ESTIMATION OF CARBON FOOTPRINT

D-AIR is an EU funded project where local governments together with airport operators work on converting airports into ecological and sustainable transport hubs, helping to reduce CO2 emissions. D-AIR is founded in part by Interreg IVC through the European Regional Development Fund (ERDF).

Outline of Presentation

- Carbon Assessment of situation in 2013
- Emission sources
  - Electricity and Water Consumption
  - Fuel
  - Land Transport
  - Aircraft
- Overall Level of Emissions

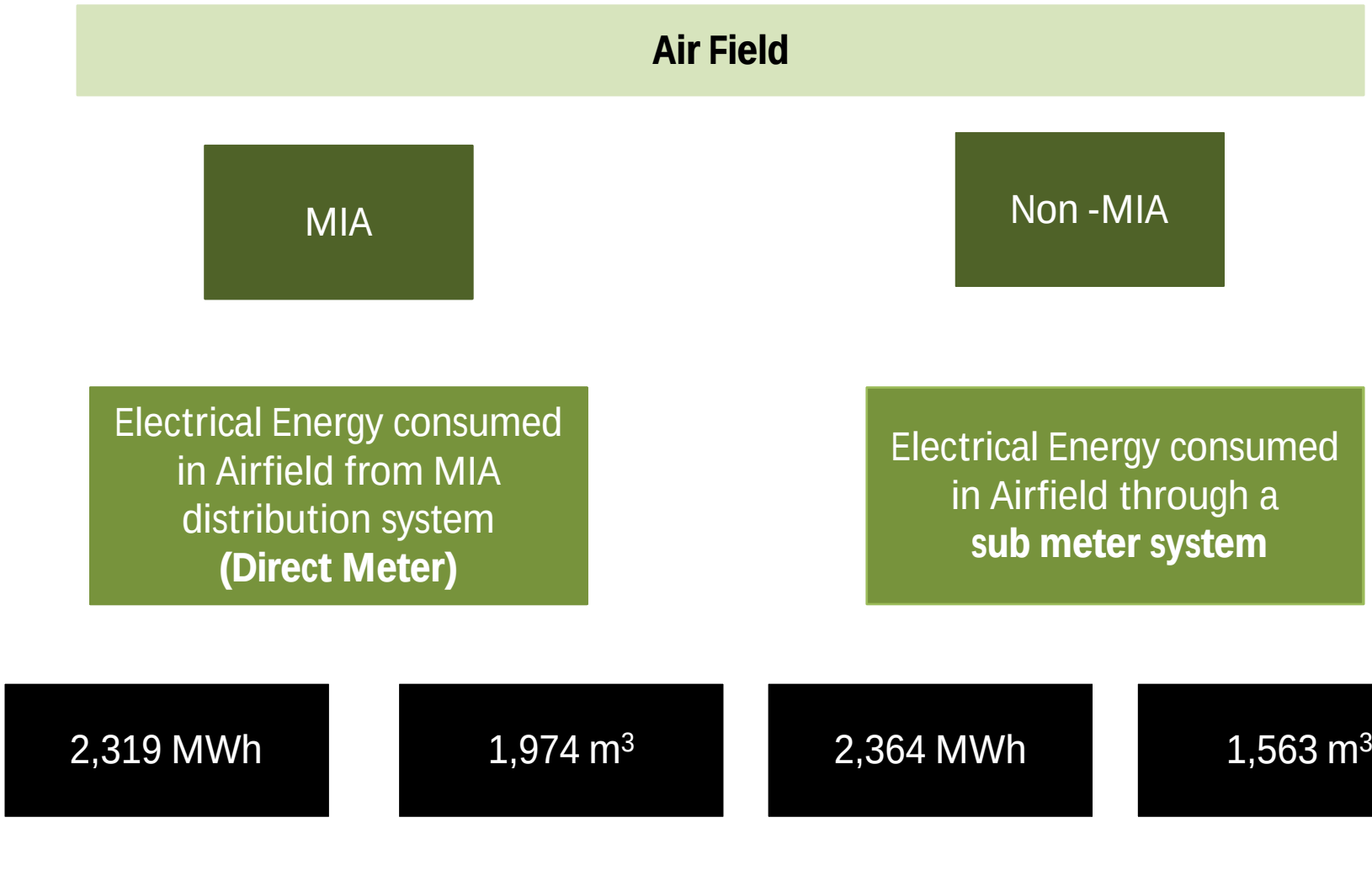
ELECTRICITY AND WATER CONSUMPTION

Electrical Energy and Potable Water Consumed within Terminal

Passenger Terminal

MIA		Non -MIA	
Electrical Energy consumed inside MIA Buildings **(Direct Meter)**		Electrical Energy consumed inside MIA Buildings: supplied through a **sub meter system**	
10,973 MWh	10,208 m^3	4,272 MWh	7328 m^3

Electrical Energy and Potable Water Consumed within Airfield



Electrical Energy and Water Consumed within Airfield

External including aircraft maintenance, preparation of aircraft meals etc.

Non –MIA
Directly from
Enemalta

8,315 MWh

43,802 m^3

Estimation of Carbon Emissions (Electricity)

Carbon Estimates are based on three scenarios:

1. **Energy mix as in 2013** which includes Marsa Power Station and Delimara Extension running on HFO
2. **Energy mix as in 2016** which includes the following elements:
   - Decommissioning of Marsa Power Station
   - Sicily Interconnector
   - 200MW Power Station running on gas and
   - Delimara Extension running on Gas.

