NAMIBIA

ACTION PLAN FOR CO_2 EMISSIONS REDUCTION IN INTERNATIONAL AVIATION

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LIST OF ABBREVIATIONS

AEWG Aviation Emissions Working Group (National Team)

NAC Namibia Airports Company

ANS Air Navigation Services

APER Action Plan for CO2 Emission Reduction

APU Auxiliary Power Unit

ATFM Air Traffic Flow Management

ATM Air Traffic Management

AIRNAM AIR NAMBIA

RNAV Area navigation

CO2 Carbon dioxide

DCA Directorate of Civil Aviation

DEA Directorate of Environmental Affairs

FIR Flight Information Region

GHG Greenhouse gas

GRN Government of Namibia

GPU Ground Power Unit

ICAO International Civil Aviation Organization

IT Information and Technology

IFSET ICAO Fuel Savings Estimation Tool

MWT Ministry of Works And Transport

NAMCOR National Petroleum Company

PBN Performance Based Navigation

PCA Pre-Conditioned Air

RNAV Area navigation

RTK Revenue Tonne Kilometres

WAM Wide Area Multilateral System

EXECUTIVE SUMMARY

The Government of the Republic of Namibia (GRN) has the responsibility for the provision of Air Traffic Services in Namibia since independence in 1990.The airspace of Namibia spans over 825,615 km^2 .The Directorate of Civil Aviation (DCA) under the Ministry of Works and Transport (MWT) provides air navigations services on behalf of GRN.

In the past few years, the GRN has made significant progress with the implementation of several initiatives to reduce the carbon dioxide (CO2) emissions in aviation such as investment in new aircraft technology, more efficient operations, airports improvements, air traffic management and infrastructure use.

One of the successes that the Directorate of Civil Aviation has implemented as an appropriate mitigation measure was the effective implementation of Performance Based Navigation RNAV 5 PBN air routes in all of its upper airspace FL245 to FL460 . The CO2 savings from 15 September to 31 December 2015 show a reduction of 570937KG of CO2.

Another area of success is in the Air Traffic Management Systems Radar, Wide Area Multilateral System (WAM). The Namibian WAM system was supplied by Era, of the Czech Republic, and employs 36 widely separated and unmanned ground stations that listen for aircraft transponder replies to radar interrogations and then retransmit those replies to a central processing station. The WAM systems' precision has helped optimize air traffic across Namibian airspace, hence reducing aviation-related carbon emissions.

The national airline Air Namibia has implemented various initiatives in improving its fuel efficiency and reducing its carbon footprint. Weight reduction measures include potable water tanks being filled to 50% tank capacity (established after passenger survey) and the replacement of hardcopy manuals in the cockpit with electronic manuals.

In 2016, Air Namibia targets to save 101 667 kg of fuel in 12 months. By end of May 2016, 18.4 tonnes of fuel were saved. This is 18.1% of the target set. This implies 57.9 tonnes reduction on CO2 emissions. Air Namibia has also implemented idle reverse thrust on landing. In May 2016 ,the evaluation on the 12 months project (Jan 2016 to Dec 2016) indicates that 19% of the target was achieved. By May 2016 , 38.1 tonnes of fuel was saved which translates to 120 tonnes of CO2 emissions reduction.

The Government of the Republic of Namibia is committed to the sustainable development of the aviation sector and to the continued efforts to protect the environment of our country. All the initiatives currently implemented, as well as the Aviation Emissions Working Group (AEWG), reflect and reiterate the commitment of the Government of the Republic of Namibia to assist the national airline and aviation sector in their efforts to reduce fuel burn and carbon missions.

1. Introduction

1.1 Namibia– Territory and border

Namibia is a country in southern Africa whose western border is the Atlantic Ocean. It shares land borders with Zambia and Angola to the north, Botswana to the east and South Africa to the south and east. Although it does not border Zimbabwe, a part of less than 200 metres of the Zambezi River (essentially a small bulge in Botswana to achieve a Botswana/Zambia micro-border) separates it from that country.

COUNTRY PROFILE

Area • Total825,615 km² (34th

318,696 sq mi

• Water (%) Negligible

Population

• 2011 census2,113,077

• Density2.54/km² (235th) 6.6/sq mi

GDP (PPP)2016 estimate

• Total$26.399 billion

• Per capita$11,786

GDP (nominal)2016 estimate

• Total$13.703 billion

• Per capita$6,118

Gini (2009)59.7 high

HDI (2014) ▲ 0.628 medium ·126th

CurrencyNamibian dollar (NAD)

Sourced from Wikipedia.com

Figure 1. Namibia's geographical location

There are 14 regions in Namibia and there is at least 1 aerodrome in each region. The Ministry of Works and Transport is responsible for the maintenance, rehabilitation and upgrading of 27 aerodromes across the country. The Namibia Airports Company is the custodian of 8 airports including Hosea Kutako International Airport, the biggest commercial airport located 40 km east of the capital Windhoek.

2. AVIATION EMISSIONS WORKING GROUP (AEWG)

The Government of the Republic of Namibia recognises the importance of climate change and global warming and has embarked on various initiatives to implement greenhouse gases mitigation measures.

The Action Plan For CO2 Emissions Reduction in international aviation is one of the most important initiatives by GRN in partnership with ICAO.

