Chapter 4

The ANA Group's Circular and Environment Strategy

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Chapter 4

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1. All Nippon Airways Co Ltd and ANA Holdings Ltd

Japan's airline industry is structured with two full-service carriers with combined market share of 90 percent. The All Nippon Airways (ANA) represents one of them. The industry as a whole generates approximately ¥34,000 trillion (US$29,000 million) in revenue. Of the 11 carriers that provide regular scheduled service domestically and internationally, ANA is the largest by revenue, passengers flown, and cargo carried. ANA ranks 23rd in the world in scheduled passenger kilometres and 20th in scheduled freight revenue tonne-kilometres.

Founded in 1952, ANA was primarily operating in the domestic market before it entered in 1986 into scheduled international service. ANA has over 242 aircraft (as of 31 March 2014) providing services for domestic Japan and international routes between Japan and Asia, China, North America, and Europe. ANA's portfolio of revenue consists of 57.7 percent domestic routes, 39.5 percent international operation, and 2.7 percent cargo.

In 2013, ANA reformed its group structure and ANA Holdings Ltd (ANAHD), the holding company of the ANA Group and ANA's parent company, was created. A 100-percent subsidiary of ANAHD, ANA, as air transportation provider, remains the core of the group. Currently, ANAHD is a 100-percent privately owned company listed in the first section of the Tokyo Stock Exchange and the London Stock Exchange.

Since 1999, ANA has been a member of the Star Alliance, a global airline alliance created in 1997. By becoming a member of this alliance, ANA has concurred with Star Alliance's Environmental Commitment Statement issued in 1999.

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Since 1993, ANA has been annually issuing the Environmental White Paper (in Japanese) and, from 1998, the ANA Environment Report (in English). In 2003, ANA announced its first midterm environmental plan called the 'ANA Group Ecology Plan for 2003 to 2007'. Its latest midterm plan is ANA FLY ECO 2020, which aims to provide security to society and earn its trust through actions and communication with diverse stakeholders and active participation in sustainable growth efforts.

In this chapter, we will walk through ANA FLY ECO 2020 and illustrate how the ANA group contributes to circular economy. We will also look at the challenges and dilemmas surrounding the circular economy of air transportation.

1.1. ANA's History of Environment Engagement and Circular Thinking

ANA's engagement in environment issues dates back to 1974 when it formed the Environment Preservation Committee as an advisory body to the company president. It was the time when *kogai* (pollution) was a highly recognised issue in Japan and noise pollution was one of the biggest agenda for the airline industry. Noise footprints in Itami Airport in Osaka, for example, had been a big issue since the first jet aircraft landed there in 1964 and resulted in restrictions such as night ban (curfew) and limits on jet aircraft operating there.

Although present technology cannot yet eliminate noise pollution, it has made dramatic advances in making aircraft quieter than before. It is said that aircraft in the 1990s are 1/15 quieter than those of the 1970s. Boeing's latest aircraft, the 787, is even quieter with 60 percent less noise footprint compared to other aircraft of the same size operating today.

As noise footprint is a typical external diseconomy, the industry has made big strides to lessen it. Whereas efforts to decrease noise pollution are progressing steadily, the airline and aviation industries are facing new challenges with increasing concerns over scarcity of fossil energy, volatility of jet fuel prices, and sustainable growth at the global level. If one looks at ANA's 1998 Environmental White Paper, noise pollution was the first topic featured whereas it was second to last in the company's white paper in 2005. Global warming, the second to the last topic in the 1998 white paper, became the main concern in the 2005 white paper.

At the same time, broader and common responsibilities as an airline and as corporate citizens are being realised in the ANA group. For example, the ANA group has contributed to sustaining biodiversity though forestation and coral regeneration programmes.

In this chapter, we will illustrate ANA group's environmental programmes from its core initiative of reducing carbon dioxide (CO_2) emissions to its 3R (reduce–reuse–recycle) activities, and the drivers of such activities to promote circular economy.

1.2. Drivers to Becoming an Environment-Friendly Airline

As a private company, what does it take to introduce and enforce environment-friendly policies?

The answer is probably the following drivers: regulatory requirements, cost incentives, and social responsibility needs as driven by the first two.

Many ANA initiatives are derived from the above drivers although some overlap multiple categories and some may not belong to any of the categories at all. Nevertheless, among these many initiatives, we will focus on those that the ANA Group has implemented proactively or directly linked to the concept of circular economy.

1.2.1. Regulatory requirements

As with other industries, the airline and aviation industries are covered by laws and rules and regulations by global bodies such as the International Civil Aviation Organization (ICAO) as well as local governments. These regulations range from what types of aircraft an airline can fly to how aircraft maintenance centres should be managed. These regulations are to be observed and complied with in full and groups such as ANA are obliged to follow them. The ANA Group's activities are governed by over 24 laws whose coverage ranges from 3R to noise and air pollution.

