GTL FUEL: DRIVING THE GROWTH OF THE GTL MARKET

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ABSTRACT

Interest in GTL projects is at an unprecedented level, buoyed by high oil prices. From a supply perspective, GTL offers gas resource holders exposure to refined oil products pricing, which is especially of interest at times of high oil prices. From a marketing perspective, GTL technology offers the potential to place high quality gas-derived products into readily available markets. Additionally, there is an almost unlimited market for the core GTL products; 10 world-scale GTL trains would produce enough GTL Fuel to satisfy just 2.5% of the world’s current on-road automotive gasoil demand. GTL Gasoil will be the product that, from a demand perspective, will drive the growth of the GTL industry. Hence, this paper focuses on the marketing of the GTL Gasoil fraction, which in Shell is called GTL Fuel when used in transportation. The paper presents the key market applications for the product - ranging from commodity-type applications to premium markets such as differentiated fuels – and the work that Shell marketers are doing to capture these markets.
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Up until a few years ago, mentioning the word diesel used to bring to mind words such as “smell”, “smoke”, and “rattle”. Just how much things have changed has been illustrated by this year’s new racing car entry in the 24 Heures du Mans race (Le Mans). Back in December 2005, the Audi R10, a diesel-powered car, was unveiled as capable of winning the famous Le Mans 24 hour race. With huge torque and superior fuel economy the car’s bid for Le Mans is as credible as any gasoline entry and, furthermore, at the Paris launch of the car, there was no smell, no smoke and no rattle. Indeed, the car’s driver and seven-time Le Mans winner Tom Kristensen commented that the almost total absence of noise is one of the things he and other R10 drivers will need to get used to. So what has changed?

Certainly one of the elements is the fuel. Indeed, the Audi R10 will be powered by Shell V-Power Diesel. Whilst the project will see two of the biggest names in motorsport striving for an historic milestone in racing, the expertise behind the technology comes from a deep understanding of what works on the road. Audi, inventor of the TDI technology and pioneer of the European diesel revolution, has worked extensively with Shell in the past – and has been involved in the development and testing of Shell V-Power Diesel. This advanced fuel is designed to help the latest generation of diesel engines to continuously deliver more power, and will utilise Shell’s exclusive synthetic GTL Fuel technology. Shell has led the introduction of this innovative fuel technology and is already supplying GTL Fuel through more than 3,000 of its service stations across Europe as the special ingredient at the heart of Shell V-Power Diesel.

GTL Fuel has the advantage that although new to motorists, it has been produced for over a decade using tried and tested technology. It is the gasoil or diesel fraction produced from the Fischer-Tropsch process, so called after its inventors, which consists of a catalytic chemical conversion of natural gas into synthetic liquid oil products. Shell first embarked on research into Gas to Liquids technology in the early 1970s, leading to the commissioning of the Bintulu plant in 1993 that has successfully delivered more than a thousand shipments of GTL products. The operational experience gained at Bintulu over the past decade has helped to drive improvements in the performance and reliability of the plant, creating a safe, efficient and profitable business. Shell is now applying this accumulated knowledge and experience to the development of world-scale GTL projects, such as the Pearl GTL project in Qatar.

In addition to GTL Fuel, GTL plants produce a range of other products, including chemical feedstocks, naphtha and lubricant base oils, all of which are already successfully marketed from Bintulu. Compared to the traditional route of extracting normal paraffin from kerosene, the GTL route is simpler and has significant capital and operating cost advantages. In the future, GTL technology could largely replace traditional technology to meet the growth in demand for normal paraffin. GTL Base Oils have unique properties with low volatility and a high viscosity index that will provide a further catalyst for cleaner and higher performance engine designs.

GTL Fuel is fully fungible with refinery-derived gasoil, and could easily be absorbed by the highly liquid, commodity gasoil market. Any premium for the product is based upon tangible benefits derived from the unique properties of the molecule - virtually zero aromatics and sulphur, and high cetane - and the possibility of upgrading conventional gasoil by blending it with GTL Gasoil. Hence, GTL technology offers the potential to place high quality, gas-derived products into readily available and high value oil products markets. Access to these markets is simplified and hence made more cost-effective by the fact that the transition from natural gas to liquid is permanent at ambient temperature and pressure, making transport possible in conventional oil tankers as well as through the existing land-based distribution infrastructure.