   This scenario is titled 'National Emissions'
3. Energy mix as above but also includes emissions generated through purchased electricity from the interconnector. This scenario is titled '**Total Emissions in 2016**'

Estimation of Carbon Emissions (Electricity)

Emissions g/KWh consumption	
CO_2	868.7
Sox	2.023
NO_2	1.19
Particulates	0.595

Source: MEPA IPPC Permit

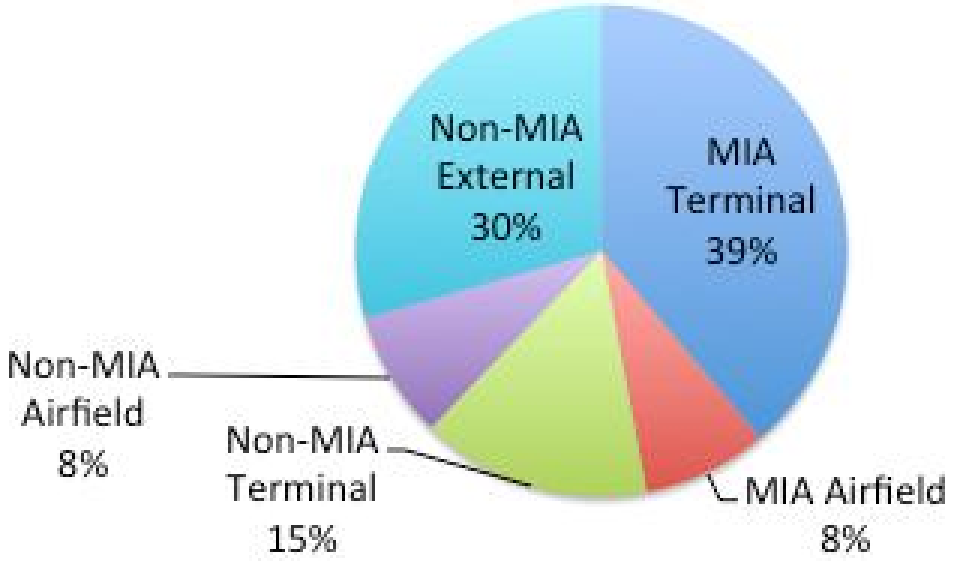
Emissions as at **2013**

CO_2 (g)/kwh	
TOTAL incl interconnector	383.64
NATIONAL	286.91

Source: Authors Estimate

Emissions as at **2016**

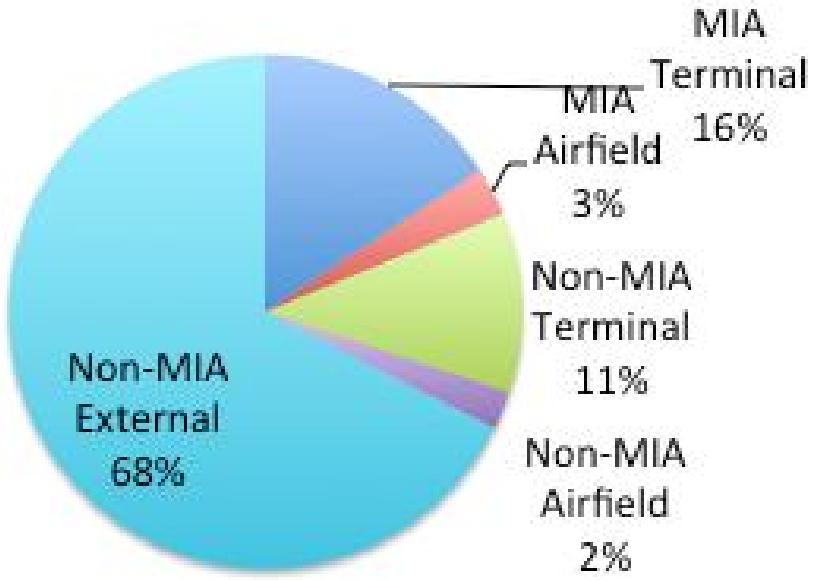
Estimate of Carbon Emissions (Electricity)



CO2e (Tonnes)	2013	2016 National	2016 Total
MIA Terminal	9,547	4,210	3,148
MIA Airfield	2,017	890	665
Non-MIA Terminal	3,717	1,639	1,226
Non-MIA Airfield	2,057	907	678
Non-MIA Direct supply from Enemalta	7,234	3,190	2,385
TOTAL	**24,571**	**10,835**	**8,103**

Potable Water Emissions

Potable Water Consumption	m3	CO2e (tonnes)		
		2013	2016 National	2016 Total
MIA Terminal	10,208	23.3	7.7	10.3
MIA Airfield	1,974	4.5	1.5	2.0
Non-MIA Terminal	7,328	16.7	5.5	7.4
Non-MIA Airfield	1,563	3.6	1.2	1.6
Non-MIA Direct supply from WSC	43,802	100.1	33.1	44.2
TOTAL	**64,875**	**148.2**	**49.0**	**65.5**



Production of Potable water in Malta is energy intensive due to RO Production

Conversion of m^3 to kwh based on assumption of 2.6 kwh/m^3 (NSO)

Emissions derived as per electricity emissions explained previously

Non-Potable Water Emissions

- Emissions from non-potable water are based on the transportation of water by bowsers to MIA and its environs.
- An estimate of the number of trips has been made based on an the average size of a water bowser as well as distance travelled of 8kms per way.
- Thereafter an estimate of the volume of diesel consumed has been made and emissions calculated accordingly.

