



Emissions trading and its likely effects on the airline industry

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| <p>Abstract:</p> <p>This study concerns the extension of emissions trading to the airline industry and was designed to clarify and substantiate likely effects of the Emissions Trading Scheme. The research question concerned potential tactic and strategic responses airlines can take to adapt to the emissions trading regulations.</p> <p>Regarding the primary research, the author used a qualitative and exploratory approach by undertaking expert interviews. The sample consisted of five airline managers, additionally two researchers and one governmental expert. Most of the research took place in Germany due to the easier access to the required data and greater industry size. The findings revealed not only specific business areas where adjustments can be made in order to reduce emissions, but also significant background knowledge of the drivers behind tactic and strategic mechanisms. Furthermore, the measures different airline types are likely to take was examined as well. Therefore, the writer selected a small regional airline, one network carrier, an alliance member and a low-cost carrier. Their microeconomic view was well complemented by the macroeconomic knowledge of the researchers.</p> <p>The answers presented a great variety of expertise. In conclusion the author was able to find various approaches to solutions, of which airlines can consider and select the most suitable ones for their particular business model.</p> | |
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1 INTRODUCTION

1.1 Background of the topic

The concept of the Emissions Trading Scheme (ETS) is based on the measurement, reporting and finally the reduction of CO₂ -emissions. It has been applied to the stationary trade since 2005 and is currently being extended to the aviation industry as well.

This means starting from 2010 all air traffic with few exceptions operating within, from or to the European emissions trading zone, is required to monitor the release of CO₂ -emissions. In 2012 the caps (definition: a limited amount of greenhouse gases that can be legally emitted by a company or country) on the basis of this year's emissions reports will become effective.¹

The actual trade works so that a restrictive benchmark is assigned to all airlines which derives from the amount of CO₂ they will release this year. In the beginning a big percentage of emission rights is freely allocated to airlines by the respective local competent authority. Airlines exceeding the amount of freely allocated emission rights with their emission must buy additional certificates from the stationary trade. Otherwise there are penalties for not buying extra emission rights. Those carriers with emissions below the benchmark-value may sell unused certificates and hence, obtain a profit (of course depending on the certificate price).

The incentive lies not only in the motivation not to exceed the caps (a maximum limit of CO₂ -emissions) and therefore not to buy extra emissions rights, but also in the potential to be gained profits from selling emissions certificates. A more detailed description of the mechanisms follows in chapter 2.

As it concerns the entire European airline industry, the study has a high significance as representing an economic statement primarily for the airlines themselves and secondarily their customers.

¹ http://en.wikipedia.org/wiki/Emission_cap

This paper is of exploratory and descriptive nature, therefore it aims at giving airlines information about likely changes, so they can use it to develop responsive strategic adjustments. Reliability is ensured by interviewing professionals of different airlines, institutes and researchers.

1.1.1 Motivation

The author chose this thesis topic according to several criteria. At first, regarding her interest in the economic courses at Arcada. Secondly, the selection was based on the compliance with Arcada's thesis writing guidelines. Thirdly, the idea derived from a former 30 pages essay produced in the English 2, Academic Writing course, with the title: "Global warming and its effect on different industries". She has been interested in environmental issues for a long time. Last but not least, as ecologic awareness is constantly growing, the author expects environmental issues to play a bigger future role in business.

As this topic was far too broad at the beginning, she was advised to concentrate on a smaller area and found particular interest in the airline industry, because it has not been researched extensively yet in terms of environmental issues. After considering the access to information, company confidentiality and level of difficulty, she decided to concentrate on the impact environmental regulations are likely to have for the airline industry in general.

As it is very difficult to numerically determine the real impact cost drivers are having on airlines' cost indices also considering confidentiality, the student regards it as a more beneficial and clearer goal to explore how the general drivers behind business decision making. Also, there are so many interrelations between cost and external factors that it is rather complicated to see through direct and indirect influences.

The coming emissions trading regulations actually derive from the fuel problem of pollution and airlines are likely to have higher costs in case they have to obtain more emission certificates (the right to emit greenhouse gases) and caps are lowered each year.

1.2 Research problem, question and limitations

1.2.1 Research problem

Emissions trading for airlines can present a variety of challenges that also depend on the individual business model. It is generally known that the airline business is a very cost-intensive industry with a high degree of competition. Profits are relatively low and most airlines operate at frequent losses.

Therefore this study wants to surround the problem of dealing with the higher costs deriving from emissions. The author intends to figure out some factors airlines can modify or adjust in their particular business model in order to survive on this difficult market and how their market position may be affected. In other words, what general measures can be taken in order to generate at least enough profits to break-even.

Also, knowledge about how much freedom these regulations give airlines to do so is to be established, as the directives claim to be economically feasible. Finally, this will also imply some likely consequences for the end consumer.

1.2.2 Research question

The research question will be answered by using a microeconomic perspective of several airlines to indicate industrial developments within the new context of emission trading regulations (the EU Directive of emissions trading for the aviation sector, P. 1 140/86).² This will be complemented by an objective point of view and background knowledge given by researchers of institutions. Persons to be interviewed are presented in table 2.

The correspondences can be found in the appendices with translation into English. Due to confidentiality and based on of ethical reasons, the name of the airlines and contact persons will not be mentioned, but is expressed by synonyms.

The main research question is:

What influences can emissions trading exert on different business areas and airline types?

² <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0063:0087:en:PDF>

The research question will be answered by using two different interview guides: one for airlines and another for researchers, who have been dealing with the research of this topic as well. The airline interview questions derive from literature that concerns airline economics and emissions trading, whereas some of the questions for institutes derive from previous research findings. The background of these interview questions will be explained in the theory chapter 2.

1.2.3 Research limitations

Issues to be excluded are technical properties such as efficiency and fuel consumptions by aircraft type, air freight and the Kyoto Protocol, from which the regulations derive, will not be examined in detail, as it is very broad and concern all industries. Also numerical analysis will be left out for reasons of confidentiality, difficulty and excess of this project.

1.3 Brief description of the further content

In the first section, the author has described the general background of the chosen research topic. This was followed by the motivation of why this specific issue was selected and purpose of the study. The second chapter will focus on a review of the most relevant literature in order to determine the most recent findings and to reveal research gaps.

It will also establish the context; in other word the scientific framework, into which this paper will be embedded, by developing interview questions from existing theories and findings. In the third chapter, the author is going to describe her own primary research in terms of method, sample definition, planning and present the persons interviewed in a table. Two different kinds of interview guides will be introduced as well.

The fourth chapter will analyze the key findings by business area. Then the results of this thesis will be interpreted, visualized in tables and also set in relation to the previous findings of other research projects.

Finally, the last chapter will summarize the author's research findings, show possible solutions to the research problem and suggest starting points for further research.

2 THEORETICAL BACKGROUND

2.1 Most relevant literature

At first, the author would like to elaborate on the availability of the secondary research sources. As there are very few persons in Finland actively following the airline industry, the student decided to expand her search for other research to her home country Germany, where institutions have been more extensively researching the impact of coming regulations.

The writer will present the previous research and literature sources according to their relevance in terms of relation to this paper's objective. The most important research papers have conducted by Scheelhase et al. (2009a,b) and Schleifer (2009). The economic theories were taken from more general books about the airline industry and airline management, such as Shaw (2007) as well as Kleymann and Seristö (2004).

2.2 International agreements

2.2.1 Summary of the Kyoto Protocol contents

As the basic regulation of greenhouse gas reduction targets, the main issues of the Kyoto Protocol are summarized by the author.³

Since several climate reports by the IPCC (Intergovernmental Panel on Climate change) have revealed that global warming is caused by anthropogenically induced greenhouse gas emissions, the UNFCCC (United Nations Framework Convention on Climate Change) has been debating about measures how the negative consequences of climate change could be possibly moderated. In terms of determination of greenhouse gas release and climate change effects, the IPCC has set up different scenarios giving estimations of how the amount of reduction is likely to reduce climatic changes. Based on these results, the IPCC has negotiated and agreed upon the Kyoto Protocol on 11th December 1997. The protocol states the following binding liabilities for the United Nations, which are to be directly applied by every member state:

³ http://www.atmosphere.mpg.de/enid/3__Wie_Klimawandel_verhindern_-__Kyoto_Protokoll_2av.html

Reduction of the greenhouse gases: carbon dioxide (CO₂), methane (CH₄), di-nitrogen oxide (N₂O), partly halogen containing substances (H-FKW/HFCs), perfluorated hydrocarbons (FKW/PFCs) and sulphur hexa-fluoride (SF₆).

In general, greenhouse gas emissions shall be reduced by 5.2 per cent on average between 2008 and 2012, so that they reach a level below 1990. Focusing on the European Union, a reduction total of 8 per cent is the target, but for each member country there are slightly different target numbers according to their economic stage

(Russia, Ukraine and New Zealand shall stay at the emissions level of 1990, whereas only Iceland, Australia and Norway are allowed to increase their levels of 10, 8 and 1 per cent respectively).

Other measures the Kyoto Protocol offers:

International emissions trading: trade of emission rights between governments and emission sources within industrialized countries.

Joint implementation of regulations: inter-supportive financing, in forms of funding and investments, for greenhouse gas reduction in other member states.

The clean development mechanism: Financial support of emissions reduction measures in other countries without regulations in order to give an industrialized member state the opportunity to obtain emissions credits (the right to emit more than intended) (UNFCCC website).

After extensive negotiation within the European Parliament and Council, on 13th October 2003, a law regarding the trade with greenhouse gas emission certificates was passed. CO₂ - emissions are to be constantly reduced within the framework of cost and ecological efficiency, so that the targets of these regulations are realistic and feasible to fulfill for airlines.

Starting from 2012, the airline industry will also be included into the general targets set by the Kyoto Protocol in forms on emissions trading and reduction. Although, compared to other industries, air traffic has accounted for a much smaller amount of total greenhouse gas release; it must be nevertheless included as the strong growth of emissions is very

concerning. The airline industry represents the most significant source for fastest growing CO₂ -emissions.

During the last decade, airlines have increasingly entered the focus of environmental studies as air travel has been growing significantly, so that aircraft emissions have rated a growth of about 87 per cent between 1990 and 2006. The content of the coming EU directives for airlines will be described later on.⁴

2.2.2 Key points of EU directive of the Emissions Trading Scheme compiled by the student (Official Journal of the European Union (2009), DIRECTIVE 2009/29/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL)

Contents of the EU directive of the European Emissions Trading Scheme (EU-ETS) applied to the airline industry from 2012.

This central document states the following directives:

Key points:

- Magnitude: the inclusion of all flights independent of origin travelling from or to European airports and within European airspace, disregarding the non-compliance of many countries neither in with the Kyoto Protocol's objectives, nor with other environmental protective measures.
- The decision of all airlines operating in this region to be obliged to fulfill the regulations is defended by the European Union with the consistency of fair competition within the airline industry.
- Airlines are required to possess and purchase emission trading rights.
- The general maximum aircraft weight to require allowances was determined to be 5700 kg.
- Starting from 2010, aircraft operators must follow the amount of emissions released and also submit these as reports. In 2012 an upper limit for release of greenhouse gases will become effective.

⁴ UNFCCC (United Nations Framework Convention on Climate Change), Kyoto Protocol [internet]

Exclusions:

- Exclusion of flight activities under visual, the majority of rescue flight and belonging to the public service sector within peripheral regions or routes with a lower seat capacity than 30,000 per year.

The “de minimis” clause excludes the following flight types:

- Commercial air transportation with less than 243 flights within 4-months periods for a maximum three sequenced periods
- Flights with lower emissions than 10,000 tons per year
- The “de minimis” clause intends to discard aircraft operators from developing countries, characterized by a low amount and flight sequence.
- 97 per cent of the historically recorded amount of emissions shall be transferred into rights in the first year of application in 2012. In 2013, it will then be lowered to 95 per cent. To do so, the average values from the timeframe between 2004- 2006 will establish the base for airline participation in the trading scheme. Nevertheless, the percentage value can be subject to modification.
- 15 % of certificates are subject to be auctioned after 1st January 2013.
- This amount will be free of cost, but it will decrease to 95 per cent in 2013.

Points regarding the trade of certificates:

The income deriving from auctioned certificates are to be used by the European member states to invest into improvements regarding greenhouse gas reduction and therefore to oppose global warming.⁵

⁵ Official Journal of the European Union (2009), DIRECTIVE 2009/29/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 [internet]

The allocation of free allowances and principles of emissions trading are well summarized in the following graphics and aim to support the previous explanations:

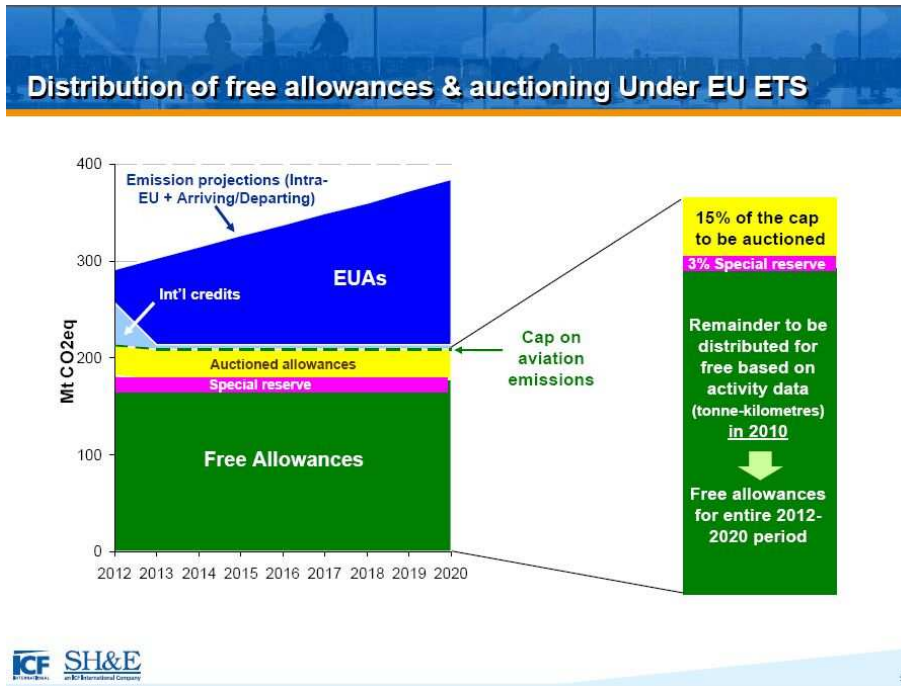


Figure 1: Distribution of free allowances and auctioning

(Treitel, David 21.11.2009, .pdf file p. 5 [internet])⁶

⁶ http://www.sh-e.com/presentations/treitel_11-18-09.pdf

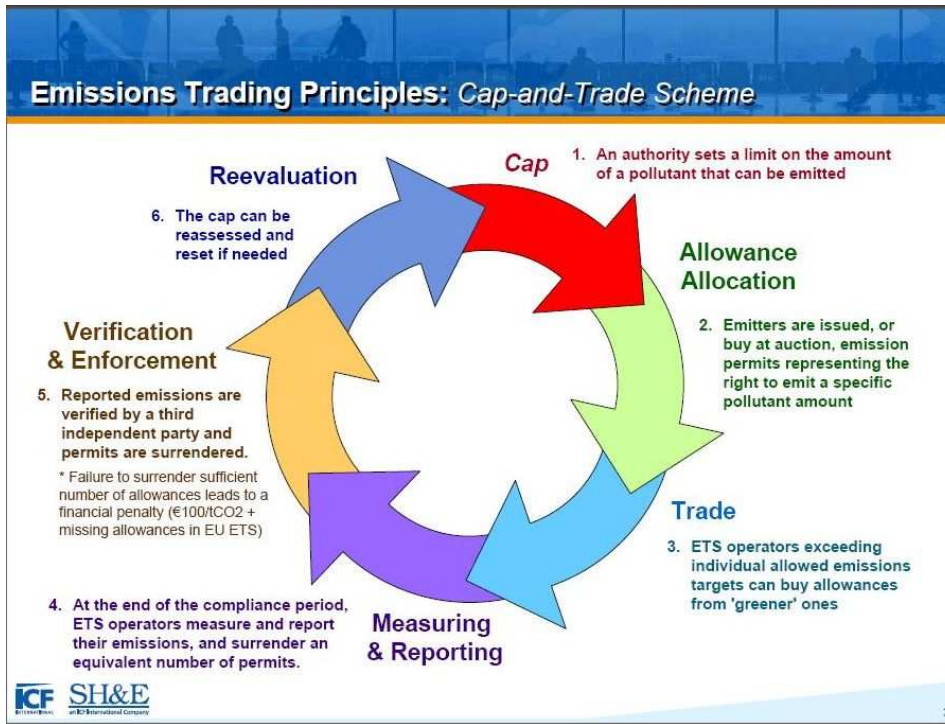


Figure 2: Emissions trading principles: Cap-and-Trade Scheme
(Treitel, David 21.11.2009, .pdf file p. 3 [internet])⁷

⁷ http://www.sh-e.com/presentations/treitel_11-18-09.pdf

2.3 Findings in previous research

2.3.1 Cost increases

When discussing cost increases of airlines, one has to mention the raise in ticket fares as well. In the near future, costs will rise more or less by the ability of European carriers to pass through emission allowances. This is supported by the findings of Scheelhase et al. (2009a, p. 22) and also explained more in detail:

‘If airlines will be able to pass through only the acquisition of allowances to be purchased in addition to the free allocation, we expect an average cost increase per ticket in order of 0.88 € to 1.40 € for a flight of 1000 km, operated by an EU-based network carrier. If the full cost of all allowances needed for such a flight can be passed through, the ticket price increases by up to 4.1 €. The cost increase for long-haul trips can be substantial, if the complete trip is subject to the EU-ETS and acquisition as well as opportunity cost will be passed on to the passenger. The price of a return ticket from Frankfurt to Singapore with non-stop flights of Lufthansa or Singapore airlines could increase by up to 85 € in case of a full pass through and an assumed allowance price of 40 €. However, if Emirates with a stop-over in Dubai is selected for the same journey, the cost increase may be less than 35 €.’

It can be expected that demand decreases, because prices become less attractive to customers, also depending upon the degree of price-sensitivity within the particular customer segment.

Another research objective here is to figure out what actions an airline can take to respond to this negative development and attract customers despite of higher prices.

The next issue also derives from the theoretical background of the cost reduction measures. In addition to cost reduction, low-cost carriers often apply extra fees for services, such as seat reservation, no free food and beverages and charges for using the rest room.

As we can see from cost leaders like Ryanair, many passengers accept these terms and extra charges. For that reason it is useful to know, if more regular airlines would adapt this system as well.

2.3.2 Flight frequency and network structure

Schleifer gives the example of a shortening of 300 flight routes in 2005, which lead airlines to savings of 1.2 billion US-dollars.⁸

Another well compatible factor to network restructuring is lowering flight frequency. For many smaller airlines it is possible to fly only a few times per week certain long-haul routes. They can save costs and also limit the decision making freedom of customers, but leaving them less choice. This also depends on the product range of their competitors, because they can only reduce costs by this measure, if competitors do not offer a significantly greater number of flights on a certain route and do not charge much higher prices.

2.3.3 Alternative fuels

An important sub-topic is also the evaluation of the development of alternative fuels, as it is generally known that fuel consumption is directly related to the amount of emissions released:

“One thing to do is to save fuel, because CO₂-emissions directly depend upon fuel consumption and are measured by it.”⁹

Furthermore, the IATA targets a carbon-neutral growth from 2020 on in their four-pillar strategy for the aviation industry. The pillars consist of technology, operations, infrastructure and economic measures. Bio-fuels belong to the technological area and are estimated to have a CO₂-reduction potential of 80 per cent. Especially promising are bio-fuel of the second generation processed from algae, jatropha and camelina bio-mass.¹⁰

⁸ LH (2006a), p.13

⁹ Interview with Assistant Manager of Flight Operations of Airline B, Date: 26. Jan. 2010, Appendices: p.66

¹⁰ http://www.iata.org/SiteCollectionDocuments/Documents/Global_Approach_Reducing_Emissions_251109_web.pdf

2.3.4 Ecologic marketing

As Schleifer explains, customer behavior comes not only from circumstances, but also from the willingness to accept higher ticket fares in order to protect the environment. Furthermore, this kind of marketing is supposed to attract and change the customer's opinion and attitude towards a comparably cheaper product. With great certainty, it will come to higher pricing of ticket fares in the near future; as airlines need to compensate for the costs of CO₂-reduction an airline could enhance its product value, if it manages to communicate its intentions with credibility to its customers.

The carrier could then gain a "First Mover" position and determine environmental protection as one of their core resources in terms of business strategy, differentiation and Unique Selling Proposition (Schleifer 2009, pp. 92-94).

Based on this result, if we want to determine whether ecological marketing is a good means of differentiation, airline managers' opinions are needed, so the author has included a question about this topic into the primary research part.

