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VIRTUAL MEETINGS AND CLIMATE INNOVATION IN THE 21ST CENTURY – CAN OFFSETTING CO_2 EMISSIONS FROM FLIGHTS BY INVESTING IN VIDEOCONFERENCING BE A WAY TO SUPPORT TRANSFORMATIVE CHANGE?

Virtual meetings and Climate Innovation in the 21st Century

Can offsetting CO_2 emissions from flights by investing in videoconferencing be a way to support transformative change?

Preface

Three trends triggered this project, which aims to investigate how a critical mass of virtual meeting solutions could be reached through innovative investments and incentive schemes.

First, an increasing amount of companies, authorities and governments are looking into more cost efficient ways to hold meetings/conferences. Business outsourcing and expansion all over the world make current business travel patterns both unsustainable and inefficient. In general, globalization contributes to a closer collaboration between governments and authorities throughout the world. This has resulted in a significant increase in conference and meeting travel. The number of seats offered on flights operating in July 2007 reached an all-time high, with a capacity of 310 million seats worldwide – equivalent to an airline seat for every single person in the United States. According to the latest statistics from OAG (Official Airline Guide), the world's authority on flight information, this represents 20 million extra seats available to travelers compared with the same month 2006.

Secondly, at the same time, many of the above actors are looking for ways to reduce their carbon footprint, especially since travelling by car and plane to meetings and conferences makes up a significant part of many companies' carbon footprint, often 50% or more among non-manufacturing companies.

Thirdly, interestingly today, technology and services are available that can support meetings and conferences in a much more time and resource efficient way. As these three trends converge, we could see a rapid uptake of solutions that provide the opportunity for virtual meetings such as video conferencing. More and more companies want to ensure that the environmental problems they create are solved in a sustainable way. Innovative mechanisms such as offsetting/compensating air travels by investing in virtual meeting solutions could provide companies with the opportunity to become part of the solutions to the problem they have created.

There is a need to move beyond incremental changes into strategic investments that can provide the solutions we need in a low-carbon society. We need new innovative ways to provide support to new solutions. The need for strategic investment is particularly pressing in countries where infrastructure is still being created, and investments in all parts of the world should take this need into consideration. In establishing a link between the use of the old transportation system and the creation of a new one, where virtual meetings with the help of Information and Communication Technology (ICT/IT) solutions play an important role, it is possible to trigger strategic actors to focus on innovative engagement and guide them to ensure that their business models are sustainable in the long term and do not depend on CO_2 intensive technology.

With the financial crisis there is a unique opportunity for investments in infrastructure and stimulus packages to deliver more than an injection to the economy, it is an opportunity to move beyond incremental improvements and focus on the development of a low carbon infrastructure for the 21st century. The need to look beyond incremental improvements can also open the door for more use of virtual meetings as many companies do not know how much the technology has improved over the last few years and how it can help improve productivity and save money at the same time.

Hopefully this report can contribute to a situation where innovative and high-tech solutions that are necessary in order to provide real and long-term emission reduction, can play a greater role in the future strategies as we move towards a low-carbon economy.

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January, 2009

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Executive Summary

Due to technological improvements, an increasing number of business trips can now be substituted by 'virtual meetings' and therefore help to minimise aviation-related carbon dioxide (CO_2) emissions. For example, an Australian study has estimated that video-conferencing could avoid 2.4 million tonnes of national CO_2 emissions, equivalent to 0.43% of the country's total.

However, despite improved quality and reliability, and the qualitative change arising from new high definition technologies such as Cisco's Telepresence and HP's Halo, substitution from air travel to videoconferencing is happening relatively slowly. This is because of barriers such as: concerns about effectiveness of the technology; limited access to bandwidth and equipment; weak vendor incentives to push large-scale use; misalignment of user incentives and; a lack of strategic impetus in many organisations; and poor information about the benefits. These barriers mean that videoconferencing is expected to have little impact on air travel, which is projected to grow by 4% a year for the foreseeable future. Growth will be even greater in developing economies such as China and India, who currently have only 60 and 20 air trips per 1000 people respectively, compared to 2,300 in the USA.

This paper argues that the current situation with marginal use of virtual meetings is not inevitable, and that the development of a global, open access, videoconferencing infrastructure could significantly reduce CO_2 emissions, with many business benefits at the same time.

An infrastructure which provided an open access site for every million inhabitants of the world's urbanised areas would have an estimated $495 million capital cost, and $347 million of annual operating costs (total number of virtual meeting rooms 4620). Much, if not all of which, could be offset by income from those who fly, users of virtual meetings, and other sources. This compares to the estimated $22 billion capital cost of a third Heathrow runway, or the $320 million list price of a new Airbus A380 superjumbo.

Key targets to use the infrastructure would include larger companies with many field activities in different countries; small-medium sized businesses; international Governmental and Non-Governmental organisations; organisers of small-medium sized events; and some distance learning and telemedicine discussions. Countries such as China or India would be especially important, with the aim of many people developing familiarity with videoconferencing before becoming attached to air travel for meetings. 'Digital bridges' could therefore supplement, and partially replace, the 'air bridges' which would otherwise be constructed.

Any scheme could be piloted through smaller scale demonstration pilots aimed at creating a dense infrastructure for key business communities and travelling routes. Three possible options for this would be top cities in China and India; top cities in selected medium sized European Union member states or in the US; and top financial centres in the world.

Introduction

There are many environmental threats to the well-being of the planet, and humans. The most recent report of the Inter Governmental Panel on Climate Change (IPCC) states that climate change related to increasing emissions of 'greenhouse gases', especially carbon dioxide (CO_2), is one of the most serious.[1] Restricting the forecast increase in average global temperature to 2-2.4 degrees will require a reduction in global emissions by 80-90% in 2050, relative to 1990.[2]

Moving to such a low carbon economy will require many transitions, including:

- Shifting taxation onto, and business revenues away from, fossil fuel based activities
- Making more effective use of resources, both through efficiency, and through the replacement or supplementation of products by service-based solutions.

These transitions will be especially marked in aviation. A major means of reducing transport-related CO_2 emissions would be through substitution of business air travel by audio, video, web and other conferencing technologies. For example:

- A study on business travel in Europe concluded that substituting 5-30% of current air travel by videoconferencing could avoid 5.59-33.53 million tonnes of CO_2 emissions annually[3]; and
- A recent analysis of the role of ICT in Australia's sustainable development concluded that videoconferencing could avoid 2.4 million tonnes of CO_2 emissions, equivalent to 0.43% of the country's total.[4]

Air travel is important not only for its 5% or more – and rising – direct contribution to anthropogenic global warming, but also because it is a core feature of the broader patterns of economic and social development which are driving carbon emissions generally. Minimising or reducing it can therefore have disproportionate effects on global emissions. Indeed, if we are unable to break current trends in an area where solutions already exist today, then the future is bleak indeed.

As discussed below, the growth of conferencing is already resulting in some substitution of travel, and associated environmental benefits. However, this is happening less rapidly than many past forecasts predicted, and some significant barriers remain.[5] The overall aim of this

[1] Intergovernmental Panel on Climate Change, Fourth Assessment Report, Summary for Policymakers, 2007.
[2] http://www.panda.org/about_wwf/what_we_do/climate_change/news/index.cfm?uNewsID=139761
[3] D. Pamlin and K. Szomolányi, Saving the climate @ the speed of light: First roadmap for reduced CO2 emissions in the EU and beyond, ETNO and WWF, 2006.
[4] Climate Risk, High-Bandwidth, Low-Carbon Future Telecommunications-based Opportunities to Reduce Greenhouse Gas Emissions, Telstra, 20-7.
[5] J. Denstadli and T. Julsrud, Videoconferencing in Norwegian industry and commerce: Increased use, less travel?, Norwegian Institute of Travel Economics, 2003.

paper is to analyse these barriers, and to identify ways in which they might be overcome in the future. A particular focus is the scope to use carbon offsetting and other mechanisms to encourage increased levels of investment in, and utilisation of, videoconferencing technologies.

The growth of these technologies, and associated services, together with other benefits such as increased productivity from less time spent travelling, could also offset any negative impacts such as reduced employment arising from less buoyant demand for air travel.

In the longer term, conferencing can substitute for both work-related and personal travel. In the short-medium term, however, cost and other factors make it likely that it will have greatest impact on the former, which is the focus of this paper.

1. An Inefficient Truth: Unsustainable Travel and the Need for Action

Transport is a major contributor to global carbon emissions, with its share increasing from 22% in 1990 to 24% in 2003 – when it accounted for 30% of emissions from developed countries.[6]

In most cases the most environmentally damaging form of travel is by air, which generally emits more carbon and pollutants per passenger kilometre than other sources.[7] The UN Intergovernmental Panel on Climate Change has estimated that, in 1992, global CO_2 emissions from aviation fossil fuel use were 0.51 billion tonnes, equivalent to approximately 2% of total anthropogenic sources of the gas.[8] The same study estimated that, by 2050, depending on the scenario, emissions would range from 0.84-5.31 billion tonnes of CO_2, or 1.6 to 10 times the value in 1992. The mid range scenario of 1.47 billion tonnes CO_2 would be three times the 1992 figure.

Because of the way in which emissions from airplanes interact in the upper atmosphere, their warming effect is thought to be greater than equivalent emissions at ground level. The current accepted multiplier is 2.7 times.[9] However recent EU-sponsored research has suggested a higher figure of 4.4 for 2000, rising to 4.7 by 2050.[10]

Hence, aviation fuel -related emissions account for at least 5% – and maybe up to almost 10% – of the total impact of CO_2 on climate change. In addition to this, there are CO_2 and other impacts (e.g. pollution and noise from aircraft engines; water and soil contamination

[6] European Conference of Ministers of Transport, Cutting Transport CO_2 Emissions, OECD, 2007.
[7] J. Penner et al (eds.), Aviation and the Global Atmosphere, UN IPCC and Cambridge University Press, 1999. (Aviation pollutants include hydrocarbons, nitrogen oxides, and sulphur dioxide, which contribute to acid rain.)
[8] Op cit.
[9] Op cit.
[10] R. Sausen et al. Aviation radiative forcing in 2000: An update on IPCC (1999), *Meteorologische Zeitschrift*, Volume 14, Number 4, August 2005, pp. 555-561(7).

from de-icing chemicals; wastes) from the operation of airports, and from the maintenance and servicing of aircraft. Both of these activities also have a substantial embedded energy – and therefore CO_2 emissions - from their construction and manufacturing stages.

