COMMONLY ASKED QUESTIONS REGARDING SYNFUELS TECHNOLOGY

1. What are the key benefits of your technology not applying the Fischer Tropsch process? What are the limitations of FT that your technology overcomes?

Synfuels Technology converts natural gas to acetylene, then ethylene, which are valuable products by themselves, and ends by producing unfinished gasoline, also known as gasoline blendstock. The product composition is independent of the feed material. The intermediate products can be isolated as finished products. The gasoline blendstock is obtained without need for separation operations such as distillation.

The Fischer Tropsch process starts out by converting natural gas to carbon monoxide, hydrogen and carbon dioxide, then reintegrates the oxidized carbon into a hydrocarbon.The initial product composition of Fisher Tropsch (FT) is highly dependent on pressure, temperature, feed gas composition, catalyst type, catalyst composition and reactor design. Post treatment requires catalytic dewaxing, hydrotreating, hydrocracking and hydroisomerization. Maximum selectivity results from lower temperature and slower reactions, more expensive catalyst and carefully controlled H_2/CO. Wide variability can be expected in product quality. Much of the product (about 50%) is wax which must be cracked, isomerized and re-processed to form liquid fuel products. Several distillation operations will be required to make the different fuel grade compnents

Synfuels GTL product is gasoline blendstock. Synfuels product has a research octane rating between 90 and 95. Byproducts are used to provide process energy to operate the plant.

The FT reactor, which converts carbon monoxide and hydrogen from natural gas to a wide ranging of alkanes makes a crude product. The crude product first must be decarboxylated and dehydrated to give a pure alkane product. Excess hydrogen is recovered and light hydrocarbons are either used as fuel or sent to isomerization reactors. The crude alkane blend is separated into naphtha, gasoline, diesel and wax fractions. The wax is sent to high temperature crackers that makes more diesel and lighter fractions including gases.

The Synfuels process converts natural gas to a gas containing acetylene in a pyrolysis reactor which is converted to ethylene in a liquid phase hydrogenation (LPH) reactor. The liquid phase hydrogenation step is the cornerstone of our technology and the basis of our success because it is highly efficient yet is very tolerant of carbon monoxide, a major component of the gas produced in the first reactor. Not having to separate the acetylene from the other gas components prior to reaction is a huge savings in operating and capital cost. The ethylene is converted to gasoline blendstock in an oligomerization reactor. Again, the ethylene does not have to be separated from the other gas components prior to conversion to gasoline blendstock, keeping the process cost effective and less complicated. A simple two phase separator allows gasoline blendstock to be moved to storage and the remaining gases, which include CO, H_2 and unreacted CH_4, to be used for power and energy generation. CO_2, which is also present, is removed from the process gas before returning it to the first ractor.

The FT reactor operates at high pressure with per pass conversions in the range of 15% to 50%. The FT process makes products that have to be isomerized and cracked over and over. High rates of recycle increase compression costs and compressor size, which lead to high capital and operating cost.

The Synfuels GTL process is once through. The gas streams that contain acetylene and ethylene are processed as is. They do not require separation. This keeps compressor sizes and costs small.

To be cost effective, FT installations must have gas feed rates starting at 300 million SCFD.

To be cost effective, Synfuels installations must have gas feed rates of about 15 million SCFD and on an equal product output basis, cost about 1/3rd as much as an FT plant. Synfuels plant sizes can exceed 300 MMSCFD.

The FT Process does not make ethylene directly.

The Synfuels process always makes ethylene as an intermediate.

The FT process converts all components of natural gas into CO and H_2, so the value of all forms of carbon is the same in the FT process.

The Synfuels process is capable of converting methane alone to final products, but its ability to convert C2 and greater hydrocarbons to useful products, such as ethane and propane, is about 60 to 70% better than its ability to convert methane. This holds true for mixtures of methane and heavier hydrocarbons. No gas separation is required to achieve the yield benefit of richer gas.

FT Technology intellectual property is owned by many different corporations including Sasol, Shell, ConocoPhillips and ExxonMobil. Many different catalyst manufacturers own patents on various catalysts and catalysts formulations used in the FT process. Great care must be used by anyone building a FT plant to own all the required licenses and technologies or legal disputes can be expected.

The Synfuels process intellectual property is either directly owned by or exclusively licensed to Synfuels International. All of the technology required to build and operate a Synfuels plant is under the control of Synfuels. This includes process, design and catalyst patents.

FT jet fuel consists of straight chain alkanes. This material cannot meet jet fuel specifications including physical density, energy density and freeze point. It can be mixed with traditional jet fuel to form a blend that has been qualified as jet fuel, but errors can always occur in blending.

