

GAS-TO-LIQUIDS

Gas-to-liquids technology promises to unlock stranded-gas opportunities abroad—for majors and for North American independents with worldwide E&P operations.

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Excerpted from

**Oil and Gas
Investor**

July 2002

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Week Publishing L.L.C.
4545 Post Oak Place
Suite 210
Houston, TX 77027
(713) 993-9320

Oil and Gas Investor
is circulated internationally
by subscription only at
\$259 per year

In the alphabet soup of chemistry shorthand, learning about GTL may now be just as important to the industry as little Johnny learning his ABCs.

Stripped to its barest essentials, gas-to-liquids (GTL) technology involves, most commonly, the conversion of natural gas into clean-burning liquid hydrocarbons, primarily diesel and naphtha. But the steps in that conversion process—methane to synthesis gas to liquid hydrocarbons—are a reminder that the devil is in the details.

The second and novel step in that process—the conversion of synthetic gas to synfuels—was first achieved in 1923 by two German scientists, Hans Fischer and Franz Tropsche. During World War II, the Fischer-Tropsche (FT) process was used by the German “War Machine” to produce an estimated 4.5 million barrels of synfuels during each of the war years.

Today, many giants of the oil and gas industry have or are planning demonstration and commercial-scale GTL plants around the globe that combine both steps. Shell already has a 12,000- to 15,000-barrel-per-day commercial plant in Malaysia. ExxonMobil, which has proposed two 100,000-barrel-per-day GTL projects—one in Alaska and another in Qatar—is currently running a 200-barrel-per-day demonstration plant in Baton Rouge, Louisiana. This spring, BP started up its 300-barrel-per-day pilot plant in Nikiski, Alaska; meanwhile, Conoco started construction on a 400-barrel-per-day demonstration plant in Ponca City, Oklahoma.

Why this flurry of gas-to-liquids projects? Simply put, the market for GTL is huge. According to one estimate, of the 5,000- to 5,800 trillion cubic feet of gas already discovered in the world, 80% is stranded: it’s too far from pipelines or commercial markets. GTL technology represents a way for both majors—and independents—to monetize that gas by converting it into clean-burning distillates. Not only are those products easier to transport than liquefied natural gas (LNG), but the global market for them is now 30 million barrels per day—and growing.

“We’re on the cusp of dramatic advances in the use of this emerging technology, which is not only available today, but economic in the right applications,” says Bill Garner, managing

director, investment banking group, Petrie Parkman & Co., Houston. “GTL is something all companies—independents and majors—need to examine as they look at strategic alternatives for monetizing remote gas discoveries.”

Apart from allowing a producer to book reserves that otherwise would have no value, the use of gas-to-liquids technology permits independents to respond to increasing global environmental and conservation concerns. “African nations like Nigeria and Angola are beginning to question the flaring of gas by offshore oil rigs; they don’t want the gas wasted,” says Garner. “One way to deal with this concern, where an operator really doesn’t have enough gas to justify building an LNG facility, is to apply GTL technology. This would not only be responsive from a conservation standpoint, but the clean-burning, converted liquids could be sold profitably, either locally or internationally.”

Petrie Parkman is helping Denver’s Rentech Inc. put together a consortium of U.S. producers to explore the use and economics of GTL in their international operations. Garner cautions that the majors, which have done the bulk of research and development on this technology, have generally shown a reticence to license their patented processes. “Given this, smaller GTL technology providers like Rentech and Tulsa-based Syntroleum Corp. may be more viable alternatives for independents, since those companies are willing to license their processes.”

G. Allen Brooks, executive director, equity research, CIBC World Markets, Houston, agrees. “Independents might be more comfortable teaming up with smaller GTL providers, not only because they’re willing to license their technology, but also because producers might have more of a voice in how a project gets developed and how project proceeds are shared.”

Driving the industry’s interest in this technology, he says, is the huge amount of stranded gas reserves worldwide that can’t support a large LNG plant, but are sufficient to support a GTL plant. Observes Brooks, “A good-size GTL plant needs only 25% to 50% of the reserves required to supply a world-scale LNG facility.”

The other driver behind the interest in this new technology is that sulfur-free diesel is produced out of the process. “More and more,

that's something the EPA and the public are demanding—cleaner-burning fuels—and why the majors are so interested.”

