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British Airways – Iberia: Environmental Friendly Synergies

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The aim of this thesis is to identify and analyse those environmental actions carried out by British Airways and Iberia independently prior to their recent merger as well as its environmental implications in order to create a common ground of knowledge and a forum of ideas to improve the overall environmental friendly policies of the resulting company, IAG.

Although the time of a zero emission sector is not yet feasible, both companies have taken the right steps to reduce externalities coming from their activities and have firmly taken decisions to solve the root problem of aviation: fossil fuel consumption. This thesis focuses on the rest of activities performed by the companies beyond aircraft fuel consumption, taking into account ground activities and on board practices. The long experience and expertise coming from both companies in these issues can result of a very fruitful collaboration and very useful synergies.

Taking into account the current framework and after analysing the new needs and routes after the merger, some ideas for improvement are set. Based on those initiatives already working in each company, one of the objectives of the thesis is to identify the most innovative and successful measures from each company in order to be shared, complemented or driven, in a reciprocal basis. The positive effects of the merger are proven to be not only economic but environmental.

Keywords
Iberia, British Airways, aviation, IAG, merger, implications, sustainability, emissions

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1 Introduction

In 24th January 2011 after listing on the FTSE 100 of the London Stock Exchange and on the Spanish IBEX 35, IAG (International Airlines Group) the resulting company from the merger between the main Spanish airline Iberia and the giant British Airways became officially a reality. The new holding is one of the world's largest airline groups with 348 aircraft, flying to 200 destinations and carrying more than 50 million passengers per year. IAG has become the third largest holding airline in Europe and the sixth in the world in terms of revenue (IAG 2012.)

Although both companies will operate by using their separate brands, new common policies are and will be needed in order to get adapted to the new situation. The ultimate target pursued through this merger was the searching of economic synergies in new opportunities and new scenarios. As an example, the growing possibilities of Madrid Barajas hub and its geographical situation contrast with the saturation at London Heathrow, permitting a promising development and a mutual benefit. Apart from the economic connotations, this new situation alters the already established programmes and projects on environmental issues, urging to analyse, restructure and reconsider the current measures. As well as in economic areas, synergies on environmental aspects can be seen as a real opportunity to boost for improvement, learn from each other and as a forum to share expertise, promote new solutions and apply new technologies. (IAG 2012.)

1.1 Research problem, aim, delimitations and methodology

The research problem of this thesis is to analyse the already developed actions by each company on environmental issues prior to the merger, select the most innovative and successful ones and suggest common actions or improvements. In other words: What actions could be selected to create a common environmental policy? Those actions successfully implemented might be applicable from one company to another, improved or even created for the occasion for the whole group according to the current needs.

This new situation requires new needs and solutions. As the ultimate goal of a merger is the economic growth, emissions inevitably increase with this growth. The ultimate aim of this study is the identification and suggestion of actions that would permit the future implementation of plans to reduce the negative effects of this kind of merger on environment. The differences between two different perspectives of business and the particularities in cultures and environments may be seen as pitfalls but also as extraordinary opportunities.

Due to the size and complexity of the companies, the actions under research are limited to those most significant initiatives strictly focused on reducing direct and indirect CO_2 emissions.

The theoretical framework of this thesis was based on literature about aviation and its impacts on the environment, future scenarios of the sector and publications from British Airways and Iberia. The methodology used during this study was mainly qualitative.

1.2 Structure of the thesis

The second chapter of this thesis briefly explains the implications of mergers among airlines and the difficulties of implementing solutions when differences of size or procedures are real pitfalls. So far, these implications have always been treated from an economic point of view. In this case, the environmental implications present a novelty and a real challenge. The chapter also warns of the dangers of creating false synergies during the process.

Chapter 3 gives us an overview of the relationship between climate change and aviation and explains the large amount of terms on sustainable issues emerged in recent times. The importance of fuel as the root problem is then presented in chapter 4. This same chapter shows the demands coming from the EU limiting the use of fossil fuels and promoting the use of biofuels. As a consequence of this, the European Union Emission Trading Scheme was created following the steps of other already implemented schemes like the one carried out in Australia.

Iberia and British Airways are then presented as the model companies in chapters 6 and 7 and their current actions on environmental issues displayed as a base for comparison. The most innovative aspects covered in each company or those ones more developed are then identified in order to get to concrete conclusions on future measures and recommendations for a common improvement.

Suggestions for improvement are given in chapter 8 after analysing the most developed aspects in each company for a suggested future implementation, covering or complementing those aspects that have not been treated so far and creating new solutions in those aspects that could be improved. The difficulties during this process are then presented as well as solutions for implementation.

The thesis is concluded with a final chapter on future aviation which may serve as a reflection on evident weak signals and as a glimpse of hope on a future zero-emission sector. Although treated from an anecdotic point of view, the background idea gives the clues about the direction technologies are moving to and lets us dream of a hypothetical future and a new scenario where dependency on fossil fuels has been finally overcome.

2 Environmental implications in mergers and acquisitions

In a constantly changing environment traditional airlines are tending to use mergers as a formula for survival. There are numerous factors threatening the stability of already established companies and even many of them have disappeared in the last decades. As appears in Iberia´s annual report 2009 the air transport market currently faces the following challenges and serves as a trigger for the current mergers among airlines. These challenges are:

- The economic crisis was behind the widespread drop in traffic, especially among business passengers, denting airline profits.
- The expansion of low cost carriers and alternative means of transport, such as the high speed train, is causing a loss of market share on the domestic markets of traditional network carriers.
- In Europe, network carriers are tending to amalgamate.
- There have been sharp fluctuations in fuel prices in recent years, cutting into airline profit margins.
- The congestion of air traffic, especially in Europe, curbs growth of the business.
- The emerging markets of Asia – especially India and China – and the Middle East will make competition tougher on long haul routes.
  (Iberia 2009.)

So far, mergers and acquisitions have been addressed from an economic point of view; but it is somehow clear that the economic growth resulting from a merger has its impact on the environment. Furthermore, the process of a merger goes inevitably hand in hand with the process of implementation of sustainable policies. Often, companies do not consider what is technically, operationally, or financially feasible from a sustainability standpoint (Deloitte 2008a, 3). The increase in pollution has frequently an economic origin. Trade, growth, foreign direct investment, among other economic factors affects the environment (Swart & Van Marrewijk 2011, 4-5). From an environmental point of view, these same researchers (Swart & Marrewijk 2011, 6-8) discuss three different hy-

potheses regarding mergers and level of income and development of the involved countries:

Hypothesis 1. *Asymmetry*

Mergers and Acquisitions (M&As) from a high income country reduce CO_2 emissions. In the model case, British Airways represents a clear asymmetry in terms of size compared to Iberia. These asymmetries could perhaps be more clear when referred to an acquisition rather than in the case of mergers, but according to the given hypothesis and taking into account not only size but level of development of the country of origin, the influence of the "dominant" company serves as important influence in the overall result of the merged company.

From a general point of view and in terms of size of the participating companies, the positive effects of the merger between Iberia and British Airways are clearly positive as costs are reduced and efficiency is gained. These aspects have their positive influence also on emissions. As explained above, an increase of industrial activity inevitably leads to an increase in emissions; hence the direct link between economic growth and technical development in sustainable issues. These economic aspects of mergers ultimately affect the sustainability of the resulting company being improved as expertise on environmental issues is shared.

Hypothesis 2. Sector-specific Impact

This hypothesis states that M&As in non-polluting or low-polluting sectors do not affect or hardly affect CO_2 emissions (i.e. agriculture or construction).

At first glance it might seem that a merger within aviation is nothing but a total disaster in terms of CO_2 emissions. But this statement serves to explain the wide range of improvement within the sector. As explained in the next chapter, aviation is a major polluter. This aspect that can be seen as a threat turns to an important opportunity following this hypothesis. Synergies are more evident in sectors like aviation, where improvements coming from these operations give much more positive results, increase

production and sustainability. Encourage multilateral agreements is, according to the authors, the most effective way to persuade countries to decrease their emission level (Swart & Van Marrewijk 2011, 4-5). This gives rise to the final hypothesis:

Hypothesis 3. Multilateralism

It is a basic instrument to reduce CO_2 emissions, especially when referred to the relationships between the resulting company after the merger and its stakeholders. The more relationships and networks created, the more information will be transmitted. This aspect is vital when it comes to reducing emissions.

Recent deals in industries as disparate as energy and retailing have demonstrated that sustainability can affect both the viability and the ultimate value of deals. In today's environment, companies that have strong corporate responsibility and sustainability (CR&S) programs in place are likely to be rewarded for their efforts. It is clear that greater consideration of sustainability related issues when evaluating potential M&A transactions will help improve the likelihood of the success of the deal. (Deloitte 2008a, 1).

It is clearly undeniable that synergies produce well-known positive effects when talking about mitigation and adaptation. But while there is increasing emphasis on the integration of climate change mitigation and adaptation (Becken and Hay 2007, 286), there is also a risk of creating false improvements and wrong synergies. These negative effects of synergies might even slow down the activities of the stakeholders involved, resulting of very low, expensive and useless procedures. In this regard, Klein et al. (2005, 579-588) argue that as a result of inherent dissimilarities between mitigation and adaptation policies, a synergetic approach could result in greater institutional complexity. This might be because of the larger number of stakeholders involved at different levels, resulting in less successful implementation of such policies. Moreover, the net effect of investing in synergetic measures may be lower than investing smaller amounts in independent and more effective mitigation and adaptation projects. In a nutshell and as re-

cent deals demonstrate, protecting the environment and treasuring the earth's resources can benefit both the planet and the bottom line (Deloitte 2008a, 3).

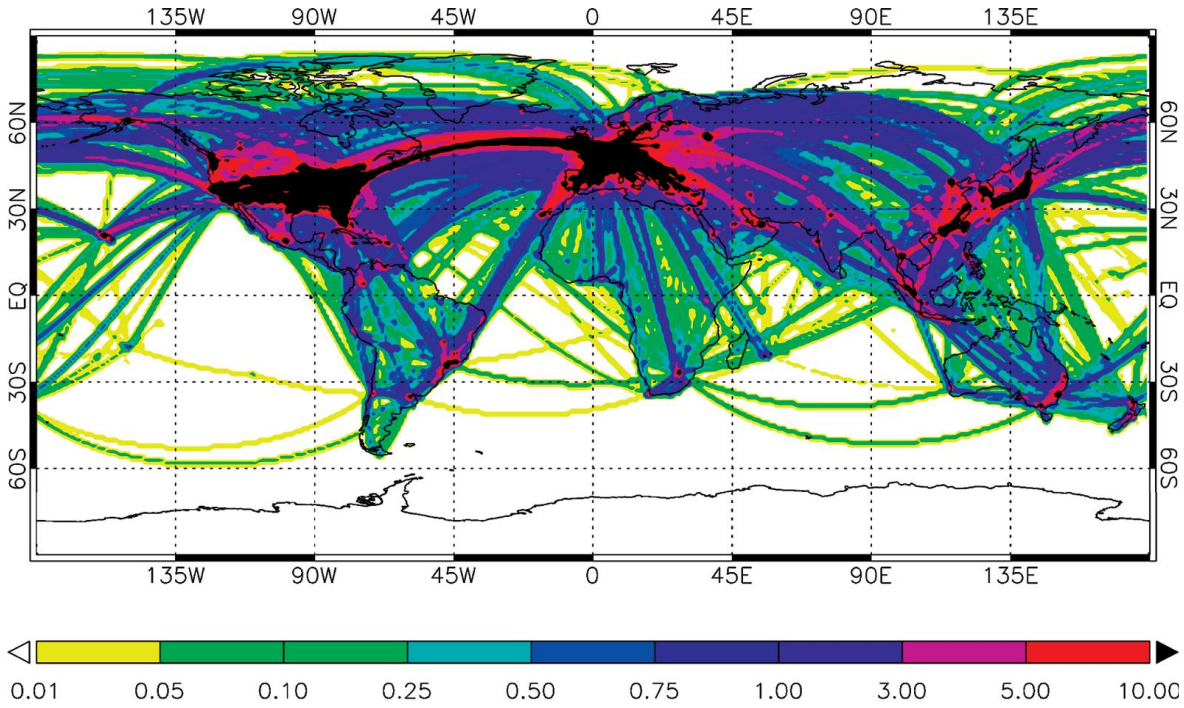
3 Aviation and sustainability

"Tourism's greatest 'Achilles heel' is aviation" (Becken and Hay 2007, 302-303).

