



The Qatar Shell Gas to Liquids Project

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He was born in Copenhagen in 1946 and joined Shell in 1970 after studying chemical engineering at the Technical University of Denmark. He has had assignments in the Netherlands, the UK, the West Indies, Denmark, Thailand and Saudi Arabia.

In 1998 he joined the project team responsible for building the Rayong Refinery in Thailand and then became Refinery Manager and Executive Director during the first two first years of operation. From 1998 until taking up his present post in 2001 he was Executive Vice President of the Saudi Aramco Shell Refinery Company in Al Jubail, Saudi Arabia.

He is married with two daughters and one grandson.

The Qatar Shell GTL project provides the platform for the growth of an entirely new industry with the GTL Fuels, in particular, opening up opportunities for new markets. The scale of the project presents significant challenges but considerable and rapid progress has already been made. Seismic data has been acquired, appraisal drilling is underway and a range of key contracts have been let. We are confident that the people and processes are in place to ensure that the project will be delivered successfully, with the first phase due to start operation in 2009.

At the first 'Finance and Investment in Qatar' conference which took place in September 2002, I made a presentation on the challenges of 'Developing a World-scale GTL Project'. I am delighted to report on the latest progress in Shell's GTL project which became a reality when the comprehensive Heads of Agreement was signed between Qatar Petroleum and Shell in October 2003.

I intend to cover three broad areas in my presentation. First, I will provide a general introduction to the scope of the project; secondly I will review progress which has already been made and the plans that are in place to ensure its delivery on time and on budget. Finally, I will outline some of the dimensions of the project and discuss some of the challenges arising from its sheer magnitude. The message of this presentation will be similar to that of the last conference but with one fundamental difference: what I say here will be supported by the evidence of the engineering work we have now undertaken and therefore will be firmly grounded in reality.

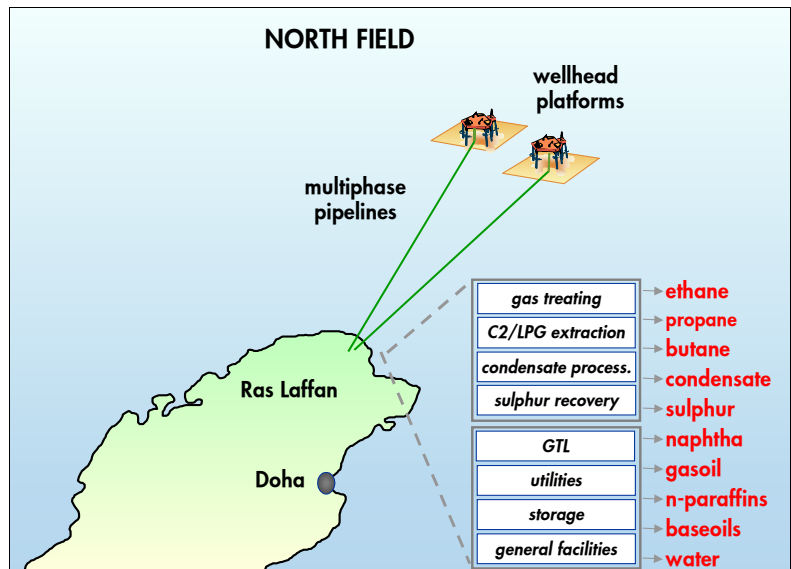
So let me turn to the project essentials. At its heart is the development of an area of the North Field to produce some 1,600 million scf per day of rich gas over the project's lifetime. It is a fully integrated upstream-downstream project that covers all aspects of the value chain which runs from the reservoir to the marketing of the products to consumers.

The project's commercial framework, a Development Production Sharing Agreement (DPSA), takes a novel approach in that it applies not only to the upstream but also to the entire downstream section and is a clear example of the progressive commercial thinking shown by Qatar Petroleum. In

accordance with this DPSA Shell is the 100% investor in the project and the current estimate for the total investment is in the range of \$ 5 billion.