Air travel also has huge indirect impacts on both local and national economies. As an IATA (International Air Transport Association) study has observed: "The sheer scale of the largest airports, and the global reach of the industry, and its technological innovation, support the often cited statistic that the travel and tourism industry drive 12% to 15% of the world output of goods and services".[11] Another European study concluded that for every million passengers European airports directly and indirectly support 2,950 jobs nationally, or 2,000 jobs regionally, or 1,450 jobs sub-regionally.[12] Many of these jobs are associated with industry and housing developing around airports, which in turn stimulates increases in car and freight traffic. Although some of this development might have occurred in other locations if airports did not exist, overall it is not unreasonable to suggest that the IPCC assumptions mean that the direct and indirect effects of air transport account for at least 10% of the total impact of CO_2 on climate change, and possibly more.

2. Forecast Growth in Air Travel

IATA forecasts that international air passenger numbers will grow at an average annual rate of 5.1% between 2007 and 2011, a slight fall from the average rate of 7.4% seen between 2002 and 2006.[13] IATA also found that business traffic grew faster than economy traffic on long-haul routes during 2006. Longer term forecasts from Airports Council International (ACI) anticipate continued growth of around 4% per annum for the next 20 years.[14]

These projections were reflected in a survey of 4,000 UK business travellers, 44% of whom travelled more in 2006 than in 2005.[15] Half of these cited business expansion in the UK or abroad as the main cause. 21% of respondents travelled more than 500 miles per week, with 16% travelling up to 1000 miles. 79% believed that their business had benefited from this travel, with only 3% stating that they could have achieved the same success for their company without travelling.[16]

2.1 Forecast Growth in Asia Pacific Air Travel

IATA forecasts that strong growth in Asia Pacific will see its share of international passenger traffic increase from 23% in 2006 to 27% of the global total of 2.75 billion passengers in

[11] InterVista, The Economic Impact of Air Service Liberalization – Executive Summary, IATA, 2006.
[12] York Aviation, The economic and social impact of airports in Europe, ACI Europe, 2004.
[13] IATA, Passenger and Freight Forecasts 2007 to 2011, Economic Briefing, October 2007.
[14] Airports Council International, 2006 World Air Traffic Report, July 2007.
[15] Barclaycard, Business Travel Survey, 2006.
[16] Op cit.

2011 – equivalent to a 279 million increase in annual passengers within the region.[17] Asia Pacific will soon have a higher share of the global market than the US domestic market, though it will still be slightly smaller than the North American market as a whole.

IATA's forecasts also show that, on Asian domestic routes, passenger demand is expected to rise by an average annual rate of 5.9%, from 1.37 billion in 2006 to 1.77 billion by 2011.[18] China's average annual increase for the five years is expected to be 8.8% and India's 8.6%.

China is obviously a key driver of Asia Pacific air traffic growth. In 2006 the country's airports handled 197.5 million passengers – 60 million more than in 2004.[19] According to one analyst the country is also estimated to have the world's third largest business travel market, after the US and UK.[20] On current trends, its size will increase enormously over coming decades.

Despite this growth, Asian aviation markets remain very undeveloped by comparison with Europe or North America – per 1000 people, India has only 20 air trips annually, and China 60, compared to 2,300 in the USA.[21] There is therefore a potential 'window of opportunity' to create take-up of travel alternatives before Western patterns of business mobility become entrenched. This is especially the case as much of the Asia-Pacific growth is likely to be in short haul rather than long haul travel.[22]

2.2 The Crucial Role of Business Travel in Airline Economics

Business and first class travel contributes a disproportionate amount of revenue for full service carriers, and so to some extent cross-subsidise leisure travel on planes.[23] One 2001 study, for example, calculated that if fares were related to operating costs (i.e. business and first fares reflected only the extra space requirements of their seats, and the additional service provided) a New York–Los Angeles roundtrip would have had a first class fare of $1300 (well under half the actual rate charged) and an economy fare of $700 (much less than the $2000 then charged for a full fare economy, but more than the discounted rate paid by many passengers).[24] Because larger corporations get discounts of 40% or more for bulk deals, first and business class travel by their executives is also cross-subsidised by executives from smaller companies, professionals and rich leisure travellers.[25]

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[17] IATA, Passenger and Freight Forecasts 2007 to 2011, Economic Briefing, October 2007.
[18] Op cit.
[19] G. Powell, 'China air travel booms', China Economic Review, 8 October 2007
[20] FCm Travel, Business travel riding the wave of economic growth, Outlook, 2007.
[21] The Times of India, 'Air travel in India lower than SL, Pak', 28 August 2007.
[22] *Impact of India-China Growth exaggerated*, June 2006
http://www.breakingtravelnews.com/article/20060728085117385
[23] Airline Economic Results and Prospects, IATA Airline Economic Task Force, December 2003 quoted in F. Alamdari, Change in Demand for Air Travel, undated article on Airport International website.
[24] JOC Research, The Case for a Compensatory Fare Structure, 26 September 2001.
[25] J. Sharkey, 'Demand Grows for All-Business-Class Flights', New York Times, 24 July 2007.

Table 1: Passenger services results by class of service – 2002

Class of Service	Capacity (%)	Load Factor (%)	% of Revenue	Operating Ratio (Revenue as % of Total Costs)
First	2.4	36	3.8	73
Business	14.8	52	28.1	129
Economy	82.8	77	68.1	105

Because passenger revenue splits are proprietary, the most recent available figures are from 2002. As Table 1 shows, even in the very depressed, post 9/11, market of that year, business class provided 28% of revenues from only 14% of capacity for full-service carriers, and had an operating profit margin of 29% compared to 5% from the economy class.[26] Although low cost carriers operate at lower fare levels it is also likely that their passengers travelling on business – which, for example, accounted for 20% of passengers on the European low cost carriers, Easyjet and Ryanair, in 2007 – account for a disproportionate share of revenues because of their willingness to make last minute bookings at relatively high fare levels.[27]

Minimising first, business and full fare economy class travel would disproportionately constrain future growth of air travel, especially in long haul, and support the transformation to a more sustainable travel/meeting infrastructure, by:

- Reducing the number of flights, both through lower frequency, and fewer destinations served, because many of currently low profitability could not be justified on a lower revenue base;
- Increasing the prices of the very lowest fares because of reduced 'cross-subsidy' from business class and full fare economy travellers;
- Reducing cross subsidies within airports, e.g. by provision of cheap facilities to budget airlines (very remote gates, or bus transfer to and from apron parking) because premium airlines pay relatively high rates for more convenient facilities; and
- As a result of these two factors, adding greater uncertainty to the case for longer-term investments in airport capacity, and related infrastructure.

The ability of low cost carriers to fill the gaps created by fewer full service flights would also be hampered by smaller numbers of last minute travellers.

Of course, sudden changes in aviation economics, resulting in reductions in passenger numbers and revenues, could have negative short-medium term impacts on employment,

[26] Airline Economic Results and Prospects, IATA Airline Economic Task Force, December 2003 quoted in F. Alamdari, Change in Demand for Air Travel, undated article on Airport International website.
[27] D. Jonas, 'Competitors Take Note of easyJet's GDS Deals', The Transnational, 14 November 2007.

and consumers. However, in the medium-long term, these could potentially be replaced by new sources of employment – for example, from providers of conferencing technologies and services, or in providing virtual meeting facilities in hotels or other 'virtual meeting' hosts. Other economic benefits could also be created, such as increased productivity as a result of less working time spent travelling, or increased property values in some areas currently blighted by high levels of aircraft noise. This would replicate experience in a number of other areas, where environmentally driven change which was initially feared to have negative economic impacts has in fact stimulated adaptation and innovation to create net economic benefits.

Experience in these areas therefore suggests that the best way of minimising negative economic effects is not to resist the travel substitution which is inevitable in a more resource-constrained and carbon-controlled world. Rather it is to create a long-term sense of direction that communities, organisations and individuals can adapt to in planned and measured ways.

3. Drivers of Business Air Travel

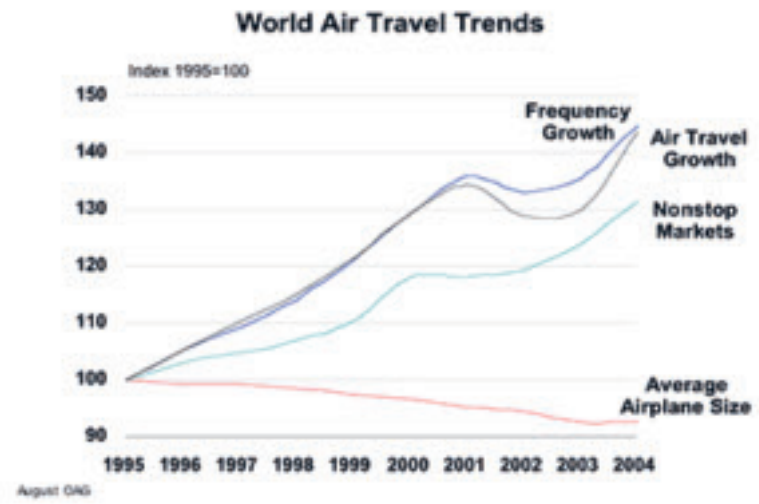
Business air travel is being driven by many factors, including:

- Growing international flows of trade, investment, cultural exchange and other aspects of economic, political and social 'globalization';
- Liberalization of air travel, resulting in increased competition, reduced costs and more services between 'city pairs';
- Changing patterns of work organisation within large organisations; and
- Broader cultural developments about the value of mobility.

