



# **air traffic controls:** the hidden costs of a new london runway

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Better Transport 

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# about

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## **fellow travellers**

Fellow Travellers is a not-for-profit, unincorporated association campaigning for fair and equitable solutions to the growing environmental damage caused by air travel. We aim to protect access to reasonable levels of flying for the less well-off, whilst maintaining aviation emissions within safe limits for the climate.

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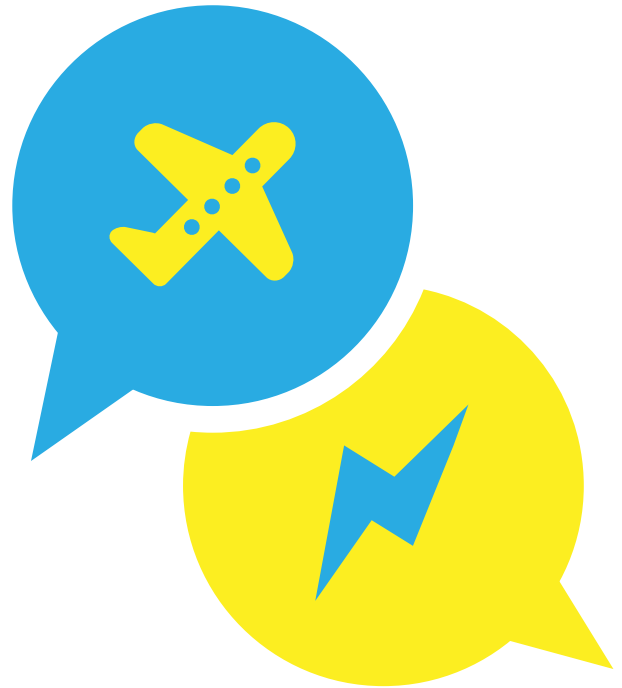
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## foreword

In 30 years, will the Climate Change Act be regarded as the most effective piece of environmental legislation there ever was? Or will it be an unmet aspiration or forgotten footnote? Decisions about whether we can both meet our emissions targets and expand airport capacity in the South East might be about to tell us the answer.



In essence, the point of the 2008 Climate Change Act is to replace earnest but vague talk of emissions cuts sometime in the distant future with a clear and legally enshrined path to stabilising our climate. It is very clear on the scale of cuts that we need to make, and the need to start now. For the aviation sector, which is pushing hard for growth, that looks like a very testing proposition.

In its guidance to the Government, the Committee on Climate Change could not be clearer that massive cuts to emissions are needed, and the whole economy will have to play its part - including aviation. Meanwhile, the Airports Commission was clear in its belief that demand for flying is unstoppable and that to remain competitive we will have to build new capacity to meet it.

This important research shows plainly what happens when you try to bring those two objectives together. Either we risk blowing our legally binding emissions targets and fluff our last best chance at stopping runaway climate change; or flying needs to get a whole lot more expensive, making it the preserve of the wealthy; or we look for another, fairer way of ensuring our flying habits meet their costs.

As this report sets out, it is a real test of the Climate Change Act and a serious challenge to the Government and the aviation industry as they seek to navigate a path through these competing demands. We cannot put it off for another day.

Stephen Joseph  
**CEO, Campaign for Better Transport**

## summary

Under the Climate Change Act, the UK is committed to cutting emissions by 80% by 2050. Meeting this target will require measures across the economy, including in aviation.

Even without a new runway the UK is on course to miss its aviation climate targets. A new runway at Heathrow, as recommended by the Airports Commission, or at Gatwick, which is also being considered, would mean the country will need even tougher measures to cut emissions.

While technological advances are expected to help, they will not resolve this problem. With or without expansion, the UK will also have to limit growth in passenger demand.

The traditional way economists suggest cutting demand – and therefore emissions – is to increase prices. The level of carbon pricing required to reconcile increased airport capacity with the UK's emissions limits would make all flight tickets much more expensive. While it is not possible to calculate the exact impact on ticket prices from the information currently available, this report has estimated the most likely consequences.

Even assuming the Airports Commission's optimistic assumptions about efficiency improvements and patterns of future demand are correct, the additional carbon pricing likely to be needed if a new runway is built in London would mean that a return flight to New York for a family of four, from

any UK airport, would be over £270 more expensive. If its assumptions prove too optimistic, the family's return flight would be more than £850 more expensive.

The impact of this pricing would be felt most sharply in airports outside London and the South East, where passengers are generally more price sensitive. Expanding London's airport capacity would mean that passenger numbers in airports in the rest of the country would be expected to be lower than they would otherwise be.

If Heathrow, Gatwick, or another airport in the South East is expanded, there are two overwhelmingly likely outcomes: either there would be a large increase in ticket prices, with flying consequently more centred on London and the South East; or the UK would fail to meet its emission targets. Supporters of airport expansion must be clear about which of these paths they plan to follow – or whether they would support alternative measures to distribute access to air travel more evenly in a carbon-constrained world.

## the uk is already due to miss its aviation emissions target

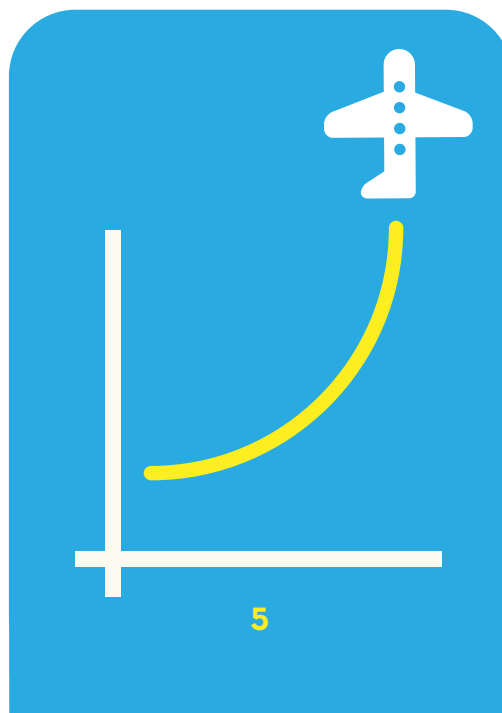
The Airports Commission recommended in July 2015 that a third runway should be built at Heathrow Airport.<sup>1</sup> While a final decision has been delayed by the post-Brexit uncertainty, the issue will be an early priority for Theresa May's government.