Taxes and mandatory transactions such as carbon-emissions trading can be considered as falling under such regulations as well. To meet the challenges of managing carbon emissions, ICAO is proposing market-based measures that, should it be mandatory for airlines in the future, will fall under this category.

1.2.2. Cost incentives

The simplest way to embed the concept of circular economy in a private entity is to look for measures that could make the operation less costly. Like any other company, ANA appreciates cost-cutting measures if given strong incentives. Other than this, the International Air Transport Association (IATA) encourages the use of voluntary initiatives to address environmental impacts from aviation as these can be tailored to the specific needs of governments, industry, and other stakeholders and can provide more flexibility and cost savings than regulatory measures (IATA website).

The most effective area of cost reduction would be fuel consumption. ANAHD's 2014 financial reports show that approximately 23 percent of operation cost is fuel cost or fuel-related taxes. As such, it is natural for ANA to reduce and stabilise fuel cost as much as possible. On the other hand, the large impact of fuel cost should translate into the use of alternative fuels at prices lower than or competitive to the price of existing jet fuel and that can be mass-produced. Currently, the price of alternative fuels are three to five times higher than that of conventional jet fuel. Thus, it would be very difficult for an airline to buy such expensive fuels even if their ecological advantages are warranted.

Following are the initiatives ANAHD and ANA have implemented in their common and unique efforts to save on fuel.

1.2.3. Social responsibility

With environment issues becoming more global, corporates have felt the need to themselves address these challenges. In 1999, ANA renamed its Environment Preservation Committee to Global Environment Committee. Although environment-related activities do not give direct positive impact on balance sheets, pressures from public opinion calling for more attention to global environment make a great incentive for corporations to participate or organise programmes addressing such concerns.

For example, ANA's sales departments, especially in Europe, are frequently asked of the group's ecological credentials. A report by the Global Business Travel Association Foundation in January 2015 reveals that 57 percent of Europe-based companies have sustainability initiatives included in their travel policies and, with regard to their business, nearly all companies measure the impact of air travel (GBTA, 2015). Corporate customers wish to know how ANA minimises its business's impact on the environment – what innovations/technology ANA uses; how ANA promotes the reuse, reduction, and recycling of materials; what ecologically responsible programmes the company is involved in; and how it is very important for airlines to undertake a myriad of initiatives in a multitude of areas to reduce the burden on the environment. Some of the frequently asked questions are:

- Do you have an ISO 14001 certification and/or any other environmental certificate?
- Can you regularly provide reports showing the CO_2 emissions directly linked to the company's business travel?
- What is the average age of the airline's fleet?
- What is the airline's kerosene consumption in tonnes per 100 passenger miles?
- What is the airline's CO_2 emissions per 100 passenger miles?
- How much waste is generated in kg per passenger?
- What percentage of waste is recycled?
- What is the airline's energy consumption on the ground?
- What is the airline's average percentage of energy consumption from renewable energy?

In recognising its social responsibility, ANA has taken direct measures in its core business and through various programmes such as coral restoration in Okinawa, forestation in areas near the airports, and the carbon offset programme for domestic air travel, among others.

ANA's initiatives on environmental issues has earned it a certification in 2008 from the Eco First programme of Japan's Ministry of Environment in recognition of the firm's environmental actions compliant with the Kyoto Protocol. ANA was the first company in the aviation and air transportation industries to receive this accolade.

2. ANA FLY ECO 2020

The ANA FLY ECO 2020, announced in 2012 as the ANA Group's third midterm environmental action plan, has six main pillars: (i) efforts to reduce CO_2 emissions, (ii) measures related to alternative fuels, (iii) resource conservation and recycling, (iv) conservation of biodiversity, (v) carbon offset programmes, and (vi) environmental compliance.

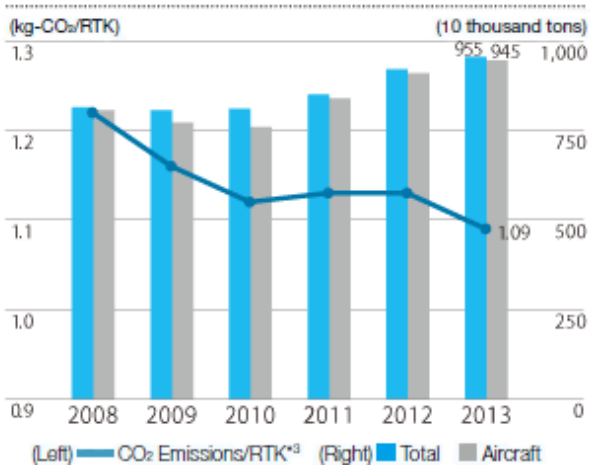
This plan, which succeeded the ANA Group's Ecology Plan for 2008–2011, includes strategies such as the introduction of Boeing 787, a more fuel-efficient aircraft with less noise footprint. The plan's awareness of 2020 is in line with IATA's aim of achieving carbon-neutral growth by 2020 or a 1.5-percent average annual improvement in fuel efficiency from 2009 to 2020 (IATA, 2009a). The IATA declaration includes a 50-percent absolute reduction in carbon emissions by 2050. The year also coincides with the end of the second commitment period of the Kyoto Protocol.