Globalization is reflected in increasing trans-national flows of goods and services, capital, people, information and technology, most of which are highly reliant on air travel for their delivery and organisation. It has also been accompanied by the development of more, and larger, multinational firms, and by internal changes within them. Economies of scale and other factors create regional or global specialisations in production facilities, and activities such as R&D. This in turn, requires increased co-ordination and information flows between them, and consequent air travel. For this, and other reasons, foreign-owned firms often generate proportionately greater air travel than indigenously owned ones.[28]

[28] A. Vecchi and J. Wickham, Clusters and Pipelines, Commuters and Nomads: Business Travel in the Irish Software Industry, GAWC212, Globalization and World Cities Study Group, University of Loughborough, 2004.

Figure 1 – World Air Travel Trends



Source: R. Tinseth, 'Back to the Future', Randy's Journal, 16 May 2005.

According to one study, "traffic growth subsequent to liberalization of air services agreements between countries typically averaged between 12% and 35%, significantly greater than during years preceding liberalization".[29] As Figure 1 shows, an important aspect of this growth was the availability of more direct flights between city pairs, making it easier for business travellers to get there and back in a day.[30] One of the case studies the study examined was travel between Malaysia and Thailand, concluding that, of the total 1.3 million passengers in 2005, "over 370,000 can be attributed to the combination of the liberalized regime and the entry of low cost carriers".

A third driver of air travel is changing patterns of work, and work organisation. A key feature of modern employment has been the rise of what Robert Reich has called 'Symbolic-analysts' (and others call 'knowledge workers') whose main role is to identify problems, analyze them, solve them and "broker" information.[31] According to Reich, interaction with colleagues, customers and others is crucial to their work and so they often "spend long hours in meeting or on the telephone and even longer hours in jet planes and hotels".[32]

[29] InterVista, The Economic Impact of Air Service Liberalization – Executive Summary, IATA, 2006.
[30] Elisabeth Rosenthal, 'Making amends for 'dirty' air travel', International Herald Tribune, 1 June 2007.
[31] R. Reich, *The Work of Nations: Preparing Ourselves for 21st Century Capitalism*, New York: Alfred A. Knopf, 1991.
[32] Op cit, p. 122. Cited in A. Vecchi and J. Wickham, Clusters and Pipelines, Commuters and Nomads: Business Travel in the Irish Software Industry, GAWC212, Globalization and World Cities Study Group, University of Loughborough, 2004.

The rising costs of developing new goods and services, potential economies of scale from sharing tasks between countries, and other factors, are also increasing the prevalence of trans-national project and task groups, both within organisations and between them.

Academics have argued that these developments, and others, have created a major cultural shift, with the emergence of new, nomadic, world view in which mobility is seen as a desirable norm, rather than an exception to the rule. This can create a perception in business that frequent air travel is both desirable, and mark of success.[33]

4. Minimising Business Air Travel

There are several factors which could 'naturally' limit growth in business air travel, including:

- A worldwide economic downturn, prompting companies to look for greater cost savings across their operations, including business travel;
- A new generation of business leaders with management strategies that have virtual meetings rather than physical meetings as the default option;
- The end of the benefits from liberalisation as an increasing percentage of aviation markets are deregulated;
- Increased competition from high speed trains on many short haul routes;
- Rising costs, as a result of increased fuel prices, and possibly higher landing charges at many airports as a result of capacity constraints;
- Increased stress arising from congestion, terrorism and other factors; and
- Less congenial travelling conditions on planes – for example, almost half (48%) of business travellers in one survey were opposed to the introduction of mobile phone services in planes, double the number who supported it.[34]

It also seems likely that Governments, companies and individuals will take action to minimise air travel because of growing concern about climate change. Projected or possible measures include:

- New or more stringent fiscal regimes, including taxes on aviation fuel, passenger departure or arrival taxes, sales tax on tickets, and inclusion in carbon trading schemes such as the European Emissions Trading Scheme;
- Greater restrictions on airport expansion, resulting in higher landing charges as a result of capacity constraints;
- Corporate restrictions on business travel, achieved by mechanisms such as departmental targets, tighter financial budgets and other means; and

[33] Richard Cresswell, *On the Move*, London: Taylor and Francis, 2006.
[34] Martin Ferguson, 'I'm on the plane!', Travel Trade Gazette, October 23, 2007.

- More effective use of travel by individuals, for example, by squeezing more meetings into trips or 'meeting chaining', in which instead of making several short 'in and out' trips to different locations, they make a longer trip and travel directly between one location and another.[35]

Despite these measures, however, the driving forces of air transport described above seem sufficiently powerful to create continued increases in demand for face-to-face interaction. Hence, a 'step change' in the prevalence of virtual meetings is essential if carbon targets are to be achieved.

5. The Potential of Virtual Meetings

Virtual meetings enable people in two or more locations to see and/or hear each other as if participating in a face-to-face conversation. The main forms are audio conferencing, web conferencing, and videoconferencing. It is the last of these which is most likely to substitute for actual travel.

As the box indicates, videoconferencing has a long history, and its use has risen steadily in recent decades. Videoconferencing revenues of third party service providers were estimated at $6.7 billion in 2007 and are forecast to reach $11.9 billion by 2010.[36] The U.S. is the largest market, worth approximately $4 billion in 2007, followed by Europe (particularly France, Germany, the UK, Italy and Spain).[37] Together, Europe and the U.S. accounted for 75% of the global video conferencing market.

China has some of the most sophisticated videoconferencing deployments in Asia-Pacific. It accounted for 44.5% of regional revenues in 2006, and Chinese companies such as Huawei and ZTE have embarked on strategies to spread their wings to other Asian countries.[38]

There are no aggregate figures for internal videoconferencing usage within organisations, although a number of companies have published data on their own internal activities (see below for examples).

5.1 Potential Environmental Benefits of Videoconferencing

Videoconferencing can create environmental benefits by substituting for travel. This avoids the pollution and carbon emissions arising from the fuel used in transport, and embodied in the equipment which supports it, e.g. aircraft and cars, as well as supporting infrastructure.

[35] 'Business travel through regional airports increasing', Travel Trade Gazette, November 23, 2007.
[36] Global Industry Analysts, Videoconferencing - Global Strategic Business Report, July 2007. Restricted access.
[37] Op cit.
[38] A. William and Y. Har, Uptrend for conferencing market, Raidah, 5 June 2007.

Of course, videoconferencing also has environmental impacts, arising from the electricity used to power the equipment and networks, the energy embodied in them, and possibly some travel to a videoconferencing facility.

Whilst there is plentiful data on conventional transport, no detailed studies have been done on the direct environmental impacts of videoconferencing. However, a comparison by the Japanese telco, NTT, found that a 115 minute videoconferencing call created 400 kilos of CO_2 emissions, compared to 2000 kilos for a face-to face equivalent involving 674 kilometres of air travel. Moreover, less than 10% of the videoconferencing-related CO_2 was related to running the equipment – over 90% was related to the 'rebound' effect of the avoided costs being spent on other activities, which generated their own CO_2.[39] This is a very high figure and, in practice, the rebound effects could be significantly reduced by a policy framework that makes carbon smart solutions more attractive, and high carbon solutions less attractive.

Several studies have examined the avoided carbon emissions from videoconferencing, including at:

- Deutsche Telekom and its subsidiary, T-Mobile, which calculated that 40,260 videoconferences between 2004 and 2007 saved 7000 tonnes of CO_2, mainly from air travel, and 200,000 hours of people's time;[40]
- The UK Department for International Development (DFID) – the 4084 calls made in 2005 between its two UK offices and its international field offices, and to aid bodies such as the World Bank avoided at least 735 meetings and a net 303 tonnes of carbon emissions;[41]
- Several Swedish companies, where it reduced travel time for about half of the employees and cut the travel budget by 10 percent[42]; and
- Vodafone – around 200 globally connected videoconferencing units, including six 'lounges' avoided CO_2 emissions of 5,520 tonnes in 2006, and contributed to a 20% reduction in air trips by Vodafone employees. Travel between sites with videoconferencing 'lounges' (which achieved an extremely high utilisation of 85% during business hours) fell by 100 trips per month per site, and the investment payback was less than two months.[43]

[39] K. Takahashi et al, Estimation of Videoconference Performance, Proceedings of the 2006 IEEE Symposium on Electronics and the Environment (registration required).
[40] See www.zero-emission-meetings.com/content/examples.
[41] P. James, Conferencing at DFID – The Economic, Environmental and Social Impacts, SustainIT, 2007.
[42] P. Arnfalk, Virtual Mobility and Pollution Prevention: The emerging role of ICT based communication in organisations and its impact on travel, Dissertation, Lund University, 2002.
[43] Institute of Travel Management, Vodafone Case Study, 2007.

Companies are increasingly aware of the travel substitution potential of videoconferencing. A recent WWF-UK survey of FTSE 350 companies found that 85% believe that videoconferencing has the potential to reduce their business flying.[44]

5.2 Overcoming Rebound Effects

One point which is often made in the literature on ICT-based travel substitution is the creation of 'rebound effects'. In the case of videoconferencing these are primarily the opportunity for extra travel which can be created by the time savings, and the extension of networks, which are made possible by conferencing technologies. However, the studies which have examined this have concluded that, at the least in the short term, considerably fewer trips are generated than are replaced.[45]

Many of the rebound effects of additional travel related to videoconferencing are influenced by the costs of travel – the cheaper this is, the more likely rebound effects are to occur. Hence, the rebound effects can be limited by broader policies to, for example, internalise external costs into fuel prices.

[44] WWF-UK, Travelling Light: why the UK's biggest companies are seeking alternatives to flying, May 2008.
[45] For example, P. James, Conferencing at DFID – The Economic, Environmental and Social Impacts, SustainIT, 2007.

A Videoconferencing Primer

Standard videoconferencing has four main elements:

- Inputs – Cameras and microphones to capture the images and sounds of participants, often supplemented by hardware or software to share computer-displayed information, scanned images, and whiteboards;
- Conversion – compression of the data (down to 1% of its original size in some cases) to by up to 500 into standard formats (e.g. MPEG-4) through a hardware or software codec (coder/decoder);
- Transmission – sending the image and sound data over either dedicated (and now usually digital) telephone lines, or over networks using Internet Protocol (IP);
- Outputs – reconverting the data into images on a computer monitor, television or projector, and sounds from associated loudspeakers.

