sasig
Strategic Aviation
Special Interest Group

Domestic Aviation, Climate change and UK transport de-carbonisation

December 2021

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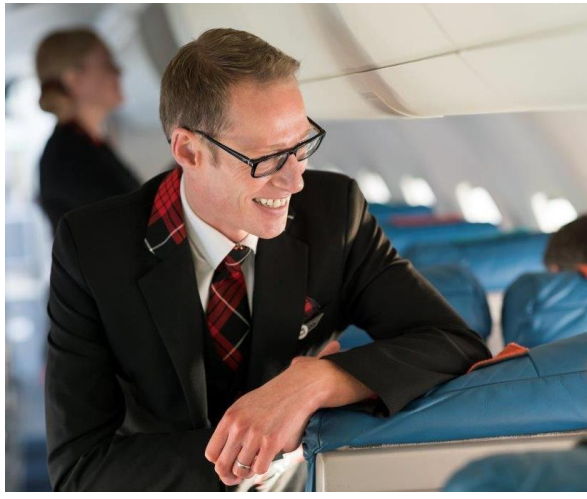
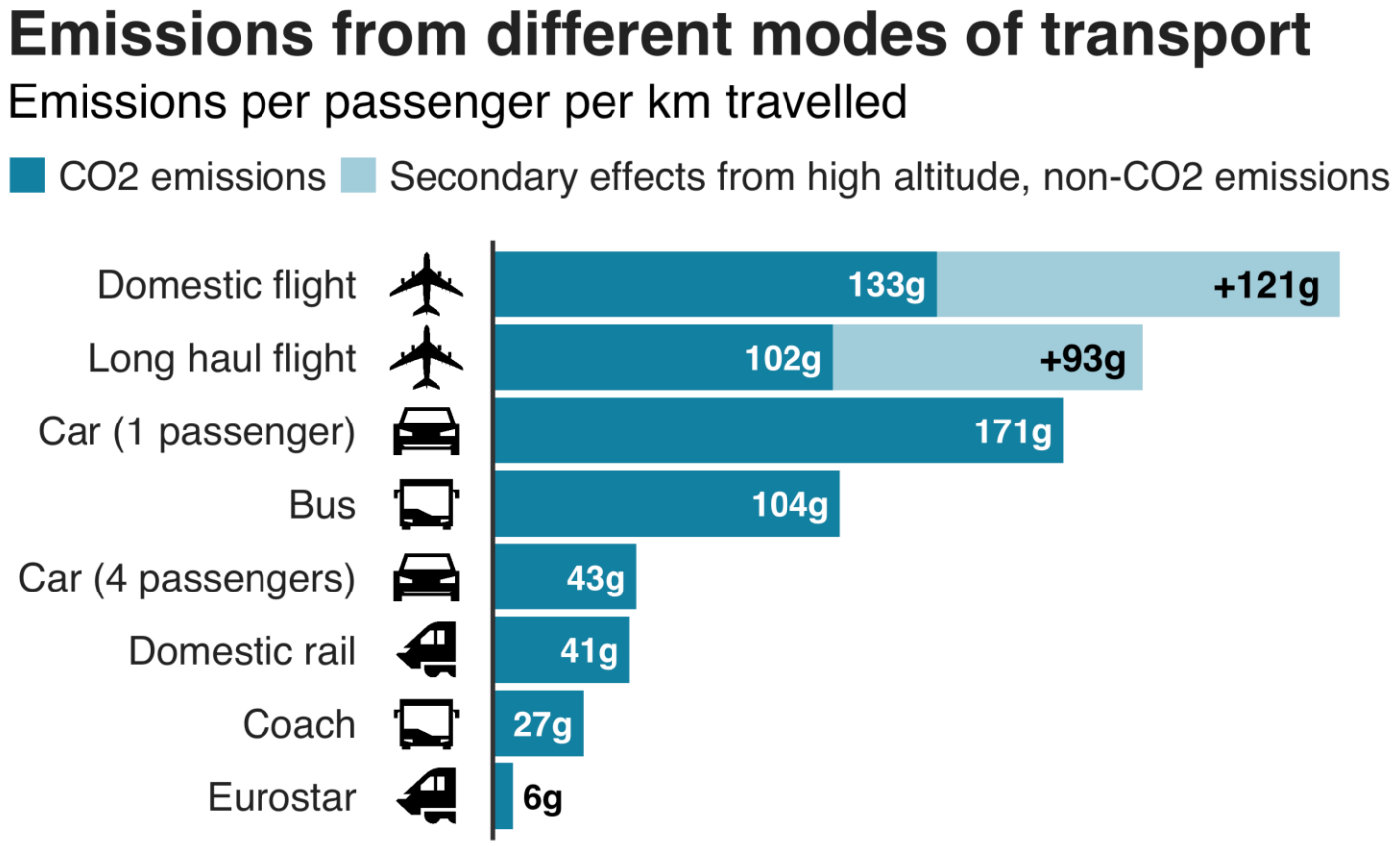