This Action Plan describes the civil aviation sector in Namibia and the main stakeholders in the AEWG for CO2 emissions reduction in international aviation. The Action Plan also details the set of mitigation measures selected by the AEWG to address CO2 emissions reduction in international aviation at the national level.

The forecast of the trends of CO2 emissions with and without the implementation of these measures is also described, reflecting the positive impacts of these initiatives on the carbon footprint of the international aviation sector in Namibia.

Environmental initiatives for international aviation in Namibia will be implemented by a national committee, the AEWG. The working group consists of national level stakeholders and is chaired by the DCA. Representatives are:

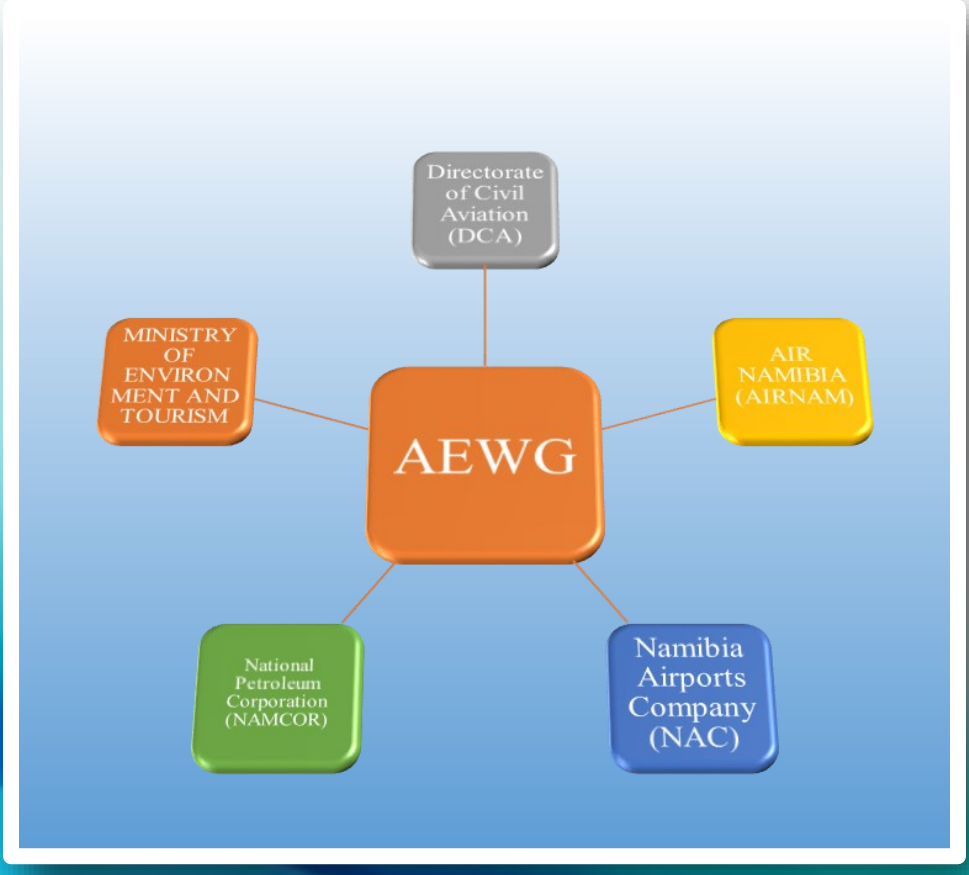

Figure 2. Aviation Emissions Working Group (AEWG) Namibia

2.1 DCA

The Directorate of Civil Aviation consist of three Divisions; i.e. Division Aviation, Administration and Navigation, Division Flight Safety and Security, and Division Meteorological Services and is assisted by a small administrative component.

Figure 3. Control Tower at Eros Airport, Windhoek

The Directorate is performing the following functions:

- Aeronautical Information Services
- Air Navigation and Technical Services
- Air Traffic Control Services
- Meteorological Services (Aviation)
- Air Navigation Services Safety Oversight
- Airworthiness
- Flight Operations
- Personnel Licensing
- Aerodromes
- Aviation Security

In fulfilling its responsibilities, the Directorate of Civil Aviation endeavours to assure a safe, orderly, regular and efficient civil aviation system. The Directorate recognizes the importance of its stakeholders and the role it has to play in the development of an efficient civil aviation system in Namibia. Whilst ensuring quality service, aviation safety and security remains priority number one on the agenda.

Cabinet has approved in 2003 the establishment of the Namibia Civil Aviation Authority (NCAA). The current project team is busy with the preparation of the required documentation, for the establishment of the NCAA.

2.2 Air Namibia

Air Namibia (Pty) Limited is a proprietary limited company incorporated in accordance with the Company's Act. Air Namibia is the national airline of the Republic of Namibia, with the Government of Namibia as its sole Shareholder.

The company's business operations primarily involve provision of air transport services for passengers and cargo. Through its subsidiary company, Air Namibia Ground Handling (Pty) Limited, it provides ground handling services for passengers and aircraft at Windhoek's Hosea Kutako International Airport.

The airline is positioned as a niche carrier serving domestic points within Namibia, the immediate regional markets of South Africa, Zimbabwe, Angola, Zambia and Botswana. The airline also serves the entire European network through Frankfurt.

Air Namibia's mandate was determined by its Shareholder, the Government of the Republic of Namibia represented by the Ministry of Works and Transport, to be a major contributor towards the attraction and promotion of tourism, as well as promotion and facilitation of trade to Namibia by providing air and cargo transport services between Namibia and other countries, as well as by operating flights within the boundaries of Namibia.