Non-Potable water	m3	CO2 e in tonnes
MIA	59,379	9.3
Non-MIA	3,511	0.5

FUEL CONSUMPTION

Consumption of Fuel

- Diesel used for equipment and transport
- Petrol used for equipment and transport
- Gas mainly used for catering

Consumption of Fuel

	Type	MIA	Other Tenants	Unit of measurement
Petrol Use (Transport and Equipment)	Petrol Use	3,904	23,441	litres
	Diesel Use	52,255	613,334	litres

FUEL EMISSIONS	
Petrol	2.2144 kg of CO2e per litre
Diesel	2.6007 kg of CO2e per litre

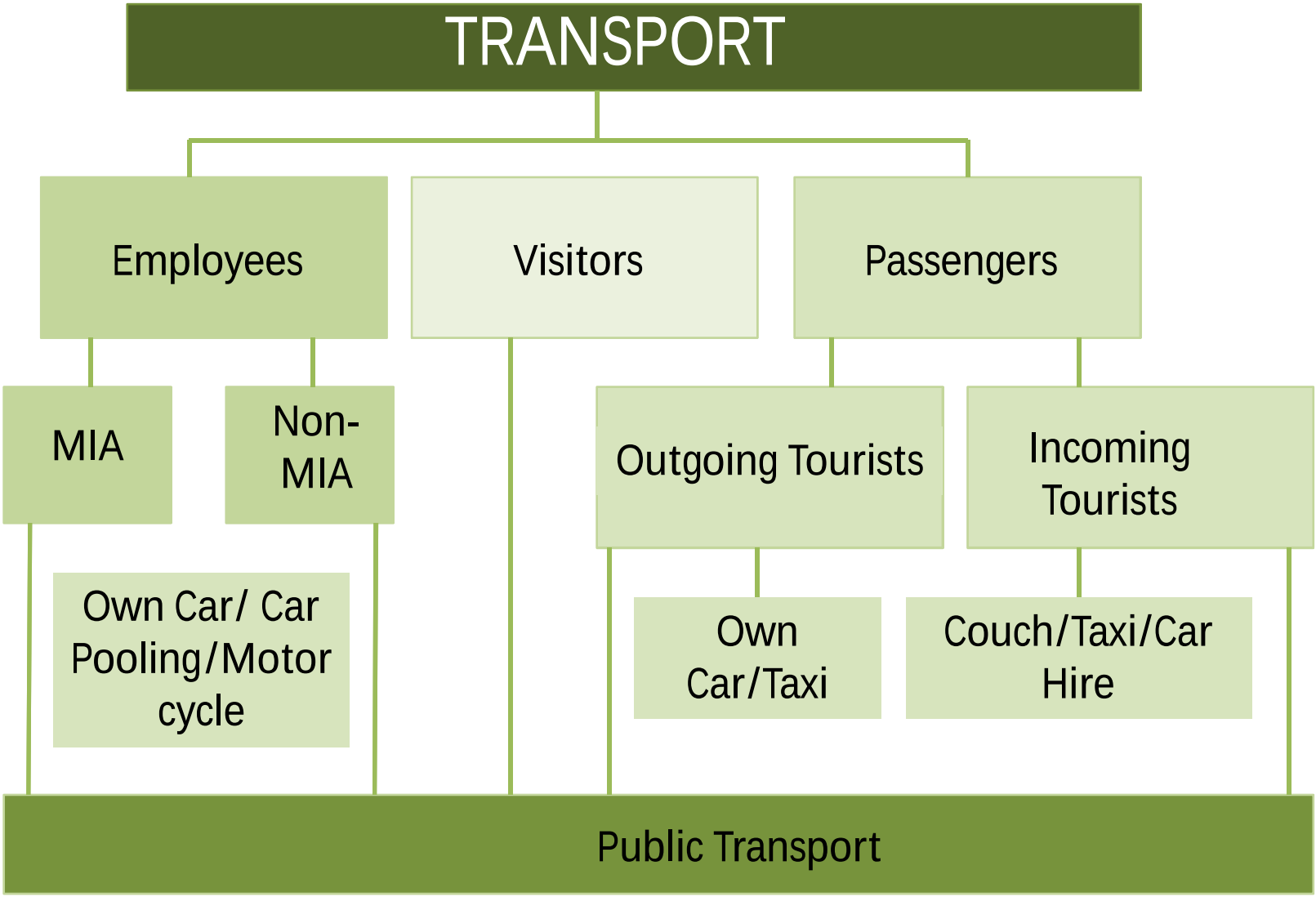
Source: http://www.carbontrust.com/media/18223/ctl153_conversion_factors.pdf

	Type	CO2 e in tonnes	
		MIA	Non-MIA
Petrol Use (Transport and Equipment)	Petrol Use	8.6	51.9
	Diesel Use	135.9	1595.1

- Gas used specifically for **aircraft catering**: 78,899 kgs translates to 236 tonnes of CO2e
- Gas used by stakeholders, mainly for catering: 28,333 litres translates to 24 tonnes of CO2e

TRANSPORT EMISSIONS

Estimation of Emissions



MIA Survey

Mode of transport	Per cent
Drive car	92
Car pooling	4
Motorbike	3
Bus	2

High proportion use their own cars to travel to work on a daily basis

Low proportion use public transport despite frequency of trips

Travelling time (minutes)	Proportion of respondents
5 to 10	21%
11 to 20	39%
21 to 30	28%
More than 30	12%

MIA Survey

Number of workers	
MIA	296
Non-MIA	2,837
Total	**3,133**

Globeground 200 workers

Airmalta over 500 workers and 300 cabin crew and pilots

Other aircraft maintenance firms: Over 250 workers

Lufthansa Technik 500 workers

Own Transport Emissions

Based on the survey results an estimate of the distance travelled (one-way) was undertaken as shown below.

MIA workers			
Length of journey (minutes)	Number of MIA Workers	Distance/hour	**Annual** Distance travelled km
5 to 10	58	15	33,154
11 to 20	106	20	160,748
21 to 30	77	25	218,517
More than 30	32	35	253,178

Other workers			
Length of journey (minutes)	Number of other workers		Annual Distance travelled km
5 to 10	557	15	304,431
11 to 20	1,014	20	1,476,030
21 to 30	735	25	2,006,478
More than 30	304	35	2,324,747

An assessment of the stock of motor vehicles was also undertaken distinguishing between diesel and petrol engines as well as the respective size of engines.

