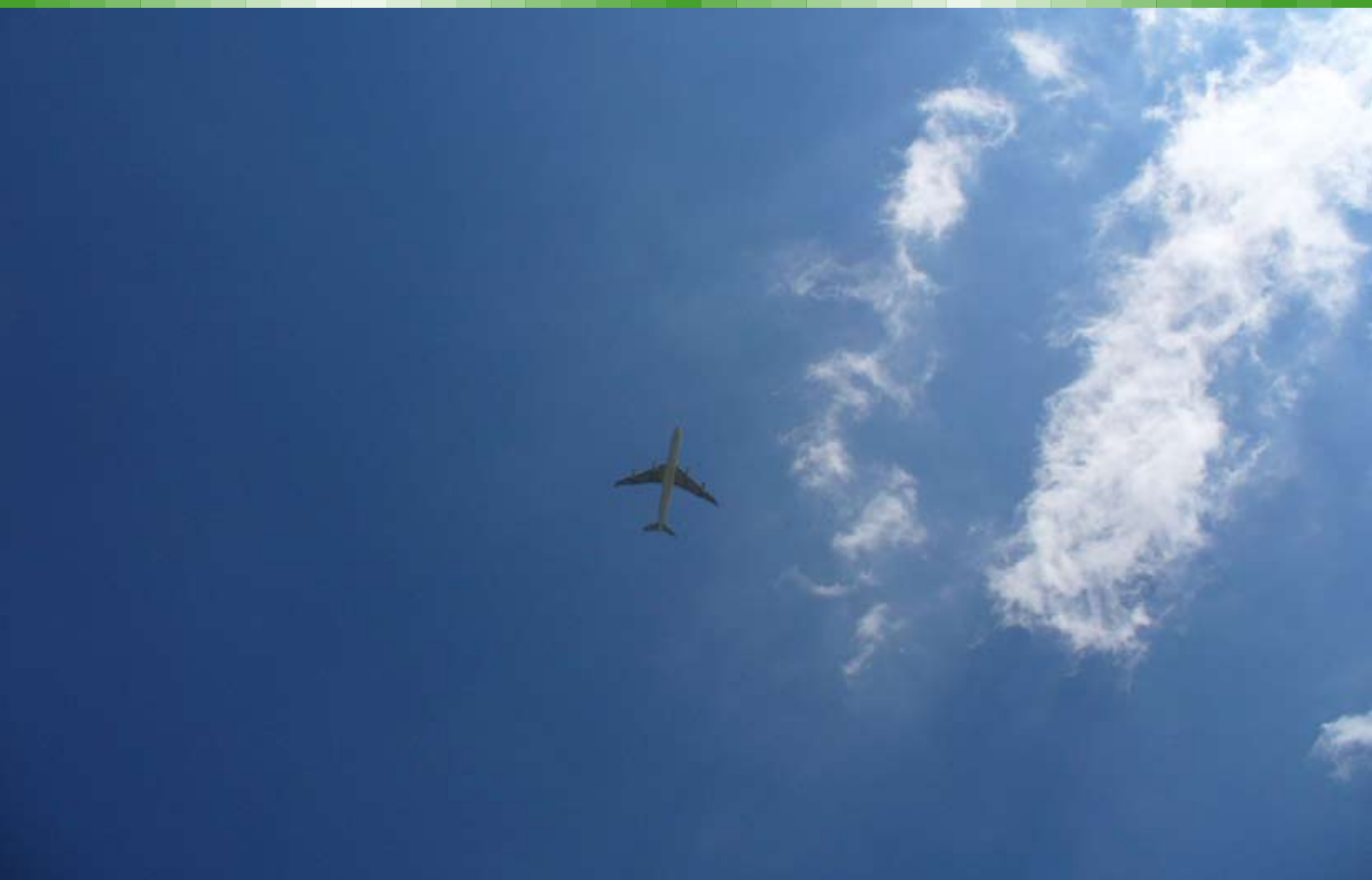
AIRPORTS COUNCIL INTERNATIONAL

Guidance Manual: Airport Greenhouse Gas Emissions Management



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As the international association of the world's commercial service airports, ACI represents the collective positions of its membership, which are established through committees and endorsed by the ACI Governing Board. These views reflect the common interests of the global airports community.

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Imprint
Guidance Manual: Airport Greenhouse Gas Emissions Management
ACI World Environment Standing Committee
1st Edition, November 2009

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SUMMARY

This manual provides guidance for airport operators wishing to manage greenhouse gas (GHG) emissions. The main aims are to provide the following:

- Clear definitions of terms to promote consistent approaches despite various regional requirements.
- Discussion on the various reasons why an airport operator might decide to manage GHG emissions.
- Guidance on how to conduct a GHG emissions inventory and what airport and airport-related sources to include.
- Guidance on what GHG emissions species to include.
- Guidance on how to categorize sources into Scopes 1, 2, 3A and 3B, and how these categories can assist emissions management programmes including setting goals and reporting.
- References to documents assisting with the calculations of the quantities of emissions.
- Guidance on the goals an airport operator can set for its emissions management programme.
- Outlines of GHG emissions reduction projects.
- Guidance on becoming Carbon Neutral and using offsetting to address residual emissions.
- Guidance on reviewing programmes and reporting progress, including the necessity to report inclusions, exclusions and caveats.
- Guidance on gaining accreditation for achievements made.

At the time of writing (November 2009) this is a rapidly developing issue and ACI expects to publish periodic updates and revisions.

1 INTRODUCTION

1.1 General Comments

1.1.1 This document provides guidance material for airport operators wishing to manage greenhouse gas (GHG) emissions. The purpose of this manual is to clarify the issues and the options available to airport operators, so that despite various regional approaches and requirements, GHG emissions associated with airport activity can be managed in a consistent manner and using the same vocabulary.

1.1.2 Due to variations in the regulations and priorities of different regions, the guidance manual must remain sufficiently flexible in its recommendations to allow airport operators to accommodate local requirements and needs.

1.1.3 Therefore, application of the recommendations in the guidance manual will not guarantee that all airport GHG inventories and approaches will be the same, but it should assist with allowing comparisons of airport inventories and achievements and, more importantly, avoiding inappropriate comparisons.

1.1.4 None of the recommendations made in the guidance manual is mandatory for any airport operator. The recommendations do not override or supersede any local or regional regulatory requirement.

1.1.5 A thorough assessment of climate change issues would include a discussion of preparing for, and adapting to, the potential impacts from the effects of climate change (e.g. rising sea levels, storm extremes), and these are not addressed in this document.

1.2 Context

1.2.1 In recent years, ACI has published a variety of statements and policy positions on environmental issues and, more specifically, GHG emissions. These statements range from ACI's high-level Mission Statement (2004) to the *ACI Policy on Climate Change (2005)* and include regional initiatives such as *ACI-North America's Environmental Goals* and *ACI-Europe's Airport Carbon Accreditation (ACA) scheme*.

1.2.2 In addition to the ACI-Europe ACA scheme, there are two other key reference documents. The first is the *World Resource Institute (WRI)* and the *World Business Council for Sustainable Development (WBCSD)* document *"Greenhouse Gas Protocol, a Corporate Accounting and Reporting Standard" (WRI 2004)*. The second is the *US Airport Cooperative Research Program (ACRP) "Report 11 – Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories" (2009).*

1.2.3 As laid out in Table 1.1 below, this guidance manual is intended to fill a gap in this hierarchy of ACI documents and to assist airport operators by providing a central document to clarify the variety of issues and documents that address various aspects of GHG emissions and their management.

