CONNECTING SMES TO GHG INVENTORY RESOURCES

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Abstract

The first step to carbon neutrality is an inventory of greenhouse gas (GHG) emissions. Small-to-medium-sized companies (SMEs) cannot afford consultants for the task, and lack the time to find necessary resources. The goals of our project, sponsored by the Centro Nacional de Producción más Limpia (CNP+L), were to identify the problems SMEs in Costa Rica face in conducting and verifying an inventory, to find information and tools to address this problem, and to connect SMEs to these resources. We researched the inventory process, applicable standards, and conducted interviews with individuals representing various perspectives on GHG inventorying for SMEs. Using this information, we designed a brochure and database to facilitate SMEs' ability to conduct a GHG inventory.

Acknowledgements

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Executive Summary

Costa Rica became the first country to declare a national carbon neutrality initiative, aiming to accomplish this goal by 2021. The Centro Nacional de Producción más Limpia (CNP+L) is the Costa Rican subsidiary of the National Cleaner Production Centers (NCPCs), a global network of the United Nations Industrial Development Organization and the United Nations Environmental Program. NCPCs guide companies to provide technical support in their process of improving sustainability and help raise awareness of cleaner production. The first step towards obtaining carbon neutrality is to conduct a GHG inventory. The process of conducting a GHG inventory is complicated and hiring a consultant is very cost-intensive. Small-to-medium sized enterprises (SMEs) often do not have the time or financial resources to commit towards completing a GHG inventory. As an NCPC, the CNP+L seeks to find ways to connect SMEs to information on GHG inventories. CNP+L therefore tasked us with the goal of developing a way to consolidate the large amount of resources already available regarding GHG inventories and connecting SMEs to these resources.

Methodology

The purpose of our project, sponsored by CNP+L, was to connect SMEs to resources that would help them determine what is necessary to prepare and execute a GHG inventory. To facilitate this dissemination of information we created a brochure and resource database. In order to identify the best way to organize these resources, we developed three main objectives:

1. Clarify how GHG inventory standards are used in Costa Rica

2. Identify available resources and understand the most effective way to connect SMEs to these resources as they begin preparing GHG inventories

3. Design and produce a brochure to outline the most important information for a company to proceed with completing a GHG inventory

Our sponsors, Sr. Carlos Perera and Sra. Akira Hidalgo, directed us to the three main verification bodies in Costa Rica. The companies were EARTH University, SCS Global Services, and the Instituto de Normas Técnicas de Costa Rica (INTECO). From these companies we sought to identify which standards are most frequently utilized while conducting GHG inventories, recognize common issues SMEs face when seeking verification, and to contact SMEs that have had inventories verified and companies that are seeking verification for further interview purposes.

To find resources available for SMEs that clarified the GHG inventory process we were put in contact with a representative from ALIARSE, a company that works with SMEs in an advisory role, and both successfully-verified SMEs and SMEs still in the verification process. Through our discussions with these companies we again sought to identify issues companies faced during the process and how they overcame these issues.

Using the information gathered from both groups of interviews we sought to create a brochure to provide companies with a head-start in preparing and conducting a GHG inventory. In addition to our brochure, we compiled resources on a database and referenced this database in the brochure to facilitate further preparation of an inventory.

Findings

The standards used to verify inventories in Costa Rica are: PAS 2060, INTE 12-01-06, and ISO 14064. Out of these three, PAS 2060 and INTE 12-01-06 (Costa Rica's National Standard for Carbon Neutrality) are carbon neutrality standards, while ISO 14064 only provides requirements for quantifying emissions in GHG inventories. PAS 2060 is thus most suitable for companies involved in international markets. INTE 12-01-06 is most suitable for companies in Costa Rican markets. ISO 14064 informs inventory verification in general, and is most suited for companies undecided on committing to carbon neutrality.

SMEs encounter a variety of problems that delay their process of completing a GHG inventory. The first issue is that SMEs do not have a good understanding of the differences between the standards used in Costa Rica prior to pursuing a GHG inventory. Often the process of the inventory is unclear to them as well. Finally, although they are interested in completing an inventory, they do not realize that they need to maintain a year's worth of specific records in order to calculate their total emissions.

A variety of resources outlining the inventory process is available publicly. We were directed to a large number of these resources through interviews with representatives from the verification bodies, SMEs and ALIARSE. These resources include checklists for inventories, inventory templates for organization of data, and documents containing emission factors by sector specific to Costa Rica.

Resource Development for Deliverables

Though there are numerous international and national resources on GHG inventories, SMEs need to be presented these resources in an easy-to-understand way. The resources gathered from our interviews and prior research were compiled into a two-part deliverable: a brochure and a database. The brochure and database were designed to be used in conjunction with each other. Our database was intended to present nationally- and internationally-recognized resources for each step of the inventory process, and our brochure was intended to

outline the information necessary to understand these resources. Based on information from our interviews, the brochure consists of the following five sections: motivation and definition of GHG inventories, GHG inventory methodology, verification standards, recommendations, and contact information for verification bodies. The database is organized into six sections: Introduction and Definitions, Inventory Methodologies, Standards, GHG Emission Calculation, GHG Inventory Templates, and Overview of Verification Bodies.

Conclusions and Recommendations

The goal of our project was to compile information on conducting GHG inventories into a resource for SMEs in Costa Rica. We found that the three major standards for verification used in Costa Rica are ISO 14064, PAS 2060, and INTE 12-01-06 (The National Standard). We were also able to find existing resources that explain the standards used in Costa Rica, and outline the process of completing a GHG inventory. SMEs face unique difficulties due to their financial limitations, lack of in-house expertise, and inability to hire a consultant to assist in developing an inventory. Having access to these resources could allow companies to produce a GHG inventory without incurring unnecessary financial burdens. Due to the nature and large number of resources gathered, a two-part deliverable was created: a database referenced by a brochure. The brochure and database, used in conjunction with each other, provide SMEs with a starting point on their path towards achieving carbon neutrality.