2.3.5 Trade incentive

When reading about the incentive mechanisms of emissions trading, it is necessary to ask, if the potential profit from selling unused emission certificates represents enough encouragement for airlines to fully cooperate, or if they demand other incentives as well.

The section about dynamic incentive effect describes the theoretical mechanisms through the cost load by acquiring certificates and the potential profit through selling unused allowances, airlines are supposed to be motivated to develop new ways of emission reduction. These two trade mechanisms outline positive and negative consequences involved in emissions trading.

The greatest benefit is assumed to be the transfer of knowledge between the state and the market, which shall also implement an important basis for further research. Nevertheless, the effect of encouragement also greatly depends on the externalities an airline operates in. Factors within the external environment are the price level of certificates, market liquidity and safety to undertake investments.

To keep an attractive price level of emission certificates, a continuous intensification and economic growth are necessary. Otherwise the incentive would diminish (Schleifer 2009, p. 24).

In case of airlines opposing the emissions trading scheme for reasons of substantial competitive disadvantages on the market, it is interesting to gather opinions about the penalties involved and the moral aspect of publishing the names of airlines, which are not reducing their CO₂ -emissions (Schleifer 2009, p. 37).

2.3.6 Comparison of alliance member and independent carrier

Nowadays there are many carriers focusing on low cost. For this study only on a few general cost reduction measures in the following business areas are taken up such as: ticket fares, cost structures, potential extra fees, reduction of flight frequency and restructuring of flight network (Shaw, 2007, pp.93- 100).

On the contrary, according to Kleymann and Seristö, alliance members may gain potential benefits deriving from their members' cooperation, as illustrated in this table:

Alliance Activity

| | Task sharing | Route network rationalization | Joint bargaining |
|-----------------------|--------------|-------------------------------|------------------|
| Cost item | | | |
| Marketing | * | * | |
| Passenger service | | * | |
| Aircraft crew | | * | |
| Engineering overheads | * | | |
| Direct engineering | * | | * |
| Station and ground | * | * | * |

* = there is significant, realistic cost reduction potential

Source: Managing Strategic Airline Alliances, 2004*

Table 1: Cost reduction potential through alliances

(Kleymann, B. and Seristö, H., 2004, p. 138)

Taking the great cost reduction potential of alliances due to their great bargaining power in the fields of direct engineering, one would suppose that they have a bigger opportunity to buy or lease new aircraft types with less CO₂ -emissions, compared to independent and low-cost airlines.

Built on that, the author wants to examine possible other airline characteristics, which are regarded as useful by airline managers when dealing with cost increase by emissions trading and restrictions. One of the main differences between operating within an alliance, of course there are various degrees of cooperation; and being an independent airline, is flexibility.

Alliance members may have a longer time of response towards (un)expected changes; therefore it will be interesting to see whether flexibility will be mentioned by the interviewees.

2.4 Summary of previous research

Schleifer (2009, pp. 95-99) summarizes the research findings in chapter 7 of her book by giving a synthesis and prospects of results. Several airlines and aircraft operators were asked to give statements about the inclusion of the European aviation industry into the CO₂-emissions trading scheme. She states that:

...the resonance towards interview questions was weak, which leads to the conclusion that there is only a low level of awareness for the explosive nature of the topic within the aviation industry right now. Although all firms emphasize in various publications that they are aware of the necessity for a sustainable utilization of resources, nevertheless, it is difficult to see concrete efforts, which surpass economic motives.¹¹

In addition, the research figured that in the long-run, development of more environmentally friendly products is unavoidable.

“Soon the costs of not acting will immensely rise and balance out the alleged losses in growth.”¹⁰

For that reason Schleifer regards climate protection as a catalyst for structural changes within the industry towards a future-oriented economy.

Eventually, she also mentions that not only the players within the aviation industry, but also the political bodies, who create regulations and make decisions, should also be involved into the actual arrangement of emissions trading .

Scheelhase et al. (2009a, pp. 23-24) have drawn four main conclusions deriving from the use of DLR (Deutsches Luft- und Raumfahrt Zentrum, Eng.: German Aerospace Center) simulation software, of which the author selects two, which are significant for this study.

¹¹ Schleifer (2009), p. 95

The result of their simulation was that airlines will have to acquire CO₂ -certificates for about 40 per cent of their emissions. Almost all airlines are going to need to purchase additional emission allowances starting from 2012. Only carriers entirely dealing with cargo on long-haul operations will be able to stay below the emission cap.

Referring to the costs, the estimated price per ton of CO₂ lies between 25€ and 40 €, which is going to cause the aviation industry costs of 1.8 to 2.9 billion € only in 2012. The researchers regard the emission reduction potential of the industry as rather low.

A point of great interest is also the finding of a big competitive disadvantage of European carriers with regard to the new regulations. Their model revealed that:

“...the percentage of free allocation of allowances compared to allowances needed for EU-carriers will remain far below the corresponding level of non-EU carriers. This is because the former operate their feeder network with relatively high specific emissions under the ETS, while the latter operate only relatively more efficient long-haul flights to and from Europe. This implies a systematic disadvantage for European network operators.”¹²

This result is confirmed by a more detailed analysis of Scheelhase et al. (2009b, p.24), but they also add other research findings, such as the assumption that the incentives of emissions trading could encourage European carriers to optimize their network structures. By substituting hub connections more often by direct long-haul flights, they could increase efficiency. Nevertheless, currently the expected future price levels for allowances and the benefits of hub-and-spoke networks still outweigh the costs of the ETS.

Scheelhase et al. suggest as solution for the competitive disadvantage the introduction of separate benchmarks for different routes, although it would make the EU directive more complicated.

¹² Steigenberger (2005) p. 2

2.5 Research gaps

Discussing Schleifer's results, the author wants to figure out how high the awareness of emissions trading within airlines really is, how big the influence of ETS on structural changes is and how big the incentive to reduce emissions eventually is within airlines.

Regarding the other research paper by Scheelhaase, Schaefer, Grimme and Maertens (2009), the writer would like to emphasize that they have given good estimations and forecast of likely future ticket prices. Additionally, they have also figured out the relationship between price level increase of ticket fares and the degree of full or partial cost pass through.

As we can see, they have applied quantitative research in forms of a software programme to calculate their results. The author regards her research as a valuable supplement to their quantitative approach. This study attempts not only to gather statements of professionals within the industry of how ticket prices and cost structures are likely to be affected, but also of how airlines can prepare on tactical and strategic levels for the coming changes. This additional information will present generally applicable and possible solutions to the research problem. The common point is that all airlines facing the same restrictions, but here the aim is to examine differences in opinions and approaches from which the problem can be analyzed. Also the practical aspect is of great importance here, because the targets require a certain CO₂ -reduction potential in order to be fulfilled in practice, but it remains to be seen how big the actual effect on emissions reduction will be in practice.

3 QUALITATIVE EXPLORATORY APPROACH

3.1 Qualitative research

The interview guides are used during qualitative interviews. There are two different sets of questions, because airlines are supposed to state their opinions about the economical side, whereas governmental bodies and researchers shall provide a good theoretical and macroeconomic background. In the following paragraph, the author explains why this method is particularly suitable for her thesis.

A survey would not be so useful, because the customers or airline passengers do not have the knowledge needed to find an answer. They are also not directly involved, because they do not usually see significant differences between airlines. The author supposes that to leisure travelers, the price is most important and will limit the research to this segment.

A focus group would be also not suitable as the student targets certain airline businesses and may need confidential information.

The members of a chosen focus group may not be willing to discuss these issues, because participant may be reluctant to openly express their opinion and may prefer to discuss more sensitive matters in person. When undertaking focus group interview a location is needed where all participants are gathered together. This is however, not possible for this study, as the participants are located in great distances from each other and lack the time and resources to meet at a pre-defined point.

Qualitative research is especially useful for issues where the location of knowledge is unclear and cannot be found from other sources, but experts or professionals. Secondly, it is often used to describe complex topics and products, because there are many factors influencing them and results depend upon different circumstances. Thirdly, there is often no obvious answer, but a complex answer, which cannot only or not at all be answered by quantitative research or evaluation (e.g. scaling 1-5).

This thesis requires a deep economic understanding and specific knowledge, because it is targeted to assess macroeconomic developments as well as tactical and strategic options, which are supposed to be determined by interviewing professionals. It is a complex issue and due to confidentiality reasons and information access supposed to be kept general.

The general approach is especially here very useful, because it is a global phenomenon, which will be applied to many airlines. In other words, all airlines will have to face the research problem.

Probably there are no clear or definite answers, so the author intends to use open-ended questions to determine the magnitude of the problem.

Of the methods introduced, the author chooses the qualitative method with focus on explorative research, for the reason that she expects to get a generally applicable knowledge to answer the problem.

Afterwards she will summarize the key statements and connect them to realistic background circumstances based on theories to be able to proof the validity of her findings.

3.2 Expert interviews

The researcher wants to use qualitative interviews and select persons of different fields within an airline and from research facilities to get a more realistic picture and a greater variety of views. Her sample includes about 8 persons of different backgrounds.

Five persons are airline managers, one interviewee belongs to a research team and two other persons are members of governmental bodies.

If they say roughly the same, she assumes her sample to be big enough and she cannot gather better knowledge by interviewing more people. Contrary, if there are differences or disagreements, the respective areas will be suggested in the section for areas for further research and can hence be examined further by other researchers. Then it will be easier to target exact problems and find possible solutions.

The writer is limited to four airlines, so there is a suitable amount of data to compare their differences and similarities. She expects her results to contain the same basic theories, but the strategic approaches, opinions or attitudes may be different.

The author will exclude quantitative data, because as mentioned earlier, it is very difficult to measure interrelationships, not to mention attitudes, numerically as a single researcher and within a limited amount of time.

The use of relevant theories and background knowledge is essential to validate research results. Then she would expect to obtain a better ability to back up and justify her conclusion. Furthermore, she will visualize the key factors, advantages and disadvantages, as well as similarities and differences in the end.

3.2.1 Description of the primary research

As mentioned above, the airline industry is not as extensively researched in Finland, as in Germany. Firstly, due to Finland's peripheral location within Europe and secondly, because of the small industry size. Finland has only one national carrier: Finnair, whereas most the other operating airlines only have service points at the Helsinki-Vantaa airport.

The most difficult part in the planning stage has been to actually obtain interview confirmations with companies and researchers.

There were many rejections, but after a couple of months the author has received enough confirmations for personal or e-mail interviews. One airline was interviewed in Finland, whereas the others are of German origin.

Her supervisor helped her to increase the likelihood of getting interview by generalizing the topic and therefore reducing the risk to get rejected. No confidential or sensitive information was required, but the interviewees were supposed to talk about general aspects and they were not expected to focus much on their company related information.

The primary research required good planning and time management, as it was necessary to travel through Germany between several different cities within only three days:

26.01.10: Morning Hamburg-> Bremen, afternoon: Bremen-> Cologne

27.01.10: Afternoon: Cologne-> Berlin

28.01.10: Afternoon: Berlin-> Hamburg -> Kiel

Now, the author summarizes the steps of conducting her research also to support other researcher's project planning:

- Developing suitable interview guides: max. 10 or 11 questions, simple and clear, not too specific, including general topics.

Before the Interview

- First contact by e-mail
- In e-mail: introducing the topic, stating the purpose of the study, interview request, stating the timeframe; good if the company can see also an advantage If request accepted: send interview questions at least 2 weeks in advance

- Agree on date, time, duration and place
- Plan the travel arrangements: transportation, hotel and how to get to the interview location (leaving enough reserve time in case of delays and when switching transportation)
- Advisable being in the city one evening before the interview

During the Interview

- Take your passport with you (some institutions may require identification)
- Have an extra copy of the questions with you (in case the participant forgot)
- Take a voice recorder (test in advance!) and note book with you
- Ask if voice-recording is accepted
- Don't influence their answers by asking about unrelated issues or directing them into a certain response
- Don't distract them in any way (e.g. by being nervous)
- Keep eye contact, show your interest and listen to them
- Only explain the questions if something is unclear to them

After the Interview

- Write the transcripts
- Send the transcript to the respective interviewee and ask for explanation if something is unclear from your side
- Give them a chance to confirm or change their answers
- If they change something, adapt them and correct the transcript
- If they don't reply, keep the transcript as it is
- Send a copy of your thesis, if the interviewee requests it

3.3 Linkage between theories and interview questions

From the theoretical background introduced in section 2.3, the author has developed two different interview guides: one for airlines and another one for institutes and researchers dealing with the topic.

The **interview guide** for airlines:

1. What major developments can be expected for the airline industry when emissions trading will be introduced?
2. How can airlines prepare for the coming emission trading scheme?
3. What kinds of different options (short-term and long-term) are available to adapt to the coming changes?
4. Which of these options would be realistic and why?
5. How are ticket fares and cost structure going to be influenced (by higher costs through taxes and purchase of emission certificates)?
6. Do you think there will be more extra fees in the future due to ecological reasons? What type of fees could that be?
7. Do you think airlines are likely to reduce their flight frequency and restructure their flight network due to the new regulations?
8. How do you see the general development and use of alternative fuels?
9. Do you regard ecologic marketing (*communicating environmental protection as a core resource to customers/ the environment*) as a good way of differentiation to gain customer attraction/ loyalty in the future?
10. Do you think there are differences in the capabilities of alliance members and low cost airlines to reduce emission? If yes, what could these differences be?
11. Regarding trade of emissions certificates: Do you think the profit from selling unused certificates is a strong incentive for airlines to reduce their own emissions?

The **interview guide** for researchers and institutes:

1. Do you regard a global emission trading scheme as possible?
2. How have you been following and preparing for emissions trading?
3. What macroeconomic developments do you expect in the aviation industry when emissions trading will be introduced?
4. How much CO₂ -reduction potential do you see in the aviation industry?
5. Do you think more flexible regulations could lead to a higher compliance of airlines with the emissions trading scheme?
6. Are there any federal initiatives that support airlines to set up and improve their emissions monitoring systems?
7. Are there financial resources that make it easier for airlines to acquire more environmentally friendly technologies?
8. How do you see the development and potential of alternative fuels to be used on a large scale in passenger aviation?
9. When do you think alternative fuels will be at an affordable price for airlines and ready for mass production?
10. Do you think the prohibition of emission intensive aircrafts would make sense?
11. What can be done about the disadvantages European carriers are going to have, because of the emissions trading scheme?

3.4 Description of airlines and institutions

3.4.1 Airlines interviewed

Airline A was founded in 1988 and had operated formerly as a domestic carrier in Finland. In 1998 it became a fully-owned subsidiary of the Scandinavian Airlines group and one year later they established hubs in Copenhagen, Stockholm and Oslo.

The number of routes has increased rapidly in 2004, new domestic routes are added and during the following years a big expansion within Europe took place. Also in 2009, 5 new routes were introduced.

The main markets of the airline are Finland and Northern Europe and its target customer segments are in European business and leisure travelers.

Airline A's hubs are located in Stockholm, Oslo and Copenhagen, from where they provide connections to the USA and the Far East.

The average age of airline A's fleet is with 10.7 years rather low, what makes it to one of the youngest in Europe operating 13 aircrafts. According to figures from 2008, the number of passengers transported per annum is 1.6 million and they have 66 daily flights serving 24 destinations. The turnover amounted for 210 million Euros

For this study, the director of network planning and revenue management; and the vice president of operations were interviewed.

Airline B was established in 1958 in Germany as a part of a holding and it is owned by the shipping company AG EMS. It is a small regional carrier that offers direct connections from their main airport in Bremen to Bristol, Brussels, Copenhagen, Nuremburg, Toulouse and Zurich. The main market is focused on the one hand on North Sea coastal traffic including the East Frisian Islands, Helgoland and Wangerog; On the other hand the charter traffic within Europe and to the East Frisian Islands traffic represents another important economic pillar.

Figures from 2008 show that Airline B had a little over 10.000 passenger and also transported about 220.000 packages to guarantee sufficient supplies for the island population. The fleet consists of 16 aircrafts with a seat range from 3 to 100.

The author interviewed the Assistant Manager of Flight Operations, who studied flight economics in England and worked as a tutor at the University of Applied Sciences for traffic and transportation in Erfurt before he moved to Bremen.

The following interviews were undertaken via e-mail as it was more convenient to the interviewees.

Airline C represents a brand that derived from a fusion of two branches of big German limited liability company operating in the logistics industry. It is owned by one of the biggest tourism corporations worldwide and its headquarters are situated in Hannover, Germany.

The airline has been operating under another brand name since 1972, but the current operational brand was founded in 2007.

As main business areas, airline C calls itself a charter flight company and provides short- to medium- haul flights. One has to remark that airline C is no alliance member but an individual carriers.

It flies to 74 destinations within 16 countries, having 300 flights per week. The fleet consists of 41 aircrafts most of which are Boeings of the classification 737 and the current average fleet age is 8 years.

Airline D was founded in 1955 by a holiday airline. The home base of the airport is in Frankfurt. It is mainly a charter flight organization that serves 10 airports in Germany. In the long-haul route network various flights to the United States, South America, Canada, Great Britain, Africa and the Middle East are available.

Concerning the short- and medium-haul network it concentrates on European destination. Its focuses main markets are focused on tourist destinations around the Mediterranean Sea, Canarian Islands as well as Madeira, Canada, North-Africa and Northern Europe.

The latest developments were improvements in technological areas, such as aerodynamics, reduction of thrust in the landing phase and new winglets to achieve kerosene savings of about 4 per cent in 2009.

The main aircraft types in the fleet are Boeing 767 (9 aircrafts, average age 16 years), 757 (13 aircrafts, average age 10 years) and Airbus A-320 (12 aircrafts, average age 9 years). 34 aircrafts are currently operated. There are also various co-operations with car rental companies, hotels and resorts; and several partner airlines. The interview contact was the press agent of airline D. Some remarks about his career: He had studied legal matters and political sciences in Freiburg, Paris and Berlin. Prior to his employment at Airline D since May 2009, he was employed at AOL Germany as communications manager.

3.4.2 Institutions interviewed

As third interviewee the student selected an institution to grasp also the more theoretical aspects. The German aerospace center is a research center with main four areas of expertise: aeronautics, space, transport and energy. It cooperates in international ventures and employs about 6500 people. There are research facilities in 13 different locations within Germany.

The DLR's mission is:

- Exploration of the earth and the solar system
- Research aimed at protecting the environment
- Development of environmentally-friendly technologies to promote mobility, communication and security.

The contact person for this study holds a diploma in merchandise and has been working in the German aerospace center for four years with focus on the aviation industry.

The fourth interview was done with an economist and researcher from the German emissions trading institute (DEHST) which is the competent authority for emissions trading in Germany. It is a department of the federal environmental office and their responsibility lies in the implementation of climate protective instruments which are stated in the Kyoto Protocol. These are emissions trading and the project based mechanisms of Joint Implementation (JI) and Clean Development Mechanism (CDM).

The DEHSt's main areas of responsibility within the aviation industry are: ¹³

Participants:

- Administration of aircrafts operators and their administering member states
- Support: workshops, sample monitoring concepts, descriptions of procedures, advices and guidelines

Monitoring:

- Detailed description of procedure, guidelines, content, requirements
- Approval of monitoring concepts

Electronical communications:

- Virtual post room (VPS) as secure and lawful means of communication between the DEHST and aircraft operators
- All forms available online

Emissions trading:

- Ensuring ecologic integrity, competitive neutrality and low transaction costs
- Cooperation with companies of the German industry
- Processing of application for and allocation of emission certificates (mainly by electronic communication)
- Account management of the national registry
- Annual emissions reports
- National and international engagement in development and improvement of emissions trading.

¹³ http://www.dehst.de/cln_153/nn_476194/DE/Luftverkehr/Luftverkehr__node.html?__nnn=true

The following interviews were undertaken via e-mail as it was more convenient to the interviewees.

The last participant in this study was a secretary of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, more particular the Division KI I 2 – Legal Issues Environment and Energy, Climate Protection; Emissions Trading. She has a diploma degree in economy and was involved in the negotiations about the emissions trading regulations. The institute has the obligation to take on the legislative responsibilities concerning emissions trading, whereas the DEHSt acts as an executive department for this matter.

The BMU (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, Eng.: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety) could not give very detailed answers, because the author's questions were more of a practical nature and not too much focused on the legislative side. Still, their statement on the first questions about the possibility of global emissions trading was rather helpful.

3.5 Reasons for interviewing selected experts

It was useful to interview not only airlines but also institutes as they provided the necessary and useful background information to understand and assess the aviation industry. The researcher of institute A has been examining similar issues as the topic of this thesis, but he and his team have mostly used quantitative modeling.

Therefore he was chosen due to the ability to give reliable industry-wide estimations that can be compared to the results of this research.

The economist of institute B, could state some good points about the administration of emissions trading, creation and auctioning of certificates. The purpose of choosing this contact person was to extend the knowledge in the administrative area. The same is true for institute C.

The interviewees within airlines were of course chosen to give a microeconomic perspective. Three of them are managers of flight operations, one is responsible for network planning and revenue management and the other person is a communications manager.

