

# Reducing consumption to avert catastrophic global climate change: The case of aviation

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## ABSTRACT

**Avoiding potentially catastrophic global climate change is a moral imperative, demanding significant reductions in greenhouse gas emissions from all important transport sectors, including aviation. However, because passenger flights and freight traffic are increasing much faster than efficiency improvements, the aviation sector will not be able to reduce emissions, or even stabilize them at current levels, without direct, forceful action to reduce demand. This paper reviews the ethical principles and empirical realities supporting the case for reducing worldwide aviation traffic. It argues that most passenger air travel and air freight shipping represents unnecessary luxury consumption, which responsible moral agents should willingly reduce in order to mitigate global climate change. It considers several mechanisms for doing so, and contends that they may succeed, but only if combined with an explicit recognition and binding commitment that for the foreseeable future, aviation must be a slow-growth or no-growth sector of the world economy.**

**Keywords:** Aviation; Transportation; Climate Change; Consumption; Growth; Limits

## 1. INTRODUCTION

“International aviation emissions to 2025: Can emissions be stabilized without restricting demand?” asked a recent article in the journal *Energy Policy* [1]. More broadly, we may ask: can total worldwide aviation emissions be stabilized over the next forty to fifty years, without restricting the number of flights? In both cases, the answer would seem to be “no”.

The trends are clear. Between 1990 and 2006, air traffic increased 119% (>108% in passenger traffic and >140% freight traffic), while over roughly the same time

period (1990-2005) carbon emitted per kilometer flown-decreased only 40% [1], leading to rapid growth in overall greenhouse gas emissions from the aviation sector. With a projected annual growth rate of 4.7% for passenger traffic and 5.2% for freight traffic over the next few decades ([2], pp. 8,146) and no transformative technologies on the horizon that might lead to rapid efficiency improvements, we can expect continued rapid growth in overall emissions. The Intergovernmental Panel on Climate Change [3] predicts that under likely economic growth scenarios, such emissions will increase by a factor of 1.5 to 5.0 by 2050, over 2000 levels. Macintosh and Wallace [1] state that under reasonable assumptions regarding economic growth and technological change, civil aviation emissions will rise by a factor of 3.5 to 5.5 by 2050, over 1992 levels.

However, emissions from the aviation sector must be stabilized in coming decades, at a minimum, and perhaps reduced, if we hope to act effectively to avoid potentially catastrophic global climate change. In order to keep mean global temperature increases from ballooning beyond 2°C, we probably need to cut total world greenhouse gas emissions from 60% to 80% of current levels by 2050 [4,5]. Clearly, no important emissions sector can greatly increase its greenhouse gas output without undermining such ambitious goals.

Aviation currently represents a relatively small share of total worldwide greenhouse gas emissions, about 2%, compared to 10.3% for ground transport ([3], p. 328; [6], p. 36). But other factors besides CO<sub>2</sub> emissions—such as contrails, cirrus clouds, ozone, sulfates and soot—may increase aviation’s impact on total radiative forcing (RF) by a factor of 2 or more [7], so aviation probably accounts for more than 2% of current climate forcing, perhaps much more ([3], p. 331). Reviewing past studies, Lee *et al.* [8] conclude that aviation represents 4.9% of current total anthropogenic climate forcing. Furthermore, because aviation is growing so rapidly, its impacts relative to other sectors are increasing, too. The IPCC estimates that if current trends continue, air transport could be responsible for 23% of worldwide growth in transport

energy use between 2000 and 2050 ([3], p. 333); another study predicts that aviation may be responsible for 5% to 15% or more of total anthropogenic RF by 2050 [9]. In addition, aviation is unlike most transport sectors because aviation fuel cannot be replaced with alternatives, now or in the foreseeable future ([3], pp. 354-355). For these reasons, limiting aviation's impacts will be difficult, yet it must be part of any successful climate change mitigation scenario.

In the face of this challenge, we need to ask directly: should people fly less, as part of an effort to keep climate change from topping 2°C, or should we continue to fly more, and accept the increased likelihood of catastrophic global climate change? I believe both prudence and morality argue for strong action to mitigate climate change [10-12] and hence for reduced flying. As the IPCC [6] and subsequent research have documented, continued global warming threatens food production, water supplies, protection from storms, and other ecosystem services that are key to the survival of hundreds of millions of people around the world. At higher temperatures, we ratchet up the possibility of drastic, irreversible changes, such as loss of the Greenland or West Antarctic ice sheets and consequent rapid sea-level rise. Such cavalier tampering with the systems which sustain all earth's inhabitants, human and nonhuman, seems highly imprudent. It also seems immoral, given that many of the worst harms of global climate change are likely to fall on those who did little or nothing to cause the problem—very poor people [13], future generations [14], and other species [15].