Further, we make these recommendations to our sponsor, CNP+L, for future work:

1. If SMEs wish to complete a GHG inventory and obtain verification, CNP+L direct them to funding available through governmental programs.
2. The development of a companion resource, similar to the deliverable of this project, for SMEs seeking to reduce and compensate their emissions.
3. The development of a recommendation on how SMEs can better market their carbon neutral certification.
4. Provide resources specific to product level verification and completing product life cycle inventories according to standards such as PAS 2050 and ISO 14044.

Authorship

Maria Grandoni

Maria researched resources and arranged resources given by interview subjects and sponsors for the database that was part of the final deliverable. She also assisted in the editing and helped design the layout of the final report. In addition she wrote interview transcripts for the appendix as well as generated interview questions for verification companies and SMEs.

Nicholas Pakatar

Nick served as one of the primary authors and editors for a large amount of the paper. He completely authored the Methodology, and the Conclusion and Recommendations. He also contributed significantly to the Findings and Introduction chapters' authorship. He edited the majority of the sections of the paper. Along with the writing, he also helped prepare the interview questions and contributed to brochure content.

Shreyas Renganathan

Shreyas was a primary author and editor for the paper. He fully authored the Literature Review and Discussion sections, and had substantial authorship of the Introduction and Findings sections. He edited several sections of the paper. Shreyas also authored the majority of the content in the brochure, and generated some interview questions.

Sebastian Vergara

Sebastian designed and translated the brochure, and authored the majority of the content of the brochure. He also served as the focal point of contact for interviews and other communication with the team. Sebastian scheduled and led all interviews, and authored part of the Findings.

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Glossary of Terms

ALIARSE – La Organización promotora de Alianzas Publico Privadas para el desarrollo sostenible de Costa Rica

CONICIT – Consejo Nacional para Investigaciones Cientificas y Technologias

CNP+L – Centro Nacional de Producción más Limpia (Nacional Center for Cleaner Production)

CO_2 – Carbon Dioxide

DCC – Direccion de Cambio Climatico (Deparment of Climate Change)

DIGECA- Dirección de Gestión de Calidad Ambiental

EARTH – Escuela de Agricultura de la Región Tropical Húmeda

ENCC – Estrategia Nacional de Cambio Climático (National Climate Change Strategy)

GEI- Gaseosas de efecto invernadero

GHG – Greenhouse Gases

HFCs – Hydrofluorocarbons

IMN -National Meteorological Institute

INTE – Instituto de Normas Técnicas de Costa Rica (abbr.)

INTECO – Instituto de Normas Técnicas de Costa Rica (Institute of Technical Standards of Costa Rica)

IPCC – Intergovernmental Panel on Climate Change

ISO – International Organization for Standardization

MEIC – Ministerio de Economia, Industria y Comercio (Ministry of Economy, Industry, and Commerce)

MICIT– Ministerio de Ciencia y Tecnologia (Ministry of Science and Technology)

MINAE – Ministerio de Ambiente y Energía (Ministry of Environment and Energy)

NCPCs – National Cleaner Production Centers

NF_3 – Nitrogen Trifluoride

N_2O – Nitrous Oxide

PAS – Publicly Available Specification

PFCs – Perfluorocarbons

PGAI-Programa de Gestión Ambiental Institucional

PROPYME – Programa de Apoyo a la Pequeña y Mediana Empresa (Support Program for PYMEs)

PYMEs – Pequeñas y Medianas Empresas (Small- and Medium- Sized Enterprises)

SCS (Global) – Scientific Certification Systems (Global)

SF_6 – Sulfur Hexafluoride

SMEs – Small-to-Medium-sized Enterprises (synonymous with PYME)

WBCSD – World Business Council of Sustainable Development

WRI – World Resources Institute

1 Introduction

Climate change is a worldwide problem, but is especially pressing for Central American countries. Central America has been identified by a European Union study as the region most vulnerable to the harmful impacts of climate change (AGRIFOR, 2009). As a thin strip of land between two oceans, the region is subject to intense and frequent extreme weather events that result from climate change. Such extreme weather events are increasing in severity and frequency (UNFCC, 2002). These events threaten to destroy local biodiversity, drastically reduce crop productivity, and cause losses of infrastructure and lives in coastal communities (AGRIFOR, 2009).

According to global scientific consensus, a significant cause of climate change is the emission of greenhouse gases (GHGs). Reducing GHG emissions is one approach to mitigate climate change, but any substantial reduction demands strong action (UNFCCC, 2002). A few organizations around the world have attempted to reach zero net emissions of carbon-based greenhouse gases, a state known as *carbon neutrality*. Carbon neutrality is achieved by mitigating all carbon emissions through reduction and compensation.

The first country to have declared a goal of national carbon neutrality is Costa Rica. Costa Rica has set a deadline for 2021 (Dobles, 2008). Since the announcement of its carbon neutrality goal in 2007, Costa Rica has launched a national strategy that includes reducing GHG emissions. Under Costa Rica's strategy companies are not currently required to seek carbon neutrality; however, to ultimately achieve their goal by 2021 Costa Rica will need efforts from companies to track their emissions before offsetting their positive carbon footprint. For SMEs in Costa Rica, recognition of environmental responsibility is a key differentiating factor in highly competitive domestic and international markets. This incentive leads small-to-medium sized enterprises (SMEs) to seek environmental certifications, including carbon neutral status. Before determining what efforts must take place to achieve carbon neutrality, a company has to first take inventory of its GHG emissions. GHG inventorying quantitatively tracks emissions from a company's operations. Based on a completed GHG inventory, reduction and compensation efforts can be planned order to achieve carbon neutrality.