The debate about whether London's airport capacity should be increased has included some discussion of environmental concerns, but this has focused on local air and noise pollution. These issues are important and need to be addressed. However, this focus on the local environmental consequences of expansion has come at the near-exclusion of discussion about the measures that would be needed to reconcile increased aviation capacity with the UK's climate change targets. Perhaps because

this connection has been so under-explored, several high-profile political figures who otherwise support action on climate change have said they believe a new runway should be built.

Under the 2008 Climate Change Act<sup>2</sup> the UK is committed to cutting its net greenhouse emissions in 2050 by at least 80% compared with the level they were at in 1990.

Within this overall limit, the government aims to limit aviation emissions in 2050



to be no higher than the level they were at in 2005.<sup>3</sup> Since this is a much less strict target than the rest of the economy is subject to, emissions from other sectors would have to be more tightly constrained to meet the economy-wide target of an 80% cut on 1990 levels. The government's advisory body, the Committee on Climate Change (CCC), has said that emissions from the rest of the economy will in fact have to contract by more than 85%, rather than 80%, if the overall target is to be met.<sup>4</sup> The CCC has made it clear that these additional economy-wide emissions cuts are at the limit of what is feasible.

Because of the expectation that aviation technology and operational practices will become more efficient between now and 2050, it is expected that this target will allow passenger numbers to increase by up to 60% compared with 2005 levels.<sup>5</sup>

There is a reasonable economic basis for this approach of prioritising emissions cuts in other sectors, rather than in aviation, as cutting emissions from aviation is generally more expensive than doing so in other sectors. However, while this relative 'marginal abatement costs' approach may be economically efficient, it takes no account of where the costs of mitigation fall: overall costs to the whole economy may be lower, but who is paying? The costs of this approach – privileging air travel with more generous targets – tend to be regressively distributed, since increased costs in other sectors, like electricity, are borne by everyone, including the least well-off, while increased aviation costs are disproportionately borne by the better-off.

However, according to the Department for Transport's (DfT) analysis, growth in demand for aviation means that even without increased airport capacity in London, the UK is set to exceed its aviation emissions target by 25%.<sup>6</sup> This allows for changes that had been planned at Birmingham, Luton and Manchester airports in 2012 to be completed by 2020. Therefore, the UK already faces a challenge to reduce its aviation emissions below the level they would reach without further expansion. Building a new runway would increase this challenge. Furthermore, given the likelihood that the UK's targets will be tightened – certainly after 2050 and possibly sooner – to meet the globally-agreed Paris Agreement's goal of limiting global warming to 2°C or less, the challenge for emissions cuts may prove to be even greater than this.

This paper evaluates the measures that the Airports Commission have calculated could allow the UK to fulfil its emissions obligations and also expand London's airport capacity. While the Commission recommended constructing a Northwest Runway at Heathrow, we also consider the impact of building a second runway at Gatwick. The implications discussed here would also be similar for other possible ways of expanding London's airport capacity.

While these measures were outlined by the Airports Commission, the implications of their findings were not made explicit in their final reports, and consequently have not yet been widely recognised. This is a significant omission from the debate, as the measures, if adopted, would be likely to make it significantly harder for many people in the UK to continue to enjoy the benefits of relatively affordable and accessible air travel.

## the commission's recommendation relies on optimistic and disputed assumptions

As the world attempts to rapidly cut its emissions in order to avoid disastrous climate change, technology will often provide much of the answer.

Breakthroughs in solar and wind power mean that zero-carbon electricity is now, in some parts of the world, cheaper than electricity from any other source. With improving batteries and smart grids, even intermittent renewables are projected to become central to power networks around the world. Carbon capture and storage technology might reduce emissions from heavy industry and any gas power stations that continue to be needed. Electric cars and buses seem likely to replace petrol and diesel vehicles in the coming decades.

Aviation emissions will also benefit from technological improvements. Larger and more efficient aircraft and engines, use of biofuels and improvements in air-traffic management, such as more direct routes, are all expected to reduce the emissions from each flight. While some may hope that a radical technological breakthrough – such as solar planes that can carry as much weight as existing planes, which may be physically impossible<sup>7</sup> – will resolve the problem, experts agree that this is not plausible within the time remaining to limit warming to manageable levels.

The extent of these potential benefits is disputed and **the Airports Commission's conclusions about how emissions can be limited depend on optimistic assumptions about future efficiency improvements, which are not widely accepted.**

The most significant of these assumptions is the Commission's forecast of future aviation emissions if no runway was built. Its estimate is substantially lower than the forecast produced by the DfT in 2013.<sup>8</sup> According to the Airports Commission, emissions without expansion would be 39.9MtCO<sub>2</sub> in 2050, while the DfT's central forecast puts this figure at 47MtCO<sub>2</sub>. Since the expected legal limit at that point would be 37.5MtCO<sub>2</sub>,<sup>9</sup> this means the challenge the Airports Commission has set for itself is **75% smaller** than the one the DfT found (ie 2.4MtCO<sub>2</sub> compared with 10MtCO<sub>2</sub>).

The Commission does not provide much detail to explain how it concluded that emissions would be so much lower than the DfT had found two years earlier. In its final report it says the lower figure is

a result of “better matching of aircraft to route flown”.<sup>10</sup> This change, which greatly reduces the level of emissions reductions that would be needed, has not been widely scrutinised. For example, it is not clear whether the DfT now agrees that its 2013 forecast was incorrect and has been significantly improved by Commission’s model. Indeed, in a separate document,<sup>11</sup> the Airports Commission itself seems to reject the view that aviation efficiency can be improved in this way. It argues, among other things, that low-cost carriers are reluctant to operate mixed fleets in which planes can be matched efficiently to routes, and that doing so is the least cost-efficient way of reducing emissions. It is not clear why the Commission does not consider this to challenge the assumptions that it made for its final report. But if this starting assumption proves too optimistic, the reduction in emissions needed would be much greater than the Commission has suggested is achievable.