Table 1.1 Hierarchy of ACI Documents Addressing Climate Change

Domain	ACI Reference Document	Comments	Key Extract
ACI Mission and Policy Positions	ACI Strategic Plan 2004-2010 – ACI Mission Statement	High level corporate mission	*ACI advances the collective interests of the world's airports and promotes professional excellence in airport management and operations.*
	ACI World Annual General Assembly Environment Resolution (November 2007)	High level call to action	*ACI member airports are urged "to make commitments on strategies to reduce carbon emissions with the ultimate target of becoming carbon neutral."*
	ACI Policy on Climate Change (2005)	Published position	*ACI airports will continue to take action to minimize emissions within their control, and will support the development of technologies and design strategies in the aviation industry that will help to reduce aircraft emissions globally.*
Strategy	Guidance Manual: Airport Greenhouse Gas Emissions Management	> This document <	
Targets	ACI and ATAG Industry aggregated aspiration (February 2009)	A global aspiration for airports' contribution to reduce aviation fuel burn.	*Best practice provision of Fixed Electrical Ground Power and Pre-Conditioned Air at terminal gates could reduce APU fuel burn, equivalent to 0.6% total aviation fuel burn.*
	ACI North America – Environmental Goals (February 2009)	Goals on vehicles, GSE, energy conservation, gate-supplied power and PCA, parking, GHG inventories.	*The US and Canadian airport industry adopted a range of goals aimed at encouraging airports to implement various programmes to reduce environmental impacts.*
	ACI Europe – Airport Carbon Accreditation scheme (June 2009)	A framework for airports to gain credit for carbon reductions and carbon neutrality.	*A European wide scheme allowing airports to follow a common framework for measurement, reporting and reduction of carbon emissions with the possibility of becoming carbon neutral.*
Measures and Inventory Protocols	ACI – Workable Solutions Compendium (due 2010)	Case studies of projects at airports.	*In progress - [possible appendix to this document]*
	ACI Policy and Recommended Practice Handbook (2008)	Practices that can be implemented at airports.	*Recommended practices to minimize or mitigate the adverse impact of aviation on climate change.*

1.3 Framework

1.3.1 An airport operator's approach to measuring and managing GHG emissions should include consideration of each of the following steps in the order presented. Generally, consideration of each step should follow the previous, and each is addressed in the sections of this document as indicated.

a) *Definitions (Section 2)* – How terms are defined for this document.
b) *Drivers (Section 3)* – Why an airport operator might address GHG emissions.
c) *Inventory (Section 4)* – Which pollutants and which sources should be included and how to do this.
d) *Goal Setting (Section 5)* – What achievements an airport operator could target.
e) *Measures to Reduce Emissions (Section 6)* – What an airport operator can do to achieve the goals.
f) *Offsetting to achieve Carbon Neutrality (Section 7)* – How to address residual emissions that cannot be further reduced.
g) *Reviewing, Reporting and Certification (Section 8)* – How to report and gain recognition for achievements.

1.3.2 *All reference material will be listed in Section 9.*

1.4 Interdependencies

1.4.1 As airport operators address GHG emissions, careful consideration must be given to the balance and interdependencies that exist among and between various environmental media. There may be trade-offs in addressing emissions, noise and other environmental issues; reductions in impacts associated with one media can have unintended adverse impacts in another area.

2 TERMS AND DEFINITIONS

2.1 Definitions

2.1.1 There are many terms that need clarification of definitions for use in the guidance manual. Tables 2.1 and 2.2 below contain definitions for terms and acronyms as used with this document.

Table 2.1 – Definitions of Terms in this Manual

Term	Definition	Comments/ Reference
Airport Operator	An organization with responsibility for owning and/or operating an airport or system of airports. Airport operators can be units of government (city, county, state, national) or a business or private or semi-private company. Depending on the organizational and ownership structure, the terms Airport Company or Airport Authority may be more appropriate. In this document only the term Airport Operator is used.	
Aviation Emissions	Aviation emissions include only the emissions from aircraft (both from domestic and international operations) including all phases of flight and APU use. The Kyoto Protocol excludes emissions from "International Aviation", while ground-based airport emissions are included in national inventories.	***See Appendix A***
Airport Emissions	All emissions from activities associated with the operation and use of an airport, including ground support equipment, power generation and ground transport. Such activities can occur inside and outside the airport perimeter fence and may be the responsibility of the airport operator or other stakeholders. Emissions from aircraft should be included in an airport inventory, although depending on the reason for the inventory, an airport operator may choose to include either the LTO cycle or the whole of departing flight emissions.	
Greenhouse Gas (GHG)	Gases in the atmosphere that absorb and emit radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect and increases in anthropogenic GHG have been linked to increases in global average temperatures since the mid-20th century, known as climate change. The most significant GHG associated with an airport is carbon dioxide (CO_2). Other GHGs included in the Kyoto Protocol are methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulphur hexafluoride (SF_6). Airports can also be sources of emissions that affect climate, such as oxides of nitrogen (NOx) and ozone (O_3). Water vapour (H_2O) is also a GHG but not one addressed by airport operators.	

Term	Definition	Comments/ Reference
Kyoto Protocol	The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change (UNFCCC). Countries included in Annex B of the Protocol agreed to reduce their anthropogenic GHG emissions (CO_2, CH_4, N_2O, HFC, PFC and SF_6) by at least 5% below 1990 levels in the commitment period 2008 to 2012. The Kyoto Protocol entered into force on 16 February 2005.	
Carbon Neutral	Being carbon neutral, or having a net zero carbon footprint, refers to achieving net zero carbon (i.e., carbon dioxide) emissions by balancing a measured amount of carbon released with an equivalent amount sequestered, mitigated, or offset. The carbon neutral concept may be extended to include other GHGs measured in terms of their carbon dioxide equivalence – the impact a GHG has on the atmosphere expressed in the equivalent amount of CO_2.	
Carbon Neutral Growth	Growth in an activity with no net increase in CO_2 emissions.	
Landing and Take-off Cycle (LTO)	The standard LTO cycle begins when the aircraft crosses into the mixing zone (or 3,000 ft) as it approaches the airport on its descent from cruising altitude, lands and taxis to the gate. The cycle continues as the aircraft taxis to the runway for take-off and climb out as its heads out of the mixing zone (or 3000 ft) and back up to cruising altitude. One aircraft LTO is equivalent to two aircraft operations (one landing and one take-off). [FAA] The four specific operating modes in an ICAO reference LTO cycle are: Take-off, climb, approach and taxi/ground idle. [ICAO]	FAA's *Air Quality Procedures For Civilian Airports & Air Force Bases*, September 2004 and ICAO Annex 16, Volume II, 1993
Scope 1 Emissions	GHG emissions from sources that are owned or controlled by the airport operator. This can include emissions from combustion in boilers, airport power generation facilities and airport fleet vehicles. In the case of renewable fuel sources, such as wood waste, wood pellets, the net GHG emissions should be considered.	Based on WRI (2004) GHG Protocol.
Scope 2 Emissions	GHG emissions from the off-site generation of electricity (and heating or cooling), purchased by the airport operator.	
Scope 3 Emissions	GHG emissions from airport-related activities from sources not owned or controlled by the airport operator. Scope 3 is an optional reporting category that allows for the treatment of all other emissions. Examples include aircraft emissions, emissions from airline and other tenant activities, and ground transport vehicles not owned and controlled by the airport operator.	

Term	Definition	Comments/ Reference
Scope 3A Emissions	Scope 3 emissions from sources that an airport operator can influence and can therefore be included in an airport's GHG emissions management programme.	Defined for this manual
Scope 3B Emissions	Scope 3 emissions from sources that an airport operator cannot influence to any reasonable extent.	
Offset Credit	An offset credit is generated upon the implementation, monitoring, and certification of an off-site project that reduces CO_2 emissions (or sequesters CO_2), reductions that would not have occurred without that project.	
Offsetting	Offsetting is to "cancel out" or "neutralize" emissions of CO_2 (and other GHG emissions) by financing projects that reduce CO_2 emissions (or result in the removal of atmospheric CO_2) and that would not have otherwise been implemented. Airport operators can achieve this by purchasing properly certified offset credits.	

