than a century now, we keep hearing about the concept that the globe would run out of fossil fuel, every now and then. It earlier happened with coal, and now, US EIA has predicted that coal reserve would last another 3 centuries at least. For petroleum, US Bureau of Mines in 1914 predicted that the world will run of oil in a decade. Till date, we have not run out of oil. It is just that we are running out of 'easy oil' (that could be extracted with ease) and we are running out of ideas as the extraction of residual oil from matured oil reservoirs, and exploitation of petroleum reservoirs in harsh environments has become a real technological challenge. And, in fact, none of the natural resources including oil and gas are limited. When human species deal only with natural products (carbon, natural water and natural air) in the absence of adding any artificial chemicals, then, there would be no need for any sustainability, because, any recycling of toxic chemical products would still remain to be more toxic to the environment, more costlier, while, its functioning would remain to be less efficient (Islam, 2020). Natural resources are no more limited and there is no need to contain the population growth by artificially brining in the concept of sustainability. The only catch is we cannot prove all the facts on a relatively smaller human time-scale, while, a relatively larger time-scale would be able to provide the required answers. It can be noted that all the global warming and its associated extreme rainfall events pertains to the data of the last two to three decades as there were no required measurements at all before that. Even the measurements claiming the extreme temperatures, more frequently, have not met the actual scientific requirements; and the fact is any environmentally sustainable project apparently looks not feasible in the absence of public funding.

Fossil fuels remained sustainable up to the era of industrial evolution. The hydrocarbons (oil) remained extremely beneficial all across the ancient globe and everyone across the world used oil for a number of purposes (including medicinal applications in the form of anti-bacterial; anti-inflammatory; anti-fungal; anti-pruritic; anti-septic; & anti-fungal). The only difference being, today, crude oil is mixed with enormous amount of toxic chemicals (petroleum resources undergoing refining) as a result of which, it has really become environmentally unhealthy. Even then, those, so called climate-change experts, who talk about the immediate cessation of fossil fuels keep using their four wheelers and two wheelers, which keeps running using the very same crude-oil and natural gas (what they preach to the society; and what they practice personally do not seem to match). Thus, enhanced exploration and drilling activities would simply disprove that fossil fuel reserves will not be declining with time. In this context, this article has tried to discuss some of the critical issues related with fossil fuel as a natural renewable energy source towards meeting growing global energy demand.

