Shell. The evolution of movement continues

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Shell fuels

> 100 years experience

Broad fuel portfolio

Technology leader

Largest retail network

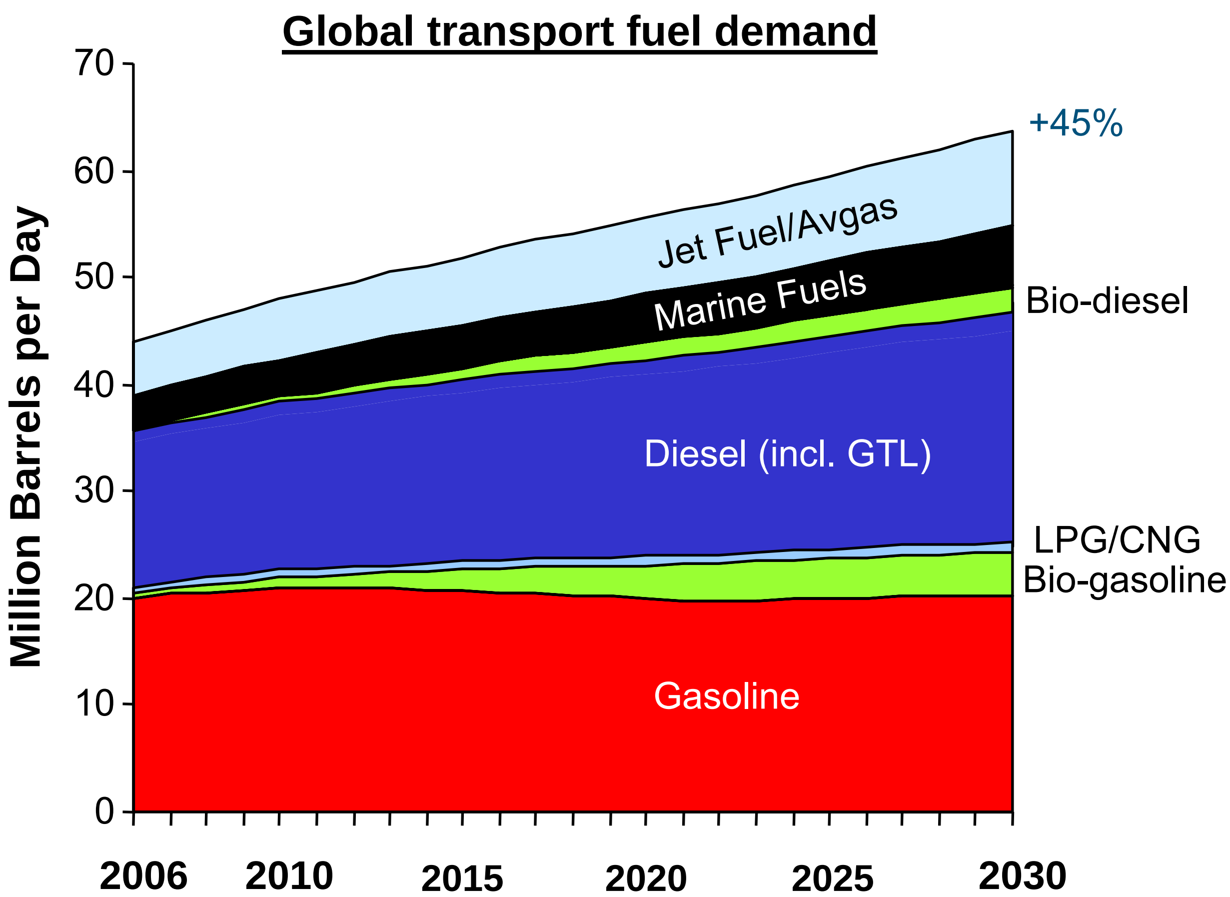
Road transport fuel

Marine fuel

Aviation fuel

Industrial and specialist fuels

Over the next 25 years transport energy will diversify and bio-fuel will have a key role to play

