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**The future of transport and development in the new millennium:**

**the inescapable implications of climate change**

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*The spreading and intensifying addiction to fossil fuel-dependent lifestyles around the world will inevitably lead to ecological catastrophe from climate change. Current patterns of development will not deliver the very low-carbon footprints essential to preventing such a catastrophe.**The longer we procrastinate in responding adequately to this prospect, the greater and the sooner will be the ensuing chaos. This chapter sets out fallacious assumptions underpinning this policy domain. It then outlines the only strategy that can achieve a relatively smooth and speedy transition for practices in sectors of the economy currently dependent on fossil fuels.*

**Introduction**

Governments around the world acting on behalf of their populations now face a dire predicament. Carbon dioxide emissions in the global atmosphere have reached a dangerous level of concentration and are predicted to go on rising considerably into the foreseeable future. Temperature and sea level increases and changes in weather patterns are beginning to shrink the habitable land mass on which a burgeoning future population, forecast to be over a third higher than it is now, will have to live. One of the most eminent US climate scientists, James Hansen (2008), has warned of the danger of the concentration of these emissions exceeding 350ppmv (parts per million by volume): at present, they exceed *390*ppmv and are well on the way toan irreversible tipping point. Fairly recently, temperatures around the world were calculated to be seriously unsafe if the global temperature were to exceed a rise of 2ºC above the pre-industrial revolution level. A rise of up to 5ºC later this century is now predicted by the Intergovernmental Panel on Climate Change (2013). The fact that these figures are global averages, with countries in more extreme latitudes likely to experience even sharper rises, provide even more disturbing grounds for concern.

Evidence of this process is reflected in the growing acidification of the oceans, and disturbing warning signs that these, together with other carbon sinks, may no longer be able to absorb roughly half of the emissions from our continuing burning of fossil fuels that they have done until recently. It is reflected too in the loss of the volume of sea ice in the Arctic and in methane release from tundra regions in northern latitudes such as parts of Siberia. These changes, on a scale never witnessed before in such a short period of human history, are part of a feedback mechanism which will inevitably accelerate the process of climate change – and yet are not comprehensively incorporated into the modeling process currently used to provide the figures determining government policy on the speed and rate of reduction of carbon emissions (Meyer, 2013). Their inclusion can only result in seeing the IPCC’s predictions to be woeful under-estimates.

A major cause of these alarming changes is the spreading and intensifying addiction to fossil fuel-based lifestyles around the world. Even a major reversal of current policies in relevant sectors of the economy, such as transport, will be unable to prevent ecological catastrophe on such a scale as to gravely prejudice the survival and quality of life of human beings and other species on the planet.

**Prospects for future generations**

Hillman (2011) has observed that no other aggregation of human behaviour in recorded history can begin to match the appalling legacy we are bequeathing to future generations by our near-total failure to face up to the implications of climate change. It would be difficult to fault the prediction that most, if not all, the following outcomes will prove correct:

* regions of the world becoming uninhabitable at an accelerating rate leading in due course to hundreds of millions of ecological migrants having to seek refuge in countries around the world which have been relatively spared the worst depredations of climate change yet whose populations will be highly unlikely to welcome them;
* extensive water and food shortages in many countries;
* catastrophic loss of life and likely wars of survival;
* widespread decrease of species diversity and genetic variability;
* declining proportion of some of the planet’s existing finite mineral reserves remaining;
* imposition on thousands of future generations an absolute need to prevent radioactive waste from nuclear-based electricity generation plants leaking from its repositories;
* grave risk of nuclear war owing to the proliferation of weapons-applicable fissile material;
* huge financial debts owing to this generation’s unwillingness to live within its means;
* a world in which news of the consequences of our abject failure to meet the challenge of climate change gets progressively and inescapably grimmer.

**The response from all sectors of society**

We do not seem prepared to reverse the process that seems almost certain to have this lamentable outcome. We are loathe even to contemplate the changes that must be made, especially those entailing a very substantial and speedy reduction in our fossil-fuel based activities. Encouraging statements are made by politicians, professional institutions, and religious leaders giving the impression that they are aware of the gravity of the situation: in urging the public and especially government to act more responsibly as current stewards of the planet, in their professed commitment to the cause of equity and social justice, and in promoting the adoption of sustainable strategies to ensure worldwide delivery of low-carbon economies.