Although aviation is not the most aggressive agent for environment compared to other industrial sectors, it represents some 2% of the total global CO_2 emissions, becoming tourism, as a sector, the 5% of this total (Davos Declaration 2007, 2). These figures may be obviously debated as other sources estimate them in different ways. As an example, aviation now accounts for 3.4-6.8% (Gössling & Peeters 2007, 223-248) of all emissions of GHG, according to this different estimation. Some analysts forecast that by 2050, these figures could quadruple (Deloitte 2008b, 3). Debates apart, it is totally demonstrated that air traffic and its emissions are increasing at a fast pace during the last decades. Someone flying from London to New York and back generates roughly the same level of emissions as the average person in the EU does by heating their home for a whole year (European Commission Climate Action, 2011). Although air transport accounts for only 20% of all tourism trips by EU citizens (domestic and international), it causes 75% of all GHG emissions of all EU tourism transport in 2000, Peeters et al. 2007). Within the transport sector, air travel is of major importance for several reasons. First, only a minor share (<2%) of the global population uses air travel for international transport (see WTO, 2005). Second, emissions from air travel are particularly harmful because they are released in the upper troposphere and lower stratosphere, where they have a larger impact on cloudiness and ozone generation (Sausen *et al.* 2005, 555-561), both important factors contributing to radiative forcing and thus global warming. Furthermore, there are aspects like air trails or contrails where research has not yet delved enough. These traces left by airplanes are nothing but emissions of water vapour when the exhaust emissions that are saturated with water vapour mix with low-temperature ambient air, especially when the latter is supersaturated with ice. Under these conditions contrails will form, and can spread as cirrus cloud (Becken & Hay 2007, 74).

As shown in picture 1, the level of emissions from aviation in the year 2000 only, presents a clear overall vision of reality within the sector. The hot spots of emissions clearly show the leading level of traffic in the bridge between Europe and America.

This fact is stressed in a higher level in the case of British Airways as a leading company connecting Europe with North-America. Moreover, the expected future expansion and increase in number of frequencies to South-America, where Iberia has a predominant position become IAG into a key actor within the sector in environmental issues. Both companies must take firm actions to become leaders in these aspects and become real pioneers in investigation, development and action executing of innovative solutions (Owen et al. 2010, 2258.)



Picture 1. CO_2 Emissions data from aviation. Year 2000. CO_2 [g/m2/year] (Owen et al. 2010, 2258.)

During the last decades and after the awakening of a corporate social responsible consciousness, loads of new terms have been appearing in publications, newspapers and media in general. Nowadays we are perhaps bombed with a large amount of services, products and even styles of living wrapped and merchandized as "sustainable", "green" or even "ecologic". But what is behind all these terms and why are they used so freely? Do these terms really mean what they intend to mean? Are they only marketing labels? The following paragraphs try to briefly describe the origin and real meaning of words

such as sustainability, corporate social responsibility or ecology. This might help to differentiate the real meaning of these words and to better understand the real context they are used in.

3.1 Sustainability

Sustainability may be described as "striving for social, environmental, economic and ethical behaviour" (Higham 2007, 220), although the most popular and extended definition of sustainability has its origins in the World Commission on Environment and Development WCED (Our Common Future, The Report of the Brundtland Commission) celebrated in 1987, where sustainable developments were defined as those that "meet present needs without compromising the ability of future generations to meet their needs" (WCED 1987, 42). This nowadays standardized definition opened a brand new perspective in terms of a wider and responsible activity of the human being in regard to the environment, giving a more holistic point of view of the relation between human action and impact beyond the traditional mentality of a one-way process of affecting our environment without giving a compensation, regeneration or feedback to the damage done. This idea was then complemented and extended by different authors as appears in this same Report of the Brundtland Commission: "sustainability means using methods, systems and materials that will not deplete resources or harm natural cycles" (Rosenbaum 1993, 34), "sustainability integrates natural systems with human patterns and celebrate continuity, uniqueness and placemaking" (Early 1993, 209; WCED 1987, 24) or "sustainability identifies a concept and attitude in development that looks at a site´s natural land, water, and energy resources as integral aspects of the development" (Vieria 1993, 1). All these definitions were founded by Bartuzska, Kazimee and Owen (Washington State University 1999.) in a single one:

Sustainable developments are those which fulfil present and future needs (WCED 1987, 42) while [only] using and not harming renewable resources and unique human-environmental systems of a site: [air], water, land, energy, and human ecology and/or those of other [off-site] sustainable systems (Rosenbaum 1993, 34 and Vieria 1993, 1).

Sustainable tourism should:

- Make optimal use of environmental resources that constitute a key element in tourism development, maintaining essential ecological processes and helping to keep natural heritage and biodiversity.
- Respect the social-cultural authenticity of host communities, conserve their built and living cultural heritage and traditional values, and contribute to inter-cultural understanding and tolerance.
- Ensure viable, long-term economic operations, providing socio-economic benefits to all stakeholders that are fairly distributed, including stable employment and income-earning opportunities and social services to host communities, and distributing to poverty alleviation.

(UNWTO 2012.)

3.2 Ecology

In recent times there has been a clear misuse of this term by media and the public opinion in general. Ecology is a science. In fact, it is a brand of biology that study interactions between organisms and their environments. The most standardized definition is that one created by biologist Professor Charles Krebs in 1972 and defined as: "the scientific study of the interactions that determine the distribution and abundance of organisms" (Charles Krebs 2008, 2). It also can be defined as: present and future environments, both living and non-living (Ecological Society of America, 2011.) Related to human development, the role of ecology and environment is important as it determines the needs of a community to improve and to prosper.

Nowadays is perhaps extended the idea of ecology and environment as the same thing, but in fact, both concepts are quite different from each other. As expressed above, ecology makes reference to biology as a part of a scientific study. This scientific branch studies the living organisms and its relationships with other living organisms. On the other hand, environment is the mean, the surroundings where these organisms interact. In short, ecology makes reference to the content while environment makes reference to the container. Both concepts, although different, are somehow related from an an-

thropological point of view. The actions carried out by humans, impact directly on the environment they are living in. And as a consequence the effects of alterations coming from the environment will have their effect over humans.

3.3 Environmental friendly

Term also referred as "eco-friendly" or simply "green". During the last years we have been bombed by a wide range of products and services surrounded by alleged "green" paraphernalia. The clue of a true eco-friendly product or service is to minimize depletion of the environment during production, transportation or performance. During these processes large amounts of resources are required. Eco-friendly companies and providers try to reduce their dependence on natural resources like water or energy and they actively work to recycle and re-use these resources. A key concept especially when referred to aviation is to reduce and to keep the use of fuel to a minimum (IATA 2009.) This aspect is somehow being carried out by airlines today from an economic point of view rather than from a sustainable way, mainly due to the increasing price of fuel in worldwide markets.

Eco-friendly products and services often make reference to companies where working conditions are humane and healthy, and their workers are paid a living wage. Known as fair trade, this affects humans and is one more component of what makes a product "green." (Hagen 2008.)

Not only the processes or the final products or services are taken into account when referring to the term "eco-friendly". The buildings where these activities are developed and the management of the spaces where the related activities are carried out are part of this same concept. The use of efficient buildings where sustainable energy is used or where a rational consumption is applied in terms of means, energy or water often reduce the environmental impact of the buildings in which these activities are housed. In this regard the treatment of sewage, the use of solar or wind energy or the recycling or re-using processes products also contribute to this same goal. (Hagen 2008.)

3.4 Corporate Social Responsibility (CSR)

> "The CSR firm should strive to *make a profit, obey the law, be ethical, and be a good corporate citizen*" (Carrol 1992, 43).

The concept of modern corporate social responsibility has its origins in the 50's, although some references appeared even earlier during the 30's and 40's. The idea has been developed through decades and even today keeps on evolving. As a stage in this evolution and as a way to find the right balance between human beings' activities and environment, nowadays consumers and stakeholders are taking an increasing interest in the activity of companies and organizations. The idea is to compensate or pay back the negative effects of economic or social activities created by human beings. What they do or have done, how it is done or has been done and how they affect the elements that surround them.

After revisiting his own four-part CSR definition, Carroll (1991, 289) stated that for CSR to be accepted by the conscientious business person, it should be framed in such a way that the entire range of business responsibilities is embraced. It is suggested here that four kinds of social responsibilities constitute total CSR: economic, legal, ethical and philanthropic. In CSR performance expectations, organizations commit to meeting stakeholder expectations on economic, environmental and social performance, as well as ethical and transparent governance policies and procedures (Higham 2007, 220; Five Winds 2006.)

As we can see, most definitions of CSR nowadays include four components (Higham 2007, 221):

- Commitment of business. ECONOMIC. Operating to add values to society
- Benefits to society/stakeholders. SOCIAL. Communities, employees and all stakeholders involved
- Environmental performance. ENVIRONMENTAL. Management and performance

- Ethical behaviour. ETHICAL RESPONSIBILITY. Including society's expectations of acceptable business practice.

