![canso - civil air navigation services organisation]

Air Navigation Service Provider Carbon Footprinting

A Best Practice Guide

Acknowledgements

Contents

Executive Summary

This document provides guidance for air navigation service providers (ANSP) which are interested in assessing and managing their greenhouse gas (GHG) emissions. By producing this document CANSO is encouraging ANSPs to consider how they can benefit from measuring their carbon emissions, or in other words 'carbon footprinting' and how this is a crucial first step in identifying and delivering environmental improvement. Case studies provide examples of how some ANSPs are significantly reducing their GHG impacts and thereby saving money, managing risks, and gaining commercial advantage as well as meeting local regulatory and legislative requirements.

The purpose of this material is to share best practice; clarify the carbon footprint issues from an ANSP's perspective; offer options for carbon footprinting; and encourage ANSPs to consider how they may benefit from carbon footprinting.

Publicly available generic methodologies and international standards, such as those produced by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI), describe how businesses can approach carbon footprinting in terms of assurance and verification. This document does not seek to restate these approaches, but describes what might be appropriate for an ANSP organisation, whether it is considering carbon footprinting for the first time or has already begun assessing its own carbon footprint.

The approach is neither prescriptive nor mandatory. Instead, it seeks to be flexible and fully respects the variability and differences in local regulations and priorities around the world. While individual needs and the level of implementation differ between organisations, measuring environmental impacts is a responsible and useful first step in effectively managing them. It allows comparison among internal inventories of each ANSP but it is always necessary to take into account possible differences.

This guide focuses mainly on the management of 'estate' related carbon impacts, such as the carbon emitted because of powering ANSP buildings and infrastructure associated with delivering ANSP operations and services. While it focuses on the carbon impact of facilities, the principles described here are the same as for measuring the impact of air traffic in the airspace that ANSPs can influence.

Introduction

The increase in global GHG concentration in the atmosphere contributes to climate change, which includes changes in global weather and temperature, the rise of the oceanic sea level and more frequent extreme weather events such as floods or tornadoes.

Measuring and reporting environmental performance is a key part of social responsibility for businesses as concerns about sustainability increase. As global warming and climate change have come to the forefront as a key sustainable development issue, and with governments taking steps to reduce GHG emissions, organisations have become compelled to measure and report on their activities and the associated environmental impact. In some countries, legislation requires businesses to do this, in others there is increasing societal pressure to do so on a voluntary basis. The aviation industry is increasingly in the spotlight as a contributor to climate change.

The aviation industry continues to grow as more people choose to fly. This enables economic growth and opportunities, but it also brings challenges to society and the environment. Environmental challenges in air transport are mainly connected with emissions. On a local level, air quality can be affected around the airport and on a global level, an increase in GHG emissions is linked to climate change. ANSPs have a role to play both in terms of the influence they can have in reducing aircraft emissions through more efficient operations, but also directly in terms of the impact of operating their facilities. With vast communications and navigation infrastructure, and a need to operate safely and resiliently 365 days a year, 24 hours a day, ANSP energy requirements lead to carbon impacts. This publication focuses on how ANSPs can take steps to reduce these emissions.

1

Carbon Footprinting and Environmental Impact Management

Environmental Impact Management

Many organisations are responsibly managing their environmental impacts through implementing environmental management systems (EMS). An underlying principle of any EMS is to review and understand the environmental impacts associated with business operations, and it is here where carbon footprinting can be useful.

Measuring environmental impacts through carbon footprinting helps an organisation to identify which areas of its operation are having the largest impact; to monitor performance; and to identify trends over time. Measurement helps to identify opportunities for improvement.

Carbon Footprinting

Carbon footprinting is a method for organisations to understand their environmental impacts and typically focuses on estimating the climate change impact of their business activities and emissions. Carbon footprinting estimates not only the CO_2 emissions that business activities cause, but also any emissions from other greenhouse gases (typically restricted to 'Kyoto gases'[1]), which are often reported in terms of CO_2 equivalent (CO_2e). International standards and inventories are commonly used to facilitate calculation and outline the calculation methodology. This process captures contributions (for example CO_2 emissions) and helps enable comparability and transparency of carbon footprints across organisations and sectors of industry.

Several standards and inventories have been developed to help businesses understand the entire end-to-end impact of their activities.

The main international standards are:
— International Organization for Standardization (ISO) 14064 – a three-part international standard for GHG management activities
— ISO 14067 – which specifies principles, requirements and guidelines for the quantifying and communicating the carbon footprint of products (CFPs)
— Publicly Available Specification (PAS) 2050 – a specification for the assessment of the life cycle GHG emissions of goods and services, and a core document for the other carbon footprint standards.

In addition to the above mentioned standards, there are two other recommended reference documents – *Greenhouse Gas Protocol, a Corporate Accounting and Reporting Standard* (World Resource Institute, 2004), herein referred to as 'GHG Protocol' and *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (Intergovernmental Panel on Climate Change, 2006).

---

[1] The Kyoto Protocol to the Convention commits its parties to binding targets based on six GHGs: carbon-dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6)

2

Why Undertake Carbon Footprinting?

There are many reasons why ANSPs make the decision to monitor their carbon footprint and GHG emissions. Some of these are set out below.

2.1 Reducing environmental impact and cost reduction

For many ANSPs one of their biggest contributors to GHG emissions is the energy consumption required for heating, cooling, and power for air traffic management (ATM) systems, operations rooms, and information technology (IT) equipment. By conducting a carbon footprint measurement, the most energy intensive areas of the business can be identified. For most ANSPs, essential operations IT must be left running 24 hours a day, seven days a week, resulting in large energy consumption. Even so, there are opportunities to implement newer, more efficient low carbon technologies, consolidate the equipment, and adjust building controls while being sensitive to the needs of current operations.

Saving costs is a good motivating factor for each company. Improving the energy efficiency of buildings can reduce costs as well as decrease GHG emissions. There are also opportunities to save costs and reduce emissions by reviewing business travel, waste generation, and water consumption.

2.2 Legislation, regulation and national targets

The Kyoto Protocol[3] is the main regulatory driver for States to reduce their emissions. Many States that ratified the Kyoto Protocol committed to reduce their GHG emissions by a certain level compared to the 1990 level. Obligations under the Kyoto Protocol to reduce GHG emissions are contained in national commitments and objectives. These national strategies or programmes on decreasing GHG emissions include emissions from facilities (especially energy consumption) and business traffic in general. In some cases, there are also limits for GHG emissions from aviation. If ANSPs do not currently have national targets to reduce emissions, they are encouraged to define their own objectives rather than have them imposed.

NATS example[2]

"Since 2008 when we started measuring and targeting energy efficiency, our energy consumption has reduced by over 30 percent in absolute terms, saving enough energy to power 2,500 family homes each year and significantly reducing costs. The cost savings really add up, saving over £4 million each year, and tens of millions since the programme began."

