

## ENVIRONMENT PROTECTION

UDC 504.05:656.73(045)

DOI: 10.18372/2306-1472.74.12296

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### THE ECOLOGICAL POLICY AS AN INSTRUMENT OF AIR TRANSPORTATION ENVIRONMENTAL IMPACTS MINIMIZATION

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#### Abstract

**Purpose.** The paper presents the analysis of the aviation impacts on the environment and the recommendations on development of environmental policy for airlines aimed at environmental performance improvement. **The analysis of the latest research and publications.** The problems of aviation interaction with environment are provided with targeted research efforts by all major regulators of the industry, but it is also important to analyze the current environmental policies of airlines to get insights of how airlines understand the environmental problems of their industry and evaluate their willingness to solve them.. **The modern trends in aviation development.** The world passenger air transportations are expected to grow up to 2030s. Statistical data on activity of the biggest national airports in Ukraine also shows the positive tendency in number of flights during the last three years. **The analysis of environmental impacts of aviation.** The growth of aviation raises the problem of environmental impacts, including contribution to climate changes; pollution of the ground atmosphere, soils and surface waters; noise pollution; wastes accumulation; threats to the habitats and diversity; reduction of arable lands; consumption of water and energy; electro-magnetic pollution; health effects, etc. **The purpose and essence of environmental policy for airlines.** An environmental policy is a presentation of airlines aims and principles in managing the environmental effects. It helps to develop the positive external image of the company. **The analysis of the airlines environmental policies in action.** The analysis of environmental policies of over 40 air companies from various parts of the world found that the content of all policies is almost the same with differences related to priorities setting and site specific environmental concerns. **Discussions.** There are some serious drawbacks in the environmental policies considered: declarative character of the policies' provision, absence of planned procedures for progress evaluation and redistribution of responsibilities to passengers. **Conclusions.** To combat the negative environmental issues of airlines activity the system of environmental management must be implemented based on the efficient environmental policy, which includes clear realistic targets with numerical presentation of potential progress.

**Keywords:** airlines; environmental impacts of aviation; environmental management; environmental policy.

#### 1. Introduction

Civil aviation is stably developing. In general, the world growth rate of air transportation, excluding the periods of the economic crisis, is 5-10% per year [1]. This significantly promotes the pace of development of other modes of transport, energy, as well as many other sectors of the economy. Each of

these enterprises forms its contribution to environmental pollution. Accordingly, each year, the contribution of aviation to the degradation of the environment quality increases, and the negative factors of the industry's activities affect not only passengers, crews and airport workers, but also the population of the surrounding areas. Moreover, according to the research, the impact zone of major

airports with the high intensity of air travel extends up to 50 km around the airport [2].

Civil aviation also expands the zone of human impacts in the biosphere: it plays a significant role in the pollution of the upper troposphere and stratosphere, i.e. high atmospheric layers, which, prior to the development of air transport, were not directly affected by man. Pollution of these atmospheric layers is directly related to the global climatic effects unfavorable for humans and the biosphere.

Therefore, the problem of the civil aviation impacts on the environment is an integral part of the global problem - pollution of the environment as a result of the development of economic and technical potential of the human society as a whole.

So, the purpose of the paper is to analyze the specific impacts of aviation on the environment and develop the recommendations on planning the reduction of these impacts in the form of ecological (environmental) policy of aviation companies.

## **2. The analysis of the latest research and publications**

The issues of sustainability in aviation industry are becoming more urgent with the growing volumes of air transportation. Another issue appearing at this stage of aviation development is the increased competition for the customers. Growing attention to the environmental issues has been considered to be a good marketing tool. Since then airlines have been trying to attract passengers by demonstrating commitment to environmental impacts tackling. This was the major driver for developing and presenting to the public such program documents as environmental policy.

The problems of aviation interaction with environment are provided with targeted research efforts by all major regulators of the industry, including ICAO, IPCC, IATA, EUROCONTROL etc. But more important from the perspective view is the analysis of the improvement of aviation environmental performance, which is are covered in a range of studies, including Arjomandi and Seufert (2014), Kemp (2013), Gossling et al. (2007) [3-5]. Thus, Lee and Mo (2011), Hares et al. (2010) state that technological improvements slow down if society is not aware and doesn't demand them [6, 7]. However, Lassen has found that even highly educated passengers who generally have environmentally friendly attitude in life are not paying much attention to these issues [8].

