



INFLIGHT FOOD SERVICE

“Pick your meal”, a new way of consumption

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THE ENVIRONMENTAL IMPACT OF INFLIGHT FOOD SERVICE

I. Food service: from an ecological impact to business opportunities

A. Data on food waste and meal preparations

First of all, airlines prepare an impressive quantity of food to feed their passengers. For the UAE airline company Emirates, 180,000 meals are prepared for a total of 400 flights every day. On average, Emirates thus prepares 450 meals per flight. However, most of those meals can be assumed to be loaded on regular transatlantic 10-hour flights. Indeed, it has been calculated that for 300 passengers, a company would load twice as much meals in order to satisfy their needs and offer different possibilities. The number of meals served also varies according to 1st class passengers who may choose from a larger variety of food and enjoy several meals.

The major issue we would like to stress in our work is the waste generated by this notable amount of prepared food. In 2013, more than six billion passengers travelled by plane and airplane food generated 3,5 million tons of waste. In 2016, this figure almost doubled to 5.2 million tons of waste according to the International Air Transport Association (IATA). Several reasons may explain this figure:

- travellers may not finish their meals (for various reasons, including food quality and taste)
- travellers may not wish to consume on board, or may not like the type of food served
- airlines board too much food that is then thrown out (partly due to regulations, see later)
- food served involves non-recyclable, single-use only packaging
- ...

This waste needs to be better processed since a critical amount is buried in landfills instead of being recycled. Plastics and aluminium are for instance used in the composition of wrappings. For recycling purpose, habits and equipment would also have to evolve since the tray commonly used by cabin crews do not allow for recycling. Cabin crews would also have to be trained to limit the time used to sort waste.

B. Ecological cost of airline waste

As mentioned before, the amount of waste produced by airline food service is increasing, it is even supposed to be doubling within the next fifteen years. The following table can be used to assess the negative impact of the excess transportation of food and waste on the environment. For each 100km the amount of waste produced in 2013 has “flown”, more than two hundred tons of CO₂ emissions from kerosene may have been emitted, meaning that this amount of CO₂ emissions may have been prevented by a better management of food production. Later, will also be assessed the economic impact of this excess transportation.

Year	Amount of waste generated by airline passengers	Estimated excess fuel consumption (litters per 100km)	Related CO₂ emissions for kerosene (tons)
2013	<i>3.15 million tons</i>	91,570	236.251
2016	<i>5.2 million tons</i>	151,163	390
Within the next 15 years	<i>(2016) * 2 ≈ 10 million tons</i>	290,698	750

In addition, food waste is also created by delays: a 6 to 8 hours delayed flight may see all its food deemed as contaminated and have to throw everything. Improving punctuality is thus another way to lower waste.

** found on quota that an 86kg adult represented a fuel consumption of 2-3 litters more per 100km*

Kerosene: 21.537 pounds CO₂ per gallon or 2.580 kg CO₂ per litter.

C. Challenges and business opportunities arising from airline food waste

For airlines, the main challenge arising aside from the ecological and waste reduction challenges will also be about maintaining a good company's image. Nowadays, people are becoming more sensitive to a business's attitude towards the environment and its capacity to recycle and be "green". Airlines may benefit from changing their habits and reducing their carbon footprint by recycling and reducing waste generation. However, they should not fall in the greenwashing trap, a relatively new practice defined as "a form of deceptive marketing in which a company, product, or business practice is falsely or excessively promoted as being environmentally friendly" by K. Cruger, that accounts for a situation in which companies, knowing the importance of being green will just give an image of good practices. Some initiatives should thus be considered to significantly and genuinely reduce waste. Serving excellent food catering and improving food quality may both promote the company's image and waste reduction.

Finally, other companies may also benefit from this necessity of modifying airlines' business models. Packaging developers like GK Thomas, which developed the "Eco-Heat Tray", are incentivised by new business opportunities to "produce sustainable packaging solutions". They will either focus on creating re-usable, lighter or cleaner items. Can also be mentioned Kaelis, which develops on-boards products or MTL Carton which developed the "Bold Cup" disposable line.