They were selected because the author wanted to have a better result by being able to compare the different opinions of persons from the same field.

In this thesis, the author used different angles. On the one hand, there were four airline perspectives which do not only need to practically implement the regulations, but also to embody them into operations and business processes.

On the other hand, there were the research and administrative institutions that were either involved in studying factors closely related to emissions trading, or active in law negotiations, preparation and administration of emissions trading.

The aim is to get a more realistic picture of the research problem as most persons from rather different fields were replying to a selected range of problem involved in emissions trading; problems or unclearities that derived from the literature.

3.6 Table of persons interviewed:

Personal Interviews:

| Company/ Institution | Positions of person(s) interviewed | Interview date & time | Interview location |
|---|---|--------------------------------------|--------------------------------|
| Airline A | 1) Director of network planning & revenue Management 2) Vice President of Operations | Friday 15.01.2010 13:00 | Vantaa- Airport, Finland |
| Airline B | Assistant Manager of Flight Operations | Tuesday 26.01.2010 14:00 | Bremen, Germany |
| Institute A, the German aerospace center | Research Associate | Wednesday 27.01.2010 14:00 | Cologne, Germany |
| Institute B, institute for emissions trading | Economist and researcher | Thursday 28.01.2010 11:00 | Berlin, Germany |
| | | | |

| | | | |
|--------------------------|--|---------------------------|-----------------|
| Email interviews: | | | |
| Institute C | Federal Ministry for the Environment, Nature Conservation and Nuclear Safety | 20.01.2010 | Berlin, Germany |
| Airline C | Coordinator of Fuel& ETS, Flight Operations | 27.11.2009 and 09.02.2010 | By Email |
| Airline D | Head of Communications | 20.11.2009 | By Email |

Table 2: Table of persons that were interviewed for this study (created by the author)

4 EMPIRICAL RESULTS

4.1 Detailed description of the key findings

As a matter of clarity and structure, the author has divided the most important results from the interview answers into topic areas. It is easier to focus on these areas than to determine key questions, because often the participants' responses were focused only at the beginning on the question, but then they gave manifold replies not directly concerning the question.

It is to note that airline D replied to only seven questions, because the author sent a set of seven questions to some airlines for pre-testing and improving the questionnaire design.

4.1.1 Industrial implications

Airline A bases the ability of airlines to cope with ETS on two factors: the fuel-saving programme and current state of the fleet. They are using themselves a fuel-saving programme, but not all airlines especially small carriers may have one, or it may not be sophisticated enough to follow the fuel consumption in great enough detail as required by the regulations.

Concerning the fleet structure, they state that airlines with a younger fleet have an advantage due to more efficiency. Airline A supports the fact that the reduction of overhead costs is directly related to a decrease of emissions.

With regard to business models, they do not see any big differences between alliance members and low-cost carriers. It depends again on the one hand on the fleet, but on the other hand on the degree of efficiency an airline is able to reach.

However, the two managers see a small potential difference concerning the fuel issue, because alliance members exert a greater influence by belonging to the fuel pool. As a member, an airline can hedge the fuel price and therefore gain a cost advantage. Small and independent carriers do not benefit from this financial instrument.

Airline B assesses the current industrial state as a waiting phase, because many airlines are waiting to get their monitoring reports approved by the local competent authority.

The Assistant Manager of Flight Operations assumes the impacts by emissions trading to be quite low. The effects on network carriers should be very low and airlines that get problems due to emissions trading have most likely had economic difficulties already before the ETS. Anyway, he is of the opinion that certain business models are favored by ETS, namely those with big aircrafts in the fleet and a large number of reservations. In the end, low-cost carriers therefore get higher allocations when reporting higher values of tonne-kilometers, so they do not need to buy many additional certificates.

Compared to alliance members, he does not see any advantages, as every alliance member is anyhow responsible itself to manage emissions trading. There would be a great benefit in reduction of administrative costs, if the alliance would undertake ETS management for all members, but the Assistant Manager thinks it is not handle that way due to the desire for individuality and freedom.

A big point of criticism for airline B is the Annex I in the directive of emissions trading which states that military and governmental flights are excluded from ETS. This is seen as unfair and very undesirable in terms of environmental protection. The question behind it is also the usefulness connected to it. It seems that this kind of traffic is more valued, so the general aviation sector is subject to emissions restrictions and obliged to pay.

Airline C expects mostly two developments: higher incentives to increase efficiency and focus on the operation of modern aircrafts.

It is stated that all airlines have the natural common goal to gain savings and reduce aircraft weight, because then the kerosene consumption will be lower what directly translates into fewer emissions.

Airline C expects alliance carriers to have problems with this, because they are using the 3-class configuration business model (cabin seats by classes: first class, business class and economy class). Also institute B supports this argument, but expects that European airlines will benefit from the pressure to more efficiency in the long-term. Of course, some airlines are likely to lose market share, but the price sensitivity is not as high as is generally assumed.

The fourth airline D focuses its answer on aircraft constructors. They expect increased pressure to develop more efficient aircrafts as only these are going to be bought and used by airlines.

Institute A mentions two other aspects of macroeconomic developments.

Institute B supports the previously mentioned assumption of a worsening in competitive structures, at least in the short-run. Nevertheless, in the long-run those airlines who have improved their efficiency first will have an advantage when kerosene prices will rise. On the example of the stationary trade, still making profits after the introduction of emissions trading, institute B expects a similar course for the airline industry. They do not see big effects and name factors with much higher impact, such as the crude oil peak in 2009, the financial crises, SARS (Severe acute respiratory syndrome) and the terror attacks of the 11th September 2001.

In their opinion most airlines support emissions trading in order to avoid a kerosene tax as it has been undeniable that something must happen within the industry. Only if emission certificate prices would rise above 100 €, the impact would be considerably big.

As for macroeconomic factors, institute A regards it as beneficial for airlines if they additionally to passenger-traffic also transport a lot of freight that can be then counted to reach a higher benchmark. Furthermore, third-country carriers have more efficient flight since they operate their short-haul network outside of the emissions trading zone and only serve Europe with long-haul flights.

This presents an actual competitive problem for European carriers. Institute A also supports the assumption that European airlines will get higher administrative costs through ETS.

4.1.2 Approach towards ETS

While airline A has been focusing on their fuel saving programme and does not see other options than to obey the laws, airline B states that small regional carriers like them, do not have the administrative resources needed to deal with emissions trading. The Assistant Manager of Flight Operations is actually the only person managing emissions trading for the airline.

As first step he explains, they interpreted the new regulations for themselves. Then they integrated them with little problems due to their already good software and small company size. They had been already monitoring and plotting their flights, so they only needed to do the same with the fuel consumption, because when the amount of fuel that was used is known, also the release of CO₂ can be calculated.

When preparing the monitoring report, they preferred to take consultant from the stationary trade, as he was already familiar with both the determinations of pre-models and the preferences of the German emissions trading institute. Generally, there are two parts involved in reporting: CO₂ -emissions and capacity in tonne-kilometers, which is only used to determine the amount of certificates to be freely allocated.

Airline C basically used the same approach.

Airline D, which is a bigger carrier, had set up an ETS-team that operates across several business areas. Their main obligations are the evaluation of aircraft operation techniques, but besides that they are also involved in IT, politics, flight- and capacity planning, as well as fuel management.

Institute A has an own fleet which is not excluded from emissions trading, because it falls under the category of research aviation. They have been following everything since they have an advisory function for the Ministry of Transportation which then again comments upon legislative measures. The main interest of both parties is the determination of likely effects for the German aviation industry.

While in beginning institute A only researched only a small number of big carriers (e.g. Lufthansa), they have been constantly extending their airline range of examination and can now make industry significant and relevant predictions.

Differently, institute B only followed the negotiations concerning the European regulations. In cooperation with other European authorities they have been impelling the implementation and progress of ETS.

As soon as decisions were made, they as the local competent authority for Germany needed to create the respective amount of certificates and undertake the auctioning of them.

Furthermore, institute B has had already the relevant experience from the stationary trade and then got expertise about the aviation industry using learning-by-doing. They had also created an entirely paper-free and secure electronic system that only needed to be slightly modified for the aviation industry in order to implement it.

As a general attitude, all institutes agree that emissions trading is a very good instrument, leaving the participants a lot of freedom where to reduce emissions, and no more flexibility is needed. Actually more flexibility would even have a negative effect by complicating ETS a lot more, therefore the administrative costs for airlines would be higher and they would need to modify their electronic system again in order to monitor for example according to different benchmarks. Commonly there has also not been a lot of resistance against the form how ETS as applied now.

4.1.3 Fuel issues

The following issues are focus on the factor fuel. It is stated by airline A that the fuel consumption increases with the age of an aircraft. They compare it to an old car; because the more a plane is worn out the more it uses fuel, what amounts for an annual increase of 0,5 to 1.5 per cent. Therefore a good target is to have a uniform fleet, but they say this is not easy to achieve.

Airline B regards SOPs in means of weight reduction and use APUs (Auxiliary Power Units) or GPUs (Ground Power Units) of as the area with the biggest potential of fuel savings for themselves.

APUs and GPUs are small vehicles are powered by current sinks and standing on the airport ramp they act as support units for the aircraft when it is on the ground.

Furthermore “profit-tankering” is also a method to lower fuel consumption that is quite excessively practiced by some airlines. Logically, of course also with regard to the respective price level; the fuller the tank, the higher the weight transport and the greater the amount of fuel used and emissions occurring. Therefore airlines must determine their focus. Low-cost airlines for instance often tank full to keep their turnaround times as low as possible to offer more frequent flights.

The airline C also mentioned the fuel-weight relationship and airline D did not give an answer due to strategic reasons.

4.1.4 Alternative fuels

Next the author summarizes the responses towards alternative fuels. The first airline is very positive about bio-fuels, but they nevertheless see two problems. Firstly, they say that fossil fuels need to become so expensive that alternative fuels really get into business. Secondly, large scale production is problematic and costly, because big amounts are needed in to supply the entire aviation industry. It will still take at least 10 years until they can be used more widely.

Airline B is of the same opinion, but further also several other important points are mentioned. When kerosene is substituted, it is of no use to merely switch between two scarce resources, but a renewable and long-term alternative must be found. The Assistant Manager said that he likes the idea of algae fuel, because it re-grows and is extendable.

Nevertheless, the entire kerosene substitution aspect is very infrastructural and heavy. Aircrafts are amortized over a long timeframe and when new fuels are developed, new aircraft types are needed as well. According to Airbus, there will be no revolutionary technological developments within the next decade. Coming back to alternative fuels, in order to use them on a large scale new storage facilities must be build, different tankering facilities and many other infrastructural parts need to be changed or at least modified, which is very costly.

Also airline C agrees, but they emphasize the considerable advantages bio-fuels could offer in terms of environmental protection. According to them alternative fuels are the future of aviation, but again the development is greatly dependent on the oil price development as well.

Last but not least, airline D takes the same position, but additionally mentions that bio-fuel are useful to reduce the dependency of airlines on kerosene.

Institute A brings up some interesting aspects giving the example of Tuifly which is interested in opening a Jatropha (an oil plant that grows on soils where no grain can be cultivated) farm in Mozambique. The most important properties of alternative fuels are: non-competition with food, low or no greenhouse gas emissions and feasibility in terms of production and costs. When cultivating such biomasses like Jatropha in developing countries, one could besides the positive environmental effects also include the development thought. Locating cultivation in a developing country could represent a valuable additional income source for the population and improve the economic state. Bio-fuel from algae is also interesting as it re-grows, but it is unsure what spatial size is needed for cultivation to be able to supply the entire aviation industry. Additionally, it is also costly and needs a lot of effort to determine the most suitable algae type for this purpose.

The greatest difficulty lies then in the certification of these fuels as they need to fulfill high requirements to be applied in aviation. Therefore the greatest potential lies in the use of bio-fuels - kerosene mixtures which are coming this or next year. This may also be beneficial in terms of properties since pure bio fuels are not as frost resistant as these mixtures.

Another advantage is that they are assigned with the emissions factor zero in the ETS regulations, so airlines would not need to purchase emission rights for them. Anyhow, current certification initiatives only concern mixtures so far and not pure bio-fuels.

Alternative fuels from more exotic resources, for instance hydrogen, are more unrealistic, because it would require a totally new technology and substitution of facilities; therefore it would become too expensive.

The Fischer-Tropsch process (creating fuel from any kind of biomass) is another alternative which is nonetheless rather undesirable as it shows very bad emission results.

As mentioned earlier, institute B also thinks the development will depend greatly on the oil price development. Theoretically, alternatives to oil definitely exist, but they are just too expensive as for now.

Institutes B and C gave the same answers, but they are rather careful as they are not specialists in that field.

4.1.5 Fleet structures

In the following section is a compilation of, airline opinions about fleet structure and features.

Airline A did not mention anything in particular in reference to the topic besides that a newer fleet is beneficial when coping with ETS, while airline B believes a fleet consisting of bigger aircrafts has the advantage of getting a lower number of fuel-consumption per seat. Due to the fact that regional carriers usually operate smaller aircrafts, because travel distances are short, it gives them a disadvantage. Therefore some routes may become uneconomic since additional certificates will be required, because the capacity per tonne-kilometer is not high enough, so the disappearance of some regional routes is to fear. It is also very likely that many airlines will eliminate small aircrafts with seats below 50 from their fleet, which will be also referred to later on. Furthermore, the ecological aspect also influences and focuses the long-term fleet strategy and there is a need for improvements.

Airline C refers back to capacity utilization, but they regard it as only partly controllable. As further options in relevance to fleet, a prohibition of emission-intensive aircrafts and intensified investments into a new generation of aircrafts are both possible.

The substitution of planes is moving into focus, not only based on and encouraged by ecological factors, but it is also strongly influenced by the kerosene price of course.

As a summary, every institute said that on the one hand airlines do generally not operate emission-intensive aircrafts and on the other hand the prohibition is not a priority and would be only useful in case of a long-term utilization of such aircrafts despite the costs and environmental aspects.

4.1.6 Flight ticket fares and possible extra fees

The next important key matter is changes in ticket fares and potential extra fees due to emissions trading. According to airline A, fares are strongly adjusted to economic downturns such as the current crises. They further explain that fare structures are very complex and quite old, so it is not easy to adjust them. As an example, one route may have up to 20 different fares related to it, but still there are hundreds of other fares in connection with different corporate and agents.

These structures impose difficulties on many airlines and instead of introducing extra charges and complicating them even more, some airlines are trying to get rid of some fees, such as fuel surcharges. The managers do not expect the introduction of additional fees, but ticket prices will be modified according to and based on the cost indices.

In reference to a current study by Air Transport World the extra costs per flight ticket will stay below 1 €.

However, airline B argues that some important factors were left out, namely the additional administrative costs arising, for instance personnel to follow emissions trading, purchase of measurement equipment. The overhead costs will be higher when the administrative costs within the fixed costs rise. Personally, the Assistant Manager of Flight Operations assumes the extra costs to amount for 4 € per ticket at the most. Taking into account the differences between small airlines and network carriers, he expects that these costs will be a little higher for small airlines, because they can't spread these costs across a big customer base and amount of flights as big carriers can.

In addition he is strongly persuaded that some low-cost airlines, for example Ryanair and EasyJet, will try to introduce an extra charge and customers will believe it as they cannot see through it. There are always some airlines that use the ecological aspect for their purposes as they have already done with fuel surcharges.

Concerning the potential of ecologic marketing as means of differentiation and customer attraction, both airlines A and B commonly do not believe customers can be persuaded to pay more due to ecological reasons.

Airline A thinks that the younger generation would be more likely influenced as they are much more aware of environmental protection, but most customers would not pay more, because they are very price-sensitive. Nevertheless, it is a part of airline A's corporate culture.

Airline B argues that nobody has really intensively tried to use ecologic marketing so far, so he is not so sure about it, but definitely both leisure and business travelers are very price-conscious.

Airline C is very convinced that there will be extra fees depending on the "cost-pass-through" ability of the respective airline, whereby low-cost airlines will have more difficulties. The Coordinator of Fuel & ETS, Flight Operations tells that especially in the low-cost segment price-sensitivity is very high, because price is one of the most important means of differentiation. He expects no extra fees in the short-run, besides maybe a cost transfer of emissions trading expenses to the customers, but in the long-run additional charges are quite possible.

Airline D also explains the relationship between oil price and ticket fares and state that nowadays few airlines are still able to reach their break-even point, most are reporting losses, so they think an adjustment of ticket prices (to emissions trading) is inevitable.

In the statement of institute A is explained that emissions trading has a similar effect like a fuel price increase. The main point is really how well an airline can distribute the costs upon the passenger-kilometer value per single ticket.

Surely, the total amount of 30-40 per cent of emissions certificates needed is a lot, but when distributing it across a large number of passenger-kilometer, it is not much money at all.

Institute B explains further that in accordance the impact assessment study of the European Commission the additional expenses of long-haul flights will be maximum 40 €. In the end it does not make much of a difference in the total price considering a long-distance flight costs already 1000 €. Institute C states exactly the same and refers to various studies that show small effect on the industry coming from emissions trading.

4.1.7 Routes, the flight network and flight frequencies

As next point, the author takes routes, flight network and frequency. Actually airline A tells that they are currently adjusting their flight frequencies and capacity to the economic crises since the demand has been in decrease from 2009 until now. To them clearly the market situation is far more influential than emissions trading in this context. In conclusion they rather regard emissions trading as one variable within the total cost structure, so it does not take priority. Only if the price per tonne CO₂ becomes very high, it would definitely affect network planning and fleet decisions.

The Operations Assistant Manager of airline B expects the disappearance of some regional route, because he is already seeing that regional airlines are having difficulties on the German market. Some examples are that Eurowings takes half of its fleet out of service and Contact Air focuses on operating from Stuttgart as home base, while Lufthansa is also likely to take out planes below 50 seats because operating such small aircrafts becomes economically unviable. This is of course only partly due to the environmental aspect, but more based on costs and decreasing demand.

Interestingly, institute B does not expect stopover as it would be too costly, but they could imagine that airports like Zurich, close by the EU-trading zone will be utilized much stronger and modify their network according to that. Many studies have presented the result that intermediate landings are much more expensive than buying additional certificates.

However, airline C sees it as an important part of their brand image to gain customer awareness of environmental issues. Besides that, they also regard it as a product feature as it represents a qualitative attribute.

Institute A brings up the important point of where an airline has situated its hubs. Foreign airlines with hubs and short-haul traffic outside of the emissions trading zone clearly have an advantage as most of their flights are not subject to the regulations.

4.1.8 Trade of unused emission certificates as incentive

As next aspect the trade of emission certificates is selected. Airline A is rather unsure if the potential profits from selling unused certificates can be an incentive. The biggest problem is that airlines can only buy additional certificates from the stationary trade, but not vice versa. Therefore a market restriction is imposed.

Another area of concern is the price development of these certificates, because they do not know if it will be more profitable to use all certificates themselves or to try lowering even more emissions and then sell the remaining certificates on the market.

Airline B regards emissions trading as a good potential income source. Nevertheless, they are also criticizing the market restriction. For them it is not a feasible option, because it is not worthwhile to engage in trading when only an annual amount of 80.000 tonnes CO₂ is released. When the Assistant Manager reminded of the last stationary trading period he emphasized that prices were close to zero simply because a great amount of certificates remained unused. He assumes that almost all airlines will need to use all freely allocated certificates themselves, so no big profits can be expected. Additionally, an airline that wants to trade needs a sufficiently big administrative background, therefore bigger airlines are more likely to engage in trading.

Airline C recognizes an incentive, but regards it as quite small, because the price of certificates is a key variable and the prices are just too low.

4.1.9 A global emissions trading system

When asking about the possibility of a global system, both airlines B and C were very positive about global emissions trading as a long-term solution and very desirable. Airline B described it as nonsense that every participating state has to assign an own competent authority and it would be much better if a global system were set up under the ICAO (International Civil Aviation Organization), as it already has a comparable structure to the EU. It would not only simplify the entire process but also retain competitive structures and fair market conditions. This statement was also supported by airline C.

Global emissions trading was not a direct question towards airlines, so there is no statement from airline A in reference to this issue.

All institutes regard a global system as the best solution in terms of environmental protection and retention of fair competitive structures. At the moment it is rather unlikely due to the many different interests. Especially countries with a developing status but at the same time having airlines listed in the top 20 of the world's most successful ones oppose a global system. First the EU needs to find strong partners, such as the USA or Canada, so the majority of emissions (up to 90 per cent) could be included. When other countries see that the system functions well they are also likely to agree. Due to the long timeframe such decisions take and possible modifications of regulations to show goodwill, nobody knows how long it will take.

As last sub-aspect, there is no direct federal support or financial resources available to support airlines in their attempts to reduce emissions in any area. However, the local competent authorities offer support by organizing workshops, publishing information and offering assistance with monitoring. Indirectly, the money that goes to research projects and institutes is beneficial for airlines since innovations can reveal new alternatives of cost and emissions reduction. Relevant federal ministries are also undertaking projects within the climate protection initiatives to achieve progresses in various fields.