As to whether GTL technology is economically viable for the industry, the jury is still out on that, says Brooks. “That’s why all these pilot- and demonstration-plant programs are under way.” Yet, he adds, GTL technology will ultimately emerge as a major factor in commercializing more gas resources internationally, just as LNG has.

Rentech: The GTL process

Although natural gas is commonly used as a feedstock, the GTL process can involve the conversion of any carbon-bearing material—be it bitumen, refinery bottoms or Venezuelan heavy oil—into liquid hydrocarbons, principally ready-for-market diesel, naphtha for making gasoline, and petroleum waxes, which can be re-used to make more naphtha and clean-burning diesel, says Dennis L. Yakobson, president and chief executive officer, Rentech (Amex: RTK).

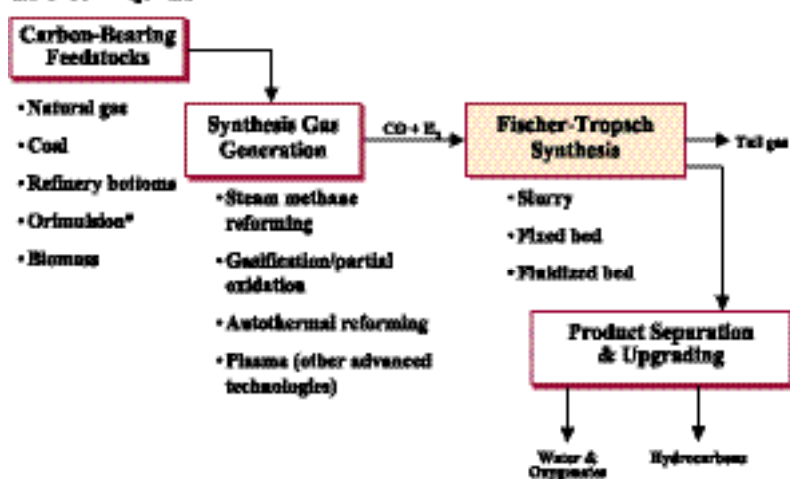
Arthur W. (Bud) Tower III, a Rentech consultant and formerly director of research for Howard Weil in New Orleans, illustrates the steps in the GTL process, using natural gas as the feedstock. Reduced to simple terms, methane gas goes through a first reactor or box where that gas passes through tubes containing steam and a catalyst which break down the methane. This process is known as steam methane reforming. What comes out the other end of the reactor or box is a mixed stream of carbon monoxide and hydrogen—commonly called synthesis gas or syngas. In the case of solid hydrocarbon feedstocks like coal, gasification of the solid feedstock takes place in the reactor, in the presence of heat and oxygen, to form syngas.

The syngas next goes into a second reactor or box—and this is where the FT technology, comes into play, explains Tower. In this second reactor or box, the syngas reacts with a catalyst—either iron- or cobalt-based—and the carbon monoxide and hydrogen in the syngas are converted into a stream of liquid hydrocarbon products, including diesel, naphtha and petroleum wax, which come out the other side of the reactor. Also vented separately from the reactor are water and oxygenates, and gases composed of unconverted hydrogen and carbon monoxide which can be recycled or used for power.

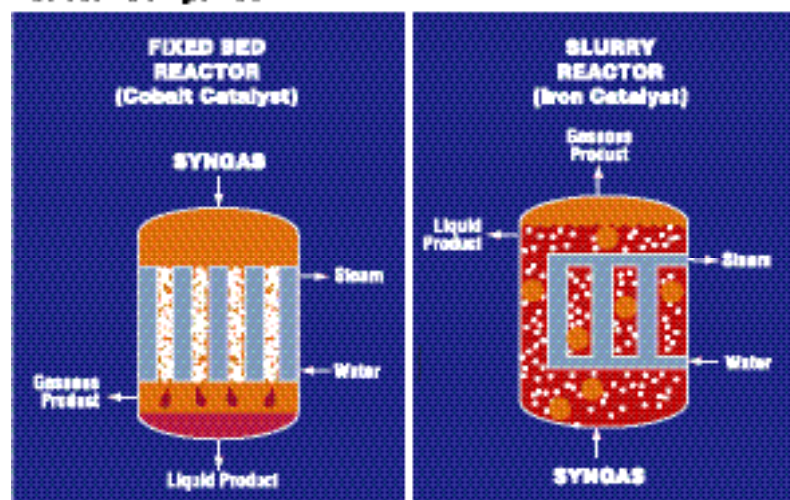
While the process appears simple at first blush, there are several types of reactors and, as noted, two types of catalysts being used in various combinations by GTL technology providers. Shell, for instance, uses a fixed-bed reactor with a cobalt-based catalyst in its Bintulu, Malaysia, commercial GTL facility; ExxonMobil, a slurry reactor with a cobalt-based catalyst in its Louisiana demonstration plant; BP, a fixed-bed reactor with a cobalt-based catalyst in its Alaskan pilot plant; and Rentech, a slurry reactor with an iron catalyst in its former Pueblo, Colorado, commercial plant and current pilot reactor.