A second optimistic assumption made by the Commission is on the future annual improvement rate in fuel efficiency. It suggests that this will be 1.15%.<sup>12</sup> This is nearly 50% greater than the government’s central assumption of 0.8% annual fuel efficiency gains, which was stated as recently as 2013.<sup>13</sup> A 2007 academic study suggested that after 2020, an annual rate of below 1% was likely.<sup>14</sup> While the Airports Commission’s assumptions, which include additional measures on top of those assumed by the government to be plausible, may be no less speculative than these others, it is notable that its model of emissions from airport expansion appears to depend on a further assumption that is, again, significantly more optimistic than others’ forecasts. Over the 33 years from

2017 to 2050, an annual reduction in per passenger km emissions of 1.15% would produce a total gain of 32%, while one of 0.8% would produce an improvement of only 23%. Therefore, if the Commission’s forecast proves to be too unrealistic, or too expensive to achieve, there would, again, be a larger volume of emissions that would have to be reduced.


Another group of mitigation measures used by the Commission is the requirement for airlines to cruise at slower speeds, change how they taxi, and reduce the spare fuel they carry, which could save a total of 3.1% by 2040.<sup>15</sup> This is only a small saving compared with the others discussed, but it is, again, not clear whether it is achievable or what the cost implications would be. The fact that, for example, airlines fly above the most efficient cruising speed demonstrates that they prefer to prioritise shorter flight times over fuel efficiency.

The Commission also assumes that airlines will use a fuel mix that includes 5.6% biofuels by 2050.<sup>16</sup> This assumption is somewhat similar to those of the CCC<sup>17</sup> and the DfT<sup>18</sup>, although it is within the range of the CCC’s “optimistic” scenario, rather than its “likely” one. Equally, it is twice the DfT’s central forecast and close to its high one. So, while this biofuel assumption is not obviously wrong, it is once again more optimistic than the government’s other advisers have said is likely. So far, the industry has made little progress in using biofuels, despite regular announcements that it would do so.<sup>19</sup> An additional challenge to increasing the share of biofuels, shown by DfT analysis, is that the indirect land use changes associated with biofuel use may lead to an overall



increase in emissions, rather than a reduction.<sup>20</sup> This is particularly the case when a greater quantity of biofuels is required, and may create a further barrier to achieving the Commission's assumptions.

In summary, the Airports Commission has made several assumptions about future efficiency improvements which are consistently more optimistic than those made by the government and the CCC, without presenting adequate evidence to explain the rationale behind this divergence. It is notable that in every case where the Commission's analysis differs from other assessments, the difference reduces the scale of the mitigation challenge. If a new runway is built and these assumptions prove incorrect, additional measures would be needed to control emissions in order to avoid breaching the UK's overall targets. And, as discussed in the next section, the Commission has indicated that, even if those optimistic assumptions were correct, further measures would still be needed to reduce emissions to the level required to meet the UK's targets.



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## carbon costing a new runway

The Airports Commission suggested a surcharge could be added to ticket prices to reduce demand for flying, in order to ensure the UK does not exceed its aviation targets after building a new runway (it also proposed an international trading approach as an alternative; this is discussed below). The most efficient way of designing this surcharge would be to link it directly with emissions, and the Airports Commission did indeed propose a carbon price. If this was introduced, ticket prices would increase according to the volume of carbon dioxide<sup>21</sup> emitted by each flight. It is important to note that this price would apply to flights at all airports – not just at any that were expanded.

In itself this is a fairly uncontroversial proposal: many mainstream economists and major businesses argue that carbon pricing is the best way for markets to be guided to reduce emissions and help ensure the world avoids dangerous climate change.<sup>22</sup> In areas where technological alternatives exist (such as power generation and electric

road vehicles) carbon pricing could incentivise switching to these emerging lower-carbon technologies.

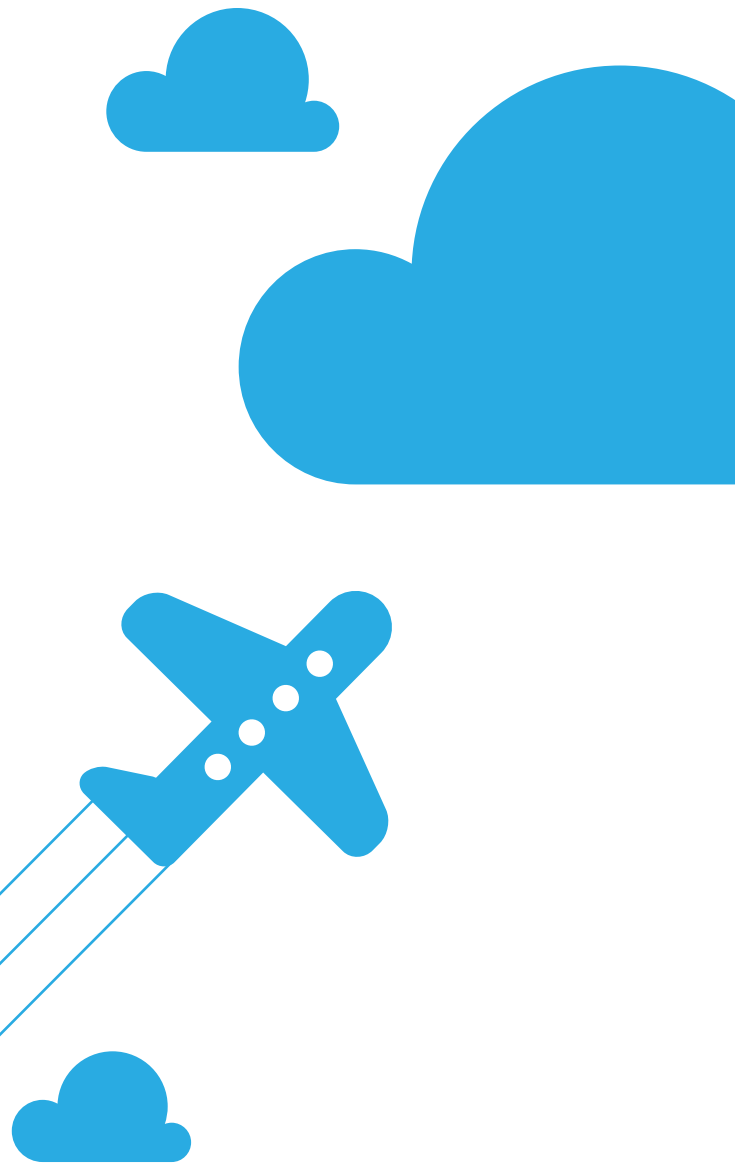
But in the aviation sector, no such step-change alternatives are available, and the scope for rapidly improving efficiency is restricted due to technological limits and structural features of the market such as fleet operating life. Therefore, carbon pricing in aviation will principally function as a demand-reduction measure.

