Aviation in times of Climate Change

Agrofuels – boon or bane for future mobility?

On a summer vacation, for a business meeting, or on a short trip – air traffic is increasing in our global society. Therefore, it is crucial to strengthen alternative and fair mobility concepts and to demand policies for emission reductions and energy efficiency. With regard to alternative types of fuel, it is essential to address the origin of feedstock and the conditions under which the fuel used was actually produced. High and transparent sustainability standards must be applied, which are based on human rights, social and ecological criteria. Furthermore, existing economic, mobility, and life style concepts must be reviewed and changed in a future-oriented manner. This requires the will for joint and coordinated efforts and strategies of all stakeholders – in the industry, by politicians and consumers.

Aviation & Climate Change

With unprecedented certainty, the Fifth Assessment Report by the Intergovernmental Panel on climate change (IPCC 2013, Working Group I report) shows that human beings are the crucial factor causing climate change. The aviation sector with its emissions also contributes to man-made climate change. At high altitudes, there are emissions of other substances apart from CO_2 which also affect the climate, such as nitrogen oxides, sooty particles, and water vapour. They lead to a contribution of global aviation to man-made climate change of about five percent (IPCC 2007); critical sources even speak of 14 percent (Lee et al. 2009).

The big challenge lies in the enormous growth forecasts for the aviation sector. Aviation is said to be the fastest growing source of emissions that have adverse effects on the climate. In its "Luftverkehrsbericht" (the German annual report on the air transport market) published in 2013, the Institute of Air Transport and Airport Research shows the development of air traffic from 2009 to 2012. According to this report, passenger traffic in Europe has increased by ten percent to 746 million and globally by 21 percent to 3.1 billion passengers. Intercontinental air freight and air mail traffic grows at similar rates, increasing by 20 percent to 1.5 million tons of cargo between 2008 and 2012 (DLR 2014).

Aviation & Climate justice

A political regulation of responsibilities and competencies regarding the climate impact caused by international aviation has proven tedious and complicated. Only a very small part of the world population, just two percent (Peeters et al. 2007), actively participate in air traffic, mostly for holiday purposes. The consequences of climate change driven by aviation have been known for a long time: more extreme and more frequent weather phenomena such as droughts, floods, and storms, the melting of polar ice and glaciers, as well as increasing sea levels. Above all, this already affects poor and particularly vulnerable groups of the population in developing countries and emerging economies. Climate justice means that according to the "polluter pays principle", countries which have a historical responsibility for global warming are to be held accountable to prevent climate change as well as its consequences and the damages caused. The countries of the Global South, however, are also called upon to contribute to mitigation efforts in a justifiable manner. The principle of "shared but differentiated responsibility" takes the different capacities into account.

Politicians and industry in unison: offsetting instead of reducing

The International Civil Aviation Organisation (ICAO) was mandated by the Kyoto Protocol of 1997 to develop a globally applicable concept for the reduction of CO_2 emissions in aviation. After years of stagnation, the 38th General Assembly of ICAO decided in September 2013 to design a globally applicable market based mechanism (MBM) by 2016, which is meant to regulate emissions from international aviation with effect from 2020. ICAO is also discussing approaches such as efficiency improvements in the combustion of kerosene, improvements in aircraft technology, and the use of new, lighter materials. Improving aircraft navigation in global airspace and increasing the degree of capacity utilisation should technically reduce the impact on the climate. Furthermore, there are plans to develop a CO_2 certification standard for aircraft that should increase transparency (ICAO 2013).

Among market based measures, different approaches are being discussed. Unfortunately, ICAO and the aviation industry represented in the International Air Transport Association (IATA) currently favour 100 percent offsetting – without binding reduction targets. The problem is that these are not CO_2 reduction measures and according to the experiences to date, the emissions permits traded follow very low quality standards (Filzmoser 2013). A more effective approach to limit global warming to less than two degrees Celsius would be emissions trading with credible reduction targets and a limited trade in emission permits. From the experiences with the European Emissions Trading System it can be concluded that only strict caps and a limited trade in ecologically and socially integrated certificates can effectively contribute to a reduction of the negative impacts on the climate.

In order to adequately address the need for climate justice, the money generated from emissions trading would have to serve as funding for development and would have to benefit especially those people who suffer the most from the consequences of climate change.

Alternative fuels for aviation

The climate mitigation targets for the aviation sector defined by ICAO and IATA are: CO_2-neutral growth of aviation by 2020 and a 50 percent reduction of net CO_2 emissions by 2050 (as compared to the base year 2005). In order to achieve these ambitious targets and to maintain its profitability even when kerosene prices increase, the aviation sector strongly hopes for the development of alternative fuels for aircraft. In many ways, this topic links to the ongoing debate on biofuels for land based modes of transport or for the energy sector. As an alternative to fossil kerosene, synthetic kerosene from the Fischer-Tropsch process is one option in aviation. Another option is hydrated plant oils.