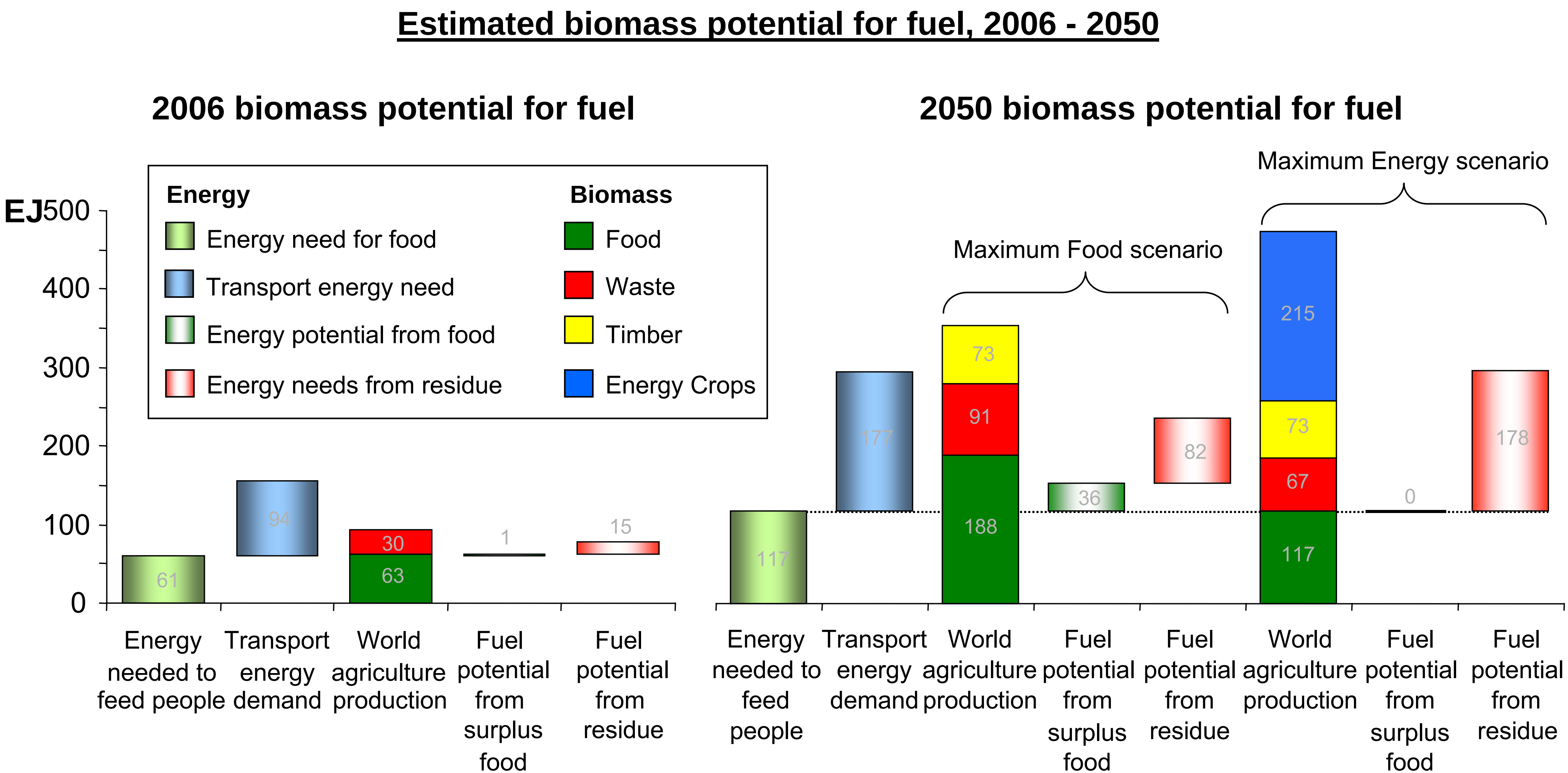


Key drivers:

- Economic growth
- Energy security
- Climate stress

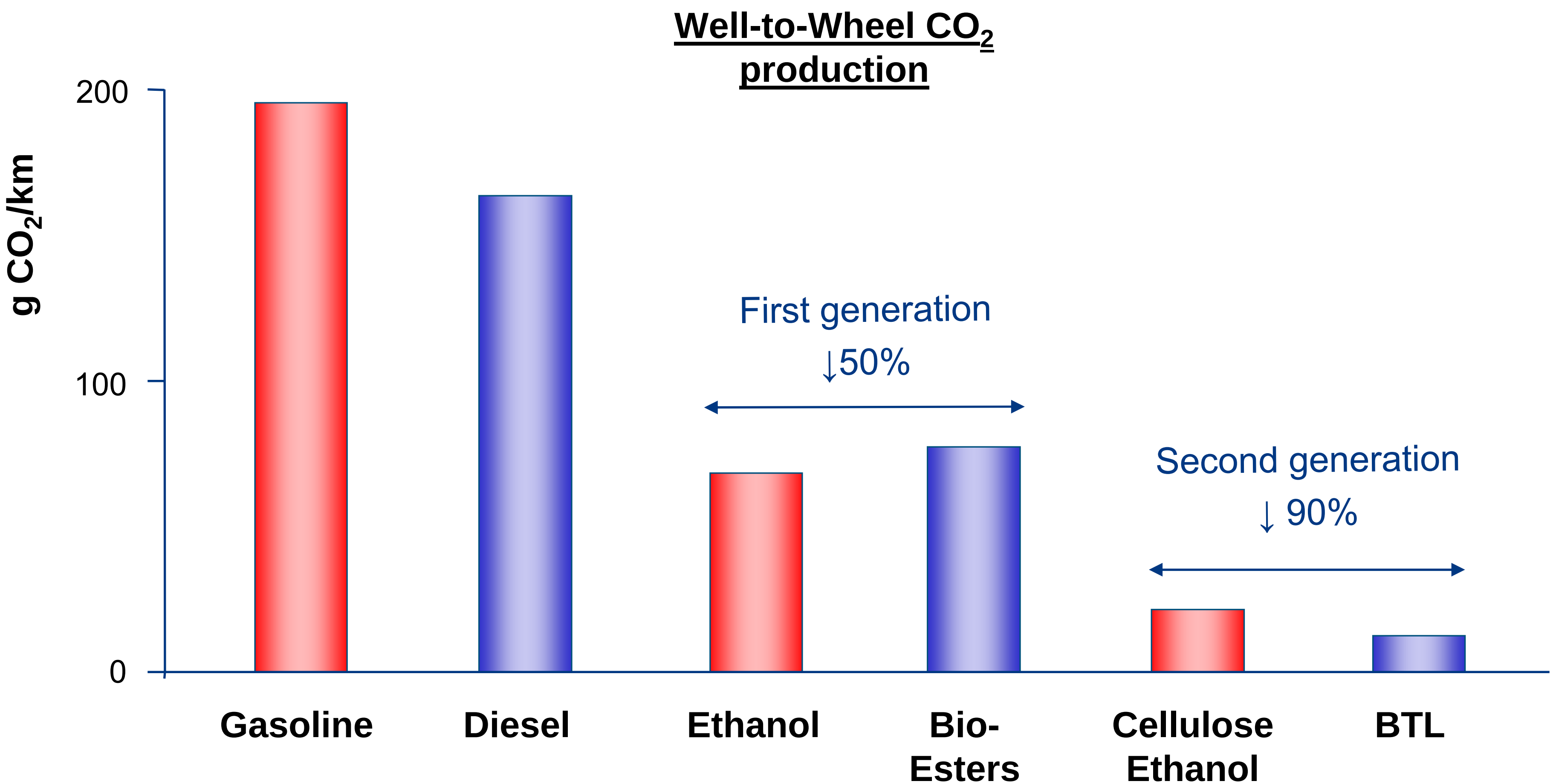
Source: Shell calculations based IEA and PIRA data

Agriculture offers sufficient biomass for transport fuel, but only if production systems are further developed and/or residue is used



Source: Shell estimates based on Food Agriculture Organisation (FAO), Hoogwijk 2004 and Smeets et al 2006

Second generation bio-fuel, using residue as feedstock, offers significantly lower CO_2 production



Source: Shell calculations based on EUCAR / JRC / CONCAWE data

There are many practical challenges to the sustainable development and use of second generation bio-fuel….

Second generation bio-fuel: practical challenges

Biomass energy density:

- One exa-joule (10^{18}) is contained in 22m tonnes of crude oil, but 55m tonnes of dry lignocellulose.

Bio-fuel energy density:

- Ethanol has 33% less energy density than gasoline; Butanol has 16% less.

