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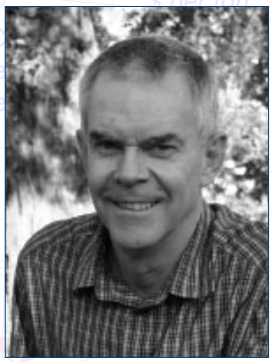
Counting on power



Unitec Civil Engineering Associate Professor Jonathan Leaver is predicting that New Zealand's future vehicle fleet will be a mix of battery electric and hydrogen fuel cell vehicles. Jenny Rankine reports.

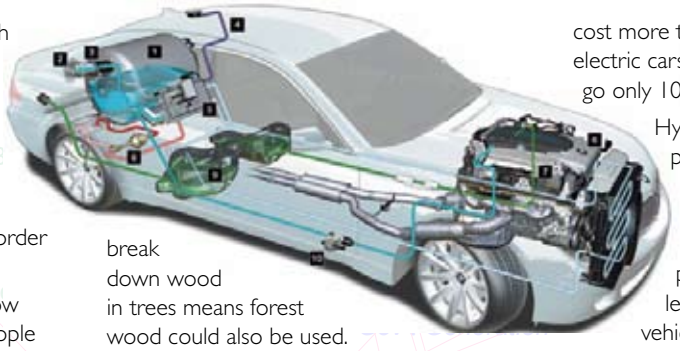
With Andrew Baglino, and Kenneth Gillingham of Stanford University in the USA, Leaver has developed an original integrated computer model of New Zealand's energy economy. It includes 1,200 variables and 7,500 lines of computer code, using algebra, statistics and first order differential equations.

It even includes an algorithm about how these vehicles will be perceived by people walking into the sales yard, who take into account price, servicing, running costs and other factors. The model can assess which of the energy technologies available in the next 40 years are the most likely to be adopted given a range of oil prices and carbon taxes.

He presented the model at a 2009 workshop in the NZIMA Energy Wind and Water programme.

The battle between alternative energy technologies is hotting up. Hydrogen, when used in a special battery called a fuel cell, produces electricity and releases only water and heat. Cars running on hydrogen fuel cells will eventually be only 10 percent more expensive than current models, with cheaper fuel costs. However, they would need a whole new distribution system.

Ethanol is harder to make, but can be produced from anything organic; sweetcorn is most common. Research into enzymes to break down wood in trees means forest wood could also be used.



Ethanol uses a lot of heat and raw materials to produce and is more polluting than hydrogen produced using electricity from wind turbines. For example, we would need 2.5 times our current forest harvest to run our vehicle fleet only on biofuel from our forests; up to two-thirds of this new land would come from existing pasture.

Electric cars powered by batteries will require an extensive upgrade to the electricity distribution system to homes to cope with everyone plugging their cars in overnight. Also, battery electric cars that match the range of current cars would cost more than twice as much. Short range electric cars would cost about the same but go only 100 kilometres between charges.

Hybrid vehicles that combine small petrol engines with batteries or fuel cells are a compromise between cost and range . Whatever the technology, Leaver predicts that petrol will power less than half of all New Zealand vehicles in 30 years.

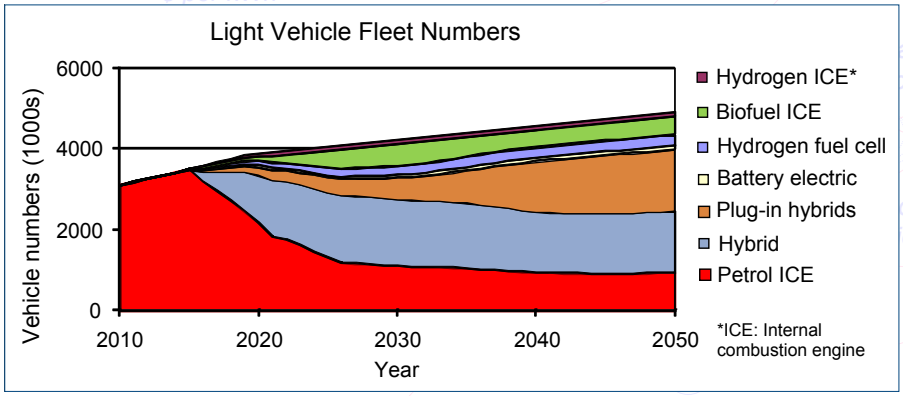
"It's a big call for the government; we need billions of dollars of infrastructure to support one of those technologies," says Leaver. Vehicle manufacturers are going with full or hybrid battery electric vehicles, but Leaver believes consumers will resist full battery electric vehicles, especially the 50 percent living in rural areas, because of their range limitations, capital cost and time they take to charge.

Leaver has also profiled likely electricity generation, air and water pollution costs and greenhouse gas emissions to 2050. "They're looking pretty good; we have massive potential for wind generation, more than three times the total electricity we generate at the moment."

Leaver will also examine a new way of burning coal in a special way to generate hydrogen; the resulting carbon dioxide could fill old gas fields and not add to global warming.

See also: www2.esc.auckland.ac.nz/EnergyWindWater/Presentations/Presentation%2008%20Jonathan%20Leaver.pdf

http://en.wikipedia.org/wiki/BMW_Hydrogen_7



Above: The limited production BMW Hydrogen 7 is powered by a 6-litre internal combustion engine that burns hydrogen and petrol. BMW claims the vehicle will reach 230 kilometres per hour.

Left: The graph shows one potential scenario from the model for our light vehicle fleet.

Background: A diagram of carbon emission variables from Leaver's UNISYD model.