There is a further problem with this approach. The price elasticity of demand for air travel – how much any given change in ticket price will influence demand for those tickets – is extremely low. The key elasticity metric for air travel is income, not price: changes in passenger income have a much greater relative effect on demand for flights than changes in ticket price.<sup>23</sup> This makes carbon price a problematic lever for demand management to meet climate goals. A recent academic paper exploring this issue at the global level concluded that,

“the ticket price-increases necessary to induce the required reduction in traffic growth-rates place a monetary-value on CO2 emissions of approximately 7-100 times greater than other common valuations”.<sup>24</sup> The authors do not regard such prices as politically realistic or deliverable in practice, a view with which we concur.

In the UK context, blanket carbon pricing at the requisite levels translates into plane ticket prices which could exclude low-income households from foreign holidays even without runway expansion in the South East. Consequently, we believe that carbon pricing is the wrong approach to aviation demand management and carbon mitigation, and cannot be delivered in practice without severe adverse social consequences. Whilst we generally support carbon pricing as the most efficient lever for driving decarbonisation in the wider economy, the particular technological, social and economic features of air travel mean it is not amenable to this mitigation approach as the main mechanism for cutting emissions. This is the rationale behind our proposal for a frequent flyer levy to manage demand instead, as set out in detail at [afreeride.org](http://afreeride.org).

The consequences of using carbon pricing in aviation are shown in the following section. When the effects of a new runway at one of London’s airports are factored in to the carbon prices necessary to meet our climate change commitments, it becomes clear that the Airports Commission’s reliance on this mitigation method simply does not represent a credible solution to the climate change problem posed by further airport expansion.



## carbon pricing: the end of cheap flights



Little attention has been given to the level of the carbon price that the Airports Commission suggested would be necessary to limit the emissions that would be produced by a new runway. Yet their proposals would have important consequences. In this section, we calculate three scenarios for possible carbon pricing in 2050, based on the Commission's analysis. The first accepts all of the Commission's assumptions about demand and future emissions-reduction measures; the second accepts their assumptions about demand but not about emissions-reduction measures; and the third considers the pricing that would be required if both sets of assumptions prove to be too optimistic. We do not suggest that any of these scenarios are likely to prove exactly correct: our intention is that they indicate a range of possible outcomes.

### **Scenario 1: accepting all of the Airports Commission's demand and emissions-reduction assumptions**

In its final report, the Commission suggested a price of £334 per tonne of carbon dioxide would be required to limit emissions if a new runway is built, even if the optimistic assumptions discussed above are proved correct.<sup>25</sup> In addition, it proposed introducing further measures, including increasing the share of biofuels, which it suggested would add a further £18 per tonne if the runway was at Gatwick or £70 per tonne for a Northwest Runway at Heathrow.<sup>26</sup> The Commission does not explicitly add these costs to the assumed carbon price, and it is indeed plausible that they would be applied separately from the carbon price. Nevertheless, unless the taxpayer covers the costs (which would be regressive) it is likely that they

would ultimately have to be paid by passengers. Therefore it is reasonable to calculate an effective total price of £352 per tonne of carbon dioxide if Gatwick is expanded or £404 per tonne if Heathrow is expanded.<sup>27</sup>

How do these costs compare with the carbon price that would be required if no new runway was built? According to the Airports Commission, the difference is quite small: they suggested that a carbon price of £334 per tonne would be required even if there was no expansion.<sup>28</sup> This is a surprisingly high figure. For comparison, the Commission refers to the Department for Energy and Climate Change's (DECC) estimated carbon price in 2050 of £196 per tonne of carbon dioxide.<sup>29</sup> Part of the reason for the discrepancy may be that the Airports Commission, in this no-expansion scenario, sought first to reduce projected emissions through a carbon price rather than through any other measures. By increasing the carbon price by £138 per tonne of carbon dioxide (from £196 to £334) they reduced emissions by 2.4MtCO<sub>2</sub>.<sup>30</sup> Yet, in the cases where a new runway was built and the carbon price of £334 per tonne was insufficient to reduce emissions to the required level, they subsequently applied other measures, which were much more cost-effective. For example, the Commission applied additional measures with a cost of £70 per tonne, which reduced emissions from a new Northwest Runway at Heathrow by 3.5MtCO<sub>2</sub>.<sup>31</sup> It is difficult to see why, in the no-expansion scenario, an increase in the carbon price of £138 per tonne would be favoured over other measures that might cost £70 per tonne, and would, as far as the Commission's model suggests, be expected to reduce emissions by at least as much.

Given this, it seems hard to believe that the carbon price in the no-expansion scenario really would need to be identical to the price in an expansion scenario of £334 per tonne of carbon dioxide. To reach an approximate, but more plausible, value, we use the DECC carbon price of £196 and add the Commission's additional measures valued at £70, for a value of £266 per tonne (if anything this value is likely to be higher than needed, as the £70 measures seem to reduce emissions by more than is needed in the no-expansion scenario). This can then be compared with the carbon price of £404 per tonne if a Northwest Runway is built at Heathrow. Therefore, **the increased carbon price that would be required, for all flights from UK airports, if the Heathrow Northwest Runway is built, and none of the Commission's assumptions prove to be too optimistic, would be £138 per tonne of carbon dioxide.** While this value is clearly approximate, and should not be treated as the basis for a precise forecast, it is likely to represent a considerable improvement on the assumption that the carbon price would need to be £334 per tonne in the case of no expansion, with only a small increase if a new runway is built.