Instead, now airlines are trying to share the environmental responsibility with their passengers by offering programs of carbon emissions offsetting, which could be quite efficient image-making tools as it is shown by Araghi et al. (2011) [9]. At the same Chan and Mak (2014) state that significant drawback for further reduction of aviation impacts reduction is not well developed reporting procedures of airlines [10]. Poor reporting is the result of not clear target setting and lack of their official demonstration.

Under the condition of reduced attention of people to the environment protecting activities of airlines during tickets purchasing, environmental policy is still important for controlling authorities, investments attraction and preparation of background for the projects of airports expansion.

So, there is a need to analyze the current environmental policies of airlines to get insights of how airlines understand the environmental problems of their industry and evaluate their willingness to solve them. The results of this study are important for the determination of the industry's research needs and preparation of reliable prognosis of future environmental consequences of aviation activity.

## **3. The modern trends in aviation development**

On a global scale, passenger air travel is expected to maintain positive growth rates up to 2030s, despite a number of challenges faced by the industry [1,11]. Airlines around the world face the problem of growing jet fuel prices and episodes of economic decline. However, these economic troubles are mitigated by the increasing number of passengers and freight air transportation. The global aviation industry reached 6.1 trillion US dollars market value in 2016, from about 5.1 trillion US dollars in 2010. Between 2016 and 2026, the number of airline passengers is expected to grow by 4.7 percent annually [11].

Some 3.7 billion passengers used air transport for their business and tourism needs in 2016, according to the figures on scheduled services. The number of annual total passengers carried was up approximately 3.5% compared to 2015 and is expected to reach over 41000 deliveries by 2030, based on current projections. Aircraft departures reached 33 million globally during 2014, establishing a new record and surpassing the 2013 figure by roughly one million flights [11].

The passenger numbers growth is conditioned by three driving factors: living standards, demographic trends, as well as price and availability. Living

standards have direct impact: higher prosperity of population equals higher number of flights taken per person per year.

Price of flight also directly affects on the choice of air transport for traveling. The unit cost of air transport has fallen by a factor of four since 1950 [4]. However, the beginning of the new millennium has seen the growth of fuel prices, which transformed into higher ticket prices.

Population growth or decline rates give not only the absolute values of potential passengers, but also reflect the population aging trends over the next years. Typically, the nations with younger populations and broader working-age groups are more likely to fly than over-65s.

Under these conditions, countries such as Ukraine, similar to Russian Federation and other countries of Eastern Europe, are expected to undergo significant population decline and, as a result, reduction of potential travelers. The financial issues of air transportation are also not very favorable for Ukrainian consumers: tickets prices are way out the affordable range for an average citizen.

But in the coming decade, the air flight cost is expected to decrease by 1–1.5% per year due to stabilization of the market [12]. New destinations, more flexible schedules and routes, as well as numerous transport connection options raise the attractiveness of air trips together with the liberalization of air markets. These may outcome in the potential increase of air traffic by over 1 percentage point per year [12].

During the period from 2007 till 2013 Ukraine demonstrated high development rates in aviation sphere: passenger flow has grown 5,1 times, number of passenger – 4,3 times as compared to 2000. Summarized values of estimated prognosis stated that total volumes of transported passengers from all Ukrainian airports would reach 7-8 million passengers annually by 2020 [13].

However, the dramatic changes in political and social life of the country, violation of territorial integrity and continuous military conflict together with strong economic recession, including skyrocketing inflation have cancelled the bright prospects of Ukrainian aviation development. The most serious impacts are complete destruction of the newly reconstructed Donetsk International Airport, the third biggest airport in Ukraine, and the loss of the airport “Simferopol”, located on the annexed Crimea peninsula.