II. International catering waste regulations

International catering waste (ICW) is defined as food waste which is no longer fit for human consumption coming from international transport vehicles including airlines. While airlines have increasingly undertaken initiatives to limit food waste through recycling or donation, their efforts are impeded by stringent regulations aiming at reducing the risk of disease contamination. Today, there is no comprehensive international regulations on food waste. However, members of the Convention on International Civil Aviation are required to take measures preventing the spread of communicable diseases which can limit recycling options. For instance, a number of countries, such as the US and Australia, quarantine food waste and directly incinerate it.

EU regulations are perhaps the biggest obstacle to ICW recycling or donation. The EU animal by-product regulation (1774/2002/EC) defines international catering waste as “catering (food) waste from means of transport operating internationally”. This includes food prepared in catering facilities, foods in stores or brought by passengers or the crew. It excludes sealed packets of foodstuff of non-animal origin, which are not in risk of contamination. ICW is classified as a category 1 animal by-product (unless coming from EU territory) and is as such subject to strict controls to avoid the contamination of animal diseases. ICW must be stored in a covered, leak-proof and labelled container which is usually provided by the airport. After the ICW has been disinfected, must be disposed by:

- incineration
- co-incineration
- manufacturing of derived products (biofuel)
- burial in an authorized landfill without pre-treatment.

The responsibility of disposal lies in the aircraft owner or company operating on its behalf. While the EU regulation requires every member state to ensure system of disposal, in practice infrastructures are not always adequate. What is even more problematic is that under these regulations, recycling of cans, plastics, glass and paper is only possible if it has not been in contact with ICW. For instance, confectionery, crisps and nuts and drinks not containing milk can be recycled. Plastic cups which have been in contact with milk or honey cannot.

To remedy for the handcuffing regulations, airline representatives advocate reforms that would take into account already existing standards that airlines are subjected to in order to assist the recycling effort.

III. Alternative Initiatives

Despite regulatory limitations, airlines and airports are implementing programs to reduce airline food waste. One must keep in mind however, that their efforts remain fragmented and much remains to be done.

A. Airlines Commitments:

- *Reusable materials and enhanced recycling services*

Airlines try to minimize plastic waste by refining their recycling services and replacing packages and cutlery with reusable ones. In 2010, Cathay Pacific recycled 33,244 kg of aluminum cans, 29,609 kg of plastic bottles and 22,050 kg of plastic cups by sorting, reusing and recycling paper and plastics and requesting similar standards for their caterers. Virgin's "Zero Waste to Landfill" program sets the ambitious goal of diverting 100% of its waste from landfills. Virgin has replaced its packages with reusable ones and has partnered with airport facilities to facilitate recycling and composting. In 2015, Virgin recycled 1,920 tons of waste. Air New Zealand and Qantas have replaced their cutlery with a lighter type of plastic that can be washed and re-used up to 8 times. SAS (Scandinavian Airlines) has gone even further by bettering its on-board recycling, using reusable plates, recyclable or combustible disposable packaging and locally-sourced food.

- *Converting waste into biofuels*

Furthermore, airlines are leading initiatives to convert waste into energy. In 2014, British Airways and the American group Solena have cooperated to build a waste-to-jet-fuel plant in London to process municipal and airline waste to convert it into jet fuel. The plant can process 551, 156 tons of waste per year. British Airways has announced it will purchase the produced fuel to power its planes. A similar initiative was taken by Qatar Airways which announced in 2010 a project to produce and supply biofuel with the Qatar Science and Technology Park, Qatar Petroleum and Airbus. Today, Qatar Airways has successfully converted 6,300 liters of cooking oil into biofuels.

- *Donations*

Some airlines, provided health regulations allow it, donate used sealed food products to homeless shelters. This is the case of United Airlines which donate unused amenities kits and leftover packets. The Australian project Oz Harvest is collaborating with Brisbane airport and Australian airlines to donate uneaten packets of food to the homeless. It is currently collecting 400 kg of food a day.

B. Airport Commitments

LIFE Zero Cabin Waste is as of today the most comprehensive model to “reduce, reuse and recycle (including energy recovery) waste collected on airplanes, and to establish the basis for other airlines to replicate this approach)” (EC Europa-Zero Cabin Waste). This is an EU initiative launched at Madrid’s Barajas airport, in cooperation with Iberia airlines, in 2014. Recoverable (plastics, cans, glass and paper) and municipal waste (including organic waste) from international and European flights will be treated. The project will be based on the training of the crew and staff, on a collection and separation protocol and on sophisticated waste processing. The project targets a waste reduction of 5% each year and a recovery of 80% of the waste diverted to landfill. It will also lower costs of disposals and create new jobs. The goal is also to create a model transferable to other airports. The model is expected to be replicated in Heathrow in 2019.

