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The Greening of the passenger car might not deliver such positive sustainability news – so what do we have to do?

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ABSTRACT: As we promote the need to reduce emissions at the tailpipe for cars, trucks, and buses, we may be neglecting the full story on what this might mean for achieving a broad set of sustainability goals. While not denying the merits of reducing tailpipe emissions, there are many unresolved questions about the indirect emission impacts as well as other sustainability impacts such as traffic congestion. This short paper attempts to place the debate within a wider setting if only to achieve more than what we see government myopically focussing on.

KEY WORDS: ***Decarbonisation; Sustainability, electric and hydrogen; batteries; autonomous cars; strategic challenges***

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The Greening of the passenger car might not deliver such positive sustainability news – so what do we have to do?

Overview

With a general condemnation of cars whose energy source is derived from fossil fuels, there is a rush to find a preferred energy solution that ticks all the right environmental boxes as well as a few others, appropriately referred to as ethical and commercial. An increasing number of countries are mandating no more cars that use petrol and diesel[1].

While we focus increasingly on ensuring clean energy cars, especially at the tailpipe[2], we often forget that the real long term sustainable solution is unlikely to be achieved by only cleaning up the energy source to propel cars to encourage even greater use of cars and including the hyped-up interest in moving to autonomous cars[3]. The point is that we need sustainable alternatives that drag us away from dependence on the car and which will require, in most western societies, a good dose of repricing of car use to ensure a future for public transport in particular and even non-ownership of cars and use of shared cars (Hensher 2020)[4]. At the same time that we are promoting the switch to sustainable transport modes[5], we are building long term support for the car on the basis of a single sustainability criterion[6], namely CO_2 emissions at the tailpipe.

This results in a real dilemma, described brilliantly by Anable and Goodwin (2021) where they describe de-carbonising transport like shot silk. The warp (blue) relates to still being able to use our cars with increased traffic, because they will be electric; we will still be able to fly away on holiday, using non-carbon fuel, and technology will give us a timely transition. The weft (green) is the overall and significant traffic reduction including a substantial mode shift to walking, cycling and public transport, increasing car occupancy overall, and embedding transport de-carbonisation principles in spatial planning to ensure that new development promotes sustainable travel choices. The challenge, however, is that only one colour is typically seen, depending on where the viewer is standing.

The agendas of most governments are narrowly based on an almost emotional commitment (and unconscious bias) to ensure the car remains king ('A car is a car' regardless of whether ICE, electric, hydrogen and autonomous) that we neglect to recognise that this carries so many negative externalities regardless of the fuel source. Enhanced mobility through electric private car use is unlikely to align well with a broader set of sustainability objectives, especially in metropolitan settings with growing congestion[7]. One might speculate that if the billions of dollars spent on researching fuel

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[1] This ignores the opportunity to utilise renewable diesel but that also has questions related to using vegetable oil.

[2] See https://www.sydney.edu.au/business/news-and-events/news/2023/02/06/counting-the-full-costs-of-transport-choices.html

[3] The amount of research funding devoted to autonomous cars is staggering given the likely benefits.

[4] https://www.sydney.edu.au/business/news-and-events/news/2020/03/02/more-on-electric-cars---life-cycle-emission-concerns.html and https://www.sydney.edu.au/business/news-and-events/news/2019/08/05/electric-cars---they-will-in-time-increase-car-use-without-effec.html

[5] Which could include onset of car share services.

[6] Sustainability as a term used in this paper refers to fulfilling the needs of current generations without compromising the needs of future generations, while ensuring a balance between economic growth, environmental care, and social wellbeing.

[7] The role of the car in a rural setting is likely to be quite different since public transport is often inadequate and unable to serve the spatially diverse needs of residents. Ride share as a car share service is likely to be too expensive unless government subsidises it at the local bus fare, which is often not the case, and community

solutions for cars and new car designs etc. were injected into public transport and other more sustainable solutions such as better infrastructure for active travel, we would, as a society, be far better off. But one suspects that manufacturers of cars believe that the profit margin is far less attractive; indeed, government gains more revenue from car ownership and use than from heavily subsidised public transport and healthy mobility (noting the potential savings in health-related costs).