Last but not least, the consulting industry is really benefitting from the uncertainty and unfamiliarity of many outer-European and some European airlines with emissions trading and therefore they seek assistance of (expensive) consultants with expertise.

4.2 Summary of main research findings

The writer has created a summarizing table to make it easier to see where the interview participants see advantages and disadvantages, as well as common factors and discrepancies by airline type. It consists of the answers each airline gave about its expectations on how different airline types are going to be affected by emissions trading. Additionally, it serves as a visual aid to summarize clearly what developments and attributes are assigned to these airline types by the interviewees. The table can be interpreted by showing advantages and disadvantages each different airline type is likely to have when dealing with emissions trading. Furthermore, there are some factors all airlines have in common and at the end, the table shows areas where there were discrepancies in the interview answers, and hence there seems to be uncertainty about extra fees.

Compilation of the most crucial statements:

| Airline type | Advantages | Disadvantages |
|------------------------------------|---|---|
| <i>Small, regional carrier</i> | <ul style="list-style-type: none"> – smaller size: easier to implement monitoring and make changes – market opportunities: taking new regional routes | <ul style="list-style-type: none"> – higher fuel-consumption per seat – costs spread over short distances – lack of resources: in administration and to engage in trade – smaller aircrafts: disappearance of uneconomic routes – some must reduce fleet |
| <i>Network or alliance carrier</i> | <ul style="list-style-type: none"> – More dominant position on the market (e.g. fuel hedging, can enforce higher prices) – not much influenced by ETS – bigger resource capacity: ETS-teams/ extra units and personnel | <ul style="list-style-type: none"> – Higher administrative costs – More difficulty to make changes: size – many intercontinental flights: more flight segments subject to ETS – 3-class configuration business model |
| | | |

| | | |
|-------------------------|--|--|
| <i>Low-cost carrier</i> | <ul style="list-style-type: none"> – higher benchmark due to higher aircraft utilization – short turnarounds | <ul style="list-style-type: none"> – may have difficulty with pass-through – strong growth: not enough free allocations in future |
| <i>Common factors</i> | <ul style="list-style-type: none"> – efficiency potential – goal: fuel saving – fleet structure & age: big aircrafts , young fleet – in short-run: worse competitive structures – good software is beneficial – good: uniform fleet, but difficult – attempt to reduce aircraft weight, use SOPs or APUs – ecologic marketing not persuasive enough for higher prices – stopovers unlikely – increased utilization of outside airports – all: low incentive through trade – all: certificate price development very uncertain – market restriction is bad | <ul style="list-style-type: none"> – disadvantage for European carriers (short-run): other carriers operate outside of the emissions trading zone) – fuel consumption increases with aircraft age: annually 0,5 % to 1.5 % – likely: many aircrafts under 50 seats will be taken out – fares are adjusted in influenced by external factors (financial crises etc.) – pass-through ability of the particular airline – ability to spread costs – flight frequency adjustments – emissions trading has a low overall effect – location of hub influence market situation – almost all airlines will need their free allocations/ certificates – All agree: global system best solution |
| <i>Disagreements</i> | <ul style="list-style-type: none"> – no extra fees – extra fees, especially by low-cost carriers – adjustments in ticket fares | |

Table 3: Summary of advantages, disadvantages by airline type

4.3 Results in relation to previous research

In reference to the previous research findings by Scheelhaase et al., the author confirms the following results:

- Emissions trading does not take a high priority within airlines, but the monitoring of CO₂ and trading of certificates is described as one factor influencing cost structures.
- Although firms are aware of the environmental need for emissions trading, few seem to have the resources in this capital intensive industry to find a long-term solution. They rather try to determine business areas where efficiency can still be increased.
- It is very likely that there will not be unused certificates and carriers need to purchase additional ones, especially strongly growing airlines.
- The reduction potential within the industry was generally assessed as low.
- In the long-run technological and structural changes within the industry are inevitable and climate protection accelerates it to some extent, but the author wants to add that oil has a much bigger influence, because it is constantly becoming scarcer and more expensive, so it would be beneficial for airlines to reduce their dependency on oil.

The results of this study disagree with the suggested solution in the Schleifer book to solve competitive disadvantages of European carriers by introducing different benchmark, exactly due to the fact of increased complexity, supported by the argument:

“One could have taken different benchmarks, but honestly I would not like it as it always distorts incentives, what is supported by studies.”¹⁴

As the author figured out that the main argument opposing this suggestion is on the one hand the low resource capacity of small carriers and on the other hand the rising administrative costs for airlines in general.

¹⁴ Interview with the researcher of Institute B, Date: 28.01.2010, Appendices: p.102

Furthermore the network structure optimization as a reaction by European carriers to cope with the disadvantage cannot be generalized. As mentioned in the results, dominant national carriers may still be able to demand higher prices: firstly, because many customers are willing to pay a little more for direct connections and secondly, the price difference for long-haul flight tickets is not really significant anymore.

In other words, when the ticket costs already 1000 €, consumers are not so price-sensitive anymore and are willing to pay 40 € more. Additionally, for some carriers it can make sense to substitute hub-connections by direct flights.

Concerning incentives through trading of certificates, the incentives are regarded to be rather low, so it is unlikely that they will cause carriers to substitute their hubs. If they do so, it is based on additional costs.

5 CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

The interview answers had a lot in common and interestingly the airlines and institutes revealed also a variety of different aspects and angles. A lot of data was gathered, but due to the thesis limitations, some aspects not directly concerning the topic needed to be cut out. Therefore also the replies concerning federal support were cut rather short and they are anyhow not of a high importance for the purpose of this research project but merely aimed to determine the extent of governmental support available and if there will be new projects. Naturally there are different methods of resolutions, but in the end every airline has to decide for itself which approaches are most the suitable ones. The choice of approach is based on the individual business model of the airline and its market position.

5.1 Conclusion and possible solutions

In conclusion it can be seen that this topic is rather complex. Generally, emissions trading is not expected to have a big effect on the industry. The core point is that the aviation industry only has a limited CO₂ -reduction potential and there are much bigger potentials in other industrial branches. In order to increase the ability to lower emissions, innovative technological breakthroughs in aircraft construction and alternative fuels are needed.

The other problem to be solved is the capital intensity to achieve improvements and dominance of oil companies within the industry that really slow down these developments. Certainly it is necessary to include the aviation industry into the emissions trading scheme and based upon the success of emissions trading, realistic goals and incentives must be created to achieve emission reduction goals.

It seems so that any kind of airline can theoretically get disadvantages from emission trading. Nevertheless the probability of these negative points differs in likelihood, because business models and externalities are different.

Fuel is obviously in all cases the central cost factor with the highest influence. It affects many other business areas. Additionally to this internal cost factor, also external aspects, such as the economic crises, threat of terrorism, diseases and security have a big impact on the industry.

Now the author presents possible solutions to the problem:

- ✚ Above all: a global system to create fair and competitive market structures as a future goal
- ✚ Due to more effectiveness and fairness also high frequency military and governmental flights should be included
- ✚ Spreading administrative costs within an alliance, choosing an individually suitable degree of cooperation and freedom
- ✚ Sophisticating the production of bio-fuel – kerosene mixtures; to reduce costs by using less kerosene and to require fewer certificates
- ✚ More differentiation by taking new routes
- ✚ Fleet: young and uniform fleet, possibly more operational block hours per day, bigger aircrafts with less weight and higher booking rates
- ✚ Low-cost carriers: must try to realistically estimate future growth (this year's benchmark value is the basis for 2012)
- ✚ Macroeconomic estimations: what business model type airlines are likely to lose market share and how much

- ✚ Researching different SOP- approaches and saving potentials on ground
- ✚ Setting up a good fuel-saving programme
- ✚ Attempt to simplify fare structures and determine the price-sensitivity of customer segment to impose higher fares on less price-sensitive passengers

5.2 Tactical and strategic implications

These possible solutions are further divided by the writer into tactical and strategic options:

| Tactical, short-term to medium-term | Strategic, long-term |
|---|--|
| <ul style="list-style-type: none"> – Using different standard operational practices – Improving the fuel saving and flight follow-up system – Saving potential exploitation in ground services | <ul style="list-style-type: none"> – Cost sharing within an alliance – Fleet modifications – Research of future growth – Simplification of fare structures – Usage of bio-fuel – kerosene mixtures – Route and flight network adjustment |

Table 4: Tactical and strategic implications

There are not many options for airlines in the short-term and they also don't have any control over external developments like a global emissions trading scheme, bio-fuel research and market developments.

5.3 Suggestions for future research

General areas that need further analysis are: certificate price estimations for 2012 when caps become effective, interrelations of resources and the goals to be achieved; and forecasting of market developments. Surely, there are still many uncertainties about future developments with the aviation industry.

The author has the following research suggestions:

- Research of possible solutions to solve the problem of low incentives in emissions trading
- Relationship between aircraft types and emissions to achieve fleet structure optimization
- How extra fees influence demand and market share of airlines
- An early detection system of new and potentially profitable routes in order to achieve regional dominance
- Different scenarios of certificate price development and their probability

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APPENDICES

Personal Interviews:

Interview with Airline A

Date and time: Friday 15.01.2010, 13:00-13:55

Persons: 1) Director Network Planning & Revenue Management
2) Chief Operating Officer

1. What major developments can be expected for the airline industry when emissions trading will be introduced?

I think the key point is really that not all airlines have a fuel follow-up or fuel saving programme. The major development includes the obligation of all airlines to follow up and to know in great detail how much fuel is burned per flight. Of course, the system of emissions trading requires you to have a monitoring system of your fuel consumption. Even small airlines and corporate jets are included, where the economic flying is not necessarily the primary target. You need to have a fuel follow-up programme, which quite naturally leads you to the question: How can I reduce the amount of fuel burned after monitoring and summarizing it? So, I think that is the biggest development concerning all airlines.

2. How can airlines prepare for the coming emission trading scheme?

The preparations actually lead towards building up the system of monitoring fuel consumption in great detail connecting to each flight.

3. What kinds of different options (short-term and long-term) are available to adapt to the coming changes?

I think the time for long-term options is gone already, because the emission trading is knocking at our door. Last year we had to submit the follow up system. This year, we have started to follow up and it is also going to be the benchmarking year. I think the options are not there, we have to obey the regulations.

The penalty not to follow up the regulation is not clarified yet, at least in Finland, because according to my knowledge it is determined by the local legislation. I think it's like a law. There are no options. We just have to adapt to it and the sooner, the better it is.

4. Which of these options would be realistic and why?

Answered to question four in question three.

5. How are ticket fares and cost structure going to be influenced (by higher costs through taxes and purchase of emission certificates)?

Well, I think it's more a question of economic downturn than emission certificates or costs behind that field. At the moment, all airlines are struggling with the fare levels and average fares are going down. So in any case, the structures must be evaluated and renewed and in the future and I don't think there will be that many or big changes because of this. It's more about the total cost level that airlines can achieve and then has an influence to the structure. For example, the fuel is affecting the fares quite dramatically. But at this point, I don't see that emissions certificates or trading would influence the fares directly.

6. Do you think there will be more extra fees in the future due to ecological reasons? What type of fees could that be?

Well, one example is the fuel surcharge when it was implemented. One of the big reasons behind that was the structure in the pricing systems is quite old. It is based on the IATA (International Air Transport Association) world and to make big changes, because of fuel prices went up so quickly, so it was easier to implement the fee and then adjust it internally and then have the effect for all fares. Each route has over 20 fares and on top of that there can be hundreds and hundreds of closed fares with different corporate and agents and so on. So it is a quite massive job to renew the whole pricing structure. So I don't think there will be any extra fees.

Some airlines are also trying to get rid of the fuel surcharge; some of the airlines don't have any. So again, it's the same as in the previous questions: the total costs and then trying to create the fare structure according to that.

7. Do you think airlines are likely to reduce their flight frequency and restructure their flight network due to the new regulations?

Currently, we are adjusting our frequencies and capacity to the downturn. So the demand has not improved to the same level than it was in 2008. 2009 it was down, and now hopefully it's starting to return slowly and now regarding the emissions trading it is more a question of adapting to the new market situation than adapting to emissions trading. Of course, the capacity management plays a bigger role and how we can change the growth of aircraft type according to the current demand on a flight level, basically.

Summary of questions 5, 6 and 7: Emissions trading is not a big driver behind network planning and the fares, but of course it is one part of the total and of course one big part of the cost structure also.

Well, I would like to answer that it depends, and that's always the most painful answer for this kind of question. Of course it is always a question of price. In case the price is becoming very high with the emission reductions, if the price of the CO₂ per tonne becomes very high, then flying can become economically unviable. Therefore, yes it can affect.

8. How do you see the general development and use of alternative fuels?

On the military side they are actually quite far developed. I think it's the great news, but the question is when the price of the fossil fuel becomes so expensive that the alternative fuel business really gets the boost. That is a little bit unclear to me and also what becomes of the mass production of alternative fuels, because it's the millions of gallons per day which are needed. But of course it is an alternative and I think it has changed a lot within the last 10 years. Ten years ago, there was no alternative. Everybody is concerned that when oil is gone, where are gone but now the community has been bringing us a bit forward.

9. Do you regard ecologic marketing (*communicating environmental protection as a core resource to customers/ the environment*) as a good way of differentiation to gain customer attraction/ loyalty in the future?

I think ecologic marketing is a question of generation. Our generation, we are a partly lost case, but differently the younger generation is much more aware of these things. The same is true for the naturally produced “Luomu” -food. I think it’s also more recognized by the younger generation. This is also playing a bigger role when it comes to the corporate culture, even in purchasing; you need to have the environmental certificate. So already in the quotation process when selecting the providers, it is important whether this provider is economical friendly or not. So this is definitely something which is the product future. But so far, how I feel (it is only the feeling); the airline customer market is not willing to pay extra for this. They are so price conscious. People go where the cheapest price is. For example, the growth of the low-cost market comes from leisure traffic, regardless of the human point of view, it derives from cheap fares. Thinking in the humanistic way, that’s how it is or could be considered.

This has been within the whole Scandinavian Airlines group for a long time an important part of the way how to work in the company and also the communication to customers.

I can slightly divert from this field, we even have an environmental certificate. The field of environmental aspects is of course a major issue and we have a really good fuel saving programme and we have been doing it relatively well. There are still challenges like when the airplane is getting older, the fuel consumption is increasing. It’s like an old car, it gets more worn down and increases something from 0,5 % to 1,5% per year. So that’s the running target, regardless we have the same airplane, the same generation and the same individual age of the airline is causing us some headache.

10. Do you think there are differences in the capabilities of alliance members and low cost airlines to reduce emission? If yes, what could these differences be?

I think it depends, where the airline currently is with the fleet. If you have a new fleet, you have the advantage that you are already there, but for an old network airline, it of course can take a few years to get to the same level and some newer low cost airlines, which have ordered new aircrafts.

Basically, I think reduction of emissions is related to reducing the overall costs. Less fuel burning means lower fuel consumption and less cost, therefore it is a natural goal to all airlines. This is one of the biggest cost units that you can actually influence especially in the future. So, I would not say there is a difference between network or alliance carrier versus low-cost carrier. It is more a question about the current fleet; what is the fleet plan for the next coming years. So there are also a lot of low cost airlines, which have ordered fleets, so you cannot just divide it into two. It varies a lot between the airlines.

Of course it is natural to all airlines to reduce the costs and fuel saving. One practical thing is that if you are big alliance member, you are often a part of the fuel pool. Therefore you are hedging the fuel price and actually the fuel is cheaper with the financial instruments than to the small airline. Therefore there may be a small difference, since the fuel price is not an issue, which comes via the number of emissions produced. There may be a difference, so it is a question really if you have the fuel saving programme, if not it depends upon how good you are and what counts. How the cost index of your flying is build up. As a summary it comes to the same. It doesn't matter if you are an alliance member or a low-cost airline. You have to do it in the most efficient way. Not related to the alliance.

11. Regarding trade of emissions certificates: Do you think the profit from selling unused certificates is a strong incentive for airlines to reduce their own emissions?

I think, we don't know yet, because the emission certificates have two categories. It's EUA, which is for the stationary industry like producing gas, burning coal, whatever other industry causing emissions. Then it's EUAA, it is the sort of emission certificates for the aviation. This year is actually the baseline year when the amount of emissions is defined for this EUAA, which means based on this year's traffic the amount of free emissions is defined. At the moment it's ok, we can buy emission certificates from the EUA with the market price, but not the other way around, they cannot buy from us. What's going to happen in the future is that there are going to be restrictions for buying rights and certificates from the different business areas.

This is going to be the question and this can turn in the worst case similar like airport slots in case the authorities restricts that this industry can produce this amount of emissions, it could become very expensive. Yes, and in this case it could become one of the core profit makers. This of course theory, but then it depends if it is more profitable to fly by ourselves or then sell certificates to some others. But for the moment, we don't really know how it's going to be, because being one of my education as an engineer, if we put an electro sign here, like a diode, you can buy from here to here, but not there then. There is a lot of waste to restrict the aviation business as such.

Interview with Airline B

Date and time: Tuesday 26.01.2010, 14:00-14:58

Persons: Flight operating manager

General information:

Airline B belongs to a holding, which deals with many areas within the transportation sector. Therefore this airline is only a part, but there also is the ferry traffic to the North-Frisian islands, a small railway station at Borkum, which drives to the harbor and city centre, as well as a few hotels, which are run by the holding complex AG EMS.

The airline owns 16 aircraft with seat ranges between 3 and 100 and we also own two helicopters. So we are also operating air traffic to islands, which focuses on Emden and the harbor of Bremen. Also the East-Frisian islands including Helgoland and Wangeroog are served.

The regional traffic goes from Bremen to a few other European destinations and from Hamburg we have the charter traffic for Airbus, which goes to Toulouse. We are now operating in the 52nd year and are one of the last carriers on the market that do not belong to Lufthansa or other big airlines. We are doing business on our own account, but we have been increasingly working with SAS in the crew share market on the routes Copenhagen and cooperate with Swiss Air to Zurich. These would be our current activities. Furthermore we are IOSA (IATA Operational Safety Audit) certified and we are of course also concerned by emissions trading. I am alone dealing with this area within our airline. There is no big department for this matter as in other airlines, such as Lufthansa.

As a German company, we are connected to our competent authority, which is the German emissions trading institute that is responsible for us. Certainly, it would have been possible to make a motion to have another responsible institute, but now this one has been chosen.

Airline B as a regional carrier is focuses on Bremen and the coastal traffic around Bremen´s harbor.

1. What major developments can be expected for the airline industry when emissions trading will be introduced?

None, beside perhaps a disappearance of a few regional routes. Several low-cost airlines might begin to introduce extra fees. There will not happen much for the network carriers. Many external parties are beginning to let provider airlines pay for their carbon footprint in advance.

The background is that these providers pay airlines for the allowance to install commercials on planes. We have also received a few of those offers. One provider even especially excels itself to care for anything related to emissions trading. Therefore the airline is supposed to attach a link visibly to the plane, war then represents a kind of additional earning. It is unknown to where the money flows then and where it is used.

The entire European aviation industry is waiting for now. We are one of the first airlines in Germany that has already received consent for the acceptance of our monitoring concept. Many airlines are still waiting for the consent. We are very happy that the German emissions trading institute did not have any objections.

I think that Ryanair and EasyJet are going to try to market the emissions trading scheme for themselves. It would be a nice “on-top charge” to introduce. No consumer would see through it.

I don´t think there will be great impacts on the so called legacy and network carriers, because the arising sums are too small. What sticks out is the factor of sum. The whole system supports Airlines which use aircraft with of greatest possible size and with a high number of bookings/ reservations. Thereby a higher capacity per tonne-kilometer is achieved and one gets more free allocations.

As a matter of principle, the fuel consumption per seat is always used for calculations and of course they are higher for small planes when compared to big aircrafts. It is to worry about the disappearance of several routes, which are now served by regional carriers, because they could not be economic anymore in the future and the already tense market situation could become intensified. A good example from the newspaper is that Eurowings takes half of its fleet out of service and Contact Air said a few weeks ago that they do not want to operate outside of Stuttgart anymore.

It is difficult and I am of the opinion that the pressure will increase. Maybe we will not so many regional carriers anymore soon, because the cost pressure is huge. What I regard as remarkable is the fact that the emissions trading scheme favors all the carriers like EasyJet and Ryanair.

The narrow-body aircrafts like Boeing 787 and 800, Airbus 23 have been used by them, while you already commit to achieve at least 80 per cent fill rate by using that business model. However, this causes traffic, where it has not existed previously, for example when I think about routes between Altenburg-Nowitz and London, in which nobody has been interested before. Now our British tourist or island inhabitants have started to suddenly visit their holiday homes on Malaga.

I think there is a conflict within the system in whom it supposedly favors and whom it discriminates. In conclusion, the one who gets economic problems with the ETS had already great difficulties before the introduction of this system, because in the end, the effects are at a minimum.