The major part of the alternative fuels currently used is from crop plants. They are called **first-generation fuels.** In aviation, mainly oil plants, especially oil palms, jatropha and camelina (a rapeseed variety) are of importance. Another alternative are **second-generation agrofuels,** which may be produced, for example, from residual materials such as straw, wood, or effluent sludge, but also from crop biomass such as different types of grass or fast-growing varieties of trees. The aviation sector also hopes for the production of kerosene from micro algae, which are **third-generation fuels.** Scientists conduct intensive research on the technological, economic and ecological feasibility of these biogenic fuels. Two points in favour of algae are that they have a significantly higher photosynthetic performance and do not compete with agricultural land.

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In the combustion of agrokerosene, the same amount of CO_2 is being emitted as from fossil kerosene. The decisive difference is that part of the CO_2 emitted when burning agrofuels has earlier been absorbed from the atmosphere through photosynthesis by the energy plants which are the feedstock of the fuel production. However, the CO_2 balance is not at all neutral. Throughout the life cycle, CO_2 is being emitted, for example in production, processing, and transport.

The contribution of agrofuels to climate mitigation and the expected benefits have been and remain highly contested. In addition, there are currently unresolved technological challenges and poor yields, especially of the second and third generation. Up to now, there are no marketable products. The particular problem in regards to the great amount of biomass are the ecological and developmental ramifications.

Lines of conflict in the provision of agrofuels

Various case studies from Asia, Africa, and Latin America prove that in the production of agrofuel crops, land use conflicts frequently occur, even leading to the displacement of local people, water shortages, water pollution, loss of biodiversity, and competition with food production.

Climate impacts and ecological footprint

Scientists, environment and development organisations increasingly point out the poor carbon footprint of agrodiesel or agrofuels. In order to make accurate statements on this, we must look at the whole life cycle footprint, including aspects like changes in land use, production of biomass, processing and transport. When looking at the carbon footprint of agrofuels, changes in land use and the production of biomass are of special importance. Consequently, models to calculate the carbon footprint have to factor in all these aspects in order to be scientifically honest and credible. This, however, is not common practice (IFEU 2014); in reality these aspects are not considered or strongly limited.

The carbon footprint of jatropha and camelina, first-generation energy plants, which are propagated as a promising perspective in the aviation sector, might under ecologically ideal conditions (companion planting, organic farming without chemical fertilizer) indeed partly have favourable carbon footprints. There is ample evidence, however, that a scenario which is favourable for the climate does not usually represent an economically acceptable one (IFEU 2014). Irrigation and fertilizers seem to be essential to obtain good yields, but they significantly increase the carbon and ecological footprint. As far as second-generation fuels are concerned, it is necessary to critically question their impact on the climate. If residues (straw, wood remains) are used as feedstock for fuel production, the two aspects change of land use and production of biomass don't need to be part of the life cycle. At first sight, this has positive but distorting impacts on the carbon footprint. The definition of what is waste, residues, remnants, etc. as a rule follows a political or economic orientation. Taking away biomass is associated with a withdrawal of nutrients or a reduction of the CO_2 absorption capacity of the respective area. When using the land at a later point of time, the use of fertilizer will increase greenhouse gas emissions (IFEU 2014). A loss of biodiversity and higher costs of food production are further development related consequences. That is why when looking at the carbon footprint, a description of

the origin and characteristics of residual products is essential. In practice, here, too, we find major deficits. According to the current state of research, fuels from algae do not have a positive effect on the climate either. Significantly more process energy has to be invested than can be generated with the oil from algae. In addition, there is a tremendously high water consumption, which in large scale technology poses challenges that have not yet been solved (IFEU 2014).

Considerable negative impacts like unfavourable carbon footprints, loss of biodiversity, regional water shortages and competition with food production up to conflicts of land ownership are also caused by indirect land use changes (ILUC). These happen when primeval forest and other ecosystems worth protecting are converted into agricultural areas, because what was previously agricultural land is now used for the production of energy plants. If indirect land use changes were taken into consideration, the unfavourable carbon footprint would be very evident for all types of agrofuels. So far, the ILUC are not part of sustainability certification.

Human rights and social impact

The displacement of local, partly indigenous groups of the population from their land and the resulting consequences which are not acceptable both in terms of human rights and social impacts – such as hunger and poverty – are part of the other negative impacts. Unclear land ownership, poor governance in many agrofuels producing countries, but also the promotion policies for agro-diesel by the European Union fuel these conflicts in a decisive manner. Another very important aspect is the working conditions of local people which are partly neither in accordance with international standards nor subject to national legislation. Due to the increase in agrofuel production, food prices have risen in many regions, which is not acceptable given the fact that 842 million people world wide suffer from hunger (FAO 2013). Case studies prove that small bottlenecks in food supply due to rising prices have enormous impacts on people in regions with a tight food situation. Demand forecasts indicate a drastic increase in future land requirements, stirring conflicts on fertile land. Even when reducing air traffic and comprehensively increasing the efficiency of aircraft, the increased land requirements for agrofuels would with highest probability collide with food production and the need for food security.