Costa Rica seeks to receive inventories from all sizes of companies. While some larger companies have conducted inventories with the help of hired consultants, others, particularly SMEs, tend to lack the financial resources to plan and execute a GHG inventory. They typically have little knowledge regarding the standards involved and the inventory process (Gonzalez, 2014). This lack of knowledge stems from the fact that the three standards used in Costa Rica (ISO 14064, PAS 2060, and the National Standard) all have different uses and are highly

technical documents. As such SMEs are in need of guidance to conduct GHG inventories and to be advised on how to select the standard most appropriate for their company.

These companies will seek assistance from the organization Centro Nacional de Producción más Limpia (CNP+L) to identify their needs as they begin a GHG inventory. CNP+L is the Costa Rican subsidiary of the National Cleaner Production Centers (NCPCs), a global network of the United Nations Industrial Development Organization and the United Nations Environmental Program. NCPCs guide companies to provide technical support in their process of improving sustainability and help raise awareness of cleaner production. As mentioned previously, SMEs may not have the financial resources to hire consultants to conduct their GHG inventories. Interestingly, there are numerous resources already available publicly; however SMEs often are not aware of these as they begin their inventories. As a nonprofit United Nations representative, CNP+L seeks to find ways to connect SMEs to information on GHG inventories. CNP+L has several years of experience guiding such companies in environmental initiatives such as obtaining environmental certifications ("National Cleaner Production Centers", n.d).

Our project was to develop a document that provides an overview of these resources, including methodology guidance and calculation tools, for SMEs as they begin their inventory process. Contacting the three main verification bodies in Costa Rica-- INTECO, SCS Global, and EARTH University-- provided a basis for the knowledge of these resources. Following these contacts, we targeted small companies to gain a broad overview their inventory process and any obstacles they encountered. Using the information gathered from both groups a brochure was developed providing an outline of GHG inventories and useful resources companies could utilize. Included with the brochure was a CD that contained examples of completed and verified inventories and spreadsheets to assist with calculating actual emission factors. CNP+L will use our brochure and CD to assist SMEs seeking assistance on conducting and verifying GHG inventories.

2 Literature Review

This section seeks to achieve three goals: to briefly review carbon neutrality and Costa Rica's path towards it, to introduce small-to-medium-sized enterprises (SMEs) as a major contributor towards this goal, and to outline the concepts involved in helping small-to-medium-sized enterprises take the first step in pursuing carbon neutrality: conducting GHG inventories.

2.1 Carbon Neutrality

A carbon neutral organization is defined as one with an effectively-zero net output of carbon emissions. This is achieved by reducing the amount of emissions released and then balancing the remaining emissions with an equivalent amount of *compensation*. Compensation covers a range of actions that effectively negate the remaining emissions released. These actions seek to indirectly contribute to the reduction of remaining emissions, or to carbon sequestration (replenishment of natural carbon stores, i.e. forests) of an equivalent amount of carbon dioxide. Compensation by funding projects that reduce emissions or sequester carbon is known as carbon offsetting. Carbon offsetting projects may include reforestation, improvements to energy efficiency, and elimination of potent greenhouse gases in industrial emissions. Carbon offsets may also be traded across companies. For example, a company may compensate its emissions by purchasing carbon offsets from another company's emissions reduction.

Carbon neutrality can generally be defined by:

$$E - R - C = 0 \quad (1)$$

In Equation (1), the term **E** represents the quantity of emissions released prior to any mitigation of emissions, i.e. the so-called baseline emissions. Term **R** represents the reduction of emissions since the measurement of **E**, i.e. comparing values of **E** between current and previous measurements. Term **C** denotes the compensation of emissions, equivalent to the quantity (**E - R)** that remains after reduction**.**

2.1.1 Costa Rica's Path to Carbon Neutrality by 2021

Begun in 1997 and enacted by the United Nations in 2005, the Kyoto Protocol was developed by the United Nations Framework Convention on Climate Change. Notably, the Kyoto Protocol required signatory developed countries to reduce their carbon emissions by five percent below their 1990 levels over a five-year period (UNFCCC, 2012). Costa Rica signed the Kyoto Protocol in 1998 and ratified it in 2002, under the terms for developing countries: pledging to reduce emissions, but without being held to a binding target.

Though Costa Rica has no binding emissions-reduction target from the Kyoto Protocol, the country has proactively engaged in efforts to curb its carbon emissions. Costa Rica's Payment for Environmental Services (PSA) program, started in 1997 by the National Fund for Forestry Finance (FONAFIFO), pays landowners to protect forest areas with funds from a national tax on fossil fuel sales (Pagiola, 2006). Between 1999 and 2005, it is estimated that this program prevented the emissions of at least 11 million metric tons of carbon. For comparison, Costa Rica's annual emissions totaled around 14 million metric tons of carbon in 2013 (Gonzalez, 2014). PSA has been so successful in preserving forest land and limiting emissions that other Central American countries are seeking to replicate the program (Pagiola, 2006).

Costa Rica's carbon-neutrality goal was announced in February 2007, in the national newspaper *La Nacion* (Vargas, 2007). Though other countries have since followed suit, this announcement made Costa Rica the first country to declare a goal of national carbon neutrality. The year 2021 was chosen as a deadline to commemorate the bicentennial of Costa Rica's independence from Spain.