Since its inception, Air Namibia makes a positive net economic (value) contribution to the national economy, in line with its mandate. Net economic gain is defined as the gross value that visitors carried into the country by the airline contribute to the economy, less the cost of Government support to the airline. Net economic gain also includes the impact that Air Namibia has on employment in Namibia. The value added is measured in terms of contribution to "Gross Domestic Product (GDP)" and employment.

Air Namibia
Carrying the spirit of Namibia

Airline Status: **In-service**

IATA Code: SW

ICAO Code: NMB

Website: http://www.airnamibia.com.na/

Main hub: Windhoek Hosea Kutako International Airport

Country :Namibia

Business model: Full Service Carrier

Network: International

Frequent Flyer Programme: Reward$

Association Membership: AASA AFRAA IATA

Codeshare Partners: Kenya Airways

In line with its vision statement of being a safe, reliable, efficient and caring airline, Air Namibia operates a fleet carefully selected to meet expectations of its stakeholders. These expectations include performance dependability and comfort. All aircraft in the fleet are all cabin pressurized, provide immense comfort offered by the generous legroom, modern interiors and trend setting features. These aircraft are subjected to high levels of safety ensured through the meticulous maintenance programmes, and highly trained flight deck and cabin crews.

Today's fleet comprises the following;

* 2 x Airbus A330-200 aircraft
* 4 x Airbus A319-100 aircraft
* 4 x Embraer ERJ 135

2.3 NAC

The Namibia Airports Company (NAC) Limited was established in terms of the Airports Company Act 25 of 1998. The NAC is a state-owned entity/enterprise and its portfolio ministry is the Ministry of Works and Transport.

NAC, the gateway to Namibia, commenced operations on 05 February 1999 and have went on to pride itself on providing unprecedented safety and security at all its airports. Since its existence, NAC has made remarkable strides in airport development and management.

The NAC is mandated to develop, manage and operate eight (8) airports:

- Hosea Kutako International Airport
- Eros Airport
- Walvis Bay Airport
- Ondangwa Airport
- Katima Mulilo Airport
- Keetmanshoop Airport
- Luderitz Airport
- Rundu Airport

2.4 NAMCOR

Namibia Petroleum Corporation (Namcor) is a legally enacted entity under the Namibian Companies Act of 1973 with the Government of the Republic of Namibia as our sole shareholder. Under the Petroleum (Exploration and Production) Act of 1991 , Namcor has the mandate to carry out reconnaissance, exploration and production operations either on its own or in partnership with other organisations in the industry. Namcor's upstream activities include exploration and production, promotion and maintaining an advisory and regulatory role.

Exploration and Production

To date, 48 exploration, one production, and two Coal Bed Methane licenses have been issued to Namibian and international oil and gas companies. Overall, a total of 15exploratory wells, 7 appraisal wells drilled in the KUDU gas field/license area have been drilled in offshore Namibia.

Figure 5. Namcor Oil rig off the Namibian coast nearby Luderitz

Commercial and Marketing

Namcor has a variety of petroleum products from their depot network. The Company also offers different customer value propositions to the various market sectors such as the mining, construction, commercial road transport , manufacturing, fishing resellers and farming sectors.

Regulatory role

The Company's role as a government institution is to actively promote the hydrocarbon potential of Namibia. In exercising this role, the company is tasked with advising the Ministry of Mines and Energy on policy issues regarding the upstream petroleum industry and monitoring the petroleum activities of oil companies operating within Namibia. Since Namibia's independence in 1990, Namcor has facilitated the signing of several petroleum agreements with international oil companies.

2.5 MINISTRY OF ENVIRONEMENT AND TOURISM

The Directorate of Environmental Affairs (DEA) under the Ministry of Environment and Tourism is a Government agency responsible for promoting environmental protection , environmental planning and environmental coordination. It manages a number of programmes which address priority environmental issues and challenges.

NATIONAL CLIMATE CHANGE POLICY (NCCP)

The main purpose of the national climate change policy of Namibia is to provide the legal framework and overarching national strategy for the development, implementation, monitoring and evaluation of climate change mitigation and adaptation activities. The policy promotes the enhancement of synergies amongst sectors and stakeholders for effective and efficient mitigation and adaptation responses to climate change in Namibia. In addition, the policy facilitates identification of sector and cross-cutting climate change strategies and actions for implementation to lower Namibia's overall risks, and the risks of the most vulnerable groups and sectors. The policy also provides legal basis for resource mobilisation to address climate change adaptation and mitigation.

FOCUS OF THE NCCP

Namibia has little control over the causes of climate change, yet is highly vulnerable to the effects. Greenhouse gas (GHG) inventories by du Plessis (1999) and Harts and Smith (2008) reveal that Namibia does not contribute significant amounts of greenhouse gasses to global emissions. Therefore Namibia's current primary focus of climate response is to build and secure the appropriate long-term sustainable resources for adaptation to the effects of climate change.

For mitigation, Namibia will predominantly focus on low carbon development and sustainable energy since Namibia does not emit significant amounts of GHG into the atmosphere. Namibia shall however explore access and utilise available global mitigation techniques for the country's economic benefit such as benefits from energy efficiency through Clean Development Mechanisms of UNFCCC. This is done through the use of cleaner more energy efficient technologies, and adapting existing renewable technologies to be more economically viable.