In rough terms, there are three levels of videoconferencing:

- 'Desktop' – making use of existing computers and monitors through the addition of webcams, use of 'plug in' meeting, messaging or VOIP software, and utilising conventional Internet connections;
- 'Dedicated' – using special consoles, often located in dedicated suites, and typically utilising high capacity telecommunications (from $40-50,000 upwards for suites);
- 'Studio' – offers such as Cisco's TelePresence, and HP's Halo, which use very high quality equipment (e.g. high definition cameras and screens, surround-sound like audio), actual size displays of participants, and carefully planned conference rooms, with pre-defined camera, microphone and speaker placements, to create a cinema-like sense of presence and engagement (currently a capital cost of around $120,000 for a small facility, and 2-3 times higher for larger ones, and connection costs of $12-20,000 per month, but likely to fall in future).

'Point-to-point' videoconferencing involves only two locations, whereas 'multi-point' ones involve three or more. This is usually accomplished through a dedicated 'Multipoint Control Unit' which all locations feed into, but an emerging alternative is decentralised communication between each of the sites, based on the H.323 standard.

The first videoconferencing actually took place in 1928, using basic television technology. The technology developed in following decades but was constrained by analogue transmission (which resulted in poor picture quality), and limited compression options. Costs were lowered, and quality improved, in the 1980s with the development of digital telephony. The development of Internet Protocol (IP) transmission in the 1990s – based on a new open standard – has also created greater flexibility in location, and reduced costs by allowing signals to utilise existing network infrastructures and equipment.

6. Barriers to Videoconferencing Take-up

Despite its environmental and financial benefits videoconferencing remains a 'niche' technology. Its' use in the media multinational, Pearson, provides a typical example. An analysis found that: "the company used its video conferencing suites for a total of 9,000 hours last year, up significantly in 2006, but still a tiny fraction of the time spent travelling by air. The average employee spent less than 20 minutes in video conferencing last year. The time taken to travel the average 4,000 miles by air was probably the best part of a working week".[46]

Of course, there are many kinds of business meeting which cannot be replaced by videoconferencing. The importance of body language and other forms of non-verbal communication mean that those which are about establishing, or cementing, trust can be difficult to replicate in a virtual manner. Issues of privacy, security and confidentiality can also be important, and mean that people will be unwilling to take the risk of others listening or watching to their interaction. However, it is also clear that there are many meetings which do not involve such issues, and could transfer to videoconferencing. A survey at the UK Department for International Development, for example, found that – despite the fact that the technology was already used considerably – 64% of respondents believe that there was scope for existing meetings to have further inputs from conferencing; and 47% believed that there was scope to replace additional meetings with videoconferencing.[47]

This 'latent demand' is being impeded by a number of barriers, including:

- Concerns about effectiveness;
- Access to technology; and
- Weak vendor incentives.

There are also several factors which impede the case for greater use of videoconferencing to achieve environmental benefits:

- Misalignment of user incentives;
- Lack of strategic impetus; and
- Poor information.

6.1 Effectiveness

Many potential users of videoconferencing see it as a poor means of communication which cannot capture important non-verbal aspects such as gesture and tone. Whilst this is always likely to be a concern for some, there is ample evidence that the technology can achieve

[46] C. Goodall, 'Video conferencing: at last a good alternative to travel?', Carbon Commentary, 29 October 2007
[47] P. James, Conferencing at DFID – The Economic, Environmental and Social Impacts, SustainIT, 2007.

effective communication (see section 4.1), and that the new high end studio videoconferencing does create much richer and satisfactory interaction than previous applications.[48]

There is also a common perception that videoconferencing is unreliable, with frequently lost connections, deteriorations in picture and/or sound quality etc. Here too, quality is improving.[49] The impact of this can also be exaggerated. For example, one study of videoconferencing in an international development ministry found that performance was good even tough there were some technical problems associated with linking calls to and from countries with unreliable telecommunications infrastructures.[50]

6.2 Access to Technology

Desktop videoconferencing is now relatively easily available to anyone with a computer, camera and microphone, and broadband connection. Room-based systems are also becoming more common. However, they are largely used for internal management and project meetings within large multinational organisations, who often purchase a managed service from an external vendor.[51] Open access (on a bookable basis) remains patchy even in developed countries, and unusual outside major business hubs, or within multinational companies, in developing countries.

High definition studio systems are especially rare, until now confined to a small number of organisations, and at only a few locations within them. Although this is changing – with HP recently announcing a deal with Marriott to install Halo suites in hotels, and Cisco one with Regus to do the same in business centres - the rate of growth in users seems likely to be slow, compared to the increase in business air travellers.[52] This is not only because of cost, but also technical issues. Each screen requires about 5Mbps of bandwidth, which can be difficult to guarantee at many locations. Interconnection between different systems is also problematic. For example, at the time of writing Cisco's TelePresence system can only been used within corporate networks, and can only communicate with other TelePresence sites. However, this situation should change as such systems do begin to compatible with external standards such as the CIF resolution standard, the H.323 communications standard, and the G.711 codec standard (as Cisco announced it would in early 2008).[53]

Clearly there is a long way to go before a dense network of videoconferencing locations allows easy access for SMEs, or specialist users such as education at the current pace.

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[48] S. Morrison, How Green Does Your Video Look?, Gartner, 18 October 2007. www.gartner.com (restricted access)
[49] *Ibid.*
[50] P. James, Conferencing at DFID – The Economic, Environmental and Social Impacts, SustainIT, 2007.
[51] D. Bradbury, 'Is video conferencing cleared for take-off?', BusinessGreen, 08 November 2007
[52] R. Kim, 'HP to deploy 'telepresence' gear at Marriotts', San Francisco Chronicle, 18 March 2008.
[53] D. Mayer, 'Cisco opens up TelePresence to rivals', ZDNet 10 December 2007.

6.3 Weak Vendor Incentives

Although the number of videoconferencing calls is increasing, the revenue associated with them is growing much less quickly, and even falling in some countries. For example, a study of video-bridging services in the North American market found that revenue fell 15% from 2001 to 2006.[54] The main reason for this is the videoconferencing-relevant aspects of the general IT phenomena of falling costs of equipment and connectivity, as a result of technical progress. This creates a focus by many videoconferencing providers on the provision of managed services to larger organisations, which can militate against market expansion through the aggressive provision of lower margin products to a higher number of users (see below). These trends are changing – interestingly, US video-bridging revenues grew 23% in 2006-7, with concern over carbon emissions said to be a significant factor. Nonetheless, videoconferencing remains a niche activity in most developed countries, with little sign that there will be large-scale take-up outside big organisations in the foreseeable future.[55] Additional measures would be necessary to achieve this.

6.4 Misalignment of User Incentives

At present, there are three major beneficiaries from a choice of air travel over videoconferencing:

- Airlines and other travel providers, who use frequent flyer programmes to create incentives for people who travel with them;
- Travel management companies who provide a transaction-based service which provides considerable financial benefit from selling air tickets, but relatively little from setting up videoconferencing; and
- Many business travellers who see work trips, especially to other countries, as a positive 'perk' of the job (especially likely when they make such trips infrequently).

Travel providers have little current interest in promoting videoconferencing as it competes with their own product. However, it can provide a means of offsetting their own carbon footprint, and this may become an attractive option for European airlines in particular when the EU Emission Trading Scheme (ETS) is extended to aviation. However, this is some way into the future, is dependent on the ETS becoming more effective than in the past, and would apply to only a minority of the world's airlines.

Travel management providers have been growing rapidly, based on their ability to control travel costs more effectively than in-house bookings, and/or to obtain lower fares or provide other support. Historically, their revenue has mainly come from fees (either flat, or as a small percentage of value), and has therefore been related to the volume of travel bookings. Hence, a choice of videoconferencing over air travel could involve considerable sacrifice. However, because of reductions in commission from airlines, and other factors, many travel management providers have begun to move to different business models, involving a larger proportion of (and, in some contracts, all) income arising from fees per 'contact', and/or base level service agreements.

[54] D. Bradbury, 'Is video conferencing cleared for take-off?', BusinessGreen, 8 November 2007.
[55] Op cit.

According to one recent survey, individual business travellers are "far more concerned about comfort and convenience than carbon".[56] And, whilst very frequent travellers may welcome an opportunity to travel less, our interviews with travel management professionals, and other sources, suggest that more individuals see it as a 'perk' of their job.[57] One aspect of this is the opportunity to see other places, and another the benefits attached to frequent flyer schemes.[58] The first of these cannot be addressed through videoconferencing, but the second can, especially as the value of many of the incentives they offer is being devalued over time (see below).

6.5 Lack of Strategic Impetus

Some large organisations are successfully reducing business air travel per employee, and in some cases, in absolute terms. Success has been achieved by measures such as:

- Better organisation of the videoconferencing service, often associated with a single global supplier;
- Use of more reliable Internet Protocol architecture;
- Requiring employees to state why they must travel instead of using virtual conferencing;
- Extensive marketing of benefits of videoconferencing to employees;
- Budgetary or trip targets for departments;
- Partnerships with travel management suppliers to provide better information, and to help implement other policies; and
- Senior executives setting an example.[59]

However, in more organisations, CSR aspirations to minimise travel are not being translated into practice. A recent survey of over 200 travel managers and senior executives by the Association of Corporate Travel Executives identified a "gap between the good environmental intentions of many businesses and the travel measures they currently employ".[60] The survey found that:

- Only 33% of respondents said their travel policy was used to encourage sustainable travel choices (although a further 35% said that they were developing such a policy);
- Less than 25% said that they encouraged staff to cut down on travel to help the environment; and
- Only 20% felt that environmental sustainability was a high priority.