In the case of Gatwick expansion, the Commission again used a carbon price of £334 before applying other measures, but did not apply the full £70 measures, instead using more limited measures. This means we cannot fairly compare the no-expansion value of £266 with the Commission's effective carbon price of £352 if Gatwick is expanded, since the same methodology would suggest that the effective Gatwick-expansion carbon price could be lower if other measures are applied.

## **Scenario 2: accepting the Airports Commission's demand assumptions but not its emissions-reduction assumptions**

The previous scenario accepted the Commission's optimistic assumptions about efficiency improvements and measures available to reduce emissions. It is difficult to know how much higher emissions would be if the Commission's starting assumptions are in fact incorrect (one option would be to use the DfT's central projection of 47Mt, but we cannot be sure that this is not itself an optimistic forecast). However, it is straightforward to see the consequences if the Commission's second set of assumptions – the measures that it suggests can reduce 3.5Mt of emissions for £70 per tonne – are not borne out, because it provided data on this possibility.

Without these additional measures, a new Northwest Runway at Heathrow would require the UK to reduce emissions from 43.3Mt<sup>32</sup> to 37.5Mt in other ways. With expansion at Gatwick the task would be smaller: 40.8Mt<sup>33</sup> would have to be reduced to 37.5Mt. In an appendix to a background report, the Commission indicated the pricing that would be needed to achieve these reductions if that was the method used. If Heathrow was expanded the price would need to be £634/tonne;<sup>34</sup> if Gatwick is expanded it would be £364/tonne.<sup>35</sup> In this instance, where we do not accept the Commission's assumptions about the availability of low-cost additional mitigation measures, this should be compared with the no-expansion price of £334/tonne. So here we find that **expanding Heathrow would lead to an increase in the UK's aviation carbon price of £300/tonne, and expanding Gatwick**

**would lead to an increase of £30/tonne.**

It is striking that the Commission finds emissions would be only marginally higher if a new runway is built at Gatwick; the modelled increase from a new Heathrow runway is nearly four times greater. This seems to be related to differences in the kinds of flights that its model predicts would increase from the alternative expansion plans, with Gatwick expansion mostly boosting short-haul flights and Heathrow expansion particularly increasing long-haul flights. We cannot judge whether such a sharp difference is plausible, but there is clearly scope for Gatwick expansion to lead to a greater proportion of long-haul flights than the model suggests, if that is what passengers and airlines demand. It is difficult to see how expanding different airports would lead to such different flight profiles if the purpose of expansion is to service market demand. As such, while the Commission's model indicates that Gatwick expansion would only increase emissions by a small amount and so the carbon prices would not change by a great deal, we anticipate that, in practice, the resulting price increase could be much closer to that required in response to a Heathrow expansion.

## **Scenario 3: rejecting the Airports Commission's assumptions about demand and emissions-reduction measures**

Finally, what if the Commission proves to have been too optimistic in its assumptions about demand as well as about possible emissions-reduction measures? So far, we have used only the Commission's preferred forecast

for future emissions from UK flights (“Assessment of need”) and ignored their other four forecast scenarios, which tend to project much greater emissions. For example, in the scenario “Low-cost is king”, in which “the low-cost carriers strengthen their position in the short-haul market and capture a substantial share of the long-haul market”, emissions without any new runway increase from 39.9Mt (in Assessment of need) to 46.8Mt.<sup>36</sup>

The Commission preferred to focus on the Assessment of need forecast, but we should also consider the carbon pricing that would be required if other forecasts prove to be correct. This is not a trivial possibility. In discussing why it selected Assessment of need rather than the other forecasts, the Commission said little more than that it had been advised that this scenario was the most likely.<sup>37</sup> It is striking that in three of their other four forecasts, emissions – and the carbon price associated with mitigating them – are much higher than in Assessment of need, while the remaining scenario, produces similar figures. **None consistently yields lower emissions or carbon prices.** So once again, whilst the Commission regarded their Assessment of need scenario as most likely, it is also the most consistently optimistic of the scenarios they modelled.

Considering the Low-cost is king forecast, which produces among the highest emissions, the Commission found that expanding Heathrow would increase emissions to 51.2Mt, while expanding Gatwick would increase emissions to 50.7Mt.<sup>38</sup> If a carbon price is the exclusive means used to reduce these emissions to 37.5Mt, the Commission’s model indicates that

this price would need to be £1225 and £1178 per tonne respectively. This compares with a carbon price of £840 in this forecast, if no new runway is built. Therefore, in this scenario, expanding Heathrow would require an increase in the carbon price of £385 per tonne, and expanding Gatwick would require an increase of £338 per tonne. We focus on the impact of expanding Heathrow in the table below, to show the upper limit of the range, but this scenario further indicates that Gatwick expansion, as well as Heathrow expansion, could lead to a large increase emissions.

While airlines may absorb some of these costs, their balance sheets show that there is limited scope for them to do so. It is therefore likely that such high carbon prices would have a dramatic effect on the cost of flight tickets by 2050, as shown by the following tables. In calculating the emissions from individual flight routes in 2050, we use the efficiency improvement figures discussed above: 63% where we accept the Commission’s assumptions and 30% where we do not.

**Scenario 1: Cost increases, in 2050, at all UK airports if a new Northwest Runway is built at Heathrow and all the Airports Commission's demand and emissions-reduction assumptions prove correct (increased carbon price of £138/tonne of CO<sub>2</sub>, current prices)**

Route	CO <sub>2</sub> (kg, economy class), assuming 32% improvement in efficiency	Initial carbon price, without new runway, one way (£266/tCO <sub>2</sub> )	Additional cost due to new runway for return flight (£138/tCO <sub>2</sub> )	Additional cost due to new runway for return flight for family of four
London to Dublin	45	£12	<b>+£12</b>	<b>+£49</b>
Manchester to Amsterdam	49	£13	<b>+£14</b>	<b>+£54</b>
Edinburgh to Copenhagen	74	£20	<b>+£20</b>	<b>+£82</b>
Newcastle to Verona	76	£20	<b>+£21</b>	<b>+£84</b>
London to Madrid	84	£22	<b>+£23</b>	<b>+£93</b>
London to Palma	90	£24	<b>+£25</b>	<b>+£99</b>
Birmingham to Malta	125	£33	<b>+£34</b>	<b>+£138</b>
Edinburgh to Malaga	125	£33	<b>+£34</b>	<b>+£138</b>
London to Athens	134	£36	<b>+£37</b>	<b>+£148</b>
Manchester to Tenerife	161	£43	<b>+£44</b>	<b>+£177</b>
Newcastle to Sharm El Sheikh	187	£50	<b>+£52</b>	<b>+£206</b>
Birmingham to Toronto	225	£60	<b>+£62</b>	<b>+£248</b>
London to Dubai	238	£63	<b>+£66</b>	<b>+£262</b>
London to New York	246	£65	<b>+£68</b>	<b>+£272</b>
London to Miami	278	£74	<b>+£77</b>	<b>+£307</b>
London to Singapore	340	£90	<b>+£94</b>	<b>+£375</b>