However, when attempts are made to translate these worthy objectives into practice, the statements made in proposing them seem unlikely to deliver them. Authoritative predictions for the future from the US Energy Information Administration (2011) indicate that global energy consumption will continue to rise, with more than a 50 per cent increase by 2035. The statements could be interpreted as little more than empty rhetoric, a judgment supported by reference to the fact that those questioning the sufficiency of current efforts are typically dismissed as theoreticians incapable of understanding human nature and political reality, as ‘holier than thou’ kill-joys, or as concealing a hidden left-wing agenda.

Forecasts in the UK Department for Transport publications (2011) suggest that hope of light at the tunnel’s end is being cast into doubt, first, by the absence of any indication that even affluent populations’ demand for high energy-based activities in the transport sector, is by any means satiated This is especially true in aviation and maritime transport which have so far escaped adequate inclusion in international agreements on the curtailment of emissions; second, by ignoring the contribution of the process of globalization which extends supply chains and thereby generally generates the need for more fossil fuel use: third, by the sharply rising third world populations’ understandable aspiration to follow the West’s lead in adopting high energy lifestyles; fourth, by the disturbing inadequacy of the Government’s carbon reduction targets; and, finally, by reasonable doubts that even these will be met.

From this perspective, a re-appraisal of the relevance of climate change to current transport and planning decisions has to be undertaken. The implications are far more significant than may be initially apparent. Every domain of policy that is directly or indirectly related to the extent of the energy-intensiveness of our lifestyles must be evaluated by reference to factors that could substantially affect it. The overriding consideration must be to relate it to the impact of climate change on the future habitability of the planet and the quality of life of its population. The contribution each proposed change would make in terms of adding carbon emissions to the planet’s capacity to safely absorb them must be incorporated into calculations on the subject. Focusing in particular on every area of fossil-fuel dependent activity which cannot be categorised as absolutely essential, will inevitably demonstrate why, as a matter of urgency, a *massive* reduction in emissions must be achieved and then maintained until such time as advances in technology have *hopefully* enabled renewable energy to largely replace the current, largely fossil fuel-based energy mix.

**Misleading judgments informing public policy**

A strong case exists for seriously challenging many widely endorsed assumptions underpinning public policy at present. As a consequence, the transition to decreasingly fossil fuel-dependent lifestyles has been rendered increasingly difficult to be achieved in the rapidly declining time available to do so. One obvious explanation for this is that one of the major functions of Government is seen to be to cater for as much public demand as possible‑ without regard to the consequences then running counter to the *necessity* of adopting and then delivering very low carbon- based patterns of activity.

Appropriate decisions to cater for future transport activity are exemplars of this process. These indicate that there is little, if any, awareness of the critical contradiction between investing large sums of public money to meet the growing demand for high-speed long-distance travel by road, rail and air while at the same time seeking to limit the devastating consequences of climate change. The inescapable fact remains that the planet’s atmosphere only has a finite *non-negotiable* capacity to safely absorb further fossil-fuel burning – which is the overriding reason for rejecting out of hand so-called ‘improvements’ to the transport infrastructure, such as HS2, Crossrail and expansion of airport capacity in the South East of England. It may be that those who propose policies such as these are in denial of the irrefutable scientific evidence on this, or think it insufficiently relevant to promoting economic growth, the policy which is so wholeheartedly supported by all the main political policies.

These outcomes can be laid at the door of those subscribing to the many questionable assumptions – close to tenets of faith – that continue to stand in the way of making a speedy transfer to lifestyles, practices and patterns of developmentthat will assuredly deliver very low-carbon footprints. Sadly, those who choose to deny the significance of climate change have wide support as the public would clearly prefer scientists to be proved wrong in their predictions on this subject and, therefore, hope that the need for the urgent adoption of a strategy to deliver such footprints will prove unnecessary. These assumptions include a near-absolute confidence on key aspects of decision making in this century.