However, marketers are constantly seeking out new, sustainable opportunities for products that add value to both the producer and the customer. Hence, Shell introduced its first blend of standard diesel and GTL Fuel as Shell Pura Diesel in Thailand in 2002. This was followed by the launch of a GTL blend designed for taxis and commercial vehicles as a clean fuel for the Athens Olympics in 2004. In marketing these fuels as well as V-Power Diesel, Shell has drawn on the experience gained from its existing premium fuels business that has seen the successful launch of a range of customer focused fuels in more than 40 markets. Marketing future fuels, such as synthetic GTL Fuel, follows a similar approach to that applied to these advanced premium fuels. The first step is to develop and test the fuel with leading vehicle and engine component manufacturers. The partners will then conduct highly
visible public trials to demonstrate the benefits of the product to interested parties such as customers and governments. Of course, the necessary infrastructure must be put in place to ensure that the fuel reaches customers at the appropriate price.

In developing a market for GTL Fuel, Shell has been able to draw upon a number of inherent advantages of the product. The first of these is that it can be distributed through the existing fuelling infrastructure and used in existing vehicles. That makes it a more cost-effective option than other alternative fuels for marketers but also for drivers who can take advantage of a new fuel without having to modify their vehicles. Independent research carried out by the California Energy Commission compared the performance of GTL Fuel with other alternative fuels such as CNG and LPG. It concluded that GTL was the most cost-effective alternative fuel for the replacement of petroleum based products and reducing local emissions.

The flexibility of GTL Fuel is another attractive feature for the market. In particular, the use of GTL in a blend opens up growing opportunities in the light of the increasing use of diesel-powered vehicles. In France, diesel vehicles now make up 70 per cent of new car registrations and total sales of diesel passenger cars in western Europe are now outstripping those for gasoline powered cars for the first time, with the trend set to continue.

However, the key advantage offered by GTL Fuel is the reduction it offers in local emissions. This is attractive to policy makers, drivers and the inhabitants of cities and traffic-congested areas. GTL Fuel significantly reduces local emissions of particulates, nitrogen oxide, carbon monoxide, and hydrocarbons. Furthermore, independent studies show that carbon dioxide emissions from GTL Fuel are currently comparable with refinery-produced diesel on a life cycle assessment basis. Considerable R&D is being invested to increase GTL plant efficiency targeting up to 30% reductions in CO₂ emissions, whilst improvements in engine technology will lead to further gains. Already, GTL Fuel can offer improved engine efficiency from minor adjustments to ignition timing and compression ratio designed to maximise the benefit of its high cetane number. All of which means there is potential to improve emissions performance still further.

The most rewarding part of our GTL Fuel marketing activities is the favourable response from our customers. Indeed, in the markets where GTL Fuel blends have been launched, the product has proved attractive to customers and has rapidly gained market share. Customer research has shown that consumers react positively to the synthetic fuels story, appreciating its innovative nature, its emissions performance and the fact that they are at the leading edge of a very new development in the fuels market. GTL Fuel, neat or blended with conventional diesels, has been tested in close cooperation with the diesel experts from the automotive industry who are convinced that it enables better performance, fuel economy and reduced local emissions.

**TESTING GTL ON THE ROAD**

Shell has been conducting a number of trials using GTL Fuel in some of the major cities around the world. These trials have helped to demonstrate the advantages of the fuel in practice and to raise awareness amongst both governments and the public. Each of the trials have tested GTL Fuel in different conditions and in different vehicles, (cars, buses and lorries), and the results of all these trials to date have shown significant reductions in particulate emissions, along with decreases in hydrocarbons and carbon monoxide, at the same time as maintaining engine performance.

Emissions benefits were seen in a trial with 25 Volkswagen Golf cars launched in Berlin by former German Chancellor Schroeder. Results showed that neat GTL Fuel used in unmodified cars provided reductions of 26% in particulates, 63% in hydrocarbons, 6% NOx and 91% carbon monoxide even compared with so-called ‘sulphur free’ diesel. In June 2005, Shell and Volkswagen were jointly awarded one of the tophonours in the world for advancements in automotive engineering and fuel development, the coveted Prof. Ferdinand Porsche prize, following their partnership in the successful GTL Fuel trial conducted in Berlin.

In London, ten Toyota cars operating on 100 % GTL Fuel were loaned to voluntary organisations to use in their every day activities. The vehicles were also equipped with Toyota’s D-CAT emission reduction technology as part of a joint Toyota and Shell research programme that is developing new
vehicle and fuel technologies. This work underlines the way that the advantages of GTL Fuel can be leveraged further when combined with advanced engine technology.