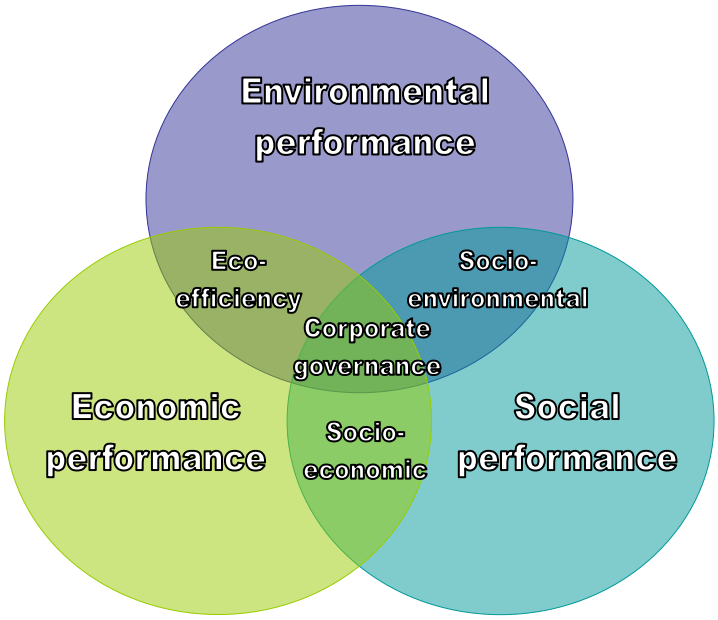


Figure 2. CSR in a sustainable enterprise (Higham 2007, 221; Five Winds, 2006; Ranganathan 1998)

Fiksel (2003, 1351) indicates that 75% of US companies claim to have adopted sustainable business practices-mainly for enhanced reputation, competitive advantage and cost savings. Airline companies are well aware of the negative environmental aspects of their day-to-day operations. With the knowledge of never, or at least so far, being able to operate in an eco-friendly way, some attempt to support environmental projects or organisations. Weaver (2002, 251-264.)

It is somehow clear that the range of action of airlines in order to diminish their foot print is at some point limited. This aspect is especially present in respect to the environmental performance of aviation. This sector depends in large amounts on the development of new technologies coming from aircraft manufacturers and new types of fuels or sources of energy. The next steps for the future to diminish the footprint com-

ing from airlines start from an overall cooperation among all the agents involved in the activity. So far it is seemed that little or no collaboration has been produced in this regard. Traditionally in aviation, each participant in the productive process has traditionally acted independently achieving limited improvements in each field. This has produced a complete stagnation within the sector and a total dependency on fuel. The current increase of fuel prices and the global crisis have served as a real boost for companies to accelerate their plans to save costs in order to survive (IAG 2012.)

The future era of an aviation sector as totally independent from fossil fuels seems still far away and sometimes even as science fiction. Only a few companies dare to research and invest on different technologies, but they definitely exist. As a kind of weak signal, companies such as the Swiss Solar Impulse are today's new pioneers in going beyond and pursuing the goal of developing new technological to change our reality. This project based in Lausanne, Switzerland, has already beaten some records flying an experimental airplane powered by solar energy. The relative success of the endeavour is such that in 2010 the company completed a whole night flight with no fossil fuels. Although still in a very early stage, the experience is undoubtedly the first step into a long-term reality where means of transport depend on cleaner and more sustainable sources of energy (Solar Impulse 2012.) Further information on this project can be found in the closing chapter of this thesis.

In a general overview we realise that fuel prices put pressure on airlines, airlines put pressure on aircraft manufacturers and the whole market put extra pressure demanding low prices from airlines all surrounded by a worldwide economic depressed environment. Hence, the urgency for companies within the sector to deal with environmental externalities not only from a strictly environmental friendly point of view but from a economic and cost saving point of view especially.

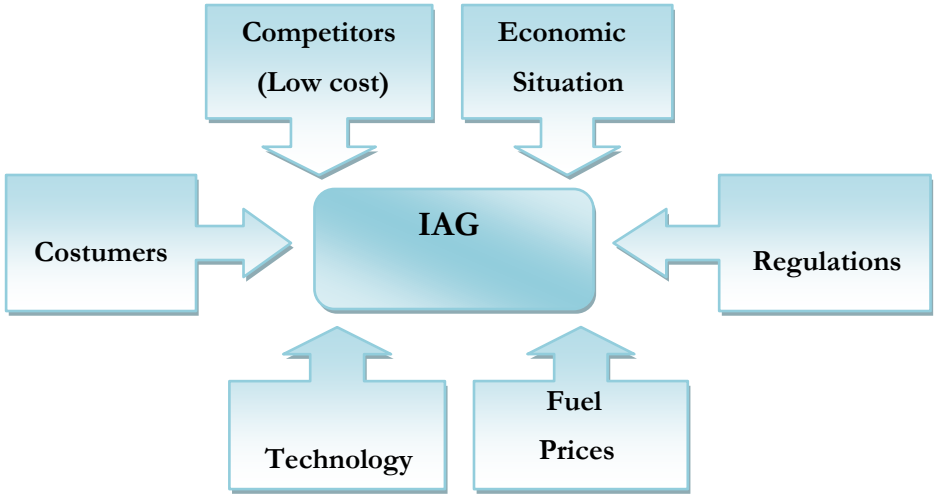


Figure 3. Forces of Changes (Lehtinen-Toivola 2011).

When attention is focused on climate's influence on tourism, adaptation is viewed as the appropriate response. When tourism's influence on climate is the primary concern, discussions centre on mitigation. An errant conclusion is that since mitigation success requires cooperation with other actors, the most risk averse solution appears to be to accept climate change and invest solely in adaptation (Patterson et al. 2006, 342.) Global climate change arguably presents the single most problematic environmental issue of our era (Sudgen et al. 2003, 1906) and for this reason, companies should take responsibility in this regard far beyond political decisions.

4 Fuel as a key factor

"Unless a technological alternative to kerosene is found for aircraft, air travel will continue to contribute to global climate change" (Becken & Hay 2007, 129).

Fuel is a key factor, if not the main one, in reducing greenhouse gas emissions from transport. "EU legislation requires a reduction of the greenhouse gas intensity of the fuels we use in our vehicles by up to 10% by 2020 – a Low Carbon Fuel Standard and this reduction can be give an idea of the overall reduction within the European Space in terms of aviation and ancillary fleet vehicles" (European Commission Climate Action 2011).

The process initiated by this legislation has required previous drastic reductions in the sulphur content of fuels and other polluting substances as a previous stage for future vehicles to perform more sustainable technologies to reduce greenhouse gas and air pollutant emissions having repercussion on health and environment (European Commission Climate Action 2011).

Some key elements of the adopted European legislation as published by the European Commission Climate Action (2011) states that:

- The legislation applies to all petrol and diesel used in road transport and gasoil used in non-road-mobile machinery. Suppliers can choose to group together to meet these targets jointly.
- A 10% reduction target is made up of: a 6% reduction in the greenhouse gas intensity of fuels by 2020, with intermediate indicative targets of 2% by 2014 and 4% by 2017;
- an additional 2% reduction subject to developments in new technologies such as carbon capture and storage (CCS)
- a further 2% reduction to come from the purchase of Clean Development Mechanism (CDM) credits.

(European Commission Climate Action 2011.)

The negative effects of greenhouse gasses coming from fossil fuels start already during the processes of extraction, processing and distribution of fuels; hence the real impacts of these fuels must be calculated on a life-cycle basis. For biofuels to count against the greenhouse gas emission reduction targets, biofuels should have a set of requirements to be considered so. They must meet certain sustainability criteria to minimise the undesired impacts right coming from their very production. Life-cycle greenhouse gas emission reductions will be calculated from a year 2010 baseline. These include that:

- The greenhouse gas emissions must be at least 35% lower than the fossil fuel comparator.
- From 2017 this increases to 50% and from 2018 the saving must be at least 60%.
- Raw materials for biofuels can not be sourced from land with high biodiversity or high carbon stock.

(European Commission Climate Action 2011.)

From an economic point of view, the cost of fuel is once more threatening the economics of air transport. During 2010, it was increasing demand for oil that "pushed jet kerosene prices up to $20 a barrel, from $88 at the start of the year to $107 a barrel by year-end. On average, jet kerosene prices in 2010 were just over $91 a barrel, an increase of almost 30% over the 2009 average" (IATA 2011, 13.)

4.1 Aviation and biofuels

In November 30th 2010 appeared a surprising article in the Finnish newspaper Helsingin Sanomat written by Juhana Rossi explaining the tests carried out by Lufthansa in order to use biodiesel for aviation purposes in a more extensive way. It was the first test ever to be done focused on commercial flights. The Finnish oil refining and marketing company Neste Oil produces this new fuel known as NExBTL word that stands for Next Generation Biomass to Liquid. Although it is not the definitive solution to green house emissions, it can be seen as an intermediate stage in the proc-

ess of finding alternative and more sustainable types of fuels (Rossi 2011, A17). The comparison of NExBTL with conventional diesel fuel shows an advantage for NExBTL in terms of energy consumption and greenhouse gas emissions for the options and scenarios considered (Gärtner et al. 2006, 19). The investigated options on the study: "An Assessment of Energy and Greenhouse Gases of NExBTL. Final Report 2006" ordered by the Neste Oil Corporation suggests that this new type of fuel has superior properties over current diesel products or alternative renewable fuels. The resultant NExBTL product can either be used as a pure diesel fuel or mixed with diesel to be used as a fuel component. The Finnish company has created a blend of animal fats and plant oils mainly coming from rapeseed and palm oils. According to this study and comparing the new NExBTL to traditional fuels taking into account a possible scenario for the site of Porvoo, Finland and another scenario for a typical European site, the study suggests the following conclusions:

- The results show a clear, but quantitatively different advantage in the energy and greenhouse gas balance if NExBTL substitutes conventional dieselfuel. This means that its use permits a higher level of primary energy saving and greenhouse gasses emissions in a long-life cycle basis compared to traditional fuels.
- The process of production of this innovative type of fuel has a lower influence on the overall result than the provision of plant oils. In this regard, this impact will be different if the raw material used has its origin in rapeseed oils or plant oils.
- The study shows that the industrial processes do not seem to defer in large amounts from its scenario in Porvoo, Finland to any other in a European level. The main problem arises when referring to the way and the impacts of the plantations when growing this kind of feedstock, e.g. as when tropical rain forest needs to be cut during the process.

(Reinhardt et al. 2007, 5.)