2. Discussion

1. If the current practice of petroleum engineering is no more sustainable, then, do we (or, at least, the mainstream scientists) precisely know the very source of its unsustainability? Whether crude-oil (which is known to have been used since the ancient era) and natural-gas are no more natural just because these energy sources cannot be naturally replenished on a human time-scale? Then, what exactly constitutes 'natural'?
2. Whether the role of petroleum products in shaping human energy needs could become insignificant in the near future? Are petroleum resources not infinite? Are the petroleum resources not part of the continuous cycle? Are the fossil fuel sources not 'solar energy stored by the trees in the form of carbon' (which then gets evolved as crude-oil, natural-gas and coal under favorable subsurface pressure and temperature)? Is there any scientific evidence that claims the cessation of fossil fuel formation? If so, then, why does fossil fuel come under non-renewable energy source?
3. Won't the discovery of natural gas reserves increase, when we keep increasing the exploration and drilling activities? With the current exploration focusing mainly only on shallow gas, are there not huge reservoirs such as deep gas, tight gas, Devonian shale gas and gas hydrates, which still remains to be exploited?
4. Following Paris agreement, whether hydrocarbons (the world's most diverse, efficient and abundant energy source) can be gotten rid-off from playing major roles in sustaining current civilization?
5. Is there a strong scientific basis that relates global warming with the enhancement in CO_2 levels, resulting from fossil fuels?
6. What happened to the prediction that England would run out of coal by 1900; and England's factories would toil to a halt – by Stanley Jovens in 1865? It's over 150 years now, following the prediction by Jovens. US has the recoverable coal reserves that would last at least for another three centuries. So, what do we mean by the predictions by experts?
7. What happened to the prediction by US Bureau of Mines in 1914, which predicted that the world would run out of oil in 10 years? So, what do we mean by the predictions from Government sectors?
8. When conventional characterization approach does not even represent precisely, even the conventional reservoirs, how could the conventional characterization approach be applied to unconventional reservoirs?
9. While all natural processes remain renewable (which is evident from the fact that the energy content per unit mass of the fuels keep increasing as the natural processing time increases), can we delineate a boundary between the renewable and non-renewable sources in the long run?
10. The natural fossil fuels get contaminated and toxic upon oil refining and gas processing. Why don't we get rid-off such toxic catalysts and chemicals; and why don't we make use of crude-oil and natural-gas directly, which remains to be completely recyclable and which would remain to be an excellent supplement in the global energy scenario?
11. When there is no productive hydrocarbon reservoir that remains to be homogeneous and isotropic, then, how do we have recovery schemes that is based on the fundamental premise that the formation remains to be homogeneous and isotropic?
12. How can we deduce an average property over a Representative Elementary Volume (REV), in the absence of deducing a proper REV, in a fractured reservoir, where the reservoir heterogeneity remains to be scale-dependent? Do we have a proper understanding of in-situ stress orientation, with reference to the distribution of global stress field? Whether fractures with no local symmetry and only a vague global symmetry would remain to be sufficient to characterize a fractured reservoir? How can we simply assume that all the assumed fractures remain intersecting at proper fracture intersections; and thereby, maintaining a smooth continuity of fluid flow? How could we assume the continuity of fluid flow at the fracture-matrix interface (by simply assuming a constant shape factor)? Feasible to collect data in proper time sequence; and at each step, verified from multiple sources?

13. How efficiently can we correlate static-data (well logs, cores, petro-physics, geology and seismic) with dynamic-data (formation evaluation well tests, long-term pressure transient tests and tracer tests) towards reservoir description in complex reservoirs?
14. How could we simply apply a parabolic dominant diffusivity equation (by ignoring the hyperbolic PDE term from the original flow equation) to describe the multi-phase fluid flow in a petroleum reservoir, where, the main mechanism of fluid flow remains to be through 'chaotic' motions that remain to be dictated by local anisotropy?
15. Does Darcy's law adequately describe the hydrodynamics of multi-phase fluid flow through a petroleum reservoir?
16. To what extent, the concept of material balance (where, reservoir rock and fluid properties do not change spatially) would remain to be useful in characterizing complex reservoirs?
17. Is it that only carbonate reservoirs remain to be challenging towards reservoir characterization? How about sandstone reservoirs developing complexity at various stages of settling, segregation, cementation and secondary cementation? When the depositional process remains to be complex, how could we have, a simplified reservoir description, even for a sandstone reservoir?
18. Water being the source, whether, carbon is not the most critical and sensitive ingredient for sustaining life on earth, with sun light as the primary energy source?
19. If oil and gas resources are finite, then, how could the boundary of the recoverable oil reserves will keep on increasing with time; and also, what exactly, we mean by the enhancement in oil and gas resources as the exploration activities keep increasing in harsh environments with advanced technology?

3. Conclusions

This article has highlighted some of the critical issues in the form of fundamental queries related with fossil fuel as a natural renewable energy source towards meeting growing global energy demand. The following conclusions have been drawn from the present study.

1. Fossil fuels (coal, crude-oil and natural gas) also fall under renewable energy sources with rate of replenishment not falling under human cycle.
2. Fossil fuel may not be the sole reason behind the enhancement in CO_2 levels; and the measurement methods of extreme temperatures require scientific transparency.
3. Despite blaming fossil fuels to be sole cause for global warming and climate change, the mainstream scientists themselves do not seem to ignore their four wheelers, which essentially run by crude-oil or natural gas.
4. Along with all other budding natural resources (including solar and wind), the oldest natural resource 'fossil fuel' will continue contributing to the growing global energy demand.

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