2.1. Efforts to Reduce CO_2 Emissions and Fuel Consumption

The airline industry is estimated to contribute 2 percent of total global emissions (IPCC, 1999). Within the ANA Group, 98 percent of CO_2 emissions come from fuel burn by aircraft with the rest coming from its maintenance facilities and vehicles on the ground.

The ANA Group targets a 20-percent CO_2-emissions reduction per revenue RTK in 2020 compared to 2005 and hopes to maintain 4.4 million tonnes per year of CO_2 emissions in its domestic route from 2012 to 2020.

Figure 4.1. CO_2 Emissions by the ANA Group



Source: ANA Annual Report (2013).

The first goal is for both international and domestic routes and is in line with IATA's goal of 17 percent (1.1 percent per year) industry-wide reduction by 2020 compared to the 2008 level. In 2013, ANA emitted approximately 9.45 million tonnes of CO_2, which was 13.3 percent less than the 2005 level, although it increased in gross volume by 4 percent compared to the previous year because of growth in operation.

The latter target was unique as it was the first of its kind in the industry to set a goal of gross CO_2 emissions. First adopted in 2008, the goal achieved more at 4.36 million tonnes in 2013, despite a 4.3-percent growth in available seat kilometres.

2.1.1. Launch customer of Boeing 787

Reducing CO_2 emissions means reducing the use of jet fuel, increasing the efficiency of fuel consumption, or both. These measures mean cost savings and can be rationalised easily.

Reducing the traditional ways of using energy such as using non-recyclable and non-reusable jet fuel will support the circular way of doing business.

As of 31 March 2015, the ANA Group has been operating 242 aircraft, 54.5 percent of which are fuel efficient. The average age of ANA's fleet is 11.3 years (as of 31 March 2013).

Table 4.1. Aircraft in Service of the ANA Group

Aircraft in Service		Mar 31, 2014	Mar 31, 2015	Change	Owned	Leased
Wide-Body	Boeing 747-400 (Domestic)	1	0	- 1	0	0
	Boeing 777-300ER	19	20	+ 1	17	3
	Boeing 777-300	7	7	–	7	0
	Boeing 777-200ER	12	12	–	6	6
	Boeing 777-200	16	16	–	14	2
	Boeing 787-9	0	2	+ 2	2	0
Mid-Body	Boeing 787-8	27	32	+ 5	30	2
	Boeing 767-300ER	26	26	–	9	17
	Boeing 767-300	21	16	- 5	16	0
	Boeing 767-300F	2	3	+ 1	0	3
	Boeing 767-300BCF	7	7	–	7	0
Narrow-Body	Airbus A320-200	19	20	+ 1	12	8
	Boeing 737-800	24	31	+ 7	24	7
	Boeing 737-700ER	2	2	–	2	0
	Boeing 737-700	11	10	- 1	7	3
	Boeing 737-500	15	17	+ 2	17	0
Regional	Bombardier DHC-8-400 (Q400)	21	21	–	15	6
	Bombardier DHC-8-300 (Q300)	1	0	- 1	0	0
	Total	231	242	+ 11	185	57