In 2017, Gatwick airport and DHL opened the first biomass burning facility to treat Category 1 waste. ICW and packaging from non-EU flights now be processed on location. The waste is converted into energy to heat the Terminal in which it is located. The site, operated by DHL, also includes a recycling facility for airport generated waste and municipal waste. It is believed that the project will save £1,000 a day in energy, waste management cost and transport for a cost of £ 35. It will also help Gatwick reach its target to recycle 85% of its waste.

The report has presented the two most detailed and advanced projects for ICW processing but many more initiatives (such as the food waste bins in the food courts of Seattle-Tacoma International Airport) are developing. ICW and airport waste has become an increasingly important area for both airlines and airports. However, it is only through a concerted effort of airlines, airports, consumers and policy makers that real progress can be achieved.

FINANCIAL IMPACT OF *PICK YOUR MEAL*

Besides obvious and crucial environmental benefits, *Pick Your Meal* can help airline companies to accomplish important cost reductions. We tried to assess the impact that Pick Your Meal might have, using two main variables: the cost of meals and the cost of kerosene.

By reducing the number of meals brought on board, airline companies can reduce these two cost items : *Pick Your Meal* will allow airline companies to pay less meals to their suppliers (most airline companies outsource catering), and will also help them reduce the weight of their plane, thus reducing kerosene consumption.

For the sake of clarity, we decided to illustrate the financial impact of our solution through the example of Air France. Since some data (actual cost of one meal, number of meals brought on-board per passenger,) is unavailable to the public, we used industry averages, or built our own estimations. The details of our calculations are available on the following link:

https://docs.google.com/spreadsheets/d/1f6CouJHo_UNbv282-F3xlgU37iJ_stZS6mesc7ifcU/edit?usp=sharing

We also chose to present 3 scenarios. Each of the scenario depicts a different decrease in the number of meals prepared per passenger: a 10% decrease (from 2 to 1.8 meals prepared), a 15% decrease, and a 20% decrease. However, we think that *Pick Your Meal* could actually help companies accomplish more drastic decreases.

Direct cost of meals

Direct costs of meals - Air France current situation and potential savings				
Data	Current	Scenario 1	Scenario 2	Scenario 3
<i>Cost of 1 meal for AF (\$)</i>	\$6.00	\$6.00	\$6.00	\$6.00
<i>Number of meals prepared / passenger</i>	2	1.8	1.7	1.6
<i>Number of passengers/ year (long haul)</i>	25,000,000	25,000,000	25,000,000	25,000,000
Direct costs of meals/ year(\$)	\$300,000,000.00	\$270,000,000.00	\$255,000,000.00	\$240,000,000.00
Savings / year (\$)		\$30,000,000.00	\$45,000,000.00	\$60,000,000.00

Interpretation: When the number of meals prepared per passengers shifts from 2 to 1.8 (Scenario 1), Air France can save \$30M every year. When the number of meals prepared per passengers shifts from 2 to 1.7 (Scenario 2), Air France can save \$45M every year. Finally, when the number of meals prepared per passengers shifts from 2 to 1.6 (Scenario 3), Air France can save \$60M every year. Therefore, by reducing the number of meals prepared per passenger, it is obvious the direct costs of meals will be reduced. The less meals per passenger Air France will prepare, the higher the savings will be.

Note: We chose to focus on long-haul flights, since Air France does not necessarily serve meals on other flights.

