Technology Update - Ocean Ethanol

“Someday, fuels will be produced from the ocean, which will allow for mid-ocean refueling of ships as well as CO2 farming to provide land-based transportation fuel...” (Greg Giese, 2003)

Core Technology Implementation

Global Energy and Ocean Ethanol LLC

With the advent of higher petroleum based fuel prices and the diminishing capacity of our refinery based system due to large oil company hedging and natural disasters such as hurricanes, an alternative to our traditional fuel production system needs to be found.

The concept I have developed not only addresses the current inherency of our fossil fuel system, but provides a real solution for the replacement of oil and its byproducts as they're integrated into our transportation system and industrial base. This article is written to give you a broad overview of our energy system, and the solution that I have developed.

What Doesn't Work

It's clear that when we reflect upon where we get our fossil fuel from and how it's produced that there is a problem. On a recent trip to Switzerland and admiring how their electric train transportation system worked, I realized that life without gasoline and diesel fumes was quite pleasurable. Switzerland is blessed with a great deal of clean hydro power, but what about the rest of us ? We rely upon fossil fuels for our transportation infrastructure and much of our industrial base. As we saw this summer, natural disasters such as hurricanes can cause widespread fuel supply problems, much of which has to do with the limited number of refineries we have. When we realize that much of our energy is produced from oil and natural gas, we also must realize that the cost of the commodity will fluctuate according to demand and supply. Add to this market factors which caused California such problems when Enron was manipulating the supply of energy.

The True Cost of Petroleum Based Economy

What is the cost of our petroleum based economy? It's a multifaceted question which has answers found not only in the acquisition and production of obtaining oil, but also in protecting the rights to access the stocks and supply in other countries. The true cost of one gallon of gasoline is highly subsidized by the government, if you factor in tax payer funded infrastructure, military presence in foreign oil producing regions, as well as lobby protected industries. We pay for our oil not only at the pump, but also through taxes that indirectly support all the government activities to obtain the physical petroleum based product, and the access rights. Aside from monetary costs, there is the cost to the environment of greenhouse gases and pollution. While the debate goes on regarding CO2 and global warming, there is no argument regarding how detrimental the combustion and utilization of petroleum is on the environment. The basic problem is the bulk acquisition, transportation, storage and utilization of oil. The massive centralized refinery system is old and tired. Hurricanes have proven that such a system doesn't work. Take out one refinery and you can see price fluctuations, which indicate a very delicate balance.

The Methanol Economy - What Happened to the Hydrogen Economy ?

As we look for alternatives, it's important to realize that you can't change an entire system overnight. The hydrogen economy will only work if we have a inexpensive form to produce it, that works within the system. A Nobel Prize winner, George Olah wrote about the benefits of a methanol economy. It's an interesting twist to the energy future, and basically emphasizes the need for a system that is easy to implement into existing transportation and industrial framework. Methanol (MeOH) is currently the high energy density fuel of choice for fuel cells tha will replace many portable device batteries. It can also be converted to gasoline through a process developed by Mobil Oil. Statoil in Norway currently has a testbed of methanol powered CHP (combined heat and power) microturbines. Indy 500 race cars use methanol. Methanol ca also be used to produce animal feed, as well as enhance plant and algae growth.

CO2 Conversion Technologies - Why CO2 ?

The concept I have developed is to convert CO2 (Carbon Dioxide) in to useful fuels. It's a novel concept that benefits the economy, the environment and provides a strategy that can be enacted on a local level. At the same time, it also addresses the inherency's with our current petroleum-based system. Last year, an investor partially funded some research that created Ocean Ethanol and it's CO2 conversion activities. Much of our research was based on the works of Professor Inui and the basic experiments performed by Paul Sabatier over 100 years ago.

Paul Sabatier (1912 Nobel Prize for work in organic chemistry) found that when you combine CO2 and Hydrogen over a nickel catalyst, you could produce methane. He was the founder of metal hydrogenation catalysts, which gives us many of the products we use today such as margarine, oil hydrogenation and synthetic methanol.

Where do we get CO2 ?

There is currently a CO2 pipeline infrastructure in the USA, Canada and many European countries. The current use is for enhanced oil recovery, where it's pumped back into the ground to boost oil production. In Norway, a pipeline was built to sequester CO2 back into the ocean. In addition, there are currently membrane filters that allow us to pump seawater through a device that separates out the CO2. This is done on a large scale with reverse osmosis desalination plants where the CO2 is usually put back into the drinking water. There are also some ideas that filter CO2 from the air, which don't appear to be economical at this time. In some areas of the world, CO2 bubbles up through the seawater and is vented wherever there is volcanic or geothermal activity. It is also a industrial byproduct at ethanol plants, powerplants, natural gas processing plants and a host of other commercial activities.