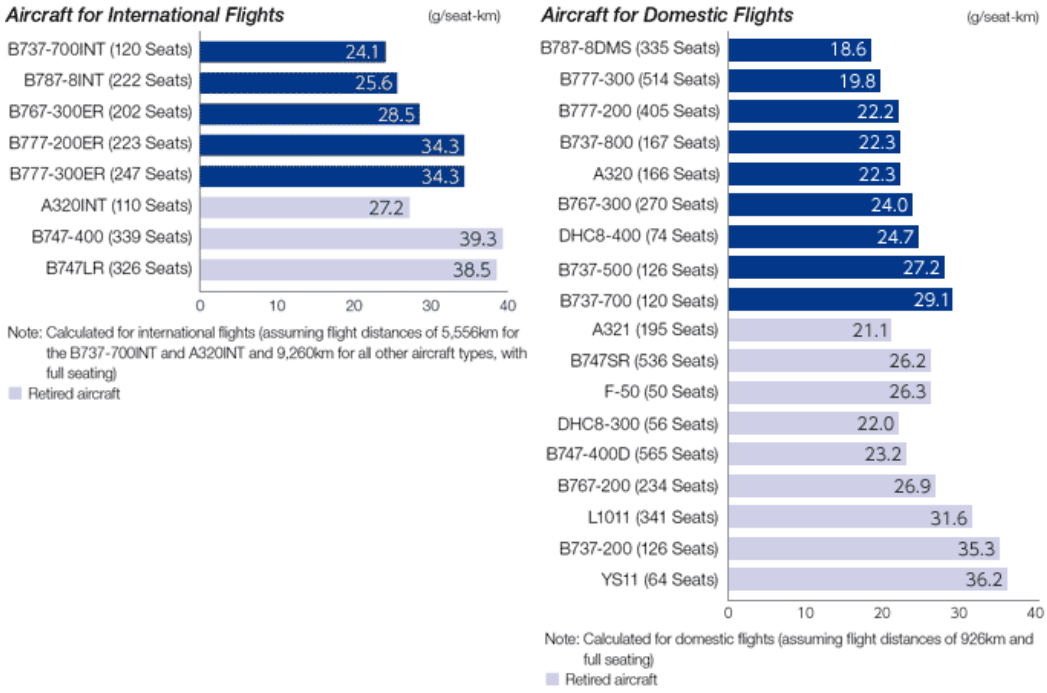
Source: ANA Annual Report (2014).

The Boeing 787, developed as the next-generation aircraft with signature carbon fibre composite frame and other features, is 20 percent more fuel efficient than the Boeing 767, one of ANA's major aircraft. As of 31 March 2013, ANA has been operating 34 Boeing 787s with two variants.

ANA, the launch customer and the first airline to fly Boeing 787, has a total order of 83 of this aircraft (including those already delivered) with three types of variants and has the largest order as of 31 April 2015. The 787 is set to become ANA's strategic aircraft.

The 787 features engines that incorporate the latest technologies, and more aerodynamically efficient wings with lighter structure. Manufactured with more environment-friendly considerations to noise and air footprints, the 787 is the only aircraft in the world with most of fuselage made of carbon fibre composite and designed with end-of-life stage consideration for recycling.

Figure 4.2. Fuel Consumption by Aircraft Type



Source: ANA Annual Report (2013).

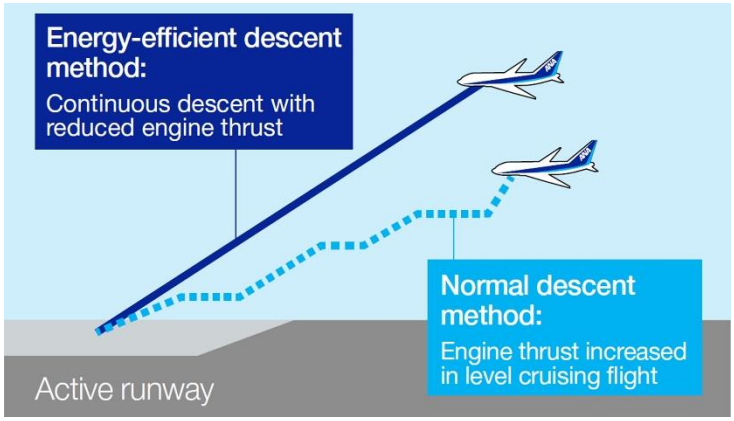
2.1.2. Fuel-reduction efforts in route operation

Other than introducing fuel-efficient aircraft, ANA has been vigorously searching for and implementing various measures to reduce fuel use. Its Fuel Efficiency Plan (FEP), launched in 2003, seeks ways to reduce fuel use and make the aircraft lighter in operation. In ANA FLY ECO 2020, another 3-year FEP was introduced.

In 2002, ANA, with support from Japan's Ministry of Land, Infrastructure, Transportation and Tourism, started to use aRea NAVigation (RNAV), a method of instrument flight rules navigation that allows an aircraft to choose any course within a network of navigation beacons rather than navigating directly to and from beacons. This method can shorten flight distance

by choosing a direct path, reducing congestion, and allowing flights into airports without beacons.

Figure 4.3. Energy-Efficient Descent



Source: ANA Annual Report (2015).

Another notable measure to conserve fuel is the continuous descent approach (CDA), a method that allows smoother approach to the airport and makes possible less carbon emissions and noise footprints. This method though is not applicable to all airports nor possible during congested times.

Provided all safety measures warrant the continuous descent approach, a pilot can reduce the use of thrust reversers during landing, thus reducing engine output which, in turn, reduces both CO_2 emissions and noise. CO_2 emissions are further reduced by shutting down one engine as the plane is taxiing toward gate after landing.