Synfuels ethylene derived jet fuel has been proven by both commercial and US Military labs to meet or exceed all jet fuel specifications. Synfuels ethylene derived jet fuel can be made from 100% renewable feedstocks such as plant derived ethanol. Synfuels ethylene derived jet fuel has a very low freeze point naturally making it an excellent choice for high altitude or arctic flight. Its high temperature stability was 60C above that of typical petroleum derived jet fuel. Although not yet fully qualified today, it is projected to be a 100% renewable jet fuel replacement.

2. We've featured a compact GTL technology recently. What's different about your technology in terms of how it works and where it can be used?

Compact GTL, a FT process, utilizes small reactors with short residence times to minimize the size of the process so that it can be placed off shore on the deck of transports. The product of the Compact GTL process is an unrefined liquid that is presumably stable in crude oil. The purpose of Compact GTL is to make production possible for crude that cannot be processed when the associated gas is flared. The economics of Compact GTL are not in the production of the liquid derived from gas but in production of the crude itself. The Compact GTL process claims that they can be profitable in the 2 to 15 MMSCFD range. This is true as long as they are being paid for a service to enable oil production through emissions elimination and not for the product they make. They have stated that they would not be the right solution for gas rates above 50 MMSCFD because that's the maximum size they could place on a ship. Larger Compact GTL systems may not compete economically with gas compression and re-injection or other technologies. We expect that the upper limit of Compact GTL will be limited to about 20 MMSCFD by economics and the impairment of access to the deck of the ship. One issue that Compact GTL does not discuss is the large amount of wax contained in the product and the long term effects of wax saltation and buildup in transport ship cargo holds and piping.

The Synfuels process can be operated in the same way, but is not limited to associated gas because we do make useful final products. For associated gas, we can make gasoline that can be sold as well as enable liquids production by combining it with crude. Our most profitable size range is 20 to 300 MMSCFD for on-shore monetization of stranded gas where substantial volumes of product can be offered for sale. Our products will always lighten any crude they are mixed with. Although we could offer the same service as Compact GTL and compete with them on the level of eliminating a gas problem, our goal is to produce products economically. The rationale for this is: products that are valued and transportable have inherent worth and are resilient to competition. Services that are valued on the elimination of a problem do poorly in the face of competition because the value of the service is only as high as lowest provider's bid. Also, the perception of a problem can change with time and changes in governments or government policies.

3. Is your GTL technology strictly for processing associated gas, or is it also suitable for deployment at, say, dry gas wells?

Synfuels technology is useful whenever we can access low value gas to make high value products. We can offer a service such as Compact GTL to "handle" gas by converting it into gasoline and blending it back into the crude. We can process dry gas, which contains little C2+, into gasoline and make a valuable and easily transported liquid. When the local market is advanced and there are ethylene converters nearby, even relatively high gas prices will lead to a profitable gas to ethylene facility.

4. How might this fit into the anticipated growth in the U.S. petrochemicals sector as a result of the abundance of shale gas?

The gas produced and transported in pipelines in North America is nearly pure methane. Synfuels can take this lean gas and make ethylene. Shale gas has been located mostly in Northwest Canada and the Eastern and Southern USA. The abundance of shale gas and the high production rates are keeping the price of pipeline quality natural gas in the $2 to $3 range. Ethylene is about twice the price of methane on a volume basis. At this price, the Synfuels process can compete economically with ethane crackers.

5. How might your technology be a "game-changer" for the petrochemicals industry? Benefits for other industries as well?

Methane, which is now in greater abundance than ever before, will become more than just a fuel but a 2 carbon chemical precursor. This is novel and a “game changer”. Methanol has been made from methane for decades via methane reforming to CO, CO2 and H2 followed by methanol synthesis of these gases to methanol, but single carbon chemistry is much more limited in utility than 2 carbon chemistry. Ethylene is widely used and manufactured. In 2011, 165 million metric tones of ethylene were produced worldwide. That was 52 pounds for every human on the planet. More of it was made and converted to diverse products in developed countries. As the world’s economies develop and industrialize, more of it will be needed. The Synfuels GTE process takes natural gas directly to ethylene. The left over gases that are produced in the first reactor, including CO and H2, are converted to energy needed by the process. No recycle and low pressure operation keeps the capital and operating cost down.

The second “game changer” is the Synfuels process will manage to keep ethylene more in line with gas prices than oil prices. As gas abundance grows, ethylene prices will stabilize and may even fall if enough ethylene is made using Synfuels GTE technology. Throughout the world, ethylene prices are rising and expected to rise, especially in countries like Japan, China and India as well as regions like Europe that are gas poor. The Synfuels GTE process will be able to take low value gas in industrialized regions, such as North America, and convert it to ethylene and make substantial profit. Our economic analysis, developed from our stage II process design done by a Houston area E&C firm, indicates we can expect an internal rate of return of 30% or more at today’s gas price and ethylene value. Use of an abundant American resource to make high value products for Americans will help improve the American economy in general.

