GREENHOUSE CONSEQUENCES of ELECTRIC VEHICLES in NZ

An assessment framework

Steve Goldthorpe

Energy Analyst, Waipu

Question:- Will EVs help to reduce NZ's Greenhouse Footprint?

Answer:- It all depends on……

- How EV's are used to meet the objective of personal mobility in the future
- How the marginal electricity supply is generated in the future
- What sources of bulk primary energy supply are available in the future

Examples of Vehicle Duty Assumptions

Personal transport needs	10,000 km per year
Average vehicle occupancy	1.2 people per trip
Unladen vehicle weight	Petrol – 1.4 tonnes Diesel – 1.5 tonnes Electric – 1.2 tonnes
Average person weight	75 kg

Examples of Vehicle Performance Assumptions

On-board energy efficiency from fuel tank (battery) to wheels	Petrol – 30% Diesel – 35% Electric – 80%
Energy loading efficiency (fuel pump vs battery charger)	Liquid fuel – 99.9% Electricity – 80%
Regenerative braking energy recovery	Liquid fuel- 0% Electric vehicle - 25%
Fuel cons.of petrol car*	8 litres per 100 km
Calculated energy need	0.514 MJ/tonne-km

*1.5 tonnes gross weight and 30% engine efficiency

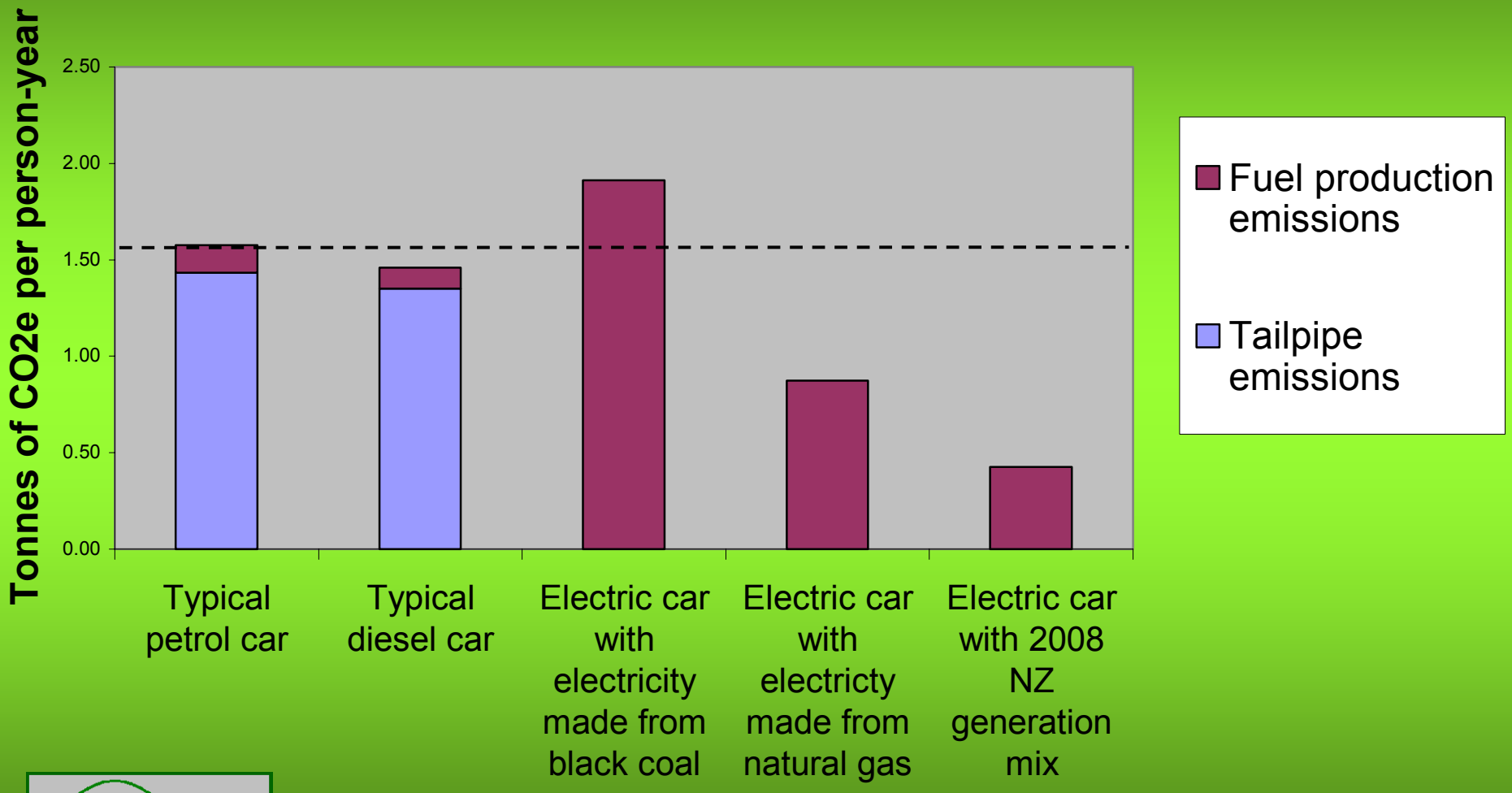
Examples of Energy Supply Assumptions

Energy distribution efficiency	Liquid fuels – 99% Electricity – 90%
Electricity generation efficiency	Black coal - 36% Natural gas - 50% Lignite - 34%
Precombustion emissions (for producing market fuels from primary resources)	Petrol - 10% Diesel - 8% Black coal - 5% Natural gas - 15%
Geothermal emission factor	25 kg.CO_2/GJ_{elec}

Data from Literature

Petrol net calorific value	32.1 MJ/litre
Fuel combustion emission factors – kg.CO_2/GJ	Natural gas - 52.8 Petrol - 66.6 Diesel - 68.7 Black coal - 91.2 Lignite - 95.2
Electricity generation mix in 2008 (Energy Data File – MED)	Renewables - 56.1% Geothermal - 9.4% Oil - 0.3% Natural gas - 23.7% Coal - 10.5%

Full Fuel Cycle CO_2 emissions from car motive power alternatives



Examples of Lignite Liquefaction Assumptions*

Lignite gasification to syngas overall thermal efficiency	70%
Petrol synthesis from syngas overall thermal efficiency	70%
Diesel synthesis from syngas overall thermal efficiency	75%

* Excluding carbon capture and storage

Full Fuel Cycle CO_2 emissions from car motive power alternatives