Statistical data on activity of the biggest national airports state that during the last three years the positive tendency of air flights volumes as well as number of passengers transported through these airports is observed. The current leaders on the market are “Boryspyl”, “Odessa”, “Kyiv”, “Lviv”, “Kharkiv”, “Dnypropetrovsk” have managed to cover the needs of population and international travelers previously provided by missing airports. In 2015 the annual passenger traffic was over 10 million. The total volume of passengers using small Ukrainian airports (16 currently operating) was almost 120 thousand. Considering the situation in the country specialists believe, that passenger traffic at these airports will keep stable with potential to reach 120-200 thousand passengers by 2025 [14]. The main state airport “Boryspyl” is supposed to develop faster, so that the volume of passenger transportation will be 8300-10500 thousand passengers per year in 2025, while in smaller airport “Kyiv” (Zhulyany) this number will reach 355-857 thousand passengers annually [14].

#### **4. The analysis of environmental impacts of aviation**

The range of negative impacts of air transport operations, in particular flights and maintenance of airplanes, cargo and passengers services, is extremely wide.

Traditionally, the impact of aviation on the environment condition is evaluated primarily from the point of the atmospheric air pollution. However, given the peculiarities of the functioning of the technical means of aviation, the question of the impact of aviation technology on the air is transferred to the new level. This is due to the fact that air transport not only directly pollutes the air with certain chemical components, but it also changes the global climate system of the planet. That is, the influence of aviation on the atmospheric air passes from a quantitative level to a qualitative one. For this reason, the analysis of the effects of aviation activity on the atmospheric air should cover separately the aircraft emissions and their effect on the environment in the airport area and on the high atmospheric levels, and the impact of land transport emissions. So, the contribution of airlines into the atmospheric pollution is made first of all by the aircraft activity and service.

It is also important that the effects of atmospheric air pollution with target pollutants (carbon dioxide, nitrogen oxides, sulfur oxides, water vapor and

particulate matter, made predominantly of sulfur and soot compounds) have different effects depending on the altitude which emissions occur at, since the ratio of the main components, dominant physical and chemical processes within different layers of the atmosphere. Thus, the water vapor in the troposphere is rapidly lost due to mixing and precipitation processes, whereas at the altitude of 20 km it is stored and moves slowly towards the pole [15]. The same water vapor becomes a prerequisite for the formation of a unique phenomenon - the contrails or inversion traces.

In turn, in the troposphere, the amount of water vapor released by the substation is insignificant compared to the existing concentrations in the atmosphere. However, along with solid particles, the water vapor can form condensation traces, some of which are stored for many hours and form pinnate clouds. The formation of these clouds is also influenced by the dust emitted by the substation.

These atmospheric phenomena are able to affect the weather formation processes and microclimate characteristics by stopping solar radiation on its way to the planet surface, which leads to cooling, or preventing heat escape from the planet surface, which leads to warming effect. At the same time, most of the components that make up aviation emissions, including carbon dioxide, affect the absorption, retention and allocation of thermal radiation, and hence the climate. As a result, the total impact of all greenhouse gases coming from aircraft emissions is characterized by the radiation impact factor (radiative forcing) of about 2.7 units as compared with pure carbon dioxide, so aviation is considered responsible for 3.5-5.5% the total radiation exposure in the period 1992-2012 [15; 16].

Climatic effects of aviation are also related to the effect on the aerosol layer, which is located in the stratosphere at all latitudes. This layer consists mainly of the smallest drops of sulfuric acid formed as a result of the oxidation of sulfur-containing gases in the stratosphere [16]. The stratospheric aerosol layer reduces the amount of short-wave solar radiation entering the earth's surface, having little effect on the long-wave radiation of the Earth. Therefore, the growth of stratospheric pollution with aerosols as a result of anthropogenic processes leads to cooling of the climate, which partially compensates global warming, but does not ensure the cease of surface temperature increase [17].

Reaction of sulfur and nitrogen oxides from the aircrafts and ground transport emissions with water

vapor of the atmosphere affects the increase in the intensity of acid rains and the resulted acidification of the soil and water ecosystems. Also, the nitrogen oxides entering the high atmospheric layers during flights significantly affect the ozone layer due to ozone involvement into chemical reactions [18]. However, certain amount of ozone is contained in the emissions of aircraft engines and provides the increase of this component concentration in the ground atmosphere, although there it poses human health hazard and is a subject to sanitary-hygienic control.

The aggregate chemical pollution from aircraft is formed by the conditions of dispersion, primarily because it enters the environment at high altitudes and therefore disperses over large areas.