*Raising the standard of living*

* The public has been led to believe that it has a right to ever-rising improvements in its material standards and life choices. Statements of all the main political parties give a strong impression that such a future is possible without the need for the major behavioural changes that the public would clearly prefer not to make. People are seen to have an inalienable right well into the future to engage in environmentally-damaging activities. It is assumed that high dependence on car use between home and places of work, education, shopping and leisure cannot be questioned if there are no acceptable less damaging alternative means of reaching these destinations. This holds true even more so in relation to flying, especially where it is thought that a fair fare based on the ‘polluter pays’ principle is being paid.

*However, a major explanation for the disastrous outcome of these lines of thinking is that it is judged perfectly reasonable for individuals to decide where and how to travel entirely from a ‘self-interest’ perspective, with little, if any, regard to the effects on other people's quality of life, on community health, on the physical environment and by no means least, on accelerating climate change. Of course, as the effects are worse where decisions lead to more carbon-intensive journeys over longer distances and at higher and therefore more energy-intensive speeds, there can be no justification for the most relevant institutions and the media to continue to be allowed to fail alerting the public to the largely inescapable links of these patterns of activity with climate change.*

* Economic growth is seen to be the primary way of improving the public’s welfare and quality of life. To escape the damaging effects of the current worldwide recession, every effort must be made to return to it – and it will have the further benefit of generating more employment.

*However, it is as if the limit on the degree to which the powerful link between GDP and greenhouse gas emissions can be sufficiently de-coupled owing to the existence of some easily adopted means of de-coupling. No doubt for that reason, at their annual conferences, all three of the main political parties in the UK regularly affirm their belief that the primary aim of government must be to return speedily to economic growth.*

*Promoting economic growth*

* It is seen as unnecessary for the sectoral components of growth to be differentiated according to their contribution to climate change and, as a consequence, that an adequate response to climate change does not have, nor must be allowed, to limit economic growth.

*However, in the absence of grounds for such a judgment, the implication is that a stratagem will assuredly be found in due course for making compatible the goals of ever-rising economic growth into the foreseeable future and protection of the global environment from irreversible climate change.*

*Valuing externalities*

* Taxation can be deployed to ensure that the ‘polluter pays principle’ is applied sufficiently effectively to allow for a realistic price to be set to cover all the costs of emitting carbon dioxide into the atmosphere. That price, it is argued, then frees the market to work in its most efficient way*.*

*However, this requires attaching a realistic monetary value that adequately compensates for the impacts of the emissions over the 100-years that they remain in the atmosphere. At present, no value is given to cover some unquantifiable but nevertheless huge short and long-term adverse effects, such as the rise in food prices following a switch from agricultural land being used for biofuels rather than food crops, and the mass migration and re-settlement of ecological refugees fleeing their homes to escape the effects of climate change.*

*Dependence on fossil fuels*

* + - Against a background of the numerous opportunities for energy saving, it is presumed that the major contributions that science and technology can make to finding cost-effective ways of reducing the amount of fossil fuels used that would otherwise be needed for continuing the pursuit of economic growth will prove adequate. These include using them more efficiently; burying underground the carbon dioxide from their combustion; investing more in renewable sources of energy,such as, solar, wind and wave power and bioenergy; more advanced techniques based on less carbon-intensive electricity generation; and identifying relatively low-carbon alternative fuels, such as shale gas and tar sands. Implicit in this approach is the view, based on sparse evidence, that, in time, these practices will lead to a *sufficient* reduction of emissions and that the public, industry and commerce can be motivated to deliver it voluntarily, encouraged by better information, subsidies, offers of grants, exhortation and legislation.

*However, many of these developments aimed at making a marked contribution to reducing dependence on fossil fuels and carbon emissions are being re-appraised in the light of recent outcomes of research and development. They include carbon capture and storage owing to the fact that the House of Commons Environmental Audit Committee (2008) stated that it has not been proven technically or commercially viable ‑ Macalister and Carrington (2011) reported that its flagship project was ‘close to collapse’; shale gas, owing to dangers of the leakage of methane – a particularly lethal greenhouse gas (Anderson 2011); oil from tar sands proving too carbon-intensive and unacceptable on environmental grounds, as reported in an issue of Scientific American in 2001; biomass as being too land-intensive as reported* by the *European Biofuels Technology Platform* (*2011); and, in the case of nuclear-based electricity, too risky, as cited by Hillman (2009). Analytical evaluation of some of these installations has concluded that they are far too expensive, especially in a time of economic recession, and* Macalister and Carrell (2011) have reported the likely withdrawal of a major utility company’s involvement in a UK nuclear programme.