2.2 Acronyms

Table 2.2 – Main Acronyms

Term	Definition
(TRB) ACRP	(US) Transportation Research Board – Airport Cooperative Research Program
ACA	(ACI Europe) Airport Carbon Accreditation scheme 2009
ACI	Airports Council International
ACI-NA	Airports Council International - North America
APU	Auxiliary Power Unit
ATAG	Air Transport Action Group
ATM	Air Traffic Management
BREEAM	Building Research Establishment Environmental Assessment Method
CO_2	Carbon Dioxide
CSR	Corporate Social Responsibility
EMS	Environmental Management System
ETS	Emissions Trading Scheme
EU	European Union
FEGP	Fixed Electrical Ground Power (supplied to aircraft at terminal)
GAV	Ground Access Vehicle
GHG	Greenhouse Gas
GIACC	Group on International Aviation and Climate Change (ICAO)
GPU	Ground Power Unit
GSE	Ground Support Equipment
GWP	Global Warming Potential
HVAC	Heating, Ventilating and Air Conditioning
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
PCA	Pre-Conditioned Air (supplied to aircraft at terminal)
UNFCCC	United Nations Framework Convention on Climate Change
UN	United Nations
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

3 DRIVERS

3.1 Introduction

3.1.1 There are many reasons why an airport operator might decide to measure and manage its GHG emissions. Fundamentally these can be divided into Voluntary or Regulatory Drivers. Each is discussed below. More detail, especially for US airports, is provided in the *ACRP Report 11 Guidebook on Preparing Airport Greenhouse Gas Inventories (2009).*

3.1.2 The motivation for addressing GHG emissions will drive the nature and scope of an airport operator's actions. A regulatory regime should define what is required. Voluntary programmes such as the ACA scheme or an airport operator's participation in a US registry (such as The Climate Registry), can fall within a framework, which provides a set of requirements. Unstructured voluntary programmes may need to be more comprehensive to achieve a less well-defined purpose.

3.2 Voluntary Drivers

3.2.1 In most regions, airport operators are not yet required by government regulation to take action on GHG emissions. However there are a number of reasons that an airport operator may voluntarily choose to take on the task.

Energy Efficiency and Cost Savings

3.2.2 Electricity used for lighting buildings and outdoor areas, the energy used for heating, cooling, and ventilation of internal spaces, the fuel used in airport vehicles and aircraft support equipment are some of the major operating costs of an airport. Most energy sources produce CO_2 and can be notable contributors to an airport operator's GHG inventory.

3.2.3 Programmes to improve building energy efficiency and reduce vehicle fuel use can provide meaningful cost savings, while at the same time contributing to reductions in GHG emissions. In fact, many energy efficiency projects, such as the installation of LED lighting or variable speed ventilation fans, can pay for themselves within reasonable operational periods by reducing energy or fuel costs.

Corporate Social Responsibility

3.2.4 Corporate Social Responsibility (CSR) is a business model and form of corporate self-regulation whereby a corporation accepts responsibility for the impacts it has on the environment and stakeholders, including consumers, employees, communities, contractors, suppliers, governments, and other parties. At a corporate level, CSR is similar to the concept of Sustainable Development.

3.2.5 Within this context, an airport operator may choose to address airport-owned or controlled GHG emissions, as well as those associated with airport activities. Airports are often major businesses in their neighbourhoods and communities, physically, visually, economically and environmentally, and as such, they have the opportunity to play a leadership role in addressing the environmental and social effects of their operations.

3.2.6 An airport policy promoting alternatively-fuelled taxis, for example, can have a profound beneficial effect on the taxi fleet of an entire city. Similarly, an airport operator's commitment to provide on-airport facilities for rail access can encourage communities to develop or expand transit service.

Environmental pressure

3.2.7 In some regions, communities and society at large can have a very keen sensitivity to environmental issues and may take a proactive stance against developments perceived (rightly or wrongly) to make a significant contribution to an environmental issue. Such environmental pressure on an airport operator is usually most prevalent when planning permission is required for infrastructure development, such as a new terminal or runway. Recent developments, such as anti-climate change protesters in the UK, have also demonstrated that the regular operations of an airport can be adversely affected.

3.2.8 As environmental pressure can result from both physical and perceived effects of an activity on the environment, an airport operator may need to respond to both. For the physical effects, the inventory and mitigation sections of this document can be used to address GHG emissions. For the perceived effects an airport and, indeed, the aviation industry as a whole, need both appropriate mitigation actions and results, accompanied by effective communications and community outreach.

3.3 Regulatory Drivers

3.3.1 Mandatory requirements and other regulation can take a variety of forms from international agreements and national legislation to conditions attached to local planning permission permits. At the time of writing, regulations in many jurisdictions are evolving and substantial development should be expected in upcoming years. A range of regulatory requirements mandates an airport operator to tailor the airport's GHG programme according to international, national and sometimes local requirements.

Kyoto Protocol

3.3.2 Under the Kyoto Protocol, the emissions from international aviation were excluded from the national inventories and emissions targets. Emissions from domestic aviation were included within in each country's Kyoto Protocol GHG emissions inventory.

3.3.3 In this context, international aviation emissions cover gate-to-gate activities including all phases of flight and APU fuel burn. Arguably, APU emissions could be considered a ground activity and not part of the gate-to-gate activity, however in practice, airport operators cannot easily determine the extent of APU emissions. By including APU emissions as part of aviation emissions, the inventory can be based on fuel dispensed to aircraft that are operated internationally.

3.3.4 Emissions associated with all the other activities at airports were not exempted from the Kyoto Protocol and thus are already included in national inventories and targets. However, most States define a threshold level of emissions below which companies or organizations are not required to report for the national inventory. The non-aircraft source emissions at airports are often below these thresholds.

3.3.5 Countries such as Australia, Canada, Japan, and the United States as well as the European Union have imposed GHG reporting and other requirements that may impact airports. Some examples are:

European Emissions Trading Scheme

3.3.6 In the European Emissions Trading Scheme (ETS) (Directive 2003/87/EC), combustion installations with a rated thermal input exceeding 20MW are subject to reporting of the CO_2 and participation in the ETS. This means that some major airports with their own power generation stations and heating plants already participate in the European ETS in the 2008-2012 commitment period.

US Mandatory Greenhouse Gas Reporting

3.3.7 The US Environmental Protection Agency (EPA) has issued a final rule requiring mandatory reporting for large US GHG emissions sources. The rule requires facilities that emit 25,000 metric tonnes (25 kt) or more of CO_2 equivalent GHG emissions per year to submit annual reports starting in 2011. At airports this would include large stationary sources, such as fuel combustion-based heating, cooling, or cogeneration facilities, typically rated at more than 30 million Btu/hr. Mobile sources would be addressed through engine certification and fuel economy or emissions standards. The gases covered by the proposed rule are CO_2, CH_4, N_2O, HFC, PFC, SF_6, and other fluorinated gases including nitrogen trifluoride (NF_3) and hydrofluorinated ethers (HFE).

3.3.8 It is important to note that the reporting threshold of 25 kt or more of CO_2e per year applies only to direct (Scope 1) GHG emissions (for example, fuel use in stationary sources owned or operated by the airport). Indirect (Scope 2 and Scope 3) emissions are not counted in threshold determinations, and are not reportable under the rule. EPA is not requiring facilities to report emissions from purchased electricity, or from mobile sources, such as vehicle fleets or aircraft.

3.3.9 In addition to this EPA rule, several states and regions of the US have initiated reporting requirements, some associated with a cap-and-trade programme. The Western Climate Initiative (WCI) is a collaborative effort of seven US states and four Canadian provinces formed to identify, evaluate, and implement measures to reduce GHG emissions. The WCI established target for 2020 to reduce emissions to 15% below 2005 levels. The recommended cap-and-trade programme includes the six Kyoto gases and will begin 1 January 2012. Airports responsible for Scope 1 sources emitting more than 10 kt CO_2e will report their emissions and the cap-and-trade will apply to those emitting more than 25 kt CO_2e per year.

Stockholm Arlanda CO_2 Cap

3.3.10 In a decision on 15 August 1991, the Swedish Government granted Luftfartsverket (LFV) permission, in compliance with the Natural Resources Act then in force, to expand its operations by adding a third runway at Stockholm Arlanda International Airport. Among the conditions for this decision, the Government prescribed that no later than ten years after the completion of the runway, emissions of CO_2 and NOx from civil aviation operations and all ground transport activities connected to the airport must not exceed their 1990 level.

3.3.11 Because the third runway was completed in June 2001, the Government's permit condition requires that CO_2 and NOx emissions must not exceed 1990 levels beginning in mid-2011. In 2008 the Environmental High Court prolonged the date until 2016, if LFV applied for a new environmental permit by 31 December 2010. The cap includes all facility and vehicle emissions.

Conditions Attached to Project Approval

3.3.12 The UK Aviation White Paper (December 2003) progress report recommends that airport developments should aim to become Carbon Neutral in the longer term (in terms of their direct emissions). More significantly, the January 2009 policy decision announced by the UK's Secretary of State included the condition that the third runway development at Heathrow can only proceed if CO_2 emissions from UK aviation return to 2005 levels by 2050. Linked to this decision, the UK's Climate Change Committee (an advisory body to UK government) has been asked to evaluate the technical feasibility of achieving this target, as well as conduct a review in 2020 to determine whether the target is on track to be achieved. If it is concluded that the target is not likely to be achieved, then capacity associated with the third runway at Heathrow shall be limited to a half that previously planned.