The onshore plant will consist of two parts. The first is a traditional gas plant for the treating of rich, sour gas from the North Field. This will produce substantial volumes of condensate, LPG and, at a later stage when a market in Ras Laffan has developed, ethane. The second part is the GTL plant, which will process the methane-rich gas, turning this into 140,000 barrels per day of GTL products. In addition to the main products of naphtha (for chemical feedstock) and gasoil (the unique GTL fuel) the plant will also produce smaller volumes of specialities, n-paraffins (a precursor to detergents) and lubes base oils, products with unique properties. The construction of the plants will take place in two phases, each of 70,000 barrels per day. They will be constructed 'back-to-back' and completed within about 12 months of each other, with the first starting up in 2009. (Figure 1)

Figure 1: Qatar Shell GTL project overview



The Shell GTL plant is clearly a very attractive and economically robust project in itself, but the importance of the development goes beyond the project as such. It provides the platform for the growth of an entirely new industry, the GTL industry. The unique properties of the GTL products, in particular the GTL Fuels, open up completely new markets. This provides a very exciting opportunity both for Qatar and for Shell, in creating a business which has the prospect of major growth and the delivery of long-term value for years to come.

As I will outline later, it is a project of impressive dimensions. However, in contrast to many other GTL projects, it is based on a tried and trusted GTL technology, which has been in place at Shell's SMDS plant in Bintulu since 1993 and has shown consistently improving technical and commercial performance.

Let me now turn to a more detailed description of the project scope and its dimensions. The offshore section of the project is based on well-known and tested ways of gas production and is relatively straightforward compared to the complex onshore section, although it still presents its own challenges. In each phase of construction there will be a simple steel jacket wellhead platform for the upstream gas production and, since no processing will take place on the platforms, these will be unmanned.

Wellhead fluids will be transported to shore via two 28 inch multi-phase pipelines constructed in carbon steel. Corrosion control is therefore a critical issue and will be based on corrosion inhibitors. Hydrate control, an equally vital issue, will use the state of the art technology of Low Dose Hydrate Inhibitor (LDHI) rather than the conventional MEG injection. While it is now marketed by others, the LDHI technology was originally developed by Shell. Where it is appropriate, Shell will continue to apply the latest technology. (Figure 2)

The onshore plant will be located in Ras Laffan Industrial City. Upwind of the plant there are eight world scale Air Separation Units (ASU), each with a capacity of 3,600 tons per day of high purity oxygen. This is a total of 14,400