The focus on clean energy through renewable sources, in particular, places the debate, in the main, on the future of batteries and hydrogen, the latter referred to as fuel cell electric vehicles (FCEVs). The extensive and ongoing research into alternative energy sources is often clouded by a narrow interpretation of the advantages of specific energy sources[8]. As time progresses, some of those promoting ways to make cars green are starting to realise that this may not be the sustainable panacea they had hoped for in terms of removing one of the most claimed negative impacts of cars on climate change.

Although rarely discussed in the transport debate at government levels, there are still notable emission and local air pollution outcomes (especially particulate matter) when we factor in the energy generation source, the manufacturing process for cars and the replacement and disposal of batteries (i.e., the circular economy), and wear on tyres vehicle brakes, and roads in general (Font and Fuller 2016)[9]; this is something that should be communicated to the consumer with appropriate incentives to change behaviour. Embedded carbon is embedded cost, and we need to implement circular economy principles to reduce the carbon that is embodied in all facets of mobility. This is the true cradle to grave analysis in contrast to well to wheel or simply rubber on the road. The modelling as to what is and is not included is key to establishing the full story of sustainable outcomes[10]. While EVs generate fewer life-cycle emissions than ICEs, the additional resources related to battery production suggest supply chain emissions 35 to 50 percent higher than internal combustion engines (see Figure 5 in Appendix). Buberger et al. (2022) show that for 790 different passenger car variants, battery electric vehicles have the highest production emissions, although in terms of production, utilisation and recycling, emissions, plug-in hybrid electric and fully electric vehicles can reduce the total life-cycle emission in comparison to combustion engine vehicles by 73% and 89%, respectively. They also

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transport services are typically very limited and available to a specific segment of the population. Hensher (2022) has proposed the idea of 'Private Car as a Service (PCaaS)' or more generally "Private Assets as a Service (PAaaS)", given a critical need to provide mobility services to residents of regional towns and rural hinterlands who have a need to visit medical specialists who are located many kilometres away, often over 200-500 or more kilometres, and where they are likely to have to stay overnight. One potentially attractive way of resolving this is to match a private car trip with a person in need (recognising that they may need to be accompanied) who has to get to the same or close by destination. To ensure that there is safety and security including quality of vehicles in this process, we propose a community membership club (CMC)[7]. There is no fee to join the CMC, but when a person requests a lift to a specific destination, there will be a small fee in the way of a donation which will be dispersed to the owner of the CMC and the driver of the private car. The apportion and sum can be decided on a case-by-case basis with some guidance on what might be deemed a fair and acceptable allocation by all parties (for example, a 50:50 split of $20). In addition, the CMC may coordinate with accommodation services to offer discounted overnight stay where that is necessary.

[8] Although Australia sees itself as a renewable powerhouse, which might push other matters to the back room.

[9] See also https://www.sydney.edu.au/business/news-and-events/news/2023/02/06/counting-the-full-costs-of-transport-choices.html

[10] A recent report reinforces the position of this paper: "The biggest problem, the Kearney report says, is that automakers have been primarily focused on reducing tailpipe emissions that come from their car fleets via electrification. And it's true that this is the primary driver of greenhouse gas emissions from the automotive sector. But in order to help meet the Paris agreement's target of limiting the global temperature increase to 1.5 degrees Celsius above preindustrial levels, the study says the auto industry must play a stronger role in increasing renewable energy in power grids and reducing greenhouse gas emissions across its entire supply chain." https://www.theverge.com/2023/2/9/23592429/ev-polestar-rivian-climate-change-report-supply-chain

suggest that with increased production of biofuels, ICEVs could become more competitive to EVs. Also, we should not discount renewable diesel that uses recycled water plastic and is mooted in the next 3-5 year to reduce CO_2 emissions by 90% compared to diesel from fossil fuels. It is a direct replacement fuel that needs no modifications to a diesel vehicle[11].

Beyond the tailpipe, it is becoming very clear that there are significant concerns that outweigh the narrow debate on what fuel to energise a car. These issues include availability and growing potential scarcity of minerals required for batteries and FCEVs, and the anti-slavery obligations in many countries related to labour costs in countries providing minerals.