Figure 8. Eros Airport runway, Windhoek, Namibia

Baseline of CO2 Emissions in International Aviation

3.1 Calculation method

The baseline for CO2 emissions in international aviation represents the evolution of CO2 emissions from international aviation in the next 21 years (up to 2035) in the absence of mitigation measures (business as usual scenario). In the case of Air Namibia, it was calculated using 3 years averaged historical data and composition was referred to same as the most recent year (2015). Air Namibia is the only airline registered in Namibia that serves international flights. Only international flights according to ICAO definition were considered for the baseline calculation.

Following ICAO's methodology described in ICAO Doc 9988, and the air traffic increase in the coming years the baseline was estimated using ICAO Circular 313, which forecasts a traffic (RTK) growth of 4% per year in the African region, the baseline was calculated (see Table 1).

The baseline obtained for CO2 emissions up to 2035 is depicted in tabular and graphical formats on Table 1 and Figure 6 respectively. According to these results, in the absence of mitigation measures, CO2 emissions from international aviation will grow from 191 372 295 tons of CO2 (tCO2) in 2016 to 510 526 298 tCO2 in 2035, which represents an increase of 62% in twenty one years.

3.2 Trends on International CO2 Emissions and RTK

BASELINE					
Year	RTK	RTK	FB (kg)	CO2 (kg)	FE
2015	150 057 569	150 057 569	57 567 333	181 912 772	0.384
2016	156 059 872	150 057 569	57 567 333	181 912 772	0.384
2017	162 302 267	150 057 569	57 567 333	181 912 772	0.384
2018	168 794 357	150 057 569	57 567 333	181 912 772	0.384
2019	175 546 132	175 546 132	67 345 637	212 812 214	0.384
2020	182 567 977	175 546 132	67 345 637	212 812 214	0.384
2021	189 870 696	175 546 132	67 345 637	212 812 214	0.384
2022	197 465 524	197 465 524	75 754 683	239 384 798	0.384
2023	205 364 145	197 465 524	75 754 683	239 384 798	0.384
2024	213 578 711	197 465 524	75 754 683	239 384 798	0.384
2025	222 121 859	222 121 859	85 213 716	269 275 342	0.384
2026	231 006 733	222 121 859	85 213 716	269 275 342	0.384
2027	240 247 003	240 247 003	92 167 155	291 248 209	0.384
2028	249 856 883	240 247 003	92 167 155	291 248 209	0.384
2029	259 851 158	259 851 158	99 687 995	315 014 063	0.384
2030	270 245 204	259 851 158	99 687 995	315 014 063	0.384
2031	281 055 013	281 055 013	107 822 535	340 719 211	0.384

Table 1. Baseline on International CO2 Emissions and RTK **(Continued on Page 15)**

BASELINE					
Year	RTK	RTK	FB (kg)	CO2 (kg)	FE
2032	292 297 213	281 055 013	107 822 535	340 719 211	0.384
2033	303 989 102	303 989 102	116 620 854	368 521 898	0.384
2034	316 148 666	303 989 102	116 620 854	368 521 898	0.384
2035	328 794 612	328 794 612	126 137 116	398 593 285	0.384
2036	341 946 397	341 946 397	131 182 600	414 537 017	0.384
2037	355 624 253	341 946 397	131 182 600	414 537 017	0.384
2038	369 849 223	369 849 223	141 887 100	448 363 237	0.384
2039	384 643 192	384 643 192	147 562 584	466 297 767	0.384
2040	400 028 919	384 643 192	147 562 584	466 297 767	0.384
2041	416 030 076	416 030 076	159 603 691	504 347 665	0.384
2042	432 671 279	432 671 279	165 987 839	524 521 571	0.384
2043	449 978 130	449 978 130	172 627 353	545 502 434	0.384
2044	467 977 255	449 978 130	172 627 353	545 502 434	0.384
2045	486 696 346	486 696 346	186 713 745	590 015 433	0.384
2046	506 164 199	506 164 199	194 182 294	613 616 050	0.384
2047	526 410 767	526 410 767	201 949 586	638 160 692	0.384
2048	547 467 198	547 467 198	210 027 570	663 687 120	0.384
2049	569 365 886	569 365 886	218 428 672	690 234 604	0.384
2050	592 140 522	592 140 522	227 165 819	717 843 989	0.384
CAGR	4.00%	4.00%	4.00%	4.00%	0.00%

Table 1. Baseline on International CO2 Emissions and RTK (Continued)