The Costa Rican government has since launched a National Climate Change Strategy (ENCC), which focuses on carbon neutrality through "equal measures of adaptation and mitigation, including a reduction in emissions across all major sectors of the economy, as well as the enhancement of carbon sinks via reforestation and avoided deforestation" (Dobles, 2008). The Costa Rican government's strategy relies on reducing emissions and then offsetting remaining emissions largely with sequestration (Dobles, 2008). In the journey to carbon neutrality, ENCC also aims to "reduce [Costa Rica's] … geographic vulnerability" to the effects of climate change. To achieve the emissions reduction and compensation component of the agenda, the ENCC relies on efforts to mitigate carbon emissions by individual companies from all sectors of the economy (Dobles, 2008).

2.1.2 The Role of Small-to-Medium-sized Enterprises in Costa Rica's Goal

According to the SME Observatory of Costa Rica, companies in Costa Rica having 6 to 100 employees are classified as SMEs (Laura & Brenes, 2009). Companies with fewer than 6 employees are designated as *micro-sized enterprises*, but can be categorized as SMEs. Approximately 98 % of formal businesses in Costa Rica are micro-, small-, and medium- sized enterprises (Laura & Brenes 2009). Out of all registered companies in Costa Rica, small- and medium-sized companies make up 60% of all exporters (PROCOMER, cited in Laura & Brenes, 2009). As SMEs comprise a large majority of Costa Rica's economy, helping SMEs learn to track their GHG emissions is a key component in a national strategy for carbon neutrality.

2.2 GHG Inventories: The First Step to Carbon Neutrality

Any initiative towards carbon neutrality begins with an emissions inventory: an account of GHG emissions released over the course of a year and classified by source. A total set of emissions inventories—calculating emissions from all operations of a certain company, for example—may be collectively referred to as an *emissions footprint*. Typically, as quantities of various greenhouse gas emissions are normalized to units of carbon dioxide equivalent (see Section 2.2.1), emissions footprints are called *carbon footprints* (Attarzadeh and Noponen, 2010). The terms *carbon footprint* and *greenhouse gas inventory* are often used synonymously (Freed, 2014).

2.2.1 Emissions Scopes and Quantification

GHG emissions may be classified using three scopes (WRI & WBCSD, 2004). Scope 1 covers *direct* emissions, or emissions from sources owned or controlled by the organization. Scope 2 and 3 emissions are labeled *indirect*. Scope 2 emissions are due to electricity usage from utilities. Scope 3 emissions are from sources not owned or controlled by the company, they include travel via non-company-owned vehicles and emissions across a product's life cycle. Standards for GHG inventories require reporting of emissions from Scopes 1 and 2, but generally designate Scope 3 emissions reporting as optional. Figure 1 provides an overview of the three scopes, along with the 7 GHGs required by the Kyoto Protocol in emissions accounting: NF_3 (nitrogen trifluoride), CO_2 (carbon dioxide), SF_6 (sulfur hexafluoride), N_2O (nitrous oxide), HFCs (hydrofluorocarbons), PFCs (perfluorocarbons), and CH_4 (methane).

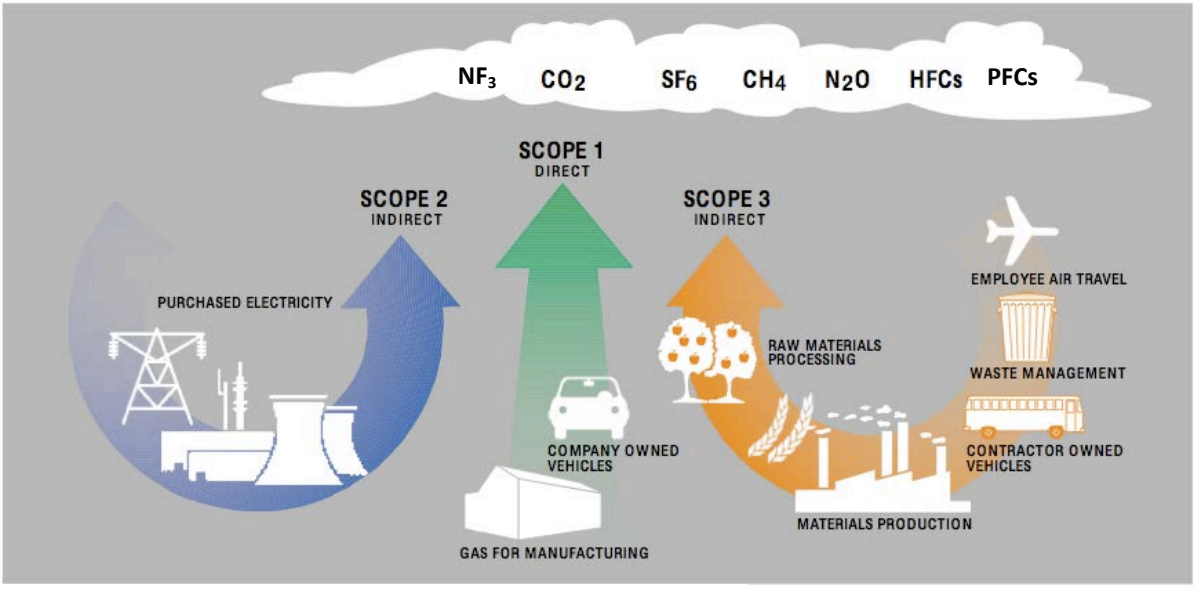


Fig. 1: Overview of Emissions Scopes (from WRI & WBCSD 2004)