**Scenario 2: Cost increases, in 2050, at all UK airports if a new Northwest Runway is built at Heathrow and the Airports Commission's demand assumptions are correct but its emissions-reduction assumptions are too optimistic (increased carbon price of £300/tonne of CO<sub>2</sub>, current prices)**

Route	CO <sub>2</sub> (kg, economy class), assuming 23% improvement in efficiency	Initial carbon price, without new runway, one way (£334/tCO <sub>2</sub> )	Additional cost due to new runway for return flight (£300/tCO <sub>2</sub> )	Additional cost due to new runway for return flight for family of four
London to Dublin	50	£17	<b>+£30</b>	<b>+£121</b>
Manchester to Amsterdam	55	£18	<b>+£33</b>	<b>+£133</b>
Edinburgh to Copenhagen	84	£28	<b>+£50</b>	<b>+£200</b>
Newcastle to Verona	86	£29	<b>+£52</b>	<b>+£207</b>
London to Madrid	95	£32	<b>+£57</b>	<b>+£228</b>
London to Palma	101	£34	<b>+£61</b>	<b>+£243</b>
Birmingham to Malta	141	£47	<b>+£84</b>	<b>+£337</b>
Edinburgh to Malaga	141	£47	<b>+£84</b>	<b>+£338</b>
London to Athens	151	£50	<b>+£91</b>	<b>+£363</b>
Manchester to Tenerife	181	£61	<b>+£109</b>	<b>+£435</b>
Newcastle to Sharm El Sheikh	211	£70	<b>+£126</b>	<b>+£506</b>
Birmingham to Toronto	254	£85	<b>+£152</b>	<b>+£609</b>
London to Dubai	268	£90	<b>+£161</b>	<b>+£643</b>
London to New York	278	£93	<b>+£167</b>	<b>+£666</b>
London to Miami	314	£105	<b>+£188</b>	<b>+£754</b>
London to Singapore	384	£128	<b>+£230</b>	<b>+£920</b>

**Scenario 3: Cost increases, in 2050, at all UK airports if a new Northwest Runway is built at Heathrow and the Airports Commission's demand and emissions-reduction assumptions are too optimistic (increased carbon price of £385/tonne of CO<sub>2</sub>, current prices)**

Route	CO <sub>2</sub> (kg, economy class), assuming 30% improvement in efficiency	Initial carbon price, without new runway, one way (£840/tCO <sub>2</sub> )	Additional cost due to new runway for return flight (£385/tCO <sub>2</sub> )	Additional cost due to new runway for return flight for family of four
London to Dublin	50	£42	<b>+£39</b>	<b>+£155</b>
Manchester to Amsterdam	55	£46	<b>+£43</b>	<b>+£170</b>
Edinburgh to Copenhagen	84	£70	<b>+£64</b>	<b>+£257</b>
Newcastle to Verona	86	£72	<b>+£66</b>	<b>+£265</b>
London to Madrid	95	£80	<b>+£73</b>	<b>+£293</b>
London to Palma	101	£85	<b>+£78</b>	<b>+£312</b>
Birmingham to Malta	141	£118	<b>+£108</b>	<b>+£433</b>
Edinburgh to Malaga	141	£118	<b>+£108</b>	<b>+£433</b>
London to Athens	151	£127	<b>+£116</b>	<b>+£465</b>
Manchester to Tenerife	181	£152	<b>+£140</b>	<b>+£558</b>
Newcastle to Sharm El Sheikh	211	£177	<b>+£162</b>	<b>+£649</b>
Birmingham to Toronto	254	£213	<b>+£195</b>	<b>+£782</b>
London to Dubai	268	£225	<b>+£206</b>	<b>+£826</b>
London to New York	278	£233	<b>+£214</b>	<b>+£855</b>
London to Miami	314	£264	<b>+£242</b>	<b>+£967</b>
London to Singapore	384	£322	<b>+£295</b>	<b>+£1,181</b>

At this upper level of carbon pricing – if the Commission’s assumptions are too optimistic – short-haul flights from the UK to Southern Europe would be significantly more expensive. While these are approximate figures, they suggest that the carbon cost alone could add £73 for a return journey to Madrid for one person. Long-haul flights would be prohibitively expensive for families who are not well off. The age of budget flights would be over, and the first people to suffer would be those who can afford foreign holidays only if they can use low-cost carriers.

Since other countries that might seek to rival London for international air travellers, like France, Germany and the Netherlands, have all signed up to similarly tight carbon targets, they face the same challenges. It is therefore not the case that failing to expand Heathrow or Gatwick would mean that the increased demand will simply be absorbed in those countries.

There may also be further costs associated with expansion, which would have to be paid by passengers. The head of BA, Willie Walsh, has said that airlines would have to pay a higher landing charge if a Heathrow runway was built, and that this would force his company to pass on an additional cost of £40 per passenger.<sup>39</sup> This possible cost – which, unlike the carbon price, would only apply at Heathrow – has not been included in the tables above.



**£73**

extra carbon cost  
a third runway  
could add to a  
return flight to  
Madrid in 2050

## expanding london's airport capacity means limiting airports in the rest of the country

It would clearly be irrational to recommend expanding an airport in London and then propose a carbon price that would render the additional capacity useless. The Airports Commission indeed concluded that, despite the assumed carbon price, there would still be enough extra demand in London for a new runway to be economically worthwhile.

