

Tesla's electric trucks are great but they won't save the planet

By Michael Le Page, *New Scientist* (weekly), print edition of Nov 25, 2017

The electric trucks being unveiled by Tesla and co will speed the transition from fossil fuels. But to cut transport emissions, we must curb road freight too

Electric cars used to be a joke – the ugly, expensive option for wealthy tree-huggers. But thanks to companies like Tesla, they are now sleek, desirable and increasingly affordable.

With the car revolution already under way, Tesla and other manufacturers are turning their attention to heavier vehicles. Yesterday, Tesla CEO Elon Musk unveiled his all-electric truck, the Tesla Semi, in [a showy event attended by hundreds of guests](#).

Just a few years ago it seemed unlikely that diesel's dominance in heavy vehicles could ever be challenged. Now the question is how long the transition away from diesel will take – and whether it will deliver the massive and rapid reductions in emissions we so desperately need to limit global warming to 2°C above pre-industrial levels.

Road transport produces around 4 gigatonnes of carbon dioxide a year, about a sixth of annual greenhouse emissions. These road emissions are growing inexorably, and [could triple by 2050](#).

There is wide agreement that it is time to start phasing out cars with internal combustion engines. A few countries even intend [to ban the sale of petrol and diesel vehicles – Norway plans to do it as early as 2025](#).

Cars are the easy part, however. Around [40 per cent of road transport emissions](#) comes from freight. To reduce these, we really need electric trucks to take off in a big way.

Big batteries

But there is a fundamental problem. The further you want to go in an electric vehicle, the more batteries you need. These are big and heavy, so the more you put in a truck, the less cargo you can haul.

Large trailer-pulling trucks – known as big-rigs or semi-trucks – can carry a load of 20 tonnes around 1400 kilometres on a single tank of diesel. To travel that far, [an electric truck would need a 25-tonne battery pack and could haul only 4 tonnes](#), calculates battery researcher Venkat Viswanathan at Carnegie Mellon University in Pennsylvania.

This makes the practical range much shorter. A [prototype heavy-duty electric truck unveiled by engine maker Cummins earlier this year](#) can haul a 22-tonne trailer, but has a range of just 160 kilometres unless a diesel generator is added on. Tesla claims the Semi can haul 36 tonnes – including the weight of the truck – up to 800 kilometres.

Tesla did not announce a price for the Semi, but it is likely to be eye-watering. A diesel semi-truck costs \$120,000. For an electric truck with a 500-kilometre range, the battery pack alone would cost \$200,000, says Viswanathan.

This is why many are expecting the freight transport industry to stick with diesel. “We don’t see yet how big changes can happen there,” says Zita Marko Daatland, head of energy market analysis at Norwegian energy company Statoil.

But maybe oil companies should be worried. For starters, not all heavy vehicles need a long range. Many cities – including London – are already introducing electric buses, to reduce air pollution.

Short-haul trucks

Electric goods vehicles are also starting to be used for short journeys. Daimler – the world’s biggest commercial vehicle manufacturer – [began delivering its new all-electric light truck this year](#), with a 3-tonne payload and 100-kilometre range. Parcel delivery company UPS was the first customer.

“Short-haul trucks are already taking off,” says Viswanathan. “This space will explode very soon.”

Partly electric [garbage trucks](#) also [hit the streets of Sonoma County, California](#), last year. The trucks have an electric engine, made by [Wrightspeed](#), along with batteries and a generator that can be powered by diesel or gas to extend the range of the trucks.

Wrightspeed claims the savings are so great that [no one will buy a diesel-engine garbage truck after 2021](#). That may be marketing hype but there are big advantages to going electric. The most compelling is that it is much cheaper per kilometre – [less than half the cost of diesel](#) in the US, for instance.

Maintenance is also cheaper as there are fewer moving parts in electric engines to go wrong, and [none of the air pollution-limiting equipment being added to diesel vehicles](#).

The downside is that batteries are still very expensive and may have to be replaced after a few years, depending on usage. “The maintenance cost of electric is negligible,” says Viswanathan. “The upfront costs are prohibitive.”