The seven greenhouse gases identified by the Kyoto Protocol (see Figure 1) vary widely in their potency to contribute to climate change. For instance, methane (CH_4) is twenty times as potent a greenhouse gas as carbon dioxide (United States Environmental Protection Agency, 2014). Reflecting this, and to provide a single metric for a carbon footprint, all measured amounts of the various GHGs are typically converted to units of equivalent carbon dioxide, using the global warming potential scale (Attarzadeh and Noponen, 2010). Global-warming potential (GWP) is a measure of the energy that a given mass of a gas absorbs over a certain period of time. GWP values are determined relative to the global warming potential of carbon dioxide, so the GWP value of carbon dioxide is defined as exactly 1 (United States Environmental Protection Agency, 2014). In a carbon footprint, emissions of various greenhouse gases are all converted to metric tonnes of equivalent CO_2, using global warming potentials.

2.2.2 Organization-level and Product-level Inventories

There are two approaches to GHG inventories: organization-level and product-level (Scipioni et al, 2012). Organization-level GHG inventories, also known as *corporate* inventories, account emissions within the operations of the company as a whole. Product-level GHG inventories, known as *product life cycle* inventories, account only for emissions over a specific product's life cycle, from manufacture and delivery through use and disposal (Scipioni et al, 2012).

As Scope 3 emissions cover product-level emissions, a complete inventory of all three scopes will require the use of both organization-level and product-level inventories (Scipioni et al, 2012). Emissions from product-level assessments, however, tend to be effort- and cost-intensive, especially for small companies. The GHG Protocol advises against including product-level assessments in a corporate inventory unless the company knows it can bear the "potentially high" costs of collecting product-level data (WRI &WBCSD, 2004). Small companies are more likely to lack the resources to account Scope 3 product life-cycle emissions, especially in addition to a corporate inventory of Scopes 1 and 2. Product-level emissions are also generally optional to include in GHG inventories (WRI & WBCSD, 2004). This project will not include further discussion of product-level emissions inventories, though many aspects of methodology are common between organization-level and product-level inventories.

2.3 Standards for Organization-level GHG Inventorying

In providing guidance on organization-level GHG inventorying, our deliverable will need to present inventory requirements set by certain standards. According to Life Cycle Engineering, an environment consultancy group, adopting an internationally-recognized standard "increases consistency and transparency in GHG accounting and reporting and provides business with information that can be used to build an effective strategy to manage and reduce GHG

emissions" (Life Cycle Engineering, n.d.). Verification also lends credibility to an inventory, improving the reputation of the company in the eyes of its customers and stakeholders. A verified inventory may also allow a corporation's voluntary emissions reductions to be recognized under a government-mandated program, were one to arise in the future (*WRI & WBCSD 2004*).

The following are the major GHG inventory standards used worldwide. Because taking product-level inventories is typically considered unfeasible for SMEs, they are excluded from our discussion of standards.

2.3.1 The Greenhouse Gas Protocol

The Greenhouse Gas Protocol (abbreviated as "GHG Protocol") was the first international standard to be developed for accounting and verifying businesses' emissions data. The Protocol was developed from the United Nations Framework on Climate Change, and still remains the most widely used GHG inventorying standard in the world. Part of the Protocol is the *Corporate Accounting and Reporting Standard,* which offers guidelines on sector-specific methodologies for corporate-level GHG inventories ("About the GHG Protocol").

The *Corporate Accounting and Reporting Standard* was designed to guide companies in preparing GHG emission inventories. The *Corporate Standard*, as it is commonly known, emphasizes consistency, transparency, relevance, and completeness of reported emissions information (WRI & WBCSD 2004). The GHG Protocol is considered the basis for GHG inventory standards worldwide, and provides guidance on conducting an inventory. Other GHG inventory standards, such as those listed below, only provide requirements—not guidance—for an inventory (Gonzalez, 2014). The result is that the GHG Protocol serves as a guide to methodologies for conducting a GHG inventory, whereas the other standards serve as specific options for inventory verification.

2.3.2 ISO 14064

The International Standards Organization (ISO) found in 2002 that businesses worldwide were struggling to follow the *Corporate Standard* for their GHG inventories because of a lack of specific requirements for an acceptable GHG inventory (Wintergreen and Delaney, 2007). With the explicit goal of "harmonization" with the GHG Protocol, ISO developed ISO 14064 as a global standard to establish specific minimum requirements for company GHG inventories (Boehmer, 2005). Authorship of ISO 14064 includes GHG Protocol contributors from the World Resources Institute and the World Business Council for Sustainable Development, as well as business representatives from around the world (Boehmer, 2005). While the GHG Protocol presents best practices for GHG inventorying, ISO 14064 establishes "minimum standards for

compliance with these best practices". Companies developing GHG inventories, especially companies seeking third-party inventory verification, can benefit from referencing both ISO 14064 and the *Corporate Standard* in conducting their inventory (Wintergreen and Delaney, 2007).

ISO 14064 comprises three parts. Part 1 addresses the quantification of GHG emissions in an inventory. Part 1 requires that organizations identify specific emissions sources in company operations, defined within a set of boundaries. These emissions are to be declared as direct or indirect, and an inventorying method is to be selected based on the emissions sources. The selected inventory methodology is to be described and justified. Emissions from biomass (e.g. wood burning, crop farming) are to be separately quantified. Excluded and included operations and emissions sources are to be explained. Part 2 addresses the design and evaluation of emissions-reductions projects, and Part 3 addresses the verification of GHG inventories and emissions data. Part 3 requires companies to present the objectives and scope of the inventory, as well as information on accuracy, errors, and uncertainties (Wintergreen and Delaney, 2007). For companies seeking to inventory their GHG emissions, Part 1 provides a set of inventory requirements to fulfil. Part 3 provides requirements for a company's internal verification of a company's inventory, performed prior to soliciting third-party verification. Part 2 lies outside the scope of this project, since it involves steps after a verified inventory.