2. How can airlines prepare for the coming emission trading scheme?

We are a regional carrier, therefore we don't have any big administrative possibilities as big airlines have. It all happened quite hurried, because the first deadline for the submittal of monitoring concepts was the 31st August 2009. We only started to prepare in July 2009, which was in retrospect even a good decision to start a little later, because the guidelines were still changed a lot.

First we began to find an own interpretation for the new regulations and then we were looking for ways how to integrate the requirements of ETS into our (operating) processes.

In addition, we noticed that we had little problems to adapt to the system due to our small company size and software.

On the one hand, we have the so called “Mona-Lisa” Software, which we could then use for the monitoring, because previously it had been already used to plot and follow our flights. Then we merely had to include the fuel consumption and plot it as well.

This was implemented by our booking documentation and the DEHSt (Deutsche Emissionshandelsstelle, Eng.: German emissions trading institute) was very pleased with it. However there are still small details in the choice of method. You have to decide between method A and B. I was asking about the differences as I was a little confused at the beginning. For our business processes it wouldn't have made a difference, so we finally chose method B for the reason of an easier implementation.

We received a kind of template from the DEHSt for monitoring, which was software based and similar to a more sophisticated Excel sheet, which we filled with the help of an external consultant. It was a low-level consultant, meaning that we didn't use Pricewaterhouse Coopers. The requirements of ETS are actually not complex, but relatively simple and straight forward. Nevertheless, we preferred to take someone who has already worked with the DEHSt.

We tried to get someone from the industrial area, who has been doing consulting already for a while, because the other industries have been included in emissions trading for a while already. We wanted this type of consultant to determine certain pre-models and the preferences of the DEHSt.

Our monitoring concept was punctually submitted towards the 31st August 2009, although the deadline was extended until middle of October. On the 23rd December 2009, we received the confirmation, that our monitoring concept was accepted without further queries. Now we have been continuing to monitor our flights. Actually, there are two monitoring parts: the transportation capacity in tonne-kilometers and the CO₂ -emissions. The tone-kilometers only need to be reported for the purpose of free certificate allocation.

As mentioned previously, we had luck with our software. I think all airlines have flight follow-up software, but we rather stood a little back as we haven't run a real fuel management programme yet. For airlines using a fuel programme, it should have been easier.

If you like to „play“ with costs, you could start at round zero, at least within our area.

We have rather early agreed to emissions trading as a good method, because it could also potentially create new sources of income. One can extensively engage in purchase of certificates and timing to collaborate on the stock market. We are a small airline, talking still about a lot of money, but without certificates our annual CO₂ -emissions account for approximately 80.000 tonnes. For such an amount it is not worth to run a whole department and to engage in big trade. Eventually, it is the main problem that there is not much what one can do.

After asking several experts, I still have the question: Who tells us how the price of emission certificates is going to develop? We can buy certificates from other firms, or rather the manufacturing industry, but they cannot buy from us on the free market. This certainly represents a market restriction. Also, nobody exactly knows how many certificates they are going to use in the future and how many needs to be purchased in addition.

When I remember the last trading period of the stationary trade, in the end the prices were at the level zero, because so many certificates were unused. It is difficult to say which costs are implied. It was easier for us just to set up the system, because when there is a fewer number of aircrafts, also fewer processes arise.

3. What kinds of different options (short-term and long-term) are available to adapt to the coming changes?

One thing to do is to save fuel, because CO₂ -emissions directly depend upon fuel consumption and are measured by it.

Strategy 1: One matter our colleagues from S.M. Bassetts have just been dealing with: of course you need more fuel the more kilogram payload you transport. Therefore it makes a lot of sense to look at the plane and see what is there, but what is actually not necessarily needed. Maybe you detect that you have too many blankets. Regarding the construction, there are two walls within an aircraft. One is a kind of isolation layer with a similar structure as a sponge, which has the purpose to absorb and enclose the developing condensation water at take-off and landing.

This is additional weight that is being transported and when the plane is still operating within the 10th year it is not so good. As a rule of thumb for a Boeing 747-400 you can save around 100 kg of weight.

In consideration of the present fuel price and under an ordinary utilization of aircraft (usually applied in network carriers), I have heard that it is possible to save around \$ 100.000 in fuel costs, which is quite a lot.

When one wants to save CO₂, one must begin to save fuel at the same time. This then has two positive effects for the airline. Another popular method of weight reduction is new seats. The gray standard seats, which are used by Lufthansa, are relatively heavy and compact. There are new ergonomic and relatively thin seats made of new materials, which of course only weigh a fraction (old seats: 20 kg, new seats: 9.1 kg), as for example used by Air France. The bigger the plane, the more sense it makes to substitute the seats and to reduce weight.

Strategy 2: One can also work on the SOPs (Standard Operating Practices), which are set by every airline independently, and state for instance how the plane is operated by the pilot. There are also some opportunities of optimization. As an example, earlier airlines tried to fly with only one engine (e.g. Eurowings) and therefore to eliminate the roll way.

There were also experiments of not using full power at take-off. There certainly exists potential in what can be done and what especially small airlines have not really used so far. The big airlines are much more active in this area, because they have real departments for optimization.

There are also other methods available on the market, such as the long discussed Vietak, which is a small robot unit that is attached on the engine and operated by an electro motor. It serves the purpose of power the plane to get it rolling for taxing so the aircraft engines do not have to be used for this anymore. There are many innovative things from many different countries and one can use these to save costs. In taxing, actually a lot of fuel is burned and if it can be reduced, it would be favorable.

Another opportunity is the use of an APU (Auxiliary Power Units), which can be used when the aircraft is on the ground. The APU is included into the fuel consumption and therefore also accounts for CO₂ -emissions.

This unit can be substituted by a GPU (Ground Power Unit). These are small vehicles with current sinks, which are standing on the airport ramp. If they are used and provided by the airport or the service trader then one can calculate the trade-off and compare how much it costs to operate an APU and a GPU for example for half an hour.

Bio-fuels are another big topic within the industry. The last one was developed by MS Siwert, but I think we are still far beyond our time. Of course there are basic approaches, but I don't see any great progress within the next ten years. For our airline, we see the biggest potential in adjustment of SOPs and fuel saving in that area.

It is not so easy to change something like in the stationary trade, where I can just build in a filter somewhere into the chimney and it is enough. Regarding an aircraft, you cannot just stop one of the engines.

Another issue is the so called "profit-tankering", where we look where it is sensible to tank regarding the price level. If you tank full, you take more weight with you, what also increases fuel consumption. All of these various trade-off opportunities are quite excessively pursued by some airlines, but on the other hand not at all by other airlines, what does not even have something to do with tourism. Ryanair, for example, tanks full as a matter of principle, because they want to keep relatively short turnaround times. It always depends upon where the focus lies.

4. Which of these options would be realistic and why?

We as an airline don't have a choice, whether we want or not. Every submitted annual monitoring report needs to be verified by an external source, which then again needs to be approved by the competent authority. This means that you need to find someone who is approved by the DEHST as a verifier and therefore is suitable to visit you and investigates if you have cheated in the monitoring report. In this matter, the DEHSt hedges itself well against cheating. Then it does not leave us much, besides accepting their practices.

Honestly, after my first encounter with the Directive, I was very angry about the Annex I, where is stated which flights are excluded from the emissions trading scheme. At first, there are government flights.

I thought to myself, this means that in military and government flights fuel can be senselessly burned and the ozone layer can be damaged, because it is allegedly necessary. On the contrary, my regional connection from Bremen to Copenhagen does not interest anyone and therefore I have to pay. This point is really odd.

The directive is very clear, so I don't think a more flexible arrangement is necessary or would even be useful. The only subject, what were desirable to change, is the creation of a global system with a central organization as the ICAO, which would set up the system and additionally an authority with a control function. The controlling authority would have to be first empowered by all member states, but I regard it as absolute nonsense that every participating state has engaged its own competent authority. When you ask the DEHSt, they also agree. According to my knowledge, after several meetings, the DEHSt is not happy about the decision and the obligations involved in their function.

A global emissions trading scheme would be possible in any case. As umbrella organization for this kind of project, the ICAO would be ideal, because it is from its structure similar to the European Union, even if politicians would see this differently. The ICAO can make laws and suggestions, but they don't have any jurisdiction. For that reason, they may not directly convert laws and there is no big difference to the EU. The ICAO would be the best and most sensible partner. Not for our business model, because we are a regional carrier, but when you look at global players like Lufthansa and United Airlines, who fly to Europe. Then someday the question arises: when every continent or economic zone begins to construct own directives, we would someday end in a chaos of regulations and I don't see any sense in that. It can also not be supportive for the structure of competition. It would be very desirable to handle it under an umbrella organization. Particularly as we have seen in Europe at the introduction of ETS that for every country a local competent authority was determined. In Germany we have the DEHSt, which requires you to use a rather exaggerated communication system, what is called "virtuelle Poststelle" (Eng.: virtual post room). In the Netherlands, you only need to fill in an Excel table and it's enough. The respective local competent authorities even have within the ETS different interpretations of the EU regulations. Therefore it would be nice to have a uniform standard. The DEHSt was very cooperative regarding federal queries.

5. How are ticket fares and cost structure going to be influenced (by higher costs through taxes and purchase of emission certificates)?

There is a good source: Air Transport World. Somebody thought the costs would amount to under 1 € per flight ticket. They assume that the effect will not be big; however they have only controlled the concrete emission certificates and left out all of the other issues around them. For instance, you need someone to follow up the ETS, undertake the monitoring, buy measurement devices and that of course creates higher overhead costs. The fixed costs are influenced by the administrative expenses. As for my own opinion, I assume it will not make more than 4 € per flight ticket. For small airlines it will be a little bit more than for big network carriers, because they can spread their administrative expenses among more flights.

6. Do you think there will be more extra fees in the future due to ecological reasons? What type of fees could that be?

Regarding extra costs, I am very convinced that after Ryanair will have introduced the toilet fee, it will not take long until we have to pay an eco-contribution as well. I think that the ecologic aspect will be cannibalized by some airlines. This is similar to the extra fuel fees. A few airlines take extremely high fuel surcharges, whereas not the whole amount is based upon fuel costs.

7. Do you think airlines are likely to reduce their flight frequency and restructure their flight network due to the new regulations?

I think we are already seeing that. Especially on the German market can be seen that regional carriers are pulped. Eurowings has taken half of its fleet out of service, Contact Air flies only from Stuttgart and in the 1-2 Fly -programme of Lufthansa reads nothing else but the market under 50 seats does not have a future. Reducing this only to environmental factors is doubtful, but it is gladly pleaded.

I think network carriers are going to use the environmental topic for their purposes. In reference to fleet structure it is to assume that in some fleet, aircrafts with only 50 seats will be taken out of service.

We rather see a chance in this, because we are independent and now some routes are becoming free on the market. Nuremberg-Brussels and from Hannover, Dortmund, Paderborn, Lippstadt and Osnabruck does not happen much anymore.

It is more of a chance to open up new markets as a regional carrier. From an ecologic point of view, in other words not only due to CO₂ and ETS, something should be changed, but also because of noise protection. These issues also influence the fleet: one thinks whether an aircraft, what was previously utilized for 10 to 20 years, should be substituted. Your fleet strategy is also focused by ecologic aspects somehow, what was not important in earlier times. During the past, only the economic numbers were of importance and that was sit. Nowadays, environment belongs to the image; you like to call your organization a “green company”.

8. How do you see the general development and use of alternative fuels?

This is actually a hot topic and there are several kinds of alternative fuel. Now we are talking about the tertiary fuels. When I think of alternative fuels, it does not help just to switch from one scarce crude material to another. A development towards coal, gas or other non-renewable fuels; I don't like it. Nothing is achieved by shifting the cost pressure from oil to the next best crude material. It would work according to that, we could as well use Uranium to power aircrafts. What functions in submarines should work in aircrafts as well. What I like is the tendency towards bio fuel from algae, because the interesting aspect is that it grows again and you can extend the algae production. However it is still in the test phase and only South African has experimented with it so far.

It occurs to me that the more they are trying and the more successful they are, the more silent it gets around them. Probably because the oil companies exert great influence on the development of alternative fuels, or rather they suppress and slow down the development.

The oil corporations don't have any interest in it and they are very powerful.

I believe we are moving into the direction, but it is not going to happen within the rapid future, but rather in a medium-term of 10-15 years.

The problem is that aircrafts cannot be amortized like cars (usually within 3-5 years), but it takes at least 10 years and then you also take into account the residual value plus you still want to sell it and then it is operated by someone else. Considering all these facts, the amortization of planes is very heavy in infrastructure.

When you begin to use other fuel types, it also means to have a second fuel storage facility, different tankering vehicles, and another tankering storage facility and so on. Therefore it is very costly.

I would have seen a chance, if such a fuel would have been used for a Boeing 787, but honestly I don't see any groundbreaking developments in the next 10-15 years. The next subject to substitution would be the A-320, but Airbus already mentioned that nothing revolutionary is going to happen within the next decade.

Merely the design in terms of facelift is going to be marginally modified, but nothing else. These developments have to go along with a new aircraft model, then I would see a chance, but not at the moment.

9. Do you regard ecologic marketing (*communicating environmental protection as a core resource to customers/ the environment*) as a good way of differentiation to gain customer attraction/ loyalty in the future?

This marketing point of view works well in some business areas. Nevertheless, it would not work in the airline industry. It is comparable to the sale of a 3-liter car: but who buys it? The 5 person family with the Volkswagen Lupo, while the seller explains the 5-seats car would be very suitable.

We set the focus on the business traveler, but I don't believe that we can persuade him with green marketing. It is more comparable to the current situation at the Royal Bank of Scotland, which is a competitor of us: I have seen a massive collapse in the demand for business travelling. They had flown via Royal Bank of Scotland, including customers and employees, and the great decrease in demand derives from their prospect for alternative means of transportation.

This does not mean that flying is regarded as an environmental sin and taking the train is the non-plus ultra, but they rather see to it that some business trips are done by train.

Nobody has actually really tried this green marketing, therefore it is difficult to me to definitely tie myself down to the statement; but I don't believe that customers are influenced in their choice of airline, because most customers are very price sensitive.

This is true for both segments: we have always known that leisure travelers have been price sensitive, but now this is true to almost the same extent for business travelers.

10. Do you think there are differences in the capabilities of alliance members and low cost airlines to reduce emission? If yes, what could these differences be?

The Star Alliance's attitude towards emissions trading: the Star Alliance does not do emissions trading for their individual members. In terms of administration, they stay out of it and every single member takes responsibility for it, so I don't see any advantage in being an alliance member. Certainly it would have been smarter if it would have been run under the alliance, then they could have significantly reduced the overhead- and administration costs, but this is not wanted because they want to keep their independence, what is also well understandable.

Low-cost carriers are clearly favored, because they receive a higher allocation of free certificates due to the fact that they report higher tonne-kilometers.

There are several reasons: they use aircrafts much longer than us. We as a regional carrier are situated at the lower end, so we fly around 6-7 block hours per day. Ryanair reaches 10-12 hours per day and Air Arabia, which is also a low-cost carrier, has even achieved to fly 13.3 block hours on average per day with their A-320.

The more you fly the more passengers and higher tonne-kilometers you get and therefore more free certificates. These airlines are very flexible, so I can imagine that not all routes completely fit in to the economic requirements. This year we are starting to report out tonne-kilometers, next year we will receive the allocation, which lasts until 2016 and I would not be surprised if one or another route disappears. Of course, you rather take more tonne-kilometers into your emissions report, because they are anyway free of charge and then some routes disappear.

What would be interesting to me are cargo airlines. If I directly fly from Hong Kong to Germany, I would need to pay for both flights: outward and return flight for the entire route. Cargo is also quite time sensitive, but not as much as passenger air traffic.

If I worked in the cargo industry, I would think: Hong Kong-Frankfurt, I try to fly via Russia or Belarus and make intermediate landing there. Then I would only need to pay the flight from Belarus to Frankfurt instead of Hong Kong to Frankfurt. It would make sense.

Therefore I can really imagine that some cargo airlines re-think their route concept and make senseless intermediary landings to reduce their routes and distances.

Otherwise, I don't believe there will be any difference. Every airline is struggling with the ETS. Some business models are clearly favored, but regarding the structure and reporting style nobody is favored. All laws are equal to anyone and well understandable. It is generally more about the money, because the bigger an airline is and the more flights it has, the more money is involved.

11. Regarding trade of emissions certificates: Do you think the profit from selling unused certificates is a strong incentive for airlines to reduce their own emissions?

The initial allocation of 85 %, whereas 15 % are used for stock market trading and purchase and 3% are a reserve for newcomers and strongly expanding airlines. There are not many airlines that will find the scope to leave certificates unused and sell them on the market. Almost all certificates will be used by the airlines themselves. Therefore I don't believe that one can expect great profits.

Certainly, if some certificates left one can sell them, but I don't see any great fleet restructuring by carriers. Clearly, there are saving potentials, but these are relatively small, so there are no big incentives.

If you want to participate, you need the administrative background to make profits. Also other things, such as infrastructure, monitoring personnel and stock-market specialists are needed. It is only an assumption, but for our airline it is not going to play any role.

Interview with Institute A

Date and time: Wednesday 27.01.2010, 14:00-15:27

Person: Environmental economist and researcher associate of the German Aerospace Center

1. How do you see the global implementation of emissions trading for the aviation industry global implementation emissions trading for aviation?

In principle yes. It is difficult, because you need to reach out further. The ICAO (International Civil Aviation Organization), as well as the world climate council, both are having this topic already on their agenda. The UNFCCC has noted in the ICAO's register that one needs to get involved in this issue to reach further goals.

The problem is the functionality of the ICAO mechanisms. It is theoretically possible, but at present rather unlikely, because of the incredibly different interests that exist. Correspondingly, it is going to be difficult to reach a consensus. In the first place, some hope appeared by the election of Obama and there are also several climate protection initiatives within the USA, especially on federal state level. At least in the short-run it will not come to an agreement within the ICAO regarding emissions trading.

Even if you can win over the USA, many developing countries still see this issue very critically. Particularly those which are formally still having the status of a developing country, but despite of that they have an extremely competitive air traffic economy. Especially regarding the now the slowly petering Kyoto Protocol, which is losing its relevance. For instance, the Arabic Emirates or Singapore are rated as developing countries, but still their carriers have positioned under the Top 10 or 20 of the worldwide most successful airlines. Especially the Arabs with their strongly growing airlines are of course likely to oppose these measures, which may under these circumstances slow down the growth. Therefore a short-term development is quite unlikely.

Regarding additional information: GIAC (Group on International Aviation and Climate Change) (final report 2010) is a group that held a meeting last year within the framework of the ICAO.

This group has been dealing with climate change and aviation, whereas they also tried to identify measures and anyhow to quantify how air traffic influences the environment, especially regarding climate change.

At first, they have come to the conclusion that they want to introduce a worldwide CO₂ -standard for new aircrafts. The means when manufacturers wanted to get a new aircraft certified it has been so that certain properties needed to get certified in order to get an approval. These properties have regarded noise and nitric oxides, but now these aircraft properties should be applied mainly to CO₂ now.

We are facing this rather critically, because CO₂ -emissions directly correlate with fuel consumption and airlines are already having a strong incentive to reduce their fuel consumption and therefore CO₂ -emissions. No airline would buy a fuel inefficient aircraft. From an environmental-economic point of view the instrument of a CO₂ -standard is not really effective and worthwhile.

In February an ICAO cap meeting in Montreal for Aviation Environmental protection will be held again, where they will decide about further procedures. This process is of course very lengthy.

Currently a new cap meeting cycle is beginning, were new environmental guidelines will be defined. It takes 3 years to come to a decision, so it will take at least until 2013, and then resolutions are usually not implemented immediately in order to give the industry some time to adjust to it.

The CO₂ -standard will by no means become effective before 2016. When it is valid it will only apply to newly certified aircraft types and presumably not to existing ones. Accordingly, the effect would be very long-term. It is a kind of minimal consensus on which the ICAO will agree.

Skeptically one could say that they are trying to divert from the emissions problem, because they can say: "Yes, we are doing something, because we have another instrument: the CO₂ -standard which is supposed make a contribution". Therefore one can refrain from emissions trading. This is the current state in the ICAO.

It would be interesting to abstract from the ICAO, as the EU already has decided upon emissions trading what leads to the inclusion of one-third of worldwide emissions. I believe that the European Commission still has hope that, when the Kyoto Protocol is going to lose its effectiveness, other states will also see the necessity in emissions trading plus other climate protection measures and are willing to participate.

It will not be introduced at once on a global scale, but firstly one has to look for strong partners. Given that the USA would adopt emissions trading and implement it together with the European Union, then probably already two-third to three-quarters of global emissions could be included into the system.

Also in Canada and Australia there are political trends that support the introduction of emissions trading and if one could reach an agreement in that area, all starting and landing air traffic of these two countries plus Europe and the USA could be included. Then already about 90 % of global emissions could be included.