If we just focus on greening the car at the tailpipe and ignore these other sustainability impacts, should we be supporting a battery or FCEV energised solution? The answer is far from obvious; however, many pundits suggest that hydrogen has far too many downsides at present to claim a scalable future. This position applies to all colour-coded definitions of hydrogen[12] with the possible exception of nuclear, colour coded red. One might conclude that we give hydrogen a miss given current knowledge and especially the growing scarcity of key minerals[13]. The problem with fuel cell electric vehicles over battery electric vehicles, given current knowledge of technology (which is changing fast), is that they are about half as energy efficient, meaning that if you start with a given amount of electricity and make hydrogen by electrolysis, a FCEV might cover 100km whereas an equivalent BEV would cover 200km if the electricity were instead stored in a battery[14]. The economics of these fuel sources will eventually play a crucial role as electricity prices in particular increase to levels that erode any operating cost advantage of electric cars over petrol and diesel cars, and maybe hydrogen[15]. Hydrogen developments in aviation may offer an opportunity for land transport, raising questions re battery technology.

However, hydrogen may yet win out, despite the claims of many that it is doomed. Toyota is developing a hydrogen internal combustion engine which does not need fuel cells and uses hydrogen instead of petrol[16]. The only FCEV currently on the list is the Toyota Mirai, an FCEV, which takes 10 mins to fill with hydrogen to drive 500 kms. All other high-capacity BEVs for 500 km will require 10 to 12 hrs of charge on a 7.5kW charger (typical at home). For example, Tesla S takes 13.5 hours to charge

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[11] https://www.worktruckonline.com/320806/everything-you-need-to-know-about-renewable-diesel

[12] See this video about hydrogen fuelled vehicles https://youtu.be/Zklo4Z1SqkE The author is quite controversial in the physics community but what she says is backed by concrete evidence. I thank Glenn Geer for informing me about this you tube talk.

[13] Hydrogen can be a useful fuel extender in a transition – some businesses are fitting hydrogen delivering devices in trucks and stationary uses that save about 25% on fuel use. This is an additive to diesel in trucks, and generators used in mines that is showing reductions of around a quarter in diesel use. The hydrogen is made by a chemical reaction in the device added to the vehicle. It appears to be working well and starting to be introduced in Australia to larger fleets.

[14] One emerging possibility we are seeing is the use of hydrogen to create large scale electricity to add to the grid's own storage but then use of battery electric in the consumption. This means you could have hydrogen generated electricity in a bus depot, consumed by electric buses.

[15] See https://www.vivaenergy.com.au/media/news/2022/viva-energy-hydrogen-service-station-on-track-for-2023-delivery. Publicly accessible commercial hydrogen refuelling station, overseas the technology has been in use for more than 10 years and there are more than 680 hydrogen refuelling stations in 33 countries. Viva Energy has placed orders for a 2.5MW electrolyser for the creation of green hydrogen as well as a fast-fuelling hydrogen dispensing system capable of refuelling multiple vehicles at once. This equipment will be the first of its kind in the Australian market and is expected to be delivered in the third quarter of 2023. The containerised electrolyser is being provided by Nel Hydrogen US, a subsidiary of Nel ASA in Norway, together with its local partner ENGV, and is expected to be the largest in Australia by a considerable margin. Once installed, it will be at least twice the size of any other electrolyser producing green hydrogen in the country.

[16] https://global.toyota/en/newsroom/corporate/35209996.html. This has the advantage of refuelling at the gas station just like we now do.

to drive 500kms (see Appendix Table 1). If we disregard existing technical issues and the high cost of hydrogen and the car itself, which will eventually come down, it is not a question of which option consumers will prefer. It is just a matter of the cost, availability, and technology development, but once ready, it takes no effort for consumers to switch from a current ICE, with no driving habit change, and especially when all petrol and diesel refuelling stations that have an effective network are hydrogen capable. With electricity prices rising fast, the advantage over ICEs in operating costs might totally dissipate and narrow the gap with hydrogen.