[2] NATS Responsible Business Report
http://www.nats.aero/wp-content/uploads/2016/06/NATS-Responsible-Buiness-report-2015-16.pdf
[3] http://unfccc.int/resource/docs/convkp/kpeng.pdf

skyguide example

In 2011 the Federal Council and Parliament decided on Switzerland's progressive withdrawal from nuclear energy production and developed the Energy Strategy 2050. In 2014, the Federal Administration and enterprises, including skyguide, established a group called 'The Confederation: Exemplary in Energy'. skyguide received an objective to implement 80 percent of an action plan of 39 best practices in buildings and renewable energy, green IT and mobility domains by 2020. A second objective seeks to improve the company's energy efficiency 25 percent by 2020 compared to 2006. By the end of 2015, skyguide already improved its energy efficiency by 29.7 percent and implemented 59 percent of its action plan. In addition, skyguide, as a heavy energy consumer (15 gigawatts (GWh) per year), received new goals in 2013 to improve the energy efficiency and CO_2 intensity improvement for its main buildings. Between 2013 and 2015, skyguide saved 1.2 GWh, equivalent to more than two years energy consumption of the Geneva Tower.

2.3   Managing Risk

Carbon footprinting often includes measuring and monitoring a range of sources of GHG emissions, and natural resources such as oil, refrigerant gases and emissions associated with processing and distribution of water. There is a risk to the environment if there is an escape of refrigerant gases into the atmosphere. Monitoring can be a useful front-line control in determining whether there are any issues or system failures.

2.4   CSR reporting

Corporate social responsibility (CSR) reporting is a way of self-regulating which allows a company to set and manage its environmental goals and monitor how it performs within the interests of its local community and national goals. CSR aids a company to work towards sustainability and often disregards any economic impacts, positive or negative. This business model allows the company to set objectives, and manage performance, and encourages a push towards sustainable development.

Airports and air traffic are often perceived negatively because of their environmental impacts. However, by undertaking a carbon footprint assessment alongside a CSR report, ANSPs can promote their efforts to improve sustainable economic growth and demonstrate how cooperation with airports and airlines leads to benefits including emissions reduction.

NATS example

As part of NATS' support for the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP) Paris Agreement in December 2015 it committed to:
— An international voluntary framework to transparently report greenhouse gas emissions performance
— Adopt the Greenhouse Gas Protocol to measure greenhouse gas emissions
— Report greenhouse gas emissions to CDP (formerly known as the Carbon Disclosure Project).

Since then NATS has taken steps to improve its internal controls, processes and management of greenhouse gas emissions, including independent external assurance of its energy and environmental performance information to the International Standard of Assurance and Engagement (ISAE) 3000 standard.

For NATS this move was not only to support emissions reductions, but also to demonstrate transparency and credibility to the public and to provide internal assurance on the accuracy of environment performance reporting data.

In December 2016, NATS achieved a B grade for its first year of reporting GHG emissions to CDP for its success in responsibly managing and reporting a reduction in GHG emissions in United Kingdom (UK) airspace and across the business estate. The average grade worldwide was C.

2.5   EU Non-Financial Reporting

The Directive of the European Parliament and Council No. 2014/95/EU[4] on non-financial reporting requires large firms to regularly feature non-financial information about their activities. It is a tool for integrating values, management improvements, and strategic decision-making.

Regular reporting helps companies identify sustainability risks and increases the confidence of investors and consumers. The directive applies only to public companies with more than 500 employees, with total assets of more than 20 million euros and net profit of more than 40 million euros. However, the Directive does not prevent Member States from requiring non-financial information from businesses that are not covered by this Directive.

This Directive provides tools to monitor and manage business performance and the impact of companies on society and to achieve a higher level of transparency of social and specialised environmental information provided by companies in all sectors.

The ultimate aim of the Directive is to promote a change towards a sustainable economy and long-term profitability, social equity and environmental protection. Beginning in 2017, respective companies will have to report their first non-financial information for the financial year 2017. It is expected that the Commission will also prepare non-binding guidelines covering environmental aspects regarding land use, water use, greenhouse gas emissions and the use of materials. Thus, this directive becomes associated with carbon footprinting.

[4] Directive of the European Parliament and Council No. 2014/95/EU amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groups, October 2014

2.6   Cooperation with Airport Carbon Accreditation

In 2007, Airports Council International (ACI) Europe members committed to reduce airport CO_2 emissions and set a goal to become carbon neutral.

ACI Europe also developed a tool to help airports achieve this goal, known as Airport Carbon Accreditation (ACA). ACA follows the basic principles given by the World Business Council for Sustainable Development[5] (WBCSD) and the World Resource Institute (WRI) *Greenhouse Gas Protocol Corporate Accounting and Reporting Standard*[6]. There are four main steps or levels of airports certification. In the third level – called 'optimisation' – third party engagement is expected. This is the necessary step for ANSPs to be involved in carbon footprint management and efficient reduction in GHG emissions. As ANSPs' customers, airports are increasingly looking for collaborative support from ANSPs in delivering their operational and environmental goals.

Source: Austro Control

Vienna Tower

Vienna Airport (Flughafen Wien AG) example

Flughafen Wien AG has been involved in the ACA programme since 2014. In 2015, it introduced Level 2 - reduction of CO_2 emissions on site. Carbon footprint is measured annually to monitor developments, trends and create new measurements for reducing emissions. The largest source of CO_2 at the airport is air traffic, which represents about 76 percent of CO_2. Only 13 percent of that is produced by Flughafen Wien AG. With efficient and effective cooperation with all involved partners, including Austro Control, the remaining CO_2 emissions at the airport can be managed and reduced.

[5] World Business Council for Sustainable Development
[6] www.ghgprotocol.org/files/ghgp/public/ghg-protocol-revised.pdf

2.7   Commercial Business

Some ANSPs aspire to grow their businesses beyond their traditional State boundaries and when tendering for new contracts are increasingly being asked to demonstrate their environmental credentials in addition to their costs and product benefits. This trend is not only applicable to aviation but to most business. An increasing prerequisite when bidding for new commercial work is having an environmental management system, an environmental policy, and understanding the carbon footprint of their operations.

NATS example

In the UK, the provision of air traffic control (ATC) at airport towers is deregulated such that NATS has to bid to win and retain contracts on a rolling basis. The requirement to have an environmental management system in place, certified against an international standard, has become ever more imperative and thus its environmental programme offers an opportunity to show additional value over competitors.

3

Carbon Footprint Standards:

What is right for you?

Following governmental and societal demands for increased transparency on greenhouse gas emissions, industry standards have been developed to help companies and organisations conduct repeatable accounting and reporting of GHG emissions.

This chapter summarises a comparison among various standards regarding GHG accounting, while identifying the similarities and differences among these standards to assist ANSPs in deciding which standard to choose.

This chapter will focus on three main GHG standards:

1. GHG Protocol
   a. A Corporate Accounting and Reporting Standard [7]
   b. The GHG Protocol for Project Accounting [8]
2. ISO 14064 [9]
   a. ISO 14064 – Part 1: Specification with guidance at the organisation level for quantifying and reporting of greenhouse gas emissions and removals
   b. ISO 14064 – Part 2: Specifications with guidance at the project level for quantifying, monitoring and reporting of GHG emission reductions or removal enhancements
   c. ISO 14064 – Part 3: Specifications with Guidance for the Validation and Verification of Greenhouse Gas Assertion
3. ISAE 3410 – Assurance Engagements on Greenhouse Gas Statements [10]

The GHG Protocol Initiative[11] is a multi-stakeholder partnership of businesses, non-governmental organisations, governments and other stakeholders. It is the first systematic guide for quantifying and reporting GHG emissions, with the first edition published in 2001.