*Reducing greenhouse gas emissions*

* Modest reductions in greenhouse gas emissions on the principle that ‘every little bit counts’ are welcomed as indicative of a process which can eventually lead to *sufficient* reductions. It is also implied that, in a democratic society, only an atmospheric concentration of carbon dioxide can be chosen that is acceptable to a majority of the electorate. Associated with this is the inference that there is both sufficient time left for this stage to be reached and that the necessary funds can be found for its delivery.

*However, the safe level of concentration cannot be negotiated as it ignores the fact noted earlier that the safe level to which we must adapt is fixed. Moreover, time to reach that level is regrettably unavailable: the deteriorating condition of the planet is far too advanced to allow for the near-universal recognition of the unsustainability of a largely ‘business-as-usual’ strategy ‑ as well as acceptance of the moral responsibility of citizens to act in light of this.*

* Carbon emissions from the transport sector overall are still rising alarmingly. In the light of this, efforts continue to be directed to enabling the car to remain the mainstay of personal travel: this can be seen in recent years in impressive improvements in the energy-efficiency of vehicles enabling less fuel to be needed; in the promotion of car sharing, car clubs and economical ways of driving; and in research on alternative fuels such as electricity generated from shale gas and bioenergy.

*Although considerable improvements have been made in the last three decades in increasing the energy efficiency of cars, that has not led to an equivalent reduction in emissions from them owing to the fact that many more households are now car-owning or multi-car-owning.*

* Rail transport is seen as a relatively low-carbon emitter and this, therefore, with all-political party support, is cited to justify the case for heavily subsidising train fares and, for instance, providing vast sums of public money for the construction of a high speed rail system from London to Birmingham and, later further north. Indeed, in support for its case, the UK coalition government has claimed that HS2 will attract significant numbers of travelers from flying and motoring. To this has been added the view that its construction will aid the competitiveness of the UK business community and thereby ‘help to fulfill our ambitions for economic growth and a low carbon economy’. Allied to this is exaggeration of public transport’s role as the way out of the impasse created by growing car use.

*However, such a view ignores the fact that the energy efficiency of cars has improved in the last three decades to such an extent that fuel consumption per person kilometre is now often lower by car than by train. This is especially true if the fuel used on a journey to and from a station at either end of the rail journey is factored into the calculation. Moreover, there is every indication that recent improvements in the car’s fuel consumption are set to continue in future. In addition, rail travel is principally associated with long distance journeys (nearly three times as long, on average, as car journeys – a factor all too frequently excluded from inter-modal comparisons. Moreover, the fact is overlooked that most current car mileage was not previously made by public transport. This error then results in chasing an ephemeral objective ‑ the belief that the situation can be reversed by sufficiently high investment in promoting rail travel.*

*Deterrents to reducing emissions sufficiently and in time*

* Public policy to limit damage from climate change is aimed at identifying the most effective policies and practices that encourage individuals and industry to switch to lower carbon lifestyles.

*However, the essential behavioural changes that must be made may take several decades to bring about. Moreover, it is common knowledge that even a public properly informed of the essentiality of making these changes is not necessarily prepared to do so. Although public opinion polls, at least in Europe, such as those reported in a European Commission publication, indicate that climate change is a real cause for concern and one greater than concern about the economic recession, governments in a democracy are expected to ‘get in step with public opinion’ (Guardian letter in 2001).**Yet, there is little evidence that that public even in the European Community is prepared to act other than to take modest steps to that end: carbon dioxide emissions from within the EU have risen rather than fallen to meet agreed targets for their reduction in the last few years.*

*Consideration of the claims of future generations*

* A future can be reasonably anticipated in which most people, once adequately educated about climate change and the processes contributing to it, will be prepared to voluntarily escape their addictions to longer and faster travel and forego the associated high fossil fuel-based lifestyles.