Battery Technology and Future Appeal

So back to batteries and all their challenges with emissions, cobalt, and lithium availability. Alternative power sources are a real technical problem. For base-load power, the greenest alternative is nuclear, but people are scared. Even the term 'nuclear' is an anathema; MRI used to be NMR (nuclear magnetic resonance) imaging which is about as far removed from nuclear fission as you can get. And even worse, if cars are autonomous, emissions linked to computers needed are as high as emissions from fossil fuel driven ICEs (Sudhakar et al. 2023). The solution is less cars and greater mobility through other modes. Shifting away from private cars is certainly the way forward. IMHO autonomous vehicles will have their place: on-demand last-mile bus (or bus-like) services which are affordable because the cost of the human driver is removed. But not for some time, despite what Mr Musk and others claim.[17]

Battery technology is increasing rapidly (see Figure 1) with increasing energy density of the cells, and cathode chemistries moving from NCM 111 (the so-called ternary mix cathodes, with equal amounts of nickel, manganese, and cobalt), as used in first BEVs being replaced with chemistries that have higher nickel and lower cobalt content, the latter 3-4%. The higher volumetric energy density also results in significantly falling prices for cells. However, even if the nickel-cobalt and lithium content per kWh of battery will continue to fall, the demand for these metals will increase significantly. Expected year-over-year growth rates are between 35% for lithium and more than 50% for nickel (see Bernhart 2018) as we see scaled-up demand for electric cars, as well as electric trucks and buses.

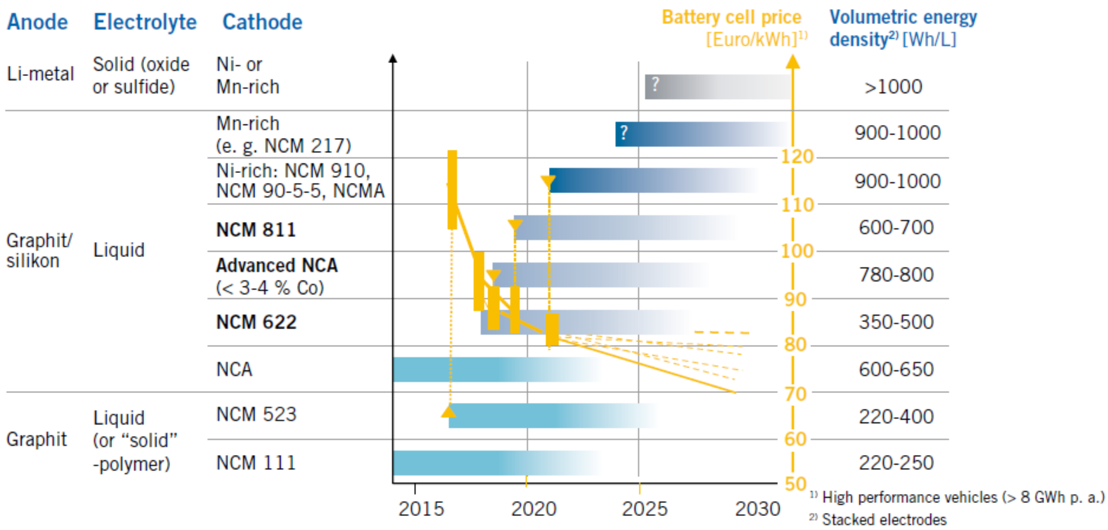

FIGURE 1 Lithium-ion Battery (LiB) technology roadmap and battery cell prices (© Roland Berger)

Vaclav Smil[18] argues that there is a long way to go before batteries rival the energy density of liquid fuels. Over the past 50 years, the highest energy density of mass-produced batteries has roughly

[17] Personal correspondence with Glenn Geer, 4 February 2023.
[18] https://spectrum.ieee.org/ev-battery-2658649740

quintupled, from less than 150 to more than 700-Watt hours per litre (Wh/L)[19]. Even if that trend continues for the next 50 years, Smil suggests that we will still see top densities of about 3,500 Wh/L, no more than a third that of kerosene. Some would argue that this is immaterial given a focus on climate change.

An exciting future prospect, however, is the use of a chemical found in crab and lobster shells to make batteries more sustainable and hence eco-friendly. Wu et al. (2022) have developed batteries that use a product derived from crustacean shells from crabs, shrimps, and lobsters to store energy, known as chitin. Through chemical processing and adding acetic acid aqueous solution, chitin can be synthesised into a firm gel membrane and used as an electrolyte for a battery. By combining this chitosan electrolyte with zinc, Wu et al. are able to create a renewable battery, which is 99.7% energy efficient even after 1,000 battery cycles or 400 hours, enabling them to be quickly charged and discharged without significantly affecting their performance. These batteries high-rate zinc-metal batteries are not flammable, and the two-thirds of the battery made of chitosan can break down in soil thanks to microbial degradation in just five months, leaving behind recyclable zinc. Once again, this significant eco-friendly solution will support the switch to electric cars, which is desirable in a narrow sense, but will result is greater use of cars, something which the sustainability agenda is trying to tame and reduce.