Domestic Flying is the most carbon intensive form of travel……..



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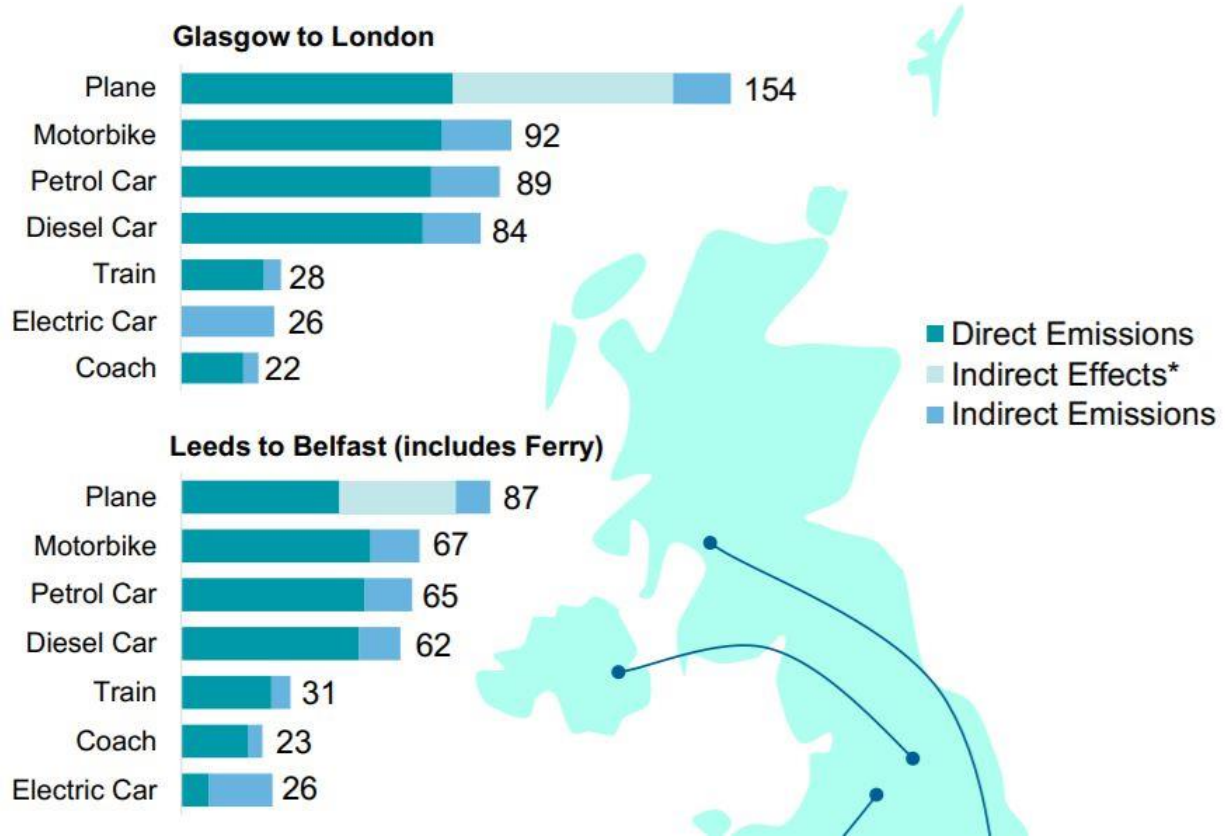
So, we should ban it…….



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France moves to ban short-haul domestic flights

12 April

Climate change

Domestic flights are a climate disaster: we need #trainNOTplane

11.10.2021 | Jess Fitch | Better Transport

Tweet

The effects of climate change are being felt around the world. The need for action is urgent. So why is the Government considering making it cheaper to fly from Manchester to London, or London to Edinburgh?

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Or at least increase, not decrease taxes….