3.3.13 In several locations in the US, airport development projects are subject to preparation of state environmental impact evaluation documents and several states now require preparation of GHG inventories. In December 2007, the state of Massachusetts began requiring preparation of CO_2 emissions inventories, as well as measures to avoid, minimize, and mitigate emissions for projects subject to the Massachusetts Environmental Policy Act (MEPA). Similarly in California, the California Environmental Quality Act (CEQA) is requiring the inventory, evaluation, and mitigation of GHG emissions.

National GHG Targets

3.3.14 The UK government has set a policy to reduce UK CO_2 levels by 26% in 2020 compared to 1990 levels, increasing the required reductions to 80% in 2050. This was established in the government's 2008 Climate Change Act and currently includes aviation emissions.
See *http://www.decc.gov.uk/en/content/cms/legislation/cc_act_08/cc_act_08.aspx.*

4 INVENTORY

4.1 Background

4.1.1 This section is designed to assist an airport operator developing an inventory of GHG emissions. The intent is to outline the essential elements of the two documents, ACRP (2009) and WRI (2004).

4.1.2 The WRI document (2004) sets down five principles that should be kept in mind.

- **Relevance** – The inventory serves the decision-making needs of the users.
- **Completeness** – All relevant sources and emissions are counted and reported.
- **Consistency** – Consistent methodologies allow for meaningful comparison with other periods and with other sites.
- **Transparency** – Full discloser of data sources and methodologies with a clear audit trail.
- **Accuracy** – Emissions quantification is systematically neither over nor under actual emissions, and uncertainties minimized, within reason. Users are able to make decisions with reasonable assurance as to the integrity of the information.

4.2 Purpose of Inventory

4.2.1 The purpose of the inventory will depend on what is driving the decision to address GHG emissions as discussed in *Section 3*. Understanding this will guide the breadth of sources that need to be included within an inventory and the appropriate level of detail and accuracy required.

4.2.2 In general terms, unregulated and voluntary inventories, such as an airport CSR or sustainability programme, should include as wide a range of relevant sources and emissions species as practical. A regulatory regime, such as the EU ETS, will usually specify exactly which sources and species should or should not be included.

4.3 Pollutants Species

4.3.1 The ACRP (2009) defines 3 levels of pollutant categories that airport operators can address.

- **Level 1**: CO_2 only. The ACI Europe ACA scheme addresses only CO_2. Generally CO_2 represents over 95 percent of the emissions at most airports.
- **Level 2**: Gases covered in the Kyoto Protocol, which are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulphur hexafluoride (SF_6). This is the level recommended by the ACRP (2009).
- **Level 3**: All six Kyoto pollutants, precursors and any others exerting a GHG effect.

4.3.2 CO_2 is the most significant GHG for most airports. While its greenhouse effects are the least potent of the Kyoto Protocol gases, the global quantities of CO_2 emissions make it the largest contributor overall. Many programmes address only CO_2 and the term "carbon" is often used instead of "CO_2".

4.3.3 At most airports, emissions of the other 5 Kyoto Protocol gases are not widespread. CH_4 emissions might be generated by rural activity such as farm animals and by natural gas leakage. N_2O sources are associated with explosives, food additive, medicines and aerosols. HFC and PFC represent groups of gases, many of which are no longer in production. Airports using large quantities of refrigerants will need to investigate the HFC pollutants associated with certain refrigerants (R-134a, R-12, and R-22). SF_6 is used in high voltage equipment and as a tracer gas; it is not common at airports.

4.3.4 For Level 3, additional substances could include NOx, SOx, particulate matter, ozone, hydrocarbons and water vapour. Many of these are currently inventoried at airports due to their impact on local air quality. Their contributions to overall climate change results are not accurately known.

4.3.5 Inventories are conducted to determine the total mass of CO_2 emissions, usually on an annual basis and usually in metric tonnes (t) or kilotonnes (kt). Other gases may be measured in grams or kilograms.

4.3.6 The masses of other GHG emissions are usually converted to an equivalent mass of CO_2 using a conversion factor, often called the Global Warming Potential (GWP) of the pollutant. For example, methane has a greenhouse effect approximately 25 times that of CO_2 (although this is complicated by the different life cycles of the gases), so 1 tonne of methane is considered to have a CO_2-equivalent mass of 25 t CO_2-e. If a GWP is used in an inventory, its source should be documented in the inventory report.

4.3.7 Starting with CO_2 as a minimum, an airport operator should choose when to include other gases, based on airport resources, availability of data, significance of sources and the purpose of the inventory.

4.4 "Scope" Categories of Sources

4.4.1 In WRI (2004), emissions are categorized into three scopes and each should be reported separately. These provide a means for identifying the ownership and control of emissions sources and thus responsibility for managing the emissions.

- **Scope 1** are GHG emissions from sources that are owned or controlled by the airport operator.
- **Scope 2** are GHG emissions from the off-site generation of electricity (and heating or cooling) purchased by the airport operator.
- **Scope 3** are the GHG emissions from airport-related activities from sources not owned or controlled by the airport operator.

4.4.2 Note that the above definition of Scope 1 is consistent with the WRI (2004). The ACRP (2009) Scope 1 definition refers to emissions sources "owned and controlled" by the airport operator – a definition which may exclude, for example, emissions from vehicles leased, but not owned, by an airport operator.

4.4.3 This manual recommends the division of Scope 3 sources into two subcategories - Scopes 3A and 3B.

- **Scope 3A** are the Scope 3 emissions which an airport operator can influence, even though it does not control the sources.
- **Scope 3B** are the Scope 3 emissions which an airport operator cannot influence to any reasonable extent.

4.4.4 This distinction is made in order to identify those sources, which an airport operator can choose to include in its emissions management programme and goals. For any particular type of source, the degree of influence will vary between airports. By categorizing a source as Scope 3A, the airport operator indicates that it can work with the owner of the source to achieve emissions reductions.

4.5 Emissions Sources

4.5.1 Examples of the main airport and airport-related sources in each scope category are given below in Table 4.1. At some airports, some sources may be placed in different categories.

Table 4.1: Examples of Scope 1, 2, 3A and 3B Emissions Sources

Source	Description	Comments
Scope 1. Airport Owned or Controlled Sources		
Power plant	Airport-owned heat, cooling and electricity production	
Fleet vehicles	Airport-owned (or leased) vehicles for passenger transport, maintenance vehicles and machinery operating both airside and landside.	
Airport maintenance	Activities for the maintenance of the airport infrastructure: cleaning, repairs, green spaces, farming, and other vehicles	
Ground Support Equipment (GSE)	Airport-owned equipment for the handling and servicing of aircraft on the ground.	Note that few airports own the actual GSE that service aircraft.
Emergency power	Diesel generators for emergency power	
Fire practice	Fire training equipment and materials	
Waste disposed on-site	Airport-owned waste incineration or treatment from airport sources	

Source	Description	Comments
Scope 2. Off-site Electricity Generation		
Electricity (and heating or cooling) generation	Emissions made off-site from the generation of electricity (and heating or cooling) purchased by the airport operator.	
Scope 3: Other Airport-Related Activities and Sources		
Scope 3A: Scope 3 Sources an Airport Operator Can Influence		
Aircraft main engines	Aircraft main engines during taxiing and queuing	
APU	Aircraft Auxiliary Power Units (APU)	
Landside Road traffic/Ground Access Vehicles (GAV)	All landside vehicles not owned by airport operator, operating on airport property.	
Airside vehicle traffic	All vehicles operated by third parties (tenants, airlines, etc) on airport airside premises	
Corporate Travel	Flights taken on airport company business	
Ground Support Equipment (GSE)	Tenant or contractor owned GSE for the handling and servicing of aircraft on the ground, if airport could provide alternative fuels or otherwise influence operation.	Otherwise Scope 3B.
Construction	All construction activities, usually conducted by contractors.	
Scope 3B: Scope 3 Sources an Airport Operator Cannot Influence		
Aircraft main engines	Aircraft main engines in the LTO cycle, excluding taxiing	Landing emissions could be Scope 3A.
	Aircraft emissions during cruise on flights to or from airport	ACRP recommends that an airport report whole-of-flight emissions for departing flights
Ground Support Equipment (GSE)	Tenant or contractor owned GSE for the handling and servicing of aircraft on the ground.	Could be Scope 3A if airports provide alternative fuels supplies.
Landside Road traffic/Ground Access Vehicles (GAV)	All landside vehicles related to the airport, operating off-site and not owned by airport operator, including private cars, hotel and car rental shuttles, buses, goods delivery trucks, freight trucks.	Passenger and staff vehicle trip would include whole of journey from home.
Electricity and other external energy	Emissions from generation of electricity, heating and cooling purchased by tenants including airlines	
Aircraft and engine maintenance	Airline or other tenant activities and infrastructure for aircraft maintenance: washing, cleaning, painting, engine run-ups	
Rail traffic	Rail traffic and other ground transport related to the airport	
Waste disposed of off-site	Off-site waste incineration or treatment from airport sources.	

