
Gas to Liquids (Fischer Tropsch Diesel) Supply and Economics

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Shell GTL - Shell Middle Distillate Synthesis

1973: First R&D
Ultra clean, water-white products



1983: Pilot plant in Amsterdam



1993: 12,500 bpd commercial-scale plant in Bintulu, Malaysia



Commercially proven technology

Ready for large-scale applications



Many Players are developing GTL Projects



ExxonMobil

Where?

- Most of the development activity is focused on the Middle East

When?

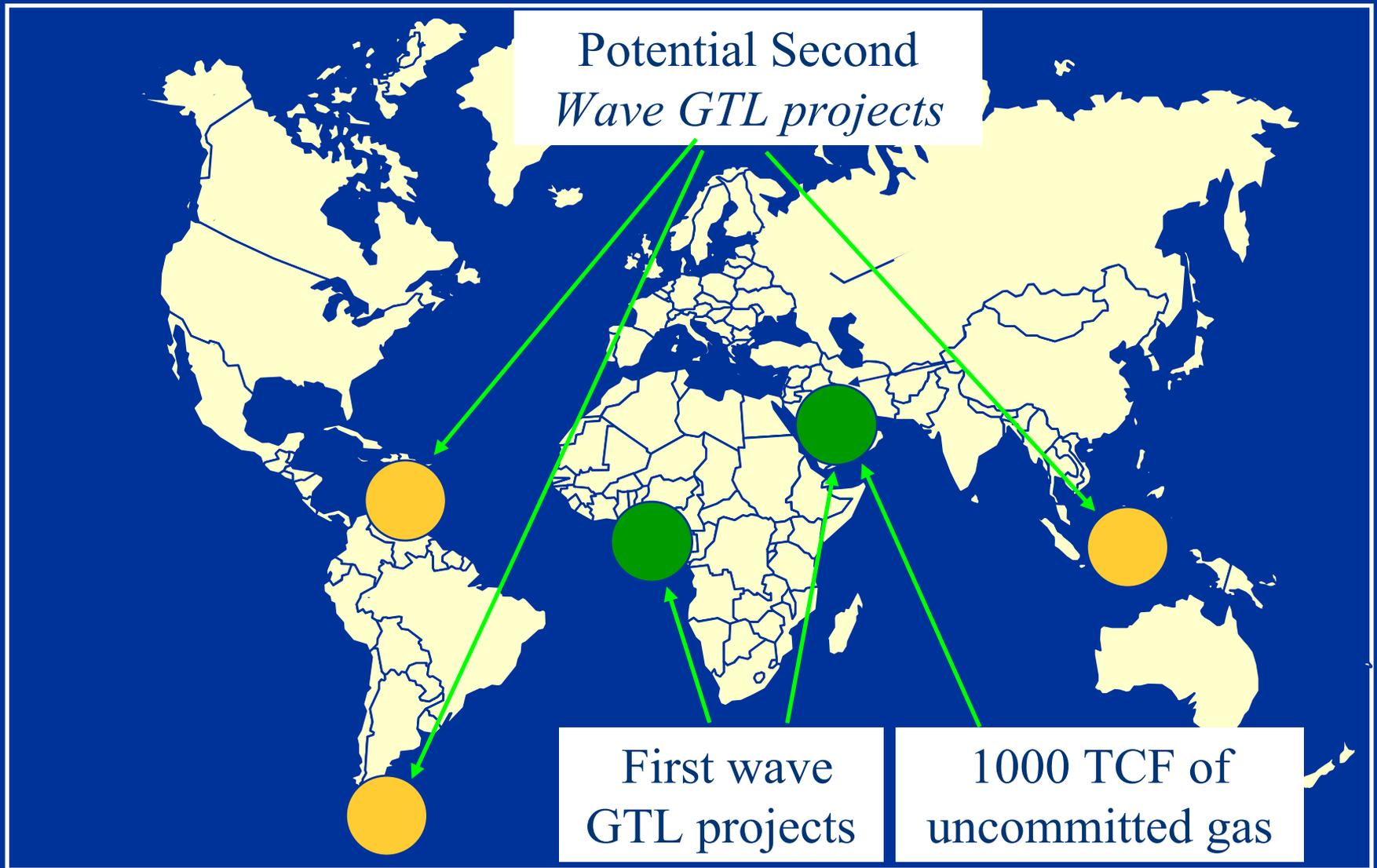
- The first large-scale GTL plants will start production towards the end of this decade

How much?