Another survey of travel management professionals for the UK magazine, Travel Trade Gazette, identified a disconnect between their growing awareness – 49% said that they

[56] Green Matters, Travel Trade Gazette Industry Report 2007.
[57] J.H. Andriessen, Less mobile, more virtual: Learning remote communication to save costs and the climate, University of Technology, Delft, 2007.
[58] P. Arnfalk, 'Can virtual meetings replace business travel? - Recycle OK, but leave my frequent flyer miles alone!', in D. Pamlin (Ed.), Sustainability at the speed of light : opportunities and challenges for tomorrow's society, World Wildlife Fund, Stockholm, 2004.
[59] Institute of Travel Management, Vodafone Case Study, 2007.
[60] Yves Weisselberger, Business travel: clean up your act, Accountancy Age, 28 Jun 2007.

were 'concerned' about environmental issues – and that of their clients, only 15% of whom were concerned according to respondents.[61]

The point is illustrated by business travel in the bank, HSBC, whose business travel-related CO_2 emissions per employee rose by almost 50% over the period 2004-6, as Table 2 shows. Of course, the same thing happened in many other banks and other multinationals – and HSBC has made significant investments in videoconferencing, and introduced more stringent travel approval processes, in an attempt to reverse the trend. Nonetheless, the outcome is especially striking because this was the very same period when HSBC was aspiring to be a CSR leader, and the 'world's first carbon neutral bank'.[62]

Table 2: HSBC's Business Travel Carbon Footprint

	2004	**2005**	**2006**
Total business travel (million km)	635	850	1,200
Business travel per person (km/full-time equivalent)	2,886	3,361	4,155
CO_2 emissions from business travel (tonnes)	88,000	124,000	179,000
CO_2 emissions per person from business travel (tonnes)	0.40	0.49	0.62

Source: HSBC Corporate Social Responsibility reports[63]

One cause, and consequence, of this lack of strategic impetus is a fragmented approach to conferencing. As the industry analysts, Wainhouse, have observed: "One of the key practical changes that an organisation can make is to centralise the purchase, deployment and tracking of collaboration technologies to ensure that the organisation can track the effectiveness and increased use of these technologies, rather than have it dispersed at a departmental level with multiple suppliers. We believe that sooner – rather than later – conferencing and collaboration technologies will become a key component of carbon reduction programmes and that the demand and acceptance of remote business will soar over the next five years".[64]

[61] Green Matters, Travel Trade Gazette Industry Report 2007.
[62] D. Jonas. 'Leading on Sustainability: HSBC Considers CSR Throughout Travel Procurement', Travel Procurement, July 2007.
[63] Op cit.
[64] Wainhouse Research, Using Conferencing and Collaboration to Reach Carbon Neutrality, 2007 Restricted access.

Fortunately, applications are emerging to achieve this, for example:

- The Video-Miles(R) software programme calculates the usage, and mileage and carbon savings arising from videoconferencing use within organisations[65]; and
- iLinc Communications's 'Green Meter' detects the locations of participants using its web conferencing software, calculates the distance between these and the meeting leader, and uses an algorithm to automatically calculate the travel and CO_2 emissions savings which result.[66]

Of course, the credibility of such tools depends upon the assumptions they are making about travel replacement, but it should be fairly straightforward for a combination of transparency and expert review to establish some reasonably accepted figures.

6.6 Poor Information

Good information can change travel behaviour – in the UK, for example, many travel management companies have recently seen a considerable increase in rail bookings, with the main reason being increased environmental concern.[67] Until recently, however, information on carbon emissions and other environmental impacts has seldom been present in the travel booking process. Moreover, there is a considerable variation in data about the carbon impacts of travel between different sources, as well as different levels of cost between different forms of offsetting.[68] Understandably, this has created considerable confusion amongst business travellers, and made it easier to do nothing with regard to travel minimisation. However, both these areas are now being addressed (see next spread) and should therefore become less serious barriers in future.

[65] See http://www.telepresenceoptions.com/2008/01/videomiles_software_monitors_c/
[66] A. Hickey, 'Web Conferencing Tool Measures Carbon Savings', CMP Channel Jan. 11 2008.
[67] Rail Travel, Travel Trade Gazette Industry Report 2007.
[68] W. Frew, 'Confusion grows as tourism takes on carbon offsets' Sydney Morning Herald, March 30, 2007.

A Travel Industry Initiative to Minimise Business Travel and Maximise Virtual Meetings

Project Icarus is a voluntary initiative of the Institute of Travel Management (ITM), a professional body for buyers, managers and suppliers of business travel in the UK and Ireland.[1] It is aimed at travel buyers, and provides:

- Accreditation of travel buying companies which take action and reduce carbon emissions;
- Awards for travel suppliers taking environmentally positive initiatives; and
- A toolkit to make corporate travel managers more aware of carbon emissions, and to provide assistance in reducing them.

The accreditation involves five stages:

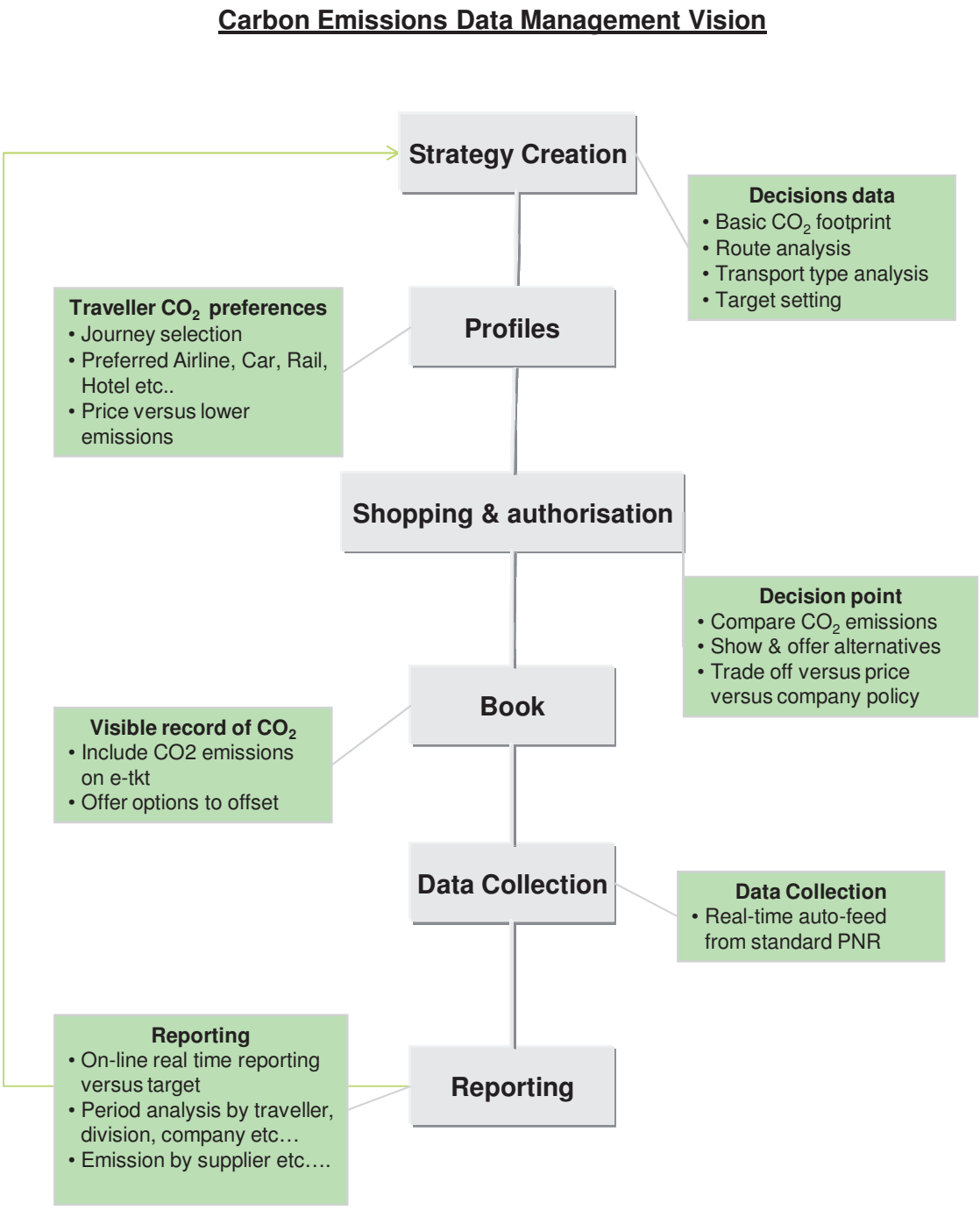
- Commitment – which involves accepting ITM's overall goal of members reducing their travel-related CO_2 emissions by 2.11% per annum (which equates to an initial, but now superceded, UK Government target of a 60% reduction from 1990 emissions by 2050);
- Bronze – for members who have measured, targeted and created a strategy to reduce CO_2 emissions from the air element of their travel programmes;
- Silver – for those who have reduced air-related CO_2 emissions by at least 2.11 % per annum, and are taking similar measures for other forms of travel;
- Gold – for those who have achieved an absolute reduction in CO_2 emissions from the air, hotel, rail, ground transportation and business mileage elements of their travel programmes by at least 4.22% per annum; and
- Platinum – as Gold, and underpinned by a demonstrably holistic view of total travel and transport management, incorporating business travel, commuter travel and travel associated with goods and services.

At the end of 2007, a few months after the schemes launch, seven corporates had made the 60% reduction Commitment, including the BBC , Inmarsat and Price Waterhouse.

The Project Icarus toolkit includes:

- Environmental Travel Policy Guidelines;
- CO_2 measurement tools;
- A 'roadmap' of how CO_2 data can be integrated into the business travel decision-making and booking process (see next page);
- Case studies;
- A list of videoconferencing facilities around the UK; and
- Videoconference practical training exercises.

Figure 2 – Integrating Carbon into Travel Management



Source: Project Icarus, Institute of Travel Management (reproduced with permission)

7. Building Digital Bridges Through Videoconferencing Infrastructure

As noted in the previous section, many potential videoconferencing applications face difficulties because there is not a dense enough infrastructure of facilities to support access from many locations. At present rates of take-up, it seems unlikely that natural market development will overcome these difficulties. Hence, the potential of videoconferencing to make a substantial contribution to minimising CO_2 emissions will not be achieved. This is very unfortunate, because the technology is one of the few means available which has the potential to reduce costs, and to offer better or superior functionality, than the alternatives it would be replacing. Hence, there is an economic, as well as an environmental, case for new mechanisms to drive the voluntary take-up of conferencing.