Lastly, when making flight plans, ANA has revised the method for calculating and planning the aircraft's gravity. Provided the total fuel on board is unchanged, this revision makes 1 percent gravity to the rear of the aircraft yield approximately 0.05 percent fuel saving.

These measures require a pilot's expert thinking based on established rules and a range of factors, including airport, weather, runway, and aircraft conditions as well as instructions from the control tower.

2.1.3. Fuel-reduction efforts on the ground

When an aircraft's engine is running, its engine compressor collects fine dust, decreasing fuel efficiency. About three times a year, ANA washes its fleet's engine compressors with warm water to remove dust and restore performance, improve fuel efficiency, and reduce CO_2 emissions, thus improving by 1 percent their fuel efficiency. Another effort is to use ground power units instead of the aircraft's auxiliary power units to supply electricity while the aircraft is parked at the gate.

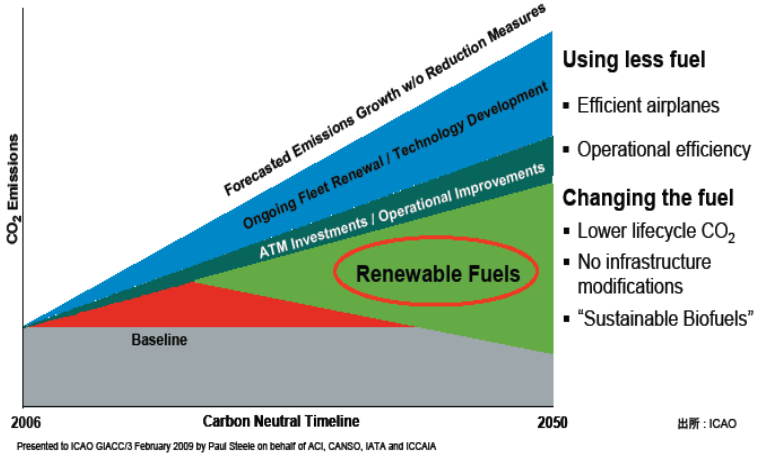
2.1.4. Other efforts

To reduce the weight of load an aircraft carries, ANA is reviewing the amount of potable water on board, changing the type of paper of inflight magazines, and adjusting the amount of utensils, beverages, etc. loaded based on reports from cabin attendants. It has also introduced lighter plates, cups, and baggage containers.

2.2. Future of Alternative Fuel

In considering the aviation industry's eco-friendly practices or circular economy, the issues of fuel efficiency or of lesser use of fossil fuel cannot be ignored. To reach IATA's goals, developing biofuel or alternative fuels is the key to success.

Figure 4.4. Timeline to Reach Carbon Neutrality



Source: ICAO.

Figure 4.4 illustrates IATA's carbon-reduction options with emphasis on renewable fuels. The technology for the use of biofuel to power aircraft has already been established. ANA first tested it with the delivery flight of its first 787 from Seattle to Tokyo by using a Dutch company's biofuel made from feedstock of used cooking oil mixed with kerosene.

ANA has also invested ¥571 million in Euglena Co, a Japanese firm that raises and uses algae to produce biofuels aside from other products, such as synthetic paraffinic kerosene and hydro-processed esters and fatty acids. The firm announced in April 2015 its collaboration with Chevron and the joint research they will conduct with the University of California San Diego on the outdoor algae cultivation technology.

2.3. Resource Conservation and Recycling

The concept of reduce–reuse–recycle or 3R, the main course for resource conservation and recycling, was very common in Japan in the 1970s as the country was experiencing the oil crisis. It can be said that the Law for the Promotion of Sorted Collection and Recycling of

Containers and Packaging enacted in 1997 (amended in 2006) has, in Japan's everyday life, elevated activities not only in areas covered by this law.

Within the ANA Group, an annual bulletin reminds employees of 3R activities where they are expected to participate. Unique in these 3R activities is ANA's effort to involve its customers in many of the measures discussed in this case study, such as requesting passengers to surrender plastic covers of their baggage, baggage tags, and boarding pass paper, thus encouraging them to be part of circular economy.

Another good example is ANA's treatment of water. For example, the remaining water from aircraft arriving at Haneda Airport used to be just discarded. After a proposal from an employee, however, it is now repurposed for cleaning aircraft maintenance facilities, etc. Since this initiative began in 2009, approximately 8,300 tonnes of water have been put to more effective use.

2.3.1. In-flight recycling

As early as 2000, ANA has been separately collecting recyclable cans and bottles and has added PET bottle collection in international flights arriving at Haneda and Narita airports.

Of the 22,500 tonnes total waste generated in the two airports in 2013, over 70 percent was collected from flights.

