SHELL GLOBAL SOLUTIONS BV

INTRODUCTION AND CONTEXT

Shell has long recognized both the importance of the climate challenge and the critical role energy has in enabling a decent quality of life for people across the world, wherever they live. But our energy system is changing to meet greater demand and environmental stresses. The big challenge, simply put, for both society and a company like Shell, is how to provide "much more energy and much less CO_2."

Transport accounts for approximately a quarter of energy use and energy–related CO_2 emissions (IEA). By 2050, worldwide car ownership could triple to around 2 billion and the number of trucks could double (IEA). Developing countries in particular are expected to experience sharp rises in vehicle numbers as their economic development continues. Without significant developments in the road transport sector, this burgeoning demand could see transport CO_2 emissions increase by up to 80% by 2050.

There is no "silver bullet" option that will deliver sustainable mobility over the coming decades. Instead, we expect to see a more diverse range—a mosaic—of fuel and vehicle options, with the preferred set of options varying by market. All options—including conventional fuels, biofuels and electric vehicles—will be needed; all will play a role in meeting demand. Some options will be more suited to short journeys in urban areas, while others will be better for long journeys between cities. One option with a fundamental long term advantage in mobility is hydrogen. Hydrogen has the potential to become a central energy carrier in a low-carbon future energy system.

WHY HYDROGEN

Hydrogen fuel cell vehicles (FCEVs) convert hydrogen into electricity and produce only heat and water. FCEVs offer a full functionality replacement to the conventional car, the driving experience similar to that of an electric car, as well as zero local emissions. They also offer the potential for zero well-to-wheels CO_2 emissions. However, the overall CO_2 saving depends on how the hydrogen has been produced and its journey to the vehicle.

When hydrogen is produced from natural gas—already the cleanest burning fossil fuel—it can greatly reduce well-to-wheels CO_2 emissions, due to the higher efficiency of the fuel cell drive train.

The CO_2 footprint of hydrogen produced from power (via electrolysis with water), which is another generation option, depends on the CO_2 intensity of the power source. Electrolysis (or power-to-gas as it is also known) can complement the intermittency of renewables by using surplus energy that can't be stored, although the business case remains challenging.

SHELL AND HYDROGEN

For hydrogen to play a significant role in transport, vehicle manufacturers, fuel suppliers and governments need to work together to create demand for hydrogen cars while simultaneously installing the supply infrastructure needed to make hydrogen an attractive option for consumers. Hydrogen mobility is a 'chicken and egg' dilemma. FCEVs will only be bought by customers if there is a refuelling infrastructure. Establishing refuelling infrastructure is only commercially attractive if there are FCEV customers.

In Germany, Shell is partnering with Air Liquide, Daimler, Linde, OMV and Total on H2 Mobility, a programme designed to overcome this challenge. H_2 Mobility brings together and coordinates the activities of these industry players with the objective of creating a hydrogen refuelling network in Germany of up to 400 filling stations by 2023.

The programme represents the most promising example of a public-private collation set up to progress the commercialization of hydrogen. Through joint cross-industry action it also helps overcome the risk of market failure until the necessary infrastructure is commercially viable.

NEXT STEPS

Shell has already developed two filling stations in Los Angeles and is assessing the potential for more in California, the UK, Switzerland, Austria, France, Belgium, Netherlands and Luxemburg. If barriers can be overcome, FCEVs, along with electrification via plug-in hybrid and battery electric vehicles, will make a material contribution to reducing emissions from road transport by 2050.