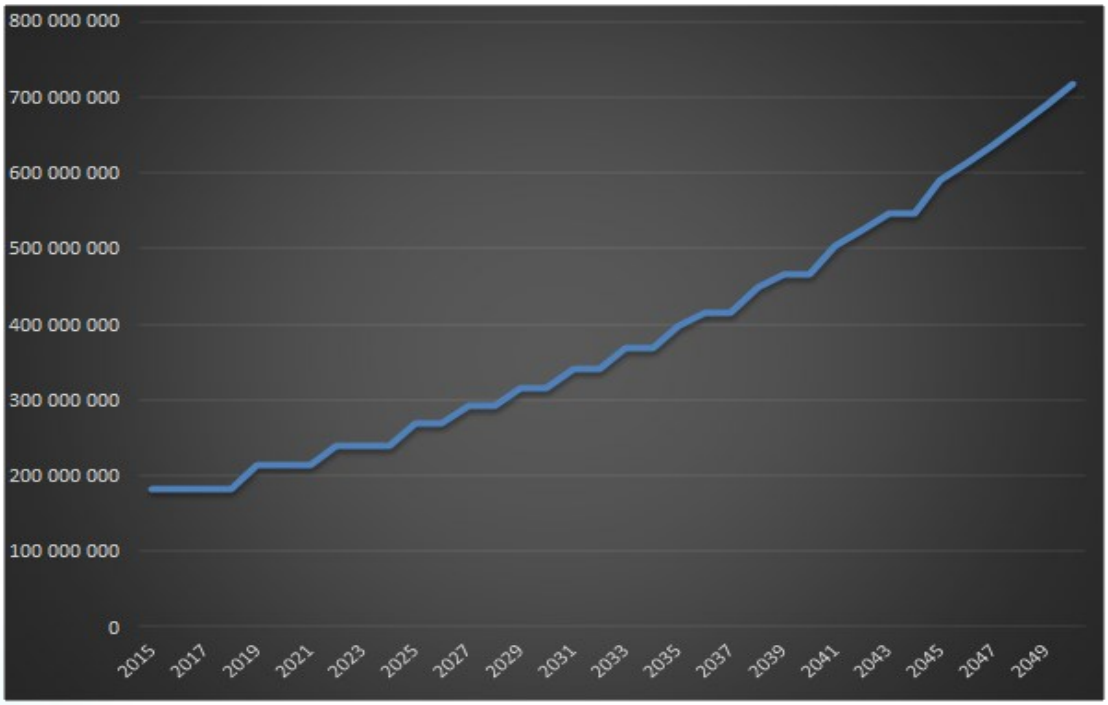

Figure 6. Baseline graphical representation

BASKET OF MEASURES FOR NAMIBIA

4. Basket of Measures for Namibia

The mitigation measures selected to reduce CO2 emissions from international aviation are focused on three categories from ICAO's basket of measures:

1. Improved Air Traffic Management (ATM) and infrastructure use
2. More efficient operations
3. Monitoring and Data Resources

4.1 Improved Air Traffic Management (ATM) and infrastructure use

The DCA has implemented RNAV 5 PBN air routes in all of its upper airspace FL245 to FL460. Track mile reductions result in 10NM saving. There is no further gains to be had as all other routes are straight lines and as a result track mile savings are not possible in future. This programme has been fully implemented.

Figure 7. Air Traffic control Tower at Eros Airport, Windhoek, Namibia

Data from report on the Environmental and Operational Benefits from PBN: CO2 savings from 15 September to 31 December 2015 show a reduction of 570937KG of CO2. Extrapolated for a year (assuming no traffic growth) shows a saving of 1929097KG of CO2

The use of Alternate is company derived. Namibia has few alternate aerodromes so fuel reduction is unlikely. Better Approach procedures provided by the DCA such as the New ILS and VOR procedures were implemented at Hosea Kutako international airport on the 18 August 2016. New procedures designed for Walvis Bay international airport are to be implemented in November 2016.

RNP APCH procedures are currently implemented at Hosea Kutako international airport , Rundu, Ondangwa, Oranjemund airports. These procedures are to be rolled out at Luderitz, Walvis Bay, Eros, Katima and Keetmanshoop airports in the future.

Table 2: DCA's List of selected CO2 mitigation measures implemented and ongoing.

Measure	Description	Start Date	End date	Expected results (tCO2 reduced/year)	Stakeholder	Assistance needs
Measures to improve the use of optimum flight levels	Provide for optimum routing for aircraft; Reduce track miles where possible; Implementation of PBN procedures;	2016	2016	Unknown however jet aircraft operating at optimum flight levels will be at best fuel burn efficiency With the low traffic numbers in the FIR the vast majority of aircraft will be at their optimum operating level.	Air Namibia All jet operators	N/A
Measures to improve the use of optimum routings	Apply : Flight Planning Optimization (vertical and lateral) ; Alternate - Optimum Selection	2016	2016	Namibia has implemented RNAV 5 PBN air routes in all of its upper airspace FL245 to FL460. Track mile reductions result in 10NM saving. There is no further gain to be had as all other routes are straight lines so basically track mile savings are not to be had. This programme has been fully implemented. Data from report on the Environmental and Operational Benefits from PBN: CO2 savings from 15 September to 31 December 2015 show a reduction of 570937KG of CO2. Extrapolated for a year (assuming no traffic growth) shows a saving of 1929097KG of CO2	Air Namibia All jet operators	
Apply Reduced Acceleration Altitude (Flaps Retraction level-off).				ICAO departure procedures can assist with flexible procedures. However there are minimum flap retraction and acceleration schedules for each aircraft. DCA can regulate use of departure procedures for noise abatement however these can be more fuel intensive. Currently none are in operation. Also highly dependent on operator requirements.	All operators	
Optimized Cost Index ;	Operators use best Cost Index for Operation.			Unknown however with optimum Cost Index operators can utilise best fuel burn efficiency This is not controlled by DCA rather it is operator dependent. DCA cannot mandate a cost index for aircraft	All jet operators.	