7.1 The Costs of a 'Digital Bridge'

Table 3 provides some very 'broadbrush' estimates of what the costs of stimulating a step change in videoconferencing take-up might be if a decision was made to 'make a difference' by quickly creating a dense infrastructure. They assume that the key requirement is to achieve a 'dense' infrastructure of public access sites so that anyone can easily access in it any of the world's significant urban areas. For the purposes of calculation, we assumed that the 4,620 sites suggested would be additional to those which are likely to be developed by the market.

It is clear that the estimated capital cost of $495 million is miniscule compared to that of airport development. For example, a third Heathrow runway could have a capital cost of up to $22 (£13) billion, whilst a new Airbus A380 superjumbo has a list price of around $320 million.[69]

The key question is whether, and how quickly, the estimated annual operating costs of $347 million could be covered by income. In the medium-long term such an infrastructure would need to become financially self-sustaining, but in the short-medium term an element of subsidy would probably be needed to encourage utilisation. A more detailed feasibility study is needed to fully assess potential income streams, but there is certainly some evidence that organisations can achieve considerable financial benefit from using conferencing. For example, the previously cited study of videoconferencing at the UK Department for International Development found that, on conservative assumptions, each call avoided tangible travel and subsistence costs of almost $300 (£156) per call.[70] In addition, the freeing of productive time for other purposes was valued at an additional £24 per call. In addition, videoconferencing provides an opportunity to strengthen relationships by greater visual contact than is possible when air travel is required.

[69] J. Russell, 'Heathrow runway may cost £13bn', Daily Telegraph, 1 December 2007.
[70] P. James, Conferencing at DFID – The Economic, Environmental and Social Impacts, SustainIT, 2007.

A further revenue stream which could support investment in a large scale videoconferencing infrastructure of this kind is money from carbon offset payments. The next section examines how this might work.

7.2 The Users of a 'Digital Bridge'

There would be many potential users for a videoconferencing infrastructure of this kind, including:

- Larger companies with many field activities in different countries;
- Small-medium sized businesses, who would be able to interact more effectively and cheaply with their customers and suppliers;
- International Governmental and Non-Governmental organisations;
- Small-medium sized events bringing together international audiences for wholly or largely non-profit purposes (e.g. academic conferences); and
- Distance learning and certain telemedicine applications involving discussion between experts, or experts and patients.

A primary target of the scheme would be countries such as China or India, with the aim of many people developing familiarity with videoconferencing before becoming attached to air travel for meetings. 'Digital bridges' could therefore supplement, and partially replace, the "air bridges" which would otherwise be constructed.

Another key audience would be important 'opinion forming' organisations such as prominent multinationals, or international bodies such as the European Commission and United Nations. If they were committed to the scheme, and set an example in practice, then many others would be likely to follow.

Of course, it would be sensible to establish small scale demonstration pilots in advance of any large scale investment commitment. Their aim would be to create a dense infrastructure for key business communities and travelling routes. Three possible options for this would be:

- Top cities in China - a dense network of perhaps 20 sites of 5 rooms each in the top 10-20 business centres (perhaps involving partnerships with hotels, such as that established by HP and Marriott) would enable a significant proportion of the Chinese business population to be located within a few miles of a public access videoconferencing infrastructure, and ensure good availability;
- Top cities in a medium sized European Union member state – a similar scheme to the above, but able to take advantage of potential EU and national government funding and sponsorship, and to build on well-established precedent of public-private partnerships for innovation (perhaps by bringing together city and regional as well national government; videoconferencing providers; hotels and other potential hosting organisations; and large users);

- Top financial centres in the world, e.g. New York City, London, Frankfurt and Tokyo – taking advantage of the physical concentration of such centres, and the large number of flights between them, and working in partnership with large banks and other financial institutions wishing to demonstrate their environmental credentials.

The following section discusses some of the mechanisms which could be used to support such pilots, and to drive demand for a broader and denser network.

Table 3: Estimated Costs of Conferencing Scheme

Type of installation	Number of installations	Capital Costs ($ million)	Annual Operating Costs ($ million)
Studio	1320[71]	$330[72]	$264[73]
Dedicated	3300[74]	$165[75]	$83[76]
Total	**4620**	**$495**	**$347**

8. Financing Videoconferencing Infrastructure and Increasing Use

One way to finance the requirement identified in the previous section is through an innovative kind of offset scheme. However, this is in itself unlikely to be sufficient to drive demand, so that other mechanisms will be necessary to achieve this. They can also help to create a wider 'buy in' for an offsetting scheme, so that it cannot be portrayed as simply a means of providing additional income for vendors. Four possible mechanisms have emerged from our research:

- A branded international network;
- Corporate charter for sustainable meetings;
- 'Frequent video users' incentive scheme for individuals; and
- New business models for travel management companies.

[71] Assumes average of 1 installation per 2.5 million people in urbanised areas, which is estimated to be a total of 3.3. billion in 2008 (see 'The world comes to town', People and Planet, 6 January 2008).
[72] Assumes an average capital cost of $250,000, based on economies of scale from large-scale production.
[73] Assumes an annual operating cost of $200,000.
[74] Assumes average of 1 installation per 1 million people in urbanised areas, which is estimated to be a total of 3.3. billion in 2008.
[75] Assumes an average capital cost of $50,000 (which is a figure not far below that achieved by some large scale current investors in videoconferencing), based on economies of scale from large-scale production.
[76] Assumes an annual operating cost of $25,000, based on cost efficiency through centralised support within regions or countries for a group of sites (a proven model in, for example, UK higher education) .

8.1 Innovative Carbon Offset Arrangements

Carbon offsetting are often seen as controversial for many different reasons[77], but is still practiced by many business travellers. For example, online travel search company Global Travel Market, reported in 2007 that 19% of bookers chose to offset their flight emissions.[78] One opportunity is therefore to develop new mechanisms to use resources from companies that want to ensure that their future flying can be reduced and support the additional videoconferencing investment described in section 6. This could be seen as a parallel, or alternative to, offsetting.

As Appendix 2 discusses, there are significant problems with fitting videoconferencing into established carbon offset mechanisms such as the Clean Development and Joint Implementation Mechanisms of the Kyoto Protocol, or the EU Emission Trading Scheme. Three key issues are:

- Additionality – as growth in videoconferencing usage is expected in most countries, and videoconferencing does not necessarily translate into reduced travel, offset schemes would need to be clearly targeted at schemes which would be unlikely to happen through market forces;
- Reliability – although there is solid evidence that videoconferencing reduces travel in the aggregate this does not mean that every individual investment in videoconferencing will achieve this – to avoid excessive verification costs, robust rules of thumb would have to be developed; and
- Credibility – many beneficiaries of both videoconferencing investment and use will be medium-large sized companies, which would represent a step change from previous offsetting schemes. Hence, any scheme would have to clearly demonstrate that it was they were not gaining additional resources for investments or sales they may be likely to make in many case – with one probably essential means of doing this being some form of royalty payment by suppliers benefitting from it.

However, if these problems can be overcome, a videoconferencing offset scheme (or schemes) would have one benefit not achieved by many others, which is fairly immediate minimisation of carbon emissions (see Table 4). This could make it of interest as a new approach, supplementing rather than replacing those already in existence.

In the short-term, the most viable route to establishing a scheme is likely to be through one or more voluntary schemes, managed by established offset companies, possibly in partnership with other key players such as NGOs or travel management providers. Appendix 1 provides one model as to how this might work.

[77] http://en.wikipedia.org/wiki/Offsetting#Controversies
[78] 'GTM: carbon offsetting for business flights', Travel Trade Gazette, July 16, 2007.

Table 4:
Comparison of a Conferencing-focused and Conventional Voluntary Offset Scheme

	Conventional Voluntary	Conferencing Voluntary
Time scale of impacts	Medium-long term	Short-medium term (with long-term legacy)
Credibility	Varies according to scheme, generally low-medium	Depends on scheme design, low if perceived to be raising revenues of multinationals, medium-high if seen to be assisting developing countries and supporting the kind of infrastructure needed for dramatic CO_2 reductions.
Areas of impact	Generally small scale schemes targeting poorer people, often in rural areas, in developing countries	Government and third sector bodies and SMEs in developing countries
Connection of offset payments with offset activities	Low	High – payments connected with travel flow directly into investments to reduce

8.2 A Branded International Videoconferencing Network

As noted above, the availability of videoconferencing is often geographically patchy, and it can be difficult for small organisations, or specialist ones such as event organisers, to create multiple connections with equivalent quality, technical back-up and reasonable cost. This is especially so when activities are 'mission critical', such as a paid for event. The result is a vicious circle, with potential users unwilling to take risks, and the market therefore failing to expand.

One opportunity is therefore to use the infrastructure being developed through an offset scheme as the basis of an international branded network which could offer a seamless, reliable, and guaranteed, multi-site service to smaller or specialist customers. This in turn would strengthen the financial sustainability of the sites being created under a scheme, by increasing revenue possibilities.

A viable network would probably include a mix of unit sizes, with dense coverage of smaller ones, and a few larger ones in strategic locations to be used, for example, for conference-type events. Such a network could be broader than sites financed by an offset scheme, as partnership agreements might also be feasible with existing managed service providers. The success of such a scheme would clearly be linked to its brand identity as a 'green service'. If this is successfully established, one medium-term opportunity would be for the network itself to issue audited carbon credits, based on estimates of travel distances avoided.

A scheme of this kind would not be completely original, as several videoconferencing providers have started to make environmental issues a key part of their offering, for example:

- Deutsche Telekom and its subsidiary T-Mobile have established, in partnership with suppliers Cisco, Polycom, Tandberg and Vidsoft, a 'Zero Emission Meeting' brand to market their Desktop Videoconferencing services;[79]
- InterCall has established a Green Conferencing as a brand[80]; and
- EyeNetwork are also using carbon and environmental issues as part of their marketing.[81]

Any new scheme would need to be clearly differentiated from, and perhaps involve partnership with, these providers.