*However, it is totally unrealistic to expect many individuals, communities or indeed countries to act unilaterally when others are not doing so. Nor is it realistic to expect a significant proportion of individuals or businesses to impose on themselves a self-denying ordinance of personal rationing. To be effective, it would require the rationing to be mandatory.*

* It is thought that the world’s population is better-off if more fossil fuel reserves are found to feed its increasingly energy-dependent lifestyles as the rising demand for them can then be more readily met. In addition, if more can be found, it puts to a later date the perceived need for strong effective steps to be taken to cut down on emissions.

*However, this comforting thought overlooks the fact that the more reserves that are found, the more will be burned thereby adding to the concentration of greenhouse gases into an already dangerously overloaded global atmosphere. Allied to this is the concern, increasingly expressed, that we are using the planet’s reserves of oil at such a rate that there will be little left within 40 years or so. It is clear from this perspective that the ‘we’ relates to the availability of oil solely for our generation. What about the claims of future generations? They may well have more essential applications for it when compared with the frivolous way in which we are using it now (long distance car commuting, international events entailing participants having to fly long distances, stag parties in Prague, skiing in the Rockies, a beach holiday in Muscat, or a round the world cruise). Insofar as presumably decision-makers wish that life on earth should continue to be enjoyed for hundreds if not thousands of years into the future, surely the claims of future generations should be factored into the calculations showing at current levels of consumption what is being left for them?*

**The implications for future developments**

The time is over for engaging in these distorting lines of reasoning and wishful thinking. They have led to considerable public investment in transport systems that almost exclusively cater for lifestyles with rising rather than sharply declining dependence on fossil fuels.

The providers of retailing, hospitals and leisure activities have exploited the benefits of economies of scale by increasing the size of outlets whilst reducing their number, in the knowledge that an increasing proportion of their customers or clients have access to a car, and they can largely ignore the personal and public costs of doing so. In a chapter of a book published in 1996, Hillman highlighted the fact that to enable access to and from ever more distant destinations, changes in land use and the built environment, particularly in suburban, urban fringe and rural locations, have resulted in patterns of activity which cannot realistically and sustainably be served without a car and in which only a small minority of journeys is possible by non-motorised means.

Indeed, it is almost as if, in decisions over the last few decades, there has been a conspiracy to do the opposite of what we so obviously should have done. The effect of this can be seen in the lowering quality of life of those without a car. The physical outcome of policy can no longer be allowed to be largely antithetical to the process of making such changes to our lifestyles and to restructuring existing urban areas and other patterns of settlement so that they effectively promote self-sufficiency, sustainability, conviviality, quality of life improvements, and most particularly very low carbon community activities.

Concern for the future in this domain of public policy would appear to be wholly justified by changes taking place in countries such as India where the annual growth rate of car ownership has reached 9 per cent. Yet the factors that appear to account for the political failure to face reality and institute measures which will ensure the speedy adoption of very low-carbon lifestyles inevitably point to the need for a much diminished role for the car.

The exponential growth of towns and cities has only been made possible by exploiting, with seemingly gay abandon, the planet’s finite reserves of fossil fuels and ignored the finite limits of the global atmosphere to safely absorb more greenhouse gases. It is salutary to reflect on the fact that at a time when it is widely agreed that carbon emissions have to be drastically reduced, in the transport sector, rail travel is heavily subsidized as is, indirectly, both car travel and flying because the ecological damage they cause is hardly if at all covered in their costs of travel.

The same holds true in relation to most overseas travel, whether for business, tourism or for social reasons. The fact must be faced that, as some destinations can only be reached by air, this must not be cited in justification of rejecting the inevitable logic, namely that this form of travel must be hugely curtailed.

**The only strategy with any prospect of success**

What are the implications of this depressing diagnosis of our predicament and is there a way out? It is often argued that every available measure will have to be deployed to achieve the desired outcome. However, there is a complementary approach which will *assuredly* ‑ not just hopefully ‑ deliver success and provide the essential framework within which the contribution of each measure can be evaluated. Such an approach obviously has to reflect the fact that it is not possible to respond sufficiently effectively to climate change in the absence of a global agreement on the method to be used to share the planet’s finite assets, especially that of a safe atmospheric concentration of greenhouse gases.