Government is slammed for sending the wrong message on the eve of COP26 by halving domestic flight tax - as Patrick Vallance says use more trains

- Government plans to slap £91 air passenger duty (APD) on ultra-long haul flights
- It will be for destinations such as Australia, east Asia and parts of South America
- Destinations like New York will remain in long haul area and tax will rise to £87
- At the same time, the duty on short haul journeys will be reduced by 50 per cent
- Aviation chiefs say move will damage airlines recovering from impact of Covid
- But Sir Patrick Vallance today said Britons should look to reduce use of flights

Budget 2021: Rishi Sunak defends lowering domestic air duty

28 October | Comments

Domestic APD cut a disgrace amid climate challenge, warns Blackford

The SNP's Westminster leader also said the Budget 'brazenly cuts taxes for the banks whilst at the same time cuts Universal Credit for the poor'.

By boosting flights in the UK, Rishi Sunak has revealed the Tories' true priorities

Leo Murray

Encouraging short-distance travel by the most damaging mode of transport shows yet again that profit trumps climate action

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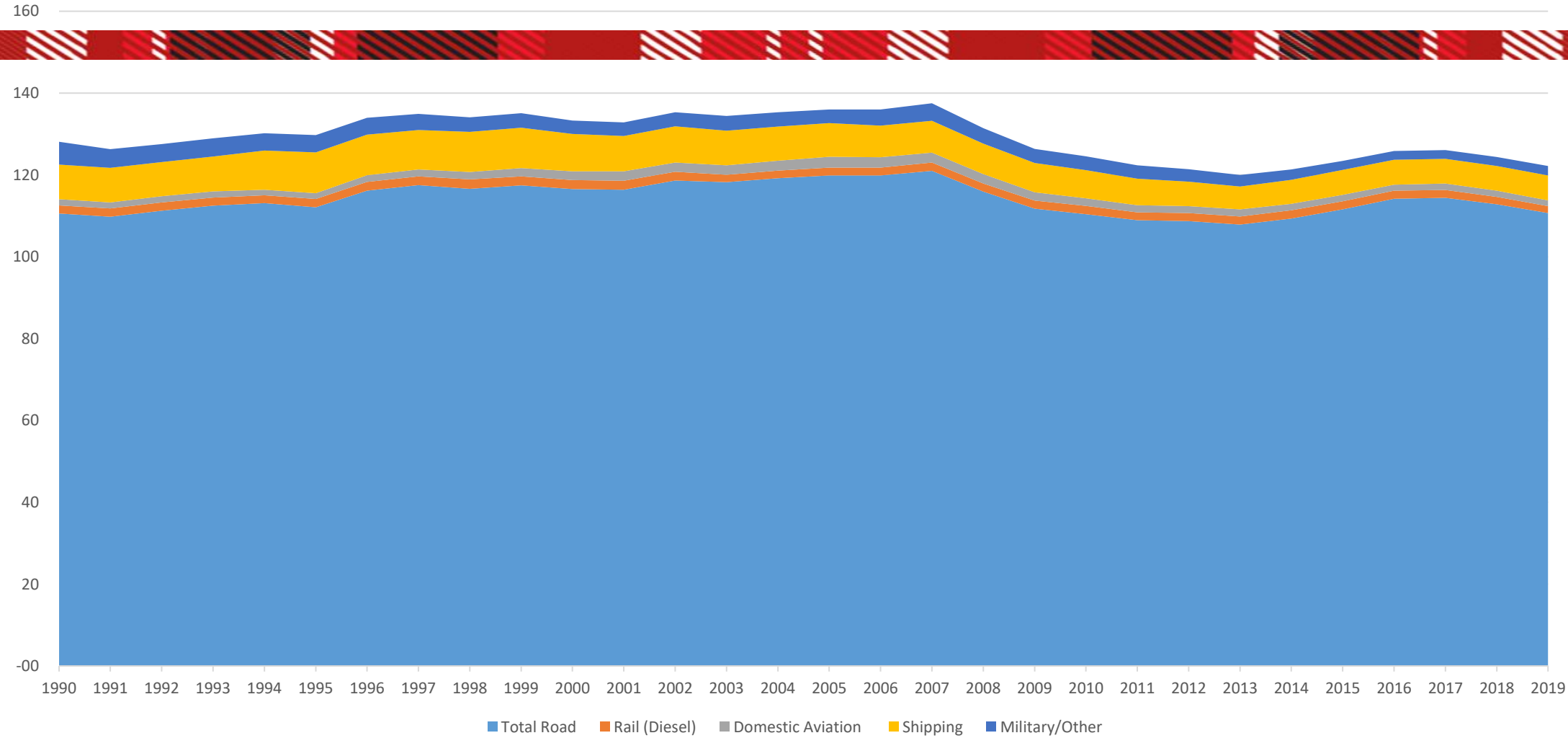
Total Domestic UK transport emissions by source (ENV0201)