Costs of meals in terms of kerosene consumption

Costs of meals in terms of kerosene consumption - Air France current situation and potential savings				
Data	Current	Scenario 1	Scenario 2	Scenario 3
<i>Number of meals prepared / passenger</i>	2	1.8	1.7	1.6
<i>Weight of 1 meal (kg)</i>	1	1	1	1
<i>Number of yearly passengers (long haul)</i>	25,000,000	25,000,000	25,000,000	25,000,000
Weight of meals (kg)	50,000,000.00	45,000,000.00	42,500,000.00	40,000,000.00
Cost of kerosene (\$ per gallon)	\$1.60	\$1.60	\$1.60	\$1.60
<i>Kerosene consumption per flight (6000km) due to 1kg of meals on board (gallon)*</i>	0.4	0.4	0.4	0.4
Cost of meals in terms of kerosene consumption (\$)	\$32,000,000.00	\$28,800,000.00	\$27,200,000.00	\$25,600,000.00
Yearly Savings (\$)		\$3,200,000.00	\$4,800,000.00	\$6,400,000.00

Interpretation: In the Scenario 1, when the number of meals prepared per passengers shifts from 2 to 1.8, the weight of meals will be reduced from 50Mkg to 45Mkg, and the cost of meals in terms of kerosene consumption from \$32M to \$28,8M; Air France can save \$3,2M every year. When the number of meals prepared per passengers shifts from 2 to 1.7 (Scenario 2), the weight of meals

will be reduced from 50Mkg to 42,5Mkg, and the cost of meals in terms of kerosene consumption from \$32M to \$27,2M; Air France can save \$4,8M every year. Finally, when the number of meals prepared per passengers shifts from 2 to 1.6 (Scenario 3), the weight of meals will be reduced from 50Mkg to 40Mkg, and the cost of meals in terms of kerosene consumption from \$32M to \$25,6M; Air France can save \$6,4M every year. Therefore, by reducing the number of meals prepared per passenger, it is obvious that the weight of meals will be reduced, as the cost of meals in terms of kerosene consumption, and that Air France will save money.

Total savings

Total savings				
Data	Current	Scenario 1	Scenario 2	Scenario 3
Direct Costs of meals	\$300,000,000.00	\$270,000,000.00	\$255,000,000.00	\$240,000,000.00
Cost of meals in terms of kerosene consumption (\$)	\$32,000,000.00	\$28,800,000.00	\$27,200,000.00	\$25,600,000.00
Total Costs of meals	\$332,000,000.00	\$298,800,000.00	\$282,200,000.00	\$265,600,000.00
Total Savings		\$33,200,000.00	\$49,800,000.00	\$66,400,000.00

Return on Investment

The investment in *Pick Your Meal* can prove very fruitful. Indeed, *Pick Your Meal* is a rather low cost solution, applied at a large scale. This can result in large scale economies.

Return on Investment			
Data	Scenario 1	Scenario 2	Scenario 3
Site development	\$15,000.00	\$15,000.00	\$15,000.00
Site maintenance per year	\$20,000.00	\$20,000.00	\$20,000.00
Wage of the person affected to the service per year	\$60,000.00	\$60,000.00	\$60,000.00
Total Savings per year	\$33,200,000.00	\$49,800,000.00	\$66,400,000.00
Return on Investment- Year 1	348.5	523.2	697.9
Return on Investment - Year 2	378.4	568.1	757.9
Return on Investment- Year 3	389.6	584.9	780.2
Return on Investment - Year 4	395.4	593.6	791.8

Interpretation: In each scenario, we consider that the site development costs \$15k, the maintenance per year \$20k and the wage of the person affected to the service per year is about \$60k. The only variable is the total savings per year as explained before. When \$33,2M are saved per year (Scenario 1), the return on investment is from about 348 to 395 between Year 1 and Year 4. When \$49,8M are saved per year (Scenario 2), the return on investment is from about 523 to 593 during the same period. Finally, when \$66,4M are saved per year (Scenario 3), the return on investment goes from about 697 to 791 during the same period.

Note: The return on investment was computed the following way: (Cumulated gains from investment - Cumulated cost of investment) / (Cumulated cost of investment)

Conclusion

The two variables used by *Pick Your Meal* - the cost of meals and the cost of kerosene - can help airline companies to accomplish important cost reductions. Each of the scenario depicts a different decrease in the number of meals prepared per passenger: a 10% decrease (from 2 to 1.8 meals prepared), a 15% decrease, and a 20% decrease, and then, the weight of their plane and the kerosene consumption would be reduced accordingly. The more the weight of their plane and the kerosene consumption would be reduced, the higher the return of investment will be.