Synfuels can turn stranded gas into a valuable transportable gasoline range liquid and can take moderately valued gas where it is widely available in industrialized countries and make ethylene, but patent pending new technology can help us bring ethylene to the gas poor regions where it is most expensive, which is the biggest “game changer” of all. Simply put, we propose that ethylene can be transported as a liquid in a common liquid carrier with LNG, as either separate components or as a blend. We are calling this our GasRich process at this time.

Worldwide LNG transport in 2010 was approximately 220 million tones and ethylene production was 160 million tones. These markets are close to the same size. Although LNG production and transport is increasing, there are a large number of LNG transport vessels that are currently unused or underutilized.

LNG is normally brought to market in the following fashion. The LNG tanker loads up at the LNG liquefaction plant or production site and transports the cryogenic liquefied natural gas to the receiving site where it is unloaded and re-gasified. The empty tanker returns for another load.

The Synfuels concept is to take advantage of, but is not limited to, the excess shipping capacity and the excess production capacity of existing LNG plants around the world or LNG production plants to be built here in the United States. An ethylene manufacturing plant, which we would like to be a Synfuels GTE plant, sends its product to an LNG production facility. The ethylene is cooled and optionally blended with the LNG and loaded aboard the LNG tanker. That tanker unloads at the receiving terminal where, if a blend, is cryogenically separated into pure ethylene and pure gasified LNG. The LNG, now natural gas, enters the natural gas supply system. The ethylene is conveyed to a chemical plant that converts the ethylene into various products or in some cases is conveyed to an ethylene distribution pipeline very similar to a natural gas distribution pipeline. Only slight modifications are required to the LNG liquid separation plant. If a blend, a cryogenic separation tower is required, but the cost of operation is much less than a typical cryogenic separation tower because the fluid entering the separation system is already cooled to its normal cryogenic boiling point such that the cryogenic separation requires little or no additional refrigeration. It will operate much like a typical liquid distillation tower.

6. How much gas could your technology process in a day, and how much syngas could it produce during the same period?

The amount of gas we process is based on the design of the production facility or skid. We have a completed design for a 50 MMSCFD facility to make either gasoline blendstock or ethylene. The simple design makes scaling from 10 MMSCFD to 300 MMSCFD practical. Our production rate depends upon the quality of the gas and whether it is rich or lean. From 1 MMSCF of methane we will make about 52 barrels of gasoline blendstock or 6.7 tonnes of ethylene. The process does make crude syngas as a byproduct which we use for power and heat production.

7. At what stage of development is this technology? Has it been deployed commercially?

The GTL technology has been demonstrated at a scale of about 35,000 SCFD in our demonstration plant near Bryan, Texas as a fully integrated process and operated continuously for 2 weeks. The first reactor in this process operates at very high temperatures so a large, near full scale model was built and has been tested for this technology to prove it will scale and operate as planned. This process technology has been vetted by Baker and O'Brien, a technology assessment engineering firm in Dallas, from whom a report can be obtained. The GTE process is simply taking an intermediate stream in the process and refining it with known technology. The Houston E&C firm that completed the design for the GTL process also designed the GTE process which includes purification of the ethylene stream. The GasRich process is detailed in the patent literature but relies only on well known and widely practiced technology so a small scale demonstration operation is not planned at this time.