CO2 and H2 to Ethanol

Our first research which was contracted through Battelle, Pacific Northwest Labs, was to develop a ethanol catalyst. Using CO2 and hydrogen as the feedstocks, we were able to prove that you can make ethanol from the combination of the gases over a Fischer Tropsch catalyst. Our investor stopped the funding, we we realized that H2 was a necessary component. The byproducts of the reaction were CO (Carbon Monoxide), methanol, acetic acid, oxygenates and water. My idea to recycle the CO with steam to make hydrogen didn't make up the balance of H2 needed into the input of the system, so the research ended there. The paper economics of the research given no-cost CO2 and low to moderate cost hydrogen gas was about $4.00 per gallon of ethanol. The entire process was about 5-10 percent efficient. As part of our experimental process, we tried to reproduce some of the published scientific methods for CO2 conversion, and were surprised to find that alot of what is published is difficult, if not impossible to duplicate.

CO2 and H2 to Methanol

During one of the experiments, there was one which resulted in a very high output of methanol. Upon further investigation, we realized that by using CO2, CO and H2 as the feedstocks, we could have a effective way to produce methanol. On a small scale, we calculated we could have a process that was 98 percent efficient in the conversion of CO2 to methanol. This process has alot of promise.

CO2 and H2 to Ethylene

Using another variation of CO2 and Hydrogen as feedstocks over a catalyst, can produce ethylene (ethane) which is a monomer that can be used to make plastics.

Reverse Fuel Cell

In my research, I also had some collaboration with a group that tried my idea of making a methanol fuel cell, and running it in reverse. The results of their experiments were very positive, and they were able to produce some methanol.

Gas to Liquids - Methanol to Gasoline

A while back, Mobile Oil invested heavily into researching and producing H ZSM-5, a zeolite catalyst for the Methanol-to-Gasoline (MTG) Process (Chemtech, 6, 86-9 (1976)). It's an efficie process that results in about a 98 percent conversion. Basically, two parts of methanol are run over a catalyst to produce one part gasoline, and one part water. A large plant was built in New Zealand in 1985 which was put into production for 10 years which proved it could work.

Spin-off Technology - Biodiesel

Using some of the catalyst or fuel cell technologies above, we can also make sodium hydroxide and methanol as part of a continuous biodiesel process. This in-situ production only needs saltwater, CO2 and vegetable oil. The National Renewable Energy Laboratory (NREL) has already completed experiments to raise algae to produce oil. Under the right conditions, the algae oil yield (per unit space) is a great deal higher than any seed oil.

Distributed Fuel Production - Miniplant

We can implement the above technologies into our existing energy infrastructure by the use of distributed fuel production. Instead of 26 huge refineries, why not have thousands of miniplants that connected in a network, provide the same aggregated output. It makes more sense since you can provide fuel at the point-of-use and eliminate the transportation expense (and possible pollution from oil spills or storage accidents). The miniplant could be installed in every gas station, and even at sea to provide mid-ocean refueling. Best of all, it empowers the local community from a labor and resource standpoint. Fuel is produced locally, and the trickle-down effect keeps the money there as well.

Modular Block Invention

To make this all work, I needed to find a way to not only prototype experimental demonstration units, but also provide a smooth transition to a market-ready device. Most gas and liquid processing units are custom built using CNC machines, exotic metals, and complicated infrastructure that was not only cost prohibitive from a prototype standpoint, but also in providing an affordable device to make miniplants. Then one night when I was watching a program on bees and how they build their efficient (space and energy) hives, I saw the answer. It was the hexagon. The result of which was my invention, the modular block. This industrial Lego system has pre-bored channels for gases and liquids, has a standardized assembly system using simple screws and has an infinite number of ways to produce vertical and horizontal passages that allow product to flow.

Best of all, this ingenious device allows you to easily add components to the system, or scale up the system by simply adding more blocks. Using standard bores for 1/8, 1/4, 1/2 and 1 inch there is a huge range of applications for building prototypes as well as functioning commercial miniplants. Since blocks are held in place by screws, any part of the system can be swapped out for repair, modification, or replacement. The center bore of the block allows easy integration for microreactors, or can be stacked to form 1 inch distillation towers.