2.3.2. Recycled and reused items

The ANA group recycles waste generated on board, at airports, and offices and promotes resource conservation and recycling. Apart from water reuse, it recycles used paper generated by office equipment and old inflight magazines, etc. into timetables, envelopes, and business cards for its offices in Japan. The airline's headrest covers are made from reusable materials.

Used uniforms of cabin attendants, ground staff, and flight crews are broken down into fibre and reused as automotive soundproofing material. The uniforms themselves are made of materials produced from plastic bottles and other recyclables.

ANA's other initiatives include recycling aircraft engine parts into their component metals, recycling vinyl sheets used to protect cargo from rain and dust into solid fuel and garbage bags, using rainwater and treated kitchen wastewater, etc.

2.4. Conservation of Biodiversity

As part of its broader activities in social responsibility, the ANA Group has contributed in forestation and coral restoration in Japan.

2.4.1. Okinawa coral restoration

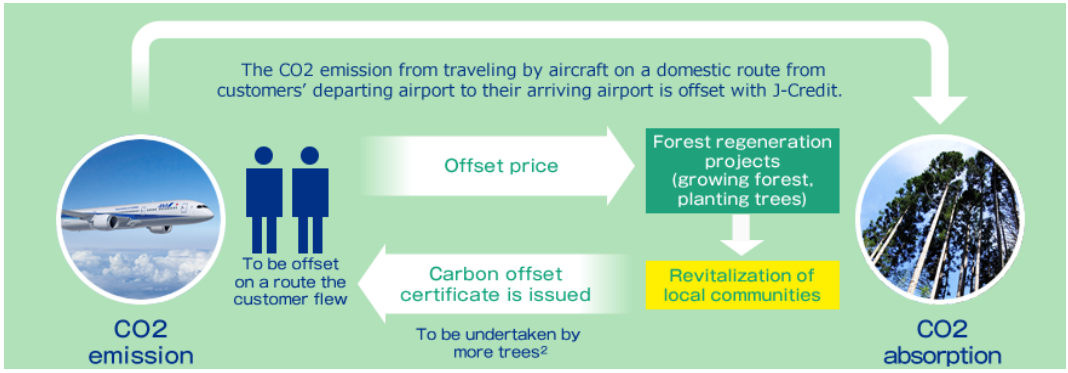
Since 2004, the ANA Group has joined other businesses in Okinawa and other prefectures to form Team Tyura Sango, an industry–government project to protect and regenerate the coral reef community near Onnason, Okinawa.

2.5. Carbon Offset Programmes

On 1 October 2009, the ANA Group launched the ANA Carbon Offset Program in all its domestic routes as part of its customer-related environmental contribution initiatives. In 2014, 24 tonnes of carbon were offset through this programme.

This programme enables passengers to donate money to tree planting activities to help absorb the CO_2 emitted by the aircraft they are traveling on. The donations are directed to 'more trees' (a general incorporated association), which uses them to cultivate forests in Japan.

Figure 4.5. Scheme of ANA Carbon Offset Programme



Source: ANA Carbon Off Set Home Page.

Passengers can calculate CO_2 emissions generated on domestic flights through a dedicated website (https://anaoffset.com). Donations can be made via credit cards. Customers can also participate in the programme any time, including retroactively offsetting the emissions of previous trips and making donations to offset emissions of future trips.

The scheme is unique because it is not a direct contribution of the ANA Group or its employees but a way of bridging customers and environmental activities through the group's business platform.

3. Challenges

Although the ANA Group continues to be an environmentally conscious company, its activities need coordination and support from various stakeholders, from the government to air traffic controllers, airport operators, and suppliers. Also, as a private company, ANA needs to sustain its growth while it pursues its objective of creating less negative impact on the environment.

From the perspective of circular economy, the following are some of challenges facing the commercial aviation industry.

3.1. How to Cope with Growing Demand

With economy growth materialising all over the world, the demand for air travel is also growing, especially in Asia. Although it can be argued that less travel will help lessen impact on the environment, it is important to note that commercial aviation is a collective activity where people move for various reasons and the airlines are there to serve their needs. History shows, however, that people are not always after speed and their awareness of the environment helps push for innovations to make air travel better. The phasing out of the Concorde is a very good example. Introduced in 1976, the supersonic jet that made transatlantic travel less than half of conventional aircraft's capability proved to be economically and environmentally unsuccessful. Aside from fuel inefficiency, the aircraft's noise footprint and the so called sonic boom effect were a real challenge to the environment. With only 20 units produced including two prototypes, the Concorde was retired in 2003. It is interesting to note that in 2002, Boeing selected its 7E7 programme (later renamed to 787) over the sonic cruiser, a concept aircraft that would carry passengers at shy the speed of sound. Boeing chose efficiency over speed (Boeing, 2013).

