

## The W-Point of Future Mobility

The hybrid-lie: why innovation starts with lower weight

Victorian London was the first megacity, the biggest metropolis of its time. Obviously there were many amenities to modern life, and of course there were problems as well. One of them came with the already exhausting daily traffic: fifty thousand horses left a thousand tons of dung on London's streets per day.

The dung not only bothered fine Londoner noses; it was also a nuisance if not a threat to public health. Maybe this is why the only survivor of the first series of Carl Benz' Motorwagen—the vehicle in which Bertha Benz once drove from the Benz' home in Mannheim to her mother's place in Pforzheim, 110 km away—is today owned by the London Science Museum. The car freed us from horses and smelled much like progress.

But in today's situation we find things only slightly improved, if not worsened. Estimates put German deaths at about 60,000 annually due to respirable dust. Berlin spent millions to get rid of pollution from its old coal ovens, replacing them with gas heaters after the collapse of the wall. But Berlin is still among the top cities every year where inhabitants breathe too much abrasion of tires and brakes and too much carbon black, the latter mostly from the latest generation diesel engines made popular for their gas mileage and allegedly positive environmental balance. The real story is that they produce many thousands of tons of nitrate monoxide NO, a neurotransmitter that directly controls the speed of thinking and blood pressure and, according to brain physiologists, should not exceed 200 micrograms per cubic meter in exhaled air.

Nitrate monoxide competes with oxygen and ousts it. One of the decomposition products of NO is peroxy nitrite, against which the known burden of nitrates from air, water and vegetables for the metabolism and the central nervous system might be a mere joke. Limit values are only to come in the European Union. Many trucks and more and more sedans are injecting two liters of urea per hundred kilometers into the exhaust, as that eliminates the nitrate oxide. So again, 100 years after the horse buses, we still breathe codswallop. And unfortunately more than back then.

A little estimate: One horse power is about 750 Watt, meaning that the London horses made 37,5 Megawatts per thousand tons of dung. Today's medium-sized vehicle has at least 80 hp, or 60 kW, and this is where the evidence of the mistake lies. In greater Berlin there are about three million cars, making 180,000 Megawatts. Since we have about 4 million people living in Berlin we end up with 45,000 Megawatts for one million people.

So why did the Victorians use 1,200 times less available energy to transport themselves? Very simple: The horse bus carried many people with few horses. The ratio of vehicle weight to load was maybe close to or even below 1. Today we use 60 kW to carry most of the time only one person through our otherwise pretty nice cities. But the

car weighs 1,200 kg! For the most part, the power of the engine is used to transport only the vehicle itself.

We like talk about 30% of driven miles in cities are used up by looking for a parking lot. We know that at least half of the rest of driven miles are done by commuters who cannot or do not want to live in the city full of respirable dust and noise. We also know that the ideal velocity on the Munich city highway for everybody to get home fastest, according to traffic jam researchers, is 30 km/h. The risk of heart attack is 30% higher for males who sleep on main streets, as the stress hormones have to constantly flow to enable them to keep sleeping. Half of all city rides are less than 2km, so going by bicycle would be faster anyway.

But wait, certainly we are not going back to old times with no cars. For distances above 10 km, for shopping or to go to the theater, in rain or cold, the bicycle is no practical choice. But we need innovation in another direction than the one we are currently traveling. And in fact, comparison to the bicycle does help: you can ride the bicycle very well with, say, 150 watts. Lance Armstrong holds 500 Watts for a few minutes or 1,000 Watts for a few seconds, but then his speed is way too high for normal city traffic. His bike however weighs maybe 6 kilograms. The wheels are 500 grams each. Did you ever roll your winter tires towards the trunk and lift them in? All that a hybrid car might save—and it only saves gas in the city—is probably wasted merely in bringing tires that heavy into their rotation alone.

But maybe the hybrid does not even save gas at all. It is even heavier than old cars with only one engine, now with an additional large electric motor, plus the large and heavy battery. Also it needs some stability for all this increased weight, making it even heavier again, especially if it is made for highway speeds, too ... a vicious circle. The hybrid makes no sense, as whatever you save in the city using electricity you loose by carrying around the useless gas engine with all its needs like cooling system, gearbox, gas tank etc. And this is vice versa on the highway: higher gas consumption for the now useless electric components.

To get you and your best friend through town warm and dry inside and out, current material science allows a vehicle that weighs maybe thirty kilograms, even if both of you bring a beer crate along. Add an electric motor and you should still be way below 100 kg. If this vehicle looks cool is a question in the design department. To operate it, a typical starter battery of our current middle-class cars will do.

And we should not be looking only at gas mileage or harmful substances per kilometer. The real factor is harmful substances per kg load and km. Building, maintaining and disposing of your vehicle has to go into that calculation.

The Motorwagen that brought Bertha Benz and her sons Eugen and Richard to their grandmother used less than one horse power. About what a pro cyclist has, and, yes, it was slow and a catastrophe uphill, but not only because of the little power; more important was that the weight of the Motorwagen was way too high at 265

kilograms. Imagine today: it weighs only a third of that, has a roof, has 30 hp, costs you pennies, keeps cities clean, accelerates better than a Porsche. Imagine it's lot's of fun. Know it's the intelligent solution.

A pity the London Science Museum has the old Benz in storage in Swindon. They should take it out to show again and get a study to demonstrate what it would look like today. And to remind us what its weight would be today.

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