These are still dreams of the future and it is going to be quite a lengthy process. We have to see whether there is a possibility to cooperate with other countries. A question regarding the arrangement arises on whether other countries unconditionally join the European system.

If necessary the EU-system also needs to be modified accordingly. This would be an assumable development for the future. As a matter of principle, one can be rather skeptical, because the lobby groups within the USA are appropriately strong, which decreases a success of short-term perspectives.

Institute A has been trying to relatively precisely illustrate the current legal framework within Europe and to model it regarding possible consequences.

Of course, on the level of airlines it is always difficult, because one can never know exactly how an airline is going to develop, for instance how many new planes will be purchased. Concerning the sector in terms of sum, the data is quite reliable and we have good results.

2. How have you followed and prepared for the emissions trading scheme?

On the one hand, we are also operating our own fleet, but we are not concerned with emissions trading, since somewhere in the small print of the EU regulation is defined that research flights are excluded. We are allowed to operate our Airbus A-320 and other planes, such as the Gulf Stream D-550, entirely without emission certificates.

On the other hand, of course we have been following everything as we are advising the Ministry of Transport. Accordingly, we do not exert a direct influence on the EU-regulations, but we have a consultive function. The Ministry of Transport makes statements on legislative measures within the EU. We support them with scientific consultation.

The federal Ministry of Transportation is mainly interested in the effects on the German aviation industry as well as on German airports. Our motivation for modeling derives from that interest.

Four to five years ago, when I started working here, this issue was not so well-known; therefore we mainly concentrated on Lufthansa.

We are also constantly extending our modeling step by step and now we can make statements for the entire sector. My colleague and co-author of our various papers represents Germany in the ICAO.

There is a group at the Cap Emission Environmental Protection, which is called “market-based measures task group (MBMTG)”, where my colleague is also representing the German interests, in the emissions trading discussions within in the ICAO. There is also a document available that concludes the ICAO’s point of view, which is unfortunately rather smoothly phrased. In principle it discourages member states from introducing measures on their own, as they could possibly influence the competition. In the end this means no real progress.

At least we have representatives in various committees and we are following the political developments. Of course, we also follow the effects on industries and economy.

3. What macroeconomic developments do you expect in the aviation industry when emissions trading will be introduced?

In our papers we have begun to calculate the accrued costs and expenses that airlines need to bear. We have reached the conclusion that the amount of emission certificates, which need to be purchased during the first phase is not even that high, at least it involves only around 30-40 %. In sum this is certainly a lot, it easily rises up to billions. However, when it is distributed upon passenger or passenger-kilometer per single ticket, it is not much money at all; of course, under the condition that certificate prices stay mostly within a normal scale.

This is currently proven by studies, which estimate prices per tonne CO₂ to be between 20 € and 45 €, partly 80 €. When this is shifted to operational costs, the share is relatively small, respectively micro-economically in terms of modeling; emissions trading has similar effects as a fuel price increase.

The effect of the oil price increase in 2008 to the maximum level until now has had a much greater impact than emissions trading is expected to have.

It is unlikely that the demand will, according to some lobby-groups, decrease massively. The next important question for us is: In what form are airlines going to pass on their costs to the customer?

This is a very exciting question, which has not been solved by economic sciences yet. There are merely some assumptions. We are also making only rough assumptions, for instance that airlines would distribute their costs evenly amongst customers, similar to the water distribution of a watering can.

In the end the extra cost on top of ticket prices will amount to 2 € to 5 € for an inner-European flight and maybe up to 50 € for a very far long-haul flight, like Frankfurt-Singapore.

As a result of this price increase, there is a new dimension of competitive structures, which has been examined by us in our latest papers. On the widely liberalized air traffic market we have the problem of where airlines have situated their hub. For example, Lufthansa has a hub in Frankfurt and Munich, whereas American airlines have these outside of Europe, such as Delta with its hub in Atlanta.

Therefore it is interesting to see how many different travel routes there are available to me as a customer. We had a paper which used the example of flying from Cologne to San Francisco. One possibility was to fly by Continental via Cologne- New York (not available anymore) and then continue to San Francisco. According to the ETS (Emissions Trading Scheme), the flight from Cologne to New York would obey the regulations, but this flight is significantly shorter than one from Frankfurt to San Francisco.

It would also be possible to take Lufthansa and go by train from Cologne to Frankfurt. This means that the American airline with its hub outside of the emissions trading zone operates only a few routes on a very large number of flights that fall under the regulations of emissions trading.

Aggravatingly, we reached the conclusion that long-haul flights scored very well regarding the specific CO₂ -emissions caused by different airlines with their respective flights.

This also has something to do with the physics of flying, because the very energy-intensive take-off phase is distributed over a long distance. Differently from short-haul flights, for example Cologne- Berlin, where the plane must be first taken up to travel altitude, what requires a lot of energy; whereas the distance is relatively short. Therefore a great amount of energy is needed, which causes a lot of CO₂ when converted into a passenger-kilometer value.

An additional problem is the high utilization of intercontinental flights for both passenger- and freight flights. As background information: the determination of benchmarks is based upon the reporting of revenue- tonne-kilometre in the monitoring concepts. Then it proves to be especially good if an airline additionally also transports a lot of freight, because everything counts as traffic capacity, which can be registered and reported. By multiplying this amount with the benchmark I get more emissions trading rights.

That is the current state for third-country carriers, which only serve Europe with long-haul flights and additionally they only operate their short-haul network outside of the ETS, which means only having efficient types of flights. From our point of view, this is the main problem where competitive disadvantages for European carriers can be expected.

Continental and American Airlines serve their short-haul network within the USA, while Lufthansa serves the smaller places within the United States via Frankfurt (Frankfurt-Seattle/ Portland/ Denver). One can also fly by American Airlines from Frankfurt to Chicago and then continue further into the States.

The air traffic industry, also including aircraft manufacturers, has been evaluating the system mostly positive so far since they can more easily sell new and more fuel-efficient aircrafts. On the other hand, they also have a critical view upon the additional costs that can slow down the economic growth and then it is more difficult to sell aircrafts. They are rather indecisive and expect no big effects, whereas for airlines it is a little more difficult.

Another point, which is often discussed in the German public but not realized very well, is the great number of Intercont- Intercont Lufthansa passengers, for instance a traveler from New York to India has a great variety of travel possibilities. Certainly, it is also possible to fly directly from the USA to India or via the Arabic Emirates by Emirates and Etihad, or via Europe.

When we again apply the logic of a watering can like distribution of additional emissions trading costs, a traveler going from New York via Frankfurt to India and back would suddenly have to pay four times the additional costs for each flight. Regarding a long-haul flight taking up to 50 € added costs for each flight segment having 4 segments, the extra expenses would suddenly amount for 200 € totally. Looking at the low fares we are having nowadays, I can well imagine that a New York- India ticket will not cost more than 1000 €, so it would be a cost disadvantage of 20 % compared to other airlines. From the Lufthansa point of view and also taking into account other European airlines: KLM, Air France, this is a really big problem.

Furthermore, concerning low-cost airlines (AirBerlin, Ryanair and EasyJet with a strong growth) the benchmark allocation of the reported revenue- tonne-kilometre based on this year represents a great difficulty that, because this value will be also taken as basis for 2012. When an airline is showing a relatively strong growth or doubles its fleet until then, they will naturally need to purchase more additional emission rights than other airlines, such as Lufthansa with only a moderate growth.

These are competitive aspects that play a role within Europe, meaning low-cost carriers may suffer from potential competitive disadvantages, simply because they grow faster and therefore require more emission certificates than are freely allocated to them.

Interestingly, EasyJet was very pro emissions trading, while Ryanair was totally against it. EasyJet argues that there are positive environmental effects, because they are all using relatively new aircrafts with a high utilization rate. It always depends upon the point of view, whether the absolute emissions are taken, which of course greatly increase by the growth of low-cost carriers, or the specific emissions of individual airlines per passenger-tonne-kilometre, which may be lower in comparison to other airline's emissions.

It is always a question of argumentation and I take the view that one should assess the absolute emissions, because these are eventually relevant for the environment. Therefore a strong growth of some carriers is rather undesirable.

4. How much CO₂ -reduction potential do you see in the aviation industry?

We are dealing with this wonderful topic every day. Our institute is rather technically oriented. We are a little untypical for the area of airport establishment and air traffic arrangement. Usually our institute employs extremely many engineers, who want to develop innovative technologies.

There is a department for material research that deals with the construction of lighter materials in order to reduce the weight of aircrafts and therefore to save fuel. Then there is an institute for propulsion technology, where new engines are developed and components are optimized.

All across Germany we have many other locations. In Gottingen aerodynamics and airstream technology is researched, where they try to minimize the air resistance of aircrafts to contribute to fuel saving.

This is all unbelievably expensive which can be proven by good graphics. The development looks like this: regarding the aircraft development from the 1950s until 2010, it is interesting that during the first years there were unbelievable progresses. In comparison to the achievements during the last few years, it has become extremely difficult to achieve savings in fuel and a decrease in CO₂, because engineers are running out of possibilities within the boundaries of natural sciences.

It is becoming constantly more difficult and increasingly more expensive to achieve progresses. Therefore one has to say that the technological potentials are already exhausted and extremely costly. From an environmental- economic and holistic point of view, it makes most sense to avoid emissions where it is cheapest. As a rule of thumb, one can say that the avoidance of 1 tonne CO₂ in aviation costs around 500-800 €, whereas these costs would probably only amount for 20 € in a coal powerplant. There should be no question within the society about where emissions need to be reduced; certainly not in air traffic due to the enormous costs.

Another problem is the impossibility in aviation to reduce all occurring emissions equally strong and at once as a result of the difficulty to develop progress. One has to think about what is more important, whether it is climate change or the improvement of local air quality at airports.

The new and fuel-efficient aircraft engines have the tendency to emit more nitric oxides. Then one needs to decide what is wanted: either less nitric oxide with automatically more inefficient fuel utilization or fuel-efficient flying with the acceptance of local air quality at airports to worsen.

Another issue is the technological progress, which happens only very slowly. It is easy to demonstrate this talking the product lifecycle of an aircraft: the air traffic industry is regarded as a very modern and innovative branch of industry. However, when thinking about the Airbus A-320, which still has many orders, one has to remember that this project started in 1984. Despite of continuous optimization an A-320 build today does not differ much or only marginally from one that was build 1995. In principle there has been quite little technological progress.

A successor for the A-320 is only planned for 2022- 2023. Then the last Airbus A-320 build in 2021 is still going to fly for 25 years. This finally means that the entire product cycle runs over 60 years. As a matter of principle, from the first blueprint until the last plane is taken out of service.

You rarely see this in any other industrial branch, because you rarely capital goods are used that long and intensively. Therefore the world fleet is also changing only very slowly as every individual plane is used for an unbelievably long time.

Taking a look at the Lufthansa: nowadays the average age of the majority of the intercontinental fleet exceeds the age of the pilots who fly it. The Boeing 787 fleet of Lufthansa, of which they are still having 60, was built in the middle and end of the 1980s, which are again about 25 years until now. Regarding safety this is not a problem, because the planes are always optimally maintained.

One can conclude from this that Lufthansa thinks: everything currently available on the market is not so much more efficient that it were worthwhile to substitute our planes. Even if they substituted their old Boeing 727 by newly build ones, in the end it would only achieve 5-8 % in fuel savings. The high investment costs needed to purchase new aircrafts are not profitable. Then you rather continue flying with your older aircrafts.

One can well recognize in what areas Lufthansa is focusing on modernity: namely in the long-haul fleet where significantly more fuel is consumed than in their short-haul traffic. According to our calculations, Lufthansa has approximately 12.800 flights a week of which 800 are intercontinental flights and the remaining 12.000 are short-haul flights. The intercontinental flights consume more than 75 % of the entire fuel consumption within the Lufthansa fleet. There is an extreme disproportion, 12.000 against 800. For that reason Lufthansa invests very strongly into its long-haul fleet to achieve effective fuel savings. This would not be worthwhile in the short-haul fleet.

Interestingly the manufacturers, Airbus and Boeing, are concentrating firstly on the construction of new long-haul aircrafts. The A-380 has been operated for two years and the Boeing 787 was just recently taken into service, while the A-350 is still under construction. Concerning these aircraft types one should have the greatest comparative benefits from new technologies.

Back to the A-320 successor, when it will be taken into service between 2022 and 2024, the older model will have been in production already for over 30 years. These are the dominating economic and technological mechanisms that lead to boundaries in the reduction potential.

Taking environmental problems, on the one hand the global traffic is growing rapidly at an annual rate of 4-6 %, but the technological improvement rate by removing old planes, trying new approach methods and other aspects amounts for only 1- 1.5 % per year.

Clearly in the long-term the fuel consumption is going to increase gradually and technology will not be able to make up for the strong growth in traffic, also regarding the growth of emissions. It is a further important point to find other measures besides technology and in my opinion emissions trading is one of those.

Why do airlines need to reduce emissions themselves, taking on very high expenses, if it would work much more efficiently in other sectors and the air traffic industry could just contribute its share to it?

It is often discussed, also airline-lobbyists like to use it, that an improved air traffic control is needed (for instance in Lufthansa's political letters). It is assumed that 10-12 % more fuel is used than it would be actually necessary, because the air traffic control structures are supposedly inefficient.

I want to emphasize that this is no argument against emissions trading. Even with an absolute efficient air traffic control the increase rate of emissions would conform to 3 years of good economic growth, but what is going to happen afterwards? Therefore this kind of argumentation is not persuasive as it is no long-term solution.

Another aspect is the attempt to optimize flight operations here in Cologne, for instance by not doing conventional approaches but by using a similar approach like a sailplane. Then they let the engines idle and float towards the runway, what is called "continuous descent approach".

On the one hand it certainly brings some advantages, but on the other hand it becomes anyhow very difficult for air traffic controllers to interfere in heavy traffic. These potentials are only possible in a very limited scope.

5. Do you think more flexible regulations could lead to a higher compliance of airlines with the emissions trading scheme?

Certainly, the idea of different benchmarks was already mentioned in our papers. It would be one possibility to avoid potential competitive distortions by setting separate benchmarks for freight- and passenger traffic or respectively for short- and long-haul flights.

On the other hand, it may upset airlines even more than they already are, because it would complicate the administration even more. Now airlines are already upset about their monitoring concepts. If they were to separate their monitoring concepts according to different flight routes, business models or freight- passenger traffic, it would mean more administrative expenses, which would be again negative for airlines.

In principle it is difficult to say. It hasn't been discussed officially whether the emissions trading scheme could be modified in that direction. Now they are doing it in this form, so I am not so sure.

I regard it as interesting how airlines have been reacting towards emissions trading. Many airlines are very opposing to it (Ryanair is against anything that increases costs and also Lufthansa were a long time against it).

Nevertheless, there are some positively mannered airlines (Scandinavian Airlines was one of the first ones to support it, even though it only regards Europe, because it is a good measure of climate protection and they see it as a part of their corporate social responsibility to participate).

Personally, I have noticed that many British airlines were in favor of it (British Airways and EasyJet). My assumption is that they reacted that way to steal to airport upgrade enemies' thunder. They say: "Clearly the air traffic has negative consequences for the climate, but we are taking responsibility for it and therefore demand some concession regarding airport upgrades, because both Gatwick and Heathrow are extremely overcharged." It is certainly better to set up a concrete upgrade design rather today than tomorrow. This is a subjective assessment and I cannot really prove it.

It could explain why some airlines are for and some against it. Most airlines outside of Europe are extremely opposing the ETS. American Airlines only submitted their reports under great protest. The American Trade Association wants to sue now against Great Britain, because it will be the administrative country in that case. We will have to see how judges are going to decide. The many different evaluations of airlines are interesting.

6. Is there federal support for airlines to set up and optimize their emission monitoring system?

To my knowledge the DEHSt (Deutsche Emissionshandelsstelle, Eng.: German emissions trading institute) organizes workshops where they discuss the requirements of emissions trading and what are the expectations towards airlines. As far as one can evaluate from a distance, it seems to be mainly a huge for all kinds of consultants and accounting firms.

Especially small airlines, particularly from third countries, are not very familiar with the European practices and then employ a consultant to help them set up the monitoring concepts.

One of the former graduates of a colleague of mine, who has been part-time lecturer in Bad Honnef, has established an own small consulting company and is now also advising Russian airlines that are flying to Europe. The consultation deals with the set up of monitoring concepts, as well as the required certificates for the respective authorities.

Another dimension is that not only persons are needed who support airlines with the set up of monitoring, but there is also a need for professional to control, audit and verify these concepts. This is really a huge market for accounting firms as I have also personal contacts to Pricewaterhouse Coopers. They are making a lot of money with it.

By means of legal guidelines, a totally new field of business was created. This suggests the assumption that airlines need to pay a lot of money for these services and these firms are the biggest winners of emissions trading.

Also the tightly scheduled deadlines were quite problematic as many airlines were not able to keep them. Therefore there was a prolongation of 3 months.

The first phase only concerns a timeframe of one year, which is not so tragic, but the second phase is going to last from 2013 until 2020 and is based on only 1 monitoring year in 2011. If some airlines forget to hand in their documents, then they will not get any emissions rights for 8 years. Even as a small carrier, flying to Europe only 5 times per day, summing this up to 7 or 8 years, it results in millions of euro. From an airline perspective this is extremely important and it would be very interesting to see current numbers about how many airlines haven't handed in yet their monitoring concepts.

You wouldn't believe what can be seen in practice, for instance when I participated in an IATA (International Air Transport Association) slot conference 2 to 3 years ago. In most cases, if you want to fly to a big airport, you need to apply for slots from the airport coordinator in advance. If no slots are assigned to you, you are basically not allowed to fly there. I came across some airlines that did not know at all how the system works. Also really big carriers were amongst them, who operate daily flights to Europe with their Boeing 747s. Then I could conceivably imagine that smaller airlines may not even have followed up with the ETS so far and they will get big problems.

This can be another difficult factor, because it is not worthwhile for small carriers to form extra units for emissions trading due to the lack of resources. Often employees from another field, already having other tasks, are involved to additionally take on the responsibility for emissions trading. Often they are even alone responsible for this entire issue.

Bigger airlines, such as Lufthansa, are not harmed by taking on a few more employees for that purpose, in case they are needed. For smaller airlines this is more complicated, taking into account that small third-country carriers often do not even have any personnel here, but only small handling agents. Then consultants become very valuable to them. In conclusion, there are no real federal initiatives, but the state rather complicates the whole issue even more.

7. Are there financial resources to support airlines to acquire more environmentally friendly technologies?

This is also an interesting question: I would say yes and no. Of course, there is no scrapping bonus for aircrafts like for old cars. Admittedly, there was a demand for it from EasyJet, but this is nonsense. For the reason that even 22 years old aircrafts, including all maintenance and optimizations, are on quite the same qualitative level as currently build A-320s. Therefore there is no objective reason to demand such a thing.

One could say that benefits of certain financial resources persist in research promotion. There is a very big European project called: JTI (Joint Technology Initiative, Clean Sky).

It is a very expensive project of which a lot of money flows to aircraft and component manufacturers for the purpose of research and development to bring forward new technologies.

These are supposed to be implemented into practice as soon as possible. We are also involved in it and the project is very important to us. There is also a lot of interest within the EU to support and promote advanced technologies to create new workplaces by establishing competitive technological developments.

Besides that, there are also general research programmes of the EU, while the most recent programme is the research project 7. We can also apply for it and then we are qualified to receive money from the financial funds of the European Commission.

At this site, we also have a test facility for combustion chambers, which are built into the engines where fuel is burned. These have the aim to achieve more fuel efficiency and to create fewer emissions of nitric oxides. At inquiry when this is likely to be ready for practical implementation, the answer was in 10-15 years.

Of course safety is playing also a big role, especially in the area of general aviation, but also for small business planes since the technology of reciprocating engines hasn't changed much since the 1950s or 1960s. These business planes have unbelievably bad emission values, but it simply requires so much capital to develop something new. There was a German entrepreneur called Thielert, who has been developing small diesel engines. Despite his great success, he got bankrupted. Even in practice he got very good critics and was technologically innovative. Nevertheless, it simply costs incredibly lot of money to bring such a project to market maturity, going through all instances and certification procedures. Accordingly no medium-sized entrepreneur can really afford it. Even regarding big aircrafts, there are eventually only two big manufacturers left on the market, Airbus and Boeing, while one can still include the smaller ones Bombardier and Embraer, for the reason of the incredible expenses involved in the development of new aircrafts and the completion until series maturity. It engulfs billions and that is why planes are produced over a very long period of time. It needs a lot of time to amortize these development costs.

As an example, when 5 billion were invested into an aircraft, but only 5 million can be amortized when it is sold, at least thousands of them need to be build to even get back the costs of research and development.

In both Germany and the United States, Airbus and Boeing are supported to export their aircrafts. There are export-import banks that support companies to make business abroad, in Germany are for example Hermes-guarantees, which make sure they receive cheap financing.

The main political interest is more to secure workplaces and less to sell other countries new and environmentally-friendly technologies.

