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Optimal time

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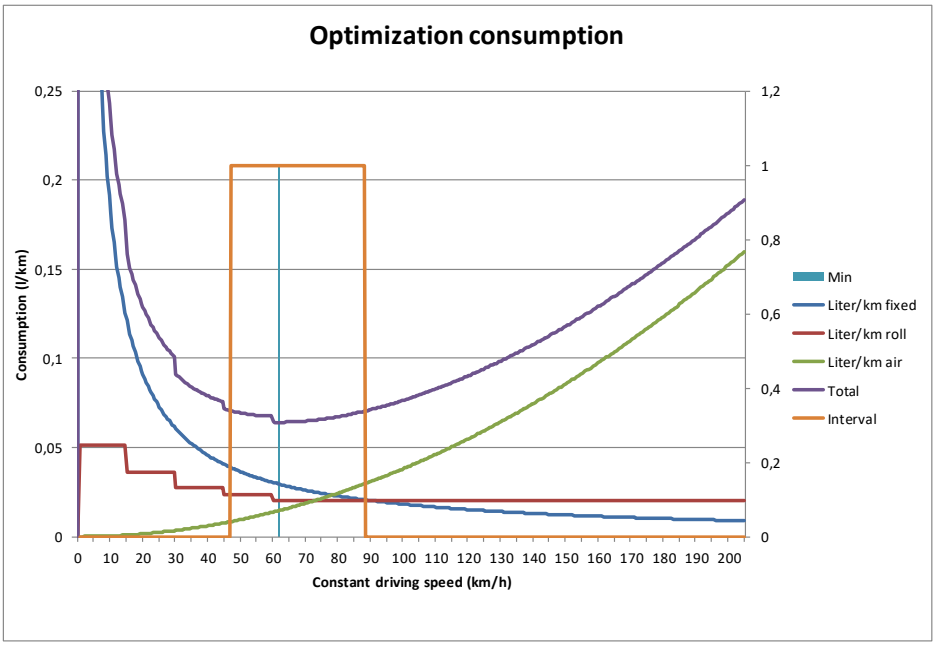
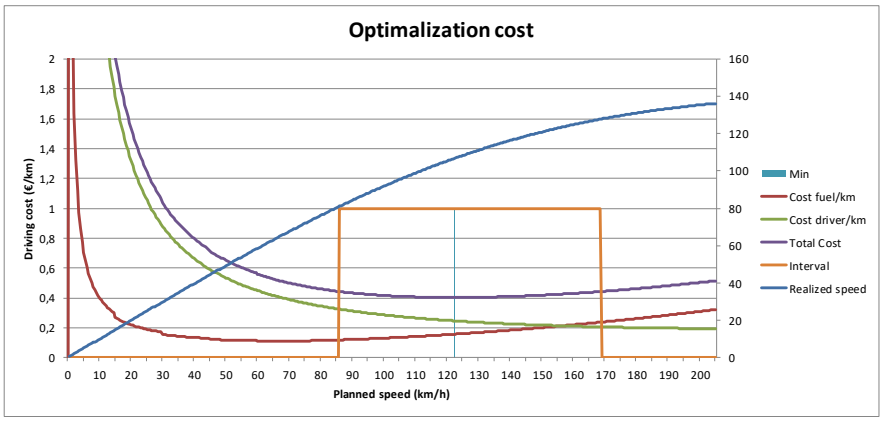
This week we read a message that many Europeans find electric transport still too expensive and we have seen that an expensive solution is not always optimal[1]. From an environmental point of view, it is not always attractive to decommission the fossil car in favor of an electric variant[2]. In the context of sustainability, this can not of course be a license to do nothing. To do the favor of the environment, and ultimately also ourselves and others, we can travel more by train. Unfortunately, there are locations that are not easily accessible by public transport. In the middle of the night you can not take a bus from Near Field to Farawayastan. So for the time being we are stuck to our fossil car for some of our journeys. The question that arises is, what is the optimal travel speed? We will determine this for traveling on motorways.