COMPLEMENTARY SOLUTIONS

Ø **Reducing cabin waste**

Ø **Optimizing non-consumed food management**

According to a report published by Green America in 2010, 75% of the waste generated during flights is recyclable but only 20% of this waste is recycled. Consequently, efforts should be concentrated on reducing cabin waste but also on recycling it.

REDUCING CABIN WASTE

1. Reduce airlines' reliance on plastic during flights

Travelers are well aware of the amount of plastic used during flights: from cutlery to plastic-wrapped headsets, there are ways to reduce the use of plastic. One of the main advantages of this material is that it is very light: weight is a crucial variable for airlines as the heavier the plane is, the more fuel it consumes. Hence here are some solutions companies can easily adopt without impacting the weight of their aircrafts.

The use of plastic can be reduced in areas other than catering. Several airlines have already made steps in this direction:

- Qantas and Virgin Atlantic have decided to propose plastic-free headsets: according to Virgin Atlantic, this allows its company to avoid using 12 tons of plastic each year.
- Emirates has developed blankets made out of plastic bottles which can be recycled after use.

Plastic accounts for 39% to 64% of the weight of meals served during Egypt Air flights. Instead of using plastic cutlery or metal cutlery (for Business Class and First Class), cornstarch cutlery or bamboo cutlery could be used instead: both materials are biodegradable and recyclable without being as heavy as metal cutlery. Moreover, cornstarch cups could be used instead of plastic cups.

Airlines should also work on optimizing food packaging when serving meals (different materials and lighter packages). These solutions can easily be implemented as they do not imply a change in processes (meals and refreshments are served in the same way, with disposable cutlery). In the EU, for non EU-flights, all waste in contact with animal by-products cannot be recycled separately, bamboo and cornstarch cutlery and cups would then be processed with food waste.

This is not a problem if Category 1 waste (food waste and waste in contact with animal by-products) can be used for another purpose. The present file proposes a solution for recycling this important amount of cabin waste.

2. Recycling food waste: an ecological fuel

Food and materials in contact with animal by-products (cutlery, food packaging...) is, in most countries, considered as waste as soon as the plane has landed. It is hence crucial to find another use for this Cat 1. waste.

Case study / British Airways:



British Airways is one of the most innovative airlines in that realm. It recently launched a program in partnership with Velocys (a British company specialized in renewable fuels) and Suez to convert household waste into an ecological and renewable fuel. This project, which has been announced in September 2017, should be completed in 2019 with the building of a power plant which will convert household waste into fuel. The material obtained should help British Airways reducing its carbon footprint as this fuel will emit 60% less greenhouse gas than a conventional fuel.

The airline had already sought renewable fuels to power its aircrafts. At beginning of the decade, it had partnered with Solena (a company specialized in green energies) for a project called *Green Sky*. The Green Sky project had a similar approach but unfortunately, it did not get British government's approval in order to process waste.

Initiatives similar to British Airways' ones exist: for instance, United Airlines has been working on a biofuel made of household waste since 2015 as well. It partnered with Fulcrum BioEnergy in order to start using this new material for commercial flights in 2018. This fuel emits 80% less greenhouse gas than conventional fuel.

These innovative solutions could go further and directly recycle cabin waste. Food which is considered as waste when the aircraft has landed could be directly converted into an environmentally-friendly fuel.

OPTIMIZING NON-CONSUMED FOOD MANAGEMENT

1. Settle a collection service for non-consumed products in the airports

The idea is to settle a partnership between the airlines and the airports within the European Union borders. Airports agree to provide an area where non-consumed food coming from planes can be sold to travelers in the airport. The airport will also provide staff to ensure the service.

The European Union regulation requires that all catering food coming from non-EU airports must be treated as a waste and therefore destroyed. Therefore, the collection service for non-consumed food can only be operational for the food coming from EU airports. Countries, which are not part of the EU but are geographically integrated to the European continent such as Norway, Liechtenstein or Iceland are considered as member states and therefore, can provide food collection service in the airports.

The collected food sale is operational in the respect of expiry date. Mostly, the idea is to ensure a turnover. The food which arrives first is sold first. It allows the collection service to optimize expiry dates management.

The collection service will be profitable for both the airport and the airline. They should settle a price for the non-consumed food that allows the airport to cover its fees and the airline to recover the money that was granted to the catering company. The negotiation of the partnership includes the settlement of the price. The collection service should generally be a non-profit one in order to get a lower price. It is obvious that the food is lower than the average price of airport food.