After twenty years of intensive research, wealthy, educated people around the world can no longer claim ignorance regarding the possibly disastrous impacts of continued high levels of energy and materials consumption on the earth's climate and on its less fortunate inhabitants. In support of a prudent and just response to global climate change, we should willingly forego some air travel. It is true that such forbearance will have important costs, in terms of less pleasure and convenience for travelers, lost profits for airlines, and fewer jobs in aviation and related industries such as hospitality and tourism [2]. Yet climate change itself also has costs, in money, lives, health and well-being, some of which are already being paid [16].

## 2. SUBSISTENCE EMISSIONS VERSUS LUXURY EMISSIONS

In deciding how to allocate efforts to mitigate climate change, Henry Shue's distinction between subsistence emissions and luxury emissions is helpful. "For standard economic analysis everything is a preference", Shue writes, "the epicure's wish for a little more seasoning and

the starving child's wish for a little water". But, he continues: "some so-called preferences are vital, and some are frivolous. Some are needs, and some are mere wants (not needs). The satisfaction of some 'preferences' is essential for survival, or human decency, and the satisfaction of others is inessential for either survival or decency" [17]. Hence we can distinguish between subsistence and luxury consumption, and between subsistence greenhouse gas emissions and luxury greenhouse gas emissions.

We can anticipate difficulties in sustaining a clear, unambiguous distinction between true needs and mere wants, in some cases [18,19]. Furthermore, modern consumer societies sometimes make it hard to provide for our necessities without indulging in prodigious energy and materials consumption (for example, it may be difficult to purchase healthful locally-grown food, or modest housing in a safe neighborhood) [20]. However, the distinction between subsistence and luxury consumption can still do useful work in deciding where it is most reasonable to pare back emissions. When a small farmer in Thailand plants and harvests rice to feed his family and buy supplies, that generates subsistence emissions, while my sushi dinner in Colorado, including fish flown half way around the world, represents luxury emissions. A lawyer's daily commute to work generates subsistence emissions, while her flight to Paris for a weekend getaway generates luxury emissions. "The central point about equity", Shue notes, "is that it is not equitable to ask some people to surrender necessities so that other people can retain luxuries" [17]. With this basic distinction in mind, we may ask whether particular kinds of air traffic generate mostly necessary or mostly luxury greenhouse gas emissions.

Commercial air traffic divides into two main categories: passenger traffic and freight traffic. In the United States currently, passenger traffic accounts for about 78% of all revenue ton-miles, while freight traffic accounts for about 22% [21]. We may divide passenger travel into two further categories: leisure passenger travel and business passenger travel. In the United States in 2005, 60% of domestic air travel was undertaken for the primary purpose of leisure travel, while 40% was undertaken wholly or partly for business purposes ([22], p. A18). Combining our two sets of categories (and assuming that adding in international flights would not greatly change the outcome), we get the following approximate breakdown regarding the generation of US aviation traffic in recent years: 47% leisure passenger travel, 31% business passenger travel, and 22% freight traffic.

Unfortunately, I have not been able to find similarly exact figures regarding worldwide aviation traffic. Generalizing from US figures, we can assume that leisure passenger travel generates roughly one-half of total world-

wide aviation traffic, business passenger travel generates about one-third, and freight traffic about one-fifth. At a minimum, we know that all three categories are important in generating worldwide aviation traffic, so all three need to be considered in a normative policy analysis such as this one. When we deploy the subsistence/luxury distinction regarding aviation emissions, we find that most seem to fall under the category of luxuries.

## 2.1. Leisure Passenger Travel

Consider first leisure passenger travel. Much of this involves discretionary tourism: often enjoyable, instructive, or revivifying, but hardly necessary. Air travel to visit friends and relatives is also often not necessary, despite occasional trips to visit sick friends or take care of important family obligations. Although doing without such trips altogether would engender real hardship, many of us could cut back on them relatively easily. In other cases, particularly on shorter trips, we could travel by train or bus, modes of transportation that sometimes take longer or are less convenient, but which also generate much less carbon per kilometer traveled [23].