Based on the principles of precaution and equity set out in the United Nations Framework Convention on Climate Change, this is the Global Commons Institute’s (GCI) proposal first put forward by Meyer (1995)and fast gaining support internationally ‑ *Contraction & Convergence* *(C&C) – see, for instance,*the Global Commons Institute website: <http://www.gci.org.uk/>. Indeed, the last Archbishop of Canterbury stated that “*C&C* thinking appears utopian only if we refuse to contemplate the alternatives honestly” Williams (2006).

It requires the imposition of a global cap on greenhouse gases and, given the finite capacity of the planet’s atmosphere to safely absorb further gases, noted earlier, sharing them on an equal *per capita* basis between the world’s populations. This is surely the only moral, politically practical and therefore realistic course of action to take. The fact that no one has a right to more than their fair share means that this will ensure that everyone’s personal responsibility to limit their use of fossil fuels is not just an aspiration but an imperative within which they will live. In the application of equal per capita shares as the principle of allocation, there must be a minimum of exceptions or extenuating circumstances, such as more units for those living in colder countries owing to higher heating bills in the winter or for those living in hotter countries owing to the higher costs of air conditioning.

Only governments have the authority and power to take the necessary steps at the level of individual and corporate decision-making to set this process in train by taking immediate steps to reach an international agreement on the massive switch to very low-carbon lifestyles. Therefore, *C&C*’s national manifestation will be in the form of a *Personal Carbon Allowance* (*PCA*), that is an equal *per capita* ‘ration’ allocated by each government, with an annual phased reduction to a scientifically-determined extent down to the agreed level of global carbon emissions. Initially, the annual allowance would cover the principal fossil fuel–based activities used in the home – heating, hot water, power and lighting – and transport. In its later more sophisticated form, the ration would include household food, consumer durables, and so on, with an allocation for each product calculated on its ‘cradle-to-grave’ carbon content.

The allowances would act as a parallel currency to real money, as well as creating an ecologically-virtuous circle. A key feature is buying and selling: a ‘conserver gains’ principle would replace the conventional ‘polluter pays’ principle.Those who lead less energy-intensive lives and those who invest in energy efficiency and energy renewables are unlikely to use all their allowance. They will then not only spend less on fuel but also have the added incentive of increasing their incomes by selling their unused units. But the cost of buying these units will rise annually in line with the reduction of the allowance as it will be determined by the availability of the surplus set against the demand for it. The process will act in a way that encourages individuals to adopt green practices far more effectively than they would through regulation, pricing, exhortation or appeals to conscience.

Since Hillman and Fawcett (2004) first set down this concept in some detail, a number of related studies have been undertaken on it and proposals put forward for its adoption. Many of these have been reported and reviewed in a special issue of an academic journal edited by Fawcett and Parag (2010). This publication focused comprehensively on the range of researchers discussing various aspects of personal carbon trading. They include research by Starkey and Anderson (2005) at the Tyndall Centre for Climate Change Research; several other projects at IPPR, the Institute of Public Policy Research, (Monbiot, 2006); the Environmental Change Institute at Oxford University, Bottril, (2006), and Fawcett, Bottrill, Boardman and Lye, (2008); the Royal Society of Arts, (Prescott, 2008) and the Lean Economy Institute (Fleming and Chamberlin, 2011).

A particularly influential study by Roberts and Thumim (2006) commissioned by the then Labour administration to explore the feasibility of per capita carbon rationing concluded that it should not be pursued at present for two reasons. First, it was judged to be ‘ahead of its time’ and would not be accepted by the general public and, second, in practice, its costs of administration would be prohibitive. These could be seen as remarkable assertions, given that the government and its advisers in the policy area of climate change have repeatedly stressed the grave consequences of climate change and therefore the need for urgent action, and that, when it was judged by government at the beginning of World War 2 that a serious food shortage was in prospect, rationing was immediately introduced, without the ‘smart’ technological advances available now for an initiative in a time of equivalent global crisis attributable to shortage. No suggestions were made at the time for the price mechanism to be applied to deal with the problem of demand exceeding supply ‑ and there were no demonstrations in Trafalgar Square!