8.3 Corporate Charter for Sustainable Meetings

To overcome the credibility issues described above, it is important that an offset scheme is operated independently of major vendors, and is supported by NGOs, the media and others. To achieve the latter, it would need to be clear that it was not enabling organisations to continue with 'business as usual', whilst making token offset payments. As noted in section 5.5, this would be a likely outcome for many organisations today, given the frequent disconnect between high level CSR commitments, and the realities of business travel. Whilst there can be considerable financial pressure on executives and others to minimise travel, there is often little other than mild exhortation to discourage it on sustainability grounds.

One reason is because companies appreciate that many employees do see business travel as a perk, and so – given that these are key individuals in achieving corporate success – do not wish to alienate them unnecessarily. Another reason is the feeling that personal contacts with customers and other external stakeholders are vital to business success, and so should be encouraged rather than discouraged. These views are understandable, but often sit badly with corporate CSR commitments and also do not take account of the new realities of videoconferencing.

[79] See www.zero-emission-meetings.com.
[80] See www.greenconferencing.com.
[81] See www.seegreennow.com and www.eyenetwork.com.

Hence, without some new source of external pressure – such as a public, and measurable, commitment to travel minimisation – it seems unlikely that much will change. Project Icarus, which is described above, illustrates one means of achieving this, which is a public charter that organisations sign up to. However, whilst imaginative and laudable, this particular scheme is UK-specific, currently has few organisations signed up, and is corporate-controlled. An international equivalent, with a higher public profile, and a greater degree of independent verification – but still, of course, with a role for progressive industry bodies such as the Project Icarus founders, the Institute of Travel Management – is probably necessary to stimulate significantly greater take-up of videoconferencing.

Appendix 1 discusses how a charter of this kind might interface with an offset scheme.

Another scheme, being launched by WWF-UK in early 2009, shows the potential for NGOs to encourage lower carbon business travel and virtual meetings. Called the "One in Five Challenge", this guided programme and award scheme helps private and public sector organisations to cut one in five business flights within five years. Details about the Challenge, initially taking place in the UK only but open to multinational companies with UK offices, are shown opposite.

WWF's One in Five Challenge

The purpose of the Challenge, starting in WWF-UK with support from the WWF offices in the Nordic countries, is to encourage more sustainable business travel by cutting back on unnecessary flying. Not only will this reduce aviation emissions, a fast growing and significant contributor to climate change, it will also help companies to reduce their carbon footprint , travel expenditure and time spent travelling.

Companies and government agencies who join the scheme will be challenged to reduce their business flying by 20% within five years. They will be supported by an audited process that will help them to quantify the commercial and environmental benefits of flying less.

Participating organisations receive:

- a specially designed WWF award badge with panda logo for award winners, which can be used for business travel and CSR communications
- a membership pack including supporting information and instructions for participation in the One in Five Challenge
- a toolkit, provided to help Participants to plan and implement a greener business travel policy
- an annual workshop to meet together as a One in Five Challenge community, to share best practice and encourage employee compliance in greener business travel policy and practice
- invitations to seminars, videoconferencing demonstrations and other events relevant to achieving the One in Five Challenge
- an awards event for those achieving the One in Five Challenge
- public recognition of all Participants and award winners on the WWF-UK website and other communications, and the opportunity to be included in a case study, to be prepared by WWF-UK.

The Challenge is initially being run in the UK only with plans to introduce it to other countries later. For more information, please see **www.org.uk/oneinfive**.

8.4 'Frequent Video Users' Incentive Scheme

A 'frequent videoconferencing user' scheme, with a range of comparable benefits to frequent flyer schemes (and provided by employers, or videoconferencing providers via slightly higher fees) may be an important aspect of changing the attitudes of many current travellers for business purposes. Whilst one of the main uses of frequent flyer miles – flights or upgrades – is obviously not appropriate, many of the other uses which miles are put to are relevant. These include free hotel nights and upgrades, and a range of other benefits.

8.5 New Business Models for Travel Management Companies

Travel management companies, and their professional bodies, are aware of the pressures on their clients, and themselves, to reduce travel-related carbon emissions. Hence, some are beginning to reconsider their business model. For example, Andrew Valler, UK executive vice-president of Carlson Wagonlit Travel, has observed that:

> "I don't think it will be long before we get paid for encouraging people not to travel. Our role as a TMC becomes one of behavioural change. We have got to change the mindset. We will have to adapt and change. It won't be simply putting people on planes and trains. It'll be about encouraging people not to travel and being paid for that."[82]

One aspect of this is the provision of greater information within the booking process. For example, GetThere, a provider of travel booking software, won an industry award in 2007 for its development of a carbon calculator to display information about the carbon impacts of travel choices at the point of booking.[83] The company has also enabled customers to designate "eco-friendly" air, hotel, and car suppliers onscreen, and created a dynamic messaging facility to educate travellers during the booking process.

The Institute of Travel Management has also outlined an information architecture that would enable a complete carbon footprinting of travel within a corporation, both to influence individual choices, and to enable reporting of overall impacts (see Figure 2).[84]

Although the move away from fare and ticket-related fees is creating more of a level playing field between videoconferencing and travel, it may be that new financial incentives need to be emerge to really create stronger positive incentives for travel management providers to 'push' videoconferencing. This will probably require 'shared savings' arrangements with clients which enable them to gain a small share of the avoided travel costs arising from its use.

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[82] 'Getting paid to say 'don't travel', Travel Trade Gazette, September 21, 2007.
[83] Martin Ferguson. 'ITM awards GetThere's green policies', Travel Trade Gazette, October 19, 2007.
[84] INSERT

9. Making it Happen

Air travel is growing inexorably, and business air travel is a key factor in this because of its disproportionate contribution to airline revenues (even of low cost carriers). Minimising this travel to a much greater degree than has been achieved to date can therefore constrain the unsustainable patterns of economic development which airport expansion can create. And, because the technology of virtual meetings – and especially of videoconferencing – can now provide an economically and socially beneficial alternative, this constraint can be achieved in less coercive and controversial ways than many other options.

The benefits of videoconferencing can be especially great in developing countries, where the patterns of business 'hypermobility' typical of Europe and North America are less developed. And again, it can be achieved without the actual or perceived negative effects on economic and social well-being which are associated with alternative methods of reducing carbon emissions.

However, for all the excitement surrounding new, high definition, videoconferencing technologies, it seems unlikely that market forces alone will reverse current trends in business air travel. This report therefore suggests several mechanisms by which greater take-up of videoconferencing could be achieved. At their heart is the notion of new carbon offset schemes to provide funding for additional investment to that which would take place anyway. Whilst doing this would be difficult, it could have the major advantages of:

- Offering robust offsets which produce immediate, and enduring, reductions in carbon emissions;
- Making a positive contribution to the economic development of developing countries; and
- Enabling multinationals to deal with an increasingly embarrassing failure of their CSR policies.

Appendix 1 outlines one way in which the different means of stimulating the growth of videoconferencing might be achieved, but, of course, others are possible. Whatever the precise form, they are likely to require new partnerships between corporates and their travel management providers, offset companies and videoconferencing equipment and service providers, and all of these and NGOs and other stakeholders.

Appendix 1 – A New Scheme to Increase Take-up

The previous discussions suggested that the credibility and effectiveness of a videoconferencing offset scheme could be enhanced by positioning it within a broader context of business travel reduction, so that the costs and difficulties of verification can to some extent be transferred to a higher level.

This could be achieved through the establishment of a targeted initiative focused on reduction of business travel amongst multinational companies, and perhaps other international organisations. The initiative could be based upon a new Charter of Ecologically Sustainable Business Meetings (EcoMeet). It would have an independent central, and very lean, administrative capability to market and administer the following components of the scheme:

- Travel targets - agreeing quantified business travel minimisation targets with Charter signatories. These would involve reducing air, and possibly car, based business travel by a percentage target, year on year. The target would take into account 'business as usual' impacts on travel for meetings so that it represented genuine additionality. Performance with regard to the targets would be certified by the company's auditors, based on information provided by the corporate travel department (or an external travel management company when this is the main provider).
- Offset payments – signatories would agree to pay a standard offset fee for each tonne of carbon generated by their business travel, and a higher fee for each tonne of shortfall in achieving their targets. These fees could either be paid to the Charter itself, or to existing offset companies working on its behalf.
- Videoconferencing support – the Charter organisation, or designated offset partners, would invest the revenues from offset payments and other income (see below) into measures to support videoconferencing. As well as direct support for equipment investment, this would include other measures such as providing guidance and training, improving standards and assisting the development of 'frequent videoconferencing user' schemes. As far as possible, the support would be targeted to recipients in developing and transitional economies, and to organisations other than medium-large corporates (e.g. public sector, higher education, small business). To avoid any danger of inappropriate investment, the Charter organisation and its partners would have the flexibility to invest any surplus funds in other offsetting projects if this proved necessary.
- Creating tradable carbon credits – wherever possible, videoconferencing investments would be certified for voluntary offsetting purposes and any credits sold to provide additional income. It may also be possible to sell any credits to travel-related companies at guaranteed and/or 'higher than market' prices.

A scheme of this kind could provide:

- Robust but also cost-effective verification mechanisms;
- A strong ‘not-for-profit’ component in the administration of, and benefits flow from, any scheme; and
- Considerable flexibility so that account can be taken both of new opportunities, and problems of implementation.

Appendix 2 – Carbon Offsetting Schemes and Videoconferencing

Carbon offsetting involves neutralising the carbon emissions created by an activity (such as a plane journey) by financing an equivalent reduction or avoidance of emissions through other activities. The main vehicle for achieving this is through purchase of "carbon credits" (typically in units of one tonne) that have been created by certified projects to reduce or avoid carbon emissions, for example, through tree planting or development renewable or energy efficiency projects. There are three main sources of such credits:

- The mechanisms created under the Kyoto Protocol of the United Nations Framework Convention on Climate Change (UN FCCC);
- The European Union Emission Trading Scheme (ETS); and
- Voluntary schemes.