4.6 Calculation Methods

4.6.1 The ACRP Guidebook (2009) provides detailed information on how to calculate the emissions from each source at an airport including aircraft, APU, GSE, ground access vehicles, stationary sources, waste management activities, training fires, construction and others. Factors for converting non-CO_2 emissions to a CO_2-equivalent mass are also provided.

4.6.2 The ACI-Europe ACA scheme (2009) provides emissions factors for converting the volume of various fuels used to CO_2 mass as well as for calculating the mass of CO_2 emitted for each kWh of electricity used in a large number of countries.

4.6.3 ICAO Document 9889, developed mainly for the calculation of local air quality emissions, provides detailed methodologies for calculating emissions from a variety of airport sources including aircraft engine start-up.

4.6.4 It is also recommended for airports to refer to any national reporting guidelines, e.g., UK DEFRA Greenhouse Gas Protocol *(http://www.defra.gov.uk/environment/business/reporting/carbon-report.htm)*

4.6.5 Emissions from the combustion of renewable or biomass fuels, such as wood pellets or biofuels, will need careful consideration. In general, the contribution of the emissions from these non-fossil fuels will have a net zero effect on the CO_2 levels in the atmosphere, because the equivalent CO_2 was removed from the atmosphere during their production in recent times.

4.7 Discussion and Recommendations

Completeness

4.7.1 Ideally an airport inventory, regardless of its purpose, should be as complete as possible covering all emissions sources at an airport and those associated with airport-related activities. One of the main reasons for covering all of these sources is the concern that an inventory without major sources like aircraft and passenger car trips might seem incomplete, and would thus lack public credibility.

4.7.2 In addition, at most airports, a complete inventory will demonstrate that Scope 1 and 2 sources are very much smaller than Scope 3. The majority of airport related GHG emissions are outside the control and ownership of the airport operator. Furthermore, if Scope 3B emissions includes the whole flight for departing aircraft, the inventory will demonstrate that even the emissions an airport operator can influence are small compared with the total.

4.7.3 If an airport operator invests in a project such as a train line to the airport (usually a joint venture with local authorities), the GHG reduction benefits should be reflected in the new inventory following implementation of the project. An incomplete initial inventory that excluded GAV might not show the GHG benefits of providing public transit.

4.7.4 An airport operator can undertake projects, not necessarily related to core airport activities, that reduce atmospheric CO_2 such as planting trees in certain areas on its own property. In order to

avoid confusion with offsetting via the purchase of certified offset credits (see *Section 7*), it is recommended that projects that have carbon reduction (or sequestration) benefits be reported separately in the inventory. Care must be taken that such CO_2 reductions are properly accounted for including such issues as the longevity or permanence of the reduction or sequestration. Guidance on this issue is beyond the scope of this manual. (*Also see paragraph 7.6*)

4.7.5 Consideration should be given to including placeholders on emissions that are not being included in a current inventory. For example, an inventory could mention aircraft LTO, or whole of flight emissions without providing figures, stating that accurate information is unavailable and that these sources will be considered in later versions. This could avoid having to add major emissions sources at some future date.

Aircraft Emissions

4.7.6 Careful consideration should be given to the inclusion of aircraft emissions in airport inventories. These are Scope 3 emissions and need to be included for completeness and credibility.

4.7.7 The ACRP (2009) guidebook recommends that the emissions from an entire flight be included in the inventory of the departure airport. The advantage of this method is the avoidance of double counting if various and regional inventories are ever combined and totals summed. Additionally, an airport operator can make a reasonable estimate of these emissions based on fuel dispensed to aircraft operators (although tankering practices could distort such calculations.)

4.7.8 There are some disadvantages of this counting method. If an airport operator improves its arrival procedures, for example, implementing Continuous Descent Operations (Approaches) or construction of a new runway reducing arrival congestion and holding, these benefits will not appear on the airport operator's new inventory. Effectively, the emissions reductions would be reflected in the departing airport operators' Scope 3 inventories.

4.7.9 An alternative is to base aircraft emissions on the Landing and Take-off (LTO) cycle of aircraft. Many methods of various levels of sophistication are available for these calculations including ICAO Document 9889. At many airports these emissions are already calculated for local air quality emissions inventories and can be relatively easily extended to include CO_2. Any improvements in local ATM, congestion, taxiing, etc. would then be reflected in the GHG inventory. For airports that take this approach, it is recommended that they leave a placeholder noting "cruise" or "flight outside the LTO" as not available.

4.7.10 Care must be taken if emissions from both the whole of departure flight and LTO are included in an inventory. The departure emissions might be counted twice.

4.7.11 The final choice should be guided by the purpose of the inventory, especially any relevant regulatory requirements. Whatever is chosen, the assumptions, exclusions and inclusions should be clearly reported with the inventory results. Such an approach will help avoid inappropriate comparisons of inventories of different airports.

5 GOAL SETTING FOR AIRPORT OPERATORS

5.1 Goals for an Airport Operator's Emissions

5.1.1 Having completed a GHG inventory, an airport operator, acting within a voluntary or unregulated programme, might then choose goals that it will strive to achieve. These goals will mainly be determined by the driver as discussed in *Section 3*.

5.1.2 A first step or goal could be to implement cost saving measures by decreasing energy use and improving energy and operational efficiency. The inventory will allow the airport operator to track any resulting improvements in GHG emissions.

5.1.3 A second step may be to target "low hanging fruit" – specific emissions sources that might be relatively easy or cost-effective to reduce. The inventory will be useful for identifying these emissions sources or activities that should be prioritized for mitigation, possibly because they make a major or disproportionate contribution to the total inventory. For example, an inventory at a US airport identified one of the major non-aircraft emissions sources was hotel and car-rental shuttle buses.

5.1.4 A next step may be to take the total emissions (e.g., all Scope 1 and 2 emissions or more) in the inventory as a benchmark and set a numerical goal based on the total. For example, an airport operator may set a goal to avoid any increase in total emissions higher than the level of the inventory of a certain year, e.g., 2005, or to achieve a decrease in total emissions, e.g. to achieve by 2015, total emissions 5% below those of 2005. Such a goal with an emissions target expressed in absolute terms, set against a clearly defined benchmark and time lines, is the most rigorous and credible method for setting a goal. It also highlights the need for inventory completeness discussed is *Section 4.7.*

5.1.5 A less onerous goal might be to define an emissions intensity or efficiency, such as the total emissions per passenger enplanement, and then to set a goal to maintain or decrease this metric over a set period.

5.1.6 A total emissions goal might be appropriate for a large, long-established airport and an emissions intensity goal might be needed to allow a younger airport to grow. Intensity targets can be criticized as they can allow growth in total emissions, and may not reduce the airport operator's overall contribution to climate change, not necessarily providing the best benefit.

5.1.7 **Carbon Neutral Growth** means than an airport operator sets a goal of maintaining its total CO_2 emissions at a constant level. Such a goal requires a clear statement of the emissions to be included. Scopes 1 and 2 emissions should be included as a minimum and possibly with the addition of some Scope 3A emissions like corporate travel. In this manner the airport operator might achieve Carbon Neutral Growth (and later Carbon Neutrality) without necessarily the airport (as a whole) achieving this.