Despite these technological developments, there remains a concern about extraction and mining. As new mining and refining capacities are emerging, future supply shortages seem unlikely. Nevertheless, continuing price risks due to high industry concentration levels for raw and refined materials as well as political risks in the respective countries, must be mitigated (Figure 2). To alleviate price and supply risks, the industry does have some instruments at hand – from commodity futures (which might also be available in the mid-term for some critical raw materials analogous with steel and other commodities now) to investments in mining and refining capacities (Bernhart et al. 2018a)[20]

[19] Wh/L is a battery's energy content in relation to its volume.

[20] We do not include the battery recycling challenge; however, see Wu et al. (2022). Redwood, for example, is working on making batteries sustainable and affordable as part of the circular economy, by localizing a global battery supply chain and producing anode and cathode components in the U.S. for the first time – from as many recycled batteries as possible. See https://www.redwoodmaterials.com/about/

Figure 2. Sources of battery minerals
Source: https://www.redwoodmaterials.com/
https://www.theverge.com/2022/12/14/23509031/redwood-materials-ev-battery-recycling-factory

Michael Bell[21], however, does not see a problem with mining lithium, cobalt, copper, and rare earths provided the mines are operated with renewable energy. He comments that "it's good business for Australia (https://energywatch.com/EnergyNews/Renewables/article14944587.ece). Zero emission mining is entirely possible (https://www.mckinsey.com/industries/metals-and-mining/our-insights/creating-the-zero-carbon-mine)" Michael Bell has also indicated Rio Tinto has a zero emission iron ore mine in WA with the plan to replace diesel equipment with electric equipment and generating electricity by solar panels. If high-rate zinc-metal batteries using chitin and zinc take off then the only mining challenge is sourcing zinc. China, Peru and Australia[22] are the major suppliers of zinc

Given plans to transition to electric cars that have zero emissions at the tailpipe, the growth in car use by electric cars may be of little concern for de-carbonisation targets; however, we anticipate increased car use adding to congestion as the transition opens up relatively attractive purchase prices and significantly lower use costs compared to the petrol car (typically 75% lower usage costs and maintenance costs in some countries, although the gap is closing with increased electricity prices, notably in Europe) (Hensher 2020). Furthermore, the resultant average speed with increased congestion will use more electricity even if the fleet is electric, creating a higher energy demand based on congestion in contrast to consumption. In time this may be resolved.

[21] Personal correspondence 3 February 2023.
[22] The major supplier of zinc in Australia is Mount Isa Zinc Mine is owned by Glencore Plc and is due to operate until 2029. Glencore produced some 241,500 metric tons of zinc, which made it the world's largest zinc producing company based on volume. Interestingly, a major source of zinc is oysters.

Despite the talk of introducing a distance-based charging (DBC) regime when a sufficient number of cars are electric[23], including its introduction already in Victoria[24], the proposed 2.5c/km DBC in Australia for electric cars is, on our calculations, too low to maintain car kilometres at the levels experienced pre-COVID-19 in Australian cities, and any higher cost is almost certainly to be rejected by the political process (Hensher et al., 2021).

Autonomous Cars are no Panacea – far from it.

Autonomous cars seem to add even more sustainability concerns. UK Department for Transport (DfT) traffic projections for England and Wales suggest that the carbon footprint of autonomous cars will increase. They show that traffic delays may rise by up to 85 per cent from 2025 to 2060 once self-driving vehicles reach the mainstream[25]. The analysis is based on predictions estimating that connected and autonomous vehicles could make up half of the car fleet by 2047, allowing more people to access this form of transport, including "the elderly and those who do not currently hold a driving licence". They claim that "the ability to work or relax while travelling in a self-driving car" means occupants will be "more amenable to sitting in traffic". A contrary view, however, is that time spent driving might decrease because algorithms could find optimal routes that get people to their destinations faster. However, if we are prepared to access these vehicles on-demand and forgo personal ownership then we could have a win-win situation: quieter roads, fewer cars shared by the many, and cheaper transport.