In 2006, the ISO adopted the GHG Protocol Corporate Standard[12] as the basis for its ISO 14064-Part I Specification with guidance at the organisation level for quantification and reporting of greenhouse gas emissions and removals. At the same time Parts 2 and 3 were published.

The *International Standard on Assurance Engagements* (ISAE) document 3410 was approved in 2012 to address the increasing emergence of carbon trading schemes and other global emissions reporting initiatives. ISAE 3410 stresses the importance of decisions being made based on reported emissions information. This standard also defines professional accountants' responsibilities with respect to assurance engagements on a greenhouse gas statement.

While ISAE focuses on assurance and accounting accuracy for an entity's GHG statement, this guidance document presents a more detailed comparison of ISO 14064 and GHG Protocol in Table 1 on the next page.

---

[7] Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard, World Resource Institute, February 2013, www.ghgprotocol.org/standards/corporate-standard, www.iso.org

[8] Greenhouse gases – ISO 14064 – Part 1: Specification with guidance at the organisation level for quantifying and reporting of greenhouse gas emissions and removals, March, 2006, www.iso.org

[9] International Organisation for Standardisation, ISO 14067 : 2013, Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification and communication, May 2015, www.iso.org

[10] International Auditing and Assurance Standards Board, ISAE 3410 - Assurance Engagements on Greenhouse Gas Statements, June 2012, www.iaasb.org

[11] www.ghgprotocol.org

[12] www.ghgprotocol.org/standards/corporate-standard

Table 1 – Comparison between ISO 14064 and GHG Protocol Chapters

Subject	GHG Protocol	ISO 14064	Comments
Purpose	Introduction **Chapter 1.** **Chapter 2.**	**Part 1** **Introduction** **1. Scope**	-
Gases	**Introduction** carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluocarbons and sulfur hexafluoride	**Part 1** **2. Terms and definitions, para 2.1.** carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluocarbons and sulfur hexafluoride	Both standards cover the accounting and reporting of the six GHGs covered by the Kyoto Protocol
Setting Organisational Boundaries	**Chapter 3.** Control approach (financial or operational) or an equity share approach	**Part 1** **Organizational boundaries 4.1.** **Annex A** control approach (financial or operational) or an equity share approach	They both present two different approaches, which are very similar in intent. They are based on the existence of different facilities or operations. Greenhouse gas protocol (GHGP) provides significantly more guidance and support when defining which approach is more likely to fit a particular company and includes real examples.
Setting Operational Boundaries	**Chapter 4.** Classifies emissions as Direct (Scope 1), Indirect (Scope 2) and Other Indirect (Scope 3)	**Part 1** **Operational boundaries** **4.2. Annex B** Classifies emissions as direct, indirect and other indirect	The definitions are the same as is the requirement for measurement of both direct emissions (scope 1) and indirect emissions (scope 2). Despite some examples given on ISO 14064, Annex B, GHGP offers significantly more guidance and support when determining which sources to include in scope 3.
Guidance on accounting of indirect emissions from purchase, sale and consumption of electricity	**Annex A**	-	No guidance on this is provided in ISO.
Accounting for sequestered atmospheric carbon	**Annex B**	-	No guidance on this is provided in ISO.
Tracking emissions	**Chapter 5.**	**Part 1** **Base-year GHG inventory 5.3.**	Both standards refer to a base year and the possibility of recalculating base year emissions when/if necessary. GHGP provides more information about the situations that may necessitate recalculating and examples of how such adjustments should be made.

Identifying and calculating GHG Emissions	**Chapter 6.** 5-step process	**Part 1 Quantification of GHG emissions and removals 4.3.** 5-step process	Both standards present a 5-step process; while the steps are not the same they are similar. GHGP provides more information and guidance on this subject and includes an overview of the GHG calculation tools available on the GHG Protocol Initiative Website.
Uncertainty	**Chapter 7.**	**Part 1 Assessing and reducing uncertainty 5.4. Ref. [5]**	ISO recommends an uncertainty assessment, and management and reduction of uncertainties, suggests the principles and methodologies of Reference 5. On the other hand, GHGP has developed a supplementary guidance document on uncertainty assessments along with an Uncertainty Calculation Tool, available on the GHG Protocol website. GHGP recognises the limitations of uncertainty usage in a highly uncertain field.
Managing Inventory Quality	**Chapter 7.**	**Part 1 GHG inventory quality management 6.**	Both standards are similar on this matter. ISO 14064 provides concise and assertive information. GHGP is much more descriptive, offering more guidance and support when developing a quality management system related to the quality of GHG emissions inventory.
Accounting for GHG Reductions	**Chapter 8.** GHG Protocol for Project Accounting	**Part 1 Organizational activities to reduce GHG emissions or increase GHG removals 5.2. ISO 14064 – Part 2 Ref. [4] and [6]**	ISO 14064 – Part 2 has specifications with guidance at the project level for quantifying, monitoring and reporting greenhouse gas emission reductions or removal enhancements. Both standards offer guidance defining principles, concepts and methods for quantifying GHG reductions. Both refer to credibility and transparency on communicating data.

Reporting GHG Emissions	**Chapter 9.**	**Part 1 Reporting of GHG 7.**	Credibility, consistency, accuracy, relevant information and the need for transparency are referenced in both standards. The most important aspects such as which gases to report, information on both organisational and operational boundaries, what and how to report, etc., are very similar, or nearly identical.
Verification	**Chapter 10.**	**Part 1 Organization's role in verification activities 8. ISO 14064 – Part 3**	ISO 14064 – Part 3 has specifications with guidance for validating and verifying greenhouse gas assertion. ISO 14064 is, for this matter, much more descriptive, although Chapter 10 also offers direct and practical information. For both the outlines are identical. ISO 14064 recommends undertaking verification. GHGP states that verification is relevant to companies that are developing GHG inventories. Note: Regarding verification, ISAE 3410 can be used as a guide for professional accountants, regardless of which standard is followed.
Setting a GHG Target	**Chapter 11.**	-	ISO does not address voluntary targets. GHGP offers a 10-step process in setting a GHG target. It also describes why and how to set a target, types of targets, and how to report against a target.

The two standards are very similar in content and intent. However, there is a clear difference in the nature of both documents. The GHG Protocol provides a more motivational drive while the ISO document is a pure process standardisation document. The lack of GHG targets in ISO 14064 highlights this difference.

In general, for an ANSP taking the first steps in carbon footprinting, and not yet familiar with this topic, the GHG Protocol can be a very useful tool. It is more descriptive and provides further guidance through real examples. The GHG Protocol also provides clear and practical information on setting organisational and operational boundaries, which is a fundamental step when calculating GHG emissions.

Nevertheless, an ANSP reporting against ISO requirements can also take some useful information from the GHG Protocol guidance and context.