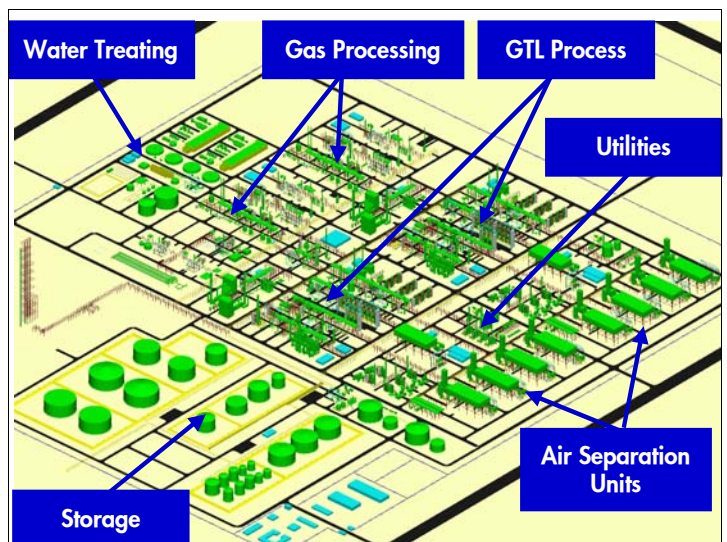
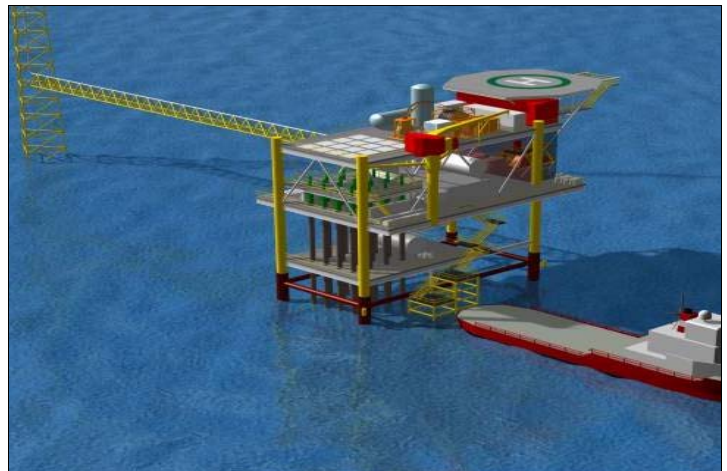
tons per day of pure oxygen, that is the equivalent of the oxygen consumed daily by 70 million humans. Adjoining these, and heavily integrated with the ASUs, is the utilities area with a very comprehensive steam and power system. The ASUs are the main consumers of power, with each of the eight units requiring a steam turbine of 78 MW to drive its air compressors.

At the heart of the plant is the GTL process area with modular sections for syngas manufacturing and the Fischer Tropsch synthesis and almost an entire refinery for the products work-up. Further downwind is the gas processing plant with the slugcatcher, gas treatment, condensate stabilisation and treatment and the sulphur processing. Then there are the water treatment facilities, which alone are a major facility, to produce water of high purity, suitable for irrigation usage, and lastly there are storage areas and various general facilities. (Figure 3)

“The unique properties of the GTL products, in particular the GTL Fuels, open up completely new markets.”

Figure 2:
Offshore platform

Figure 3:
Onshore plant layout



Let me now turn to the progress made to date on the Shell GTL Project. Shell's first proposal was made to Qatar Petroleum in July 2001, a 'Statement of Intent' was signed in February 2002, and the comprehensive HOA was signed in October 2003. Pre-FEED has now been completed and the FEED phase started in March 2004.

I think many will realise that this has required considerable efforts and commitment to allocation of resources. Those efforts will need to be sustained in order to achieve the targeted completion of the Final Development Plan and the Final Investment Decision in the second half of 2005, and then the completion and start-up of phase one of the project in 2009.

We have already seen some really good progress on the ground. This includes the acquisition of 3D seismic data which was completed in 2003 for an area of some 800 km² covering the area of the North Field provisionally allocated to Shell. This was achieved by chartering a vessel already operating in the North Field and given further impetus by the assistance and cooperation we received from Qatar Petroleum. The purpose of acquiring this data was to provide input both into the extensive subsurface modelling which is in progress and to optimise the exact well location for the appraisal well drilling with a view to minimising drilling hazards. (Figure 4)

Let me turn now to the appraisal drilling itself, an activity which obviously could not be started prior to the signing of the HOA. However, with the first well spud on 14th February 2004, the preparation for this work, something which under normal circumstances could take up to a year, was completed in less than four months. That included putting in place all the systems and procedures, including the well completion design and testing programmes and some forty procurement and services contracts, all of which needed approval in a joint Qatar Petroleum/Shell Tender Committee.

One of the largest contracts was for a drilling rig. Shell managed to contract the ENSCO 96 rig which had already been used to drill in the North Field. To date

it has drilled to a depth of some 2,500 feet, having completed about a quarter of the well. (Figure 5)

This first well is a 'Data Well' with the purpose of confirming the gas compositions assumed in the design and used as a basis for assessing the economics of the project. This well will later be converted into a development well. The second well will delineate the area and will later be abandoned.

