Shell. The evolution of movement continues



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Shell fuels







Road transport fuel



Broad fuel portfolio



Marine fuel



Technology leader



Largest retail network



Aviation fuel



Industrial and specialist fuels

Liquid hydrocarbons have fuelled movement for over 100 years. Fuels have evolved to meet increasing demands of consumers and society...



- High energy density
- Wide range of products
- Technology and infrastructure established
- Cost-effective



Additive technology:

- Improve performance
- Greater flexibility





Cleaner road transport fuels have enabled the introduction of cleaner vehicle technologies Over the last 100 years, Shell has driven fuel technology to move the development of fuels forward...



The Energy Challenge:

How can we meet the growing demand for secure energy in an environmentally and socially responsible way?



Over the next 100 years, energy policy is expected to drive the diversification of the fuel mix to help meet the Energy Challenge

Energy policy drivers: '4 Es':

- Energy security
- Economic development
- Environmental impact local emissions and CO₂
- Ease of implementation



For road transport fuels:

- Petrol and diesel will become cleaner and will continue to be the principle transport fuel options for the foreseeable future.
- Synthetic fuels and biofuels will become increasingly important, mainly as blends with petrol and diesel
- Hydrogen has the potential to be a viable fuel option in the longer term.

Cleaner gasoline and diesel will continue to help lower local emissions but there are still CO_2 challenges to be tackled

Key challenges:



Air quality

- Ongoing phase-down of sulphur levels in gasoline and diesel will continue to help the introduction of cleaner vehicles around the world
- UN and World Bank initiatives to improve air quality in developing countries
- Use of advanced blending components such as Gas to Liquids



- Increased use of bio-component blends
- Improved refinery efficiency
- Energy companies and auto manufacturers to work together to maximise fuel efficiency and optimise the engine combustion process
- Innovative fuel additives could help reduce fuel consumption and lower CO2 emissions

CNG and LPG are niche fuels that can offer some air quality and CO₂ benefits



- Local emissions from CNG and LPG are similar to those of modern gasoline vehicles
- Lifecycle CO₂ emissions from modern LPG and CNG vehicles are around 15% lower than modern gasoline vehicles
- Gaseous fuels require vehicle modification and infrastructure changes/development
- Gas to Liquids (GTL) Fuel is also made from natural gas and is easier to implement than CNG since it can be used in diesel vehicles without modification



Gas to Liquids (GTL) Fuel – can reduce local emissions and be used in today's infrastructure

- Cleaner-burning synthetic fuel made from natural gas
- · Can be used in today's infrastructure and diesel vehicles
- Lower local emissions can help tackle air pollution in cities
- Lifecycle CO₂ from GTL system comparable with refinery system
- Identical products can be made from biomass (BTL) and coal (CTL)

Local emissions from GTL Fuel compared with conventional diesel





Source: ASFE

Emissions benefits vary depending on vehicle type and technology level Emissions reductions for light duty diesel engines Shell has been a GTL leader for over 30 years and we're investing to deliver even greater benefits in the future



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- At forefront of GTL technology for over 30 years
 - Proprietary technology throughout production process
 - Opened Bintulu GTL plant in 1993
 - Building world's largest GTL plant in Qatar



Investing in R&D to reduce CO₂ production
– Future generations of GTL plants could produce 30% less CO₂



- Bringing the benefits of GTL Fuel to our customers
 - Shell fuel containing GTL Fuel available at ~4000 service stations in Europe and Asia
 - Winning technical partnership with Audi

Biofuels can help to reduce CO₂ production and improve energy security

- Made from biomass
- Generally produce less CO₂ over life-cycle compared to gasoline/diesel
- Vary by feedstock, manufacturing process, CO₂ production and cost: first and second generation
- Can be used in today's vehicles at low concentration blends with petrol/diesel



Shell is a leading distributor of first generation biofuels and we're investing in second generation biofuels that offer greater benefits...

200



- Distributed biofuels for over 30 years
- A leading biofuel distributor today
- Sold over 3.5 billion litres biofuel in 2006 – enough to avoid ~3.5 million tonnes CO₂



Shell is investing in R&D and bio-technology companies to commercialise second generation biofuels...





Bio-component W2W CO₂ production First generation 50% Secon



Source: EUCAR / JRC / CONCAWE

Cellulose Ethanol from straw

Biomass to Liquids (BTL) from woodchips

Biomass to Liquids - using GTL technology for biomass

- Biomass to Liquids (BTL) Fuel is identical synthetic product to Gas to Liquids (GTL) Fuel
- BTL offers significant reductions in local emissions as well as significant reductions in W2W CO₂ production
- Shell's leadership in GTL and BTL is widely recognised



In 2005, Shell and Volkswagen scientists were awarded the **Professor Ferdinand Porsche Prize** for advancements in automotive engineering for their work in GTL and BTL development.

Right: Dr Wolfgang Warnecke (Shell) Left: Dr Wolfgang Steiger (VW) In the longer term, hydrogen offers the potential to dramatically reduce emissions and increase energy security

- Most efficiently used in fuel cell vehicles
- Flexible sources of hydrogen can increase energy security
- Zero local emissions
- · Requires new infrastructure and vehicles





Hydrogen Production

Lifecycle CO₂ production depends on hydrogen source and manufacturing process

Shell is an early leader in hydrogen, with a clear strategy towards commercialisation

- Only energy company building hydrogen infrastructure in USA, Europe and Asia
- Four hydrogen demonstration projects
- Working to develop mini-networks
- Challenges: production/distribution costs, production process CO₂

Infrastructure development





Washington DC - combined petrol/hydrogen filling station



Iceland – initiative to transform Iceland into hydrogen economy

No single fuel will meet all '4 Es' this century

vehicle infrastructure)

(supply &

Ease of Implementation

- but a broader fuel mix will help to meet the challenges...



Environmental Performance (local emissions & CO2)

Shell offers the commitment, innovative technology and scale to help meet the energy challenge



- Quality cost-competitive conventional fuels
- A global leader in differentiated fuels
- At forefront of Gas to Liquids Fuel technology and production
- A leading distributor of first generation bio-fuels today



- One of the first to invest in second generation biofuels
- An early leader in hydrogen