5.1.8 **Carbon Neutral** status means that an airport operator's Scope 1 and 2 (and possibly some or all Scope 3A) emissions are, firstly, reduced to a minimum practicable level, and then offsetting is used to compensate for any residual CO_2 emissions. This is further discussed in *Section 7* of this manual.) In this manner, the activities of the airport operator have no net contribution to global anthropogenic CO_2 emissions.

5.1.9 ACI's World Annual General Assembly Resolution (2007) refers to airport operators achieving Carbon Neutral status as an ultimate goal.

5.1.10 GHG goals adopted by an airport operator should be endorsed by the organization's governing body such as the Board of Directors, CEO or Director General. Responsibility for achieving the goals should be assigned to the highest position possible.

5.2 Goals for Other Airport-Related Emissions

5.2.1 Scope 3 emissions sources are outside the airport operator's ownership and control. However, for Scope 3A emissions (by definition), an airport operator can influence and assist the emitter to reduce those emissions. Airport operators can control many factors on the ground that can reduce the GHG emissions of these sources. Thus, it can still be beneficial for an airport operator to set goals for such sources, either on the emissions themselves, or on the relevant activities, and any reductions achieved should be reflected in the airport operator's Scope 3A inventory.

5.2.2 Such goals could be either qualitative or quantitative, and some examples are provided below.

- The number or proportion of terminal gates with fixed electrical ground power (FEGP) and pre-conditioned air (PCA) available and the proportion of aircraft no longer using APU.
- Reduction in the average taxiing and queuing time for departing and arriving aircraft.
- The number or proportion of passengers using alternatives to single-occupancy vehicles, including rapid transit.
- The number or proportion of GAV including taxis and buses using alternative fuel or with low GHG emissions.
- The number of hotel and parking garage shuttle bus trips.

6 MEASURES TO REDUCE EMISSIONS

6.1 Four Pillar Strategy

6.1.1 Emissions reduction actions for airports are outlined in *Sections 6.2 and 6.3* of ACI's Policy and Recommended Practices Handbook (2008). Mitigation measures that address pollutants that impact local air quality, invariably provide GHG emissions benefits as well. There are four main categories of measures.

- **Regulatory Measures** that regulate the amount of emissions by setting emissions standards or prescribing procedures.
- **Technical Measures** that reduce emissions through the implementation of technical devices.
- **Operational Measures** that influence the emission levels through changing operation of emissions sources.
- **Economic (or Market-Based) Measures** that influence emission levels through providing economic incentives.

6.1.2 The discussion below describes actions to reduce the main sources of emissions. These can be implemented within one of the above categories of measures or as a combination of several.

6.2 Reduction of an Airport Operator's Emissions

6.2.1 Some examples of measures for Scope 1 and 2 emissions reductions include the following:

- Modernization of the power, heating and cooling plants.
- The generation, use or purchase of electricity, heating and cooling from renewable sources including wind, solar, hydroelectric, geothermal and biomass sources.
- The design, inclusion or retrofitting of "smart" and energy efficient buildings and component technologies, including double glazing, window tinting, variable shading, natural lighting, LED (light emitting diode) lighting, absorption-cycle refrigeration, heat recovery power generation and the like. LEED and BREEAM building certification programmes can provide guidance.
- Modernization of Fleet Vehicles and GSE, and use of alternative fuels for buses, cars and other air and land side vehicles, including compressed natural gas (CNG), hydrogen, electric, compressed air and hybrid vehicles, taking into account the impact of severe weather conditions.
- Driver education on fuel conserving driving techniques and implementation and enforcing of a no-idling policy.
- Solid waste management that includes recycling and composting, and reduces volumes of waste going to landfills. Reusing excavation and demolition material on-site also reduces transportation emissions.

6.3 Reduction of Other Airport-Related Emissions

6.3.1 Non-aviation emissions are dominated by ground transportation in Scope 3A. GHG mitigation measures can include the following:

- Provision of public transport and rapid transit to and from the airport including buses, coaches, light rail and trains.
- Educational campaigns (or using by-laws) to reduce vehicle idling, taxi dead-heading (one way trips), and individual passenger drop-off and pick-up.
- Hotel and rental car agency shuttle bus consolidation.
- Encouragement of alternative fuel or hybrid taxis, rental and other cars using incentives such as priority queuing, parking cost reduction and priority parking areas.
- Providing infrastructure to fuel and power low-emission vehicles including recharging stations.
- Establishing working groups with business partners to share best practices and responsibilities in carbon reductions.

6.4 Reduction of Aviation Emissions

6.4.1 The emissions from aviation as a whole are dominated by aircraft in flight. ICAO and IATA efforts to reduce aviation's total GHG emissions are focused on three main areas – aircraft technology, operational and ATM improvements and future implementation of sustainable biofuels.

6.4.2 Airport operators can contribute to improvements in the aircraft activities of taxiing and APU usage with the mitigation measures including:

- Providing (and enforcing the use of) fixed electrical ground power (FEGP) and pre-conditioned air (PCA) supply to aircraft at terminal gates, allowing auxiliary power unit (APU) switch-off.
- Improvements in aircraft taxiways, terminal and runway configuration to reducing taxiing distance and ground and terminal area congestion.
- Departure management including holding aircraft at the gate (with APU switched off) until departure slot is ready. Such practices can also encompass virtual queuing and Collaborative Decision Making.
- Arrival management that provides gates for aircraft, as far as possible, immediately after landing.
- Coordinating with aircraft operators and ATM to improve arrival and departure procedures and flow, especially in working with stakeholders on the value and tradeoffs for such changes.
- Engaging passengers directly in offsetting their share of trip emissions via an on-site carbon emission calculator and programme to pay an offset fee either for local GHG improvements or through a reputable programme.

6.4.3 It should be noted that the provision of FEGP and PCA to aircraft will decrease aircraft APU fuel burn and associated emissions, but will increase purchased electricity. While this could increase Scope 2 emissions (or Scope 3 if electricity is billed to an airline tenant), electricity generated by

power stations will invariably be produced more efficiently and with less GHG emissions than that by an APU. An inventory at an airport with new FEGP/PCA will need to take note of these considerations.

6.4.4 The use of diesel-powered Ground Power Units (GPU) may not necessarily reduce total GHG emissions.

7 OFFSETTING AND CARBON NEUTRALITY

7.1 Goal of Carbon Neutrality

7.1.1 If an airport operator has set a goal of achieving Carbon Neutral status, the primary focus should be to reduce or eliminate activities that generate carbon dioxide (and other GHG) emissions. Such measures are outlined in the preceding section.

7.1.2 Almost inevitably, there will be emissions that can be reduced but cannot be entirely eliminated. The cost of such elimination may also be an influencing factor. Examples of such emissions include corporate travel and diesel fuel for specialist machinery that cannot easily be replaced (e.g., snow removal equipment). To address the gap between on-site reductions and achieving Carbon Neutrality, an airport operator may need to use Carbon Offsetting.

7.2 Carbon Offsetting Concepts

7.2.1 CO_2 has the same impact on climate wherever it is emitted, so the reduction of CO_2 emissions has the same benefit wherever it is achieved. It can be more economically efficient to reduce CO_2 emissions (or remove CO_2 from the atmosphere) in some other location, in lieu of reducing those remaining emissions that cannot be easily or cost-effectively eliminated at an airport.

7.2.2 In general, an offset is a "compensating equivalent." In the context of GHG emissions, the concept of Carbon Offsetting is to "cancel out" or "neutralize" emissions of CO_2 (and other GHG) by using emissions reductions achieved in a different activity or location, reductions that would not have otherwise been implemented. This requirement of "additionality" is fundamental to offsetting; it involves the concept that projects would not have occurred without the funding and implementation of the offsetting project.

7.2.3 There are two possible means to employ offsets.

a) The creation of offset credits.
b) The purchase of offset credits.

7.2.4 An airport operator wanting to use offsetting to address its emission gap will usually only be involved in the second of these steps.

7.3 Creating Offset Credits

7.3.1 An offset credit is generated upon the implementation, monitoring and certification of an off-site project that reduces CO_2 emissions (or sequesters CO_2), reductions that would not have occurred without that project. Many types of projects can generate reductions in GHG, for example:

- Increasing energy efficiency (reducing energy use).
- Using "waste" energy in cogeneration.

- The introduction of renewable energy sources such as wind, solar, geothermal and biofuels, replacing the combustion of fossil fuels.
- Sequestration of carbon dioxide in forests and agricultural soils.
- Carbon capture and storage (carbon dioxide or methane).
- Capture and destruction of potent greenhouse gases, such as halocarbons.