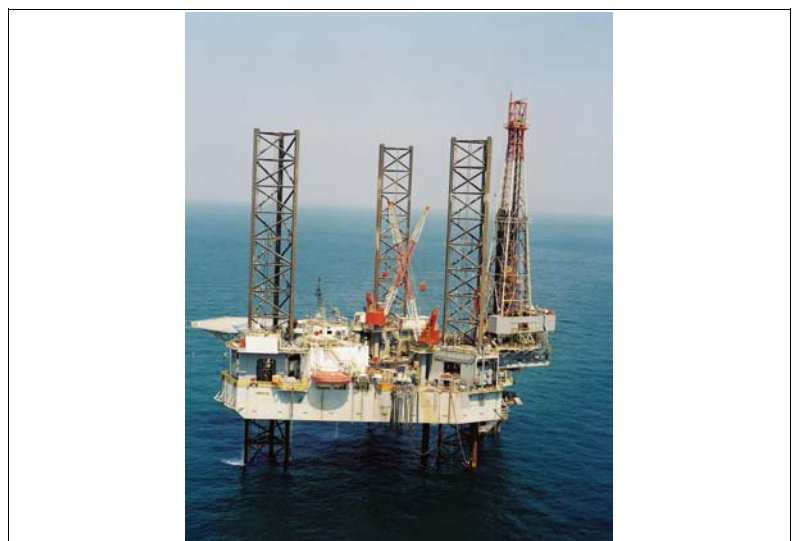
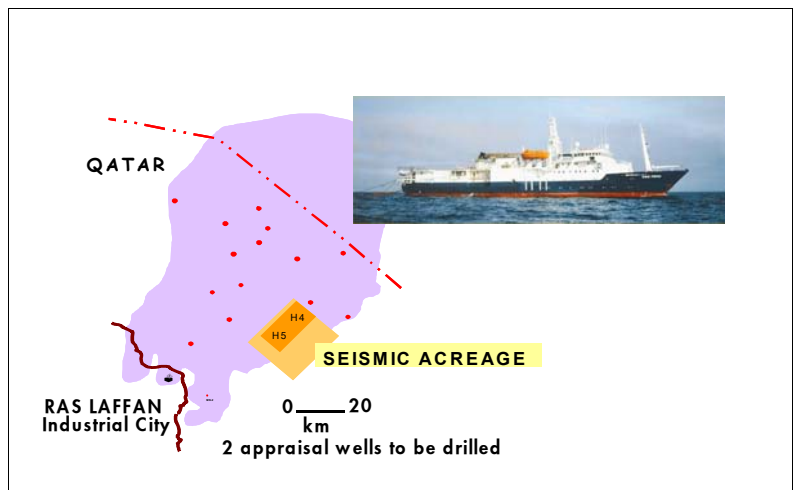
I would like to briefly outline the FEED contract which was announced on 9 March 2004 with JGC of Japan. This means that the pre-FEED phase, a major effort in itself, has already been completed and will form the basis for the Preliminary Development Plan which is shortly to be submitted to Qatar Petroleum.

The FEED work will mainly be carried out through JGC's joint venture with KBR – MW Kellogg – in their offices located in Greenford in the UK.

"We have already seen some really good progress on the ground."

Figure 4: 3D seismic acquisition

Figure 5: Appraisal well drilling



Minor elements in the contract will be undertaken in JGC's office in Yokohama and in KBR's office in Houston.

The scale of the FEED is considerable. It will require almost half a million man-hours, at its peak involving some 250 contractor staff and will last a total of 14 months. It is estimated that the main element, the Project Specification, will consist of no less than 120 large volumes, containing some 650 Piping & Instrumentation Diagrams (P&IDs), and some 800 uniquely engineered packages.

In line with Shell's Project Management best practice, considerable efforts will be made to ensure this document is comprehensive and of the highest quality. Ensuring the highest standards in project specification is one of the most crucial factors in the success of a project, in ensuring that it will be delivered on time and on budget.