In a fixed-bed reactor, the syngas goes in the

Gas to Liquids



Reactor Comparison



top of the reactor, passes through tubes with a proprietary catalyst in them, and the converted liquid hydrocarbon products drip out the bottom of the reactor; the gases, out the side. In a slurry reactor, the syngas goes in the bottom of the reactor, passes through molten wax in which a catalyst is suspended. The converted liquid hydrocarbons then come out the side; the gases, out the top.

“In a slurry reactor, the flow of product is four times greater than in a fixed-bed reactor, and the cost of the slurry, only a quarter of the fixed-bed reactor—plus the catalyst in a slurry can be replaced without going offline,” says Yakobson. “As for the catalysts themselves, cobalt has a two-to-four-year life versus about six months for an iron catalyst. However, an iron catalyst is needed for any GTL feedstock other than natural gas to make up for the hydrogen deficit in nongas feedstocks. Also, an iron catalyst, unlike a cobalt catalyst, is somewhat sulfur- and ammonia tolerant.”

The markets for GTL

Given all this, Yakobson believes ExxonMobil, with a patent covering the combination of using a slurry reactor with a cobalt-based catalyst, has a cost advantage over other cobalt-based competitors. “But we’re not competing with an Exxon, Shell or Sasol/Chevron, which

Top chart shows entire GTL process, involving the conversion of carbon-bearing materials into synthesis gas, then into liquid hydrocarbons. Chart below shows how two types of reactors—using FT technology—convert synthesis gas into liquid products.

"A good-size GTL plant needs only 25% to 50% the [gas] reserves required to supply a world-scale LNG facility." G. Allen Brooks, CIBC World Markets

are planning to build giant GTL plants in gas-rich Qatar, with respective capacities of 100,000 barrels per day, 75,000 to 110,000 barrels per day and 34,000 barrels per day. We're looking at smaller plants around the globe, and we're using completely different steps in the FT conversion process. In short, we think there's room for everybody in what's going to become an increasingly important technological niche

for the industry."

Currently, ChevronTexaco Energy Technology Solutions, a division of ChevronTexaco, has contracted with Rentech to do research and development aimed at integrating Texaco's gasification technology—which produces syn-gas from liquid and solid feedstocks other than natural gas—with Rentech's GTL technology. Rentech's work is part of a contracted \$14-million study Texaco has with the Department of Energy to examine the conversion of U.S. coal

INDIES RIDE GTL TRAIN

One prominent U.S. independent looking to take advantage of gas-to-liquids technology is Denver-based Forest Oil Corp. (NYSE: FST), which is currently sitting on a large discovery in the Ibhuesi Gas Field in the Orange River Basin off the west coast of South Africa.

"Four wells drilled on the block have cumulatively tested at 190 million cubic feet of gas per day," says Robert S. Boswell, chairman and chief executive officer. "Our challenge now is to commercialize this field."

Among the potential local markets for this major gas find is Moss-gas—an entity which recently merged with Soekor to form the new integrated national oil company of South Africa, PetroSA, and which runs what is currently the world's largest operating GTL plant.

Located onshore in Mossel Bay, South Africa, this plant consumes around 200 million cubic feet of gas per day and produces about 30,000 barrels per day of liquid fuels, primarily gasoline and clean-burning diesel. However, this facility, which uses an iron catalyst in a slurry reactor, is facing supply constraints from its related producing operations in the Bredasdorp Basin offshore Mossel Bay.

"By the fall of this year, we hope to have progressed in our contract negotiations with PetroSA and others to the point where we can pursue the financing and construction of a pipeline to this plant in 2003 and 2004, with first gas coming online in late 2004," says Boswell.