Not only does *C&C* offer the only prospect of ensuring that the worst effects of climate change are avoided, but a range of other highly desirable outcomes will follow in its wake. Hillman (2006b) drew attention to the public health benefits likely to stem from people recognising that more cycling and walking not only enables them to live more easily within their carbon allowance but also delivers improvement in their physical fitness and general health. In 1992, he had also referred to the lowered demand on the NHS that would follow.

Policy on social justice will be enormously advanced and personal and national budgets will be driven by *economy*. As the ration is reduced each year, down to the ecologically safe level, demand for fossil fuel-dependent products and activities will fall away, easing considerably the problems associated with the scarcity of fossil fuels and security of their supply.

The populations of the developing world will be the main beneficiaries as they will become the recipients of transfer payments at the level of the individual far more equitably and justifiably, and on a far larger scale, than from technology transfer or charitable aid from affluent countries. These beneficiaries will almost certainly use the revenue from this source to improve the quality of their lives to ensure that this part of their income is maintained. It is highly unlikely that the monies received would be used by adopting energy-intensive lifestyles as the effect of that would be to ‘kill the goose that laid the golden egg’!

There will be a demographic benefit too as the sharing of the global gases that can be safely emitted into the atmosphere will be made according to each country’s population in the first year of *C&C*’s adoption. If any country’s population rises thereafter, its share will fall, and vice-versa. In this way, it will be able to be used to influence population numbers.

There can be no denying that managing the transition to very low-carbon lifestyles in the developed world will not be easy. Most aspects of life and nearly all sectors of the economy will be profoundly affected. The outcome of the introduction of an annual carbon ration down to the very low level that must be achieved is unpredictable. No one can realistically pre-determine to what extent units will be used for transport purposes, such as car travel, in the face of the competing claims on it for heating, hot water, lighting, power and so on. However, it can be stated emphatically that the future of fossil-fuel-based activities can only be realistically predicted by considering how individuals will respond to the inevitable introduction of the annual sharply declining carbon allowance.

Consider the consequences for future transport demand: at present, the average individual’s annual emissions in the UK just for car and public transport are about *three times* the amount that can be allowed for the total ofan individual’sfossil fuel uses for a year (roughly equivalent to one round flight from London to New York!). Against this background, Hillman (2007a) has highlighted the strong possibility that activities entailing long distance travel by any means other than perhaps sailing, will fall dramatically, and therefore that all transport policy, practice and high cost transport infrastructure projects already sanctioned to meet the largely unconstrained growth in demand, will need to be critically re-appraised. On the other hand, provision for the inevitable huge growth in demand for low-carbon (and incidentally very low-cost) green travel – cycling, walking and bus ‑ and, complementing this, for local, short distance, patterns of provision, will replace it.

It is very likely that most forms of motorised travel, especially those such as rail which are associated with relatively long distance journeys will decline sharply rather than continue to rise. The bus may be the exception owing to the fact that it only caters for short distance trips, and is generally very economical in fuel used per passenger kilometre. The same holds true, though to a lesser extent, for the coach in spite of the fact that, in the main, it caters for longer trips.

Changes in land use and transport planning infrastructure in favour of compact urban developments will logically follow, with high levels of investment – albeit at much lower costs ‑ needed for urban planning changes and for the considerable increase in provision for walking and cycling and public transport running on renewable energy so that the great majority of travel is short distance and carbon free. The process of rationing would naturally promote such investment as public demand for energy-intensive travel declines sharply.

**What can we do?**

How is our failure as individuals to make the changes from our current lifestyles to be reversed? Hillman (2007a) has argued that a widespread programme of public education on the links between carbon emissions and our energy-profligate lifestyles is needed so that it becomes obvious to voters that there is no alternative to the government introducing carbon rationing. More recently (2007b), he has emphasised that we must learn very quickly to come to terms with the implications of the irrefutable evidence of ecological decline and therefore the significant behavioural changes that must be made to limit the rate of that decline.