Significant contribution to air pollution is also provided by ground sources: emissions of special vehicles, passenger and freight vehicles, as well as the emissions of harmful substances during the operation of power plants of airports and boiler houses, production and repair shops, and the evaporation of petroleum products during their storage. It is important to note that the composition of pollution from these sources is significantly different from direct emissions of transport, and includes such highly toxic compounds as phenol, formaldehyde, acetone, toluene, metal dust, aerosols of alkalis and acids, ethylene glycol.

Together with atmospheric pollution, air transport contributes to the pollution of surface waters and soil. The main reason is the dumping of industrial and household wastewater containing various pollutants, as well as the deposition of toxic substances from the atmosphere on soil and water bodies.

Pollution of wastewaters with petroleum products, which is especially characteristic for airports, leads to diverse and profound changes in aquatic biocenoses, degradation and, ultimately, the death of flora and fauna of reservoirs [18]. The industrial wastewaters of airports are characterized with the presence of various toxic compounds of aluminum, beryllium and chromium, acids and alkalis [18].

The pollution of soil and water bodies by air companies is also resulted by surface runoff from industrial areas washing and fuels and lubricants storage. The surface airports runoff accumulate various pollutants: residues of washing and disinfection reagents, products of artificial coatings destruction, mineral suspensions, petroleum

products, heavy metals, dissolved organic impurities and nitrogen-containing substances.

A separate source of surface runoff pollution at the airports is de-icing and anti-icing treatment of aircraft and aerodromes for the removal of snow-ice deposits. In this case, special active reagents containing urea, ammonium nitrate, surfactants, alcohols and other toxic compounds are used.

Pollution and irrational use of land resources also leads to the accumulation of large quantities of solid and liquid waste in airports, including decommissioned aircrafts and motor vehicles. For example, in the airports of the country, the total amount of solid wastes accumulated per year at the beginning of the XXI century was about 125 thousand tons, in particular, 43 thousand tons of industrial waste, 80 thousand tons of domestic waste and 2 thousand tons of waste, removed from the planes of international airlines [19]. These wastes occupy large areas at airports, sometimes the landfill area is 5-10% of the airport's area. In this case, only about 10% of the total amount of toxic waste is neutralized.

Together with land resources, airports use a large amount of water resources to meet technical, household and other needs. Thus, Ukraine's airports annually consume about 7 million cubic meters of water. In this case, the volume of recyclable and re-used technical water is only 6% of total consumption [19].

At all stages of the flight cycle there is intense acoustic (noise) environmental pollution, which is considered to be the main negative consequence of the aviation operation and it attracts increased attention of international organizations-regulators of civil aviation activities. The main sources of noise include aircraft engines, auxiliary power units, and airfield special equipment for various purposes, equipment of manufacturing workshops and facilities. It is aviation engines that make the largest contribution to the noise pollution.

Other physical factors also lead to the degradation of the quality of the environment in the zone of the industry influence. Thus, the work of radar equipment and radio engineering equipment of civil aviation leads to electromagnetic pollution, and emissions of aircraft and land sources - to the thermal pollution of the environment.

Air travel is also a factor of infectious diseases and epidemics spread to significant distances from the places of their origin. Airport operations can also result in biological pollution of the environment

through the transfer of new plant and animal species, especially insects, which may endanger native flora and fauna, or the reduction of biodiversity due to the disruption of natural habitats by infrastructure, physical and chemical pollution of the environment, and the use of biosafety means.

So, the range of environmental impacts of aviation is wide enough to conclude that there must be special plan for their mitigation, because the identification of these impacts is only the start of the process and must not be the aim. The formalization of the targets of environmental effects minimization is performed through the development and implementation of environmental policy. This is especially expedient for air transportation industry, as it gives possibility to differentiate the environmental effects of various branches of aviation, as soon as they have different intensity and combination of impacts, as well as different possibilities for the implementation of new technical and organizational solutions. Thus, airlines can not control environmental aspects of repair and maintenance facilities.

Herewithin, we continue with the airlines, as they have higher flexibility and financial potential for setting and reaching environmental targets, as compared to airports or production enterprises, which must provide services to various users in many cases irrespective to their environmental performance.