- 10 large scale GTL plants by 2020 is a reasonable estimate. The output from these plants will meet
 - ~2.5% of world diesel demand,
or
 - the diesel demand of the US West Coast,
or
 - ~10% of the diesel demand of OECD Europe



GTL Fuel is made from "Stranded" Gas Reserves

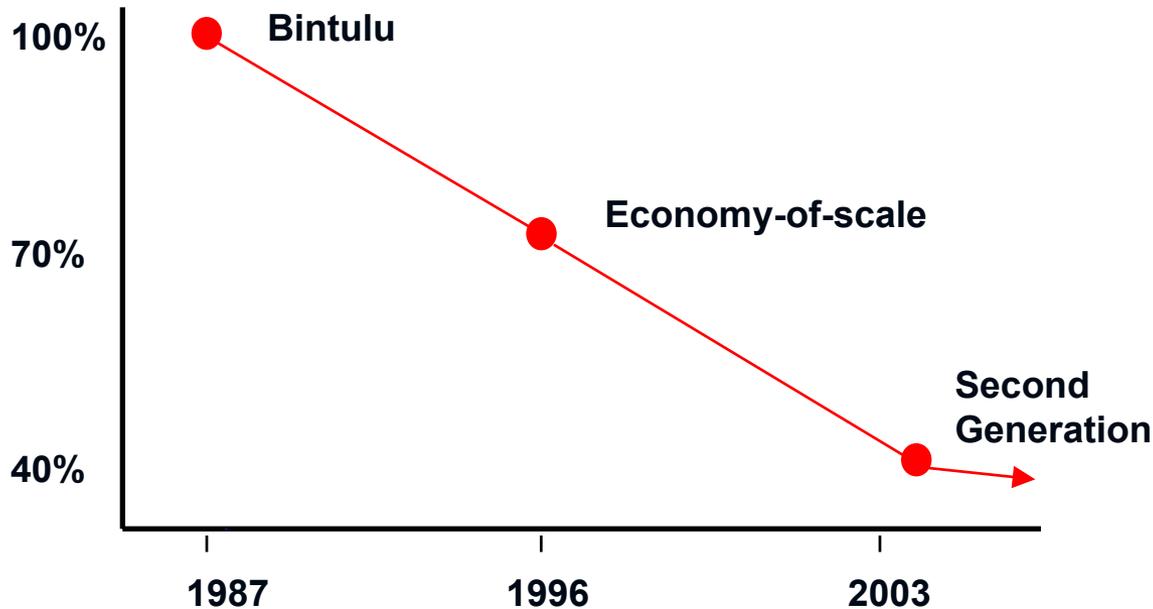


Possible Markets for GTL fuel ex Middle East



Economics of GTL Projects

GTL Plant Unit Capex
(US\$/bpd capacity)



Issues

- Complex
 - Technology
 - Project Execution
 - Operations
 - Marketing
- Capital Intensive

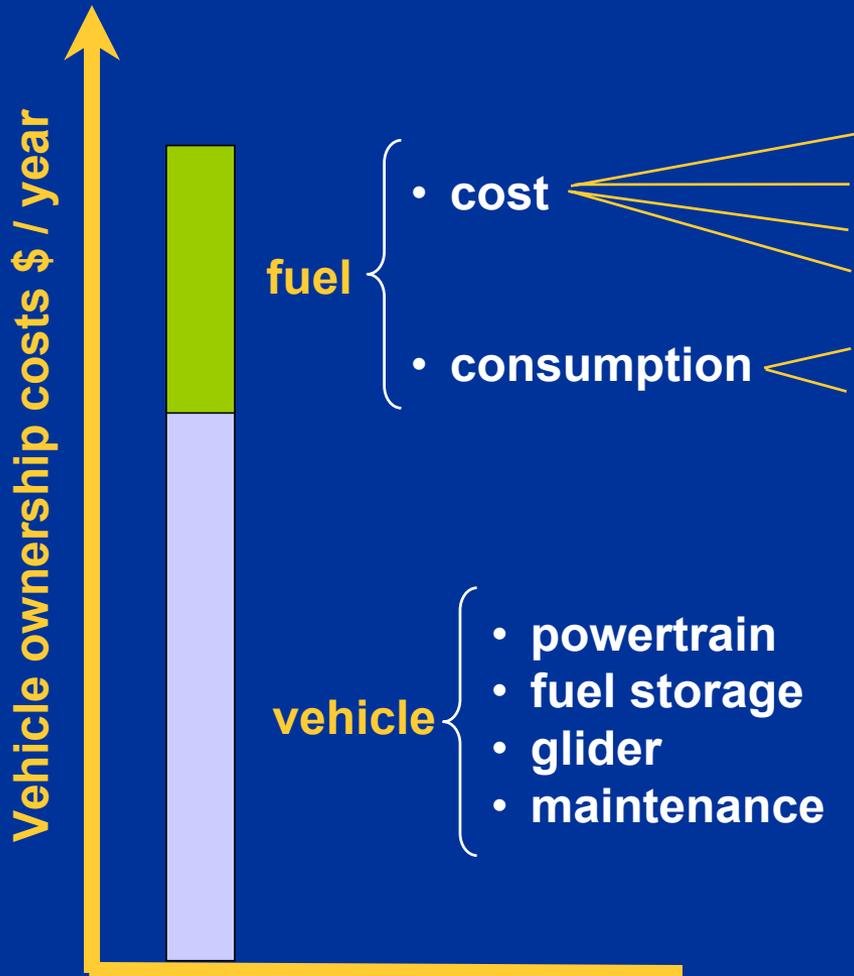
Critical Success

Factors

- Low construction costs
- Low gas production
- Limited alternative gas usage
- Support for plant investment