Airlines like to use the argument that the costs arising from emission trading deprive them of the money they need to invest into the acquisition of new aircrafts and technologies with lower emissions. Economically this is exactly the right thing to happen. Money shall not be wasted on expensive technologies, but emissions trading shall be used to finance the most cost efficient emission reduction. Besides lower fuel consumption, airlines are also following other goals by acquiring new aircrafts. These are for instance lower maintenance costs, a high reliability and of course it looks good towards customers when modern aircrafts are operated.

8. How do you see the development and potential of alternative fuels to be used on a large scale in passenger aviation?

Also for us this is an interesting topic from the environmental-economic view point. As explained earlier in detail, it takes a long time to develop new aircraft technologies and to bring them on the market.

It is exciting to see what would be possible through the appliance of alternative fuels. A regenerative type of fuel generated of bio mass, which could be almost free of CO₂ could achieve saving potential completely without the need to have new technologies.

One could also shift these potentials from the aircraft itself to the production and utilization of these alternative fuels. Correspondingly, I see a great potential given that achieve a large scale application could be achieved. At present there are various different initiatives and production processes.

Tuifly want to set up a Jatropha farm in Mozambique (an oil plant that grows on soils where no grain can be cultivated). Therefore there is no competitive situation with food. When this nut-like plant is grinded you get oil that can be treated to get aircraft fuel. This would be a very positive development. Another interesting alternative is fuel from algae, which has been strongly discussed currently, but it is still at the beginning. According to researchers there are thousands different kinds of algae and the right one need to be identified and test first in order to find the one that grows best, is easiest to harvest and most cost-efficient to process biomass from.

A further problem is the conditions for certification, because alternative fuels need to have the properties required for an aircraft fuel, but I think they are already relatively far with it. We can expect that this or next year alternative fuels will be at least approved as mixtures. Kerosene can be easily substituted by these alternative fuels. Of course you can also do it gradually by mixing kerosene to a certain percentage with these new fuels and then use them in that way.

It would be quite different regarding these very exotic alternative fuels, like hydrogen. It would require building totally new aircrafts, additional hydrogen storage tanks at every airport and an extra supply system for hydrogen, what would be really complicated.

This is not very likely to happen. Hence, I see the greatest potential in these 1 to 1 mixable and substitutable bio-fuels with kerosene, as well as the gradually mixable alternatives. How this is going to spread greatly depends upon the development of the oil price. One has to note that two goals could be achieved at once. On the one hand, airlines could be less afraid of raising oil prices to \$ 150 or even \$ 200 as it happened in 2008, on the other hand these alternatives would offer a greater independency of oil.

Given that this development contributes to the application of more environmentally friendly fuels, also a new supportive instrument would be created, because in conformity with the EU- emissions trading regulations these fuels carry the emissions factor of zero. This means that if an airline uses such fuels, it does not need to purchase emission rights for them. These rights could then be either sold on the market or the airline can purchase less rights. These could be a great development, but the biggest problem concerns the implementation on a large scale.

There have been continuous calculations and discussions about the size of agricultural area under cultivation needed to substitute the entire airline fuel by bio-fuels. The results gave rather absurd numbers and for conventional processing, like for diesel-fuel production, an area of 3 times the size of Germany would be needed to be able to supply the entire worldwide air traffic.

Others say that an area of the size of Belgium would be sufficient enough to cultivate algae. It is still very unsure which processing method is going to be used and which one reveals to be the most suitable. Besides Jatropha and algae, there is also the Fischer-Tropsch process, where any biomass can be used to produce synthetic fuels.

Then there is still the question how needs to be evaluated regarding CO₂ -aspects from cultivation to application. Of course, first a lot of energy there needs to be put in and then also possible side effects must be considered as well.

If one would use sweet corn for the purpose of fuel production, price levels would rise and a major part of the population in developing countries relies on it as staple food, which would have extremely negative consequences for them. However, the Jatropha cultivation in developing countries would be rather positive as it would create new workplaces and it could represent a new source of income for the population.

Then you would not only include the positive environmental aspects, but also the thought of support for developing countries.

Everything also needs to be evaluated according to its usefulness and transport costs: transporting Jatropha from Mozambique to Europe. It is still in its infancy.

We do not need to worry too much about the scarcity of oil. Theoretically the alternatives are available; they are just still a little too expensive in production for the time being. I think the development will be anyhow positive.

As additional point concerning the certification of bio fuels, we should ask ourselves if it were not more sensible to use them in other industries, for example in power-heat coupling or biogas plants. Then one could minimize all of these conversion losses. These are concrete questions for later on.

The Fischer-Tropsch process can be also used for natural gas and coal to get fuel, but concerning the ecological assessment the results are very bad because of the high fossil CO₂ -pollution and the high loss of energy when converting these into fuel.

An optimal solution would be a cycle of alternative energies. The CO₂ -release during combustion could be absorbed again by plants in growth. If you had a perfect cycle, there were no increases in CO₂, but this will probably never be feasible as there will always be environmental pollution and additional energy needed for these processes.

9. When do you think alternative fuels will be at an affordable price for airlines and ready for mass production?

It greatly depends upon the oil price when alternative fuels will be at an affordable price level. There are strong incentives to support the relevant research projects and also to make private investments in that area. This well recognizable in reference to the economic crises: since oil has become relatively cheap, people have been talking much less about alternative energy sources than they did when the oil was at a much higher price level. At a high price, there really is a strong incentive and the introduction of these technologies can suddenly happen quite quickly. What is going to take longer is the construction of production capacities. In global aviation, currently about 200 million tonnes of fuel are consumed annually. This is quite a lot to generate from biomass.

Firstly bio-refineries need to be build, what naturally takes some time. Within a timeframe of 10-15 years it is certainly possible, especially by admixture with conventional fuels.

My graduate, who wrote his Bachelor thesis about this topic, figured out that it is even beneficial to mix bio-fuels according to several papers. This is because pure bio-fuel also has some undesirable properties, for example it freezes earlier than conventional fuel. Freezing stability is, due to the low temperatures in high altitudes, extremely important. Then it is even good to have a 50 to 50 mixture.

Current certification initiatives are anyway only referring to mixtures and not to pure bio-fuels. Regarding emissions trading it would be more complicated for airlines again, because they need to proof to what extent bio-fuel was added to the normal fuel. Even fuel suppliers need to obtain certificates and proof the consistency of the fuel mixture to be sold. Then the appearing emissions can be taken into account only to 20 % for emissions trading, depending upon the extent to which the two fuels were mixed.

10. Do you think the prohibition of emission intensive aircrafts would make sense?

As I already mentioned, the suggestion by EasyJet was not positive. On the one hand, airlines do not generally operate emission-intensive aircrafts referring to CO₂ (at least not without reason), so any airline eventually has the incentive to use fuel-efficient aircrafts.

Even in Russia, they are seeing this issue quite clearly. For a long time, they had used old Soviet-aircrafts that were extremely inefficient. Now looking at Russian airlines, almost any of them is using modern aircrafts from the West. They also have realized that it is more efficient to operate these and therefore they can commercially be more successful.

I do not think such a prohibition would be sensible as it is often already regulated by the market itself through the fuel price. During the last few years, there has been an obvious correlation between fuel price and old aircrafts that were taken out of service due to that.

Something really interesting from a global viewpoint is the fact that even in the USA surprisingly many old aircrafts were used. In the end, also airlines are realizing that it eventually ruins them regarding the high fuel prices. Then they have either the choice to totally take the fleet out of service, or to substitute it by new planes. The pressure on the market is incredibly high. For many airlines fuel has become the most important cost driver, amounting for 40-50 % of overall costs.

11. What can be done about the disadvantages European carriers are going to have, because of the emissions trading scheme?

Maybe I have to add that our institute has pointed out some of these disadvantages already in our papers, but finally one must remark that these disadvantages are actually not very relevant. They are not as bad or serious that they would represent a competitive disadvantage. It has also been discussed that airlines could modify their flight network so that they integrate intermediate landings nearby or just somewhere outside of the EU. Nevertheless, this would cause far too high costs and unnecessarily prolong the service periods of the crews.

Many customers anyhow have a willingness to pay for non-stop flights. If you want to fly from Frankfurt to Singapore, it works either directly by Lufthansa or with Emirates via Dubai, but in the end Lufthansa always manages to enforce a premium price for direct flights on the market.

There is always a customer segment that wants to fly preferably quickly and does not want to accept any inconvenience, for example by switching planes or long waiting times. Therefore Lufthansa can demand higher ticket prices than Emirates, which has a stopover. I do not see a big disadvantage here.

Furthermore, we have always expected a watering-can like cost distribution, but airlines can perform this in very flexible ways. The customer segment with less price-sensitivity can be charged more money since often this segment is anyhow less competitive. However, there can be still very cheap ticket, as those of Ryanair for 5-19 €, which will still exist even with emissions trading. I think airlines will perform this very smartly and distribute additional costs well across the demand.

Probably most airlines would say that emissions trading is very bad from political points of view. For Lufthansa the value of additionally required emissions certificates would go quickly up to 200-300 million €. That is a lot of money and there are more administrative costs, because more personnel will be needed. These costs are strongly influenced by emission certificate prices.

I assume that airlines will not leave many emission rights unused since the first allocation is relatively tightly measured and amounts only for 60-80 % of the rights needed.

Therefore airlines would need to massively reduce their operations, whereas improvements of 20-30 % are not solely achievable by technical improvements. It is not easy and relatively expensive. For instance, for expanding airlines such as Ryanair, which desire to continue growing the required amount of money is relatively high.

Competitive disadvantages in the transatlantic market would disappear, if the USA were included. The more countries participate, the lower competitive distortions and avoidance reaction and the higher the economic efficiency.

Interview with Institute B

Date and time: Thursday 28.01.2010, 11:00-11:58

Person: Economist and emissions trading researcher

1. How do you see the global implementation of emissions trading for the aviation industry global implementation emissions trading for aviation?

As a very clear statement: yes. It is not only possible, but I also regard it as the best that could happen. In theory there is no doubt, but practically it is difficult: not so in terms of technology, but certainly within the field of politics. From a political point of view it is a critical matter, especially if it is undertaken under the UNO (United Nations Organization) and with the UNFCCC (United Nations Framework Convention on Climate Change) and post Kyoto Protocol. We will still have to wait a few years to see it happen. I believe though that the trend is going into that direction. Europe has started and therefore includes already a significant part of emissions, which amount for about 40 %.

If the system proves to be successful, it will also persuade newly industrialized countries. The next step would be to add developing countries, what I regard as a conceivable way. I don't know how fast it is going to happen. I think it is more likely that it will not happen under a Kyoto succession protocol, but that the ICAO (International Civil Aviation Organization) which is obliged for this responsibility by the Kyoto Protocol and is going to establish a system that will regulate emissions further.

Someday a system will not only be discussed anymore, but also actually implemented. My hope has become stronger, because I am under the impression that Europe is taking its own system seriously, a number of big airlines has interest that Europe is not standing alone and that the rest of the world will also go along with it.

There will be influences on the respective ICAO committees and there will be discussions to impel the process, therewith we are really going to have a global system under the ICAO someday. On the behalf of airlines there could be still stronger efforts towards the ICAO. In various conversations I have gotten the impression that efforts have become stronger. The knowledge has grown that the ICAO is the best way to go forward, because it is quite unlikely that the whole system is going to be cancelled again through any legal procedures.

Furthermore competitive distortions for European airlines could be avoided, if the ICAO builds a global system. This is certainly the easier way than to attempt to stop the European system for air traffic by using political efforts or relationships. Airlines would have the adequate influence.

It would be best if the system functions well, emissions are actually diminished and a trade develops that also catches the attention of the financial sector, which should then have an interest on continuous development. It would be good if financial ministers noticed that, income can be generated by the trade, which could then be invested into sensible projects.

One would need to dispose the financial sector more strongly in favor for emissions trading, which could act as a very good motor to accelerate the whole process.

2. How have you followed and prepared for the emissions trading scheme?

There are several answers. Concerning the topic of monitoring and handing in of concepts and reports, we have not been following the developments, but rather impelled them in cooperation with the responsible European authorities and the Commission.

We had followed the development between 2006 and the beginning of 2008 when the European regulations were negotiated. The European Commission presented the first draft of its regulations in December 2006, which was negotiated within the following 2 years. In the first preliminary consideration of the Commission still a climate factor of 2 existed, which was not mentioned anymore in the final version.

The European Parliament tried again to introduce such a factor, but was not successful. The arising questions regarding cap- lowering, auction shares and other political crunch points were followed by us more or less interestedly, because they were not important for our work. It does not play a role for us in which sum caps is lowered and how many percent of shares are auctioned. We are just creating more or less certificates or auction according to that, whereas the mechanisms stay the same. We were merely waiting for a decision, which mandates us to finally make concrete preparations as time became more and more limited.

It was for us as an executive authority a more important matter to actually get a decision in time than to get 10 % of auction shares, while politicians may have another opinion. That was the time when we were following the developments.

As soon as a clear agreement between the Parliament, Council and the Commission was reached, we started to prepare. It was still uncertain for a short time which one was going to be definitely the responsible German authority. Then there was no one but us who could and wanted to take on the task.

We had the infrastructure, registry, emissions trading and monitoring experience from the stationary trade, as well as the personnel, whereas during the past years we have been performing the additional work from our own resources what has lead to a considerable amount of overtime work. There was a project group that has impelled all necessary preparations.

Altogether, from middle of 2008 until the summer of 2009, we had created all conditions for the submittal of monitoring concepts. Furthermore, we also gave information concerning the required contents of the monitoring concept, created model monitoring concepts, performed events, set up a website and wrote mailings and personal messages.

Then of course we establish our expertise about the air traffic industry trough learning-by-doing to be able to evaluate the matters well and appropriately. Therefore we also had an active exchange of information with other European colleagues to secure a uniform implementation and interpretation of the regulations and monitoring guidelines.

Additionally, there is the technological aspect.

Institute B had already created an entirely electronic and paper-free handling of processes for the stationary trade, which means that there were already from the beginning entirely electronic emission reports, allocation applications, communication and this was then adapted to the air traffic industry.

We had to sophisticate the software programme for the submittal of monitoring concepts to make it possible for companies to fill in their entries already offline into the Formula-Management- System (FMS) and send them electronically via a secure connection to us.

In the stationary trade signature cards are required for this, but here we could wave them, but of course still needed authentication and identification to make sure that really the companies themselves sent the data and not some hacker.

The software development also took some time, because the content of regulations was not fully determined by then, which would have needed to be included in the FMS software already. Eventually it worked out and the software was finished last summer in time before the deadline and we could operate it.

The compliance with the deadline end of August 2009 as defined in the monitoring guidelines did not work out well, what was mainly caused by the Commission. The problem was the introduction of the system, because certain issues needed to be determined until a certain time before one could continue with further parts. If these contents are not fully determined or decided, you cannot write the software, create sample monitoring concepts and all other tasks cannot progress either. The preliminary work must be finished in time.

The late publication of the administration list of states by the Commission cost us a lot of time, because it should have been published until 1st of February, but it was finally published in August. Without knowing which operators to supervise, we were unable to send any information. The actual idea was to hand in the monitoring concepts until 31st of August. However, the operators just found out on 11th of August to whom they are supposed to submit their concepts and we could not just leave them only 3 weeks time to do all the work, because it requires a lot of effort.

Within the German data collection regulation there was a rule stating that operators have 8 weeks time to hand in their concepts after the list was published in the federal gazette.

Therefore the formal deadline just ended on the 20th of October 2009. This threw us back, because actually the operators were supposed to get their concepts approved already until 31.12.2009, just in time before January 2010. We did not achieve this as we received most concepts only briefly before the 20.10.2009.

Many airlines had also submitted incomplete or unclear concepts of what certain query loops resulted. Therefore, our team couldn't work full-time on this issue, because it consists of personnel with actually other responses, namely for the stationary emissions trade. Airlines that sent us their concept until 31.08.2009, although there was no obligation for it, received feedback until the end of the year concerning missing aspects or approval was sent. For most other airlines it has not worked. The cause was the belated determination of monitoring guidelines and the delay of the list of administrative states to supervise.

3. What macroeconomic developments do you expect in the aviation industry when emissions trading will be introduced?

I would assume that the competitive situation will slightly worsen for the European aviation industry, at least short-term. This often happens to “front-runners”, because the pressure towards more efficiency increases.

Nevertheless, this is going to bring advantages in a few years when kerosene will be more expensive, due to the fact that the European airlines were obliged earlier to obey the pressure towards more efficiency. It can also represent a chance to EU-carriers, especially airlines with new aircrafts and a good management can benefit from it.

There will be others which are going to lose market share, whereas last but not least we need to remember that the majority of emission rights is freely allocated. The market is not as price-sensitive as airlines would want to make us believe. Probably there is a higher price-sensitivity in the low-cost sector. It will be conceivably possible to enforce price increases. Probably they will still be able to generate profits the same way as electricity companies did, because the value of certificates can be included into ticket prices although a part of certificates was given for free.

From that point of view I see it quite calmly. Also the electricity companies were complaining when emissions trading was introduced in 2004 and then they made billions of extra profit between 2005 and 2007. Therefore I assume that the situation for the air traffic industry will not be critical either.

Naturally there will be some reactions of avoidance. I could imagine that the airport of Zurich is going to be stronger utilized or that airlines consider intermediate landings outside of the European system. Nevertheless, all studies I know support the evaluation that this is not going to happen on a large scale; because airlines need to pay landing fees and they would need more time. The costs of a stopover, take-off and landing in many relations exceed those of the price for emission rights, which are not considerably expensive.

The European Commission has determined through an “Impact Assessment Study” that ticket prices are going to have an increase of maximal 40 € for long-haul flights considering the respective certificate prices and utilization rates, so that it won't make much of a difference for ticket prices of 1000 € or more.

I consider the macroeconomic effects of emissions trading by itself as quite comprehensible. In comparison to the macroeconomic big impacts of the crude oil peak last summer, the financial crises, SARS (Severe Acute Respiratory Syndrome) or the 11th September, I regard all these issues as being much more influential. Not to forget the strong influence of taxes for kerosene and oil, which also concern airlines to a much larger extent than emission trading. The prices for emissions would need to increase to 3-digit numbers in order to reach such strong effects as from the above mentioned examples.

European airlines have of course agreed to emissions trading to avoid a kerosene tax, because it was clear that something must happen. There was also support in advance, otherwise the Commission wouldn't have been able to impel the whole matter. At least there was no strong resistance, because if there was no emissions trading, what other alternatives would there be? The public pressure to do something to avoid emissions in such a strongly growing industry that destroys climate protection efforts in other areas is constantly increasing.

4. How much CO₂ -reduction potential do you see in the aviation industry?

Regarding this, I probably do not know more than you, namely what is written in newspapers and specialist publications.

I am not any aviation engineer, but I am an economist, so I do not know what technical potentials there really are. According to the literature and other media, the potential is between 30-40 %; in medium- and long-term even 80% are assumed to be possible. IATA (International Air Transport Association) has created a pillar concept that even considers CO₂ -free air traffic for 2050 or 2080.

The reduction potential is assumed to be rather big, even by only looking at the progress the Single European Sky is supposed to achieve in terms of fuel savings. In case these results can actually be achieved as they are stated there, of which I am not very persuaded.

Most likely the reduction potentials were prettified and assumed to be higher than they actually can be in realistic terms. This is only a personal feeling which I cannot prove. It is not our terrain to judge single European Sky and we do not have the required specialist knowledge about it.

It is not so easy to simply fly slowly, because everything needs to be coordinated and organizationally voted for, but it could be a possible reductive measure for the air traffic to slow down the travel speed a little. Of course, this first would need to be discussed in the respective committees of airlines. Also small changes are conceivable, such as modifying the engines or single taxing.

BBI (Berlin Brandenburg International) is also an airport of short ways and as not many airports are built anymore, one could find ways to optimize the existing ones.

Very visionary are the totally new aircrafts concepts, for instance the ones consisting of only wings or the circle-shaped planes entirely without wings which are supposed to achieve reductions between 20 % and 40 %, given that they are realized someday. I regard the reduction potential as relatively big and not as negative as the aviation industry itself likes to claim. Bio-fuels can also be a good reduction method, but the tendency suggests it won't be realized before 2020, but who knows if it's not going to happen faster.

5. Do you think more flexible regulations could lead to a higher compliance of airlines with the emissions trading scheme?

Emissions trading by itself is already very flexible, because companies are not forced to keep their emissions below certain limit. Of course one could specify that airlines may only use the amount X.

But airlines can always buy additional emission rights and they may choose where they reduce emissions. It is neither stated nor restricted to technological aspects only. To my knowledge emissions trading is the most flexible regulative instrument.

One could have taken different benchmarks, but honestly I would not like it as it always distorts incentives, what is supported by studies. Currently we are having a discussion in the stationary trade, where we are using fuel-differentiating based benchmarks.