To better answer the question of how much leisure passenger air travel involves luxury consumption, it would help to compare the relative wealth of frequent flyers to non-flyers and occasional flyers. Unfortunately, I have found good worldwide data on this difficult to obtain. Dargay, Menaz and Cairns [24] found that 71% of United Kingdom passengers making international leisure flights had an annual income above the national median of £ 24,700 (US\$38,475). The Travel Industry Association of America ([22], p. A20) reports that the median income for US domestic air travelers in 2006 was \$87,100; also considerably higher than the national average. In 2006, US households with an income less than \$25,000 generated 6% of domestic flights, while households with an income greater than \$100,000 generated 37% [22]. UK and US residents, in turn, are much wealthier than the global average; in 2000, 80% of households worldwide earned \$5130 or less annually, while half the world's households earned \$1480 or less [25].

Given the cost of air travel, it seems unlikely that the poorest 80% of the world's population account for more than 1% or 2% of annual passenger air miles, and their flights probably arise out of necessity more often than the flights of the world's global elite. All this suggests that leisure passenger air travel is largely a matter of indulging in (admittedly pleasurable, admittedly now often routine) luxury.

## 2.2. Business Passenger Travel

Consider next business passenger travel. With Skype and similar video conferencing technologies, some of

this travel has been rendered unnecessary; business can be conducted without it. Still, much buying, selling, consulting and planning is best done face-to-face. Businesses are primarily in business to make money; they pay for these trips and therefore appear to consider them worthwhile expenses: necessary, perhaps, to maximize profits. All this suggests that much business air travel should be placed in the category of a necessity. Certainly, that is the way it often feels to many business air travelers: tired, uncomfortable, enduring bad food and windowless hotel conference rooms, missing their families.

Then again, much business activity today, as the world becomes ever wealthier, centers on purveying luxuries: unnecessary things; or unnecessarily complex, expensive, or exotic things. Perhaps, too, maximizing profits is not itself a necessity—although managers tend to think it is, and employees may need to accommodate managers, because without a job peddling luxuries, they might find it hard to provide necessities for themselves and their families. In the end, it is difficult to divide business air travel into the essential and the inessential, the necessary and the unnecessary, precisely because we have succeeded so well in binding ourselves within a complex, interconnected world economy that demands profit maximization. What we can confidently say, is that the business community could accommodate reasonable schemes to cut back on air travel, provided they were fairly administered, so that some businesses did not receive undue advantages over others.

## 2.3. Freight Air Traffic

Finally, consider freight air traffic. Air freight can be divided into two primary categories. First, goods that people could do without: pineapples, cut flowers, designer dresses, etc. Second, goods that people could have waited a few more weeks to receive while they came via ship, spewing much less carbon, such as office machinery, computers, I-pads and auto parts [26]. Whether one places a particular good in one category or the other does not matter for our purposes, since both categories clearly represent luxury carbon emissions. Food, clothing and the appreciation of beauty are human necessities. But there is no necessity to eat fresh shrimp from thousands of miles away, wear designer dresses, or place cut flowers on our tables in the depth of winter; nor need we transport what food, clothing, furniture or beauty-objects we do purchase via aircraft.

There is a third sub-category: necessary goods that must be shipped very quickly, because the need is unexpectedly sudden, or otherwise imperative. An obvious case would be specialized medicines, or rare medicines sent to remote locations. Biological materials, tissue samples and living organisms for both medical and re-

search needs, often require rapid transportation; another category might be time-sensitive documents, although ubiquitous electronic communication has perhaps rendered this less important. It is not easy to think of other examples; presumably, this third sub-category makes up no more than a very small amount of current air freight. Therefore, this generator of approximately one-fifth of all worldwide air traffic should be treated mainly as a luxury that could be replaced by ground transport. Note that we could decrease these luxury emissions, in many cases, without even giving up the luxuries in question; just waiting for them with a little more patience would suffice.

## 2.4. Facing Our Real Options

In sum: most airplane flights today are unnecessary and generate luxury (or at least discretionary) greenhouse gas emissions. The international community should keep this in mind, as we attempt to fairly allocate emissions reduction efforts across economic sectors and national boundaries. If India must choose between cutting back on airline travel for its urban elites, or slowing rural electrification, with its promise of electric lamps for village residents, rural electrification should probably win out. Similarly, if the choice is between the globe's wealthiest 5% flying less, or its poorest 5% paying more for food, water, or electricity, the wealthy should probably fly less, rather than risk having the poor suffer and sink deeper into poverty.