Volumetric Energy Density

Fuel	MJ/litre	Octane
Gasoline	32.6	95-98
Ethanol	22.0	120
Butanol	27.5	94

Fuel	MJ/litre	Cetane
Diesel	36.6	51
BTL / GTL	34.3	75-80
FAME	32.4	50-60

Biomass sustainable sourcing:

- Fragmented supply infrastructure renders control of sustainability challenging
- Increased demand for agriculture feedstock has exacerbated sustainability issues
- Price of feedstock in competition with 1st generation bio-fuels has increased
- Main issues include conversion of protected land, social and environmental issues
- Depending on future growth scenario, there might be more competition for land.

Source: United Nations, OECD and Shell data

…and hence many economic challenges to the sustainable use of second generation bio-fuel

Second generation bio-fuel: economic challenges

Biomass cost:

Energy source cost: US$/GJ	Crude oil $35/bbl	Crude oil $70/bbl	Wheat $150/ton (mean 2005)	Wheat $191/ton Jan-May'07	Sugar $220/ton 2005-07	Corn $2.0/bushel (mean 2005)	Corn $3.4/bushel Jan-May'07	Straw $50/dry-ton
	5.4	**10.8**	**8.8**	**11.2**	**12.9**	**4.6**	**7.9**	**2.9**

- Between May 2005 and January 2007 US Gulf yellow maize prices rose by +68% and soft red winter wheat rose by +27%.

Bio-fuel production cost:

Production cost: US$/GJ	Gasoline $35/bbl	Gasoline $70/bbl	Ethanol $400/ton type-Brazil	Ethanol $600/ton type-USA	FAME $600/ton EU-2000	FAME $1000/ton EU-2006	Second Generation EU-2006
	8.0	**16.1**	**14.9**	**22.4**	**16.3**	**27.2**	**~ 20-50**

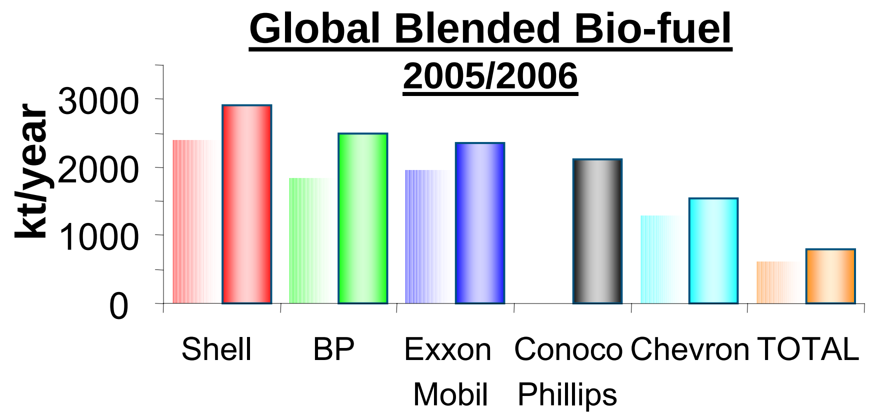
Biomass handling:

- Solids handling is c.200% more expensive than liquids handling.

Source: Shell calculations based on industry, IEA, United Nations and OECD data

Shell is at the leading edge of bio-fuel, both in distribution of first generation bio-fuel and development of second generation

- Shell has distributed bio-fuel for over 30 years
- The leading bio-fuel distributor today
- Sold over 3.5 billion litres bio-fuel in 2006; enough to avoid ~3.5 million tonnes CO_2 .



Shell's investment in bio-fuel distribution, research and development and bio-technology

Advanced bio-component research

Bio-fuel R&D in five research centres: Chester, Amsterdam, Hamburg, Houston, Bangalore

Biomass to Liquids (BTL) from woodchips

BTL demonstration plant under construction

CHOREN INDUSTRIES

Cellulose Ethanol from straw

Cellulose ethanol demonstration plant operational

IOGEN® CORPORATION

Multiple supply partnerships

ENSUS Teeside 400m litre capacity Shell 10-year offtake

ensus

Global distribution capability

3.5 billion litres distributed in 2006; enough to avoid ~3.5m tonnes CO_2

Source: Shell calculations, EUCAR / JRC / CONCAWE

It is essential that there is financial reward for bio-fuels based on potential for CO_2 reduction.