Coal plants would be unfoundedly favored, although they could not achieve the corresponding emission reductions when constructing a new plant and shutting down an old one. There are also other unjustified distortions. All studies regarding different benchmarks have shown wrong incentives and unfairness, which are not justifiable from a professional point of view. Why should a certain group be put in a better position, if it is not justified from an emissions point of view?

I regard this as difficult and I am happy about the current solution with one benchmark for everyone. I was not under the impression that there was a lot of resistance against it. From the outside it looked like a relatively undisputable matter.

6. Is there federal support for airlines to set up and optimize their emission monitoring system?

Mainly not. I have no knowledge of any federal initiatives. All airlines are already using control systems, because they need to monitor their kerosene consumption and when they know the amount of fuel used, they also know how many emissions were created.

Not all flights are obliged to emissions trading, so there must be a clear separation between emission binding and unbinding flight in monitoring. The monitoring guidelines prescribe a certain monitoring method that is determined by exact flight-specific tank measurements.

Some airlines complained that this does not directly conform to their organizational procedures.

There is no initiative that would make it easier for companies to modify their systems or to buy a new data management system and I would regard it as exaggerated. Not every effort needs to be government-funded, the also all profit generated by airlines would need to be nationalized. I think the state can demand some additional effort from airlines as well for ecologic and economic regulations.

The only thing that represents something similar to federal support is the development of a Euro Control support facility, which collects data from the Central Route Charges Office (CRCO) and the flight planning (CMFU) in order to identify emissions trading obliged flight and to make estimations about emissions. This happens through the known flight route and aircraft type.

Then it is known how much kerosene per flight hour was burned and how much is used for take-off and landing, so euro control can make estimations and support airlines to identify all flights within great circle distances with legal certainty.

At the moment they are developing a support tool that will be provided to airlines. If it will cost anything is currently in discussion. It may be possible that the competent authorities or ministries are going to finance the development to bring the project forward and airlines would then pay for all costs incurring. Of course there is an interest from the side of authorities to get access to these data and for us the support tool is useful as well.

One could call it federal support, in case both the government and airlines benefit from it, if the entire development costs are financed by the state. It would be clearly federal support if the state entirely financed this project including the costs to run it.

7. Are there financial resources to support airlines to acquire more environmentally friendly technologies?

This was mostly determined in the previous question. Actually there are financial resources, but these are not administrated by us.

There are demonstration projects within the framework of climate protection initiatives of the BMVBS (Bundesministerium für Verkehr, Bau und Stadtentwicklung, Eng.: Federal Ministry of Transport, Building and Urban development), BMBF (Bundesministerium für Bildung und Forschung, Eng.: Federal Ministry of Education and Research),

BMWi (Bundesministerium für Wirtschaft und Technologie, Eng.: Federal Ministry of Economics and Technology) within the framework of the BMU (Bundesministerium für Umwelt, Eng.: Federal Ministry of Environment), which for instance support more efficient engines or according to regulations these types of projects could be supported.

I know that the German Post has received financial support for its natural gas vehicles by the programme or that particle filters for diesel engines were also a topic. Financial resources are available and the airlines certainly have a better knowledge of the possibilities to get that money.

The DLR (Deutsches Zentrum für Luft- und Raumfahrt, Eng.: German aero space center) receives governmental financing in the area of principle research.

These resources are also beneficial for the aviation industry, even if only indirectly. There is nothing available from us, but I believe it is possible to gain access to governmental resources.

8. How do you see the development and potential of alternative fuels to be used on a large scale in passenger aviation?

I, as an economist, cannot judge the technological side and I must rely on publications. According to the specialist press the developments sound very positive in medium- and long-term. Eventually aircrafts were already successfully operated by using kerosene-bio fuel mixtures. It is also possible to entirely run engines with bio-fuel. Certainly only bio-fuels of the second and third generation will be used, but research projects are running continuously. I am a little critic about the application on a large scale, because there will possibly be strong competition in its utilization. One aspect is the competition between food and bio-fuel with the arising question where the bio fuel can be used most efficiently: if for planes, cars, diesel engines or heating systems. Where is it possible to save the most CO₂? I do not regard it as already decided that the aviation industry is going to receive a big share of alternative fuels.

Controversially it may not be extremely unlikely since it has a high economic efficiency and it may afford to pay respectively high prices. The most likely development is even for engineers very hard to foresee and still unclear.

9. When do you think alternative fuels will be at an affordable price for airlines and ready for mass production?

The previously said applies here as well. I cannot judge it, but estimations suggest 2020, what is probably a rather careful evaluation. I would assess the issue rather optimistically simply from the fact that many financial resources flow into the research of alternative fuels, a lot of effort is undertaken and then it often works out faster than expected.

This is similar to the development of catalysts, particle filters, euro 1, 2 and 3 and CO₂ - emissions values per km for cars.

In comparison to previous estimations how the development could be even under best conditions, all statements proofed to be too careful in reference to the current situation. So why should it be different for the aviation industry? Nevertheless, I must emphasize that I do not have any underpinning expertise about this.

10. Do you think the prohibition of emission intensive aircrafts would make sense?

Maybe; I do not know enough of the distribution of aircraft types. There are still old aircrafts that consume considerably much and are rather noisy, so someday they need to be taken out of service. I assume that already due to safety reasons they need to be prohibited after a certain amount of time and at a certain age.

I do not regard an enhancement of this prohibition as a priority from an emissions point of view, but one needs to follow the development of emissions trading when it is up and running. One needs to observe how long aircrafts are used and how strong the resistance of airlines is regarding a substitution, still considering the economic and technological progress of course.

Already in other areas there was a market prohibition for products that scored badly in energy efficiency, such as light bulbs or refrigerators. Therefore I could imagine the same things for airlines, if emission-intensive aircrafts are still operated despite of all incentives and after a great deal of coaxing. Someday also old car types with euro class 1, 0 or even without any euro value are going to disappear. It is a well-known instrument and when it is implemented with sufficient transitional time and is announced well in time, there is no reason for companies to sue the state due to business damage. Developments just continue.

This has no priority, but of course one should support the need for action if such a measure becomes necessary.

The respective rules would need to be defined by the department of environment and the ministry of transport. This is not our field; we could at most deliver some data on aircraft types, which could only represent a part of the operated aircrafts. Euro Control and the DLR would certainly have much better data.

11. What can be done about the disadvantages European carriers are going to have, because of the emissions trading scheme?

A global system is the only feasible way. Anything else in discussion, for example a free allocation of all emission rights, an abolition of the ETS or more financial support would all have either negative effect, is prohibited or no future-oriented and long-term solution.

Whether the ICAO or the UNFCCC creates such a system is unimportant.

Most importantly is that a global system will occur and is then appropriately demanding. It should include good caps that do not allow business-as-usual, because then the system would be useless again and not bring any progress. The caps need to be based on the suggestions of the World Climate Council and need to be lowered according to climatic necessities. Then it should work well.

E-Mail communication:

Airline C:

1. What major developments can be expected for the airline industry when emissions trading will be introduced?

- Incentive and stimulus to increase efficiency even more
- Operation of modern aircraft types

2. How can airlines prepare for the coming emission trading scheme?

Currently we are in the final phase of our emissions monitoring timeframe (January 2010) for the tonne-kilometre and Emissions data reporting processes. Therefore, some processes of electronic data processing have been modified to suit the requirements of the emissions data to be reported.

Additionally, the integration or rather the implementation of external monitoring- and reporting tools, which makes it possible to process and evaluate all relevant data of relevance for ETS in accordance with the German emissions trading institute.

3. What kinds of different options (short-term and long-term) are available to adapt to the coming changes?

The possibilities are limited. Of course, there is to possibility to indirectly refuse the participation on the emissions trading scheme by not handing in concepts and reports. However, this is not sensible from an economic point of view for most airlines. Another option is supported by many airlines, also by us, namely: the creation of global emissions trading.

This plays a very important role for the retention of competitive conditions conform to the market for all airlines under consideration of fairness. Lufthansa, for instance, only handed in their reports under protest, which also strengthens the assumption that the implementation of emissions trading is critical for competition within the market and may lead to a disadvantage for European Airlines.

Basically, the most important option with regard to the coming regulations is a possibly still improved utilization of aircrafts. The greater the load factor, the greater the tonne-kilometer will be in 2010, which leads to a greater amount of emission certificates, which results in lower costs for obtaining additional certificates. Nevertheless, the increase of exploitation is an option, which has been taken even before the introduction of EU-ETS a signification role from an economic perspective.

An alternative option is the safeguarding of certificate demand synchronized with the safeguarding of fuel amounts (for example hedging).

Further options:

- Prohibition of emission-intensive aircraft types in Europe (e.g. Tupolev)
- Investments by the state from acquired income from emissions trading into new technologies
- Less frequent flights, but therefore increased use of bigger aircraft to increase the load factor and lower the amount of emissions release per passenger.

4. Which of these options would be realistic and why?

Increase in capacity utilization: realistic, but only partly controllable.

Investments into new technologies: realistic and presents incentives for airlines. The operation of aircraft types of a newer generation, like B-787, which save weight and fuel through usage of fiber-compound materials, is supported by the EU-ETS. Improvements in efficiency lead to fewer expenditure on purchase of emissions certificates.

5. How are ticket fares and cost structure going to be influenced (by higher costs through taxes and purchase of emission certificates)?

Yes, definitely. The costs arising from emissions trading can be classified as “cost-pass-through”. This will be strongly noticeable for the passengers and especially for pure Low-cost carriers it will be a big challenge, because in that market segment price-sensitivity is very high and the most important characteristic of product-/ service differentiation.

Changes in crude oil prices do generally have an influence on kerosene surcharges of airlines and therefore also on the ticket price. Therefore, it could be observed for many airlines that ticket prices have been adjusted according the oil price.

6. Do you think there will be more extra fees in the future due to ecological reasons? What type of fees could that be?

In the short-run one can assume that there will not be any further fees, excluding the emissions trading costs that will be passed on to customers. In the medium- and long run, additional charges cannot be excluded, whereas the entire aspect of customers’ price-sensitivity will be moved into the focus of airlines and that will have an aggravating influence on the industry.

7. Do you think airlines are likely to reduce their flight frequency and restructure their flight network due to the new regulations?

The substitution of the fleet is going to play a bigger role for airlines. However, this is nowadays already happening due to the changing kerosene price. The incentive to focus the fleet on efficiency is even encouraged by emissions trading.

It can be assumed that it will exert a direct influence on the long-term fleet strategy of airlines. In my opinion as reduction of flight frequencies can most likely be expected in the field of business aviation. This is due to the fact that there is a threshold value of 100.000 tonnes CO₂, which has the consequence of being excluded from emissions trading if an airline drops below this minimum. This is very attractive for many small business airlines.

8. Wie sehen Sie die Entwicklung alternativer Brennstoffe und deren Nutzung in der Luftfahrt, speziell bezogen auf die kommenden Regulierungen?

The development of alternative fuels is the future of aviation. Especially bio-fuel is being researched intensively at the moment and seems to present considerable advantages regarding environmental protection. Though, this development will still take several years, and of course the question arises how the price level of alternative fuels is going to be compared to that of fossil fuels. This will determine the incentives for airlines to choose between bio-fuels and kerosene. From the EU-ETS's point of view, alternative fuels are the future.

9. Do you regard ecologic marketing (*communicating environmental protection as a core resource to customers/ the environment*) as a good way of differentiation to gain customer attraction/ loyalty in the future?

Absolutely, we are also planning to put the issue of efficiency more into the perspective of the customer. Besides the usual qualitative attributes that create a certain brand image, the topics efficiency and environmental awareness will move more into focus. From the point of view of airline C, the core competence shall be communicated towards and remembered the customer. In our case this is going to happen via printed media (for instance brochures).

10. Do you think there are differences in the capabilities of alliance members and low cost airlines to reduce emission? If yes, what could these differences be?

In principle one must distinguish between different business models. Regarding low-cost carriers, reductions can be easily achieved, because anyhow savings and weight reduction are having a high priority and are possibly easier to achieve. Less weight saves kerosene and therefore one has lower emissions. Especially the classic alliance-carriers have difficulty to realize and implement this due to their business model (3-class configuration: cabin seats by classes: first class, business class and economy class).

11. Regarding trade of emissions certificates: Do you think the profit from selling unused certificates is a strong incentive for airlines to reduce their own emissions?

The incentive certainly exists; it is just not very high though, because the costs for emissions trading are going to be within limits, compared to other operative costs. The price of emission certificates represents a key function. In reference to the current prices of certificates one can assume a rather low incentive to reduce CO₂.

Airline D:

1. What major developments can be expected for the airline industry when emissions trading will be introduced?

The pressure upon aircraft constructors to develop a very efficient aircraft in terms of fuel consumption is increasing. In future, only cost efficient airlines will be able to survive.

2. How can airlines prepare for the coming emissions trading scheme?

Airline D has established an ETS-Team, which is operating as a cross-sectional function over several areas.

The main responsibility lies in the field of aircraft operation techniques, but also the areas of IT, politics, flight- and capacity planning, as well as fuel management are embedded as well.

3. What kinds of different options (short-term and long-term) are available to adapt to the coming changes?

The legal framework leaves little freedom. The lawful regulations are clear and define strict rules. Airline D tries of course to use its business options so that fiscal effects are reduced.

4. Which of these options are realistic and why?

I cannot answer to this question due to strategic reasons.

5. How are ticket fares and cost structures going to be influenced (by higher costs through taxes and purchase of emission certificates)?

The development of oil prices has been displayed through the introduction of kerosene surcharges. These surcharges have been developing in relation to the price of crude oil, which has been following the kerosene surcharges, because it has to regard the actual hedging of airlines.

Already today, the profits per ticket just let the fewest airlines reach the break-even point. Many airlines are operating at a loss. Therefore the adjustment of flight ticket prices is inevitable.

8. How do you see the general development of alternative fuels?

The actual results of bio-fuels give a hopeful attitude, but until they will be introduced for used at a greater volume, several years of waiting time are expected. Therefore they will not play a role within the next regulative framework, which is going to be enforced in 2020. Hopefully the development of bio fuels is going to reduce the dependence of aviation industry on crude oil. The related positive environmental effects are very much in line with our company philosophy to support a sustainable tourism development, which would be desirable.

Institute C:

1. How do you see the global implementation of emissions trading for the aviation industry global implementation emissions trading for aviation?

Technically in any case; there are also a set of studies dealing with it. It would be even easier to set up a global system than a regionally limited one (such as the inclusion of the air traffic into the EU- emissions trade in 2012 that concerns all flights from and to European airports) since there were no segregation problems then.

Politically the matter is unfortunately not that clear. Also at the last UNFCCC (United Nations Convention on Climate Change) conference in Copenhagen could achieve no progress. Surely there is a clear mandate in the Kyoto Protocol stating that emissions from international aviation (also including international shipping) need to be reduced.

The emissions caused by aviation and shipping were formerly not included into binding reduction obligations, because they could not decide how to attribute them correctly to the respective nations. This is indeed a big problem since a big part of emissions is created above the oceans. Additionally the various flight routes are differently used by passengers from industrial countries compared to those from developing countries.

Especially developing countries are strongly opposing a uniform inclusion of all aviation emissions while pointing out the “common but with different responsibility” towards climate change. So far, also the International Civil Aviation Organization (ICAO) with this instruction has not been discharging any binding measures of emission reduction. This certainly is a problem at aviation emissions are strongly growing and furthermore in these altitudes their climatic impact is partially much stronger than emissions from the ground. For that reason, the EU wants to make the first step towards a global system by including the EU-aviation into the ETS (Emissions Trading Scheme).

2. How have you followed and prepared for the emissions trading scheme?

This question rather targets companies – The Federal Ministry of Environment was in charge of the negotiations and implementation concerning emissions trading.

3. What macroeconomic developments do you expect in the aviation industry when emissions trading will be introduced?

As implied in my first e-mail, we do not have any significant studies about this issue. Significant are for instance the Impact Assessment of the European Commission, with the RL- suggestion. Basically, for all familiar studies I know applies: The effect on the aviation industry is relatively small since the (short-term) costs of avoiding emission trading are with a few exceptions very high and therefore the aviation industry is going to buy prevailing certificates to cover their emissions- if they are not covered sufficiently by the free allocation- from other sectors and projects abroad.

The implied cost will be mainly passed on to the customers via inclusion into ticket prices.

The additional costs per ticket will not be very high (approximately 5 € for short-haul, 9 € for medium-distance flights and about 40 € for longhaul flights; respectively for outward journey and return flight under the condition of a certificate price of 30 € per tonne CO₂ according to the Impact Assessment study). Therefore the demand will show only little reaction.

4. How much CO₂ -reduction potential do you see in the aviation industry?

There is no sweeping response to that question. Purely theoretical, the reduction potential could be 100 % if certificate prices were astronomically high. But that is not what this is about. Under consideration of the reduction potential we need to distinguish between: short-term (operating measures, better utilization, small technological improvements like lighter seats or the attachment of winglets onto the aircraft wings) and long-term (improvement in propulsion technology, new form of fuselage or facelift, new fuel types) and of course it depends on what certificate price is assumed.

Differently from other sectors (for example ship traffic), there are hardly reduction potentials in aviation that can be achieved at very low costs since the part of kerosene costs is quite high and the expenses from fuel price increases are much higher than those occurring through CO₂ and emissions trading. In this respect there is already a very strong incentive to increase efficiency, so that the cheap measures have already been applied.

5. Do you think more flexible regulations could lead to a higher compliance of airlines with the emissions trading scheme?

I do not really understand this question. Emissions trading already is an instrument with the highest degree of flexibility, since it is not determined where and when emission reductions need to be performed. The companies can choose this by themselves. Through the trade of certificates the aviation industry can even profit from cheap prevention potentials in other sectors. Anything else (legal conditions, kerosene taxes, a closed emissions trading only for aviation) would be far less flexible.

6. Is there federal support for airlines to set up and optimize their emission monitoring system?

The implementation of emissions trading in Germany takes place through the German emissions trading institute (DEHSt). The DEHSt as well as institutions of other member states provide extensive means to aircraft operators (as for instance model monitoring concepts) and organize in advance diverse workshops and info- events for operators. Additionally there is also hotlines and FAQs.

7. Are there financial resources to support airlines to acquire more environmentally friendly technologies?

There is a series of research programmes that are also used for aerospace purposes. The main concern is the improvement of propulsion technology, so a lot of fundamental research is undertaken (Airbus receives extensive public EU- resources as well as Boeing within the USA).

8. How do you see the development and potential of alternative fuels to be used on a large scale in passenger aviation?

I am no expert for this. There has been a series of test flights using bio-fuels. Until it can be applied on a large scale, many technological problems need to be solved.

The production processes are very expensive, because fuel of high quality is required for aircrafts, so an economic long-term application is rather questionable.

Then it must also be determined if it were not more useful to use it in other areas, such as heating, because in aviation the usage of bio-fuel is only possible on a limited scale.

9. When do you think alternative fuels will be at an affordable price for airlines and ready for mass production?

See above.

10. Do you think the prohibition of emission intensive aircrafts would make sense?

What is meant by emission-intensive? This is always relative regarding either relative emissions (per passenger) or absolute (then there were no long-haul jets anymore).

As explained in question 5, emissions trading shall reach the pre-determined absolute reduction goal of emissions in a very flexible way. With such a prohibition nothing can be achieved, because it would not change the growth in the number of flights and aircrafts. Nevertheless, it would have an effect, but that would be only specifically.

Besides the technological innovations (emissions trading also creates incentives to shorten investment cycles) there are also other measures that can be used by companies (see above under question 4: prevention and avoidance options)- the advantage of emissions trading is the creation of a large variety of incentives- even influencing demand (by including the costs for greenhouse gas certificates into ticket prices, these incentives are eventually borne in mind when a decision about the execution of a journey and choice of transportation).

11. What can be done about the disadvantages European carriers are going to have, because of the emissions trading scheme?

See above. I see disadvantages only on a limited scale- in comparison to other measures emissions trading has many advantages. If it is not wanted that emissions remain unrestricted so the sector could not contribute its share to climate protection, then you can leave it in the current stage- then the hardly achieved reductions in other sectors are partially or completely used up. That is quite senseless from economic viewpoints.

At introduction of emissions trading for air traffic in 2012 operators will receive freely allocated certificates (only 15 % of the cap will be auctioned, additionally also basic growth period of emissions trading from 2004- 2006). By that, it is even possible for airlines to profit from emissions trading (through windfall profits, meaning an inclusion of the value of received certificates- regarding the similar discussion of energy providers in emissions trading, which they will need to buy at an auction after 2013 especially due to the pass on of opportunity cost to customers.). Therefore it remains to be seen what the effects of emissions trading on the air traffic industry are going to be.

Due to the economic crises current emission certificate prices are very low and there seems to be no excess of them in energy- and industry companies. These can be shifted to future periods (banking), so the price can be expected to remain on a lower level for a longer time. By this, the assumptions of Impact Assessment (30 €/t CO₂) are by far not reached yet and are the prognosticated low effects will turn out to be even lower.