Another perspective is that this is a journey.[26] If the telecommunications companies truly achieve Vehicle to Infrastructure comms (V2I) and Vehicle to Vehicle (V2V), then there are optimisation opportunities, but probably only when it is a "pure" fleet. Until everything is replaced there will be redundancy in the system. But if we manage to combine autonomous, ride share and car share by optimising the seat need (number of cars) and reduce it, the combination of technology and ownership and its impact on the wider set of sustainability indicators may change, even if it is bad news for regular public transport, redefining where the greater gains in sustainable outcome might occur. The dominant focus on public transport in metropolitan areas as the sustainability king may turn out to be a barrier to progress.

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[23] John Rose has been tracking EV sales. From 2011 to 2022, Australia is averaging around 1.1 million new cars sold each year. This declined slightly over COVID-19 but is starting to trend up again. In the words of John Rose (21 February 2023): "What is interesting is looking at how the market is evolving after accounting for scrappage. In 2012, the total fleet grew by 267,191, however 253 of these were EVs. Of the new vehicles added, only 0.09% were EVs. If we look at 2021, the fleet grew by 171,426, however 20,665 of this growth is EVs or 12.05% of the addition. Australia is replacing the total vehicle fleet with EVs at an even faster rate than just looking at new car sales which suggests we are scrapping non-EVs and replacing them with EVs at a larger and ever-growing percentage. I expect that from 2022 onwards will be a huge positive change on such a low base and it will be years before the stock is truly electric or even hydrogen."

[24] See https://www.vicroads.vic.gov.au/registration/registration-fees/zlev-road-user-charge.
EVs and hydrogen vehicles in Victoria pay 2.6 cents/km and for plug-in hybrids to 2.1 cents/km (even when driving out of State). The Western Australia government has proposed a distance-based road user charge for zero and low-emission light vehicles, but will hold off on its introduction until July 1, 2027, to give the state's new $3,500 EV subsidy a chance to drive uptake.

[25] https://eandt.theiet.org/content/articles/2023/01/autonomous-cars-would-worsen-road-congestion-study-finds/?utm_campaign=Making%20News%20in%20Transport&utm_medium=email&_hsmi=242445919&_hsenc=p2ANqtz-86k-M0dl-o7YXBjz1ks8z7zpGaXocnV6GDNr0dUWi-jqgniDqEZjL99KfdafVZDC2bxq8QhVwMDu4zrmOTAFwWMZ2_F7kYM6AOdqqjBafBVNzZRFk&utm_content=242445919&utm_source=hs_email

[26] Personal communication with Dave Mead, 8 February 2023.

There may also be a potentially positive link to artificial intelligence (AI). Tyler Cowan has explored this[27] and suggests that a lot of human-built entities do not perform perfectly, to say the least. The lack of transparency in AI operation will mean a lot of non-transparent failures with AI as well. Cowan says "I thus would put an AI in charge of a military drone swarm but not the nuclear weapons. In the meantime, I don't expect the ghost in the machine" to appear anytime soon".

Sudhakar et al. (2023) in an MIT study conclude that in the future, the energy needed to run the powerful computers on board a global fleet of autonomous vehicles could generate as many greenhouse gas emissions as all the data centres in the world today. To accomplish that, they modelled the workload of a popular algorithm for autonomous vehicles, known as a multitask deep neural network which can perform many tasks simultaneously. They explored how much energy this deep neural network would consume if it were processing many high-resolution inputs from many cameras with high frame rates, simultaneously. For example, if an autonomous vehicle has 10 deep neural networks processing images from 10 cameras, and that a vehicle drives for one hour a day, it will make 21.6 million inferences each day. One billion vehicles would make 21.6 quadrillion inferences[28]. To keep emissions from spiralling out of control, they found that each autonomous vehicle needs to consume less than 1.2 kilowatts of energy for computing. For that to be possible, computing hardware must become more efficient at a significantly faster pace, doubling in efficiency about every 1.1 years.

Concluding Thoughts

There is at least one clear message from the points raised above. There is a general failure at all levels of government to identify and account for the widening suite of emission and non-emission impacts that represent the fuller picture on what sustainability really means. This may change the list of priorities. Figure 3 reminds us of the need to account for both direct and indirect emissions, commonly referred to as three scopes. Direct emissions are emissions from sources that are owned or controlled by the reporting entity (e.g., at the tailpipe). Indirect emissions are emissions resulting from the activities occurring at sources owned or controlled by other entities.