7.3.2 A rigorous process of quantification and verification must be met for a project to generate an offset credit that is officially recognized by the UNFCCC. Offset credits created under the UNFCCC are generally considered of high environmental integrity and are used by government regulated schemes such as the European Union's emissions trading scheme. Again, additionality is a key criteria, projects must not have occurred under a "business as usual" scenario, and emissions must be permanently removed or the CO_2 permanently sequestered.

7.3.3 Clean Development Mechanisms (CDMs) are examples of projects that are undertaken in developing countries who do not have specific emissions reduction caps. Certified Emissions Reductions (CER) are the offset credits generated by CDM projects. Another well-regarded offset credit is called the Gold Standard, developed and monitored by the World Wide Fund for Nature (WWF).

7.3.4 Airport projects that reduce GHG emissions will generally not produce offset credits, depending on the relevant regulation regime discussed in *Section 3*. According to the Kyoto Protocol articles airport reductions can count towards domestic national emissions reductions targets for Annex 1 (developed countries). In non-Annex 1 (developing countries), the projects would need to be UN certified per section 7.3.2 above.

7.4 Purchasing Offset Credits

7.4.1 For an airport operator, the act of offsetting most often occurs when an offset credit is purchased. Effectively, the purchase of the offset credit provides the funding for the project that resulted, or will result, in the certified GHG reduction.

7.4.2 The ACI-Europe Airport Carbon Accreditation (ACA) scheme (see *Section 8.3* below) offers a framework for airport operators to gain formal recognition of carbon management efforts and the achievement of Carbon Neutral status.

7.4.3 Theoretically, an airport operator could directly fund its own off-site GHG reduction projects. However robust the project, it may be quite difficult to get official recognition if the airport operator has a goal of being certified as Carbon Neutral.

7.5 Concerns and Limitations

7.5.1 The limitations and criticism of some existing carbon offset programmes can include:

- Transparency – what exactly is being offset, how are offset dollars being spent, ratio of the cost that goes to the purchase of offsets compared to the cost required to administer the tracking system;

- Verification that offset credits being purchased are real – are overall global emissions of GHGs actually being reduced; third party verifications such as those from the Gold Standard and ISO are available;
- Permanence – for example, forestry is a popular method to offset emissions, but is not permanent, because trees produce GHGs through decomposition when they die, or through combustion in the event of a forest fire;
- Inconsistency – offset credits purchased through one provider may not be equivalent to those purchased through another, prices for offsets are not consistent, and other issues;
- Incompleteness – a Carbon Neutral airport operator does not mean a Carbon Neutral airport as all Scope 3 emissions are not necessarily addressed and an airport operator could be open to accusations of "greenwashing";
- Additionality – Projects funded by offsetting payment must be shown to be "additional" in that they would not have taken place without the imposition of the offsetting project. This can be very difficult to establish with complete certainty, and may remain a criticism of offsetting as a concept.

7.5.2 In order to minimize these limitations, it is recommended that offset credits should only be purchased through accredited, transparent and monitored sources. Many programmes exist and it is possible to find offset credits with almost any desired criteria.

7.5.3 US airport operators may have concerns about the legality of spending airport funds on projects outside the airport operator's area of influence. Investment in offset credits created from non-airport projects may be considered revenue diversion. The FAA defines "revenue diversion" as "the use of airport revenue for purposes other than the capital or operating costs of the airport, the local airport system, or other local facilities owned or operated by the airport owner or operator and directly and substantially related to the air transportation of passengers or property…"

7.6 Airport Carbon Reduction Projects

7.6.1 Airport operators can undertake projects that reduce atmospheric CO_2, but are not necessarily related to core airport operations, such as the planting of trees on airport property. Some schools of thought would categorize such projects as "offsetting". In order to avoid confusion with offsetting via the purchase of certified offset credits, it is recommended that projects that have carbon reduction (or sequestration) benefits be included in the GHG inventory and reported separately. Care must be taken that such CO_2 reductions are properly accounted for including such issues as the longevity or permanence of the reduction or sequestration. Guidance on this issue is beyond the scope of this manual.

7.7 ACI Recommendations

7.7.1 The fundamental approach to achieving carbon neutrality is to reduce emissions to the extent practicable and then to address remaining emissions using carbon offsetting as a last resort.

7.7.2 It is important that any purchased offset credits comply with international standards and that the calculation is verified by an external auditor accredited by UN to ensure independency.

8 REVIEW, REPORTING AND CERTIFICATION

8.1 GHG Programme Review

8.1.1 An airport GHG management programme could be established as (or within) an Environmental Management System (EMS). An EMS provides a formalized structure for identifying an environmental issue and regulatory requirements, formulating and implementing a plan to address and mitigate the issue and monitor progress, and to periodically review the scheme and its results. The International Standards Organization (ISO) has published guidance material on EMS, which is ISO 14001:2004.

8.1.2 The process follows the Plan-Do-Check-Act cycle. In terms of the sections of this manual, the Plan components of an EMS would include reviewing the drivers, conducting a GHG inventory, and setting goals. The Do step would include implementing emissions reduction projects and possibly offsetting. The Check step, the topic of this section, involves reviewing the progress of the GHG management programme, including updating the inventory on a regular basis, reviewing the goals that had been set and assess the progress that has been made.

8.1.3 Based on that Check step, the Act step might involve readdressing any of the other steps including goal setting or mitigation actions. Thus the cycle continues with a return to the Plan and Do steps and so forth. The value of this structure is the systematic review process to ensure the goals are realistic and that on-going progress is made toward achieving them.

8.1.4 The review should be developed for the three following topics:

- **Situation**: This section describes the current status of the GHG emissions inventory. It would include a trend analysis over the past to demonstrate the effectiveness of the implemented programs and progress towards the goals.
- **Past Achievements**: This section describes the activities that have taken place during the reporting period. It includes ongoing as well as newly started programmes and benefits, but also potential shortfalls. The results are benchmarked against the goal or stipulated targets, and areas for improvement are identified.
- **Planned Activities**: This section, based on the two previous sections, describes the planned actions for the next reporting period. This can include formal requests for budget, the decisions on corrective actions to be taken or the launching of new programs.

8.1.5 This review is presented to the responsible management level and should be formally approved with the results properly disseminated.

8.2 Reporting of GHG Emissions Management

8.2.1 Reporting on a GHG emissions management programme allows an airport operator to measure and thus manage its performance. The benefits of providing regular reports both internally and to

public forums include increased transparency and accountability, better stakeholder relationships and the ability to benchmark performance peers.

8.2.2 An airport GHG inventory report should include at the least the following components.

- Airport information including name and size (annual movements, passenger and cargo).
- The reporting period.
- GHG emissions species and quantities divided into Scopes 1, 2, 3A and 3B, with notes explaining the major contributing sources and important inclusions and exclusions.
- Clear definitions of the terms and units (unless properly referenced).

8.2.3 It can be useful to provide a break down of the components of the different Scopes and also placeholders for sources not included if deemed insignificant or not relevant. *Appendix B* of this manual provides some recent examples of inventories from a number of airports. Note that these are only summaries of these particular inventories.

8.2.4 Reporting can take one of a variety of formats with a range of details and information, depending on the priorities and size of the organization.

- The company Annual Report may include a section providing news on the progress of environment projects and GHG management.
- The airport operator may publish a dedicated annual Environment Report.
- The airport operator may have a Corporate Social Responsibility programme that includes the issuing of a regular report.
- Dedicated Sustainability or Sustainable Development reports are also published by some airport operators.
- Reports on the GHG Inventory or on GHG Emissions Management may be issued.

8.2.5 The reports are usually produced annually and can be printed on recycled paper or distributed electronically. Airport websites often have sections dedicated to environmental and sustainability issues.

8.3 Certification

8.3.1 In June 2009, ACI Europe launched its Airport Carbon Accreditation (ACA) scheme, which provides a framework for airport operators to address their carbon dioxide emissions and obtain certification for milestones reached. The scheme is voluntary and for each of the 4 levels attainable an airport operator must submit proof of certain actions, which are audited and verified.

8.3.2 The scheme requires that emissions are reported in line with the GHG Protocol (WRI 2004) and that airport operators also identify where they have direct "Control" over emissions (generally Scopes 1 and 2) and where they can only "Guide" or "Influence" emissions from other activities.

