

Are diesel's farm days numbered?

Farm machinery prototypes that operate with zero carbon emissions are now available.

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Transport counts for the largest share of energy use in Ireland and 97% of transport energy was sourced from oil-based products in 2018. The Government is committed to decarbonising Ireland's transport sector, which currently makes up 20% of Ireland's greenhouse gas (GHG) emissions.

Biofuels bring a wide range of environmental benefits, including the reduction of greenhouse gases and other emissions. Bioethanol, for example, is typically produced from crops such as maize, wheat and sugar cane, with biodiesel produced from oil crops such as rapeseed as well as from wastes such as used cooking oil and animal fats.

So, while farms can be big users of energy, they also have a great capacity for energy generation and storage. But biofuels alone won't be the answer.

Alternative fuels to diesel include biogas, hydrogen and electricity. Non-diesel tractors are not a new phenomenon. Engines such as the Brutschke electric tractor in the early 1900s and the Allis Chalmers fuel cell tractor from 1959 were interesting developments, but weren't viable in the 20th century when oil was relatively cheap for the user.

The full cost in terms of global warming was never included in the retail price. We are now seeing prototypes run on innovative fuels, particularly hydrogen, in battery

electricity and biomethane. We are also increasingly seeing the use of autonomous vehicles (machine robots) as a means of cultivating fields, harvesting, etc.

So large, heavy, 100hp – 200hp tractors may be replaced by lighter multi-purpose vehicles powered by electricity or even hydrogen.

The components needed to make batteries and the sources of hydrogen, including the cost of materials, need to be kept in mind. Nonetheless, interesting transport and fuel technologies are emerging.

Electric

The case for solar and wind as renewable energy sources is continually improving and renewable electricity from such technologies is now supported by Renewable Electricity Support Scheme (RESS) auctions. Fendt are working on electric battery-powered vehicles, as are New Holland and John Deere.

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John Deere presented the first fully electric tractor, known as the SESAM (Sustainable Energy Supply for Agricultural Machinery), back in 2016.

More recently, John Deere's autonomous tractor concept is powered by a very compact electric drive unit.

The tractor has a total output of 500kW and can be equipped with either wheels or tracks. Flexible bal-



lasting from 5t to 15t is possible, to help reduce soil compaction. Thanks to the electric drive, there are no operating emissions.

JCB recently announced their all battery 24kWh electric 5256-60E telehandler. It powers a full day on a single charge.

This is a good step forward, which may not be out there ploughing and harvesting in the fields yet, but the direction looks clear. It's not cheap, but is a good example of how a company like JCB is moving forward, not only with battery vehicles but also with hydrogen for some of their earth moving equipment.

Biomethane

Switching from electricity, consider biomethane, which is an upgraded biogas that can be used to power



Picture courtesy of John Deere

vehicles. Biomethane, or renewable natural gas (RNG), is methane produced by anaerobic digestion (AD), plants fed with energy crops, animal manures and the food sector.

In Ireland, we have the potential to produce biogas and upgrade that biogas to biomethane for fuel cell vehicles. This is proven technology. The Valtra N101 is developed as a prototype biogas tractor. The idea of using the farm as a filling station could be an interesting concept in the future.

Hydrogen

There are already prototypes such as the New Holland hydrogen tractor. We are also seeing prototypes in buses from Linde and in cars from Toyota. But with 95% of global hydrogen production currently coming from fossil fuels i.e. 'grey' feedstocks, it does not help any 'net zero' ambitions. It may

be possible to generate hydrogen using renewable energy in the future.

There is a distinction between blue hydrogen, which comes from carbon capture and storage generation, and green hydrogen, which come from electrolysis, usually through solar and wind.

The general feeling is that until the hydrogen infrastructure improves, progress will be slow, but within the next 10 years, it could have a significant impact on the farming and transport fleets.

So, we will have a growing range of low emission vehicles available. Larger vehicles such as refuse trucks and farm tractors will require hydrogen and biogas for the necessary power to weight ratio.

Government funding will be needed to support the integration of on-farm power generation and its use as trans-

port fuels.

Farms are ideally placed to help meet Net Zero targets and our renewable energy targets, but our rural electricity grid was not built for 'two-way traffic'. It was built to put power into our homes and farms, and it has done so spectacularly well.

But we need to look at an enhanced electricity grid with a decentralised programme, with much more storage and vehicle-to-grid technologies possible. A weak rural electricity grid will restrict deployment of electric vehicles.

We are facing into exciting times, with opportunities to decarbonise our heat, transport and electricity sectors, and farms and farmers can be sure that they will not only have new sources of power for their vehicles, but also potentially new markets for farm-produced energy.