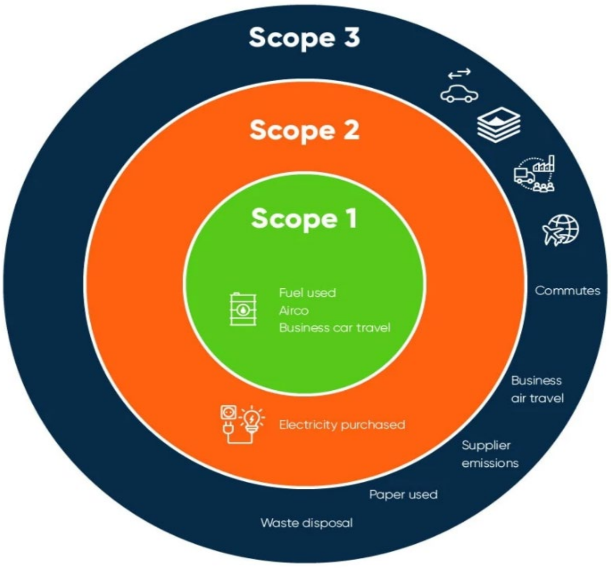

Figure 3. Scoping levels of emissions

[27] https://marginalrevolution.com/

[28] To put that into perspective, all of Facebook's data centres worldwide make a few trillion inferences each day (1 quadrillion is 1,000 trillion).

There is a real risk that with the rush to sell CO_2 reductions in a myopic way associated with the tailpipe of cars, buses, and trucks, and indeed any motorised form of transport, that the blue warp from shot silk is becoming the misled interpretation of a sustainable solution and is akin to what I have historically referred to as emotional ideology linked to 'choice vs. blind commitment'. We need to take off the blinkers and look wider, unencumbered by institutional constraints and biases. I hope I am wrong, but all the signs are not good. Finally, although sustainability is a top of agenda commitment, so is liveability, and a careful balance must be maintained.

