Gas-to-Liquids
Jet Fuel development

An update on progress of the Synthetic Jet Fuel Consortium

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Overview of Qatar

- Land area 11,000 km²
- 1.5 m people, ≈≈20% are Qatari
- Qatar's proven natural gas reserves stood at 910 trillion cubic feet (Tcf).
- 15 percent of total world reserves and the third-largest in the world.
- Most of Qatar's natural gas is located in the massive offshore North Field.
- the largest exporter of LNG in the world.
Qatar Growth Enabler: Energy

- State-owned Qatar Petroleum (QP) controls all aspects of Qatar's oil sector.
- Qatar Petroleum (QP) have paid GTL projects significant attention over the last several years. By 2012, Qatar is likely to have 177,000 bbl/d of GTL capacity at two facilities: the Oryx GTL plant & the Pearl GTL project.
- In 2003, QP and Sasol formed Oryx GTL, world's first commercial-scale GTL Plant with the capacity to produce 34,000 bbl/d of low-sulfur & high-quality liquid fuels.
- In 2007, QP and Shell formed Pearl GTL company. 140,000 bbl/d GTL liquids from end 2010.
Qatar Growth Enabler: Energy

- Qatar Fuel (WOQOD) distributes petroleum products manufactured by QP.
- Public share company 60%, QP 40%.
- Q Jet, a subsidiary of WOQOD, supplies aviation fuels to more than 35 international airlines at Doha International Airport.
- The new Doha International Airport will have an annual passenger capacity of 24M which is projected to grow to 50M by 2015.
- Qatar Airways has one of the youngest fleets globally and flies to 90 destinations. Current fleet size 65 aircraft, planned to reach 110 by 2013.
Fully integrated project “from reservoir to market”.
Development & Production Sharing Agreement.
QP 70%, Shell 30% + Pearl project Operator.
1,600 MMscf/d well head gas
140,000 b/d capacity for GTL products.
120,000 boe /d upstream products.
Phase I 70,000 bbl/d -2010
Phase II 70,000 bbl/d -2011
Synthetic fuels can meet the technical challenges of today and tomorrow.

- Synthetic fuels can be produced from Gas, Coal and Biomass.
- Synthetic fuels are cost effective as they are compatible with the fuel infrastructure and drive trains of both today and tomorrow.
What is Gas to Liquids (GTL)?

Conversion of natural gas to clean, high quality products, using proven technology and >10 years commercial experience.
What is Gas-to-Liquids jet fuel?

- Liquid kerosene fuel derived by synthesis of Natural Gas via the Fisher-Tropsch process
- GTL contributes to the ‘Diversity of Supply’ of jet fuel to the aviation industry by creating a performance fuel component from non-crude oil feedstock
- The GTL kerosene is used in a blend with conventional Jet fuel
- The GTL Jet fuel component is Sulphur free and has no aromatics
  - Excellent freeze-point
  - High energy content (per unit weight)
  - Good combustion and emission properties (local air quality)
- Life-cycle analysis shows that the CO2 footprint of a GTL-plant is similar to a modern complex refinery
Fuel composition

Gas-to-Liquids Jet

Typical UK Jet A1

C number | Chemical type
---|---
n-P | iso-paraffinic
i-P | n-paraffinic
N | naphthenic mono-aromatic
DiN | di-naphthenic
MoAr | aromatic
NmoAr | di-aromatic
DiAr | di-aromatic

Gas-to-Liquids Jet Fuel development
ICAO Workshop Montreal 10-12 Jan 09
Potential use of GTL Kerosene in Jet Fuel

- Opportunity to use GTL Kero as blend component for jet fuel in aviation
  - Blend ratios from 35% up to 50% GTL Kero are being tested

- GTL Kero can potentially offer the following benefits:
  - Improved engine performance from better thermal stability thus permitting hotter engines
  - Virtually zero aromatics which leads to reduced soot emissions – less contrails and improvement in air quality
  - Potential fuel economy (higher specific energy, lower density), improvement in payload range

- Business case to be developed
  - BOD for anti-oxidant additive injection equipment at Pearl (w.i.p.)
  - Product approval targeted for 1st half 2009 (see slide)
  - Complex logistics – supply chain (see slide)

- Potential customers
  - Airports in GCC countries
  - Mega-City airports with air quality issues (e.g. London City airport)
Supply-Chain: GTL Kero to GTL Jet blend

Primary Supply

Pearl GTL (Ras Laffan)

Product Importation

GTL

“GTL” Jet fuel

Terminal/Refinery

For Storage & Blending (up to 50/50%)

Price FOB Ras Laffan

Freight (RLC to Terminal)

Transport to Airports

Airport

Transport to Airports

Driving energy

Gas-to-Liquids Jet Fuel development
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QP & Shell to become largest producer globally of GTL fuels around the end of the decade.

QR and partners studying potential benefits under November 2007 agreement.
Successful trial on 1st Feb 2008 of GTL Jet fuel blended with conventional kerosene used on Airbus A 380 test flight from Filton, UK to Toulouse, France.
Consortium research programme

GTL jet fuel programme
To fully quantify GTL impact on:
- The global environment
- Local air quality
- Fuel burn

Performance
- Quantify fuel effects on Payload/Range performance
  - Airbus, Qatar Airways

Combustion
- Quantify effects of fuel composition on altitude relight, emissions
  - Rolls-Royce

Properties
- Assess fit-for-purpose props, compatibility, thermal stability
  - Qatar Petroleum, Shell, WOQOD

- The programme will assess:
  - Performance (payload/range)
  - Combustion (operational & emissions)
  - Properties (compatibility & thermal stability)

- Research carried out in leading institutes in Europe & Qatar Science & Technology Park

- Programme investigates properties of modular paraffinic fuels and therefore applicable to a wide range of alternative fuels – not only GTL
Fuel approval status

- Significant progress on 50/50 blend clearance of Fisher-Tropsch fuels in global specifications:
  - ASTM D 1655
  - DEFSTAN 91-91
- Exhaustive research report defines compositional envelope based on suite of 5 FT fuels
- Consortia partners actively support the CAAFI (FAA-led) and UK AFC certification efforts
- ASTM ballot flagged only minor comments and full approval of 50/50 FT semi-synthetic fuel widely expected by June 2009
Next Steps

- Continue to support Fisher-Tropsch approval for commercial aviation via agreed industry protocols (CAAFI, ASTM, & DEF-STAN)
- Commercial GTL flight by Qatar Airways once approval is in place
- Additional testing and investigation within the Qatari consortium to fully quantify synthetic fuel impact on:
  - The global environment
  - Local air quality
  - Fuel burn
- Publication of research findings to benefit wider industry and broad range of synthetic alternative fuels and inform future specification setting efforts
Thank You