A year-long trial in California, tested GTL Fuel in six trucks with conventional engines as they delivered bottled water. The results showed that even without particulate filters, nitrogen oxide emissions were reduced by 16% and particulates by 23%. Similar reductions have been seen from trials of GTL blends in heavy-duty lorries and diesel-hybrid buses in Japan.

In Shanghai, an Audi A8 using 100% GTL Fuel was one of the class winners of the Michelin Bibendum vehicle challenge. The trial involved a series of driving and emission performance tests carried out on the Formula One race circuit. This provided a powerful illustration to the wider public of the high performance that can be achieved using GTL Fuel. In China, Shell has entered into cooperation with three prestigious universities with the aim of demonstrating the benefits of GTL Fuel and helping find clean energy solutions for Shanghai.

AN ATTRACTIVE, COST EFFECTIVE ROUTE TO LOW EMISSIONS

It is, however, important to be clear that in the short to medium term, GTL Fuel production will be small, up to 3-4% of total diesel demand by 2020, so that crude oil will remain the main source of transport fuel. This means it will be important to target particular markets where GTL Fuel’s emissions performance can offer the most significant advantages.

As the world’s population grows and with it the demand for mobility, as exemplified in China, it is clear that the world’s major cities will face increasing challenges in dealing with local air pollution. There are currently 25 cities, with populations of more than 10 million people (so called mega cities), and 68 more with populations of over 4.5 million. Rapidly expanding mega cities, such as Shanghai and Beijing, currently have high transport emission levels causing significant local air pollution, as well as growing populations and old diesel fleets. GTL Fuel offers one pragmatic way of helping those cities to meet the challenges of providing more sustainable transport. In particular, the flexibility of GTL Fuel means that we could envisage a situation where vehicles could use GTL Fuel in urban driving conditions or on congested highways and then revert to advanced diesel in rural areas where air pollution is less of a problem.

There is real potential to realise further advantages from GTL by working in collaboration with engine manufacturers. Shell is part of a project supported by US Department of Energy that is working to develop a clean combustion engine with DaimlerChrysler, whilst in Japan the government is supporting a project to explore the potential for dedicated GTL engines.

While limited GTL Fuel is available now, its increasing availability will be one element in a rapidly changing and increasingly diverse fuels market. Those changes are being driven by concerns about energy security, environmental impact and economic development and GTL Fuel can play a role in addressing each of these issues. On energy security, GTL offers governments the chance to diversify their energy supplies and in particular to reduce the dependence on oil. With regard to environmental concerns and stricter legislation, both consumers and governments want cleaner fuels, and the low emissions performance of GTL Fuel presents both groups with a very attractive option, particularly in larger cities.

With more volume available in more markets in the short to medium term, GTL can also be seen as part of the synthetic fuels continuum, providing flexible feedstock options such as biomass (BTL) and coal (CTL) as well as natural gas. BTL can significantly reduce CO\textsubscript{2} (by up to ~80%), and CTL can exploit vast coal resources but requires CO\textsubscript{2} management. Identical synthetic products are produced from these feedstocks that can enable the development of advanced engines to fully exploit the homogenous chemistry and premium properties of GTL Fuel. Governments and car manufacturers are showing growing interest in synthetic fuels as a step towards the longer-term goal of high efficiency, low emission hybrid technology or renewable fuels.

To governments, GTL Fuel offers the potential for cost-effective emissions reductions using existing infrastructure and without the need to replace vehicles or make expensive conversions to other alternative fuels such as CNG. To consumers, it provides a premium fuel, with improved performance
including reduced noise levels and emissions, as well as the chance to use an innovative fuel in both heavy-duty buses and trucks and high performance diesel cars. Better still, it can be used in existing engines and refuelling infrastructure.

All these reasons make GTL an attractive gas conversion technology to resource holders, producing a range of products that are attractive to customers. The technology has been proven over a decade of operations, whilst the products have been demonstrated in many countries and vehicle types. This means Gas to Liquids provides an opportunity for significant business growth in the fuels market but also a pragmatic and cost-effective way of meeting the challenge of sustainable mobility.

The 2006 Le Mans race will see Shell V-Power Diesel fuel technology put to the test alongside some of the world’s fastest gasoline-driven cars for what is widely regarded as the world’s toughest motor race. Le Mans is considered by many as the ultimate challenge, where blistering power, engine endurance and unrivalled fuel economy are critical to success. The GTL industry has come a long way. Audi have won 4 of the last 5 Le Mans races and the prospect that they may add another success with a diesel engine car, fuelled by a GTL blend, is exciting for all those involved in both the GTL and the Motor industries.