You can flatten the question about the optimal travel speed and only look at your fuel costs. Imagine having a five-speed[3] car running on petrol with a maximum power of 96 kW (130 hp) and a top speed of 205 km/h. The weather is warm and the air conditioning is on. Together with some other constant losses such as radio, lighting and power steering, that power is 5 kW. The rolling resistance is 100N and the internal friction in the engine is also 100N. You can calculate the optimum with this data. The influence of the air conditioning on consumption is inversely proportional to the speed, so faster driving reduces the influence of the air conditioning. The influence of the friction of the engine also decreases because we shift the gears up. The air resistance increases in proportion to the square of the speed. The graph shows that your consumption is minimal at 62 kilometers per hour. If you accept 10% more consumption, the lower limit is 46 km/h and the upper limit is 89 km/h. You can drive 25% faster, with only 10% extra consumption compared to the minimum. It can also be seen that if you push the throttle a little deeper, your consumption will increase per driven kilometer. At top speed it is 1 liter of petrol on a distance of just over 5 kilometers. Consumption in urban areas or in traffic jams is much higher: you will only drive a couple of kilometers per hour. When you have passengers on board and you are in a traffic jam, you can offer them a free fitness in favor of fuel consumption by pushing the car.

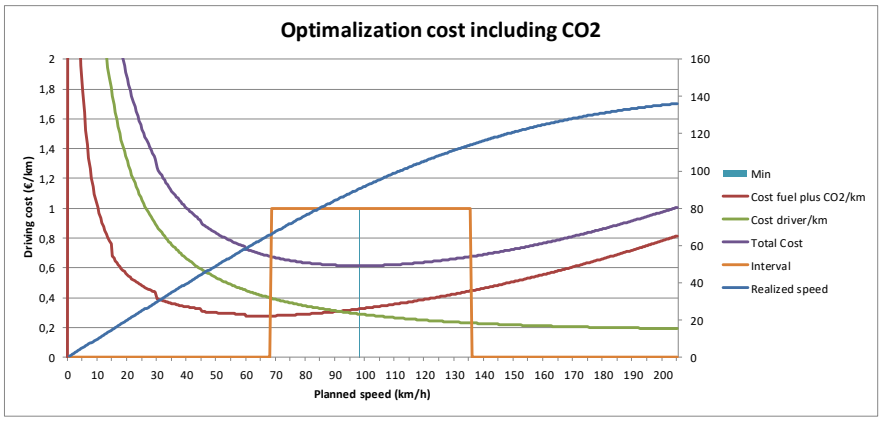


[1] https://nl.investing.com/news/aandelen-markt-nieuws/stekkerauto-voor-veel-europeanen-te-duur-91265
[2] http://www.assetresolutions.nl/en/column/maintain-or-replace
[3] We will not bore you with the gear ratios. Oh well we do crazy, these are rounded 3.1, 2.0, 1.3, 1.0 and 0.8 for gears 1 to 5

The optimization is different by involving the costs of time. Most people (let us say: all we know) do not have unlimited time at their disposal and wish to limit the travel time to some extent. That time is worth something to us. We assume that an hour lost traveling time per car costs 26,25 euros[4]. Harder driving costs more fuel, but it saves time. The optimum shifts: we can make a little more pace. The total costs are the lowest at 122 km/h and when we accept 10% extra costs, we can even drive 170 km/h. This speed is of course even higher when the travel time becomes more expensive. Values with which the petrol heads can come home, where we do not account the fines and the higher insecurity.



What we should not forget is that we also cause damage to the environment by burning petrol. We charge 2,60 euros per liter per liter of petrol for the CO_2 released[5]. That damage has quite an influence. When we take the fuel costs, time and clean-up costs into account, the optimum decreases to just under 100 km/h. It is striking that the maximum speeds on our motorways are in the optimum interval. With the graph we can also test the policy of our previous government. If we now drive 130 km/h instead of 120 km/h, this has a considerable influence on the fuel and CO_2 costs, but due to the "time is money" principle, the higher maximum speed is only slightly more expensive.



If we place the graphs next to each other, optimum speeds of 62, 122 and 98 km/h can be seen. The interval at which we accept 10% extra costs is strikingly large. You can see that 100 km/h in all comparisons is close to the interval of 10% deviation. So if everyone will now be driving 100 km/h on the right lane, then we can increase our speed on the left. The only disadvantage is that we no longer have anyone to be tailgating, with which we could keep our consumption within limits.

John de Croon and Ype Wijnia are partner at AssetResolutions BV, a company they co-founded. They give their vision on an aspect of asset management in columns. The columns are published on the website of AssetResolutions, www.assetresolutions.nl/en/column

[4] http://www.assetresolutions.nl/nl/column/kosten-van-onderzoek-versus-doorstroming-bij-ongelukken#_ftn6; in the chart Cost driver/km

[5] http://www.assetresolutions.nl/en/column/the-value-of-co2