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Appendix

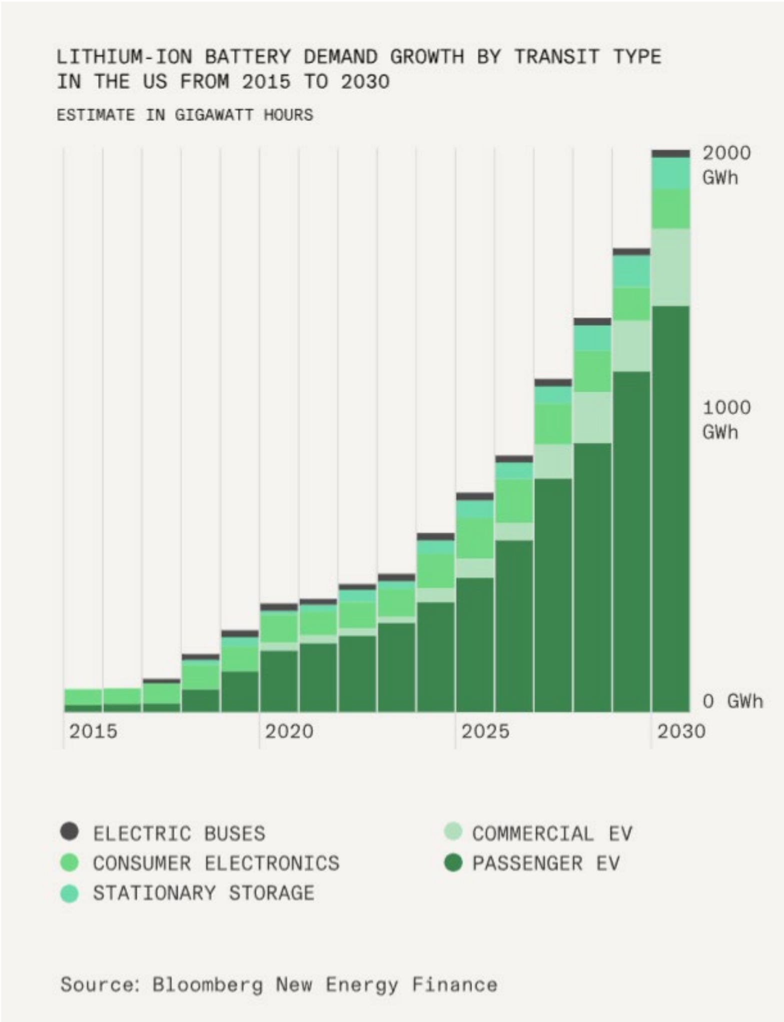
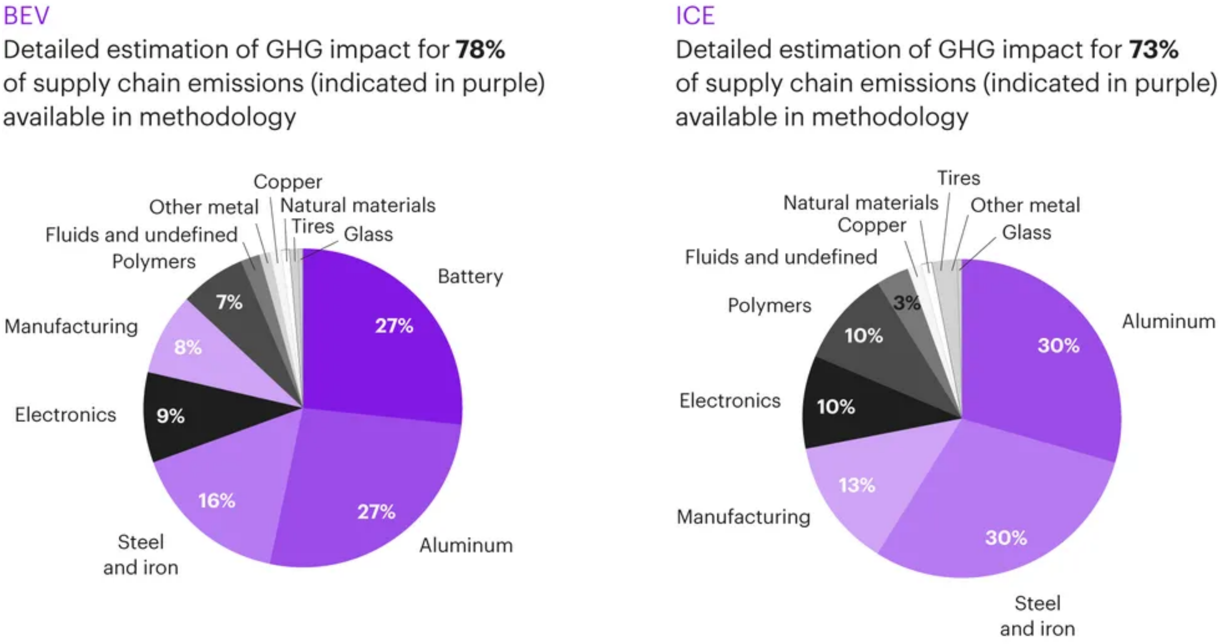


Figure 4

Figure 5

Currently, supply chain emissions for an EV are approximately 35 to 50% higher than for ICEs



Notes: EV is electric vehicle. BEV is battery electric vehicle. ICE is internal combustion engine. GHG is greenhouse gas.
Sources: Polestar LCA report; Kearney analysis

Table 1

NSW GOVERNMENT Transport for NSW

About us   Projects   Operations   Industry   Data and research   News and events

Home / Projects / Electric Vehicles / Charging an Electric Vehicle / Range and charging

Range and charging

Electric vehicles - electric range and charging

See all of the battery electric vehicles (BEVs) and fuel cell vehicles (FCEV) currently available in Australia.

Filter by: All

	Design	Type	Electric range, km (WLTP)	Electric range, km (Real)	Time to charge, hrs (7.4kW charger)
Toyota Mirai FCV (Sedan)		FCEV	550	495	0 hrs 10 mins
MINI Electric Classic (Hatchback)		BEV	233	199.47	4 hrs 24 mins
MINI Electric MINI Yours (Hatchback)		BEV	233	199.47	4 hrs 24 mins
Renault Kangoo Maxi Z.E (Van)		BEV	214	183	4 hrs 28 mins
Mazda MX-30 E35 Astina (SUV)		BEV	200	171.22	5 hrs 23 mins
Hyundai Kona Elite Standard Range (SUV)		BEV	305	261.11	5 hrs 27 mins

Source: https://www.transport.nsw.gov.au/projects/electric-vehicles/charging-an-electric-vehicle/range-and-charging