## **5. The purpose and essence of environmental policy for airlines**

An environmental policy is a written statement that outlines a business' aims and principles in managing the environmental effects and aspects of its operations. It's not compulsory to have an environmental policy but it is essential for the implementation of an environmental management standard, such as the European Union Eco-Management and Audit Scheme (EMAS), BS 8555 or ISO 14001. It can also help develop the positive external image of the company by demonstrating commitment to reduce environmental impacts to customers, potential clients, investors, suppliers and business partners. This in turn can lead to financial benefits, such as increased investment, customer sales and market share.

The environmental policy can provide a range of internal significant benefits to business:

- help to keep the enterprise functioning within the environment protection regulations;

- make employees aware about their personal effects on the environmental roles and obligations in the sphere of environment protection;
- reduce costs due to conservation of raw materials, water and energy resources;
- reduce the number of accidents;
- improve environmental impacts monitoring;
- reduce intensity of the impacts on the environment: volume of emissions, discharges and waste generation.

Of course, all the mentioned benefits will be obtained only if the approved environmental policy is implemented and the set targets are achieved. This means that the environmental policy must be integrated in the everyday work of an enterprise and become the basis of environmental management system (EMS) or some plan of environmental improvements with exact deadlines.

There is no standard format and requirements for the content of environmental policy. The guarantee of the success is the clear definition of aims and desired benefits. Before writing the policy it is recommended to conduct environmental audit (internal or external – depending on available resources) to define the current environmental performance and existing incompliance with the nature protection regulations. In case of airlines the analysis of existing environmental policies of other air transport companies, as the range of environmental impacts and potential for their reduction are very similar.

The key factor that makes the environmental policy work is setting realistic and achievable targets with strict plan of implementation. The general recommendations are to make the policy short, easy to read, accessible to all interested parties. It should provide information about the business mission and future prospects, plan of regular monitoring of the progress in achieving the targets and plan of the staff involvement in the process. The heart of environmental policy is the commitment to continually improve environmental performance, prevent pollution and save natural resources. The policy should be reviewed after its first six months, and then every year. If the business activities or operations change significantly, the policy must be amended.

## **6. The analysis of the airlines environmental policies in action**

As it was set in the previous section the development of the environmental policy must start with the

analysis of case studies of other airlines. We have collected information about the corresponding documents of European and World major airlines. The study was based on the documents available online, because free and open to public access to the environmental policy is one of essential attributes of its success. Generally we have analyzed over 40 documents from around the world.

The studied documents were titled as “Environmental Policy” (most of major airlines, including Air France, UK airlines and Irish Airlines, Qatar Airlines, Ethiopian Airlines, Canadian Airlines, Air India, Southwest Airlines etc.), “Environmental Mission Statement” (most of the US local airlines, like Maryland Airlines, for example), “Environment Strategy” (Australian Airlines, Lufthansa, Alaska Airlines), “Environmental Focus” (Scandinavian Airlines), “Environment Responsibility Statement” (Arabian Airlines, like Air Arabia), or “Occupational Health and Safety and Environment Policy” (Turkish Airlines), “Environmental Guidelines and Action Plan” (Japan Airlines), “Safety, Health and Environmental Policy” (Malaysia Airlines), but the content was basically the same:

1. *Compliance with the environmental regulations and standards.* At the beginning of environmental policies most airlines commits to comply with applicable national and international laws in the field of nature protection, however, this is a compulsory requirement for operations in any civilized country.

2. *Climate impacts mitigation.* All airline companies have committed their readiness to work on the reduction of greenhouse gases emissions and noise pollution as the major environmental issues of the modern aviation.

3. *Limitation of impacts on local communities.* Most of airlines are ready to work on improvement of on land operations to reduce the emissions of major air pollutants by optimization of routes, substitution of older equipment with low and zero emissions units (mostly electricity powered) and reduction of auxiliary operations.

4. *Waste reduction.* Improved waste recycling is also among the top responsibilities stated by the airlines considered, however, it is related only to the waste generated during the flight. The variation of this provision is efficient management and utilization of wastewaters.

5. *Energy and resources conservation.* The aim to reduce the consumption of energy and materials

(water, fuels, etc.) is the most beneficial for all companies and therefore it is paid considerable attention. Moreover, it is often provided with the most detailed target values and plans of implementation.