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Domestic Aviation emissions in context:

- Domestic aviation emissions peaked in 2005 at 2.65mt CO_{2e} and have declined steadily to current date (2019) at 1.42mt CO_{2e}

- From 2010 to 2019, Domestic aviation emissions declined by 23% (from 1.84 to 1.42mt CO_{2e}) whereas total emissions from road travel were static (110.4 to 110.7mt CO_{2e})

- International aviation emissions (ex UK) have however, climbed significantly in this period but it is crucial to separate domestic from international – domestic air competes with road, international does not.

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DfT Transport & Environment Statistics 2021: Annual Report

Review of the source data:

Table 47: Findings of ATTICA project

	Metric values			CO_2e emissions ($MtCO_2e/yr.$) for 2005			LOSU
	GWP_{20}	GWP_{100}	GTP_{100}	GWP_{20}	GWP_{100}	GTP_{100}	
CO_2	1	1	1	641	641	641	High
Low NO_x	120	-2.1	-9.5	106	-1.9	-8.4	Very low
High NO_x	470	71	7.6	415	63	6.7	Very low
Water vapour	0.49	0.14	0.02	123	35	5.0	–
Sulphate	-140	-40	-5.7	-25	-7	-1.0	–
Black carbon	1600	460	64	10	2.8	0.38	–
Contrail	0.74	0.21	0.03	474	135	19	Low
AIC	2.2	0.63	0.089	1410	404	57	Very low
				CO_2e/CO_2 emissions for 2005			
Low NO_x, inc. AIC				4.3	1.9	1.1	Very low
High NO_x, inc. AIC				4.8	2.0	1.1	Very low
Low NO_x, exc. AIC				2.1	1.3	1.0	Very low
High NO_x, exc. AIC				2.6	1.4	1.0	Very low

Table 47 from 2021 GHG factor methodology paper

- Source for all claims are the BEIS Scope 3 GHG emissions factors
- Scope 3 reporting purpose, not Scope 1 or 2
- Aviation factors cannot be replicated with publicly available data.
- Indirect effects noted as having a Low to Very Low LOSU but a 90% factor applied to both Domestic & International Flights.

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Averages and factors

- The figures are computed by taking total historic transport mode emissions, divided by estimated passenger kms.
- Aviation has a 90% factor applied for “Indirect Effects”
- Ferries are biased towards Freight with over 88% of total ferry emissions allocated to Freight, not passenger travel[4].
- Rail travel aggregates electric & diesel emissions and journeys – despite only 40% of the network being electrified, 80%[5] of rail vehicle kms are electric. Strong bias in passenger kms to electrified London commuter routes, which disguises diesel rail’s effective emissions per pax km which are far higher.

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[4] 2021 Government GHG factors, methodology report

[5] p28 RSSB Decarbonisation taskforce final report Jul 2019

BEIS figures are NOT the carbon cost per additional passenger journey….

- The figures are based on average passenger's carried – increasing the number of passengers carried would reduce the carbon intensity per pax km (more passengers = less carbon!)
- In practise, adding one extra passenger to an existing train, ferry or scheduled flight adds very little carbon.
- However, car journeys are truly marginal and so the figures more effectively describe the carbon cost of car travel.

	ATR72-600, Y72 - Ave one way		
	Aberdeen - Manchester	Isle of Man - Liverpool	
GC Distance +8% (km)	462	156	
Fuel burn, nil pax (kg)	855	419	
Fuel burn, 72 pax (kg)	951	461	
Δ Fuel burn (kg)	96	43	
Direct CO_2, nil pax (kg)	2,693	1,318	
Direct CO_2, 72 pax (kg)	2,994	1,452	
Δ CO_2 (kg)	301	134	
Marginal CO_2 per pax per trip (kg)	**4.18**	**1.86**	
Full Cost CO_2 per pax per trip (kg)	**54.05**	**26.27**	**75% LF**

Loganair flight planning computations using live winds and routing data. No indirect effects caused due altitude and actual temps.