2.3.3 PAS 2060

Companies' public claims about their carbon neutrality may sometimes be founded on misinterpreted or miscalculated emissions data. This misrepresentation, termed *greenwashing*, may be due to faulty methodology or assumptions (Carbon Clear, 2011). After a number of high-profile greenwashing cases arose in 2008, the British Standards Institute recognized the lack of standardization in the various aspects of corporate carbon neutrality: organizational boundaries, methodology, reduction, and offsets. To counter this, the PAS 2060 standard was developed in 2009 to establish requirements for carbon neutrality. Following "a series of consultations with the private, public, and third sectors", the PAS 2060 standard was finally released in 2010 (Carbon Clear, 2011). PAS 2060 requires emissions inventorying according to the GHG Protocol *Corporate Standard* or ISO 14064, and also contains requirements for emissions reduction and offsetting. PAS 2060's definition of carbon neutrality incorporates a baseline year, as expressed by:

$$\underbrace{(E_{t-1} - E_0)}_{\mathbf{E}} - R_t - C_t = 0 \quad (2)$$

Equation (2) follows the same format as the carbon neutrality definition in Equation (1). However, $\mathbf{E_{t-1}}$ represents the quantity of emissions released the previous year (at time *t-1*) measured relative to a baseline level of emissions $\mathbf{E_0}$. The baseline year is defined as the first year of a verified emissions inventory. As in Equation (1), R_t and C_t are the amounts reduced and compensated, respectively, since the previous year.

2.3.4 National Standard for Carbon Neutrality (INTE 12-01-06)

To establish a set of common requirements for companies to certify as carbon-neutral in Costa Rica, INTE 12-01-06 was released in 2009, at a time when there were very few standards for carbon neutrality in the world. The National Standard was updated in 2011, after revisions following the release of PAS 2060 in 2010. Like PAS 2060, the National Standard covers requisites not just for emissions measurement, but also for reducing and offsetting emissions. The National Standard defines carbon neutrality differently than PAS 2060—namely, the baseline level E_0 is set to zero.

$$E_{t-1} - R_t - C_t = 0 \quad (3)$$

Equation (3) differs from Equation (1) solely in the definition of the **E** term. Here $\mathbf{E_{t-1}}$ represents the quantity of emissions as measured the previous year. As before, R_t and C_t represent reduction and compensation since the previous year's inventory.

Unlike PAS 2060, the National Standard requires companies to demonstrate total carbon neutrality each year. This is to say, the National Standard requires that companies reduce and compensate all of their emissions, and not just the difference in emissions from the baseline (the **E** term in Equation (2)).

2.4 Inventory Process

Figure 2 outlines the process of performing a GHG inventory, as presented by the GHG Protocol *Corporate Accounting and Reporting Standard* (WRI & WBCSD, 2004).

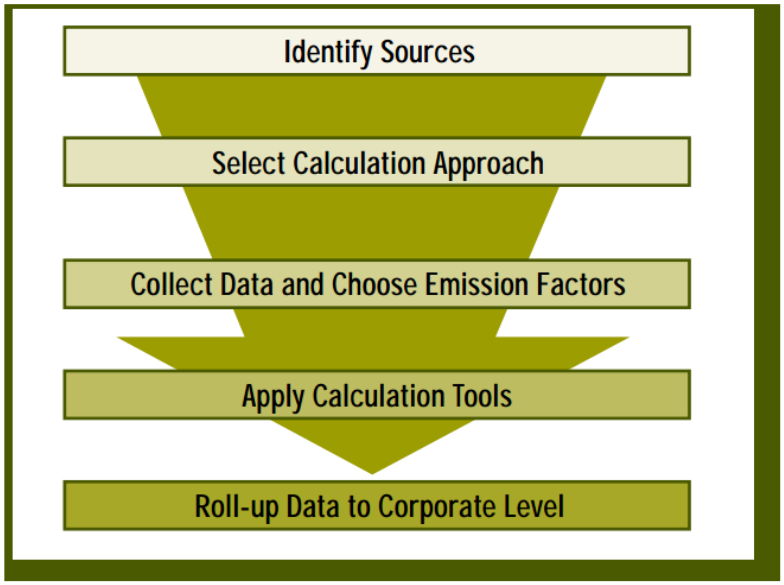


Fig.2 Steps in Identifying and Calculating GHG Emissions, from *A Corporate Accounting and Reporting Standard, Revised Ed. (WRI & WBCSD 2004)*.

2.4.1 Identifying Sources

To prepare for an inventory, the company needs to determine its organizational and operational boundaries. Organizational boundaries define the operations to be considered in the inventory. Organizational boundaries may be established either by the *equity share* or *control* approaches. By the equity share approach, a company includes operations according to its share or interest in the operation. By the control approach, the company includes only the operations it controls authoritatively. Consequently, when a company owns all of its operations, either approach will result in the same organizational boundary. After identifying the operations to include by setting organizational boundaries, a company must then set operational boundaries. Operational boundaries define which emissions to include, and involve categorizing these emissions by scope.