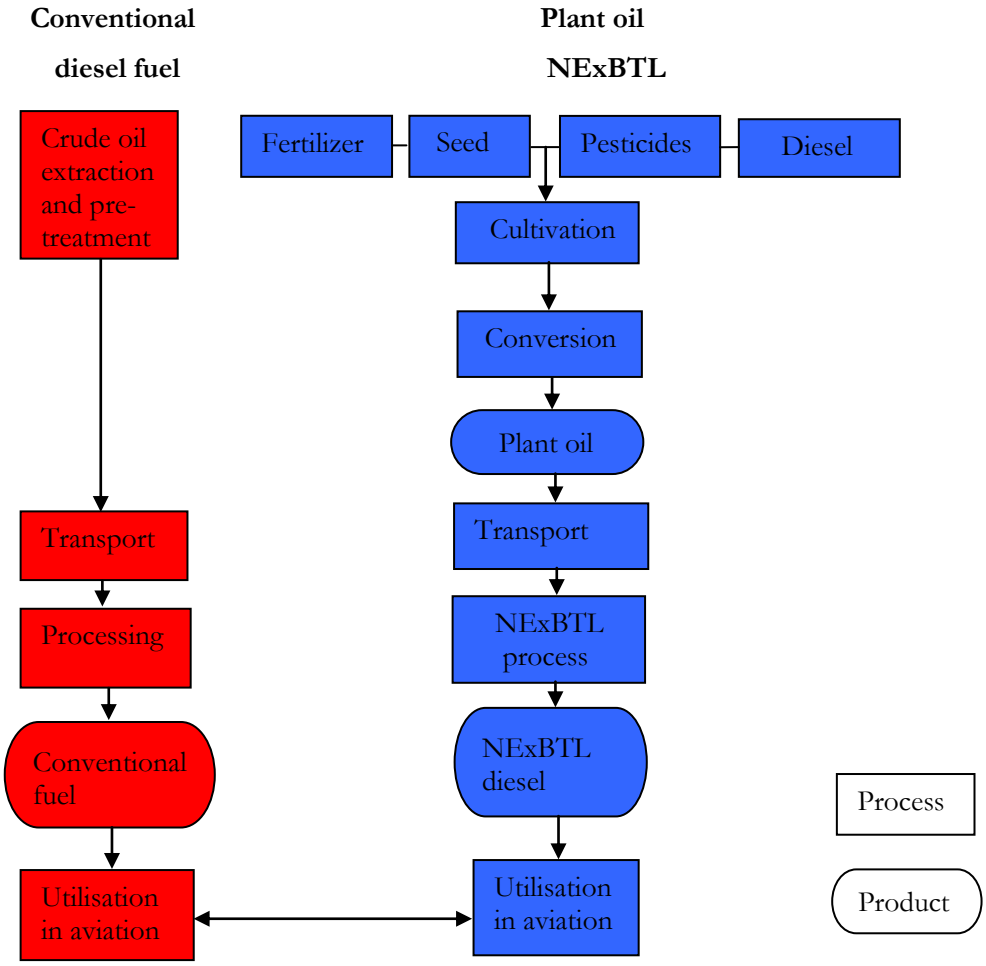


Figure 4. Traditional fuels vs NExBTL (Gärtner et al. 2006, 3)

Emissions from directly converting land to agricultural use for producing biofuels (direct land use change) can contribute significantly to the greenhouse gas emissions from biofuel production. However, increased demand for agricultural products for use in biofuel production may lead to more land being converted for agriculture elsewhere. This indirect land use change leads to increased emissions. It is important that the emissions from both direct and indirect land use change are included when comparing the greenhouse gas impacts of biofuels to the fossil fuels being replaced (European Commission Climate Action 2011).

Although this innovative type of fuel seems to be the next natural steps towards more sustainable processes and although the comparative with traditional processes seems to provide a positive advantage to NExBTL, we cannot help to think that there is a long

way ahead and these are only the first steps to get to a future zero emission sector and its expansion to other industrial sectors. Of course it is a very positive initiative and must be seen as a real revolution, especially after we realise that the whole sector has been basically still in terms of sustainability from its origins. As seen in the previous figure we cannot help to doubt if the processes used during the production of new fuels are really worth it in terms of impacts compared to the established methods for traditional fossil fuels. The net result seems to be beneficial at a first glance, but the whole process keeps doubts from a holistic point of view. In this regard we identify two well-defined streams of opinion. Mr. Michael Wang from the Centre for Transportation Research Argonne National Laboratory in his study: Key differences between Pimentel/Patzek Study and Other Studies (2005) and based on the study written by these two authors, proposes some discrepancies with the results. In fact, Pimentel and Patzek (2005, 66) stated that:

1. Corn ethanol requires 29% more fossil energy than ethanol contains
2. Herbaceous cellulosic ethanol requires 50% more fossil energy
3. Woody cellulosic ethanol requires 57% more fossil energy
4. Soybean-based biodiesel requires 27% more fossil energy than biodiesel contains
5. and sunflower-based biodiesel requires 118% more fossil energy

Wang (2005, 1) and many other studies criticize these results assuming that the figures presented in this study are overrated and based on pessimistic assumptions. In fact, his critics lead to the following conclusions:

1. Corn ethanol requires 26% less fossil energy
2. Cellulosic ethanol requires 90% less fossil energy

Although this and other studies seem to be well-grounded, we must take into account that biodiesel production is not properly assessed in Wang's study. In fact, he bases his comments on biodiesel using references coming from American sources as the DOE (Department of Energy) and the USDA (United States Department of Agriculture) in studies coming from 1998 evaluate soybean-based biodiesel and conclude that bio-

diesel consumes 69% less fossil energy during its production. Although nowadays these types of fuel are not definitive zero-emissions alternatives, we can consider them a huge leap towards this final goal. We can not evade the fact that the production of these new raw materials involve externalities and that the fact of creating a eco-friendly product does not mean using eco-friendly means or even that the whole process is advantageous compared to the final resulting product. Even this same institute, IFEU from Heidelberg in Germany, which wrote these positive conclusions for Neste Oil and through two of the same authors, published a second paper stressing the negative side effects of these fuels. Focusing on palm oil-based biofuels, Reinhart et al. (2007, 6) affirm that the energy and greenhouse gas balances for palm oil-based biofuels are disadvantageous:

- If specific already existing rubber plantations are converted to oil palm plantations.
- If tropical natural forests are cleared and the following oil palm plantation is only used for a short period of time (e.g. for only one or two plantation cycles, 25 or 50 years, respectively).
- If tropical natural forests on peat soils are cleared for the establishment of oil palm plantation.
- If the utilisation of palm oil originating from already existing, established plantation leads to the establishment of oil palm plantations under the conditions described in the first three scenarios above through so-called displacement of leakage effects (indirect land use changes). In these cases, an increased demand for palm oil by a stronger utilisation for bioenergy may lead to the establishment of new plantations on natural forest sites.

This new types of fuels are the evolution towards a definitive sustainable source of energy while new technologies are investigated. Electric sources through sustainable means are of course, the ultimate goal; but different sectors such as aviation are still quite far from benefit from this, hence the importance of these intermediate stages to provide the large amount of energy consumed to maintain these activities. Biofuels play then an important role in this process.

As we have seen, there are two well-defined positions nowadays in this regard. On the one hand, that one which defends these fuels as sustainable and are seen as a natural product, as they are obtained from biomass or its metabolic by-products. They have been considered attractive by governments as they reduce their dependence on fossil fuels, thus reduce pollution and offer sustainable programs and opportunities for rural areas. Biofuels can partially replace fossil fuels. Compared to other alternative energies, such as hydrogen, replacing fossil fuels with biofuels in road transport can be done at lower costs because they require no major changes in current technology or distribution systems. The use of another type of energy, as obtained from hydrogen which is based on a completely different technology, would require major changes in the stock of capital. Although hydrogen must not be ruled out as an alternative fuel, biofuels are to have the most growth in the short term.

On the other hand we can find the opposite position to these new methods. The increase in biofuel production generates high demands on the natural resource base, with possible negative consequences, both environmental and social (FAO 2007, 2-10). Since biofuels are produced from food or compete for land that can be used for food production, impacts on food markets are direct. Increased demand for biofuels can produce an increase in the price of energy crops and other crops and competing products. Production of biofuels can demand large amounts of water in some cases, which may decrease the availability of water for domestic use, threatening health and food security of people (FAO 2007, 13).

5 Emission Trading Schemes (ETS)

> *"As air travel becomes cheaper, EU emissions from aviation are increasing fast. Someone flying from London to New York and back generates roughly the same level of emissions as the average person in the EU does by heating their home for a whole year"* (European Commission 2012.)

In recent years, the creation of an ETS has been the subject of much public and government attention. Australia was the home to one of the world's first ETS when the New South Wales Government introduced the Greenhouse Gas Reduction Scheme (GGAS) in 2003. Australians have observed the first phase of the European Union's ETS in 2005-07, its early design problems, and the recent proposals for post-2012 arrangements that incorporate lessons of experience.

5.1 The European Union Emission Trading System (EU ETS)

As a main issue on reducing industrial greenhouse gas emissions in order to avoid the effects of climate change, the European Union has created the first and most complete plan about trading of greenhouse gas emissions allowances. This will affect all of the 27 EU members and 3 European Free Trade Association (EFTA) countries (Norway, Lichtenstein and Iceland) plus Croatia which will be included by 1 January 2014 due to the country's planned accession to the EU on 1 July 2013. From the start of 2012, emissions from all domestic and international flights that arrive at or depart from an EU airport will be covered by this Emissions Trading System (European Commission 2012.)

This project was created in 2005 and it is based on the "cap and trade" principle as explained by the European Commission on Climate Action. This means that there is a certain share or quota on the total of greenhouse emissions produced by factories, power plants and other installations. This will affect commercial aviation after a more than controversial decision, as this sector is agreed to produce only the 2% of global CO_2 emissions (Davos Declaration 2007, 2) and as commented in chapter 3 of this

thesis. The delicate economic situation of the airlines from September 11, 2001 until today has increased the difficulties of the companies to cope with these requirements in the future. According to these same requirements, at the end of each year each company must surrender enough allowances to cover all its emissions, otherwise heavy fines are imposed. If a company reduces its emissions, it can keep the spare allowances to cover its future needs or else sell them to another company that is short of allowances. The flexibility that trading brings ensures that emissions are cut where it costs least to do so (European Commission 2010.)

It is expected that after using this system, the emissions will be 21% lower in 2020 and will be implemented for airlines at the beginning of 2012 (Ibid.2010.) Although surrounded by controversy and doubts, this initiative has motivated other countries and regions worldwide to start systems based on the same concept. It is a wish coming from the European Union to create a future net of interaction and cooperation on this same goal of reducing green house gases around the world.

According to the European Commission, this method will have more environmental benefits compared to its economic impact on airlines and consumers than the other options contemplated, as fuel taxes.

5.2 Trading with allowances in aviation

The system will enable companies to manage their surplus allowances on the market to those companies with a deficit of them. To meet their requirements, airlines will be able to merchandise with their credits, invest on cleaner technologies or participate on clean energy projects developed in third countries under the Kyoto Protocol.

As commented above, this procedure will become operational at January 2012 and emissions from all domestic and international flights that arrive at or depart from an EU airport will be covered by the EU Emissions Trading System. In addition to the 27 EU Member States, the EU ETS for aviation covers three EEA-EFTA States (Iceland, Liechtenstein and Norway) and will extend to Croatia by 1 January 2014 due to the

country's planned accession to the EU on 1 July 2013. It will thus soon cover 31 countries (European Commission 2010).

These new changes will put pressure on airlines to renew their fleet and develop new technologies in order to reduce their footprint and therefore improve their allowances. Although it is a necessary step, the economic implications are also taken into account and these new investments will probably have indirectly impacts on fares. These negative aspects are probably amplified due to the current global economic situation, especially in the European area.

6 Research methods

This chapter presents a brief exposition of the method used for the thesis. This includes a brief presentation of the case, the method used, a short description of the documents used during the investigation and some comments on the objectivity of the study as well as the difficulties found throughout the research. Here can be found the processes during the first part of this paper and describes and gives information about the way the second part was undertook.

6.1 Presentation of the approach

The starting point which served as a trigger for this research was the recent merger between British Airways and Iberia. Mergers have always been viewed and treated from an economic perspective but not from an environmental standpoint. More than answering questions like: What is the level of cooperation in environmental issues between the model companies? This thesis goes straight to the root of the problem in a more practical way with the question: What actions are suitable to develop a right common environmental programme?

Hirsjärvi et al (2008, 157) argues that qualitative research aims to find facts more than to prove existing theories. Therefore the ultimate aim of this paper is not to demonstrate results after an investigation but to make suggestions on a new scenario in environmental issues. The circumstances that surrounded the investigation led to these conclusions. Increasingly authors and researchers who work in organizations and with managers argue that one should attempt to mix methods to some extent, because it provides more perspectives on the phenomena being studied (Easterby-Smith et al. 1991, 31).