But, since the UK is limited in the total volume of emissions it can produce in 2050, expanding London's aviation capacity would tend to constrain aviation elsewhere. Indeed, the Airports Commission found that a carbon price would distort demand, so that passenger numbers would be relatively lower outside London and the South East. This is because price sensitivity is greater outside the wealthier parts of the country.

On the basis of the Airports Commission's optimistic assumptions of efficiency improvements, passenger numbers are expected to increase in all regions of the UK between now and 2050. But, if a new runway is built in London or the South East, this growth would be heavily concentrated in that area, at the expense of the rest of the country.

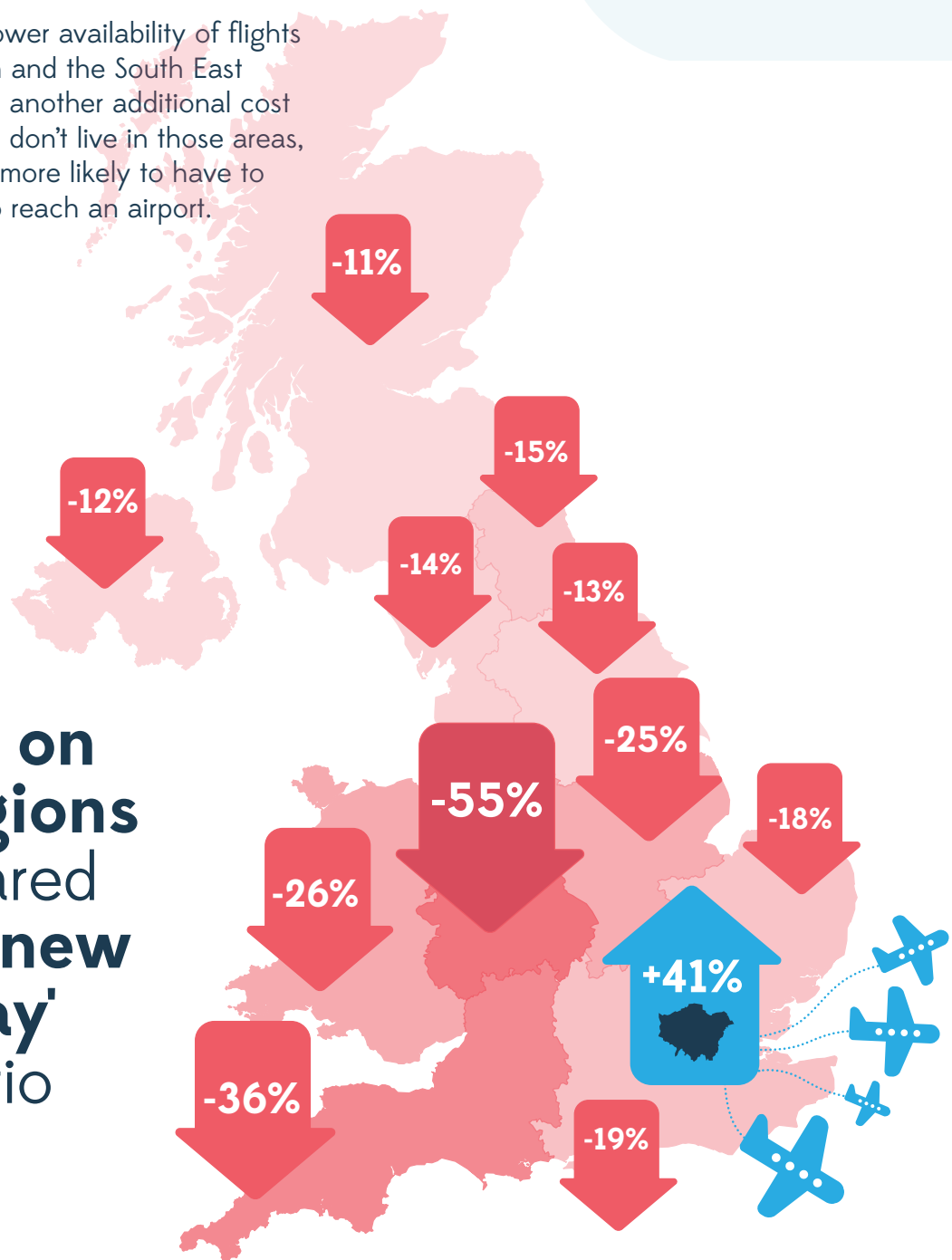
Separately from its final report, the Airports Commission published a series of tables<sup>40</sup> that showed the impact that expansion of a London airport would have on airports across the UK. While the Commission did not dwell on these findings in its final report, its data shows it expects expansion of London airports to significantly limit the expansion of other airports, as a result of the impact of the higher carbon price required to reduce total emissions having a greater effect on demand outside London and the South East.

Analysis of the Commission's data by the Aviation Environment Foundation<sup>41</sup> - who grouped the airports by region - found that all regions except London and the South East would have to accept much lower growth in passenger numbers than would be expected without expansion of London's airports.

Their projections suggest that, in comparison with no new runway being built at Heathrow, passenger numbers would by 2050 be 11% lower in Scotland, 12% lower in Northern Ireland, 14% lower in the North West of England, 15% lower in the North East of England, 26% lower in Wales and 55% lower in the West Midlands. These regions would also be constrained if Gatwick is expanded, although with slightly smaller restrictions, according to the Commission's modelling.

The relatively lower availability of flights outside London and the South East would also add another additional cost for people who don't live in those areas, who would be more likely to have to travel further to reach an airport.

**effect on  
uk regions  
compared  
to 'no new  
runway'  
scenario**



To attempt to share the economic benefit of expansion beyond London and the South East, the Airports Commission recommended that the government should encourage greater domestic aviation.<sup>42</sup> Given the evidence that passenger numbers will be constrained at regional airports by emissions limits and carbon pricing, it may not be realistic to expect benefits to be spread in this way.

An overlooked aspect of the debate about airport expansion is that UK aviation will, by 2050, be in a zero-sum game, after efficiency improvements have allowed for some increase in passenger numbers. Increasing passenger numbers at one airport will require them to be constrained elsewhere. Even with the Airports Commission's optimistic assumptions about efficiency improvements, they could not escape the conclusion that expanding an airport in London comes at the expense of other airports.