- Under BEIS (2019) statistics, the carbon cost would be computed as 462km x 0.254g = 117kg an error of x 28.

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Introduction to “Indirect Effects”

- Clear consensus that high altitude emissions of NO_x, SO_x and water vapor has a net warming effect – low consensus on the quantitative effects.
- Studies have been at a macro level to assess the cumulative impact of aviation on the global climate – the effects are described “per flight” to give a sense of scale, but this is not the same as presuming each flight causes an effect.
- Unlike direct CO_2 emissions, indirect effects act over shorter timescales and are geographically concentrated.

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Indirect Effects of High-Altitude emissions

Contrail formation and AIC

- Contrails are caused when supersaturated air is exposed to water vapor from an aircraft's exhaust.
- The conditions for contrail formation do not occur below 29,000 ft in less than 100% humidity under ISA.[1]
- The warming effect is due to infrared radiation being reflected back to earth, rather than radiated to space. In daytime, some of the effect is cooling, at night the effect is purely warming.

High Altitude NO_x

- Complex chemical interactions with ambient oxygen form Ozone, a GHG.
- NO_x also permits hydroxyl reactions to breakdown atmospheric methane into CO_2 and CO. This has a significant cooling effect as CH_4 is a potent GHG with GWP_{20} of 84
- The largest climate response from NO_x occurs around FL370 (37,000 ft or 227hPa)[2]

[1] Schmidt-Appleman criteria
[2] Skowron, Lee, De Leon

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High Altitude Indirect effects summary:

- Predominantly High-Altitude effects caused by Long-Haul flights, cruising at FL370+
- Recent study found 2.2% of flights likely account for 80% of all contrail effects[3] and that short haul flights had minimal impact.
- Domestic flights typically cruise at levels between 8,000 ft and 27,000ft and spend little time above 30,000ft.

It is inappropriate and poor science to apply indirect factors to domestic UK flight emissions.

[3] Teoh & Schumann 2020

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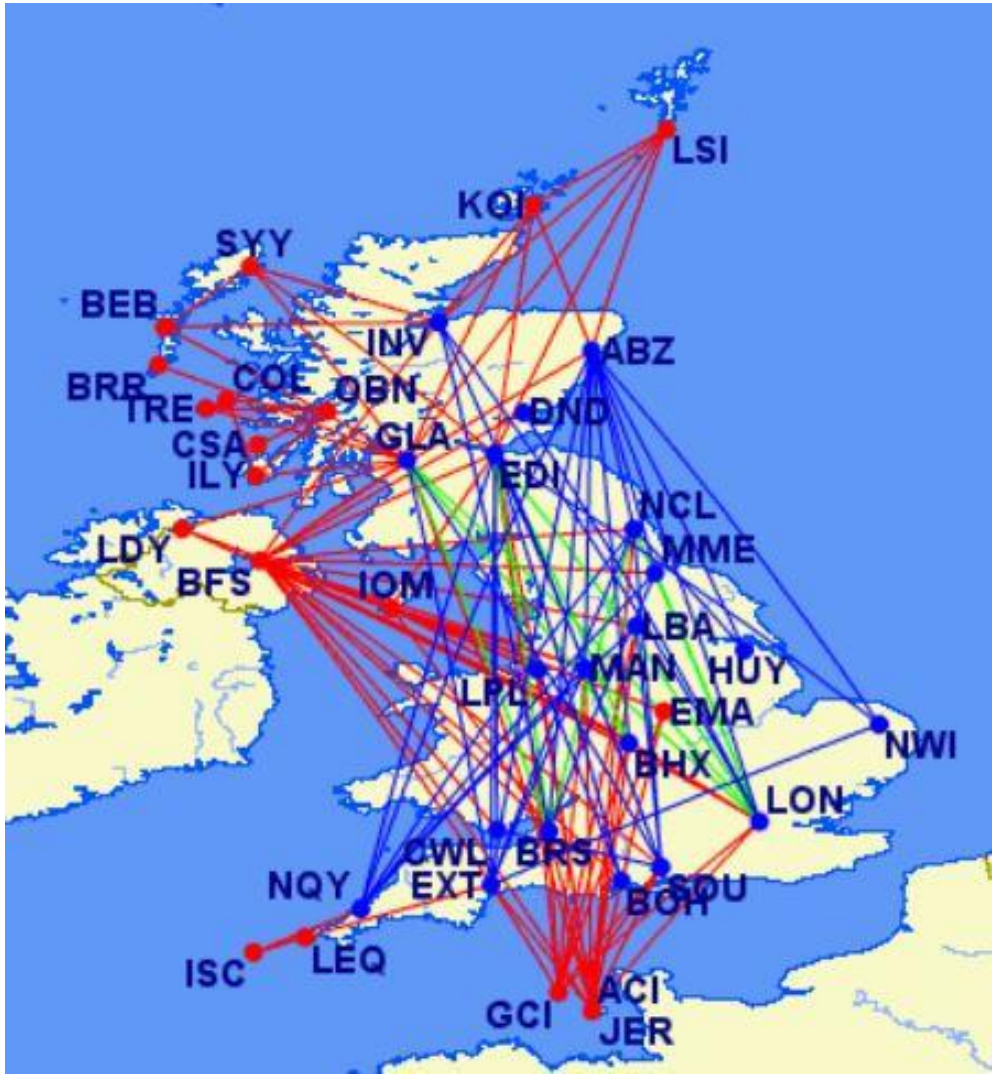
Domestic Air network (Oct21)

