Third Quarter 2022

The Next Big Thing – Energy Innovation?

Eliminating fossil fuels faces a number of hurdles including the fact that there is insufficient energy to replace the role of oil and natural gas in today's economy. As a fuel, petroleum has advantages clean energy alternatives can't match. It is easily refined, transported, and stored, used only when needed, and available 24/7. Negatives include pollution, the release of greenhouse gases and the impact on climate change, which have fueled calls of its demise.


Spindletop gusher 1901. Original photo by John Trost.

Perhaps equally important for the long term is that important non-fuel uses of oil and natural gas are so numerous that burning it up doesn't make sense in a world of increasing scarcity. Worldwide, the easy finds are gone. In January 1901, when the Lucas well at Spindletop, Texas, struck oil, the gusher blew for nine days at a rate estimated at 100,000 barrels (16,000 m3) of oil per day. Today, companies squeeze oil out of the rock of shale fields. Every technological advance to produce oil and gas from more difficult formations comes with increasing costs.

While solar and wind energy are proclaimed as clean energy, both have considerable environmental costs including production of materials used in panels and turbines, extensive land use, loss of wildlife habit and bird kills, and the failure to provide 24-hour energy reliability. Batteries capable of storing excess solar and wind energy are still under development and considerable environmental costs are incurred to mine and process minerals required for their construction. Efforts are underway to make these energy forms more efficient, including using blockchain technology to expedite distribution.

Hydroelectric energy, produced primarily through the release of water stored in large dams, is an ideal clean energy except it once again requires extensive land use, loses its capacity to produce energy when severe droughts decrease water storage, and new dams are fiercely resisted by environmentalists.

The search for clean energy alternatives that overcome the disadvantage of current technologies may well be the next big thing in investing. Because without solving the energy problem, we can't continually add on demands to our energy grid for electronics, automation and so much more.

Some of the innovations underway

Nuclear energy's first use as a weapon of mass destruction has long tainted its acceptance as a source of safe energy. But advancements have been made in this area including small modular units that are attracting considerable interest.

Molten salt reactors could provide carbon-free electricity with fewer radiation risks than traditional nuclear. The concept is in the development stages.

Green hydrogen, produced from renewable sources rather than natural gas, is seen as a source of energy, as well as helping decarbonize industrial processes, gas heating and heavy transport.

Technologies developed in the oil and gas industry for drilling deeper and horizontally are expanding access to geothermal energy. Magma power uses heated steam produced by magma

deep within the earth to generate electricity.

The quest to make fusion power a reality through the use of lasers is getting closer.

Development of the first commercial-scale, grid-connected wave energy test site in the United States is underway and expected to be operational in 2023.

The solution to our current energy woes may be some or none of the above. There may a new innovation that someone, somewhere, is beginning to conceptualize. The real game changers are often ideas whose potential is overlooked or viewed as impractical. Our challenge is to keep our minds and options open to new opportunity.

Gasoline accounts for only 46% of oil consumption in the U.S. Heating oil, diesel and other fuels make up 26%, followed by airline fuel at 8%. The remaining 20% is used to make 1000s of products.

Petroleum uses:

Lubricants: Almost all industries use lubricants for the proper functioning of machinery. In addition, lubricants are used in cooking, bioapplications on humans, ultrasound, and medical examinations.

Pharmaceuticals: By-products like mineral oil and petrolatum are used in the manufacture of topical medicines. Complex organic molecules used in pharmaceuticals are linked to simple organic molecules of petroleum byproducts.

Agriculture: Ammonia, a source of nitrogen in agricultural fertilizers, is manufactured from petroleum using Haber's process. Many pesticides are produced from petroleum.

Chemical Industry: Chemical fertilizers, synthetic fibers, insecticides, synthetic rubber, nylon, plastics, pesticides, paints, etc. are produced using the major petroleum by-products like naphtha, grease, petroleum jelly, wax, butadiene etc. Distillates of petroleum that include toluene, benzene, xylene, amongst others are used to obtain raw materials that are further used in products like synthetic detergents, dyes, and fabrics. Benzene and toluene which gives polyurethane is often used in oils or surfactants, and used to varnish wood.

Domestic uses: Household products like detergents, Vaseline, wax, etc. are by-products derived from petroleum. Cosmetics that contain oils and perfumes are petroleum derivatives. Kerosene is used in many countries for cooking, lighting, and other domestic purposes.

Rubber: Petrochemicals are used in manufacturing synthetic rubber which is further used to make rubber soles on shoes, car tires and other rubber products.

Other uses: Naphtha is used to manufacture solvents for paints, cosmetics, commercial dry cleaning etc. Paper manufacture and foodstuffs use wax. Asphaltic bitumen is employed in the construction of roads and airfields and the manufacture of roofing felts, waterproof papers, pipeline coatings, and electrical insulation. Decomposing liquid hydrocarbon fractions make carbon black which is compounded with rubber in tire manufacture and used in printing inks and lacquers.

Natural gas uses:

Hydrogen gas (H_2) is one of the key ingredients to create fertilizer. Natural gas is primarily methane, which reacts with high-temperature steam to create large amounts of H_2. In addition to being used in ammonia, methanol, propane, and acetic acid, the hydrogen produced by natural gas can also be used to make fuel cells—yet another source of electric power.

Commercial applications: Natural gas plays an important role in the industrial production of materials such as steel, cement, glass, bricks, and paper. Many of the polymers in plastics for electronics, bottles, and clothes are made using natural gas.

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