8.3.3 The ACA does not subdivide Scope 3 emissions into Scopes 3A and 3B, but does refer to the option of including some Scope 3 emissions within targets. Using the definitions in this manual, airport operators can exercise some control over Scope 3A emissions, so an airport operator could choose to group these emissions with its Scope 1 and 2 emissions.

8.3.4 The ACA provides four levels of certification, whose requirements are briefly described as follows:

- **Level 1 – Mapping** – An inventory of sources and annual quantities of CO_2 emissions under an airport operator's direct control (Scope 1 and 2 sources) with options to include some Scope 3 sources and non-CO_2 GHGs. A list of other emissions sources (Scope 3) is also required.
- **Level 2 – Reduction** – As well as the Level 1 inventory, a Carbon Management Plan for Scope 1 and 2 sources should be developed and implemented, and evidence of measurement, reporting and on-going emissions reductions must be provided.
- **Level 3 – Optimization** – The inventory must be extended to include some Scope 3 sources including (at least) aircraft LTO, APU, surface access and corporate travel. The Carbon Management Plan must be extended to include further stakeholder engagement and on-going emissions reductions must be demonstrated.
- **Level 3+ - Neutrality** – As well as the Level 3 requirements, the airport operator must demonstrate that it has offset its residual Scope 1 and 2 emissions and has thus achieved "Carbon Neutrality."

8.3.5 Only CO_2 management is mandatory for the ACA scheme. Airport operators can include emissions of other GHG on a voluntary basis.

8.3.6 The ACI Europe ACA scheme is available to any airport in the world and ACI World is currently investigating options for a formal global adoption.

9 REFERENCE DOCUMENTS

9.1 Relevant documents include the following:

Document	Abbreviation	Reference/ Document Location
ACI Mission Statement		www.aci.aero
ACI World Annual General Assembly Resolution (2007)		www.aci.aero
ACI Policy on Climate Change (2005)		www.aci.aero
ACI North America – Environmental Goals (2009)		
ACI Europe – Airport Carbon Accreditation Scheme (2009)	ACA scheme (2009)	www.aci-europe.org
ACI Policies and Recommended Practices Handbook (2007)	PoI and RP (2008)	www.aci.aero
Airport Cooperative Research Program (ACRP) Report 11 Guidebook on Preparing Greenhouse Gas Emissions Inventories (2009)	ACRP (2009)	http://144.171.11.107/Main/Public/Blurbs/160829.aspx
The World Resource Institute (WRI) and The World Business Council for Sustainable Development (WBCSD) document "Greenhouse Gas Protocol, a Corporate Accounting and Reporting Standard" (WRI 2004)	WRI (2004)	www.ghgprotocol.org
ACRP Synthesis 10, Airport Sustainability Practices (2008)		http://144.171.11.107/Publications/Public/Blurbs/Airport_Sustainability_Practices_160369.aspx
ICAO Document 9889		www.icao.int
ISO 14001-2004 Environmental Management Systems Requirements and Guidance for Use	ISO 14001	

APPENDIX

Appendix A: Addressing Aviation's GHG Emissions

There has been much discussion at ICAO, at the UNFCCC and in the general media, regarding the need for the aviation industry to set goals or targets or even a cap on CO_2 or GHG emissions. In order for airport operators to understand the relevance of these issues to their airports and their GHG emissions management programmes, the most important discussion threads are outlined below.

ICAO's Environmental Goal

The International Civil Aviation Organization (ICAO) is a United Nations agency established to facilitate international civil aviation and set standards for aircraft and airports. ICAO's Assembly Resolution 35-5 declares its Environmental Goals, including limiting or reducing the impact of aviation of greenhouse gas emissions on the global climate. The assessment of this goal mainly involves calculating and projecting aviation's total fuel burn in future decades. This includes only the fuel burnt in aircraft, both internationally and domestically. Efforts are focused on improving fuel efficiency through aircraft technology advances, operational and air-traffic management improvements, and future biofuels. The main airport-related issues are APU fuel burn and congestion.

ICAO Technology Goals

ICAO's Committee on Aviation and Environmental Protection (CAEP) is setting and reviewing fuel burn Technology Goals. These are different to the ICAO's Environmental Goals, in that they concern the cutting edge of new aircraft frame and engine technology and the expected fuel efficiency performance of new aircraft designs in the medium (10 year) and long (20 year) terms. Technology goals were set for aircraft engine NOx emissions in 2007 and in 2010, CAEP will decide on noise, NOx and fuel burn goals for both aircraft technology and operational efficiencies.

ICAO's Aspirational Goals

Following the ICAO Assembly in 2007, ICAO established the Group on International Aviation and Climate Change (GIACC) with a mandate, inter alia, to establish an "aggressive Programme of Action including voluntary measures, technology, operational measures, ATM, positive economic incentives and market based measures". Another task included "possible global aspirational goals on fuel efficiency".
In October 2009, ICAO held a High Level Meeting with the principal task of confirming and developing the Programme of Action for ICAO to take to the Copenhagen meeting. The Programme of Actions included an annual average fuel efficiency goal of 2% through to 2050, the regular compilation and reporting of international aviation CO_2 emissions, state action plans, and promotion and development of sustainable biofuels. ICAO will also develop a CO_2 standard for aircraft, explore the feasibility of goals of more ambition, work with industry on technology and alternative fuels, update guidance on operational efficiencies, establish a process to develop a framework for market-based measures and consider assistance to developing countries.

UNFCCC and the Kyoto Protocol

International Aviation was excluded from national inventories and targets in the Kyoto Protocol and the UN Framework Convention on Climate Change (UNFCCC) gave ICAO the responsibility of addressing these emissions.

In December 2009, the UNFCCC will meet to draft the successor to the Kyoto Protocol whose first commitment period expires at the end of 2012. It is expected that International Aviation will be included in any new agreement but it is unknown in what form. The Programme of Action produced by GIACC may not be enough to form the basis of a proposal that ICAO can take to the UNFCCC.

Appendix B: Examples of Airport Greenhouse Gas Inventories

Airport	**Zurich Airport, Switzerland**	
Study Year	2008	
Movements	274,991	
Passengers	22.1 million	
Cargo (t)	419,843	
Scopes	Mass / Species	Comments
Scope 1	30,788 t CO_2	Includes own power plant, furnaces, emergency power and own vehicles and machinery
Scope 2	2,639 t CO_2	
Scope 3A	112,260 t CO_2	Includes aircraft taxiing, APU, GPU for handling, 3rd party construction and access road traffic in airport perimeter: - Aircraft taxi: 89,149 t
Scope 3B	2,899,331 t CO_2	Landing and whole of departing flights to destination (performance based), GSE, other furnaces, aircraft maintenance, fuel farm, access train traffic. - Performance based LTO (excl taxi): 159,555 t - Performance based whole flight (excl LTO): 2,720,002 t
Total Airport	3,045,018 t CO_2	
Airport	**Stansted, UK**	
Study Year	2008	
Movements	166,493	
Passengers	22.3 million	
Cargo (t)	198,054	
Scopes	Mass / Species	Comments
Scope 1	3,511 t CO_2	Gas, wood pellets, refrigerants, company vehicles and airside fuel use
Scope 2	51,314 t CO_2	Electricity
Scope 3A	248,626 t CO_2	Aircraft taxi, hold, APU, staff vehicles, waste, business travel
Scope 3B	134,876 t CO_2	LTO (excl. taxi, hold, whole of flight), passenger GAV, third party airside fuel
Total Airport	438,327 t CO_2	
Airport	**Seattle Tacoma, USA**	
Study Year	2006	
Movements	340,058	
Passengers	30 million	
Cargo (t)	341,981	
Scopes	Mass / Species	Comments
Scope 1	40,000 t CO_2	Stationary sources, GSE, GAV (including employee vehicles, shuttle buses) on airport land
Scope 2	26,000 t CO_2	Electricity
Scope 3A	592,000 t CO_2	Aircraft taxi and delay, employee vehicles off site, shuttle buses off site
Scope 3B	3,996,000 t CO_2	Landing and whole of departure flights to destination (based of fuel dispensed), Passenger vehicles off site.
Total Airport	4,654,000 t CO_2	

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ACI World Environment Standing Committee
1st Edition, November 2009