The long and confirmed experience of British Airways and Iberia provides the background of a firm knowledge and know-how in environmental issues. The comparison between these two companies and their policies gives then a wide range of ideas for investigation.

6.2 Case study and method used

The research method used for this thesis is mainly qualitative through specialized literature, academic research, personal observation and other studies. The researcher´s experience as an employee in Iberia Airlines, as one of the model companies, served as a clear influence on the choice of the research topic and as a guidance when selecting the right information. This fact served as an extra aid when providing specialized knowledge to the final result and explains the ease of access to firsthand information.

Due to the secrecy shown by both companies when referring to environmental issues after the new situation, the complete access to information was somehow limited during the research process. In fact, after several requests, access to interviews on these issues was denied by both companies. In return, wide access to both physical and virtual data base was obtained. These changes during the investigation led to a complete different conclusion, resulting of a lack of formal empirical answer but counteracting with a wide range of suggestions. Case-study research is not always recognised as a proper scientific method mainly due to the fact that it provides little basis for scientific generalization (Yin, 1994).

6.3 Document analysis

The information presented in the first part of this thesis provided a description of the current framework in which airlines currently operate and affect the environment with their externalities. Due to the lack of data about mergers treated from an environmental point of view, publication and audits were taken from sources unrelated to aviation. The existing information about climate change provides extensive literature in this regard. This is mainly based on books about the relationship of tourism and environment or companies and environment. Interviews within the company would have served as interesting tools in this research. Unfortunately, and as explained above, this aspect was finally not contemplated due to lack of cooperation.

The second part of the study collects the current actions developed by each company and that was obtained mainly from internal documents, annual reports and publications on Corporate Social Responsibility published by the same companies. The re-

searcher's experience, as employee since 200 within the company, also played an important role in the investigation.

6.4 Critical evaluation of the objectivity

The doubt about objectivity arises when referring to publications coming from the same model companies. There are several papers such as annual reports, Corporate Social Responsibility reports or general information from the official websites of the companies which could seemingly serve as a perfect marketing tool. In fact, these reports are basically written in the name of the company with no author in particular. Although there appears to be some bias towards self marketing, the pressure put on airlines by upper institutions such as the European Commission, national governments or even consumers, makes airlines take these issues very seriously. This is why the credibility of this sector could be considered higher compared to any other. During the research process a certain degree of influence is always somehow unavoidable, understandable and justifiable. To qualify each result, or group of results, with comments and comparisons gives the strong impression that you are trying to influence the objective judgment of the reader (Lindsay, 1995, p. 17)

The conclusions of the study are based on literature collected at the target companies and through external sources. This phase of "material procurement" was about gathering as much useful material as possible to provide a right framework. This aspect was complicated by the lack of feedback coming from the companies to facilitate an interview. The novelty of the situation could have worked as an obstacle for the companies and as a possible justification to completely open up due to the high level of confidentiality. Nevertheless, the actions presented in the second part of the thesis yield a group of proposals that might be useful in the implementation of actions to improve sustainability within the company. These proposals could easily be developed or improved in futures studies.

7 Iberia

Founded in 1927 it was the first Spanish airline and also the first company to fly between Europe and South America. It is been the first airline to establish the concept of a walk-on shuttle service between two cities (Madrid and Barcelona) which keeps on being the most transited aerial route in the world (De la Fuente 2009, 1). Due to its strategic geographical position, both Spain and its main airline are in a very advantageous position to serve as a hub for transatlantic routes. The historical roots with Latin America are seen as an important strength for the company in these markets. In fact, Iberia is the leading airline in on routes between Europe and Latin America. Moreover, in recent years the connections between Madrid and Africa have experienced a noticeable increase due to these same geographical strategic factors and are identified as an attractive niche of business for the future.

7.1 Facts, figures and impacts

In order to identify the possible threats, impacts and challenges that the merger faces, this is a general outlook of Iberia:

Fleet *	160 aircraft
Destinations *	116 in 45 countries
Number of passengers *	24,300,000

*****_Figures include Iberia's franchise company Iberia Regional/Air Nostrum in 2010_
Source: Iberia Airlines 2011

The main impacts generated by the company are concentrated in its core activity. In fact, the company offers the largest number of flights and destinations from Spain to Europe and from Europe to Latin America. Its shuttle service connecting the cities of Madrid and Barcelona on a walk-on basis is the busiest aerial route in the world. But apart from these activities, Iberia is the world's largest aircraft maintenance and engineering company maintaining its own fleet and another 100 carriers around the world. Another area of action compounds handling activities. In 2008 attended 228 airlines, 74 millions of passengers and about 380,000 aircraft. For this duty, the

company owns a total fleet of 8,363 ground vehicles (Iberia 2009, 382.) The total amount of impacts can be extended by adding the activity of other elements such as Auxiliary Power Units (APU) and the total consumption of energy, goods and water coming not only from its core activitiy but from its administrative buildings and units. Another extension of the activity of the company, at least indirectly, comprises the movements of workers from their homes to their final jobs or the waste management at all levels of the activity.

7.2 Actions

Iberia applies its policies following the goals set by IATA's "Zero Growth in Emissions by 2020" project. This strategy tries to reduce carbon emissions without compromising the growth within the sector. This means that although the sector will continue its growth, emissions will stay at current levels. This major goal will be pursued by improving fuel efficiency and by a 50% reduction of total emissions by the sector by 2050 compared to 2005 (IATA 2009, 2.)

Below are listed the most significant and innovative initiatives carried out by Iberia in terms of CO_2 reduction in recent times. These actions might serve as models for future implementations in IAG as the resulting holding of the merger between the two airlines and as a way to share ideas, improve the current actions and create new ones. The selected ideas are: a) First Experimental Flight with Biofuels, b) The IAGOS Project, c) Biofuel from Seaweed, d) Fleet Renewal, e) Weight Reassignment, Rerouting and Progressive Approaches, f) CO_2 Calculator, g) CO_2 Sequestration, h) Electrical Projects and i) Recycling. These ideas are developed in the following paragraphs:

a) <u>First Experimental Flight with Biofuels. October 2011</u>

As member of IATA, Iberia plays an active actor to achieve the target for a carbon-neutral growth by 2020. For this reason, in October 3rd took place the first flight of the company propelled by biofuels. Following the pioneer flight by Lufthansa about a year ago, the company experimented with one of its Airbus A320 with a blend of biofuels based on Synthetic Paraffinic Kerosene (SPK) produced by Honeywell-UOP in col-

laboration with Repsol IPF and was the result of the project Vuelo Verde (Green Flight) developed by the airline. The flight covered the route between Madrid and Barcelona. This flight reduced its CO_2 emissions by nearly 1.500 kg on this route (Ronda Iberia 2011, 126-127.)

In the efforts of the EU to reduce emissions and following its White Paper on transport 2011, by 2050 the key goals include:

- No more conventionally-fuelled cars in cities.
- 40% use of sustainable low carbon fuels in aviation; at least 40% cut in shipping emissions.
- A 50% shift of medium distance intercity passenger and freight journeys from road to rail and waterborne transport.
- All of which will contribute to a 60% cut in transport emissions by the middle of the century.

(European Commission 2011, 3-9.)

Under the project developed by Iberia, biofuels should not come from tropical forests or other areas with their own ecosystems, and that they do not reduce the food production of developing countries (Ronda Iberia 2011, 127). The production of these new types of fuels at a competitive price compared to fossil fuels has become one of the main challenges within aviation. In fact Iberia has signed an agreement of cooperation with SENASA (Services and Studies for Air Navigation and Aeronautical Safety), an organism depending on the Spanish Ministry of Development to help get cleaner biofuels.

b) <u>The IAGOS Project</u>

Iberia has been designated by the European Research Infrastructure (ERI) to participate in this project to measure the air quality on routes from Madrid to its destinations in South America. The IAGOS project, which initials stand for "Integration of Routine Aircraft Measurements into a Global Observing System", agreed with Iberia the installation of onboard specific instruments and devices to measure the chemical composi-

tion of the atmosphere at high altitudes during the performance of long-haul flights to South American destinations.

The findings after these experiments will set light on impacts coming from the sector on the environment and their contribution to climate change. In a more accurate way: It will establish and operate a distributed infrastructure for long-term observations of atmospheric composition, aerosol and cloud particles on a global scale from a fleet of initially 10-20 long-range in-service aircraft of internationally operating airlines (IAGOS 2012).

c) Biofuel from Seaweed

A new project created among Iberia, AENA (National Airports), REPSOL YPF (the largest Spanish oil and gas company) and the expertise of the company Algaenergy to develop an investigation centre next to Iberia's Terminal 4 at Madrid-Barajas airport. The aim of this centre of investigation is the development of biofuels from micro seaweed, especially those ones created from the types "Anabaena" and "Murielopsis". Both species are said to be well-indicated for this purpose. This centre will also investigate the properties of some sorts of micro seaweed to reduce CO_2 emissions as some of these species utilize these emissions as food (Algaenergy 2012.)

d) Fleet Renewal

At this point, fleet renewal has been proven to be the most effective solution within the possible range of actions used by airlines to improve their fleet efficiency. Due to the high prices of fuel and the economic crisis, companies have put pressure on aircraft manufacturers as a way to maintain their level of benefit due to the increase of costs. According to Airbus, air traffic in Spain will almost double by 2030. Spanish airlines "will have operative 400 new aircraft over the next 20 years. Each additional unit of these aircraft comes from the need to replace less efficient aircraft for more eco-efficient, to and from the growing demand of domestic and international air transport. Spain is one of the favourite destinations for many international air travellers and also

one of the main axes connecting Europe and Latin America. Low cost carriers will also play an important role in increasing passenger traffic in Spain" (Airbus SAS 2012, 1).

Iberia´s great plans towards eco-efficiency and fuel saving took place during the period 2000-2010 when its complex fleet (consisting of a mixture of Boeing, Airbus and McDonnell-Douglas aircraft) was unified to a single one of the most modern Airbus family. With this decision, the company reduced costs in maintenance and logistics and put in service a much more efficient fleet in terms of fuel per seat.

Regarding its long haul fleet and following its plans to expand its frequencies to North, Central and South America, IAG signed a contract with Airbus to receive eight Airbus A330 aircraft for Iberia with an option of purchase of eight units more in the forth-coming years. This fleet will be Iberia's only twin engine wide body aircraft fleet. They will be powered by General Electric engines and will be much more fuel efficient. With this decision the company improves its efficiency in terms of fuel consumption per seat, basically due to the simple fact of using a twin engine plane instead of its current Airbus A340-300 and A340-600 fleet, all of them provided with four engines. (Ibid. 1)

e) Weight Reassignment, Rerouting and Progressive Approaches

Although manufacturers have improved aircraft efficiency during the last decades, fuel prices have pushed companies to pursue efficiency in every flight by implementing measures that have to do with fuel management. The three basic pillars of this goal are: weight control, adaptation of efficient routes and improvements in approach tech-niques.