Own Transport Emissions

MIA		
Carbon Emissions (kgs) BOTH WAYS		
MIA	Petrol	Diesel
<1.4	123,903	3,306
1.4-2L	34,405	53,962
Greater than 2L	3,316	9,445
TOTAL	**161,624**	**66,714**

Other Workers		
Carbon Emissions (kgs) BOTH WAYS		
Other workers	Petrol	Diesel
<1.4	1,137,710	30,359
1.4-2L	332,477	495,493
Greater than 2L	42,964	86,730
TOTAL	**1,513,151**	**612,582**

CO2e (kgs)	MIA	Other Workers
Own Transport	228,338	2,125,733
Car Pooling	4,964	46,212
Motorcycle	1,843	16,925

Public Transport

There are six direct routes which service the airport

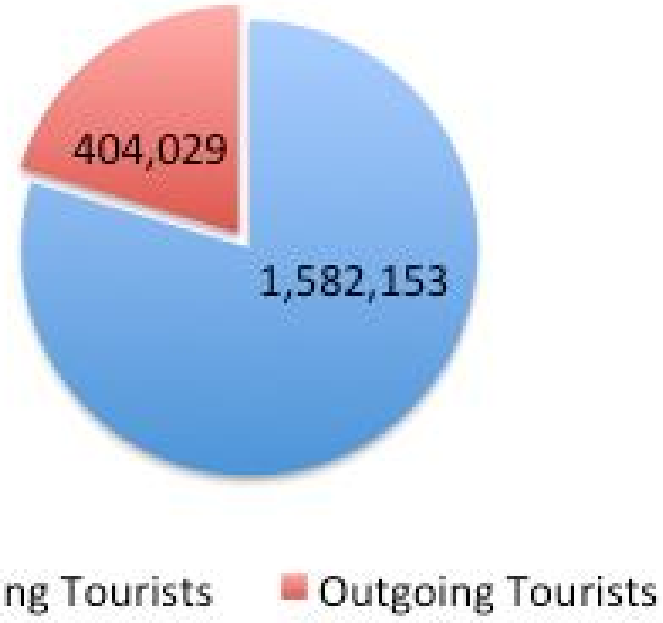
Bus Route Number	Locality	Route Length in KM (Outbound)- Nov 2012	Route Length in KM (Inbound)- Nov 2012	Total Route Length	Annual Base Trips (Nov 2012)	Total KM Contracted	Extrapulated Fuel Usage (litres)
X1	MIA - Cirkewwa	38.03	37.93	75.96	8,030	609,959	216,297
X2	MIA - San Giljan	17.02	22.41	39.43	13,140	518,110	183,727
X3	MIA - Bugibba	34.34	35.75	70.09	13,140	920,983	326,590
X4	MIA - B'Bugia	21.3	17.7	39	13,140	512,460	181,723
X5	Valletta - M'Scala	21.3	17.7	39	4,069	158,691	56,273
X7	Valletta - Birgu	21.45	20.57	42.02	6,753	283,740	100,617
TOTAL					58,272	3,003,943	1,065,228

Frequency of the routes varies between 30 minutes to 60 minutes

Based on the CO_2e of diesel, the total amount of emissions from Public Transport amount to:

2,770 tonnes

Incoming Tourists



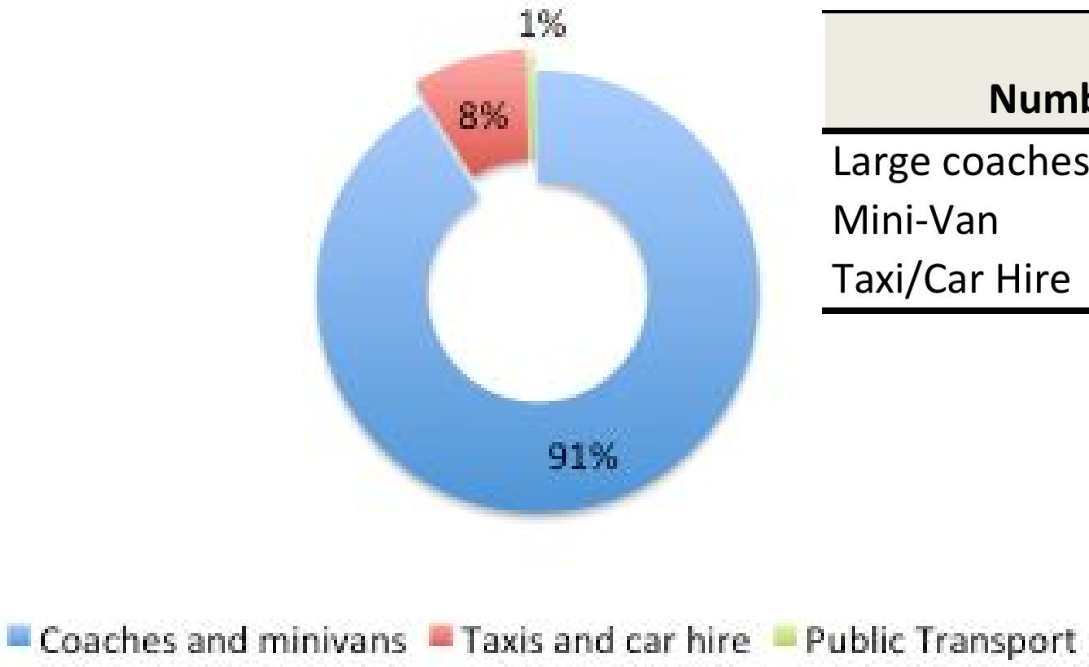
		2013
Package tourists		737,000
Non-Package	Students	81,911
	Other non-package	645,193
	Business	118,049
Total		**1,582,153**