Generally, a company with a GHG report that met ISO requirements would for the majority of cases also meet GHG Protocol requirements, and vice versa. It is also feasible to review both documents and create an internal process to accomplish an assessment that best meets national needs.

4

Getting Started

This section describes the high-level steps required to complete the calculation of a carbon footprint. While it is best practice to work towards one of the international standards described in Section 3, if an organisation has not calculated a carbon footprint before, it should review this chapter before beginning. Which approach to take depends on organisational capabilities, goals and objectives, and how the results will be used. Accuracy and consistency is paramount and may require advice from a consultant or expert in the area. A five-step approach is advised:

— Identifying GHG sources
— Defining the calculation methodology
— Collecting activity data and emission factors
— Calculation
— Integrating into the company's managerial processes

Defining clear operational and geographical boundaries covered by the carbon footprint assessment enables the process to remain as concise or broad as an organisation needs. This allows for transparency, especially if the results are to be reported externally. Typical boundary considerations include:

— If an organisation has multiple sites, how many of these are included?
— If an organisation works internationally, are sites in different countries calculated differently using country specific emission factors or just one set of emission factors from the originating country?
— Are the activities and emissions from any contractors and sub-contractors included?

Where an organisation is owned by multiple parties, the GHG Protocol describes two methods of consolidating GHG emissions to define the operational boundaries:

— **Equity share approach:** GHG emissions are split based on a company's share of equity in the operation, which is usually a company's percentage ownership.
— **Control approach:** GHG emissions are the responsibility of the company that has control over the operations from which they are emitted. It does not account for GHG emissions from operations that a company may own equity in but has no control over.

Once the boundary limits of a carbon footprint assessment are set, a widely accepted approach for identifying and categorising the emissions is by grouping activities into three broad groups known as 'scopes' defined by the GHG Protocol. The three scopes commonly used to categorise emissions from business activities are:

— **Scope 1**: Direct emissions. This includes all GHG emissions owned or controlled by the business. Examples include emissions from fossil fuels burned on the site, emissions from other entities owned or operated by the ANSP, or entity leased equipment and vehicles.
— **Scope 2**: Energy indirect. This includes indirect GHG emissions from consumption of purchased electricity, heat, steam and cooling. These indirect emissions are a consequence of the organisation's own activities but occur at sources they do not own or control.
— **Scope 3**: Other indirect emissions. These occur at sources not owned or controlled by the organisation and are not classified as Scope 2. Examples include business travel and any outsourced activities such as waste disposal.

To ensure relevant activities are captured, an assessment of all activities can establish whether the activity has direct emissions over which the business has control, or whether it is an indirect

source. Once the activities have been identified and categorised within the three scopes and boundaries set, the organisation should determine the period they will report. This is typically the preceding 12 months and ideally corresponds with the financial or calendar year, which allows for easier comparison of performance.

Aircraft emissions

Aircraft operators have the primary responsibility for GHG emissions created from their use of fuel while delivering their services (Scope 1). However, recognising that ANSPs can influence emissions from aircraft under their control, some ANSPs choose to measure and report on air traffic emissions under their Scope 3 reporting. For some ANSPs, the influence they can have on aircraft fuel burn can be more significant than the impact they can have managing their own direct emissions. Because of the complexity in measuring aircraft emissions, many organisations will take the approach to measure the impact of individual projects.

Some examples where an ANSP can influence emissions include:
— Large scale infrastructure design change affecting the vertical and horizontal performance of aircraft in terms of where they actually fly day-to-day or affecting how airlines fuel plan to use airspace (airspace design, free-route, precision-area navigation (P-RNAV), standard instrument departures (SIDs), and standard terminal arrival routes (STARs))
— Small scale changes to procedures
— Implementing controller or air traffic management tools or procedures such as speed control
— Tactical delivery by controllers of aircraft flight profiles day-to-day (direct routeing, continuous descent operations, continuous climb operations)
— Collaborating with military and other stakeholders (flexible use of airspace)

4.1 Basic Carbon Footprint

A basic carbon footprint is generally only used internally by an organisation and is relatively straightforward to determine. It can be used as a starting point if an organisation is new to carbon footprint measuring and reporting. The major emissions are from direct emissions (Scope1), and from energy indirect emissions (electricity, Scope2), and it is usual to exclude some or all of the indirect emissions (Scope 3) which are harder to quantify.

To calculate a basic carbon footprint it is necessary to collect data from all utility meters feeding the organisation and to quantify the total. The utilities usage is then converted into an amount of CO_2 using set conversion measures known as emissions factors. An emission factor is defined as the average emission rate of a given GHG for a given source, relative to units of activity. Each country will have its own set of emission factors for organisations based in that country or internationally. Just focusing on energy use, it can be understood how the emissions factors might vary from one country to another and from year to year. The carbon intensity of the energy used depends on that country's energy supply in terms of proportions of energy derived from nuclear, coal, gas and renewables.

These emissions factors are necessary to complete a thorough carbon footprint. When the country has its own emissions factors document, it should be used in the carbon footprinting process. Indirect emissions sources such as waste and emissions from the supply chain are optional for the basic footprint.

The completed footprint will be expressed in tonnes CO_2 (t CO_2) or tonnes CO_2 equivalent (t CO_2e) if assessing a wider range of GHGs. For example, including emissions from air conditioning systems such as chlorinated hydrofluorocarbons where different emissions factors apply. It is good practice to present data as an overall amount for the organisation as well as subtotals in each emissions source; this enables the primary sources to be identified for reduction initiatives.

Basic Carbon Footprint Examples – depending on different setting and preferences
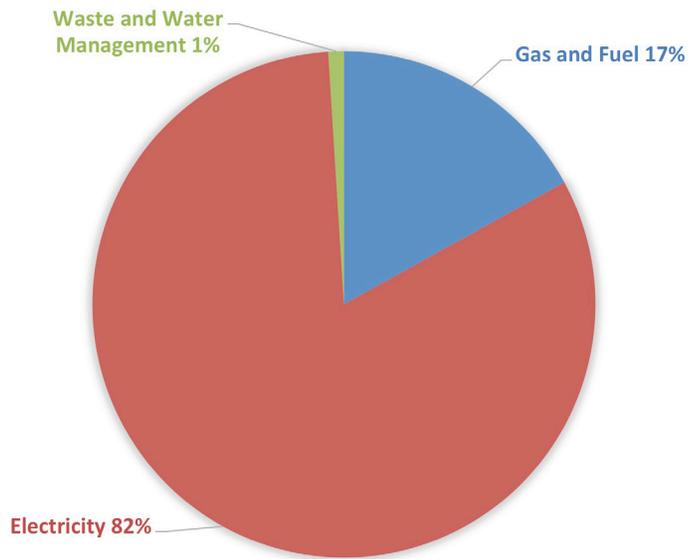
Figure 1: Generic Examples of Basic Carbon Footprint (ANS CZ example)

