

There and Back Again: navigating low-carbon business travel

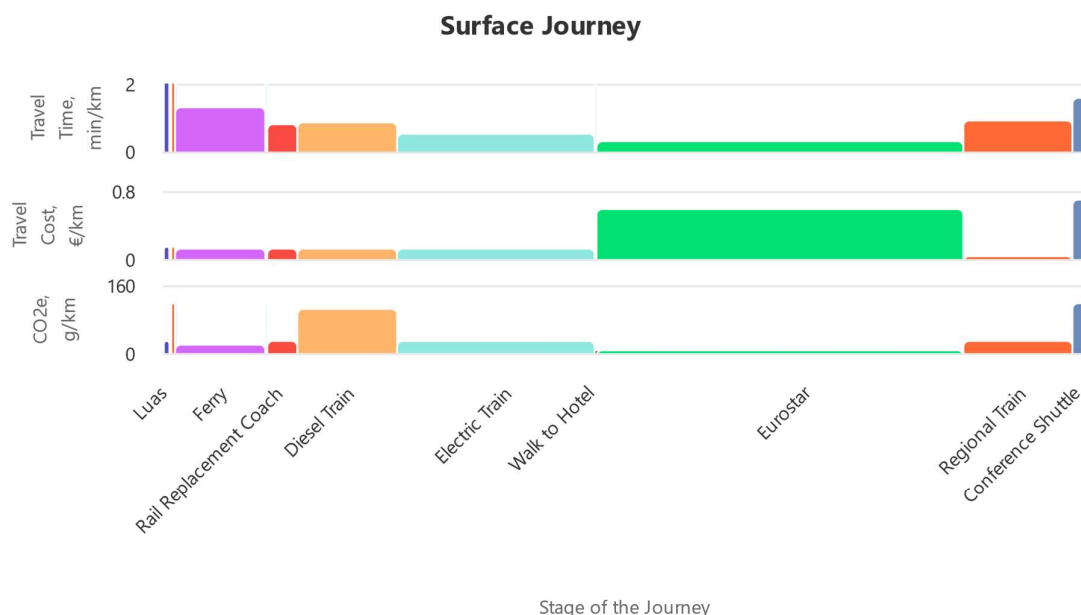
Time, Money, and Carbon Cost Details

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Illustrating the costs along the journey

Ready for more details on the time, money, and carbon costs by land/sea vs. air? Here are some charts that give some additional insights. The charts that follow show the *intensities* of each leg of the trip, in the sense of the time, carbon, or Euro expended for each kilometre travelled. The first chart shows these for the surface outgoing journey, and the second for the return journey by mostly by air.

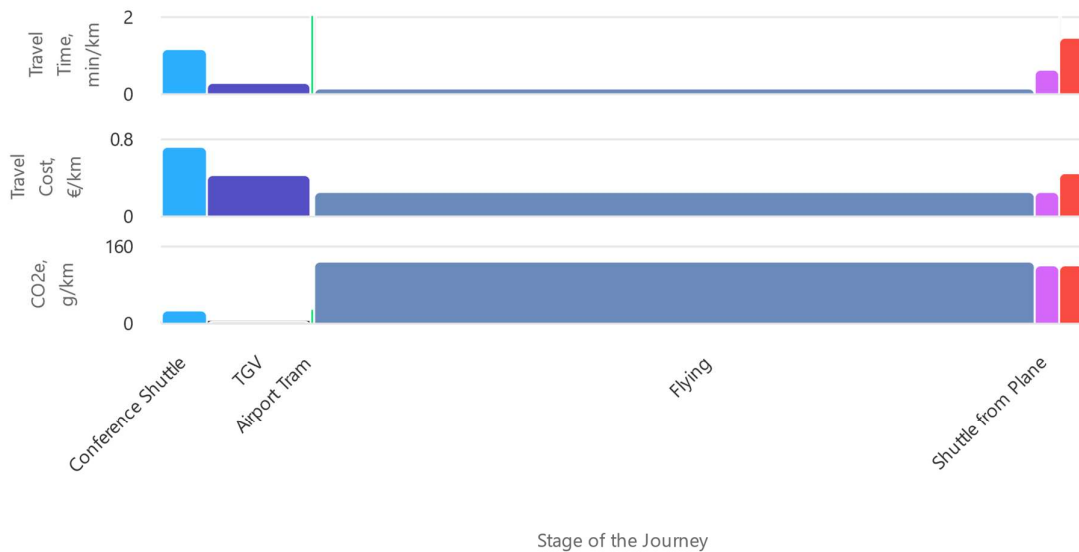
Each chart shows the journey in one direction, starting from the starting point (zero kilometres) and going up to the full length of the trip in kilometres. Each leg of the journey is shown as a rectangular box, and the box's width shows what distance was covered by that leg. The height of the box shows how intense that leg was, in terms of time (top), money (middle), and carbon equivalents (bottom) expended per kilometre. Consequently, one can see the total expenditure of each leg by looking at the total *area* of the box.