Coaches/Mini-Vans

All modes of transport

Taxi/Car Hire

Incoming Tourists

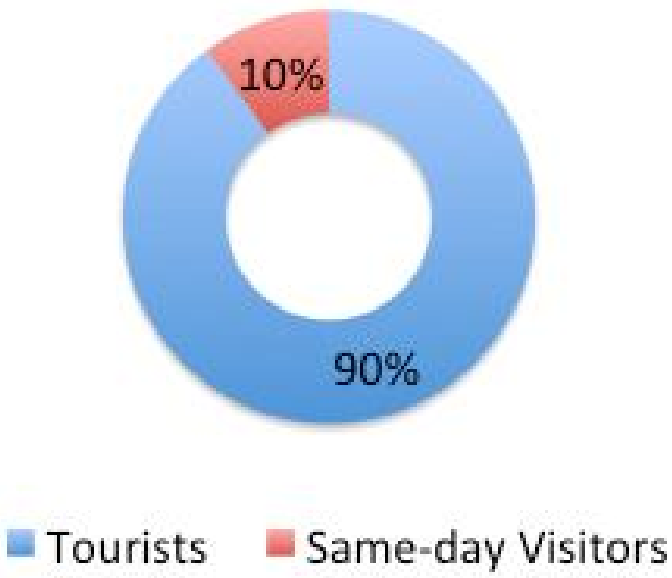


	Number of trips	Average occupancy
Large coaches	71,508	33
Mini-Van	54,670	5.1
Taxi/Car Hire	171,941	2

Coaches and Mini Vans → CO2e 702 tonnes

Taxis and Car hire → CO2e 522 tonnes

Outgoing Tourists



Number of outgoing tourists excl 0-16 year olds
363,317

Same day travellers
40,566
1 passenger per car Two Trips

Tourists
322,751
2 passengers per car Kiss and Fly:Four Trips

- Distance travelled based on the proportion of population in regional areas.
- Type of cars based on proportion of diesel and petrol engine in national stock of motor vehicles

CO2e 1,132 tonnes

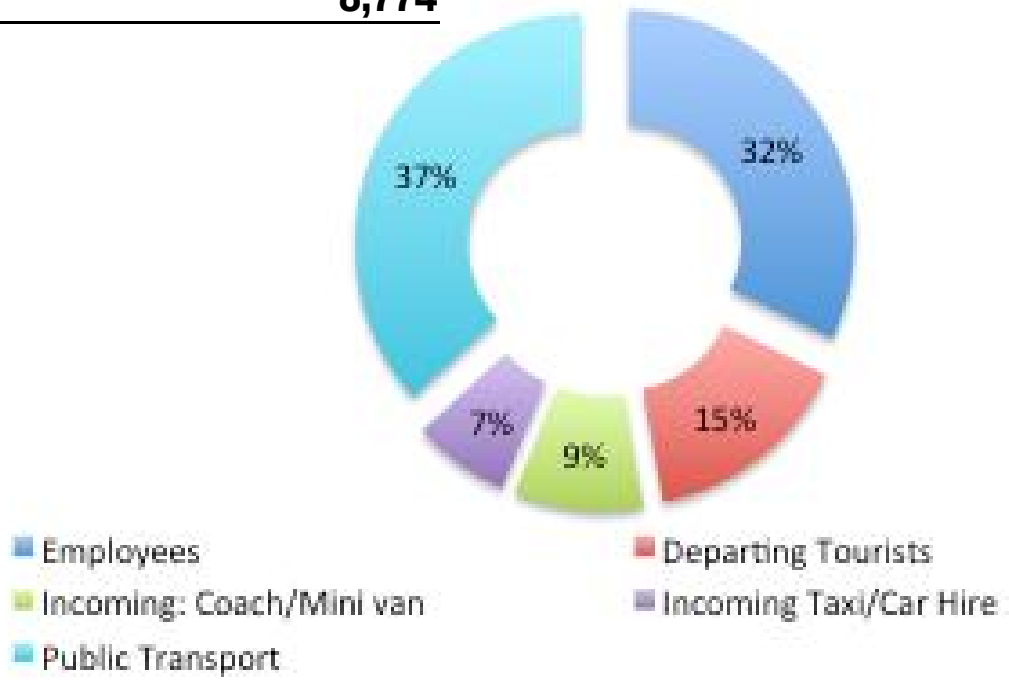
Visitors

- Based on the number on the number of car park entries and exits at Visitor Airport (560,000 entries)
- Excluding Outgoing Tourists (as per previous slide)
- Implies about 196,303 entries by visitors
- Distance travelled by visitors based on the regional population data

CO2e 1,223 tonnes

Land Transport

Transport Emissions (External) CO_2e (Tonnes)	
Own Transport	2,354
Car Pooling	51
Motorcycle	19
Departing Tourists	1,132
Incoming: Coach/Mini van	702
Incoming Taxi/Car Hire	522
Public Transport	2,770
Total	**8,774**



AIRCRAFT EMISSIONS

Aircraft Emissions

The report does not cover aviation emissions occurring between airports but rather CO_2 emissions occurring within the airport and related to airport activity within the boundary.

The report captures CO_2 emissions generated from aviation through:

- Unassisted Ground Movements
- Use of Auxiliary Power Units
- Aircraft Testing

Aircraft Emissions

- The methodology used to derive this estimate is based on the following approach:
  - a stock of the number and type of aircraft landing at MIA during 2013 was taken;
  - a highly representative sample of the aircraft types was selected;
  - emissions attributed to the aircraft type within the sample per minute in ground operations were derived from industry sources;
  - these emissions were multiplied by the average number of minutes an aircraft spends in ground operations;
  - the total emissions were derived by grossing up the sample results to derive a population estimate.