Different fuel-vehicle combinations can have significantly different costs



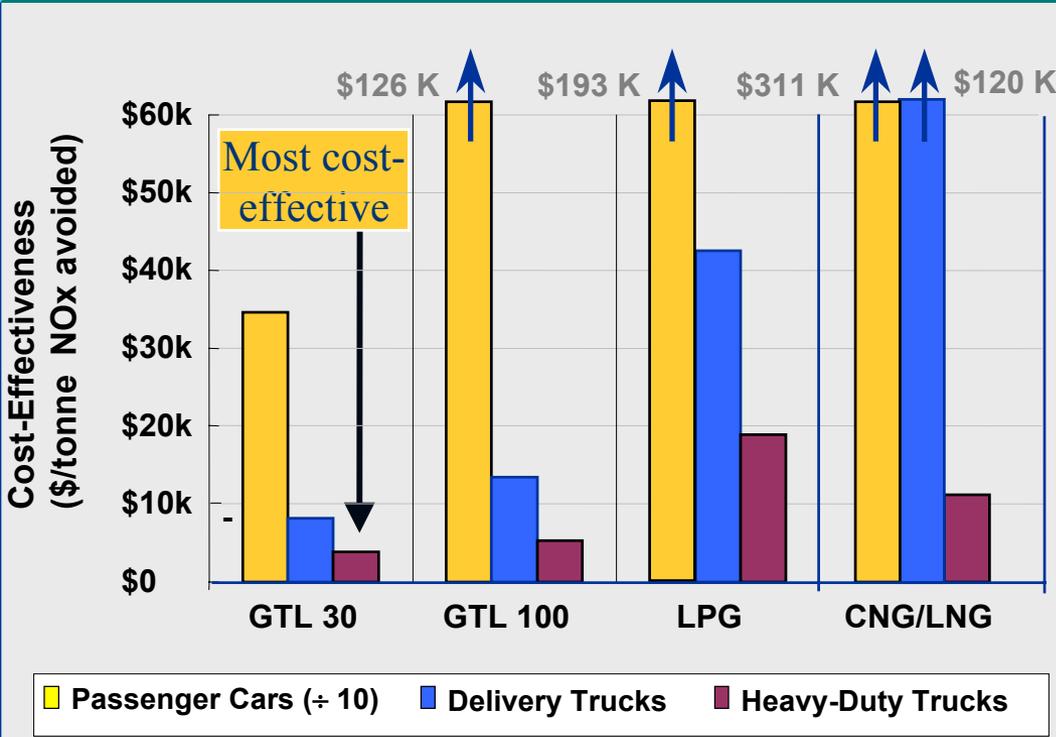
Vehicle ownership costs, compared to conventional fuelled vehicles

vehicles	GTL	CNG
plant		
transport	↑	↑
storage		
fuel station		↑↑
vehicle mileage		
fuel economy		
powertrain		↑
fuel storage		↑
glider		
maintenance		↑



GTL fuels are more cost-effective in reducing emissions than other alternative fuels for a range of vehicle types.

NO_x Cost-Effectiveness of Fuel-Vehicle Combinations for 2002



Relative to CA Diesel

GTL 30 results in the biggest tonne emission reduction per dollar

- Lower implementation cost of GTL fuel options more than offsets more modest emissions reductions
- GTL 30 is the most cost-effective
- Better cost-effectiveness can lead to significant impact on emissions inventory:
 - Low cost affords implementation for large fraction of vehicles
 - Net result is high overall absolute impact, if sufficient GTL diesel were available in California
 - Importance of consumer



Cost-effectiveness Study USA

Recent independent WTW study performed by TIAX:

For 2002:

- GTL fuels offer significant reductions in criteria pollutants
- Other gas-based fuels can achieve greater reductions (per vehicle), but the cost impact of using GTL fuels is significantly less
- GTL fuels are (several times) more cost-effective for reductions in criteria pollutants

For 2010:

- GTL fuels will continue to be the most cost-effective option for reductions in criteria pollutants from **existing engines**
- Emissions will be strictly controlled and all **new engines** will have similar emission levels, eliminating the environmental drivers for CNG / LPG
- GTL provides the potential for further benefits from new, highly efficient engines



GTL Supply and Economics - Conclusions

- the first wave of large scale GTL plants is likely to commence production towards the end of this decade
- a reasonable estimate of scale is 10 large scale GTL plants in production by 2020
- output from this number of plants would meet ~2.5% of world diesel demand, but could have a significant impact on local demand
- the cost of GTL fuel (Fischer-Tropsch diesel) will be slightly higher than that of conventional diesel
- however GTL fuel is more cost effective than other alternative fuels in reducing criteria pollutants