- The majority of domestic flights (60%) cross water and have no possible rail replacement.

- Out of 127 total domestic air routes, only 46 had a direct rail alternative. Of these, only 16 have journey times less than 5 hours and of these, only 7 are electrified rail

(Source: Loganair analysis of OAG data for Oct21)



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Domestic aviation taxation

Taxation position currently

- APD tax of £13 per one way flight.
- Domestic flying all included in EU, now UK ETS – pays for carbon emissions @ c. £70 per tonne
- Over 80% of domestic flights operated by carriers with mandatory offsetting programs (Loganair, easyJet, BA, Blue Islands)

Even after the APD adjustment back to the original levels, domestic air passengers will still pay more in taxes per km/kg CO_2 emitted than other modes and significantly more than the higher emitting international air traveler.

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Taxes and subsidies versus emissions by mode

	Aberdeen to Manchester return (per pax)				
	ATR72-600	Medium Car 1 pax	Medium Car 2 pax	Rail	
Marginal CO_2 (kg CO_2) per passenger	8.36	124.27	130.49	-	
Hotel Stay (Total)	-	13.90	27.80	13.90	
Total Marginal CO_2 per pax per trip	**8.36**	**138.17**	**158.29**	**13.90**	
Fully Costed Direct CO_2 (kg) per pax	96.37	124.27	65.24	38.91	75% LF Plane & Train
Hotel Stay per pax	-	13.90	13.90	13.90	
Total Full Cost CO_2 (kg) per pax	**96.37**	**138.17**	**79.14**	**52.81**	
BEIS Scope 3 (Direct CO_2 only)	118.99	201.29	107.59	53.72	Includes Hotel
BEIS Scope 3 (Indirect + Direct CO_2)	227.30	203.46	108.68	54.17	Includes Hotel
Total APD Tax (75% LF) / Fuel Duty	£ 1,404	£ 26.87	£ 26.87	£ -	Assumes fuel VAT reclaimed
Total ETS Costs (@ £70/mt)	£ 409	£ -	£ -	£ -	Assumes hotel VAT reclaimed
Carbon Offset Costs (mandatory charge)	£ 108	£ -	£ -	£ -	
Public Subsidy (total trip)	£ -	£ -	£ -	-£ 14,627	(2019 £7.1Bn div 550m train kms x journey kms)
Total Taxes/Subsidies per trip	£ 1,921	£ 26.87	£ 26.87	-£ 14,627	
Total Taxes/Subsidies per passenger round trip	£ 35.57	£ 26.87	£ 13.44	-£ 67.17	

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Conclusions

- The BEIS statistics are not an accurate reflection of the relative carbon costs of different modes of transport.
- Once a public transport schedule has been set, far less CO_2 is incurred by making use of train, ferry or plane than driving (even electric cars).
- Indirect effects are inappropriately applied and distort the relative carbon intensity of air travel
- Rail emissions are heavily biased by intensive, electrified commuting into London. The average rail journey is 38km with, which is not reflective of low load factor, long distance diesel rail emissions.
- The primary alterative to domestic flying is car use on the vast majority of routes but sole car use emits more direct CO_{2e} than domestic flights per passenger km.

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