Better Approach procedures provided by DCA	Review of existing conventional approaches; Introduction of RNP APCH procedures (PBN)	2016	2017	New ILS and VOR procedures implemented at Hosea Kutako 18 August 2016. New procedures designed for Walvis Bay to be implemented November 2016. Currently implemented at Hosea Kutako, Rundu, Ondangwa, Oranjemund. To be rolled out or Luderitz, Walvis Bay, Eros, Katima and Keetmanshoop in the future. A major benefit of th RNP APCH is that they require no ground infrastructure. So Rundu now has instrument flight procedures where previously none existed. Also Hosea Kutako has an instrument approach to Runway 08 for the first time. With RNP APCH procedures at aerodromes not previously serviced by any instrument approach, the frequency of diversions due weather is reduced. As an example a diversion for Air Namibia in the ERJ135 from Ondangwa to Eros costs in the vicinity of NAD$60000 plus the additional GHG emissions.	All operators	RNP APCH design organisation currently contracted to DCA. Budget for procedures an essential.

Table 2: DCA's List of selected CO2 mitigation measures implemented and ongoing.

4.2. More efficient operations

Air Namibia has an Operations Efficiency Program (OEP) in place. Some projects are part of the airline's Standard Operating Procedures (SOP) and some are ad-hoc from time to time continuously.

Table 3 shows what Air Namibia has already put in place as part of Operations Efficiency Program. OEP contributes to less fuel burn which consequently contributes to reduction in carbon emission. Figure 8 shows Air Namibia's APU usage trend decreasing as monitored from 2014 to May 2016.

Measure	Description	Start Date	Completion date	Expected results (tCO2 reduced/ year)	Stakeholder	Assistance needs
Minimising weight	Fuel loading is matched to flight plan minimum fuel requirement. Air Namibia migrated from basic SITA flight planning module to more capable SITA Gra-flite module (implemented 2013). This is an indication that the flights do not carry excess fuel unless for economic reasons i.e. tankering due to fuel price differences at some stations. Paper Manuals are removed from the cockpit. Air Namibia has a paperless cockpit. Dispatchers implored to use closer arrival alternates. Lighter apparatuses (trolleys and cutlery) are used onboard Air Namibia flights. Inflight magazines are only distributed to 2/3 of the passenger seats. Potable water- weight reduction: Air Namibia have implemented that portable water tanks be filled to 50% tank capacity. This was established after passenger needs survey. In 2016 we target to save 101 667 kg of fuel in 12 months. By end of May 2016, 18.4 tonnes of fuel was saved. This is 18.1% of the target set. This implies 57.9 tonnes reduction on CO_2	Jan 2016 (portable water project)	Dec 2016	321 tonnes	Air Namibia	N/A

Table 3: Air Namibia's List of selected CO2 mitigation measures implemented and ongoing.

Measure	Description	Start Date	Com-pletion date	Expected results (tCO2 reduced/ year)	Stake-holder	Assis-tance needs
Minimis-ing / delaying flaps (take-off and landing)	Pilots apply : Low Drag Approaches ; Reduced Flaps Take-off ; Reduced Flap Landings These are Air Namibia Standard Op-erating Procedure (SOP).			Not quanti-fied	Air Na-mibia	
Reversers use	**Idle Reverse on Landing** In May 2016 evaluation on the 12 months project (Jan 2016 to Dec 2016) indicates that 19% of the tar-get is achieved. By May 2016 38.1 tonnes of fuel is saved which im-plies that 120 tonnes of CO_2 re-duced.	Jan 2016	Dec 2016	633 tonnes	Air Na-mibia	
Flying cost index	**Dynamic cost index:** Air Namibia target to fly optimized cost index to save fuel. By May 2016 it was reported that 128.6% of this target is achieved in 5 Months and 881.0 tonnes of CO_2 carbon is so far reduced. 279.7 tonnes of fuel saved. This target was achieved in 5 months of the project period (Jan 2016 to Dec 2016). More savings are expected by the end of the pro-ject period. Flight plans are based on long Range cruise.	Jan 2016	Dec 2016	686.6 tonnes	Air Na-mibia	

Table 3: Air Namibia's List of selected CO2 mitigation measures implemented and ongoing.

Measure	Description	Start Date	Completion date	Expected results (tCO2 reduced/ year)	Stakeholder	Assistance needs
APU vs GPU usage	APU usage is monitored and the trend is decreasing (see Figure 1). In 2014 the average APU hours per flight cycle was 2.26 and it has improved to 1.70 in 2016. The APU usage is part of the 12 Months (Jan 2016 to Dec 2016) project, by May 2016 9.1% is achieved. About 155.1 tonnes of fuel saved and 488.6 tonnes of CO_2 reduced. Alternatively, a GPU is used instead of APU at stations where there are GPUs.	2014 (currently on 12 Months review project Jan 2016 – Dec 2106)	Ongoing	5356 tonnes	Air Namibia	
Aircraft Maintenance	Air Namibia has introduced engine wash in the maintenance programs (On going for 5years). Maintain aerodynamically clean aircraft i.e. flush skin repairs and immaculate flight control surface rigging Engine quality checks after engine overhaul to ensure a return to original fuel mileage.			Not quantified	Air Namibia/ SAAT/ Lufthansa Technic	

Table 3: Air Namibia's List of selected CO2 mitigation measures implemented and ongoing. (Continued)

