If 10 trucks per kilometre were powered by an overhead catenary system, electricity demand would be 1MW/km, placing huge demands on the grid
Penny Atkins

Future truck power

The drive to deliver low carbon vehicle powertrains has mobilised an army of leading academics and engineers. Peter Shakespeare reports

At the end of February, UK academics and automotive engineers gathered at the National Motorcycle Museum to discuss current issues and developments on the journey to meeting global emissions targets.

Opening the Future Powertrain Conference 2018, Matthias Wellers, the MD of AVL Powertrain UK, set the scene by saying that the automotive industries around the world were on the back foot. Rapid changes in policy, legislation and taxation aimed at reducing emissions are now occurring. A session of the conference covered road transport.

European Road Transport Research Advisory Council (ERTRAC) scenarios indicate that by 2050 up to 79% of the overall vehicle parc will need to be electrified to help keep CO_2 emissions within international Kyoto Protocol limits.

Developing sustainable and suitable battery technology to achieve this led the UK government to invest £246 million in new technology. It has awarded £80 million of this to a programme called the Faraday Challenge. At its head is Peter Littlewood, a professor of physics at the University of Chicago. He outlined that one of the biggest challenges we face is finding the natural resources to manufacture all the batteries required. Littlewood told the conference that, in terms of scale, supplying the automotive industry with sufficient batteries will mean 1,000 times the current annual production of lithium-ion batteries.

In terms of charging them, the power requirement will be nine times the annual output of the Hoover Dam. It is estimated that just to electrify the vehicle parc in the USA would require the entire global mining output of lithium and cobalt. New reserves must be found and technologies developed to recycle worn-out batteries so the natural resources used in their cells can be reused. He announced that a national battery manufacturing development facility was being established near Coventry to work with 20 universities, 25 industry partners and 100 PhD students to meet the considerable challenges ahead.

Also at the leading edge of research, but on internal combustion engine (ICE), is the University of Brighton's Advanced Engineering Centre. Working with Ricardo, its major focus is improving ICE thermal efficiency.

Principal research fellow Penny Atkins outlined future energy vectors for heavy-duty powertrains. She highlighted challenges surrounding power generation and supply for both plug-in hybrid and overhead power supplies for heavy trucks. Assuming 10 trucks per kilometre, power demand would be 1MW/km from overhead supplies, which would place huge demands on the grid. Charging a heavy battery electric truck will consume 1,000 to 2,000kWh of electricity per day. Assuming 79% of trucks will be battery-electric by 2050, generating the sustainable power to charge them poses a major challenge.

Conference speaker: Dr Penny Atkins

Atkins said advanced biofuels can deliver a 90% reduction in CO_2 emissions over fossil fuel. The University is conducting research into the properties of advanced liquid fuels and the injection process to improve combustion efficiency required to achieve this.

Referring to hydrogen as 'electrofuel', Atkins also pointed out that a strategic approach for its generation will be required due to the large amounts of energy required. She said that the German Department of Energy believes 'electrofuels' will become viable from 2030. In 2015, the energy demand of the EU was 2,744TWh. By 2040 it estimates output from renewable sources will rise to 6,000TWh.

One common theme during the heavy transport session was the need for a combined systems approach. This requires future changes to energy and logistics systems. But the value of reducing CO_2 emissions from road freight is high, as it represents 8% of total global emissions. TE