6. *Information communication.* The end of the most processed document was the obligation to make employees, customers and partners more aware of the environmental issues mentioned above and encourage them to do the same.

Still there are some very specific provisions individual for certain policies. This is typical for the airlines of active international transportation, but not leaders of the market. Thus, for example, Turkish Airlines pay equal attention to sustainable tourism and environmental performance, which is reflected in their policy. They have also included issues of occupational safety in the commitment. Among the Energy and resources conservation target they state the aim to gradual transfer to alternative fuels to reduce the pressure on the environment and consumption of non-renewable resources.

Some airlines have chosen deliver their general values and principles, like guarantee of human rights, combat any form of exploitation and respect to host communities (Canadian Airlines).

Scandinavian Airlines, SAS, promote the unique element of environmental strategy – the so-called “green approach”. It means that the pilot does not begin the flight until the flight path and landing clearance are given. Using the shortest possible flight path and without holding in the air, an even descent begins in sufficient time from the cruising altitude to the runway. A slightly lower than normal air speed is also applied to reduce fuel consumption.

Singapore Airlines have chosen to include a compensation program in their environmental policy: they have taken the responsibility to invest part of their profit to support on a regular basis the Harapan Rainforest Initiative, a collaboration between international non-governmental organizations including BirdLife International and Burung Indonesia to conserve and protect one of the most biodiverse rainforests in the world. The conservation of biodiversity is also an element of environmental policies by Japan, Alaska and Australian Airlines.

Australian Airlines are highly interested in rational usage of water resources being scarce on the continent, so, they established the requirement to reduce water consumption and install water efficient appliances at all partner-organizations.

The important peculiarity of the US airlines environmental policies is the lowered urgency of climate-related impacts of aviation, being considered within the European Union the most significant adverse impact of aviation. By contrast, the US companies believe that local air quality and noise must be the current focus of attention. Uncertainties regarding both the contribution of aviation to climate change, and the impacts of aviation particulate matter and hazardous air pollutants, force air transport companies undervalue these issues both in action plans and environmental obligations (American Airlines, Delta, Thomas Cook Airlines etc.). At the same time, some companies, especially small ones, normally include only one clear target in their environmental policies, and this is climate effects reduction (Qantas, PASSUR etc.).

However, some companies dare to develop and implement very ambitious environmental programs aimed at complete transformation of the current industry practices, including significant reduction of greenhouse emissions (“Eco-skies” by United and “Sky Eco” by Japan Airlines).

Another important issue for major US airlines is the maximization of land use efficiency. The attention to this target has risen since the governmental authorities postpone or stop the plans of development of the top American airports due to related threats for the local air quality and noise pollution. The similar target is set by Alaska Airlines, which strive to keep the natural environments unchanged with the slogan: “We fly people to beautiful places; let's keep those places beautiful”.

Southwest Airlines have included in their policy the aim to prevent reagents and fuel spills, which is not present in the policies of other companies.

South African Airways support the initiative to reduce environmental effects (especially biodiversity reduction) of food produces, which supply the airlines.

The most significant targets are set by major airlines, like Lufthansa, which commit to constant modernization of the fleet and invest in aircraft improvement. Except cutting carbon emissions they also strive to reduce emissions of nitrogen oxides with specific plan and program.

## **7. Discussions**

The development and communication of an environmental policy is an important step towards the transformation of airlines activity into

environmentally conscious. However, there are some serious drawbacks in the environmental policies considered. First of all, most of documents contain very general provisions without any specific figures or benchmarks. The exceptions are Lufthansa group, South African Airways, Japan Airlines, Scandinavian Airlines and Irish Airlines. As a result the companies do not conduct the analysis of their achievements and failures. This is a major obstacle for the efficient environmental performance management: continuous control of the progress enables in-time improvement and amendment of management practices to provide the best results of environmental impacts reduction. For example, regular report by Scandinavian Airlines states, that the result of their innovation is an average fuel saving of around 150 kg per landing with a Boeing 737-600, equivalent to the reduction in CO<sub>2</sub> emissions of just over 450 kg. Lower flight speed on flights between Oslo and Bergen since 2008 showed that carbon dioxide emissions have been reduced by 420 kg [20].