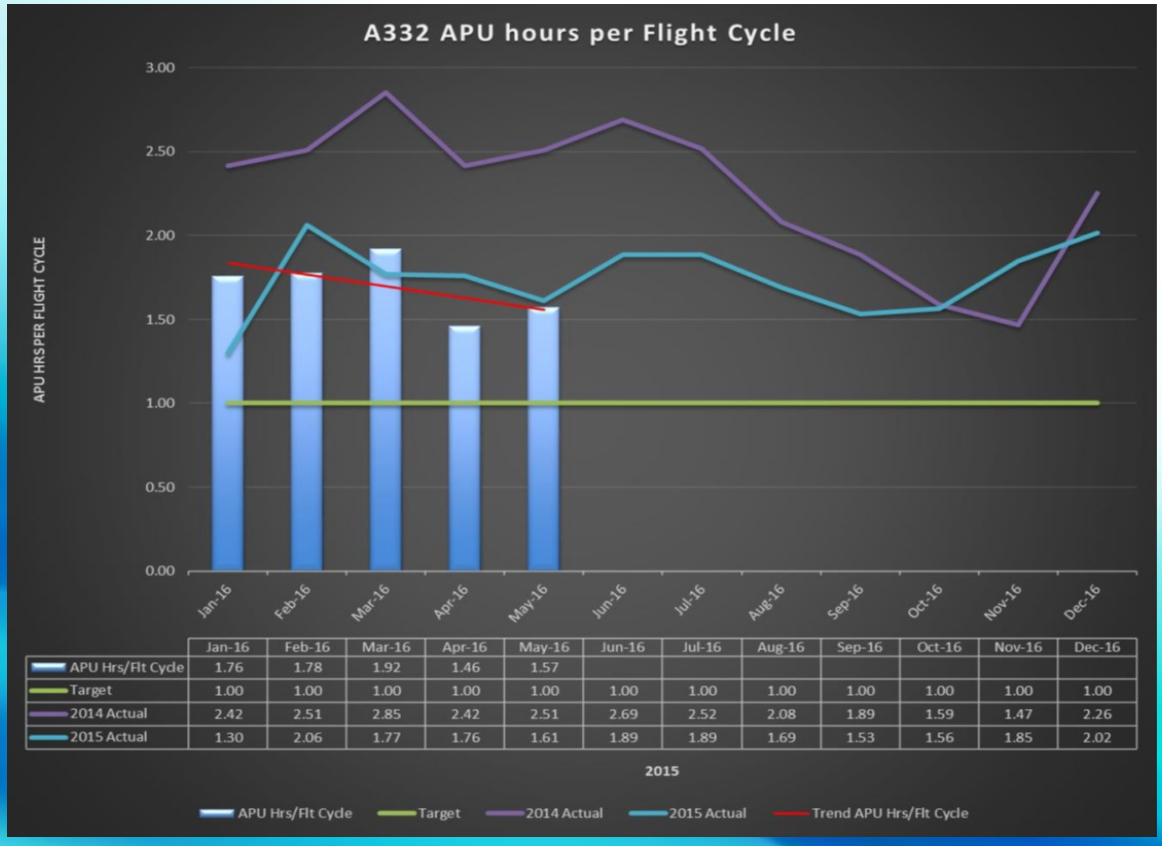

Figure 8. Air Namibia Airbus 330-200 APU hours per cycle.

4.3 Monitoring and Data Resources

During the process of updating the Action Plan, improving the sources of information and the monitoring process were identified as key elements to ensuring the implementation of the mitigation measures. These elements support the decision making process for future mitigation measures that could be implemented in Namibia.

Figure 9. Eros Airport runway, Windhoek, Namibia

The AEWG will focus on strengthening the monitoring process to facilitate the interaction between the key stakeholders through the information interchange.

5. Expected Results

The implementation of the mitigation measures selected by Namibia will lead to the reduction of an average of 8 925 697t CO2 emissions from international aviation per year. This figure is based on the assumption that the current level of operations will not continue to grow, however it is likely to increase.

This quantification was performed using the current fuel efficiency rate obtained from the historical data of 2013 to 2015 where most measures already implemented will be maintained as mitigating measures of Air Namibia and the DCA (see Table 2).

The expected results over the baseline horizon are depicted in on Table 4. Figure 10 provides a graphical representation of these results and reflects these results with the CO2 emissions and fuel efficiency expected in the baseline scenario.

EXPECTED RESULTS					
Year	RTK	FB exp. Result (kg)	CO2 exp. Result (kg)	FE exp. Result	CO2 saving (kg)
2015	150 057 569	57 567 333	181 912 772	0.384	0
2016	150 057 569	57 567 333	181 912 772	0.384	0
2017	150 057 569	54 742 745	172 987 075	0.365	8 925 697
2018	150 057 569	54 742 745	172 987 075	0.365	8 925 697
2019	175 546 132	64 238 591	202 993 947	0.366	9 818 267
2020	175 546 132	64 238 591	202 993 947	0.366	9 818 267
2021	175 546 132	64 238 591	202 993 947	0.366	9 818 267
2022	197 465 524	72 365 178	228 673 962	0.366	10 710 836
2023	197 465 524	72 365 178	228 673 962	0.366	10 710 836
2024	197 465 524	72 365 178	228 673 962	0.366	10 710 836
2025	222 121 859	81 541 752	257 671 935	0.367	11 603 406
2026	222 121 859	81 541 752	257 671 935	0.367	11 603 406
2027	240 247 003	88 212 732	278 752 234	0.367	12 495 976
2028	240 247 003	88 212 732	278 752 234	0.367	12 495 976
2029	259 851 158	95 451 113	301 625 518	0.367	13 388 546
2030	259 851 158	95 451 113	301 625 518	0.367	13 388 546