It is also good practice to show trends over time to understand how the organisation is performing. Once this information is available, it is a relatively simple step to also present the information in terms of 'intensity based metrics', for example carbon per employee or per aircraft movement, or as carbon intensity compared to revenue.
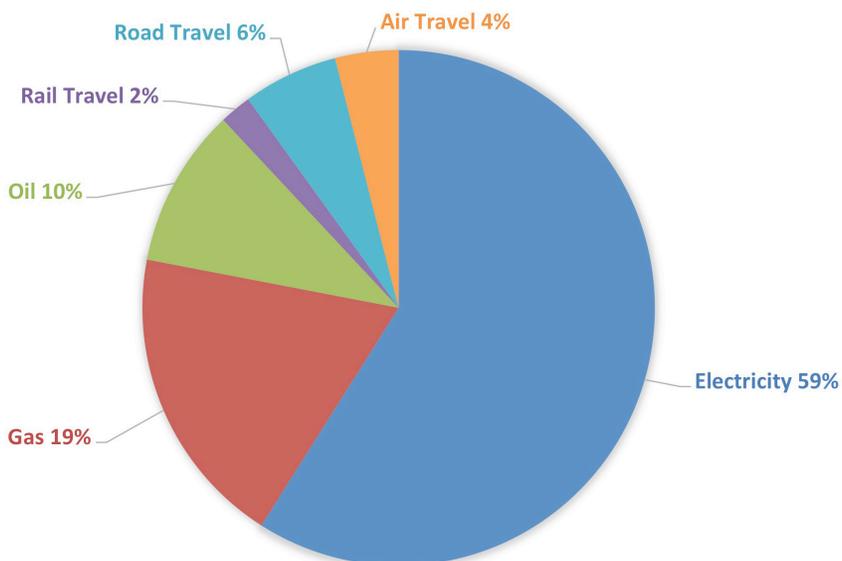
Figure 2: Generic Examples of Basic Carbon Footprint (NATS example)

Source: NATS
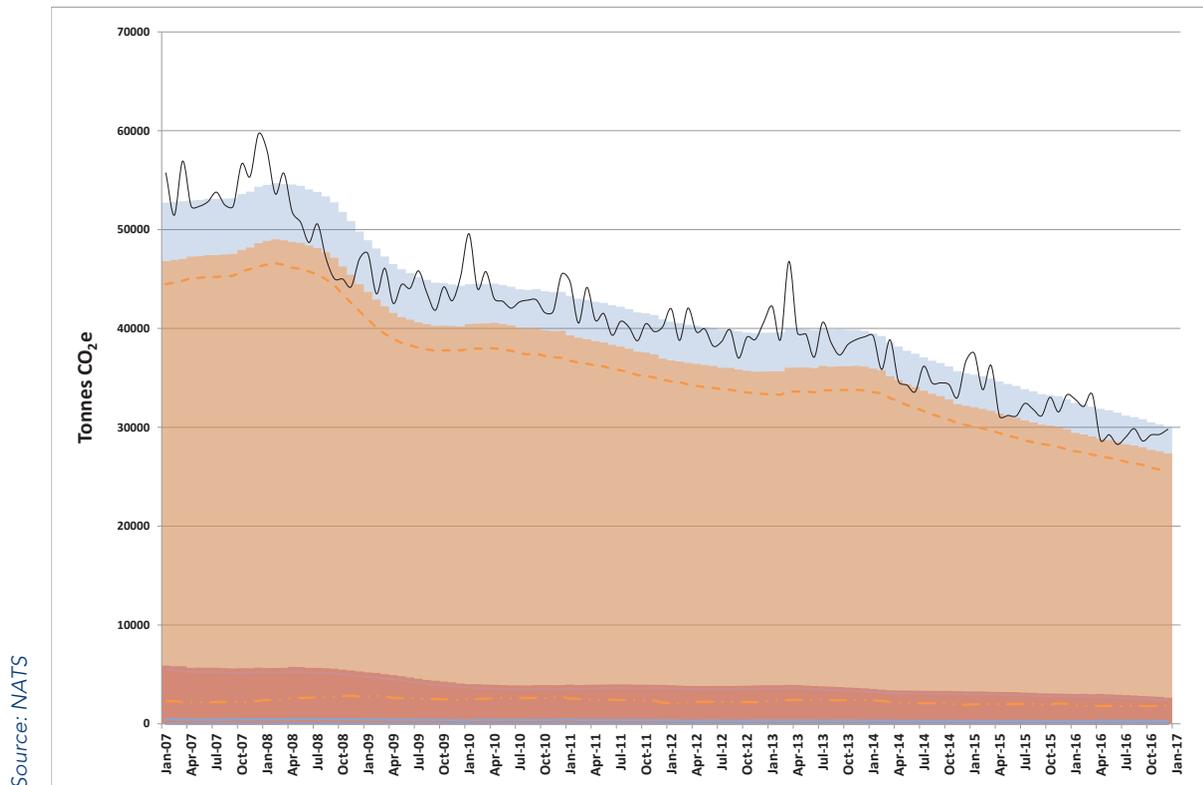
Figure 3: NATS Carbon Footprint from energy consumption over time.

The Figure 3 graph captures the carbon impact of powering NATS buildings and infrastructure in the UK. Dotted lines indicate different component parts of the business and individual buildings. The overall trend is down by over 30 percent since 2008 due largely to consolidating buildings to more efficient sites and employing energy reduction initiatives.

4.2 Full Carbon Footprint

If an organisation intends to apply for accreditation then it is likely that a full assessment of its carbon footprint will be required, including calculating its Scope 3 emissions.

This section provides a step-by-step guide for calculating a full carbon footprint. As with a basic carbon footprint, an organisation should start with defining the scope and GHG sources (see section 4.1).

4.2.1 Identify key activities and areas of impact

It is necessary to carry out a detailed review of the organisation to identify 'environmental aspects and impacts'.

Environmental Aspects and Impacts[13]

An environmental aspect is defined as an "element of an organisation's activities or products or services that can interact with the environment". An environmental impact is also defined within ISO14001:2015 as "any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects". These are often thought of as cause and effect. One aspect (cause) can have multiple impacts (effects).

[13] Environmental Management Systems, ISO 14001:2015 - Requirements with guidance for use, September 2015, www.iso.org

When identifying environmental aspects, ANSPs should consider the different business activities, including routine activities and specific projects. It is worth noting that not only should the environmental aspects that the organisation can control be considered, but also those that they can only influence, such as outsourced services. It is also relevant that environmental aspects must be identified in situations of normal operation and in emergencies.

After this identification, it is necessary to proceed to the respective assessment of significance and ranking of aspects. The methodology for this should be set internally and should be adjusted whenever appropriate; nevertheless, there are some examples of criteria that are commonly used such as legal compliance, quantity, frequency, severity. For the purposes of footprinting, the assessment of aspects and impacts should identify all elements that should be captured in the overall footprint process within the previously defined scope.

This evaluation prompts many organisations to manage their impacts by focusing on actions to mitigate the significant environmental aspects as a priority.