Pipe is, by no means, cheap. "We're looking at roughly \$130 million to reach the beach with 170 miles of pipeline from the Ibhuesi," says John McIntyre, Forest Oil senior vice president, new international ventures. "Then there's another \$100- to \$150 million of outlay for onshore transmission lines to get the gas some 230 miles to Mossel Bay. However, the gas-resource potential on our two [offshore] licenses is quite large and merits this size of investment."

Using the gas-amplitude anomalies from Forest Oil's 3-D seismic and applying them to 2-D seismic lines across the producer's licenses, Cobb & Associates, a Dallas-based independent engineering firm, has estimated a gas-resource potential for the area ranging

from 2.5 trillion cubic feet to 25 Tcf.

Even with expenditures of \$230- to \$280 million, the economics of the GTL gas-supply project are enticing, agrees Boswell. "Based upon our analysis of competitive fuel prices in South Africa, we believe we can achieve an after-tax rate of return that is attractive."

Looking beyond this gas-supply project, he notes that, apart from the majors, smaller companies like Rentech—in which Forest is a minority shareholder—and Syntroleum are independently developing GTL technologies for license. "Our goal is to have access to those technologies, so we can apply them around the world, where there may be large, stranded gas reserves whose economic development is going to be dependent upon either the availability of a GTL process or gas liquefaction."

The former process has a distinct advantage over the latter. LNG has to be compressed, put in special facilities, then decompressed before being put into pipelines, he says. The liquid hydrocarbons from the GTL process, on the other hand, can be transported by conventional tankers, railroad cars, or anything that's used to transport crude or refined products.

Boswell also believes the technological benefits and costs of GTL plants are becoming competitive with "greenfield" refineries. "In a GTL plant, you're reforming a hydrocarbon chain, as opposed to refining or cracking hydrocarbons. As a result, you have lower contaminants, no particulates, very low or no aromatics, and the world's cleanest transportation fuels that still have high octane and high cetanes. In fact, GTL fuels are one of the few fuels that will meet California air-quality standards."

There's yet another benefit arising from putting GTL technology to work. "The rap with natural gas always has been that you can't move it—that it's got to stay within the local economy," says McIntyre. "That, of course, means a producer's gas sales would therefore be locked into the local currency of a country. And if there's a disconnect between that currency and the U.S. dollar, that producer's got a problem. However, with GTL technology, that producer could take that same gas and export the converted liquids

and refinery bottoms to liquid hydrocarbons and power.

In Bolivia, Rentech is working on a 10,000-barrel-per-day GTL plant project. "Here's a situation where a country has 35- to 40 trillion cubic feet of natural gas reserves—with no market for those reserves," says Mark A. Koenig, Rentech director of investor relations. "Meanwhile, it's importing all its diesel fuel." The Bolivian government and Rentech believe the country can take a portion of those gas re-

to world markets—at world prices—and not be tied exclusively to a local economy."

With corporate offices in Vancouver, Canada, and international headquarters in Bakersfield, California, Ivanhoe Energy Inc. (Nasdaq: IVAN; Toronto: IE) is another North American independent that has already come to recognize the importance of this new technology. During the past two years, Ivanhoe, which drills gas targets in California and East Texas, has been in negotiations with Qatar Petroleum to execute an international GTL project. This project would allow the operator to develop an estimated 25 trillion cubic feet of proven gas reserves in a portion of the North Field offshore Qatar.

Besides being responsible for installing offshore platforms and drilling development wells in the North Field, Ivanhoe would also be required to build pipeline facilities, a GTL plant that—using Syntroleum's technology—would have the capacity to convert the gas into 185,000 barrels per day of ultraclean liquid fuels, and an NGL plant with the capacity to convert the balance of the gas into 155,000 barrels per day of gas liquids.

"As we progress towards a definitive agreement with Qatar Petroleum for this major project, we are also exploring financial and marketing opportunities in Japan and elsewhere," Ivanhoe president and chief executive officer Leon Daniel recently told *Gas-to-Liquids News*.