Table 4.Expected results from 2016 to 2050 **(Continued on Page 26)**

EXPECTED RESULTS					
Year	RTK	FB exp. Result (kg)	CO2 exp. Result (kg)	FE exp. Result	CO2 saving (kg)
2031	281 055 013	103 303 195	326 438 096	0.368	14 281 115
2032	281 055 013	103 303 195	326 438 096	0.368	14 281 115
2033	303 989 102	111 819 055	353 348 214	0.368	15 173 685
2034	303 989 102	111 819 055	353 348 214	0.368	15 173 685
2035	328 794 612	121 052 858	382 527 031	0.368	16 066 255
2036	341 946 397	125 815 884	397 578 192	0.368	16 958 824
2037	341 946 397	125 815 884	397 578 192	0.368	16 958 824
2038	369 849 223	136 237 925	430 511 843	0.368	17 851 394
2039	384 643 192	141 630 950	447 553 803	0.368	18 743 964
2040	384 643 192	141 630 950	447 553 803	0.368	18 743 964
2041	416 030 076	153 389 598	484 711 131	0.369	19 636 533
2042	432 671 279	159 491 287	503 992 468	0.369	20 529 103
2043	449 978 130	165 848 342	524 080 761	0.369	21 421 673
2044	449 978 130	165 848 342	524 080 761	0.369	21 421 673
2045	486 696 346	179 652 275	567 701 190	0.369	22 314 243
2046	506 164 199	186 838 366	590 409 238	0.369	23 206 812
2047	526 410 767	194 323 199	614 061 310	0.369	24 099 382
2048	547 467 198	202 118 724	638 695 168	0.369	24 991 952
2049	569 365 886	210 237 368	664 350 083	0.369	25 884 521
2050	592 140 522	218 692 056	691 066 898	0.369	26 777 091
CAGR	4.00%	3.89%	3.89%	-0.11%	

Table 4.Expected results from 2016 to 2050 (continued)

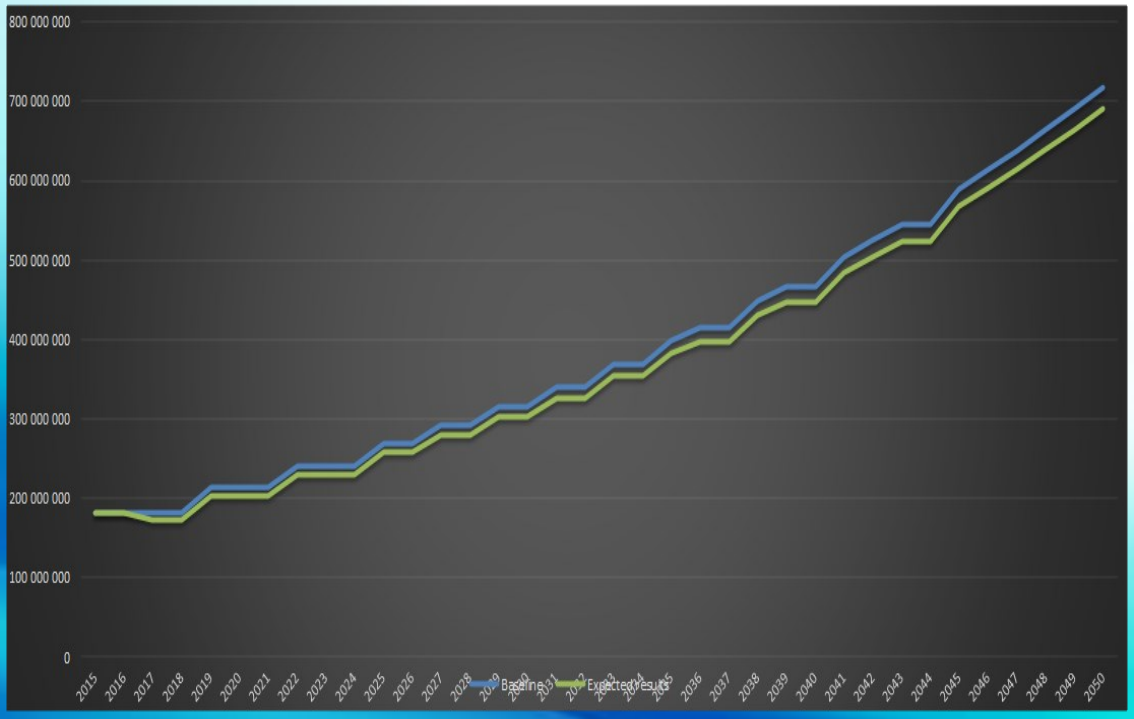

Figure 10. Baseline and expected results

6. ASSISTANCE REQUIRED

The most challenging aspect for the DCA is record-keeping of accurate data on fuel consumption by air transport operators in Namibia. Therefore assistance will be required to:

A. Guide or direct the airlines on the types of software available for collecting fuel data and transforming this data into the format required by ICAO.

B. Improve the source of information with the key stakeholders.

C. Training, seminars and awareness programmes are needed in the region on the importance of fuel management for all stakeholders i.e. airlines, ground handlers, and fuel companies.


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