Another important fault is that the commitment to minimize contribution to the climate changes is often reduced to the offer to pay compensation for the emissions produced by an aircraft. By implementing Voluntary Carbon Offsetting schemes, airlines allow passengers to offset the carbon emissions caused by their travels at their own free will [21]. The offsetting costs are calculated by multiplying the CO<sub>2</sub> emitted during the particular flight by a fixed price per one ton of CO<sub>2</sub> emissions [22].

But this approach is of minor efficiency, as numerous studies show that passengers rarely account the consequence of their air travels on the climate, even highly educated passengers who generally have environmentally friendly attitude in life [23; 24]. From the other side, there is no single opinion about the emission calculation methods and offsetting prices, which leads to low credibility to this approach on the whole.

More perspective, but less convenient ways are optimizing free luggage allowance and demanding airlines contribution towards carbon offsetting projects. The first is not convenient for passengers and the second – is not convenient for airlines, as they will have to bear the most of the financial burden from greenhouse emissions compensation. But real environmental friendliness is found in the last way, as it stimulates the airlines to make meaningful changes starting from practices and

ending up with changing technologies and structure of aircrafts.

Low interest to the issues other than climate and noise reduction, including soils and waters pollution, biodiversity and habitats degradation devalue the importance of any environmental policy: by committing to global, but hardly implemented target, airlines lose possibility to do something significant on the local level and thus create the situation when they have nothing to do. So, it is recommended to set clear targets with specified deadlines (normally 3-5 years) and measurable criteria of progress and efficiency. To make the policy work one should plan regular assessment of achievements and policy improvements.

From the other point, the environmental policy being the background for environmental management system development and basis for delivering environmental vision of airlines has low influence on purchasing practice of customers. The studies show that people are not ready to pay more or to choose certain company only if it has better environmental policy or any at all. There are some minor difference (wealthier people, females and elder people are more interested in environmental issues and may consider this fact in making the choice of air carrier), but on the whole most customers do not consider airlines environmental commitment, partially because they are not aware of the fact that some airlines are more responsible than others, partially because they personally neglect environmental problems. However, the development of environmental consciousness will eventually make these issues an important element of companies' image promoting the attraction of business partners and investments. It will be also important to build positive attitude of population to the projects of aviation facilities expansion.

## 8. Conclusions

The aviation industry creates a wide range of impacts on the environment, including contribution to climate changes with greenhouse emissions; pollution of air, soils and surface waters on the local level; noise pressure on passengers and local communities; threats to the habitats and diversity; reduction of arable lands; consumption of water and energy resources; electro-magnetic pollution; health effects, etc.

To combat these negative environmental issues the system of environmental management must be implemented at the air transportation enterprise and the

beginning of this process is the development of environmental policy. Many airlines have already developed the corresponding document under variety of titles. However, the issues they cover are very similar, including managing climate effects, local air and noise pollution, and resources conservation. Many companies have included specific issues in their policies, ranging from food production impact reduction to changing flight practices. But the analysis shows that efficiency of these policies is not high enough to provide significant green changes in the industry. The reasons are declarative character of the policies, lack of progress control procedures and numerical presentation of targets set. The interest of population to the environmental policies is also not very enough to stimulate airlines to further changes in the industry. Technology has succeeded in reducing aircraft emissions by 40% in engine improvements and 20% in reduced air resistance of the fuselage [25; 26]. However, the growth of airline industry as it is shown in the perspectives analysis, raises new environmental demands to the industry.

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Received 10 October 2017

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**Екологічна політика як інструмент мінімізації впливів авіації на навколишнє середовище**