Iberia has understood that an excess of weight when freighting a flight means a logical increase in fuel consumption. For this reason, some actions have been carried out in order to diminish the total weight related to onboard activities. In this regard, galleys, toilets, trolleys and their contents as well as seat distribution have been redesigned. An important measure to contribute to this target is the reduction of drinkable water of the airplane tanks. The total content of these tanks have passed to a 75% after estimat-ing that in a regular short-medium haul flight, the 100% of the capacity is rarely used.

The company participates in the DORIS (Dynamic Optimization of the Route in Flight) project. The project pursues the goal of diminishing CO_2 in flights between Europe and United States by finding the optimal and shortest route after takeoff. The system provides updated information according to the particular characteristics of the flight and the current weather conditions. During the whole flight process, the techniques used make a clear difference in fuel consumption if a correct flight plan is designed and if it is performed in a sustainable way. From the right cruising altitude to the right speed, all factors affect the final fuel consumption during a flight. Approach is also a key element during this process and the way it is performed has its impact on the overall efficiency of the flight. For this reason, Iberia applies new procedures to assure that the approach techniques are carried out in a progressive and continuous way. Old procedures consisting of sudden changes of level contrast with the softer and progressive changes carried out today. Among the large amount of advantages achieved by using these procedures and those ones related to fuel consumption, noise abatement is without doubt an important achievement (Iberia 2012.)

f) Co_2 Calculator

In order to educate and inform, and following other airlines' initiatives, Iberia has launched a new service available from its own website for the purpose of calculating the carbon footprint produced during a selected trip and taking into account type of aircraft and class. Calculations were made based on regulations published by the ICAO (International Civil Aviation Organization) in its "Carbon Emissions Calculator", a methodology developed for the standardization of CO_2 emissions inventories for airlines and have been verified by external audits.

The methodology is completed with a series of improvements in data base collection according to the particular characteristics of the airline, type of route and fleet; making the applicable data provided more accurate to the operation of the company. The data base of the inventory is based on externally verified flight information, which includes more than 150,000 flights operated by Iberia in the last year to comply with the rules of Emissions trading for Aviation in Europe (European Trade Scheme ETS) (Iberia 2012.)

g) Co_2 Sequestration

The company supports the initiative Programme of the United Nations for the Environment to promote tree planting and forest conservation. The project is part of the worldwide Plant for the Planet campaign created by the United Nations Environment Program (UNEP), whose goal is to plant 1 billion trees all over the world. In cooperation with the project Corredor Ecológico Ardilla (Squirrel Ecological Corridor), Iberia promotes "connectivity between natural areas, improving conservation, doing reforestation and a sustainable management of the forest to fight climate change" furthermore Iberia plantations are performed on land owned by public entities in collaboration with the Forest Service for its planning and management. Subsequently a follow-up takes place and ongoing maintenance of the plantations, work is carried out by the gardener workforce belonging to the Association of Parents of Disabled of Iberia (APMIB). (Iberia 2012.)

Funds collection will be managed by the Plant for the Planet foundation, a non-profit organisation through voluntary, private donation and especially through Iberia´s CO_2 calculator when purchasing a ticket at the airline´s website, iberia.com. The first so called "Iberia Forest" will be located in Valdebebas; a forestry park situated near the airport and became a reality in March 2012. This same initiative will be carried out in different parts of the country under the same project in areas around the airports of different cities such as Barcelona, Bilbao, Valencia and Seville. (Ibid. 2012.)

h) Electrical Projects

In August 2011, AENA (Aeropuertos Españoles y Navegación Aérea) the public operator of the great majority of airports in Spain, began a new experiment in collaboration with the Spanish Ministry of Development, ENDESA (the largest electric utility company in Spain), General Electric and the French manufacturers Citroen and Peugeot. In a simultaneous experience at the airports of Madrid, Barcelona, Palma de Mallorca and Lanzarote, a fleet of 33 vehicles of the models Citroen C1 and Peugeot iON were tested in usual ground activities. These vehicles are 100% electrical and perform an estimated autonomy of 150km, enough to cover the hardly 100 km performed in an everyday operation. General Electric was the designated company to design and provide the charging stations distributed in the airport areas (Flynews 2012.)

Picture 5. Electric car at Madrid Barajas Airport. Terminal 4
Source: Espor Madrid 2011

According to the website and if the experience is positive, AENA the public organism in charge of the national airports will assess the possibility of substituting the current fleet of 4,000 vehicles. The use of this new fleet of 33 vehicles is estimated to reduce CO_2 emissions in 13,200 kg per year and it would permit estimated savings of 13,000€ in a yearly basis (Ibid. 2012.)

i) Recycling

With the cooperation of external companies, Iberia launched in 2011 an integral system to recycle urban waste at its Madrid offices as well as a system of treatment of dangerous waste at its domestic destinations. With this initiatives Iberia tries to reach the goal of a "zero urban waste" company in the forthcoming years. The initial targets for 2011 were to recycle a 50% of its total waste (Iberia 2012.)

8 British Airways

It was officially created in 1974 after the two existing national companies, the British Overseas Airways Corporation (BOAC) and the British European Airways Corporation (BEA), joined under a single brand named as British Airways Board and afterwards known simply as British Airways (BA). Nowadays, British Airways is the largest company in the UK in terms of number of aircrafts, range of fleet and destinations.

British Airways will be remembered in history for being one of the two companies, in association with Air France, to operate the mythic supersonic airliner Aérospatiale-BAC Concorde from its first flight in 1976 until its last one in 2003. It was three year before on 25 July 2000 when a fatal incident involving the Concorde in Gonesse, France, served as the trigger to end up the activity of this legendary type of aircraft after a career marked from its very beginning by economic losses (British Airways 2012.)

BA, a traditional Boeing client mainly due to its historical affinity and links to the USA, started a new era in 1998 with the purchase of aircrafts from the American manufacturer Boeing's main rival Airbus. This fact was seen as a real change of tendency in the company's policies and a new era in terms of environmental and economic consciousness. The particular situation of British Airways as a European company with strong commercial links with North America, place the company in a delicate situation of balance between the commercial and the economic duty.

8.1 Facts, figures and impacts

Fleet*	238 aircraft
Destinations	133
Number of passengers*	31,825,000

**March 2010*

Source: British Airways 2012

8.2 Actions

British Airways focuses its actions on five basic pillars: carbon efficiency, carbon emissions, noise, air quality and waste/recycling. All these actions have a final goal of reducing CO_2 emission per passenger kilometre, reducing net CO_2 emissions by 50% by 2050, reducing average noise, improving air quality at its Heathrow hub and improving recycling at a target of 60% by 2015. The company also plans a zero waste target from Heathrow and Gatwick (British Airways 2011, p.11).

The actions carried out by the company are now listed and developed. As well as with Iberia in the previous chapter, the most innovative ones are here presented and serve as model and possible influence for future common initiatives. These are: a) Internal Tools, b) Fleet Renewal, c) Scientific Research into Biofuels, d) Waste Management and Rainfall Reuse, e) New Aircraft Coatings, f) Forest Footprint Disclosure Project and g) Voluntary Carbon Offset Scheme.

a) Internal Tools

In 2010, British Airways created the Environmental Compliance Group (ECG), an internal tool which supervises and serves a forum for environmental issues within the company. The company's Corporate Responsibility Report 2010/2011 explains that this tool brings together representatives from around the company to ensure that our environmental programmes and risks are appropriately managed. Meeting quarterly, the ECG monitors compliance with regulation and company policy, and assesses developments in environmental legislation with recommendations for future compliance. It also enables us to trend performance against key measures and share best practice. (British Airways 2011, 6.)

b) Fleet Renewal

According to British Airways and coming from a plan already devised in 2007, its old fleet of Boeing 767-300 and Boeing 747-400 will be replaced with a mixture of Airbus

A380 and Boeing 787's. Both the A380 and Boeing 787 are much greener than the aircraft they replace (British Airways 2012.) According to this source:

- the Boeing 787 has a 30% lower fuel burn than the Boeing 767
- the Boeing 787 NOx emissions are about 46% less per aircraft than the 767
- in terms of CO_2 emissions, the Airbus A380 has 17% lower fuel burn per seat than the Boeing 747
- the A380 emits about 10% less NOx per aircraft than the Boeing 747-400

Both the A380 and the Boeing 787 make only a quarter of the noise impact made by the B747-400 (Ibid.2012.)

c) Scientific Research into Biofuels

British Airways cooperates with Solena, a US specialist on renewable fuels. The goal of this association is the creation of Europe's first sustainable biojet plant converting waste material (biomass) into sustainable alternative fuels. This plant expects to initiate operations in 2014 when it will convert 500,000 tonnes of waste per year into sustainable aviation kerosene. This fuel will save 145,000 tonnes of carbon dioxide each year. In cooperation with Rolls Royce, as engine manufacturer, some tests are being conducted on those aviation fuels. Laboratory testing began early in 2011 and will be followed by further tests leading to full engine tests towards the end of next year. This project is supported by the US Federal Aviation Association's CLEEN (Continuous Lower Energy, Emissions and Noise) programme (British Airways 2010, 12-14.)

Furthermore, the company supports the OMEGA programme, a consortium of nine universities studying the impact of aviation on the environment.

Cooperation with other airlines, companies and stakeholders in general with strong interests in developing sustainable fuels is centralized by the Sustainable Aviation Fuels User Group (SAFUG). British Airways also worked together with the Roundtable on Sustainable Biofuels (RSB), and organism which develop global sustainability standards for all biofuels and also take part in projects including the IAGOS (Integration of rou-

tine Aircraft measurements into a Global Operating System) project, funded by the EU. This project, also participated by Iberia, takes in-flight measurements of non-CO_2 gases in the atmosphere (British Airways 2011, 14.)

d) Waste Management and Rainfall Reuse

According to British Airways, the company has recycled 45% of waste at its main bases of Heathrow and Gatwick (British Airways Corporate Social Responsibility 2010-2011). Furthermore, non-recyclable waste at Heathrow and Gatwick is processed through a waste-to-energy plant. Among the different actions carried out by the airline in this respect, British Airways reuse and recycle unwanted office furniture, computer and communication material. The company recycles now in cooperation with the cleaning companies at Heathrow and Gatwick airports newspapers from inbound flights into these airports. In 2011 Project 65 was launched aimed at increasing the overall recycling to 65% of total Engineering waste by 2013 (British Airways 2011, 14-16.)

As a future plan, the airline has formed a cross departmental working group to establish onboard recycling of catering products including paper, cans and bottles. This poses a significant challenge because of the constraints of space and stringent controls on the management of international food waste. The project plans to conduct evaluations on selected routes to European destinations and expect to extend the lessons learned to other routes on our network (British Airways 2011, 30.)

