A New Approach for Evaluating Energy Choices

To minimize controversy in evaluating the wide range of energy options, Mcilvaine Company has developed a common metric to measure the harm and good of each option. The metric, called Quality Enhanced Life Days, is based on life quality of affected individuals. This common metric approach not only provides the basis for sound decision-making, but encourages discourse and debate rather than confrontation.

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I. Introduction

The world's energy use will keep on growing. Over the next 40 years energy consumption will double. The growth will come from the 1.6 billion people who do not have any access to electricity, the 2.4 billion who have almost no access to electricity and still burn wood and manure as their main source of energy, and the 3 billion people who will be born during the next four decades.

At 3,000 kWh per person per year, 10 billion people living in 2050 will need over 30 trillion kWh per year to lead a decent life. They will need energy in different forms, which can be supplied by some but not all energy sources. Oil can be easily transported and processed for use in vehicles, power plants, and home heating. Other energy sources are difficult to apply to all needs. As a result, oil sets the price for energy alternatives. Coal and gas can be converted to liquid fuels, but at a cost. Solar and wind can be converted to electricity which can provide energy for

 1040-6190/ http://dx.doi.org/10.1016/j.tej.2014.11.003

batteries which can be used in vehicles. However, the conversion costs have to be taken into consideration.

Perceptions relative to the availability, cost, safety, environmental impact, and security of energy sources drive policies and investments. These policies and investments then create new realities. For example, Ukraine perceives an energy security problem with gas delivered from Russia and embarks on two large coal-to-gas plants, which then substantially change the market. Australia perceives that a carbon tax is punitive and that climate change is a low priority and launches a number of coal conversion programs.

Gas-to-liquids plants can cost up to $15 billion. Coal-to-liquids plants cost even more. Investments in these plants are highly dependent on the perceived demand for the next 20 years. Demand for one particular energy form is a function of the attractiveness of alternatives such as wind, solar, electrical energy storage, tar sands, coal bed methane, underground coal gasification, shale gas, shale oil, oil shale, small modular nuclear, small-scale liquefied natural gas (LNG), advanced coal-fired plants, and other technologies.

The biggest variable in the mix among these alternatives is coal conversion. The proven coal reserves (defined as presently known and economically minable) is 860 billion tons (Fossil and Nuclear World). This quantity would supply the world, at present consumption levels, for another 100 years. But coal has a much bigger potential than just this identified resource. Consider that there are 1 trillion tons of coal under the North Sea. Billions of dollars are being invested in underground gasification technology to inject steam and oxygen and extract gas. CO_2 generated in the process would be used to increase the yield of shrinking North Sea oil reservoirs.

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China is well underway with a program to convert coal to gas, fuels, and chemicals at rates equal to the entire U.S. shale gas program. If the projects in the planning stage are implemented, China will utilize 20 percent of the world's annual coal consumption just to make gas and liquid products.

The ultimate mix of all these energy sources will be determined by perception and competition. In a chess game, the winner does a better job of perceiving the moves of the loser. Among the losers to date are owners of LNG regasification terminals in the U.S.: they did not perceive the moves of shale gas extraction companies. However, if owners convert these terminals to export LNG and build others to do so, then power plants that are relying on large quantities of cheap gas will be the losers. So both the quality of the competition and the perception of the opponent are factors in success. Some of the important inputs include:

- World use of coal for power generation is slated to grow at over 2 percent per year. When one adds the conversion of coal to liquids and gases, consumption will increase by more than 3 percent per year through 2030, with a much bigger surge in the next five years (Fossil and Nuclear World).
- Coal-fired power plants that use oxygen instead of air and sequester the CO_2 for enhanced oil recovery have no air emissions. There is no stack. In addition, valuable byproducts include rare earths, alumina, sulfur, gypsum, and ammonium sulfate. The value of the CO_2 is great enough to make carbon capture profitable only in areas where there is an enhanced oil recovery need.
- There is more demand for CO_2 to enhance oil recovery than could be supplied by all the world's coal-fired power plants. The problem is that the demand is not where coal is being combusted.

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