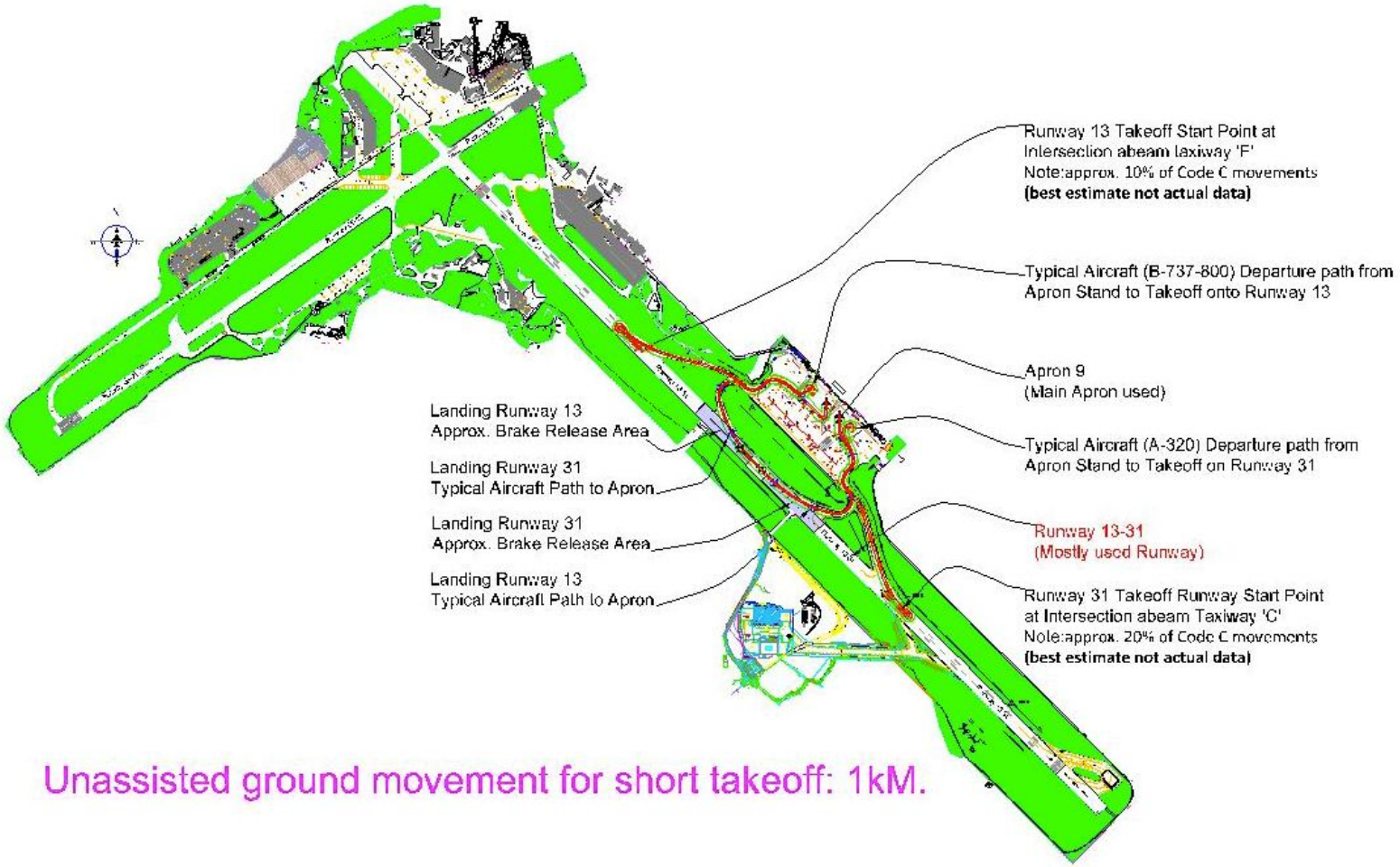
Unassisted Ground Movement

Aircraft type	Number of landings in 2013	CO_2 emissions in Kg/min during taxiing by each aircraft	Total CO2 emissions in Tonnes for taxiing during landings and take offs by all aircraft **
320	4866	44	3,460
738	4053	43.6	2,856
319	3921	44	2,788
320R	915	44	651
321	528	44	375
772	299	254.3	1,229
75F	289	57.2	267
ATP*	226	25	91
E70	153	23.3	58
733	122	42.9	85
CNJ	120	11.1	22
Total CO2e emissions in Tonnes in 2013 by 92.3% of all aircraft			**11882**
Total CO2e emissions in Tonnes in 2013 by all aircraft			**12873**