Bio-fuel performance is not as good

Volumetric Energy Density

Fuel	**MJ/litre**	**Octane**
Gasoline	32.6	95-98
Ethanol	22.0	120
Butanol	27.5	94

Fuel	**MJ/litre**	**Cetane**
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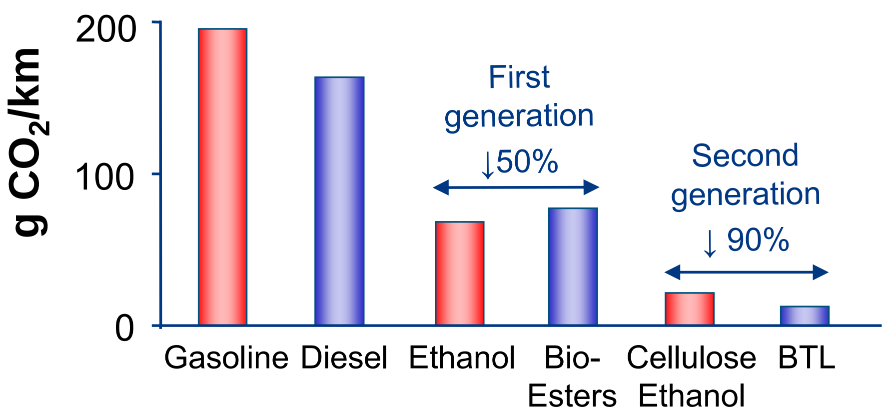
Bio-fuel costs more to produce

Production cost:	Gasoline $35/bbl	Gasoline $70/bbl	Ethanol $400/ton	Ethanol $600/ton	FAME $600/ton	FAME $1000/ton	Second Generation
			type-Brazil	type-USA	EU-2000	EU-2006	EU-2006
US$/GJ	**8.0**	**16.1**	**14.9**	**22.4**	**16.3**	**27.2**	**~ 20-50**

The main benefit is lower CO_2



Shell has some concerns about policy being used to drive bio-fuel growth

Mandates & support: while mandates (including Low Carbon Fuel Standards) will "coerce" compliance, appropriate use of subsidies will help create the base for natural growth of bio-fuel Mandates on their own risk various market distortions, such as fuels suppliers finding the least-cost means of compliance rather than necessarily (for society) the best long term methods of reducing CO_2 or increasing bio-fuel supply.   Without help, the market will take too long to react in the genuinely necessary way. Subsidies would help "jump start" the right response.

Research & Development: the best form of support would be aimed at suitable R&D and at capital expenditure on suitable bio-fuel production, with the ability to differentiate to favour the best forms of infrastructure.

Carbon capture & storage: while the caps may lead to some CCS activity, without support for research and demonstration it is unlikely that the market will develop CCS in a timely way.CO_2 credits for CCS projects will help.

Low carbon fuel standard: by promoting competition in carbon reduction, a Low Carbon Fuel Standard is a preferable policy than an RFTO.

Shell advocates mechanisms that reward the sustainability and CO_2 performance of bio-fuel over a sustained period

Low carbon fuels: Policy should focus on reducing CO_2 production on a well-to-wheels basis per unit of distance traveled. Incentives should be based on rewarding fuels and fuel components (including bio-fuels) that have the greatest potential for CO_2 reduction. It must be recognised that some bio-fuels are more carbon-efficient than others.

Government policy will need to focus on consumers, vehicle/engine manufacturers and the fuel suppliers. Delivering low carbon transport will require policy and regulations that stimulate action by both energy companies and engine/vehicle makers. This should balance obligations on each sector, while also recognising the impacts of, and actively influencing, consumer behaviour.

Government support will be required to accelerate technological innovation and deployment. Securing a lower carbon road transport sector requires a technology policy that addresses all key phases – "Discover, Develop, Demonstrate and Deploy". Launch support will be required to progress new, low carbon fuels to market.

Regulatory certainty and alignment is needed for low carbon fuels to be introduced to the market commercially. Commercial deployment of low carbon technologies will require Governments to provide long-term regulatory certainty so that the private sector has sufficient confidence to invest. Alignment of policies and standards across borders will increase economies of scale, improving investment economics and promoting free trade.