

Chapter 20 of Dr MacKay's celebrated book, "Sustainable Energy without the hot air", available at <http://www.withouthotair.com/>, deals with transport. We believe that the element in that chapter dealing with cars, electric cars, passenger trains, buses and trams is misleading.

Electricity and the primary burn

Dr MacKay's energy consumptions for electric vehicles (whether cars or trains) relate to the energy **at the plug**. Since the generating industry in the UK delivers only 35.6% of the energy burnt in power stations to the plug, all Dr MacKay's values for energy usage by electric vehicles need to be multiplied by 2.77, here rounded to three. Dr M makes that clear in chapter 2 although he there assumes the generating industry delivers 40% of the burn to the plug.

In defence of his presentation Dr M says that the thermal losses in present power stations are ignored because in the future those power stations will not be there, e-mail of 13th September 2009. We rejoin; that future is a long way off. In the interim those losses cannot be ignored.

Public Transport

On pages 119 and 120 Dr M compares buses and trains that are full with a single occupancy car. That rhetoric creates the impression that the bus and the train are, in relative terms, marvellously efficient - a train returning 1.6 kWh per 100 Passenger-km "if full", equating to 1,885 passenger-miles per gallon.

In contrast we found that, system-wide, Network Rail returns the equivalent of only 94 passenger-miles per gallon (32 kWh/100 pass-km), see <http://www.transport-watch.co.uk/transport-fact-sheet-5.htm>. Hence, the actual fuel efficiency of national rail is 20 times less than Dr M's "full" train - little better than an efficient diesel car operating at 60 mpg in uncongested conditions with the national average of 1.6 people aboard.

On page 121, Table 20.8, Dr M cites electric trains from Japan returning 6 kWh per 100 pass-km, with an average load. The 6kWh is equivalent to 18kWh burnt in power stations which yields the equivalent of 167 miles per gallon, far above the 94 that Network Rail actually achieved for all its services in 2005/6 op cit. We ask – why has Dr M suddenly gone to Japan?

The difference, an astonishing factor of 20, between our calculations and Dr M's assertions arises mainly because (a) over a week or year the average UK train, far from being "full", has only circa 20% of the seats occupied and (b) only 36% of the energy in power stations reaches the trains.

Electric cars

On page 127 Dr M makes the statement that "electric cars can deliver transport at an energy cost of roughly 15 kWh per 100 km. That's five times better than our baseline fossil fuel car".

Well, 15 kWh per 100 km at the plug does equate to 201 miles per gallon. However:

- (1) The 15 kWh has to be multiplied by 3 if it is to represent the energy burnt in power stations, yielding the equivalent of a not particularly unremarkable 67 miles per gallon.
- (2) Dr M acknowledges that the G-Wiz is scarcely able to carry two people and returns between 16 and 33 kWh/100km rather than the manufacturers' claimed 13. He then uses 15 kWh/100 km in his comparisons after inspecting a number of manufacturers' claims, many of which turn out to relate to two-, or possibly, one-seaters.
- (3) Dr M does not compare electric cars with conventional ones of the same performance. Instead the comparison is with a typical car returning "33 mpg". Here we comment – what about the "Smart Car" reported to return 86 miles per gallon.

- (4) Dr M makes no allowance, within the numbers cited, for the energy associated with battery manufacture and scrapping.

In contrast we found that, given the current UK generating industry, the electric car in urban conditions would use nearly 60% more energy than a diesel vehicle of the same power and, emit nearly 30% more carbon, see <http://www.transport-watch.co.uk/transport-fact-sheet-5c.htm>. Those calculations ignore (a) the energy lost in battery manufacture and scrapping (b) the greater weight of electric cars, said to weigh 40% more than the conventional competitors. For those reasons our calculations probably carry significant bias in favour of the electric vehicle.

Conclusion

Chapter 21 (dealing with heating) starts with the words “In chapter 20 we learned that the electrification could shrink transport’s energy consumption to one fifth of its current levels”. That appears to us entirely wrong, see paragraph immediately above.

Dr M continues with the statement that “Public Transport can be about 40 times more energy-efficient than driving a car”. In contrast we find that, in real life, the train and the bus perform little better, and often worse than a moderately sized diesel powered car.

On page 129 (chapter 20) Dr M says “This moment of celebration feels like a good time to unveil this chapter’s summary diagram, figure 20.23”.

Our view is that by writing a chapter on transport that fits exactly with Government policy Dr M has secured himself an advisor’s job, but, like the policy, his analysis (to do with transport), and figure 20.23 in particular, does not relate to the real world.

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For the reasons stated, fascinating though this book is it should be used with great caution, at least when dealing with transport issues.

That said, there is no doubt that if oil ran out we would either have to resort to bicycles or to battery powered cars charged by electricity from nuclear or renewables, as argued by Dr M in the later chapters of his book. However, that future is several decades away as is the ultimate collapse of oil supplies. In the intervening period, far from the electric car being green it would be an environmental disaster because of (a) its higher primary energy consumption compared with conventionally powered vehicles and (b) the problems that may arise in scrapping or recycling the 34 million batteries that would be required if the present vehicle fleet were to be battery driven.