* Engine emissions estimated

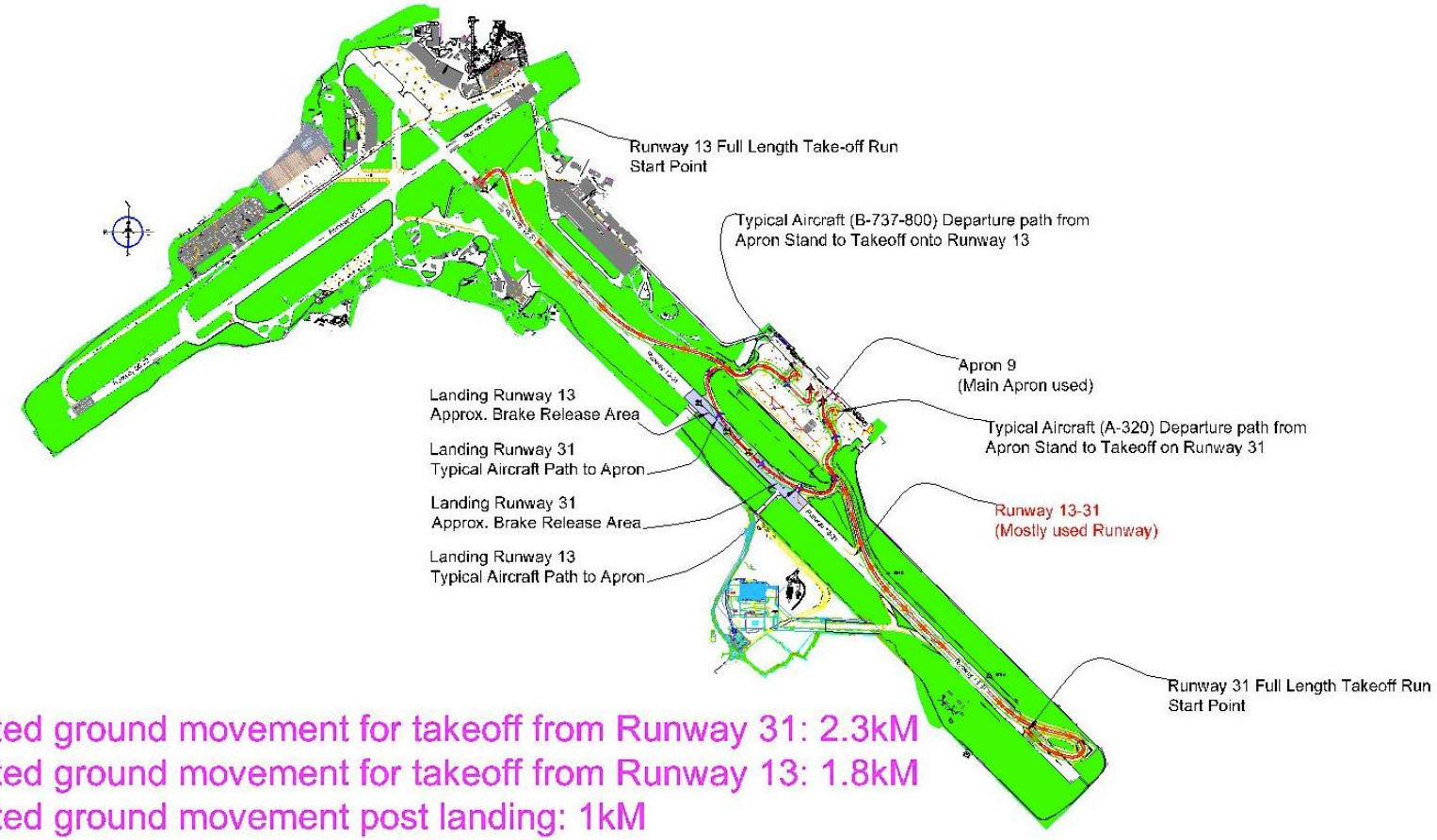
** Assuming take offs and landings are equal in number and that each plane averages a total of 16min taxiing for taxi in and taxi out

Unassisted Ground Movement



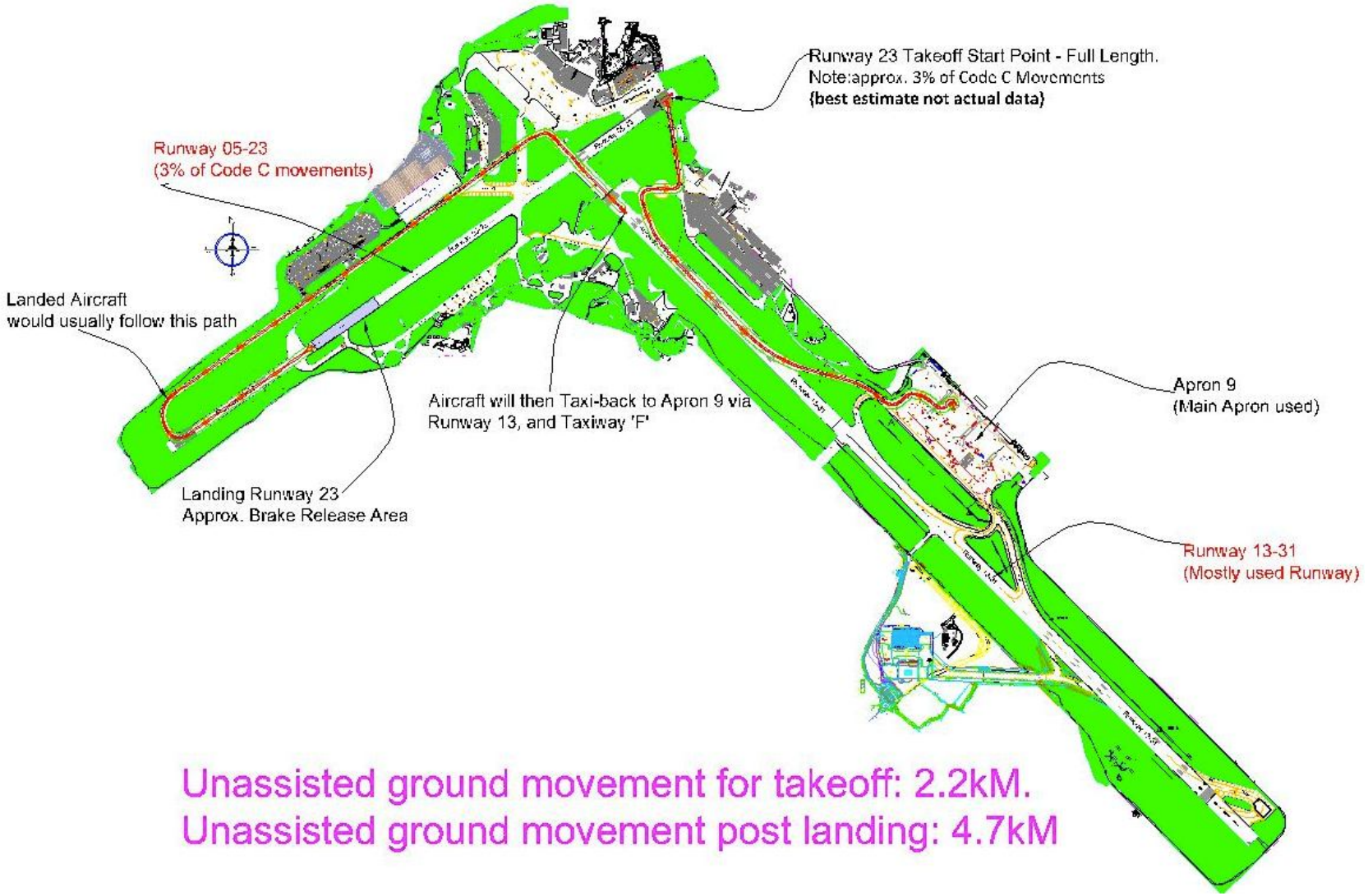
Unassisted ground movement for short takeoff: 1kM.

