ORYX GTL

How Technip delivered Middle East’s first GTL plant
In March 2003, the ORYX GTL project was launched at Ras Laffan to build a world-class “first-of-a-kind” GTL plant based on the Sasol Slurry Phase Distillate\textsuperscript{TM} (SPD\textsuperscript{TM}) technology. The ORYX GTL plant includes:

- **3 core technology units:**
  - Synthesis-gas production (Haldor Topsoe)
  - Fischer-Tropsch (FT) synthesis (Sasol)
  - Product work-up (Chevron)

- **Ancillary process units:**
  - Reaction water treatment
  - LPG clean-up
  - Air separation
  - Hydrogen production
  - Heavy ends recovery

The complex also includes the full production and distribution of utilities (water, steam, power), thorough effluent treatment to match the high environmental standards of Qatar, product storage and ship loading facilities.

**A large-scale second-generation GTL plant**

The ORYX GTL complex has positioned Qatar as the leading producer of synthetic petroleum products made from natural gas. The plant converts gas from the North Field into high value, low-sulphur environmentally friendly diesel, naphtha, and LPG.

GTL is a new way of bringing natural gas energy to the market, enabling gas-rich countries to strategically diversify their gas monetisation options.

GTL products from ORYX have superior environmental characteristics, producing ultra-low emissions during combustion compared to conventional products from oil refineries.

The high quality gas-derived products are easily sold on an almost unlimited market.

**The first GTL plant in Qatar**

- **Client:** ORYX GTL Ltd.
  (JV 51% Qatar Petroleum – 49% Sasol Synfuels International)
- **EPC Contractor:** Technip
- **Lumpsum turnkey contract awarded in March 2003**
- **Conversion of natural gas into liquid hydrocarbon products (34,000 bpsd of GTL Diesel, Naphtha and LPG)**
- **Utility systems started up in December 2005**
- **Process unit commissioning from August 2006**
- **On-spec GTL products to storage in January 2007**

The ORYX GTL Project was implemented in two phases - the EPC project and technological improvement following startup -, and was managed by our Rome office, one of Technip’s main operating centres.
ORYX GTL plant: project scope

Rising EPC costs and resource shortages in construction, logistics and procurement were the real challenges in implementing the ORYX GTL project, a large and technically complex project.

The EPC lumpsum contract was awarded at the end of 2002 and came into force in March 2003.

Technip’s contract scope included: engineering, procurement and supply of equipment and materials, construction, commissioning, start-up, initial operation and performance testing of this grassroots GTL plant.

Engineering activities specifically focused on safety, constructability, operability and environmental impacts.

Technip successfully completed this large project by leveraging its 50-year experience in hydrocarbon processing project execution.
The project’s main challenges

For plant handover purposes and to manage the interface between construction and commissioning, the plant was divided into 229 systems, each having the following certified steps:

- Construction Completion (CC)
- Ready for Commissioning (RFC)
- Ready for Operation (RFO)

The industry’s leading vendors and erection contractors were engaged considering the size of the main equipment (diameters up to 10 m, lengths up to 60 m, weights up to 2,000 tonnes), and piping and the complexity of the plant’s civil structures.

Piping pre-fabrication was extensively used and exceeded 4,500 tonnes. Extensive use was made of reinforced pre-fabricated concrete structures, as more cost-effective given the type of resources available locally.

A significant amount of instrumentation was installed to guarantee proper plant performance. The overall number of control and safety valves approached 1,500 units. Technip designed the DCS, MMS and SIS systems to meet the highest safety standards as well as the highest on-stream factor.

The large amount of cooling needed and the absence of available cooling water led to many air coolers. The procurement of this equipment was a critical step in the project execution, as it saturated the supply capacity of air-fin exchanger manufacturers worldwide.

The main quantities reveal the large size of the ORYX GTL plant:

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant area</td>
<td>72 hectares</td>
</tr>
<tr>
<td>Equipment</td>
<td>1,650 pieces</td>
</tr>
<tr>
<td>Concrete</td>
<td>63,000 m³</td>
</tr>
<tr>
<td>Steel structures</td>
<td>8,000 tonnes</td>
</tr>
<tr>
<td>Piping</td>
<td>12,800 tonnes</td>
</tr>
<tr>
<td>Equipment</td>
<td>26,000 tonnes</td>
</tr>
<tr>
<td>Instrument cables</td>
<td>1,200 km</td>
</tr>
<tr>
<td>Electrical cables</td>
<td>500 km</td>
</tr>
</tbody>
</table>
Major success factors

- Involvement of Technip’s construction and commissioning experts in plant design from day one.
- Careful planning of each phase of the project, with a particular focus on start-up which was under Technip’s complete care and responsibility.
- The existence of a proactive and fair dialogue between the Owner, Licensor and Contractor.
- Home office Project Team organised as a task force.
- Use of highly experienced staff and specialised vendors.
- Quick release of purchase orders for the Fischer-Tropsch reactors and other long-lead items.
- Direct management of plant finishing works and punch-list clearance by Technip’s construction teams (direct hire).
- Prompt personnel recruitment for plant start-up and operation ensuring proper training, both at site and at similar industrial plants.
- Strong support from Sasol for expertise in plant operations.

Excellence Award 2010 - Project rewarded by IPMA (*) for the mega sized-project category.

(*) International Project Management Association
A complete HSE program was set up, including:

**Procedures**
- Permit to work (PTW), with certified personnel
- Lock out – Tag out (LOTO) procedure

**Training**
- Site HSE induction
- Distribution of a safety booklet to each member of the workforce
- Confined space entry
- Working at heights
- Commissioning
- Pre-start-up safety training, including Quantitative Risk Assessment per unit

**Sustainable Development initiatives**

**Environment**
Development of pollution control policy including:
- Low NOx and SOx emissions with continuous monitoring and control
- Closed drain systems to prevent soil contamination
- Waste water treatment unit to upgrade reaction water up to irrigation water quality (irrigation of 2 hectares of land newly planted with trees), cooling water quality and demineralised water quality
- Waste management, recycling of wood, metals, and plastic

**Employment of local workforce**
Wherever possible, use was made of local skills for example in workshops, and for maintenance and transportation activities.

**Traditions**
The work was carried out in the respect of local traditions and holidays.