For this reason Shell has set up a strong project management team for the FEED phase. This is an integrated team covering both the offshore and the onshore FEEDs and involves just over 100 full time Shell project staff, with more than another 130 staff in various support function roles in the technical headquarters in the Netherlands.

All the comments I have made so far underline that this is clearly a big project, as big as some of the world's largest oil refineries and petrochemical complexes. Shell has certainly built projects of these dimensions before but this will be by far the largest such construction ever undertaken in Qatar. We are confident that we have the people and processes in place to ensure that it can be delivered successfully.

Let me focus now on some of the dimensions of the construction work. The plot size is 1.6 by 1.4 km or 230 hectares, more than 450 football fields. The total number of items of equipment is 2,300, weighing approximately 100,000 tonnes, some four to five times as much as that required for a two train LNG plant. The volume of concrete is five times that used for the CN Tower in Toronto, the tallest building in the world.

A similar story can be told for most of the other elements in the construction of the plant, from quantities of steel, to

cables to insulation and control loops. (Figure 6)

So why are such large quantities needed to manufacture these 140,000 barrels per day of GTL products? The answer is basically rooted in some of the fundamentals of the process. The syngas manufacturing and the FT synthesis are both extremely exothermic. They release some 5,000 MW - five GW - of process heat, while at the same time requiring some 1,100 MW in shaft power and nearly 900 MW in direct heat consumption. Steam is the medium chosen to close this loop, resulting in a steam generation level of about 8,000 tons per hour.

It is also interesting to note that the plant applies large catalyst systems in five processes requiring a total of some 5,600 tons for a first fill. Of this, the FT catalyst is by far the largest at 4,800 tons, with an active surface equivalent to the surface of the whole of England. All this has to be checked as part of the commissioning during which we estimate there will be more than two million checks to be ticked off. The first drafts of the detailed commissioning and start-up plans are already being prepared and have identified no less than 15,000 discrete activities. That is a daunting task but one for which Shell has a well proven system, the 'Flawless Program' which will be applied rigorously.

All in all this presents some significant challenges but those challenges can be managed by detailed early planning and identification of risk.

The project applies a classical risk management system with all the usual steps of identifying, assessing and responding to risks. In itself this is not

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Figure 6:
Onshore project dimensions

Project Dimensions	
Process	
Process heat release	5,000 MW
Shaft power consumption	1,100 MW
Heat consumption	850 MW
Steam generation	8,000 tons/hr
Catalysts (5 processes)	5,630 tons
Construction	
Plot area	230 ha
Equipment number	2,300 items
Equipment weight	100,000 tons
Piping	50,000 tons
Structural steel	30,000 tons
Concrete	200,000 m ³
Cables	1,800 km
Insulation	700,000 m ²
Control Loops	4,000
Heavy lifts	> 1,200 tons >24
Start-up	
Commissioning checks	> 2 million
Comm. & start-up activities	~ 15,000

necessarily sufficient to meet the challenge of risk management. It needs to be applied with a high degree of discipline and rigour across all areas of the project, the technical as well as non-technical, and across the entire organisation through all phases of the project.

We have chosen the DNV 'EasyRisk' web based tool to help us manage this challenge but its success will depend on the 'risk culture' we manage to create. This should not engender a risk averse attitude but encourage an open minded approach to risk identification and the understanding of risk response. This is the subject of much management attention in this early phase of the project.

Many of the major implementation risks in the project risk register are quite obvious and related to external factors, most notably that of 'concurrent projects'. The sheer scale and number of projects underway in Qatar presents real challenges. Huge levels of investment is planned over a relatively short period of time and this will require equally significant levels of materials such as cement, rebar, structural steel, piping, cabling, equipment. All these will need to be imported into Qatar and transported to the construction sites, presenting a major logistics challenge to Qatar's infrastructure.