Unassisted Ground Movement



Unassisted ground movement for takeoff from Runway 31: 2.3kM
Unassisted ground movement for takeoff from Runway 13: 1.8kM
Unassisted ground movement post landing: 1kM

Unassisted Ground Movement



Unassisted ground movement for takeoff: 2.2kM.
Unassisted ground movement post landing: 4.7kM

Auxiliary Power Unit (APU)

16,777 Landings in 2013

Fuel consumption 7328 x 80kg/hr =586,240kg p.a. average for an average 1 hour duration

CO2e 4,249 tonnes

Aircraft Testing

- Engine tests comprise engine washes ,engine change , bleed faults, generator faults, starter faults, boroscope, engine performance and other relevant tests.
- The tests require the use if JET A1 fuel.
- The amount of fuel consumed has been provided by relevant stakeholders.

130.8Tonnes = 162,687ltrs of Jet A1

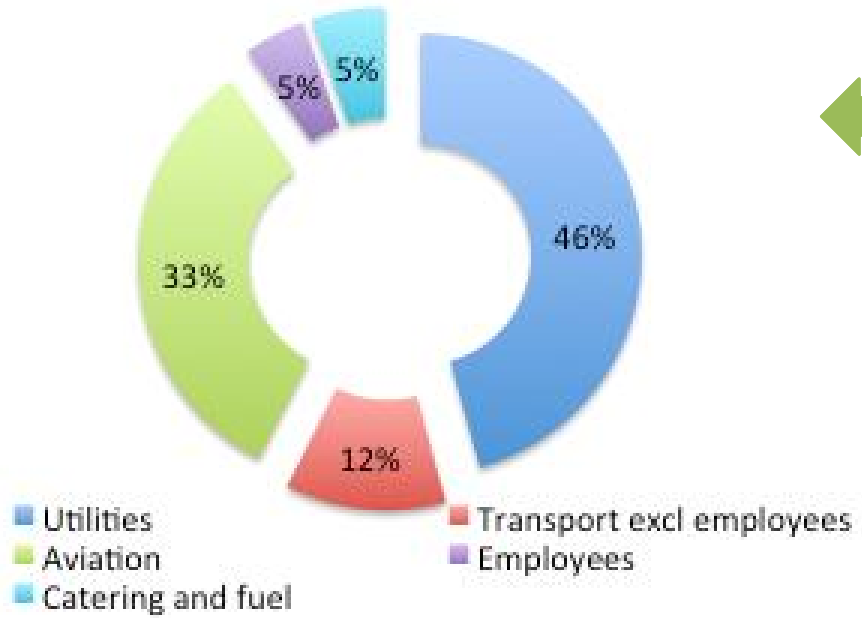
CO2e 414 tonnes

Overall Level of Carbon Equivalent Emissions

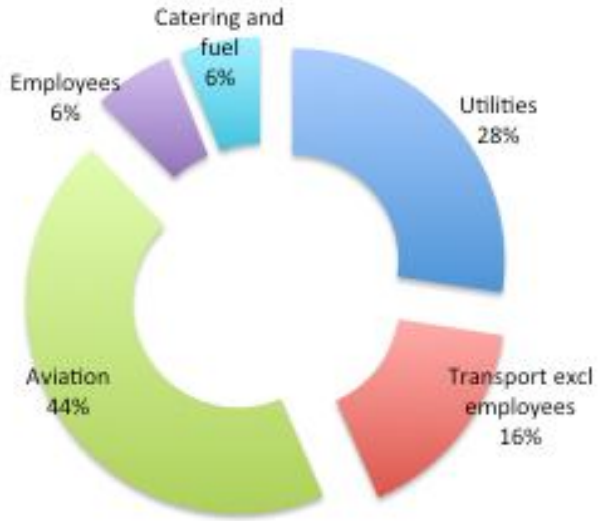
	Carbon Emissions tonnes (Based on 2013 emission levels)		Carbon Emissions tonnes (Based on 2016 TOTAL emission levels)		Carbon Emissions tonnes (Based on 2016 NATIONAL emission levels)	
	MIA	**Other Tenants**	**MIA**	**Other Tenants**	**MIA**	**Other Tenants**
Energy						
Fuel Use	145	1,647	145	1,647	145	1,647
Electricity	11,413	12,988	5,040	5,736	3,770	4,289
LPG	-	18	-	18	-	18
Water	37	121	22	54	18	40
Catering	-	1,087	-	632	-	541
Sub-total	**11,595**	**15,861**	**5,207**	**8,086**	**3,933**	**6,536**
Transport						
Employees	235	2,189	235	2,189	235	2,189
Outgoing Passengers and visitors						
Outbound Tourists		1,132		1,132		1,132
Visitors		1,224		1,224		1,224
Passengers Incoming Tourists						
Coach		702		702		702
Taxi		522		522		522
Bus		2,770		2,770		2,770
Sub-Total		***8,774***		***8,774***		***8,774***
Aviation						
Taxing		12,908		12,908		12,908
APUs		4,249		4,249		4,249
Engine Testing		414		414		414
Sub-Total		***17,572***		***17,572***		***17,572***
OVERALL TOTAL		**53,802**		**39,639**		**36,814**

Overall Level of Carbon Equivalent Emissions

2013 Emissions



2016 Total Emissions



Translates to 20 kgs CO2e/passenger – Captures all emissions including those not related to passenger activity