Furthermore at London Heathrow's new Terminal 5 has been implemented an innovative system of water reusing from rainfall that has the capability to reuse about 85% of all rainfall and covering the new terminal with 70% of its non-potable water needs and becoming Europe´s biggest rainwater harvesting system (Heathrow Airport Information 2012).

e) New Aircraft Coatings

British Airways has been collaborating with the company Triple 0, a company that has been developing a special aircraft coating with aerodynamic properties. The first tests are being held on an Airbus A380 and will afterwards be implemented in the rest of the fleet depending on the results. The ultimate goal of the experiment is the improvement of aircraft airworthiness in order to improve its fuel efficiency (British Airways 2011, 11.)

f) Forest Footprint Disclosure Project

British Airways started its participation in the Forest Footprint Disclosure Project already in 2009 when it was created and becoming thus, the first airline to do it (British Airways 2011, 25-27). FFD engages with private sector companies to ask them to disclose their current understanding of their 'forest footprint' based on exposure to five key commodities - soy, palm oil, timber, cattle products and biofuels - in their operations and/or their supply chains. All of these commodities have the potential to be sourced from recently deforested land (Forest Footprint Disclosure 2011, 2). According to this project, British Airways' forest footprint is estimated at a minimum of 314 acres. BA's greatest single commodity usage was timber, which had the lowest footprint because, according to BA's Corporate Responsibility Report, the company purchases mainly certified timber and paper. According to this study's parameters it was in the purchase of beef when the company had the greatest forest footprint risk. This initiative helps us understand the importance of the supply chain when referring to procurement and gives us a wider view of the effects and externalities of every industrial or economic activity, even far beyond our nearest environment (British Airways 2011, 27.)

g) Voluntary Carbon Offset Scheme

In 2008, British Airways introduced its own carbon offset scheme giving the chance to its customers to donate voluntary economic contributions to finance clean energy projects in developing countries. From its very beginning, almost half a million passengers

have used the British Airways carbon offset scheme (British Airways 2011, 28). In co-operation with Climate Care, a non-profit organization based in Oxford, the funds raised are invested then in renewable energies and energy-efficiency projects as well as in reforestation. Whilst 'planting trees' is a relatively simple message to convey to potential purchasers, taken alone it will not be the solution to climate change which is why Climate Care's focus is on 'technology' type projects. These include the installation of biogas digesters in villages in India to provide a renewable fuel for cooking, which reduces pressure on the local forest resources; the installation of 50,000 energy-efficient lamps in houses in South Africa (Becken and Hay 2007, 219.)

From 2012, the majority of British Airways flights are expected to be included in the EU Emissions Trading System. This will mean that all the tickets sold for travel into and out of the Euro zone will include an element of carbon pricing within the ticket.

9 Suggestions and conclusions

IATA (International Air Transport Association) suggests in its Annual Report 2011 a roadmap of actions based on four well-defined pillars of actions in its commitment to cut net CO_2 emissions. These pillars are:

1. TECHNOLOGY

    - Each generation of aircraft is 20% to 30% more fuel efficient than its predecessor.
    - Cooperation in investigation is a basic issue.
    - With the possibility of offering up to 80% reduction in emissions over the complete carbon lifecycle, biofuels are a key part of aviation's future. In this case investigation is also basic.

2. OPERATIONS

    - Improvements through flight management enhancement, flight planning optimization, auxiliary power unit usage, maintenance and aircraft weight management.
    - Improvements above are achieved through different initiatives such as regional workshops, remote support, fuel efficiency training and more fuel saving initiatives.

3. INFRASTRUCTURE

    - By shortening air routes and in consequence lessening emissions.
    - Cooperate with stakeholders to identify and introduce more flexible routing options.
    - Create guidance material on civil and military cooperation (ICAO as pioneer).

4. ECONOMIC MEASURES

- Promote emissions reduction.
- Create lobbies for a formal global framework for economic measures.
- Promote cooperation between industry partners.

(IATA 2011, 31-32.)

Taking these pillars and guidelines into account, the following actions try to propose solutions that could be applicable to the new situation of the company after the merger and according to the specific characteristics of each company separately. These guidelines should be, furthermore, complemented by the background concept of the 3 r's of environment: reduce, reuse and recycle; or even the most updated version, the fourth one: repair.

Figure 6 for example, represents the suggested alternative sources of energy that could be implemented at London Heathrow and Madrid Barajas as main hubs operated by British Airways and Iberia and as a hypothetical experimental first phase. In these actions the different weather conditions have been taken into account promoting and encouraging the use of wind power in England and having solar energy as a secondary source. Likewise, solar energies would be the main and more effective source of power in Spain having wind power as alternative or complementary. These methods would reduce the current dependency on traditional energies and will be a significant step forward to achieve a certain stage of sustainability in the ancillary activities beyond the core activity of flying. As seen throughout this thesis, the collaboration among stakeholders has been demonstrated to be basic for the right development of these sorts of initiatives. Airlines on their own would never be able to carry out them without the joint work of airports, technology companies, researchers or manufacturers.

Basically, almost every ramp activity developed in an airport today is based on fossil fuels. This same fact leads us to raise an alternative solution based on electricity and at the same time offer a sustainable source. As seen below, almost every activity could find an equivalent alternative in sustainable energies. External supply or generation

might be used only as an emergency alternative source or as punctual back-up aid in certain peaks of energy consumption.

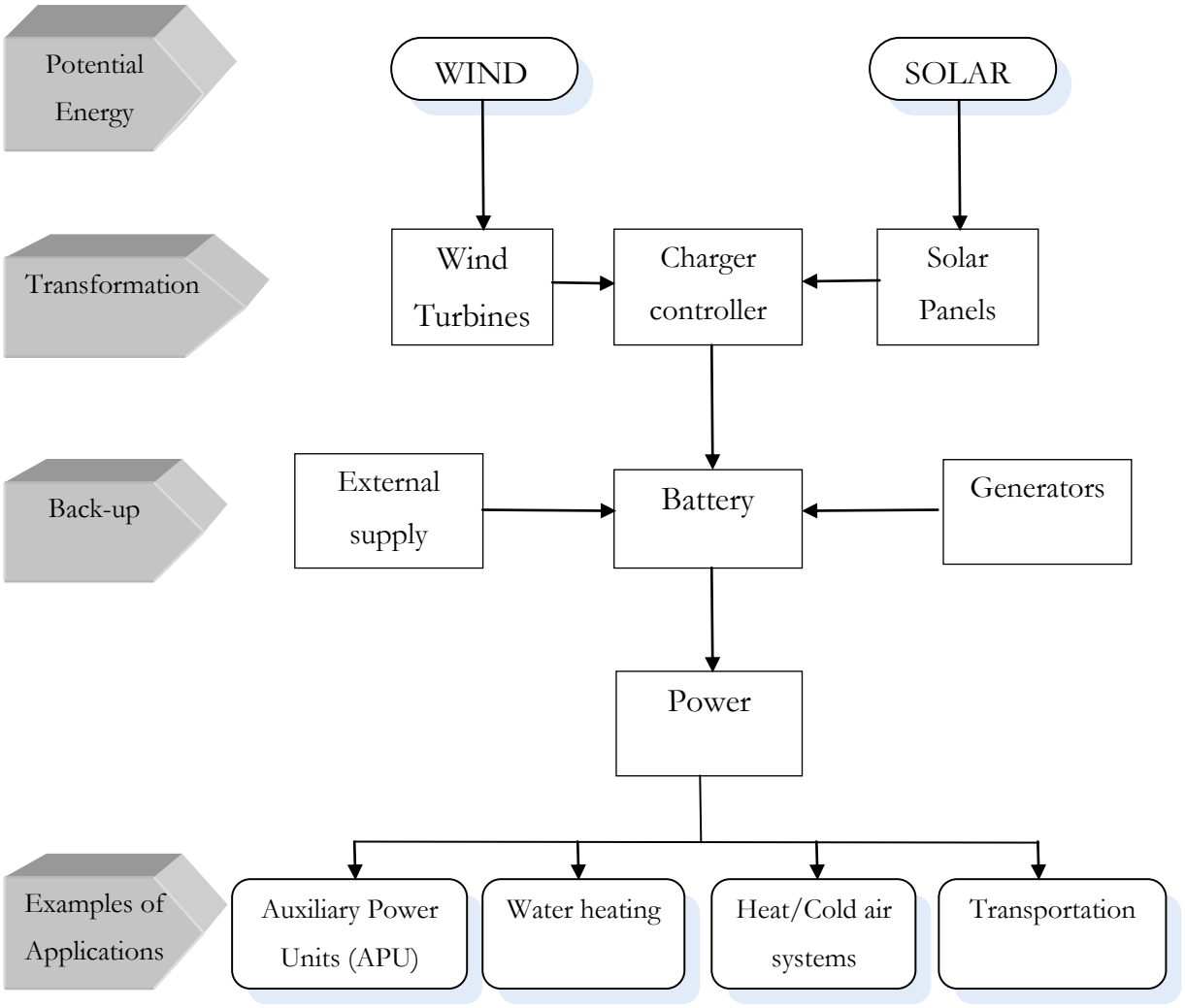
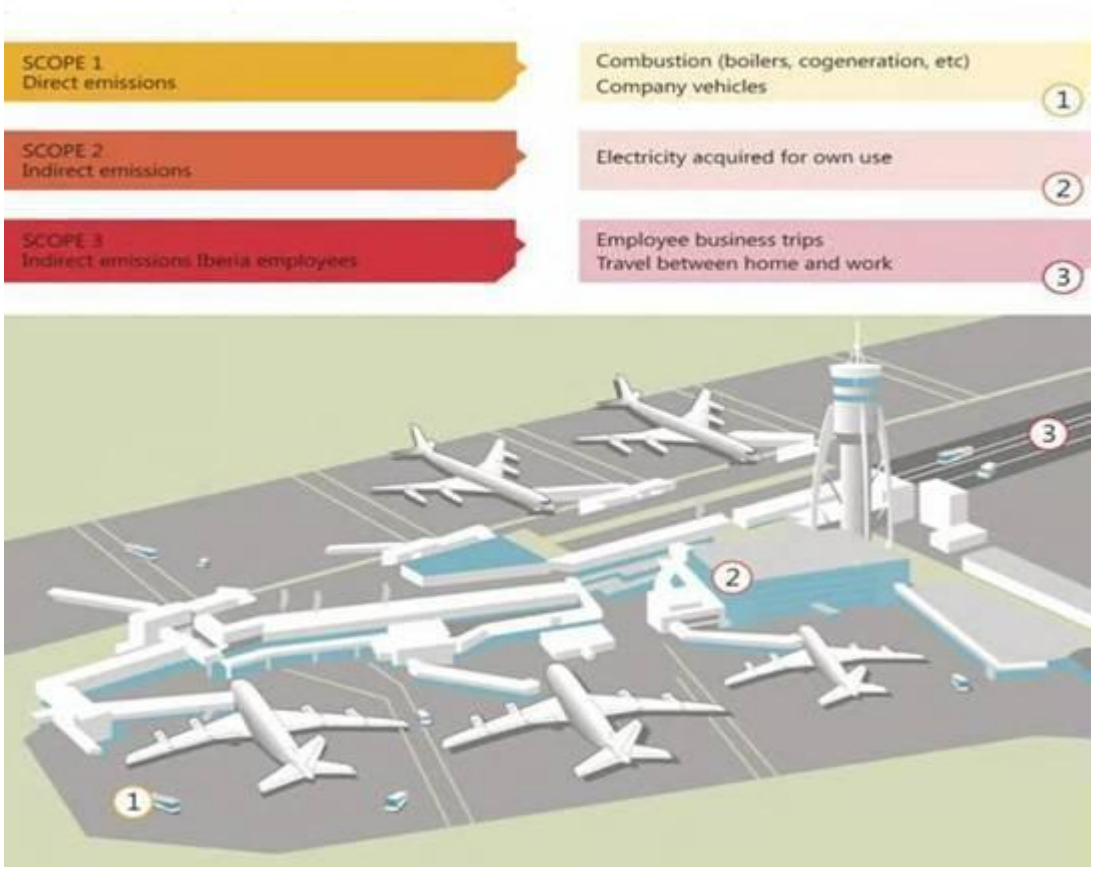


Figure 6. Suggested energy management and use at a hypothetical sustainable airport (Inspired by Becken and Hay 2007, 217)

Picture 7, shows us a general overview of the main sources of pollution at an airport and the fields of improvement that could be applied. The three main scopes of action are divided into three well-defined areas: ramp activities, terminal activities and all those indirect activities related to employee and passenger trips to and from the airport. All these activities could be supplied in electricity by using the initiative presented in picture 6 based on sustainable energies. Furthermore, these initiatives could be

complemented with the implementation of other helpful models as the one launched in London on rainfall harvesting and its reuse.