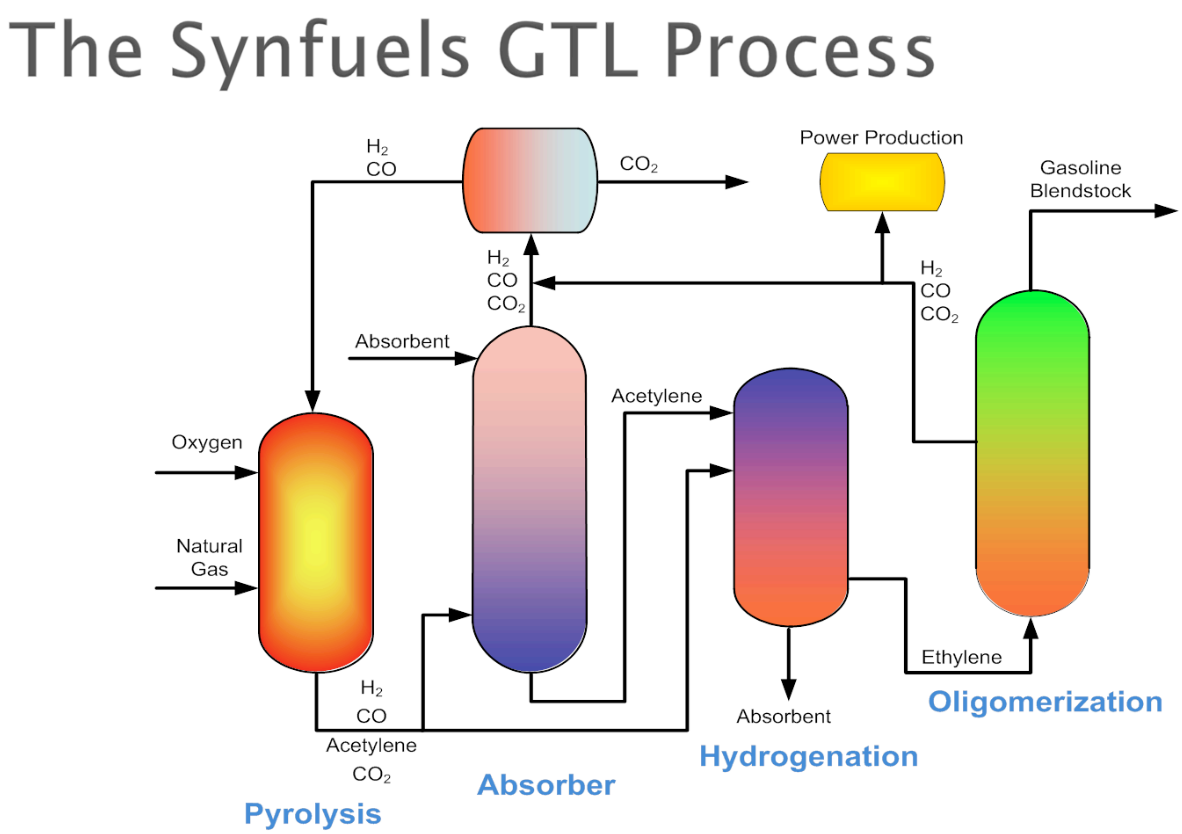
None of this technology has been deployed commercially at this time, but funds are being raised for a 140 MMSCFD GTL plant in Texas.

8. How might this technology fit into the nascent natural gas vehicles push in the U.S.?

Our technology will make gasoline more widely available and possibly help the USA and Canada control gasoline price rises and fluctuations. Although I do not think our technology will dramatically affect conversion to or deployment of natural gas powered vehicles, it will not encourage growth in that market.

9. Do you have any photos of the system "in action" and/or a diagram showing how the process works?

We can supply photos of the demonstration plant. The process is described in basic terms here:



10. Would you like to add any comments that my questions do not address?

Here is our comparison of the GTL, Compact GTL and Synfuels technologies

Synfuels	**Conventional Fischer Tropsch**	**ComPact FT**
Single Pass	Multiple Recycle	Some Recycle
Small Reactors	Large Reactors	Small Reactors
Suitable for 15 to 300 MMSCFD	Suitable for 300 to 3000 MMSCFD	Suitable for 2 - 20 MMSCFD
Ethylene, Gasoline Blendstock, acetylene	Mixture of Linear Hydrocarbons	Mixture of Linear Hydrocarbons
Works more efficiently with richer hydrocarbons	Hydrocaron richness does not impact result very much	Hydrocaron richness does not impact result very much
Inexpensive reactors opeate at moderate pressure	Reactors operate at very high pressure	Reactors are very expensive
Suitable for Associated Gas, Stranded gas or Low Cost Gas relative to Product Value	Suitable for Low Cost Gas far from Market	Suitable for Associated Gas Only
Makes Several Finished High Value Products	Makes a Mixture that can be refined into several fuel and lubricant value products	Makes a liquid product that can be co-transported with crude oil
Once through process makes immediately isolatable finished products	Several re-processing steps required to make saleable products	No reprocessing because product is not intended to be a finished product
Small to Medium footprint plant	Large Footprint Plant	Very small footprint plant
All IP owned or licensed to single party	General FT IP owned by several competing parties	General FT and small reactor FT design IP owned by several competing parties
New Technology - all patents still protected	Enabling Technology past patent protection	New technology but rival patents
very wide turndown of about 50%	Normal turndown of about 15%	Turndown strongly damped by integrated heat transfer
Rapid startup - about 12 hours from cold to operating conditions. Safe Shutdown can occur within a few minutes.	Normal startup - several days. Safe shutdown take several hours.	Start-up time less than a day but rapid shutdown of exchanger reactor could result in reactor damage
Ethylene Product can be converted into hundreds of second generation polymers and chemicals	Final products are not meant to serve as raw materials for anything else.	Makes no isolated product