4.2.1.1 Energy use

Due to the nature of activities conducted by an ANSP, energy use (e.g., generators, powering buildings and air traffic systems, and fuel) would be expected to be a significant environmental aspect; therefore, activities should be undertaken in this area regularly. Some activities that can help minimise impacts associated with energy consumption include:

— Raising the awareness of employees
— Replacing conventional lighting for other more efficient lamps (LED or fluorescent)
— Improving the management of heating ventilation air conditioning (HVAC) equipment operating hours

— Free-cooling techniques (i.e., outside air is used when appropriate)
— Installing motion sensors for lighting control
— Options for renewable energy production

4.2.1.2 Transport

Activities that can minimise impacts associated with transport (business travel, inter-site commuting, maintenance visits and duty travel) include:

— Raising the awareness of employees (e.g. economical driving training for professional drivers)
— Preference for online meetings
— Options to travel on transport with lower carbon footprint (public transport, biking, car-pooling, use of train rather than car or aircraft)
— Acquisition and use of electric cars or hybrids

Mobility is one of the most energy-consuming activities for an ANSP. In skyguide, it is equivalent to the energy consumed by its infrastructure (15 GWh in 2015). However, only a fraction of the use relates to business travel; in fact, 83 percent of this amount is consumed by employees commuting from home to the office. skyguide has made itself accountable for this consumption, and has developed a 'work from home' practice for all eligible roles in the company. For eligible employees, up to 20 percent of their time can be worked from home, which should help to reduce consumption each year to an equivalent of one and a half year's energy consumption of Geneva Tower.

4.2.1.3 Recycling and Waste Management

Other activities that can help minimise impacts associated with waste management include:

— Raising the awareness of employees (e.g. specific training for employees on the electromechanical systems)

— Depositing and selective collection of waste by type of waste, especially hazardous and non-hazardous
— Rigorous monitoring of waste management service providers

For example, skyguide takes note of the compression of waste and arranges with other companies to reduce the number of waste pickup and disposal journeys for the garbage trucks.

4.2.1.4 Water Use

Activities to minimise impacts associated with water consumption include:
— Raising the awareness of employees of water usage
— Decoration with plants that require low water consumption
— Replacing conventional water taps for taps with sensors or timers
— Optimising irrigation in garden areas or using rainwater for irrigation
— Using water-efficient toilets.

4.2.1.5 Supply Chain

Activities that can help minimise impacts associated with the supply chain, including policies and processes for sustainable procurement (purchased goods and services, catering, transport and distribution) include summarising commonly purchased products and services, and where possible, identifying the respective ecological criteria. Specific examples are highlighted in Table 2.

Product/ Service	Ecological criteria
Desktop computers, laptops and printers	Compliance with Energy Star[14].
Herbicides, pesticides	Preference for non-hazardous products, or other less dangerous, and/or more efficient.
Paper	Paper should be totally chlorine free or elemental chlorine free; Preference for paper with a higher percentage of recycled fibres; Paper weight reduction (such as printing with 75mg instead of 80mg paper); Raw material from certified forests, including Forest Stewardship Council (FSC) certification or Programme for the Endorsement of Forest Certification Schemes (PEFC).
Services: waste management operator, holding cafeteria, maintenance of green areas, cleaning services.	Option by companies certified by the Environmental Management Standard - ISO 14001:2015 and EU Eco-Management and Audit Scheme (EMAS) ; Ensure information and/or proper training on good practices in environment.

Table 2 – Products and Service Providers: Ecological Criteria

[14] International standard for energy efficient consumer products originated in the United States by the Environmental Protection Agency and the Department of Energy. It has since been adopted by Australia, Canada, Japan, New Zealand, Taiwan, and the European Union.

Skyguide saved 937 kg of paper per year by switching paper weight from 80 to 75mg paper (hardly noticeable).

4.2.1.6 Dangerous and Hazardous Substances

Impacts associated with the use of dangerous and hazardous substances (e.g., refrigerant losses to atmosphere) can be reduced by:
— Raising the awareness of employees (e.g., specific training for employees on the electromechanical systems)
— Ensuring regular maintenance of HVAC equipment to detect possible gas leakage
— Rigorous monitoring of HVAC maintenance service providers (e.g. ensure maintenance of equipment is by certified technicians, and in legal compliance of maintenance intervals).

4.2.2 Define the methodology

As an accurate carbon footprint is likely to form the basis of long-term future assessment of carbon use, it is important to define the methodology used from the outset. This will also help in a large organisation that may depend on many individuals to collect the necessary data.

Emissions from individual sources may be determined via measurement, calculation or a mixture of both. An example of measurement is the reading of utility meters where a simple calculation model is used, for example to determine CO_2 emissions from the total distance travelled in a car journey. For each CO_2 source considered (for example electricity, business travel, etc.), it is necessary to document the methodology used so that it may be verified and applied consistently in the future.

For comparison purposes, a base year of carbon emissions is usually determined. The exact scope of this base year should be documented in sufficient detail so that it may be adjusted should the organisation or the methodology change significantly, affecting future calculations of an annual carbon footprint.

4.2.3 Collect Emissions Data and Calculate Footprint

A routine program of data collection should be defined and executed. This may be quarterly or monthly but needs to be regular enough to enable an understanding of the carbon footprint so that it can be measured against set targets.

The effects of carbon reduction initiatives may also be measured by regular assessments. It may make sense, for example, to measure the major contributors monthly and only quarterly for the minor contributors. Contractual agreements with suppliers may be written to require them to report regularly their carbon contribution, which will reduce the data collection burden on the ANSP.

The most appropriate area for data collection will vary among organisations, but will likely involve finance, facilities management and administration sections as these groups have access to all the information from energy and transport suppliers. Many utilities management tools exist which help collate the data and may already be in use in some organisations. Some commercial tools also provide a means of calculating the carbon impact of utilities' use. It is worth identifying what an organisation currently uses.

One way of ensuring data collection takes place is to implement an EMS; this would install a systematic method of monitoring and recording environmental data, as well as help verify data quality as an accredited EMS requires external audits.

4.2.4 Verify Results

If the detailed footprint is to be used for public reporting, or to fulfil reporting requirements for offset credits as part of a carbon neutral scheme, it will be necessary to have the footprint results independently audited by an external body.

ISO14064 is an internationally recognised standard, which specifies principles and requirements for an organisation to quantify and report GHG emissions. Whether an organisation

is working towards accreditation or is new to quantifying GHG emissions, using an external auditor will provide assurance on methods used and results. Non-financial reporting is becoming much more recognised. Chapter 10 of the GHG Protocol outlines verification methods and the International Standard on Assurance Engagements (ISAE)[15] has developed auditor guidelines for assurance engagements on GHG statements (ISAE 3410).

This task is analogous to auditing company financial accounts and is typically performed by similar companies. The audit will take into account the completeness of the assessment and consistency with previous calculations, including the definition of scope and boundaries, as well as the data collected for the reporting period. Auditing should be performed by an organisation accredited for GHG emissions auditing.

4.2.5 Reduction Plan
The next step after accounting GHG emissions should be to define a reduction plan. These reductions are calculated by comparing changes in the company's actual emissions inventory over time relative to the base year, which can highlight important steps for developing a reduction plan:
— Setting GHG targets
— Identifying suitable areas for reduction
— Focusing resources on activities that result in the most cost-effective GHG reductions (4.2.2).

4.2.6   Carbon Offset
There is a point at which the emission

reductions that can be achieved through a reduction plan can have a negative impact on the company's performance and/or are cost-prohibitive. Thereafter companies can partly, or completely, neutralise its carbon footprint through investing in projects that reduce or avoid GHG emissions. These then compensate for the environmental impact of the ANSP.