Picture 7. Sources of Emissions in Ground Operations by Scope (Iberia 2009, 367)

(1) Direct emissions related to all those on-ground activities performed to support operations such as auxiliary power units or fleets of vehicles for all ramp activities. In this respect, cooperation among stakeholders (airlines, governments, handling companies or airport owners) is crucial to coordinate actions in order to reduce emissions. The use of renewable energies to power vehicles and machinery to performed duties such as aircraft loading/unloading, baggage transportation, crew transportation, apron buses, de-icing, aircraft pushback, auxiliary power units (APU) or air starter units (ASU) are highly commendable.

(2) Indirect emissions caused by electricity acquired for own use. The large amount of electricity consumed in the daily operational routines of an airport gives the chance of a wide range of actions to compensate or reduce the dependency on this energy.

The key actions towards this goal should be focused on investments in sustainable sources of energy such as solar or wind technologies. Namely, the final target of these initiatives would be to achieve the sufficient independence from the current sources of energy that would allow reducing CO_2 emissions.

Water management and its sustainable use is also a matter of growing interest. Water scarcity is already an existing problem in Spain and even lack of precipitation has led to problems in England in the last decades where water harvesting infrastructures are not so well-developed due to the historically lack of this kind of problem. The new terminal 5 at London Heathrow is a good example of sustainable use of rainfall water and serves as a model to be applied not only in IAG but also in a worldwide basis.

3 Indirect emissions produced by Iberia employees and airport staff through their trips from/to workplace. Public transportation and every action aimed to promote more environmentally friendly means of transport should be encouraged. Moreover, these vehicles should tend to use modern technologies based on more sustainable sources of energy. Vehicles for individual use should improve efficiency through collective use and the use of electric or hybrid cars might be encourage by facilitating specific infrastructure.

Picture 8. Solar panels at Denver Int. Airport

Source: Got Powered 2012

Picture 9. Solar panels on a private hangar at Bob Hope Airport. Burbank, California

Source: Kyocera 2008

As part of the construction of a new private aviation hangar at the Bob Hope Airport in Burbank, Calif., Independence Power has completed a 268 Kw solar power system which meets 100% of the requirements for the new hangar and attached office building. The structure was built by Shangri-La Construction, and is occupied by Avjet Corporation. The Japanese company Kyocera Solar Inc. provides the solar panels (Kyocera Solar 2008.)

Picture 9. Logan Airport, Boston.
Source: Boston Globe 2011

Picture 10. Logan Airport, Boston

There are probably thousands of possible actions carried out by each company in an independent way and there are other numerous initiatives for IAG as the resulting company. Nevertheless, in the following table are presented the most significant, useful and innovative at the moment. Those initiatives already implemented in both companies are then propose for implementation in IAG. The following ideas are thought to make a difference compared to other important airlines and might be seen as a real impulse to the slow steps taken by the sector to reduce its CO_2 emissions. The difficulties to implement these initiatives are then displayed as well as the suggested measures to ease the final implementation.

Table 10. Suggested actions

British Airways	Iberia	Barriers to implementation in IAG	Measures to remove barriers
Research into Biofuel (Biomass)	Research into Biofuels (Algae)	• Early stage of these types of fuels and technologies • Difficulty in coordinating already existing programmes • Heterogeneity of projects • Problems with supply chain • Different types of fleet in each company	• Create a common organism • Certify the sustainable origin of biofuels • Increase research through the existing projects to accelerate the use of biofuels (high fossil fuel prices) • Cooperate with manufacturers, universities, other airlines and stakeholders in general

–	CO_2 calculator	• Available data not adapted to the new situation • Available data based on averages and calculations • No further information or alternatives given to customers • Lack of accuracy	• Apply in BA and IAG • Base data on actual cargo, passenger and fuel consumption figures, not averages or assumptions. (i.e. Finnair case) • Cooperate with Finnair as member of the same alliance. • Offer alternatives to customers
Forest Footprint Disclosure (FFD) Project	–	• Only applied in British Airways • Possible lack of reliability and transparency	• Implement the project in Iberia • Implement the project taking into account IAG´s synergies • Improve transparency and provide public information

CO_2 sequestration	CO_2 sequestration	• A question of image more than of real interest • Not well-developed initiatives • Lack of long-term maintenance	• Cooperate and unify a possible common programme (i.e. based on the United Nations Environment Program) • Promote scientific research • Attention to long-term maintenance • Inform and encourage public promotion
–	Use of electric vehicles in ground operations	• Lack of cooperation with public airports • High costs during implementation, maintenance and power consumption • Lack of development in electrical solutions	• Coordinate actions with public organizations • Implement common policies for both airlines • Cooperate with manufacturers, universities and governments

Improve efficiency per passenger-km	Improve efficiency per passenger-km	• Lack of data and experience due to the new situation • New routes • Predominance of the economic side rather than the sustainable.	• Create new calculations through re-routing • Eliminate or reassign non sustainable routes. • Use of updated fleet. • Inform passengers of the different options
Recycling and reuse	Recycling and reuse	• Lack of procedures and infrastructure • Current initiatives insufficient or only applied in certain activities (i.e. maintenance) • Wide variety of stakeholders • Inequality of development between projects	• Promote high-scale initiatives • Create or improve on-board initiatives • Cooperate and coordinate actions with airports • Apply rainfall water harvesting systems in Spain (water scarcity)

Internal tools. (Environmental Compliance Group. ECG)	–	• Not applied in Iberia • Different national laws and regulations • Only used as internal tool	• Apply this tool both in Iberia and IAG • Create common organisms • Create open forums and networks
–	DORIS project (Dynamic Optimization of the Route In Flight) between Europe and United States	• Creation of new routes still in progress • Lack of transparency • Not applied in British Airways • Not applied in routes to/from Central and South America	• Recalculate routes and apply this project based on the new situation • Improve data availability • Implement as a usual routine
Smart buildings and terminals (Terminal 5, London Heathrow)	Smart buildings and terminals (Terminal 4, Madrid or Terminal 2, Barcelona)	• Coordination with public actors • Lack of financial support • Lack of sustainable culture • Lack of research	• Increase cooperation with public agencies, universities and manufacturers • Implement new solution for water reuse (Heathrow Terminal 5 model) • Inform and promote awareness

Projects in R&D&I (i.e. aircraft coatings)	–	• Difference in type of fleets (Boeing/Airbus) • Different research programmes • Lack of public funds	• Create common organisms • Share knowledge and know-how • Create a common fund • Cooperate with stakeholders
Tools for e-learning and feedback (Flyability project)	–	• Customer or public in general find difficult to participate • Lack of online initiatives and programmes • Confidential information	• Implement both in Iberia and IAG • Increment online information and learning • Encourage customer participation • Facilitate and take into account public initiatives
BA offsetting scheme	Iberia offsetting scheme	• Complexity of the new situation after the merger • Not synchronized programmes • Uncertainty of fund use • Different audits	• Adapt and unify offsetting schemes for IAG • Increase awareness and provide more information for customers • Improve and unify audits

10 Epilogue

Solar Impulse is a project basically created by two Swiss pilots, Mar Bertrand Piccard and André Borschberg with the purpose of developing an aircraft powered only by solar energy. As a modern pioneer, Piccard had already performed the first non-stop balloon circumnavigation around the globe in 1999. This new project financed by private companies such as Deutsche Bank, Omega SA and Solvay as main partners or Bayer MaterialScience, Swisscom or Toyota as supporters and donors. The technical expertise is provided by the European Space Agency (ESA), the Ecóle Polytechnique Fédéral de Lausanne (EPFL) and Dassault, a French group of companies specialized in aeronautical development (Solar Impulse 2011.)

The ultimate objective of this mission is to complete the first circling of the earth with a piloted fixed-wing aircraft using only solar energy.

Although the first studies on solar aviation took place already in the 1970´s, it was not until 2003 when the first feasibility studies performed by Solar Impulse addressed the problem of developing a solar airplane with power autonomy also during night and cloudy periods. 2010 was a real milestone for solar aviation when the Swiss based company Solar Impulse performed its first manned flight demonstrating the feasibility of a complete day-night-day cycle propelled only by solar energy. The pilot and co-founder of the project, André Borschberg, completed a flight of 26 hours, 9 minutes and 10 seconds being so far the longest and at a higher altitude flight in solar aviation (Ibid. 2011.)

This is a brief chronology of the recent history of solar aviation:

- 1970´s: first reduced models when more affordable panels entered the market.
- 1980: first human flight on a solar powered airplane by Paul MacCready in United States
- 1990: Eric Raymond crossed the States in 21 stages on board the Sunseeker

- 2001: although without pilot, the American company AeroVironment developed the remote-controlled aircraft Helios for NASA which established a record of altitude of 30.000 metres.
- 2005: the company AC Propulsion succeeded to fly an unmanned aircraft during 48 hours non-stop during night and day by only using solar energy.
- 2010: the British-American company QinetiQ sets an new world record flying 14 days a non-manned aerial vehicle
- 2010: the HB-SIA developed by Solar Impulse and piloted by André Borschberg performed the first night manned flight propelled by solar power in history
- 2011: design and construction of the HB-SIB, the second generation of aircrafts by Solar Impulse with improvements in cockpit habitability, power autonomy, aerodynamics and altitude range
- 2014: scheduled round the world trip on board the HB-SIB by Solar Impulse (Solar Impulse 2011.)

Picture 11. Model HB-SIA developed by Solar Impulse
Source: Solar Impulse 2011

Although today these projects may sound almost as science fiction or may even be surrounded by a kind of halo or romanticism, the truth is that thanks to these pioneers and visionaries and their projects, sectors such as aviation where technology plays and important part, have advanced by leaps and bounds during the last century. We all have in mind the flamboyant images of those who tried to give the first steps in aviation at the beginning of the twentieth century with their almost absurd artefacts or even the bizarre drawn sketches by Leonardo da Vinci.

With this final chapter, the idea is to capture and spread the idea of these small, almost unnoticed steps as the real germ of a future scenario in aviation in particular and in human progress in general. The beginning of a new cycle is right ahead of us and curious news like this serve us as real weak signals for huge future changes.

Will this be the beginning of a new era?

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