Kyoto Protocol Mechanisms

The Kyoto Protocol sets national carbon emission allowances for signatory countries (which are industrialised and transitional economies). It created three instruments, collectively known as the 'flexibility mechanisms', to allow states to meet their target through actions in other countries. This can help to reduce the overall costs of compliance, because there is access to more cost-effective emissions opportunities, and provide additional resources for poorer and transitional economies. One of the mechanisms – trading of emission allowances between signatory governments – is at a macro level and therefore of no direct relevance to videoconferencing. However, two other mechanisms are of partial relevance:

- Joint Implementation (JI) of new carbon reduction projects between signatory countries, with the carbon credits which are created counting for the allowance of the financing country and being saleable into the market (thereby helping to finance investment); and
- The Clean Development Mechanism (CDM), which works in a similar way to Joint Implementation, but involves investment in developing countries.

There is no central record of JI projects (partly because emissions reductions from them don't count until 2008) but one 2006 study identified 101 projects with Letters of Approval: the majority of these in the Czech Republic, Bulgaria and Hungary.[85] The main projects are in biomass, hydro, landfill gas and wind energy, with a small number of others including afforestation, agriculture, coal bed/methane, and household energy efficiency.

Although there seem to have been no transport-related JI projects to date, there is at least one avenue for them. This is the 'other' sub-section (for projects not covered in other sub-sections, and that result in emission reductions of under 60 tonnes of carbon dioxide (CO_2)

[85] K. Karousakis, Joint Implementation: Current Issues and Emerging Challenges, OECD, IEA, 2006.

equivalent annually) of the Small Scale projects category. The official documentation explicitly states that this includes emissions reduction in the transport sector.

The CDM has a greater emphasis on transport, with initiatives aiming to create modal shift given prominence in the literature. However, in 2006 only one transport scheme - the Transmilenio bus rapid transit initiative in Bogota, Columbia – was approved, with a further 9 being under consideration.[86] It has been suggested that sectoral-based transport schemes might be better as they "allow the scaling up of activities to a level that affects long-term structural change. Permitting sectoral projects under the CDM may allow for the implementation of comprehensive measures such as transport master plans that can enable a variety of activities impacting transport trends significantly." [87] However, this would likely require new rules for the CDM.

While CDM projects are independently verified by third parties, a coalition of NGOs has developed a Gold Standard as an additional screen for CDM projects. The Gold Standard Foundation offers a quality label to CDM/JI and voluntary offset projects, fetching premium prices.[88] The method is built into the regular CDM and JI project cycle, and adds three special screens for quality control:

- Does the project use renewable energy or energy efficiency technologies?
- Does the project go above and beyond a "business as usual" scenario?
- Does the project promote sustainable development?

Potential problems with achieving videoconferencing eligibility for JI and/or CDM projects are:

- Gaining acceptance as transport projects – they would not be seen as such by many Government officials or transport experts, who may also raise difficulties about how any modal shifts arising would be validated;[89]
- Gaining acceptance as well bounded projects leading directly to carbon reductions – some may argue that videoconferencing does not meet the CDM terminology of emissions "under the control of the project participants that are significant and reasonably attributed to the CDM project activity" due to the diffuse links between individual transport decisions and final emissions from aircraft, cars etc.;
- Demonstrating additionality – any calculations of carbon reductions from videoconferencing projects would have to discount those arising from the 'natural' growth of take-up, which would require guesstimates of future trends in participating organisations that not everyone might find convincing; and

[86] http://cdm.unfccc.int/Projects/DB/DNV-CUK1159192623.07/view.html
[87] http://www.eceee.org/conference_proceedings/eceee/2007/Panel_8/8.147/
[88] See www.cdmgoldstandard.org.
[89] D Bongardt et al. Sustainable Transport and the Clean Development Mechnaism – can there be a juncture? Draft, unpublished.

- Demonstrating innovation – processes or technologies used in CDM projects are not expected to be used in similar projects in the normal course in the economy.

However, these difficulties can be easier to overcome for private sector projects, which are often less complex and more easily established than public sector ones.[90]

The European Emission Trading Scheme

Phase 1 of the EU Emissions Trading Scheme (EU-ETS) ran from 1 January 2005 until 31 December 2007 and Phase II will run from 2008-2012.[91] Currently the scheme covers only fossil-fuel intensive sites (power stations, industrial sites and sites with boiler and/or CHP plant with an aggregated thermal input capacity of 20MW (subject to a *de minimus* threshold). The scheme creates tradable allowances (one for each tonne of CO_2 emissions) known as EU Allowances (EUAs), which must be surrendered by each site annually equivalent to the CO_2 emissions of the previous year. If the allocated allowances are not sufficient for this, the organisation must either purchase them in the market, or pay a substantial fine related to the degree of under-performance. If there is a surplus of allowances, these can either be sold or 'banked' for subsequent years of the scheme. In Phase 1, the cost of carbon allowances has generally been low because of the very generous caps set by many national governments. However, the European Commission has been more stringent in approving the National Allocation Plans for Phase 2, with the aim of making allowances scarcer and therefore more expensive.

The scheme is now being expanded to include transport. In December 2006, the Commission adopted a proposal for legislation to include aviation in the EU-ETS in two stages.[92] From the start of 2011, emissions from all domestic and international flights between EU airports will be covered. One year later, at the start of 2012, the scope will be expanded to cover emissions from all international flights – from or to anywhere in the world – that arrive at or depart from an EU airport. The intention is for the EU ETS to serve as a model for other countries considering similar national or regional schemes, and to link these to the EU scheme over time.

The UK Government is also considering the scope of a surface transport ETS.[93] This will include consideration of the costs and benefits of trading at an EU level, and the desirability of introducing trading at a UK level. While it may be done as a separate UK scheme it makes more sense to include it as part of the EU ETS. It is generally acknowledged that including surface transport within an ETS will be difficult in practice.

[90] Op cit.
[91] http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_275/l_27520031025en00320046.pdf
[92] http://ec.europa.eu/environment/climat/aviation_en.htm.
[93] Defra, Climate Change: The UK Programme 2006, March 2006.

These developments would open possibilities for transport providers, particularly airlines, to promote videoconferencing as a cheaper means of reducing their own emissions than in-house actions. On the other hand, the entry of aviation into the EU-ETS could reduce the practice of airlines promoting voluntary carbon offsets to passengers.[94]

Voluntary Schemes

There are a growing number of companies offering independent carbon credits for purchase by organisations or people wishing to offset carbon generating activities. Some of these offer them in combination with the sale of carbon credits from ETS or Kyoto sources. For others it is their sole activity. Many of the schemes developed to date have been used to fund afforestation or clean energy projects in developing countries. However, some also fund schemes in developed countries.

There are a number of concerns about the quality of these voluntary schemes, and whether the schemes are providing real, quantified, additional and permanent reductions in GHG emissions. A recent report by the Swedish Energy Agency, for example, concluded that the voluntary offset market is not transparent and contains some dubious players.[95] To address concerns a number of quality assurance schemes have been, or are being developed:

- **Voluntary Carbon Standard**[96] (VCS) owned and managed by an independent non-profit organisation, provides a simple set of criteria to provide some quality assurance to the voluntary carbon market. The VCS will ensure that all project-based voluntary emission reductions that are independently verified to meet its criteria – defined as Voluntary Carbon Units (VCUs) – deliver contracted emissions reductions, ensures additionality compared to what might have happened if the project had not taken place, prevents double counting and prevents leakage effects. The VCS has created a registry managed by the Bank of New York which is used to register, transfer and retire VCU's from the market and therefore prevent double counting.

- **Gold Standard** (see earlier) launched a methodology for voluntary offset projects in May 2006.

- **UK voluntary Code of Best Practice for carbon offsetting** – Defra has proposed a voluntary code of best practice for carbon offsetting for UK consumers.[97] In the original consultation Defra proposed developing a quality mark which will be attached to products that have had credits certified under the Kyoto Protocol (i.e. CERs, EUAs and

[94] For example BA works with Climate Care to offer voluntary carbon offsets. See http://www.britishairways.com/travel/climateimpact/public/en_gb.
[95] Swedish Energy Agency, Make the right choice for carbon offsetting, November 2007, English summary of report in Swedish .
[96] http://www.v-c-s.org/
[97] http://www.defra.gov.uk/corporate/consult/carbonoffsetting-cop/index.htm

ERUs) because they are robust and verifiable. This mirrors Government's criteria for offsetting, and is designed to encourage others to move towards the use of standardised, verified and transparent carbon emissions reductions from the regulated market.[98] However, in the responses to the consultation many commentators were clear that, if the code was to deliver the key aims, it should encompass high quality VERs.[99] A number of ways of including VERs were suggested, including a robust accreditation scheme. The Government is currently considering whether VERs may be included and, if so, on what basis. Government is in the process of running a competitive tender to appoint an independent accreditation body to assist us in producing the Code and to accredit offset products. The successful bidder will develop the criteria to demonstrate compliance and produce the Code.

While there is a need for robust standards for voluntary offset schemes, it is argued that these have to be appropriate and many smaller projects cannot afford the registration and auditing costs required to gain approval under the above schemes.[100]

Incorporating videoconferencing projects into a voluntary offsetting scheme would be straightforward. However, most small scale voluntary projects provide a "human face" which tend to be more attractive to public and corporate customers. They often have social or other benefits such as landscape. Examples of typical projects include provision of efficient cooking stoves for villages in developing countries or regeneration of rainforest. The projects have to offer an element of economic and social sustainability. Corporate videoconferencing may not offer the same attractiveness to consumers wishing to voluntarily offset their emissions.

[98] The UK Government Carbon Offsetting Fund (GCOF) offsets carbon dioxide emissions from central Government official and Ministerial air travel from April 2006 – April 2009, using a portfolio of projects under CDM.
[99] http://www.defra.gov.uk/corporate/consult/carbonoffsetting-cop/analysis-consultation-responses.pdf.
[100] http://green.itweek.co.uk/2007/01/government_offs.html.

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TOGETHER WWF AND HP HAVE DESIGNED AND LAUNCHED AN INNOVATIVE PRIVATE SECTOR-NGO PARTNERSHIP

This paper is part of WWF's work with IT/ICT and is a collaboration with SustainIT that also delivers on a joint initiative with HP where the key objective is to identify the first billion tonnes of CO_2 reductions through the use of IT. The paper is also a contribution to the collaboration between WWF and the World Economic Forum. The text is written by Professor Peter James from SustainIT with support from Dennis Pamlin, Global Policy Advisor, WWF.

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