Summary

- Negotiate a partnership between the airport and the airlines within the European Union territory.
- The partnership contract defines the procedures for implementing the collection service: space and staff allocated, price of the products, redistribution of the benefits
- This partnership can only operate in the European Union due to the regulation. All food coming from abroad must be destroyed upon its arrival.

Example: *Partnership Aéroports de Paris – AirFrance KLM*



AirFrance KLM has integrated sustainability in its range of activities. Its strategy is based on 4 pillars: environment, customer experience, social policy, and local development.

Its ambition 2020 aims at reducing the environmental impact of its activities in all the ways possible. Since 2014, the group has agreed to take into account the objectives of sustainable development of the United Nations. AirFrance KLM has also signed the *Caring for Climate* initiative and the *Charte Paris Action Climat*. It is a key partner of the COP21 Climate Conference.

In the frame of the *2020 Perform* plan, AirFrance has set up new objectives in order to become more sustainable. By 2020, the company aims at recycling 100% of non-hazardous waste and 60% of hazardous waste. Samely, KLM defined among its 2020 ambition its wish to achieve 100% of recycled and recovered waste.

That kind of partnership would completely match AirFrance KLM's ambitions and would definitely be a profitable operation.

2. Increase the airlines' offer by creating a complementary price

For the last few years, airlines have diversified their offering in order to offer the customer the amount of services he wants. In general, most airlines now provide 3 types of offer: the economic one, which excludes the luggage, the standard one, which includes meals and luggage, and the business class one.

We will focus on AirFrance's offer in order to develop our other solution in order to reduce food waste in-flight.

AirFrance has 3 different offers:

- *Light*: the ticket is unchangeable, luggage isn't included, there is no free access to snacks, meals or drinks
- *Standard*: luggage (23kg max) included, free access to snacks, meals and drinks, the ticket is changeable with fees but not refundable.
- *Flex*: luggage (23kg max) included, free access to snacks, meals and drinks, the ticket is refundable and changeable, no fees.

In general the price gap between the different classes varies seasonally. In low season, the *standard* ticket can be 50% more expensive than the *light* one. Whereas in high season, the standard ticket amounts to twice the price of the *Light* class.

When you look at these 3 different offers, you can see that there is no happy medium between the *Light* class and the *Standard* class. On one hand, you get access to nothing (no luggage, no meals, snacks or drinks) and on the other hand you get to choose between 2 meals, sweet or salty, and a great variety of snacks. The idea is to create a "sustainable" class between the two.

Creation of a “sustainable” price

When buying the *Sustainable* ticket, the consumer agrees to not choosing its meals in-flight. The airline must provide the customer one or two meals according to the travel time and full access to drinkable water. It allows the airlines to reduce its food stock: they no longer have to guarantee the customer a choice between two meals. As the standard class customer chooses its meal, the sustainable class one will take the meal left by the first one. If there are more *sustainable* passengers than there are *standard* one, the company will only have to plan a single type of meal-choice.

This price can attract a great number of customers who are ready to pay a lower price with lower choice, especially for long-haul flights. This solution is all the more interesting that, as we saw it above, international flights in Europe have the obligation to destroy any additional food left.

It's not just a solution to lower food waste, but also to increase the offer and to adapt it to the wishes of the customers. This solution would be all the more profitable for the company that the airlines have to plan fewer meals, there is less food waste, therefore and less profit loss. More than a step towards more sustainability, it must be considered as an economic opportunity for the civil aviation market.

As it is a *sustainable* price, the airline should settle a price, which covers the cost of the meal consumed by the customer, and the luggage if the company decides to include it in the price. It is important to know that the customer cannot know the type of the meal (vegetarian, chicken, etc.) when buying the plane tickets. He agrees to accept whatever meal is served, according to what remains.

For complementary solutions/Sitography

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Authors:

- Camille CHEM-LENHOF
- Mathis FORMAN
- Quentin JEAN-VOLDEMAR
- Sacha LIGUORI
- Vasiliki MALOUCOU KANELLOPOULOU
- Camille MONVOISIN
- Emma PETON
- Coline RIVALIN
- Sophie ROBERT
- Florian VESLIN