To put the matter this way may sound strange. After all, such consumption choices are rarely considered today when we discuss climate change, either in domestic policy discussions or international negotiations. My suggestion is that such choices will need to be made in the future. Technological and managerial efficiency improvements will probably not be sufficient, within aviation or in other important economic sectors, to achieve the emissions reductions we need [27]. Consumption itself will have to be reduced in order to avoid catastrophic global climate change, which, to repeat, is a moral imperative. But which consumption, and whose? It seems only fair to reduce discretionary consumption rather than truly necessary consumption, if choices must be made.

At this point, faced with limiting popular kinds of consumption and accepting little or no growth in an important sector of the global economy, the temptation may be to avoid the problem by putting our faith in technological fixes [28]. To take one important example, the authors of the IPCC's chapter on "Transport and its infrastructure" in the 4th Assessment Report succumbed to this temptation. After noting that aviation traffic is among the fastest-growing significant greenhouse gas sources worldwide, they considered numerous changes to aviation

practices, including relatively trivial improvements in airplane technologies and changes in worldwide flight patterns, while avoiding the obvious alternative of limiting the number of flights [3]. But the time for such evasions is over. Justice demands that we squarely face the options in front of us. Our options include a world with less air travel and a largely predictable, benign climate; and a world with more air travel and a less benign, less predictable climate. They do not appear to include a world with ever-increasing consumption, including ever more airplane flights, and a benign, predictable climate.

## 3. EMISSION REDUCTION ALTERNATIVES

### 3.1. Taxes

Assume that we have established the need to stabilize or reduce the amount of passenger and freight aviation traffic worldwide; there are a number of options for doing so. First, we could tax aviation, driving up its cost and hence driving down miles flown by aircraft. One possibility is a tax on jet fuel, to be paid by the airlines; another is a tax on passenger tickets and freight, to be paid by passengers or purchasers of goods. Such taxes have proven an effective means to drive down consumption and spur efficiency improvements, and to find the optimal, low-cost mix of the two ([6], pp. 59-61; [29]). Wit and Dings [30] estimated that a charge of US\$50 per ton of CO<sub>2</sub> emitted could decrease the amount of aviation emissions in EU airspace by 9%, with half the reduction coming from increased efficiencies and half from reduced consumer demand.

On the upside, this approach tends to be economically efficient. On the downside, such taxation is regressive, hitting less affluent customers harder than rich ones. It would work, in part, by pricing poorer customers out of the market for passenger flights and discretionary consumer goods. Yet perhaps the threat of global climate change is important enough to demand sacrifices from all of us, even the wealthy.

### 3.2. Direct Limits

An alternative approach to reducing aviation traffic would be to strictly limit the number of allowable discretionary flights available per person. For example, countries might limit their citizens to one flight annually, with reasonable exceptions for family emergencies. Or, they might limit citizens to one untaxed flight annually, place a surtax of \$500 on a second flight and \$1000 on a third, and not allow any more. Regarding freight, possibilities would include prohibiting air transport of non-essential goods, or prohibiting all goods that could physically be accommodated on ships. Such an approach would be

more transparently coercive than taxation approaches, but not more coercive in reality for most people around the world, who rarely if ever fly.

On the negative side, many people dislike direct limits on consumption, seeing them as intolerable infringements on personal freedom. On the positive side, they work; for example, Singapore restricts the number of new license plates it issues annually, keeping total vehicles on the road within reasonable limits [31]. Directly limiting flights would represent a dramatic commitment to tackling global climate change. What it lost (supposedly) in economic efficiency might be gained in moral clarity.

### 3.3. Cap and Trade

A third approach would be to bring aviation under a cap and trade scheme. Under a European Union plan that began in 2012, emissions allowances will be capped at or near recent emissions levels for the airline industry as a whole, then allocated to the various air carriers, a certain portion for free, with the rest auctioned off among them [32,33]. Trading in these allowances will then be permitted among the carriers, with their price fluctuating according to market demand. In addition, airlines will be able to purchase further emissions allowances from other economic sectors on the EU carbon market. The rationale for this last mechanism is that it allows for maximally-efficient carbon reduction across the entire EU economy, but Anger and Kohler [34] have shown that this is likely to limit the actual carbon reductions achieved by airlines in the short to mid-term. In any case, this loophole will allow overall emissions from the aviation sector to grow; closing it would force the sector to stabilize, or even contract, if total allowances were ratcheted down over time. Given a hard, sector-specific cap, this third approach to reducing aviation emissions would combine some of the market flexibility of the first approach with the moral commitment to reducing total emissions of the second.