"Based upon the proposed terms of the project, Qatar contributes the reserves at no cost in return for approximately 55% to 60% of the revenue over the life of the project," Ivanhoe vice president of investor relations John MacDonald told *GTLN*. "However, Ivanhoe will receive a majority interest in the revenue until our investment and production costs are recovered during the early years of the project." MacDonald estimates construction costs for the entire project will run \$5 billion; production costs are pegged at about \$4.50 per barrel of GTL product, which would be 70% diesel and 30% naphtha.

Elsewhere, Ivanhoe is pursuing negotiations towards a definitive contract to produce GTL products in Egypt. The proposed capacity of the plant there, to be located directly on the coast of the Mediterranean Sea, is currently 90,000 barrels per day.

serves, build a GTL plant and meet its diesel fuel needs at home—while providing jobs. Rentech is similarly working with Pertamina, the state-owned Indonesian oil company, on a grassroots GTL plant.

Of greater relevance to independents, Rentech is currently attempting to assemble a consortium of engineering, construction and product-marketing firms. Its goal would be to provide independents and national oil companies—for a turnkey price—onshore and offshore GTL plants, ranging in capacity from 5,000- to 15,000 barrels per day, with appropriate process guarantees and suitable end-product, off-take contracts.

The company is also working with several major independents to form a second consortium to fund the design, construction and operation of a demonstration-scale plant in the U.S. "The cost will be relatively small, the low financial risk will be shared by all parties, and once the project is complete and the parties are satisfied the technology works, they'll be able to get process guarantees for a 10,000-barrel-per-day plant."

A potential participant explains, "I'd hate to have to stand in front of my board of directors 10 years from now and have them ask me, 'Why don't we have access to GTL technology?'"

While the majors are somewhat reluctant to license their GTL technology, and may be more interested in a share of reserves, in exchange for their technology and capital, smaller players like Rentech and Syntroleum take a different tack. Says Jakobson, "We're not interested in a share of anybody's reserves. If a producer signs an agreement with us, we get a one-time license fee on plant construction equal to \$1,000 or more per daily barrel of plant capacity and a running 5% royalty on production, based on the price of crude oil—not on the sales value of the liquid product produced."

Looking to the future, the Rentech chairman notes that if GTL products were produced from all available sources, that could add an estimated 27 million barrels per day to global liquid hydrocarbon supply. "Since we're currently producing worldwide about 76 million barrels of oil per day, and demand is expected to go to 120 million barrels per day by 2020, GTL has the potential to make a significant contribution toward meeting projected demand."

Syntroleum

Syntroleum Corp. (Nasdaq: SYNM) is another independent developer of a proprietary process for converting gas into GTL products. Currently, the company is pursuing financing for its 11,500-barrel-per-day Sweetwater gas-to-liquids project in northwestern Australia. At the same time, the company is engaged in supporting possible GTL projects by its licensees in Qatar, West Africa and Peru, says Kenneth Agee, Syntroleum's chairman, president and chief executive officer.

Most recently, it and Marathon Oil Co., which currently owns a small equity interest in Syntroleum, announced agreements to expand

the configuration and capability of a \$36-million Syntroleum GTL demonstration complex, currently under construction at the Port of Catoosa near Tulsa, Oklahoma, and due to be completed in mid-2003.

The expanded plant, partially funded by the Department of Energy, will produce ultraclean diesel fuel for long-term testing in government- and private-fleet vehicles. The plant expansion is also designed to make the completed 70-barrel-per-day complex mirror the major components of a commercial-scale GTL plant. In return for its own investment in this project, Marathon will have access to the complex for operator training and the right to convert its investment into a combination of credits against future license fees and Syntroleum stock.

Conoco

Among the bigger players today in GTL technology development is Conoco. Although a relatively late entrant into this arena in 1997, the company was able to kick-start its research by drawing upon the deep reservoir of scientific and engineering talent of its then-parent, DuPont. By 1999, Conoco decided it had made enough progress in GTL research to go out and hire its own R&D team.

Today, on a sprawling campus in Ponca City, Oklahoma, the firm has 165 people—soon to be 200—working in 20 labs and running a like number of syngas reactors, 30 FT reactors and five hydrocracker reactors—all with proprietary technology. In addition, the company is currently building on an 11-acre site, at a cost of \$75 million, a 400-barrel-per-day GTL demonstration plant, scheduled to be completed this fall.