It is widely acknowledged that the UK's economy is too heavily weighted towards London and the South East of England, and Theresa May's government has signalled its intention to continue its predecessor's policy of fostering a Northern Powerhouse. Building a new runway in London or the South East would appear to contradict this goal.

## international carbon markets are unlikely to fix the problem

There is expected to be an agreement on international aviation emissions at the International Civil Aviation Organization's meeting in September-October 2016. The conference is likely to agree to introduce a market-based measure to limit net aviation emissions to a level that would make it easier avoid dangerous climate change, with a likely target for emissions to be capped at their 2020 level. This would address the problem that the Paris Agreement does not specify how states should address emissions from international aviation.

This deal is being constructed around offsetting emissions growth using carbon credits. By this method, airlines would, at least initially, be able to avoid reducing passenger numbers while remaining within a framework where the world can limit climate change. This might appear to offer a way for a new runway to be built without relying on a high carbon price – but it is unlikely to be a credible solution.

By the second half of the century, the world is aiming to produce net-zero emissions, which will greatly increase the global demand for any available carbon credits. The CCC has said that the UK should not assume that these international carbon credits will be available in 2050 and beyond:

“these will become increasingly scarce / expensive as all countries aim to achieve very challenging emissions reduction targets; it is therefore not prudent to plan that aviation will be a net purchaser of credits in the global market in 2050 and beyond.”<sup>43</sup>

Accordingly, by mid-century any credits that are available to UK aviation are likely to be so expensive that they would increase ticket prices by similar amounts to the domestic carbon pricing discussed above. The CCC emphasises that “the supply of cheap credits will be exhausted over time”.<sup>44</sup>

So, the UK government's advisors have warned that international credits cannot be relied on to resolve the problems that airport expansion would exacerbate. Indeed, as they said in their February 2015 letter to Howard Davies, the head of the Airports Commission, aviation emissions can instead be limited with efficiency improvements, use of sustainable biofuels and with restricted growth in passenger demand.<sup>45</sup> While international carbon markets may eventually help to reduce emissions from aviation, the measures that are currently on the table as part of the UN talks are very unlikely to be enough to close the gap between likely UK aviation emissions by 2050 with a new runway, and the maximum level compatible with the Climate Change Act.



## conclusions

The publication of the Airports Commission's final report created the impression that the environmental challenges of airport expansion had been resolved, and that the only question was whether the new runway should be built at Heathrow or at Gatwick. But, despite the Commission's report, these problems have not been addressed in a way that most people would consider satisfactory. This has been largely overlooked because the Commission's proposals for reducing carbon emissions have not been widely scrutinised.

The traditional economist's method of addressing the externality of greenhouse gas emissions would be to put a price on these emissions, and this is one of the main approaches taken by the Airports Commission in its final report. Yet, while this could be effective in cutting aviation emissions, the greatly increased ticket prices would mean that foreign holidays would no longer be affordable for many people. It would

also further concentrate economic activity in London and the South East of England, at the expense of the rest of the country.

In reality, if a new runway is built it would be used. The Airports Commission's approach of putting a price on carbon that makes flying unaffordable for all but the rich would be enormously difficult for any government to actually implement. Public commitment to meeting the UK's climate change targets may not be sufficient to accept such a sacrifice. Unless the government of the day truly has the will to tax flying so heavily, expanding London's airport capacity would be virtually guaranteed to mean the UK will miss its national emissions targets. Given the likelihood that the UK's targets will be tightened – certainly after 2050 and possibly sooner – to meet the Paris Agreement's goal of limiting global warming to 2°C or less, the challenge may prove to be even greater than set out in this paper.



Carbon pricing is not the only option to manage demand for air travel. An alternative would be for the government to intervene to ensure that most people could afford a limited number of international flights, with higher tax rates for frequent fliers. This approach has been described by A Free Ride.<sup>46</sup> Targeting demand reduction measures at frequent fliers is likely to be particularly effective because this group take such a high proportion of all flights: government survey data shows that 70% of all international flights by UK residents are taken by just 15% of the population.<sup>47</sup> Introducing such a measure could obviate the need for new runway capacity, by curbing demand growth equitably – with the greatest effect at airports in the South East, which is home to by far the greatest concentration of frequent fliers in the UK.<sup>48</sup> Air travel would still be available at low cost for those travelling once or twice a year on holiday, but overall levels of flying would be consistent with the UK's climate change commitments.

London aviation expansion has been presented as a conflict between national economic benefit and local environmental sacrifice. But there is a third dimension, which has largely been overlooked, yet which would have a dramatic impact on everyone who uses air travel, regardless of where in the country they live. As this paper has shown, even with its consistently optimistic assumptions about efficiency improvements and future demand – and even more so if those assumptions prove to be too optimistic – the carbon prices implicit in the Airports Commission's analysis would spell the end of cheap flying, putting foreign holidays out of reach of the less-well off, and particularly those who don't live in London and the South East.

If a new runway is built in London or the South East, there are two overwhelmingly likely outcomes: either there would be a large increase in ticket prices, with flying consequently more centred on the wealthiest parts of the country; or the UK would fail to meet its emission targets. Supporters of a new runway must be clear about which of these paths they plan to follow – or whether they would support alternative measures to distribute access to air travel more evenly in a carbon-constrained world.

## endnotes

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21. A further problem is that efforts to limit the climate change caused by aviation have so far focused only on carbon dioxide emissions. Yet the contribution of other factors, such as nitrogen oxides, ozone and water vapour, emitted at altitude, means that aviation is in fact known to have a significantly greater effect on global warming than that of the carbon dioxide content of exhaust emissions alone. So far, scientific understanding of these other factors has been too limited for those other sources to have been included in efforts to limit emissions: for instance, relative warming impact depends on the timescales considered, as different gases have different lifetimes and warming effects. Consequently, producing a simplistic CO<sub>2</sub> equivalent figure is not considered a robust approach. But, if climate change is to be controlled, these additional impacts will have to be considered in the future. This will only make controls on aviation emissions tighter, and there are important implications for carbon trading as a key mitigation measure, since aviation emissions have greater warming impacts than emissions from other sources for which they may be

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