3.2. Mass Production of Biofuels

Although the technology and the product of aviation biofuel have already passed approval, the challenge remains whether airlines can procure the necessary amount to make it an integral part of their fuel use.[1] For example, ANA has used biofuel diluted to 15 percent although it could have accommodated less-diluted one if only the airline was able to obtain it. Boeing estimated in 2010 that one percent of its global aviation fuel could be biofuels (Bloomberg Business, 2010) but it is unlikely it could meet that projection. IATA estimates that three percent of total aviation fuel can be provided by biofuels under certain sets of policies required by both the industry and governments (IATA, 2014a), still a very small share and still a long road ahead. Companies from a broad range of fields, including airlines, energy, manufacturing, and trading have joined together to form the Initiatives for Next Generation Aviation Fuels (INAF) to establish the necessary supply chains and promote wider use of next-generation fuels. The ANA Group is participating in INAF as a steering member and will be working to formulate the road map that will enable the commercial use of next-generation aviation fuels, including biofuels, by 2020.

[1] Besides the regulations and rules on the use of biofuel, the biggest challenge facing the producers of alternative biofuels is the investment required to scale up their production. The airlines, in turn, are faced with scarce supply of biofuels sold at extremely high prices. The prices of biofuels are expected to come down as more feedstocks become available. Case Study ANA, The Sustainable Aviation Fuel Users Group, http://www.safug.org/case-studies/ana/

3.3. Can a Second-Hand Aircraft Market Be Justified?

Just like cars, aircraft also have second-hand market. Although ANA had procured second-hand aircraft in the past, its current fleet consists of new airplanes except for a Boeing 767 that was procured from another airline and converted into a freighter aircraft and another that had been sold to a third party but was bought back to fill ANA's short-term aircraft shortage.

As ANA procures new aircraft, it phases out older aircraft to be more competitive and to bring down cost. Since ANA's phased-out aircraft are supplied to the second-hand market, the question comes whether buyers of these older aircraft are justified in flying less eco-friendly aircraft.

The industry is facing a trade-off issue as far as eco-friendliness is concerned because of the introduction in the market of fuel-efficient aircraft. To some experts, the second-hand market is shrinking because people want newer aircraft for many reasons and the recent low-interest rate in the financial market has enabled second-tier carriers to tap into cash for more expensive new aircraft.

The second-hand market is ideal for the recycling and reuse concept of circular economy. When an aircraft reaches its end of life, 85 percent of its components can be still recycled (UAM website).

3.3.1. Aircraft conversion programme

One way to recycle and reuse is to convert passenger aircraft into cargo-only aircraft or freighters. Passengers do not want aircraft with tired-looking interiors and worn exteriors. In many cases, the life cycle of aircraft is longer than what passengers can endure. With less or no depression for the aircraft, it is still very economical to invest in conversion programmes as long as demand is there.

3.4. Fuel-Price Volatility May Affect Aircraft Purchases

The recent drop in fuel prices have some experts wondering whether airlines may lose interest in newer, economical but expensive aircraft. The background is that new fuel-efficient aircraft have not come to enjoy the scale merit of production as they are new to the market and catalogue prices are still relatively higher.

ANA is determined not to change its aircraft-procurement plan because of fuel price getting lower. However, with lower fuel price bringing the break-even point lower, it may consider deferring the retirement of some aircraft should market demand warrant it.

4. Policy Recommendations

In considering the promotion of circular economy in the airline industry or in any industry for that matter, it is more effective and efficient to find solutions that can serve as economic incentives to stakeholders. Policies that can supplement economic incentives should be welcomed.

4.1. Supporting Distribution of Biofuels

As the basic technology for biofuel production is already widely acknowledged in the industry, it is critical to give incentives to further the technology for mass production and to reward airlines that promote the use of biofuels. Although IATA has outlined many proposals (IATA, 2015), the need for public–private partnerships should be highlighted to create and maintain supply chains of biofuels to bring down distribution cost. The prices of conventional jet fuel and biofuels still have a significant gap due to the low production and distribution together with far less than needed supplies of the latter. Economic incentives or rewards for developing solutions require public funding support during its infancy.

Furthermore, among a variety of biofuels developed, biofuel from cooking oil and waste is an easy-to-understand means from the perspective of circular economy as it creates a feeling of engagement by consumers (= air travellers). This may be easier to justify when the price gap between conventional fuel and biofuels becomes marginally acceptable. The policies to support development and distribution of biofuels should be drawn not just from the supply side (manufacturers and airlines) but, ultimately, from the demand side or the consumers.