The plant's purpose is to demonstrate to potential customers—independents and national oil companies—that the GTL process works, and to help Conoco solve any engineering problems at an intermediate scale-up stage, says Paul J. Grimmer, Houston-based manager, diversified businesses, business development.

“On the front end of the plant, we'll be using a proprietary Conoco technology, whereby methane and oxygen are combined and then, in the presence of special catalysts in a proprietary reactor, synthesis gas is made,” he says. “That gas will then be fed into a set of slurry reactors with a cobalt-based catalyst, wherein the syngas' carbon monoxide and hydrogen will be combined to make longer-chain hydrocarbons—diesel and naphtha.”

By the end of 2003, after its demonstration plant has been up and running for about a year, Conoco hopes to sign *at least* one deal to build a commercial plant—whether its capacity is 60,000 barrels per day or greater than 200,000 daily barrels, says Grimmer. “Then we're looking at four years for the design, construction and start-up of such a facility—so year-end 2007 is our target for GTL-plant commerciality.”

Currently, the company is interested in plants that fall within this capacity range—in Qatar, Algeria and Russia. It also has special relationships with Libya and Iran—countries that de-

spite current U.S. sanctions may eventually be GTL markets. The cost of just a 60,000-barrel-per-day plant is \$1.5 billion.

That isn't a lot of capital to spend, considering the huge worldwide market for GTL, and the potential return on capex from a company's application of this technology, he says. “GTL technology represents a way to change [stranded] gas into distillate products, which are easier to ship to market than LNG.”

He adds that while the global market for distillates is now about 30 million barrels per day, it'll be at least 10 years before the industry as a whole can make even a million barrels per day of such products from GTL technology. “So this market is huge—and growing, given that world demand for energy is rising 2% to 3% per year.”

Still, can domestic producers *really* avail themselves of this new technology? “We recently told several U.S. independents that if they found enough stranded gas in a given country, we would be willing to partner with them and build a plant—provided we were the operator of that plant,” says Grimmer. “The only reason for being shy about licensing an entire GTL system is that a lot of us have trade secrets and patents wrapped up in this technology that we don't want disclosed.”

The financial arrangement between a GTL provider and an independent wanting to monetize stranded gas assets doesn't have to be an onerous one, he insists. “If a producer has a bunch of gas and wants to develop a field, it could either sell us the gas outright, or we could charge a fee for converting the gas to liquids and give the producer back the GTL products produced. There are a thousand ways to structure such deals.”

But how much gas reserves would a producer need to justify the building of a GTL plant? “A 60,000-barrel-per-day plant, which is our minimum size, would require 500 million cubic feet per day of gas using the Conoco process,” he says.

“And if an operator wanted to keep that plant full for 25 years, to derive the greatest economic benefit, about 4.5 trillion cubic feet of gas reserves would be needed.”

Citing the efficiency of Conoco's GTL process, Grimmer says, “For every million cubic feet of gas that would come through the front door of one of our plants, we could make 120 barrels of diesel and naphtha—split roughly two-thirds and one-third, respectively—assuming there weren't any specialty chemicals markets close by.”

The potential profitability of GTL for Conoco: “The rates of return would be double-digit—they'd have to be for our group to compete for capital with other business units of the company,” he says. Grimmer notes that Conoco's annual capital budget now runs about \$2.5 billion, and that it will rise to around \$5 billion once the merger with Phillips is completed. “Given our outlook for GTL, and the monster number of these plants that can be built worldwide, we should be spending at least \$1 billion annually on this technology.” □

GTL Project Listing as of June 1, 2002

Existing Plants

Owner/Developer	Location	Product	Capacity (b/d)	Feedstock	Process	Start Date
BP	Alaska	Syncrude	300	Natural Gas	BP/Davy	2002
Mossgas	South Africa	Fuels/Specialty	30,000	Natural Gas	Sasol	1992
Rentech	Colorado	Syncrude	<1	Simulated Syngas	Rentech Slurry	1983
Sasol I-III	South Africa	Specialty	175,000	Coal	Sasol	1955-1982
Shell Bintulu	Malaysia	Specialty	12,500	Natural Gas	Shell SMDS	1993
Synergy Technologies	Calgary, AB	Syncrude	4	Natural gas	Synergy Tech.	2000
Synfuels Texas A&M	Texas	Fuels	12	Natural gas	Synfuels Int'l	2001
Syntroleum	Oklahoma	Fuels/Specialty	2	Natural gas	Syntroleum	1990