The first step to conducting an inventory is to categorize emissions by source. Emissions typically fall under one of four categories. They are stationary combustion, mobile combustion, process emissions, and fugitive emissions. Stationary combustion consists of combustion of fuels for heating and stationary power generation. Mobile combustion includes combustion of fuels in vehicles. Process emissions include emissions from manufacturing processes. Finally, fugitive emissions consist of emissions from leaks, waste, and other non-manufacturing processes. Emissions from sources owned by the company should be accounted under Scope 1 (direct emissions), and emissions from purchased power (electricity, heat, steam) should be accounted under Scope 2. It is recommended that Scope 3 emissions (from non-company-owned sources, e.g), if identifiable, be accounted.

2.4.2 Data and Emissions Factors

Direct measurement or monitoring of emissions is rare, and may be unfeasible especially for small companies. Most commonly, emissions are calculated using emissions factors (Gonzalez, 2014). Emission factors are quantities of specific greenhouse gas emissions released per unit of product or process (Attarzadeh & Noponen, 2010). Multiplying an emissions factor with data from the corresponding company activity data—such as liters fuel, kilowatt-hours of electricity use, or kilograms of product—results in an estimate of total emissions from that activity. Costa Rica's National Meteorological Institute annually updates a list of Costa Rica-specific emissions factors (Gonzalez, 2014), and factors not given on this list may be obtained from the global emissions-factor database of the Intergovernmental Panel on Climate Change (WRI & WBCSD, 2004).

With access to data on fuel carbon content, fuel use data—as from invoices for gasoline and diesel usage—may aid the calculation of vehicular Scope 1 or Scope 3 emissions. These vehicular emissions may be converted to CO_2e (CO_2 equivalent units) using the global warming potentials (GWP) provided in the Greenhouse Gas Protocol (WRI & WBCSD, 2004).

2.4.3 Calculation Tools and Inventory Reporting

Scope 2 purchased electricity emissions may be calculated with a record of electricity use and access to Costa Rican grid electricity emission factors. Depending on the company's sector, there are numerous sector-specific calculation tools available. Of note, INTECO has developed a widely-used spreadsheet-based tool with built-in Costa Rican emissions factors, unit conversions, and uncertainty measurements (Gonzalez, 2014).

For companies with multiple facilities, GHG inventories from each facility need to be consolidated at the corporate level. It is important that facility reporting to the corporate level include a brief description of emissions sources, justification for boundaries, observable trends from previous years, progress towards business targets, and a discussion of uncertainties and error.

2.4.4 Verification

The final step once the inventory has been completed is verification. Verification confirms the accuracy of inventory data and the compliance of inventory methodology with a given standard. Verification lends credibility to a company's inventory of its emissions, and is a requirement for further steps towards carbon neutral certification—steps such as emissions reduction and compensation. There are three major bodies that verify corporate GHG inventories in Costa Rica: SCS Global Services, EARTH University, and Instituto de Normas Technicas (INTECO).

2.5 Case Studies

Examples of GHG inventories from SMEs in Costa Rica were not available from preliminary research. Among publicly-viewable GHG inventory reports (by companies of any size, in Costa Rica and elsewhere), it was difficult to find inventories accompanied by explanations of inventory methodology and boundaries. However, one GHG inventory report from the UK (see below) was transparent and highly detailed in the breakdown of its emissions and description of its inventory process.

2.5.1 Case Study: Carbon Footprint of Office-Based Company in the UK

In 2011, the United Kingdom enacted a law requiring all publicly traded companies on the UK stock exchange to conduct organizational carbon footprints annually. While companies in Costa Rica conduct and report their GHG inventories voluntarily, Rathbone Brothers PLC provides an example of a carbon footprint performed for a mandatory report. The company's carbon footprint from its 2009 corporate responsibility report is provided in Figure 3.

The footprint is broken down first by emissions scope, and then further by emission source. Data from the baseline year are presented, serving as a reference point for the company's emissions reduction efforts so far. Referenced footnotes in the report clarify aspects of the company's inventory methodology, which was derived from the GHG Protocol *Corporate Accounting and Reporting Standard*. Though details on verification are not explicitly provided, the report states that the inventory is compliant with ISO 14064, Part 1.

The full report clearly outlines the organizational and operational boundaries. All emissions across Scopes 1 through 3 were measured, and clarifications of calculation methods are included. A wide range of Scope 3 emissions are also inventoried, and comparisons to previous years' data are discussed. The report includes a statement of quality assurance by Carbon Smart, the third-party organization hired to conduct Rathbone Brothers PLC's carbon footprint. Provided in the statement are quantifications of data quality, and comments on how the inventory satisfies the GHG Protocol's principles of relevance, completeness, consistency, transparency, and accuracy.

Rathbone Brothers PLC reports a total of 699 employees. This far exceeds the European Union's definition of an SME by size (fewer than 250 employees). However, due to the clarity and comprehensiveness of the inventory, SMEs may find this example illustrative of what to expect for a completed and verified inventory report. Because of the lack of a manufacturing or "goods" component, this report may specifically be useful for SMEs in the commercial or service sectors.