Many countries have launched study projects to tackle the issue of distribution of biofuels. In Japan, the Committee for the Study of a Process Leading to Introduction of Bio Jet Fuel for the 2020 Summer Olympic Games and Paralympic Games in Tokyo was formed by the Ministry of Land, Infrastructure, Transport and Tourism and the Ministry of Economy, Trade and Industry in July 2015. Other countries have set up similar projects/groups like the Commercial Aviation Alternative Fuels Initiative and the European Advanced Biofuels Flightpath, to name a few.

In ASEAN countries, the Southeast Asia Sustainable Aviation Fuel Initiative was formed in 2013 and has since partnered with expert organisations and ASEAN. For this initiative, Indonesia should be highlighted as its government has set a target to airlines to use 2 percent biofuel as jet fuel by the end of 2016.

Although this will unlikely materialise, it is worth noting that a country experiencing rapid growth in air traffic is setting a challenging target. It will require significant international and domestic support to move toward that milestone.

4.2. Comprehensive Recycling Structure along the Value Chain in the Air Travel Industry

Like most developed countries where management of waste has somewhat been done in many ways through various regulations and incentives, there is room to explore at each value chain. For example, recycling on many international routes is hindered due to quarantine issues in Japan, itself a very important global agenda. Japan requires that most waste offloaded from an aircraft be burned, thus making it difficult to recycle. Any industry development that allows not only the burning of waste generated in the sky but also its safe recycling and/or reuse should be welcomed.

4.3. Institutionalisation and Formalisation of Waste Management

In many developing countries, people engaged in recycling or reuse are part of the informal sector. To reduce or recycle waste, it is strongly recommended that people who belong to the group of the most poor be formalised as labour and the process to be institutionalised. The cost of such work should be covered by consumers through taxes or terminal fees. In addition, refund of collected recyclable materials should be considered to help support institutionalisation.

4.4. Co_2 Emissions Regulations by International Bodies

The International Council on Clean Transportation (Kharina, 2015) has reported that a meaningful and ambitious CO_2 standard is needed to provide an extra incentive for development of new technology and deployment of new aircraft. It estimates that manufacturers remain 12 years behind the technology goals of ICAO. ICAO is looking forward to the crafting of CO_2-emissions regulations by 2016 with prevailing high hopes similar to the significantly mitigated noise pollution problems after rules were implemented by ICAO.

5. Conclusion

Under the Long-Term Strategic Vision announced in January 2015, ANAHD and the ANA Group plan to increase its aircraft fleet to approximately 305 aircraft. They estimate that 75–80 percent of the new-generation aircraft will be fuel efficient. To fulfil its environment target, ANA is striving to attain two goals within 2020 as this is a critical and special year. Tokyo is hosting the 2020 Summer Olympics and demand to travel to Japan is expected to grow significantly. Under such circumstances, steadily continuing the current measures and innovations within ANA and the industry is highly expected to make the airline more environmentally friendly while achieving sustainable growth.

References

All Nippon Airways Co, Ltd (1998, 2005), *ANA Environment Report*.

ANA Holdings Inc. (2012, 2013, 2014) Annual Report.

Bloomberg Business (2010), 'Airlines May Get 1% of Fuel From Biofuels By 2015, Boeing Says', 22 July.

Boeing (2013), *Frontiers*, October 2013, p. 24, Available at; http://www.boeing.com/news/frontiers/archive/2013/october/index.html#/4/

GBTA (Global Business Travel Association) (2015), 'Sustainable Business Travel Initiatives on the Rise in Europe', GBTA news release, 26 January, Available at; http://www.gbta.org/foundation/pressreleases/Pages/rls_012615.aspx (accessed 14 September 2015).

IATA (2009a), 'Carbon-Neutral Growth by 2020', *IATA Press Release* No. 26, 8 June.

IATA (2009b), *A Global Approach to Reducing Aviation Emissions.*

IATA (2014a). Available at: http://www.iata.org/pressroom/facts_figures/fact_sheets/Pages/alt-fuels.aspx (accessed December 2014).

IATA (2014b), *World Air Traffic Statistics* 58th Edition.

IATA (2015), *IATA Fact Sheet,* June.

IATA website, 'Improving Environment Performance', Available at: http://www.iata.org/whatwedo/environment/Pages/index.aspx (accessed 13 May 2015).

IPCC (Intergovernmental Panel Climate Change) (1999), *Special Report, Aviation and the Global Atmosphere*.

Kharina, A. and D. Rutherford, Ph.D. ICCT (2015), *Fuel Efficiency Trends for New Commercial Jet Aircraft:* 1960 to 2014. Whitepaper, August 2015.

UAM (Universal Asset Management Inc.) website, 'Green Solutions', Available at; https://www.uaminc.com/portfolio/green-solutions (accessed 17 May 2015).