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**Мета:** у статті представлений аналіз впливу авіації на навколишнє середовище та рекомендації щодо розробки екологічної політики, спрямованої на підвищення екологічної ефективності авіакомпаній. **Аналіз останніх досліджень та публікацій:** проблеми взаємодії авіації з навколишнім середовищем охоплені цілеспрямованими дослідженнями всіх основних регуляторів галузі, але також важливо проаналізувати діючі екологічні політики авіакомпаній, щоб отримати уявлення про те, як авіакомпанії розуміють екологічні проблеми своєї галузі та оцінити їх готовність вирішувати ці проблеми. **Сучасні тенденції розвитку авіації:** очікується, що пасажирські авіаперевезення у світі будуть стабільно зростати до 2030-х років. Статистичні дані про діяльність найбільших національних аеропортів в Україні також демонструють позитивну тенденцію щодо кількості рейсів протягом останніх трьох років. **Аналіз екологічних впливів авіації:** зростання об'ємів авіаперевезень підвищує проблему впливу на навколишнє середовище, включаючи внесок у зміни клімату; забруднення приземної атмосфери, ґрунтів та поверхневих вод; шумове забруднення; накопичення відходів; загрози для ареалів та біорізноманітності; зменшення орних земель; споживання води та енергії; електромагнітне забруднення; наслідки для здоров'я тощо. **Призначення та сутність екологічної політики для авіакомпаній:** екологічна політика - це презентація цілей і принципів авіакомпаній у сфері управління впливами на навколишнє середовище. Вона допомагає розвинути позитивний зовнішній імідж компанії. **Аналіз діючих екологічних політик авіакомпаній:** аналіз екологічної політики більш ніж 40 повітряних компаній з різних регіонів світу показав, що зміст їх практично збігається, а відмінності стосуються встановлення пріоритетів та специфічних місцевих проблем. **Обговорення:** у розглянутих політиках виділено ряд серйозних недоліків: декларативний характер положень, відсутність планових процедур оцінки прогресу та поширення прийнятої відповідальності на пасажирів. **Висновки:** для боротьби з негативними екологічними аспектами діяльності авіакомпаній необхідним є створення системи управління навколишнім середовищем на основі ефективної екологічної політики, яка включає в себе чіткі реалістичні цілі з кількісними характеристиками, які можна проконтролювати.

**Ключові слова:** авіакомпанія; впливи авіації на навколишнє середовище; екологічний менеджмент; екологічна політика.

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**Экологическая политика как инструмент минимизации влияния авиации на окружающую среду**

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**Цель:** в статье представлен анализ влияния авиации на окружающую среду и рекомендации по разработке экологической политики, направленной на повышение экологической эффективности

авиакомпаний. **Анализ последних исследований и публикаций:** проблемы взаимодействия авиации с окружающей средой охвачены целенаправленными исследованиями всех основных регуляторов отрасли, но также важно проанализировать текущие экологические политики авиакомпаний, чтобы получить представление о том, как авиакомпании понимают экологические проблемы своей отрасли, и оценить их готовность решать эти проблемы. **Современные тенденции развития авиации:** ожидается, что пассажирские авиаперевозки в мире будут стабильно расти до 2030-х годов. Статистические данные о деятельности крупнейших национальных аэропортов в Украине также демонстрируют положительную тенденцию по количеству рейсов в течение последних трех лет. **Анализ экологических влияний авиации:** рост объемов авиаперевозок повышает проблему воздействия на окружающую среду, включая вклад в изменения климата; загрязнения приземной атмосферы, почв и поверхностных вод; шумовое загрязнение; накопления отходов; угрозы для ареалов и биоразнообразия; сокращение пахотных земель; потребление воды и энергии; электромагнитное загрязнение; последствия для здоровья и тому подобное. **Назначение и суть экологической политики для авиакомпаний:** экологическая политика – это презентация целей и принципов авиакомпаний в сфере управления воздействиями на окружающую среду. Она помогает развить позитивный внешний имидж компании. **Анализ действующих экологических политик авиакомпаний:** анализ экологической политики более 40 авиакомпаний из разных регионов мира показал, что содержание их практически совпадает, а различия касаются установления приоритетов и специфических местных проблем. **Обсуждение:** в рассмотренных политиках выделен ряд серьезных недостатков: декларативный характер положений, отсутствие плановых процедур оценки прогресса и распространение принятой ответственности на пассажиров. **Выводы:** для борьбы с негативными экологическими аспектами деятельности авиакомпаний необходимо создание системы управления окружающей средой на основе эффективной экологической политики, которая включает в себя четкие реалистичные цели с количественными характеристиками, которые можно проконтролировать.

**Ключевые слова:** авиакомпании; воздействия авиации на окружающую среду; экологический менеджмент; экологическая политика.

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