At the personal level, it is self-evident that we will be far more motivated if we are aware of the extent of our personal contribution to the problem. To do so simply requires the completion of a carbon dioxide emissions self-audit, such as ones designed by Hillman(2006a) and DEFRA (2001). The resulting total is likely to be telling particularly when it is compared with the annual total with the world’s current annual per capita emissions of just over 4 tonnes, the average of the UK population of about 12 tonnes (of which the household car accounts for over a quarter), and the average of well under one tonne for much of the current populations of India, Africa and Bangladesh.

Among the numerous logical consequences of curtailing emissions will be the inclusion in applications to a local authority for planning permission a carbon footprint calculation covering both the constructional process and annual emissions from the development will have to feature of will be. At the same time and for the same reason, there will be increasing pressure to reject applications for low density developments given their association with higher levels of car ownership and car mileage.

There can be no escape from four unarguable truths, and the logical reaction to them in behavioural terms that can be drawn from stopping to deny both their existence and their relevance to policy. First, insofar as we know that our own patterns of fossil fuel-dependent activities are making matters worse, we are all complicit to varying degrees. Second, ‘doing something’ can only be interpreted as representing meaningful progress if it results in an essential target being met on time for, otherwise, it can easily delay and make more difficult our coming to terms with the inadequacy of the steps being taken. For instance, the EU target of providing 15 per cent of its member states’ energy requirements from renewables by 2020 implies that the great majority will still be coming from burning fossil fuels, thereby still adding to the concentration of greenhouse gas emissions in the years beyond that date. Third, unfortunately, there is much in the pipeline stemming from past and therefore unavoidable patterns of activity. Finally, all of us, without exception, have a responsibility to make the necessary changes to limit the damage through changes in our personal and working lives. In particular, professions such as that of transport and urban planning, have a critical part to play.

**Conclusions**

Given the urgency of the situation, the implications of failure to limit carbon emissions to the fair equal share for each individual dictated by the planet’s finite capacity to absorb the emissions safely are dire. We cannot continue passing the buck between individuals, industry and government. We must stop pretending or implying through our decisions that the harm that we are causing is either unavoidable or only marginal and that we have as much time as is needed to get it right. The carbon dioxide emissions that we are now adding to the atmosphere will affect the climate for well over 100 years. We cannot go on deceiving ourselves that the essential reduction to a much lower overall level of emissions can be achieved in the absence of everyone being subject to a mandatory requirement not to exceed their fair share. It is wishful thinking to believe that it can be achieved on a voluntary basis.

The only strategy with any prospect of success in delivering the degree of reduction that is essential is the one based on *C&C* and *PCA*s. Although it is very difficult to predict how people will use their annual allowance given all the claims on it, it is very likely that demand for car travel and developments which are dependent on it will fall dramatically, that rail travel will be limited and air travel will be exceedingly rare.

It is indefensible to reach decisions that will inevitably prejudice the prospects for future generations enjoying life on earth as we have been able to do. The longer we procrastinate, the greater the certainty of environmental degradation, social upheaval and economic chaos. Whilst the challenge is immense, it is essential that it is met. The time is long over for denial that apocalyptic disaster is inevitable unless we take drastic steps immediately to reduce substantially further burning of the world’s fossil fuel reserves. If the measuring template were in place, every year’s delay could be seen to leave in its wake both the loss of biodiversity, quality of life and, in all likelihood, the loss of actual life on an alarming scale.

Responding to climate change is ultimately a moral choice. We can no longer proceed as if we have a right to turn a blind eye to the damage we are causing. What will we do in the decades ahead when justifiably challenged by our children and grandchildren on our woeful failure to have acted in time? The accumulation of irrefutable evidence on climate change will make it progressively unacceptable to attempt to excuse ourselves either by claiming that ‘we did not know’ the consequences of our actions or, in many respects even more reprehensibly, by just pleading guilty – and even joking about it.

It is incumbent on us all to be involved now by coming to terms with the fact that the role of transport and other sectors of our fossil fuel-based economies must be heavily reduced. Otherwise we are wittingly condoning insufficient action. In all conscience, we must not bequeath a dying planet to the next generation. We are heading inexorably in that direction.

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