Column widths indicate distance travelled (km); column areas indicate total travel time (min), travel cost (€), and emissions (gCO₂e).

Highcharts.com

Air Journey



Column widths indicate distance travelled (km); column areas indicate total travel time (min), travel cost (€), and emissions (gCO2e).

Highcharts.com

Hurry up and wait

Taking travel times first (shown at the top of each chart), the heights of the boxes show minutes per kilometre. This is essentially the inverse of speed – so instead of showing the distance you can cover in an hour, it shows the time it takes to cover a kilometre. Lower is better.

To get a sense of the total “time cost” of one leg of the trip, I just need to look at the total area of the corresponding box – the height (minutes per km) times the width (km). For example, the ferry carried me 110 km (the width), at a rate of 1.3 minutes per km (the height), taking a total of 2 ½ hours., walking is literally off the chart (i.e. the tops are not shown), taking from 8 to 16 minutes per kilometre (depending on queues, traffic lights, sense of urgency, etc.), but walking trips are so short that this doesn’t add up to a lot of travel time. Meanwhile, air travel is the speediest at about 8 seconds per kilometre, but because the flight covered so much distance, it actually adds up to a decent chunk of time at 1 ½ hours.

In total, the surface route through the UK took nearly 19 hours, while the return by air took only 10 hours. The hotel stay, which didn’t cover any distance, added a further 9 hours to the outgoing trip that aren’t shown in the chart. Is this part of the trip’s time cost? Depends on the accounting – sure, I would have been sleeping anyway, right?

Also not shown in the charts are waiting times. It’s worth mentioning that the longest *single* waiting time was at Charles de Gaulle Airport (nearly 3 hours), but that the longest *total journey* waiting time was for the surface route (5 ½ hours, compared to 4 ¼ hours for the air journey) – that’s because of the many changes of travel mode, with a bit of waiting for each one.

How expensive is a piece of string?

Next, the money costs are shown in the middle of each chart. In the event, the surface route was a lot more expensive than flying—€526 compared to €296. But a huge part of this was due to two factors: a Eurostar trip at peak period, and a hotel stay. If there'd been any way to take the Eurostar segment off-peak, and if the hotel stay were avoidable, then the cost could have been down to €146. But in practice there was really no way do it all in one day, and avoiding that peak hour train would have extended the entire trip, leading to yet another hotel stay and more costs.

While the peak-hour Eurostar was the most expensive long-distance trip leg (at 60c per km), the Sail/Rail ticket – covering the sailing to Holyhead and all the rail connections to get to London – was a relative bargain, at only 12c per km. So where the sail/rail journey is at a disadvantage on travel time, it's very competitive on price.

Counting Carbon

Back to the point of it all – the carbon footprint. The bottom sections of each chart show the clear carbon impact of air travel – it has among the highest carbon intensities per kilometre travelled, and it covers the most ground on the return trip. All this adds up to, by far, the largest contribution to global warming of any trip element, with nearly 100 kg CO₂, making the return journey nearly 108 kg CO₂.

In contrast, the surface route emitted just over 32 kg CO₂, or just over 44 kg CO₂ when including the hotel stay. Either way, this is a massive reduction in carbon emissions for just the outgoing part of a single journey.

Worth mentioning here is that there are other modes of travel that emit a lot of carbon – in particular, diesel buses and diesel trains. Their carbon intensities are on the same order of magnitude as the airplane, but because the distances covered were so much shorter, their contributions were significantly less. High speed rail had the best carbon performance and normally covered a lot of ground, but the ferry also performed reasonably well – largely because I didn't bring a car, so one person is a small part of the total ferry load.

	Total Travel Time	Total Cost	Total Carbon Emissions
Surface route (not including hotel)	19 hours	€354	32 kg CO₂
Surface route (including hotel)	28 hours	€527	44 kg CO₂
Air route	10 hours	€296	108 kg CO ₂

The Fine Print

Meticulous carbon counters may be interested in where I got my emissions factors. It's important to point out that none of this includes embodied carbon – the initial carbon cost of building the infrastructure and manufacturing the vehicles I used, as it's much more difficult to find reliable estimates.

But for the carbon factors for the journeys themselves, I used the following:

- UK's Department for Energy Security and Net Zero, Conversion Factors for Greenhouse Gas

Reporting 2023: emissions factors for Tram, Bus, Coach, Ferry foot passenger, and Hotel stay

- Campaign for Better Transport, 2023: emission factor for Diesel and Electric Trains in the UK
- Eurostar: emissions factor for Eurostar Train
- SNCF: emissions factors for TER and TGV Trains in France
- IEA Mobility Model: emissions factor for Air Travel