The most common offset projects are reforestation, replacement of fossil fuels by alternative energy projects, waste recovery, or by purchasing carbon credits.

4.2.7   Reporting
While it is not mandatory that an organisation disclose its carbon footprint, it can contribute significantly to the corporate objective and the footprint can be communicated as part of the ANSP's corporate and social responsibility reporting. When reporting, it is useful to present the total carbon footprint in context rather than in isolation, where possible showing the ANSP's contribution relative to the region and other businesses in the area.

To highlight the result of carbon reduction initiatives, comparison with previous years and performance against any reduction targets will show how the organisation has performed. To address any significant changes within the organisation's activities, it may be useful to present the carbon emissions normalised to key business indicators such as CO_2 emissions per employee or CO_2 emissions per facility.

[15] International Standard of Assurance and Engagement (ISAE) 3000 Revised, Assurance Engagements Other than Audits or Reviews of Historical Financial Information, The International Federation of Accountants, December 2013

5

Conclusion

Many CANSO Member organisations have already seen the benefits of carbon footprinting in their own organisations. By measuring their estate impacts they have been able to identify areas of improvement, reduce environmental impacts and use of resources, while reducing risks and costs and supporting customers in their environmental goals.

Measurement through carbon footprinting has not only been the driver to implement short-term actions, but also for a permanent change in staff mind-set and the organisations' approach in general. Once the implementation of carbon footprinting has been embraced, the benefits quickly become obvious and carbon footprinting becomes an integral part of the organisation's philosophy.

References

1. CANSO Carbon Footprint for Air Navigation Service Providers Guidance Document, April 2008

2. International Organisation for Standardisation, ISO 14064 : 2006, March 2006, www.iso.org

3. International Organisation for Standardisation, ISO 14067 : 2013, Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification and communication, May 2015, www.iso.org

4. PAS 2050 – a specification for the assessment of the life cycle GHG emissions of goods and services, and a core document for the other carbon footprint standards, February 2008

5. Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard, World Resource Institute, February 2013, www.ghgprotocol.org/standards/corporate-standard, www.iso.org

6. IPCC Guidelines for National Greenhouse Gas Inventories (Intergovernmental Panel on Climate Change, 2006

7. NATS Responsible Business Report, 2015 - 16 – www.nats.aero/wp-content/uploads/2016/06/NATS-Responsible-Buiness-report-2015-16.pdf

8. Energy Strategy 2050, Swiss Federal Council and Parliament, September 2016

9. www.nats.aero/news/nats-is-the-first-ansp-to-commit-to-international-standard-reporting-of-greenhouse-gas-emissions/

10. International Standard of Assurance and Engagement (ISAE) 3000 Revised, Assurance Engagements Other than Audits or Reviews of Historical Financial Information, The International Federation of Accountants, December 2013

11. Directive of the European Parliament and Council No. 2014/95/EU amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groups, October 2014

12. The GHG Protocol for Project Accounting, World Resource Institute, November 2005

13. Greenhouse gases- ISO 14064 – Part 1: Specification with guidance at the organisation level for quantifying and reporting of greenhouse gas emissions and removals, March 2006, www.iso.org

14. Greenhouse gases - ISO 14064 – Part 2: Specifications with guidance at the project level for quantifying, monitoring and reporting of GHG emission reductions or removal enhancements, March 2006, www.iso.org

15. Greenhouse gases - ISO 14064 – Part 3: Specifications with Guidance for the Validation and Verification of Greenhouse Gas Assertion, www.iso.org

16. International Auditing and Assurance Standards Board, ISAE 3410 - Assurance Engagements on Greenhouse Gas Statements, June 2012, www.iaasb.org

17. Environmental Management Systems, ISO 14001 : 2015 - Requirements with guidance for use, September 2015, www.iso.org

18. EMAS, EU Eco-Management and Audit Scheme (EMAS) Regulation (EC) No 1221/2009 of 25 November 2009

Acronyms

ACA	Airport Carbon Accreditation
ACI	Airports Council International
ANS CZ	Air Navigation Services of the Czech Republic
ANSP	Air navigation service provider
ATC	Air traffic control
ATM	Air traffic management
CDSB	Carbon Disclosure Standards Board
CFP	Carbon footprint product
CH_4	Methane
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CSR	Corporate social responsibility
EMAS	Eco-management and audit scheme
EMS	Environmental management systems
EU	European Union
FABEC	Functional Airspace Block Europe Central
FSC	Forest Stewardship Council
GHG	Greenhouse gas
GHGP	Greenhouse gas protocol
GWh	Gigawatts per hour
HFCs	Hydrofluorocarbons
HVAC	Heating, ventilation, and air conditioning
ICAO	International Civil Aviation Organization
IPCC	International Panel on Climate Change
ISAE	International Standard on Assurance Engagements
ISO	International Organization for Standardization
IT	Information Technology
N_2O	Nitrous oxide
NATS	National Air Traffic Services (UK)
PAS	Publicly available specification
PEFC	Programme for the Endorsement of Forest Certification
PFCs	Perfluorocarbons
P-RNAV	Precision-area navigation
SF_6	Sulfur hexafluoride
SID	Standard instrument departure
STAR	Standard instrument arrival route
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

Glossary

Term	Definition	Source information/ Reference
Assurance engagement	Engagement performed by a practitioner to express a conclusion conveying the level of assurance of a certain report against applicable criteria.	ISAE 3410, Assurance Engagements on Greenhouse Gas Statements
Applicable criteria	The criteria used by the entity to quantify and report its emissions in the GHG statement.	ISAE 3410, Assurance Engagements on Greenhouse Gas Statements
Boundaries	For the purpose of this guideline and with respect of GHG counting and reporting, we have boundaries as an inventory determining emissions counted and reported by the company/organisation.	GHG Protocol
Carbon Footprint	A carbon footprint is defined as the total amount of greenhouse gases produced directly or indirectly to support human activities. The footprint is usually expressed in tonnes of carbon dioxide (CO_2).	www.timeforchange.org/what-is-a-carbon-footprint-definition
Carbon neutrality	Status when the company completely offsets its carbon footprint to theoretically have zero carbon impact on the environment.	GHG Protocol/ ISO 14064
Direct GHG emissions	Emissions as a result of operations/activities of the company and also from sources owned/controlled by the company.	GHG Protocol
Greenhouse gases (GHGs)	The six gases listed by the Kyoto Protocol – CO2 (carbon dioxide), CH_4 (methane), N_2O (nitrous oxide), HFCs (hydrofluorocarbons), PFCs (perfluorocarbons), and SF_6 (sulfur hexafluoride).	Kyoto Protocol
Indirect GHG emissions	Emissions as a result of operations/activities of the company from a source owned/controlled by another company.	GHG Protocol/ ISO 14064
Inventory	A list of sources and related GHG emissions within the company.	GHG Protocol/ ISO 14064
Kyoto Protocol/ Gases	UNFCCC protocol which entered into force on 16 February 2005. Countries listed in Annex B of the Kyoto Protocol agreed to meet reduction targets of GHG emissions (CO_2, CH_4, N_2O, HFC, PFC and SF_6) relative to their 1990 levels during the period 2008 – 2012. http://unfccc.int/kyoto_protocol/items/3145.php	GHG Protocol
Scope 1	Direct GHG emissions resulting from activities controlled by the company (e.g. fuel used for heating or cooling, vehicle transport).	GHG Protocol
GHG Protocol	GHG emissions from the off-site generation of electricity purchased by the company.	GHG Protocol
Scope 3	Indirect GHG emissions from products and services purchased by the company, e.g. from sources which are not owned or controlled directly by the company.	GHG Protocol

CANSO Members

CANSO – the Civil Air Navigation Services Organisation – is the global voice of air traffic management (ATM) worldwide. CANSO Members support over 85% of world air traffic. Members share information and develop new policies, with the ultimate aim of improving air navigation services (ANS) on the ground and in the air.