Agrofuels and european legislation

The EU member states want to achieve their mitigation target most importantly by increasing bioenergy production. The Renewables Directive (RED) obliges states to ensure a share of at least ten percent of renewable energy by 2020 for all modes of transport. The EU furthermore stipulates that the CO_2 emissions caused by agrodiesel must be 35 percent below those of fossil fuels, and from 2017 50 percent.

A clear proof of sustainability is part of the European policy. When using agrokerosene, at least the same performance as in the case of fossil kerosene must be proven, plus a lower carbon footprint. The RED formulates sustainability standards for agrofuels which will be credited towards the EU targets. It differentiates between binding requirements (for example, greenhouse gas footprint) and those which only require reporting. Evidence of sustainability will be provided in the form of certificates. More demanding criteria and standards would have to take into account human rights, socio-economic and additional ecological aspects and be embedded in laws and processes. For RED, however, this is not yet a binding requirement and only covered by reporting requirements. Only a legally binding requirement could ensure that the feedstock for alternative fuel can be made available in a conflict free manner. The EU currently recognises 15 certification systems. The Roundtable on Sustainable Biomaterials (RSB) and the International Sustainability and Carbon Certification (ISCC) are among the most ambitious, because of their broad coverage of sustainability criteria, among other things.

Aviation has so far remained exempt from the tangible implementation of the quota targets mentioned above. But it may be credited towards the RED targets, provided that the binding sustainability criteria are fulfilled and proven by certification. The reason given is the currently rather small share in the fuel consumption of total traffic (IFEU 2014).

However, the fields of conflict described prove that sustainability certification cannot capture many of the negative impacts mentioned. When there is a lack of good governance or misuse, there is often a gap between these effects and a number of risk factors that can be exploited by profit oriented players. In response to the objections by various environment and development organisations, the European Commission presented a draft amendment for the RED at the end of 2012 which is meant to lim-

it the share of fuels that use food crops as feedstock to five percent of the overall target. The amendment also takes account of a binding ILUC factor in the sustanability reporting to include it in a compulsory manner into the greenhouse gas footprint from 2020. A decision on this draft has not yet been taken.

A ten percent blend of alternative aviation fuels by 2025, as it is demanded, for example, by the "Aviation Initiative for Renewable Energy in Germany" (aireg), is ecologically and socially highly questionable.

Aviation tax & competitive conditions in the aviation sector

Since the fuel for aircraft is exempt from energy taxes and since no value added tax is charged on international flights, the German treasury loses about 10.4 billion euros per year (as of 2013). While the aviation sector gets subsidies that damage the environment, the aviation tax introduced in 2011 generates not even one billion euros per year. Therefore, with regard to the equal and fair competition between all modes of transport and in order to strengthen the ecological steering effect, it is advisable to discontinue subsidies which are damaging to the climate. The aviation tax should be kept, as it is the only fiscal steering tool for the most environmentally unfriendly mode of transport, and it should be developed further, taking development aspects into account (Thießen 2013).

Conclusion

The demand for energy, petrol for vehicles and aircraft kerosene continues to grow steadily. Given the target of limiting global warming to less than two degrees Celsius, politicians, industry, and consumers all have to work on the implementation of sustainable models. Human rights, social and ecological criteria have to be taken into account in order to ensure that the industrialised countries' demand for fuel does not happen at the cost of people in the feedstock producing regions.

With a focus on aviation, the tourism industry plays a central role. More than most other sectors, tourism depends on an unspoilt environment. In order to conserve the environment on the long run, there is a need for a targeted development of products that are climate friendly, including sustainable mobility concepts and awareness raising among consumers. Avoid, reduce and compensate are central approaches that must equally apply in politics, science, industry, and to consumers.

Demands addressed to politicians, researchers & the aviation industry

The importance of agrofuels is stressed by climate-related political targets. To mitigate the areas of conflict shown and with a special focus on climate justice, Bread for the World demands:

- To recognise mobility as one of the main sources of greenhouse gas emissions and to agree on and implement binding reduction targets
- Fair conditions for the competition between all modes of transport by discontinuing environmentally damaging direct and indirect subsidies in aviation and the promotion of environmentally friendly mobility
- A speedy implementation of the RED amendment and thus a reduction of the blending target for first-generation fuels to five percent by 2020 for all modes of transport
- Promotion of investments in research, innovation and development towards environmentally and socially sustainable fuels, in accordance with the strictest ecological and social criteria
- More support and advice for governments of feedstock producing countries with regard to good governance, corporate social responsibility and the establishment and implementation of ambitious sustainability requirements.

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