In terms of port facilities for dry cargo imports Ras Laffan is already today experiencing limitations due to the priority given, for obvious reasons, to the export of hydrocarbon products. Doha Port has its own limitations as well and, already, the requirements of the Shell GTL project in isolation look like placing a heavy burden on those facilities for a two years period. Clearly this is an issue where there are needs, and opportunities, for significant investments in Qatari infrastructure.

Similarly there are questions related to the overall capacity, and risk capacity, of the EPC contractors and subcontractors, the availability of skilled labour and field supervision as well as a question mark over possible immigration

restrictions. This means there are a number of issues which will need much more analysis and, in several areas, active coordination and planning, working together with the Qatari authorities.

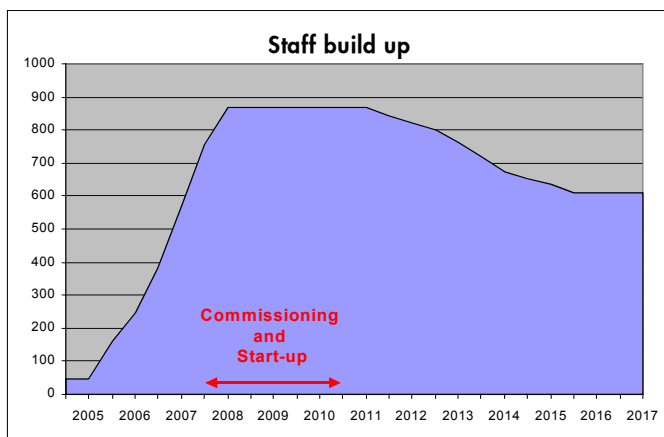
Having so far mainly spoken about project implementation and technical challenges, I will now turn to the competences and skills required for a successful implementation of an integrated world scale GTL plant. These range from upstream skills, to basic GTL R&D and technological capabilities, and a variety of skills in project implementation disciplines, as well as a broad spectrum of commercial expertise.

Responding successfully to this unique GTL challenge will need a closely coordinated, integrated approach to the resourcing and management of the total enterprise, presenting an organisational challenge. Shell has already made several studies in this area and established a framework for a human resources implementation plan. Central to this plan is an organisational study, which has set out proposed manpower numbers and structures based on extensive knowledge Shell has built up through benchmarking work over many years.

Manpower numbers are projected to peak at 900 staff around the time of start-up of phase two. This will gradually reduce to a level just above 600 as experience is built up and authority is delegated through a lean, flat organisation as it moves from an initial functional organisation to a production unit based organisation. (Figure 7)

“Responding successfully to this unique GTL challenge will need a closely coordinated, integrated approach to the resourcing and management of the total enterprise.”

Figure 7:
Organisational challenges



While this is not common practice in Qatar, we nevertheless believe it is an achievable plan, provided that underlying organisational principles are installed as paradigms from day one.

Shell is fully committed to Qatarisation and the stated targets of 50% Qatarisation within 5 years, although this will clearly also be an area where there are potential constraints, given the many concurrent projects referred to earlier. Shell is already fully engaged with Qatar Petroleum's HR department on sourcing and training questions and has agreed a forward plan.

This involves the recruitment and training of young Qataris for technical and operations jobs from 2005. At the same time the first Qataris have already

been recruited and the first Qatar Petroleum staff assigned to the Shell GTL organisation.

So let me conclude by restating some of the key features of the project. We have already seen sustained progress in many areas and the resources are in place to ensure this progress is maintained through to completion. While the project is of huge dimensions, and poses many challenges, those challenges are manageable but will require continued investment in Qatar's infrastructure to deliver this and other projects.

Finally, as the first world-scale GTL plant, it is more than just another project. It signifies the birth of an exciting, entirely new growth industry based on unique products and it will deliver long-term value for both Qatar and Shell.

“[the GTL plant] signifies the birth of an exciting, entirely new growth industry .”