Commercial Scale - Under Construction

SasolChevron	Nigeria	Fuels	34,000	Natural Gas	Sasol	2005-06
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Commercial Scale Plants - Under Development

Oman-India Fertilizer	Oman	Ammonia*	1,750 t/d	Natural Gas	Haldor Topsoe	2006
Oman-India Fertilizer	Oman	Urea**	1,350 t/d	Natural Gas	Snamprogetti	2006
Sasol/Qatar Petr.	Qatar	Fuels	34,000	Natural Gas	Sasol	2005
Syntroleum	Australia	Specialty	11,500	Natural Gas	Syntroleum	2005

Under Discussion/Feasibility Study Stage

ANGTL	Prudhoe Bay, AK	Fuels	50,000	Natural Gas	N/A	2006
ANGTL	Cook Inlet, AK	Syngas	8,000-10,000	Coal/Gas	N/A	2006
Conoco/Qatar Petr.	Qatar	Fuels	120,000	Natural Gas	Conoco	N/A
DrakeSynergy	Nigeria	Fuels	20,000	Natural Gas	Synergy	N/A
GTL Bolivia	N/A	Fuels	10,000	Natural Gas	Rentech Slurry	N/A
EMEX Corp.	Colorado	Diesel/Specialty	2,500	Natural Gas	BlueStar	N/A
ExxonMobil	Qatar	Diesel/Lubes	100,000	Natural Gas	Exxon AGC-21	N/A
Forest Oil	South Africa	N/A	10,000	Natural Gas	Rentech	N/A
Ivanhoe Energy	Qatar	Fuels	185,000	Natural Gas	Syntroleum	N/A
Ivanhoe Energy	Egypt	Fuels	45,000	Natural Gas	Syntroleum	N/A
Ivanhoe Energy	Oman	Fuels	45,000	Natural Gas	Syntroleum	N/A
Narkanan GTL Int'l	Iran	N/A	35,000	Natural Gas	N/A	N/A
PDVSA	Venezuela	Syncrude	15,000	Natural Gas	N/A	2004
Rentech	N/A	N/A	N/A	Ind. Offgas	Rentech Slurry	2002
Rentech	Indonesia	Fuels	15,000	Natural Gas	Rentech Slurry	N/A
Sasol/Chevron	Australia	Fuels	30,000-45,000	Natural Gas	Sasol	N/A
Shell	Argentina	Middle Distillates	75,000	Natural Gas	Shell SMDS II	2006-07
Shell	Australia	Middle Distillates	75,000	Natural Gas	Shell SMDS II	2006-07
Shell	Egypt	Middle Distillates	75,000	Natural Gas	Shell SMDS II	2006-07
Shell	Indonesia	Middle Distillates	75,000	Natural Gas	Shell SMDS II	2006-07
Shell	Iran	Middle Distillates	75,000	Natural Gas	Shell SMDS II	2006-07
Shell	Malaysia	Middle Distillates	75,000	Natural Gas	Shell SMDS II	2006-07
Shell	Qatar	Middle Distillates	75,000-110,000	Natural Gas	Shell SMDS II	2006-07
Shell	Trinidad	Middle Distillates	75,000	Natural Gas	Shell SMDS II	2006-07
Syntroleum	Chile	Fuels	10,000	Natural Gas	Syntroleum	N/A
Syntroleum	Peru	Fuels	5,000	Natural Gas	Syntroleum	N/A

Pilot Scale - Under Construction or Development

Conoco	Oklahoma	Fuels	400	Natural Gas	Conoco	2002
JNOC	Japan	Fuels	7	Natural Gas	N/A	2002
Mossgas/Statoil	South Africa	Fuels/Specialty	1,000	Natural Gas	Statoil	2002
Syntroleum/Marathon	Oklahoma	Fuels	70	Natural Gas	Syntroleum	2003

Floating GTL Facilities Under Development

Mogal Marine	Australia	Methanol	1.2 mil. t/y	Natural Gas	ICI's LCM	2005
Syntroleum/PGS	Australia	Fuels/Specialty	N/A	Natural Gas	Syntroleum	N/A

*Two plants, each producing 1,750 tons/day

**Two plants, each producing 1,350 tons/day.

Source: Hart's Gas-To-Liquids News