Shell and Biofuels

Shell is committed to providing sustainable energy. Developing lower carbon fuels is part of our commitment to sustainability and is also a great business opportunity for us.

Government policy

Governments in a number of countries are encouraging the production of conventional or 'first generation' biofuels through mandates and incentives. Shell, as a fuel supplier, is guided by these mandates and is working to meet obligations and benefit from opportunities. As mandates increase, Shell is drawing on its many years' experience of buying and supplying ethanol for Brazil, in response to government policy there.

Expertise and assets

In recent years the United States government has also encouraged the introduction of ethanol for blending with gasoline. Shell has further developed expertise in trading, storage, handling, blending and distribution of ethanol. We have invested in dedicated distribution infrastructure to achieve supply and quality control. Today Shell has five ethanol hubs in the US – facilities where ethanol comes in by train, is stored and loaded onto trucks. 30% of all US ethanol goes through our facilities.

Reliance on supply

With this capability, Shell has become the world's largest distributor of conventional biofuels. However, outside Brazil and the US, government policy is developing fast and Shell now buys and blends ethanol or FAME for a further 10 countries. As this global market emerges, Shell is moving to secure cost-effective supply and is working more closely with processors and manufacturers. An example is a recent 10-year future purchase agreement, supporting construction of a 400-million-litre UK ethanol plant.

Sustainability

In working closely with the manufacturers, who, in turn, work closely with the producers of the organic raw material, Shell is pressing for CO_2 reduction and social and environmental safeguards through contract language and dialogue. In addition to this work with our own suppliers, Shell is championing development of an internationally recognised standard in the supply chain for biofuels. We are providing input to a number of governments on certification for both CO_2 and sustainability and we are a founder member of the Roundtable on Sustainable Biofuels.

Next generation biofuels

Even with these new standards, a constraint on the potential of conventional biofuels is that they use food crops. If biofuels are to scale-up to help meet the level of global demand for transport fuels that is predicted, then non-food organic raw materials – with the potential to be provided in high volumes and without negative competition for land – need to be developed. This means that new processes to convert the alternative materials into high-performance fuels are needed. And, in the long term, these next generation biofuels will need to be cost-competitive with gasoline and diesel.

With Shell's commitment to sustainability, and our heritage and leadership in fuel innovation and conversion technologies, we are well placed to lead the development of next generation biofuels.

Technology

Our technology division, Shell Global Solutions, has a dedicated bio team across four research centres (US, UK, Netherlands, India). Open innovation is important to us and we have forged a number of key partnerships to accelerate our work. These partnerships are with universities researching the fundamental science but also with organisations working on commercial application. Our aim is to narrow down the technology options to a feasible set of commercial solutions.

Alternative raw materials

Lignocellulose, the tough molecules that make up cell walls in plants, can be found in a number of forms: prairie grasses or fast-growing trees (switchgrass, miscanthus, poplar, willow); residue from food crops (sugar cane bagasse, corn stover, wheat straw); leftover from trees used for timber (wood residue); or post consumer waste (waste paper, waste wood, waste food or even sewage). Lipids, or droplets of oil, can be found in many living organisms such as algae and inedible oily plants like jatropha. Potential volumes and land use are key considerations.

Alternative processes

Breaking down and converting these new raw material options into fuel is far more complex than converting sugarcane or rapeseed. Processing them efficiently at scale, in terms of cost and CO_2 emissions, is challenging. Shell and its partners are working on a number of new processes. These include using biological catalysts (enzymes), gasification together with Fischer-Tropsch synthesis, hydro-treating (removing oxygen and adding hydrogen) and acid-hydrolysis.

Alternative fuels

Conventional biofuels, ethanol and FAME, have a number of shortcomings as fuels. Therefore, as we explore new conversion processes, we are also looking at how they can deliver a number of other interesting fuel molecules. These include a high performance synthetic fuel we call BTL (biomass to liquid), which is virtually sulphur-free and can be blended into diesel at higher proportions than FAME without engine modification. Hydro-treating of vegetable oil is another route to a similar diesel-type fuel.

Commercial application – cellulosic ethanol

Shell has partnered with a Canadian company called Iogen to develop ethanol from lignocellulose (in this case straw) through a process using enzymes. The partnership began in 2002 and the world's first commercial demonstration plant opened in Ottawa in 2004. The CO_2 profile at this demonstration plant is around 90% less than gasoline. Iogen and its partners are now assessing design and feasibility of a full-scale commercial plant.

Commercial application – BTL

Shell has partnered with a German company called Choren to develop a high performance synthetic fuel from lignocellulose (wood residue in this case), through a gasification and Fischer Tropsch process. The partnership began in 2005 and the world's first commercial demonstration plant is planned to open in Freiberg in 2008. The CO_2 saving, compared to diesel, at this demonstration plant is estimated to be around 90%.

Economics and CO_2

Shell is working to meet the technical challenges of converting alternative bio materials, whilst ensuring that life-cycle CO_2 production is low and performance of the fuel is high. However, next generation biofuels are expensive and it may be difficult to convince people to pay for their key environmental benefit – CO_2 reduction. With the right technical breakthroughs and credit for their CO_2 saving in the commercial framework, we believe next generation biofuels could make a real impact – both on meeting global demand for transport fuel and on slowing the rate of growth in the world's CO_2 emissions.

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