Combined Resources Technology

Bring together the CO2 conversion technology along with the modular block invention and the resources form to complete a system that allows us to produce a fuel on a small, renewable, and affordable scale. The miniaturization of a refinery will allow the production of fuel to occur in a device the that will fit in the palm of your hand.

Point-of-Use Fuel Vending

Extend this technology further into the marketplace and you can use the miniplant to be installed in vending machines that will someday re supply your methanol fuel cell battery for your palm device, cell phone or iPod. Deployed into gas stations, you may soon be filling up your tank with a fuel produced or blended with ethanol, methanol, or gasoline that was produced by local, community based resources.

Technology Funding Problems

There is a huge need for alternate energy funding. The problem is that the groups that need it, have the least access to it. The SBIR (Small Business Innovation Research) programs work well for larger companies, and even some smaller ones get funded. But with most government funding, you have to be within their funding guidelines and what they want to research. For now, that is hydrogen.

Summary

There is a bright future for alternatives, but what is needed is for angel investors to fund projects which show promise to help alleviate the existing petroleum based system. CO2 conversion technologies address many of the current problems with system while providing a more environmentally sound strategy that allows people to utilize their current transportation and energy network.

Technology - As of November 2005

Our investor ran out of money and we had to temporarily suspend our groundbreaking research right at the peak of development at Battelle (Pacific Northwest Labs). We were able to prove that we can make ethanol and methanol from CO2 and Hydrogen. The catalyst our team of scientists was developing was on its way to providing a cost-effective alternative to fossil-fuel production. This leading edge research was on its way to providing distributed fuel production via miniplants. Instead of centralized refineries, my concept was to bring production to point-of-use (i.e. gas stations where ethanol or biodiesel can be blended directly into existing fuels).

Our research did develop into one patent being filed for the revolutionary Modular Block System that was my brainstorm to have modular reactors that can be put together by simple hex screws to make numbering-up and scale-up systems easily integrated into other gas/liquid processes. The modular system will also revolutionize gas-sampling and any gas or liquid process by eliminating pipes altogether. Licensing of this system is currently available.

In addition to our CO2 conversion to alcohols, we also were researching a revolutionary way to produce biodiesel. Our continuous transesterification system was designed using our Modular Blocks allowing a miniplant production unit for use on farms, islands and at sea. This leading-edge device would provide 6 gallons of biodiesel per hour - perfect for smaller applications.

Our ultimate goal was to provide renewable fuels from the Ocean. Initially this would have been done by extracting the CO2 from the surface of the ocean and electrolyzing the hydrogen from the salt-water. With this process, we can produce both ethanol and methanol. By harvesting algae and kelp (high vegetable oil content) by roaming mid-ocean fuel ships, we could produce biodiesel. Large ship-mounted wind-turbines would produce continuous electricity for energy requirements to run the electrolyzers. The only byproduct of the process (biodiesel) was glycerin, which can be made into soap or sold in raw form in the cosmetics industry. Our other research may lead us to producing SCP animal feed via methanol enhanced growth, including single cell protein, yeast, algae and C3 plants (which exhibit up to a 30 percent growth increase when methanol is applied directly to foliage). Methanol can also be used in sewage treatment plants to increase the rate of sewage processing by encouraging growth of bacteria and algae.

As global warming issues still concern us, research into the sequestering of CO2 as a waste product continues to get Federal research grants. We're providing an alternative to make fuel from CO2 and completely privately funded. I urge you to contact your representative in the Congress or Senate and tell them to fund green energy initiatives, which is good for all of us in terms of lower fuel prices, but also good for the environment.

While investor problems were a setback to all of the research and development, I'm confident that a new investor will step forward. For early stage investors, we will extend an option to register our stock for liquidity, with the ultimate goal to do an IPO and go public - Greg G - Inventor/Energy Developer September 29th, 2005.

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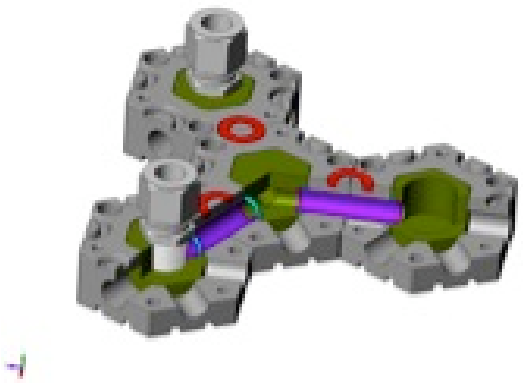

Modular Block System