CANSO represents its Members' views to a wide range of aviation stakeholders, including the International Civil Aviation Organization, where it has official Observer status. CANSO has an extensive network of Associate Members drawn from across the aviation industry. For more information on joining CANSO, visit canso.org/join-canso

Full Members - 87

— Aeronautical Radio of Thailand (AEROTHAI)
— Aeroportos de Moçambique
— Air Navigation and Weather Services, CAA (ANWS)
— Air Navigation Services Agency of Kosovo
— Air Navigation Services of the Czech Republic (ANS Czech Republic)
— AirNav Indonesia
— Air Traffic & Navigation Services (ATNS)
— Airports and Aviation Services Limited (AASL)
— Airports Authority of India (AAI)
— Airports Fiji Limited
— Airservices Australia
— Airways New Zealand
— Albcontrol
— Austro Control
— Avinor AS
— AZANS Azerbaijan
— Belgocontrol
— Bulgarian Air Traffic Services Authority (BULATSA)
— CAA Uganda
— Cambodia Air Traffic Services Co., Ltd. (CATS)
— Civil Aviation Authority of Bangladesh (CAAB)
— Civil Aviation Authority of Botswana
— Civil Aviation Authority of Mongolia
— Civil Aviation Authority of Nepal (CAAN)
— Civil Aviation Authority of Singapore (CAAS)
— Civil Aviation Authority of the Philippines
— Civil Aviation Department (CAD Hong Kong)
— COCESNA
— Croatia Control Ltd
— DCA Myanmar
— Department of Airspace Control (DECEA)
— Department of Civil Aviation, Republic of Cyprus
— DFS Deutsche Flugsicherung GmbH (DFS)
— Dirección General de Control de Tránsito Aéreo (DGCTA)
— DSNA France
— Dubai Air Navigation Services (DANS)
— Dutch Caribbean Air Navigation Service Provider (DC-ANSP)
— ENAV S.p.A: Società Nazionale per l'Assistenza al Volo
— Empresa Argentina de Navegación (EANA)
— ENAIRE
— Estonian Air Navigation Services (EANS)
— Federal Aviation Administration (FAA)
— Finavia Corporation
— General Authority of Civil Aviation (GACA)
— Ghana Civil Aviation Authority (GCAA)
— HungaroControl Pte. Ltd. Co.
— Instituto Dominicano de Aviacion Civil (IDAC)
— Israel Airports Authority (IAA)
— Irish Aviation Authority (IAA)
— ISAVIA Ltd
— Japan Air Navigation Service (JANS)
— Kazaeronavigatsia

— Kenya Civil Aviation Authority (KCAA)
— Latvijas Gaisa Satiksme (LGS)
— Letové prevádzkové Služby Slovenskej Republiky, Štátny Podnik
— Luchtverkeersleiding Nederland (LVNL)
— Luxembourg ANA
— Maldives Airports Company Limited (MACL)
— Malta Air Traffic Services (MATS)
— National Airports Corporation Ltd.
— National Air Navigation Services Company (NANSC)
— NATS UK
— NAV CANADA
— NAV Portugal
— Naviair
— Nigerian Airspace Management Agency (NAMA)
— Office National de LÁviation Civile (OFNAC)
— Office National Des Aéroports (ONDA)
— ORO NAVIGACIJA, Lithuania
— PNG Air Services Limited (PNGASL)
— Polish Air Navigation Services Agency (PANSA)
— Public Authority for Civil Aviation - Oman (PACA)
— ROMATSA
— Sakaeronavigatsia Ltd
— SENEAM
— Serbia and Montenegro Air Traffic Services Agency (SMATSA)
— Serco
— skyguide
— Slovenia Control
— State Airports Authority & ANSP (DHMI)
— Sudan Air Navigation Services Department
— Swaziland Civil Aviation Authority
— Tanzania Civil Aviation Authority
— Trinidad and Tobago CAA
— The LFV Group
— Ukrainian Air Traffic Service Enterprise (UkSATSE)
— Viet Nam Air Traffic Management Corporation (VATM)

Gold Associate Members - 10

— Boeing
— FREQUENTIS AG
— GroupEAD Europe S.L.
— Harris Corporation
— Inmarsat Plc
— Leidos
— Leonardo S.p.a.
— NAVBLUE
— Raytheon
— Thales

Silver Associate Members - 64

— 42 Solutions B.V.
— Adacel Inc.
— Aeronav Inc.
— Aireon

— Air Traffic Control Association (ATCA)
— Airbus Defence and Space
— Association Group of Industrial Companies "TIRA" Corporation
— ATAC
— ATCA – Japan
— ATECH Negócios em Tecnologia S/A
— Aviation Advocacy Sarl
— Aviation Data Communication Corp (ADCC)
— ADB SAFEGATE
— Avitech GmbH
— Bayanat Engineering Group
— Brüel & Kjaer EMS
— CGH Technologies, Inc.
— Comsoft GmbH
— CSSI, Inc.
— EIZO Technologies GmbH
— European Satellite Services Provider (ESSP SAS)
— Emirates
— ENAC
— Entry Point North
— Era Corporation
— Esterline
— EvBase Technologies Inc.
— Guntermann & Drunck GmbH
— Helios
— Honeywell International Inc. / Aerospace
— IDS – Ingegneria Dei Sistemi S.p.A.
— Indra Navia AS
— Indra Sistemas
— Integra A/S
— Intelcan Technosystems Inc.
— Jeppesen
— JMA Solutions
— Jotron AS
— Kongsberg Defence & Aerospace AS
— LAIC Aktiengesellschaft
— LEMZ R&P Corporation
— Lufthansa Systems FlightNav AG
— Metron Aviation
— Micro Nav Ltd
— The MITRE Corporation – CAASD
— MovingDot
— NEC Corporation
— NLR
— Northrop Grumman
— NTT Data Corporation
— Project Loon
— Rockwell Collins, Inc.
— Rohde & Schwarz GmbH & Co. KG
— Saab AB
— Saab Sensis Corporation
— Saudi Arabian Airlines
— SENASA
— SITA
— SkySoft-ATM
— Snowflake Software Ltd
— STR-SpeechTech Ltd.
— Tetra Tech AMT
— Think Research Limited
— Unifly