In fact, all three approaches could lead to big emissions reductions. Set a tax high enough, set allowances under cap and trade low enough, or directly limit passenger flights and freight traffic sufficiently, and we can drastically cut the number of flights and thus aviation's overall greenhouse gas emissions and other impacts. But realizing such benefits demands an acceptance that, for the foreseeable future, aviation must be a slow-growth or no-growth area of the international economy. It means an explicit and firm commitment that total miles flown cannot increase. In recent years, some European governments have shown a willingness to consider such a commitment. For example, the government of the United Kingdom recently denied permission to build new runways at London's three airports, explicitly stating that

increasing flights was incompatible with the country's commitment to reducing carbon emissions [35].

## 4. LIMITS TO GROWTH

The mere suggestion of "limits to growth" provokes intense resistance from the aviation industry [36]. Should such efforts come closer to fruition on a larger scale, further protests will no doubt be heard from allied business interests, not to mention peeved consumers. They will point out that we can accommodate more flights if we cut emissions elsewhere in the global economy—but businesses and consumers from other economic sectors are quick to make the same point. Understandably, no one wants their own consumption or profits limited. But without setting limits, we apparently cannot solve the problem [37,38].

Aviation proponents argue that greater emissions gains may be made in other sectors at lower costs, whether we measure costs in terms of money spent to reduce emissions, profits foregone due to decreased economic growth, or both [2,23]. They may be right. This has been a main argument for allowing emissions credit trading between different economic sectors more generally. But while such arguments may make economic sense, we must remember that equity is just as important as efficiency in allocating emissions reductions [10,39]. Here the fact that most aviation emissions are luxury emissions makes an important difference. Even if slowing rural electrification reduced annual carbon emissions much more cheaply than limiting aviation, and even if aviation growth proved a much more effective wealth-multiplier than rural electrification, grounding the wealthy might be more justifiable than leaving poor people in the dark.

Aviation proponents suggest that the sector's prodigious contributions to general economic growth should exempt it from limits [2,28]. But this ability to multiply economic activity, far from justifying aviation's continued expansion, might be one more reason to rein it in. After all, it is economic growth itself that is the primary cause of global climate change. According to the Intergovernmental Panel on Climate Change: "GDP/per capita and population growth were the main drivers of the increase in global emissions during the last three decades of the 20th century" [40]. According to the US Department of Energy, "economic growth is the most significant factor underlying the projections for growth in energy related carbon dioxide emissions in the mid-term, as the world continues to rely on fossil fuels for most of its energy use" [41].

Perhaps climate change, ocean acidification, worldwide species extinctions and other global environmental crises demonstrate that endless economic growth is not possible on a finite planet [42,43]. Even from within the

current orthodox economic paradigm, which takes the possibility and goodness of endless economic growth as its central article of faith, it makes sense to cut back on unnecessary economic activities in order to protect the essential ecosystem services on which all life—and all economic activity—depends [16,44]. This would seem to justify creating no-growth or slow-growth sectors of the world economy, when these sectors cannot grow without undermining global efforts to mitigate climate change.

Such limits need not be permanent. If people eventually design a zero-emission airplane—or even a very-low-emission airplane—then we might be able to safely end restrictions on flying. But as the authors of a recent Airbus report note, with considerable poetic understatement: “the path towards zero emissions... may be a journey that never ends” ([28], p. 15). Similarly, if humanity reins in our prodigious fertility and manages to significantly reduce global populations a century or two hence, that could open up room for increased flying, or increased consumption of other goods and services. But in the meantime, back in the real world, right now, people need to fly less, in order to avert catastrophic global climate change.

## 5. CONCLUSION

Perhaps the final word may be left to Archbishop Desmond Tutu, a moral leader on important global issues for so many years. “We have a big problem to solve”, he writes, in the foreword to a recent collection of essays on climate change ethics. “Do not fly in the face of the poor by allowing the emissions produced by endless and unnecessary business flights to keep growing. Insist on an 80 percent cut in your national emissions and hold your governments to account. In matters of climate change, as in all our lives, our obligation is clear: we must do unto others as we would wish them to do unto us” [11].

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