Nikola Motor Company in Utah thinks it can solve both the range and price problem. It plans to produce electric semi-trucks powered mainly by hydrogen fuel cells rather than batteries, to give a range of 1200 kilometres.

Hydrogen stations

But it isn’t going to sell these hybrid trucks outright. Instead, from 2021 it will lease the trucks to customers, charging them per mile of use. Nikola will build the trucks, the hydrogen stations and even make the hydrogen on-site from grid electricity. The company has already signed contracts worth \$6.5 billion, says CEO Trevor Milton. “We are booked out for 10 years.”

Milton doesn't think purely electric trucks can compete in the long-haul business for the foreseeable future. He says the energy-to-weight ratio of batteries needs to increase by a factor of 10 or 20 to make them competitive.

The hydrogen fuel cell approach could work where trucks ply the same routes over and over again, says Viswanathan. But because building hydrogen stations is far costlier and more difficult than building charging stations, he doesn't think it will take off widely.

The good news, though, is that advances in batteries could make all-electric long-haul trucks competitive with diesel far faster than generally thought, says Viswanathan. The energy-to-weight ratio of batteries only needs to double, he thinks. At the current rate of progress, that could happen in as little as a decade.

Tesla is also relying on automation to help make all-electric trucks competitive sooner than this. The Semi will be capable of platooning – travelling nose-to-tail in convoys to reduce drag, with the following trucks driving themselves. [Viswanathan calculates that platooning](#) could produce energy savings of up to 15 per cent, allowing trucks to carry more cargo or travel further on the same batteries.

The Semi is only semi-autonomous – it can stay in lane by itself, for instance – but fully self-driving trucks could cut costs even further by eliminating drivers, travelling a little slower and by recharging when electricity is cheapest – which is likely to be when the wind blows or on a cloud-free day. “I think these technologies will be enormously important for improving range and battery life,” says Viswanathan.

It's tough to predict what will happen, says Jason Roycht of engine maker Robert Bosch. His firm has a lot invested in diesel, he says, but will also be making the electric engines for Nikola. As economies of scale kick in, the price of electric vehicles could fall sharply.

Cutting emissions?

Even with all these innovations, it seems unlikely that the switch will deliver big reductions in greenhouse emissions anytime soon. Take Norway, for example. It is leading the way when it comes to switching to electric cars, but it will still fail to meet its 2030 targets for cutting transport emissions, says Hans Jakob Walnum of the Western Norway Research Institute. “In the short-term it's going to be nearly impossible to meet those targets.”

One reason is that road freight has been increasing strongly. And because road freight is still very closely linked to economic growth, neither Norway nor the European Union plan to limit its overall growth. That leaves improvements in efficiency as the main way to reduce emissions.

The flaw with this approach, says Walnum, is [the “rebound effect”](#): improvements in energy efficiency may deliver big savings at first but [encourage increased usage that then swallows up some of the gains](#). When the cost per kilometre of carrying freight falls, for instance, the end result is that more freight gets hauled further. “You get these very long supply chains,” he says.

Going electric won't entirely solve this problem, at least not in the short term. For starters, even if electric trucks are a success, it is still likely to be several decades before most diesel

juggernauts go the way of the dinosaurs. Electric cars have a big head start but will still only make up only a third of the global fleet by 2040, [Bloomberg New Energy Finance estimated earlier this year](#).

And while electric vehicles are often described as zero-emission, [they are really only low-emission](#): there are emissions from their manufacture, and from the fossil fuels used to generate much of the electricity that powers them. If overall road freight keeps growing – perhaps boosted by technologies such as autonomous driving – that growth could offset some or even all of the savings made from going electric. [Electric vehicles also produce some air pollution](#), too.

This matters, as to have any chance of limiting warming to near 2°C, we need to be cutting emissions by more than [5 per cent per year](#). If governments are serious about limiting climate change, they need to find ways to limit road freight growth in the short term, such as a high carbon tax or more support for rail freight. Hoping Elon Musk will solve all of their problems isn't the answer.