The Carbon Footprint of Electric Bikes

and comparisons with other forms of transport

(from: *How Good are Bananas?* By Mike Berners-Lee; 2020)

A mile by electric bike

3g CO_2e per mile for a fully electric bike travelling at 12 mph with no hills or stops
5g CO_2e per mile at the same speed with five stops per mile and 20m of climbing[5][4]
Add 10–100g CO_2e per mile for the bike's embodied carbon

Electric bike emissions are truly amazing

In the ten years since the first edition of this book, electric bikes have come of age – and they turn out to be incredible from a carbon point of view. They are so good that I am just about to buy a folding one for my daily commute.

How can a mile on an electric bike be 20 times more carbon friendly than a mile on a conventional machine? The astonishing figures begin to make sense when you consider how you get your own energy – from, that banana trees are many times less efficient at capturing the sun's energy than, for example, solar panels. Also only a small part of the banana tree's energy finds its way into the banana itself, which then has to be transported around the world to reach you. On top of this, electric motors are perhaps four times as efficient as human legs at turning chemical energy into bike propulsion. If all our electricity was from solar power, the electric bike would beat the conventional bike by a factor of nearly 1000.

My numbers are for a fully motorised ride, although, by law, electric bikes must be a hybrid between pedalling and motor power. They assist you, but don't do all the work. This is probably just as well, because it means that electric bikes still keep you fit but make possible a greater range. However, this also means that the real footprint of cycling an e-bike is somewhere between the footprint of conventional cycling and the numbers I've given here.

The embodied emissions in the e-bike are similar to a regular bike except for the extra battery and engine. But they are probably lower per mile, since you are likely to ride the bike further over its lifetime

than a conventional bike. The battery turns out to account for just 0.5g per mile provided you use it to the end of its life.[6] I've assumed that you will look after your battery carefully, so that you get 1000 full charges out of it. To do this, charge it up slowly (trickle charge) and neither let it run totally flat nor charge it to the very top. And don't let your bike stand around for weeks on end – get out and use it![7]

Comparative carbon 'cost' of various forms of transport

1. ***'Cost' per (person) mile*** = fuel, tyres, maintenance of vehicle & infrastructure

2. ***'Embodied Cost'*** = vehicle production and infrastructure construction shared over all miles travelled over the 'vehicle's' life

3. All this has to be taken with a pinch of salt because there are so many variables including the fact that no human activity has a zero carbon status; we all have to breath and expire CO_2 !

4. Air travel not included but Berners-Lee does a London – Glasgow return included cycling, bus, train, car & plane

Mode	**Style**	**1. CO2e gm**	**2. Embodied CO2e gm**
Cycling	E-bike on flat roads	3	10 - 100
	E-bike on hilly roads	5	..
	Push bike fuelled by banana	40	..
	Push bike Cereal fuelled by cereal & milk	70	..
	Push bike fuelled by bacon & egg roll	250	..
Bus	Full 90-seater e-Bus	6	700
	Half full double decker	45	700
	Full long-distance coach	25	200
	Rural bus with just driver	2,500	600
Train	London tube	68	No clear figures found
	tram	72	
	Intercity standard class	80	
	Intercity First Class	160	
Car (3-4 people)	5-door electric car	180	50-110
	Fuel efficient car at 60mph	290	80 - 190
	Range Rover at 90mph	1100	250-220