Tonnes of CO_2e by emissions source

	Tonnes CO_2e
Air	273
Rail	102
Taxis	6
Non-company cars	77
Electricity	1,665
Company cars	13
Gas	254
Total	**2,390**

Absolute and relative CO_2e from Rathbones' offices under scope

	2008/09	2007/08 (Base year)
Office square metres (m^2)	10,695[5]	10,727
Number of employees as at 31 December	699	704
Scope 1		
Gas use (kWh)	1,243,539	1,455,655
Gas (CO_2e tonnes)	254	300
Company cars (km)	64,889	83,416
Company cars (CO_2e tonnes)	13	19
Total CO_2e (tonnes)	267	319
Scope 2		
Electricity (kWh)	3,060,113	2,984,736[6]
Total CO_2e (tonnes)	1,665	1,603[7]
Scope 3		
Business travel (km)	2,905,584	2,701,346
Total CO_2e (tonnes)	458	470[8]
Total CO_2e (tonnes)	2,390	2,392
CO_2e (tonnes) per employee	3.4	3.4
Electricity and gas CO_2e tonnes/m^2	0.18	0.18
Waste (tonnes)	213	226[9]
Paper (tonnes)	98	98[10]

4 We have expressed our carbon footprint in terms of CO_2 equivalent (CO_2e) to accommodate non-CO_2 greenhouse gas emissions
5 Bristol has moved offices which has resulted in a small change in the total floor area for the group
6 Electricity consumption has been re-baselined for 2007/08. We previously reported 1,999,470 kWh but we have added an additional 985,266 kWh following the identification of unreported consumption in London
7 Data re-baselined (see above). 1,074 tonnes CO_2e was previously reported
8 Data extrapolated to allow comparison with the complete data coverage of flight data for this year and to maintain consistency of approach
9 A small change in the estimated waste volume reflecting better data quality
10 Data re-baselined to include previously excluded envelopes

Fig. 3 Carbon footprint from page 49 of the 2009 corporate responsibility report of Rathbone Brothers PLC, an investment bank in the UK (Rathbone Brothers PLC, 2009)

3 Methodology

CNP+L sought to find a way to connect SMEs to resources that would help them determine what is necessary to prepare and execute a GHG inventory. Our purpose was to design a brochure that guides SMEs in their efforts to do so. Our background research helped us to identify and understand the different national and international standards used to verify GHG inventories. The focus was on the standards followed in Costa Rica. Once we understood these standards we sought to learn how SMEs in Costa Rica currently understand and implement the standards as specific inventory methodologies. To discern this information and develop the most effective brochure we used three distinct steps:

1. Clarify how GHG inventory standards are used in Costa Rica

2. Identify available resources and understand the most effective way to connect SMEs to these resources as they begin preparing GHG inventories

3. Design and produce a brochure to outline the most important information for a company to proceed with completing a GHG inventory

3.1 Objective 1: Clarify how GHG inventory standards are used in Costa Rica

After meeting on site with our sponsors through CNP+L, Sra. Akira Hidalgo and Sr. Carlos Perera, we were directed to the three major verification companies in Costa Rica. The companies were EARTH University, SCS Global Services, and the Instituto Nacional de Tecnologías de la Comunicación (INTECO). The contact information for the heads of each verification department was provided to us. We reached out to all three via e-mail and coordinated times to conduct interviews.

Before conducting these interviews we organized a general list of topics we wished to address with this group of company representatives (Appendix B). The three major themes we focused on were identifying which standards are most frequently utilized while conducting GHG inventories, recognizing common issues SMEs face when seeking verification, and contacting SMEs that have had inventories verified and companies that are seeking verification. The interview structures varied but were generally more discussion-based than strictly structured.

Through our background research we had already developed a general understanding of what standards are typically employed internationally. To narrow the scope to focus on Costa Rica's implementation, it was important to discuss which of these standards are most commonly utilized by companies in Costa Rica. As part of our previous research we had discovered that Costa Rica produced a National Standard, known as INTE 12-01-06, established in 2009 and most recently revised in 2011. Due to the recent development of this standard

there was little information available outside of these interviews. It was therefore important to gain a deeper understanding of this standard when talking to these three representatives.

An important aspect in designing our brochure was to include ways for SMEs to avoid obstacles experienced by companies who had previously conducted a GHG inventory. We sought to find barriers SMEs commonly encounter when the verification companies performed verification audits for these smaller sized companies. In addition to identifying these barriers, we obtained suggestions and recommendations from the representatives to help SMEs overcome the barriers.

Our final objective was to obtain a list of companies that had been successfully verified by each of the three verification companies as well as companies that had shown interest in beginning to take a GHG inventory. The purpose of obtaining this list was to identify which companies were of the target sizes (small to medium size companies). After identifying the most relevant companies, we contacted representatives in their environmental management departments for further interviews.

3.2 Objective 2: Understand how to connect SMEs to GHG inventory resources

We were provided with contact information for small companies by EARTH and SCS Global services. The list of companies from INTECO was available publically. We researched which of these companies were SMEs and compiled this list to present to our sponsors, Sra. Hidalgo and Sr. Perera. They identified three companies as important targets or ones who have worked with CNP+L in the past. We then contacted these companies in order to gain an insight into their experience pursuing verification of their GHG inventories.

Additionally we were put in contact with a representative from ALIARSE, a company that works with SMEs to serve in an advisory role. ALIARSE is an alliance of both public and private companies who seek to promote sustainable development within Costa Rica. The representative we interviewed works with SMEs to assist in their sustainable development. With this representative we looked to gain a broader sense of the most effective way to disseminate information to small companies. Most importantly we sought to determine the most effective layout for our brochure. In this sense the representative would be able to advise what topics were most important to include in the brochure.

Similar to the interviews with the verification bodies, the interviews with SMEs were loosely structured but had two main areas of focus (Appendix C). These two main objectives were chosen to help clarify the design of the deliverable. The targets were to obtain access to any resources they found useful in the completion of their inventory and to identify the issues they faced and how the issues were overcome.

The resources companies used to prepare for their inventories consist of tools, descriptions of standards, and additional information that could be obtained through the verification companies. Tools include excel spreadsheets or online databases that outline and calculate the exact emissions that a company would need to track. The descriptions of standards used by these companies are crucial to presenting the information included in an understandable manner. Verification companies typically provide training classes and handouts to outline the process used to compile GHG inventories. If the companies found these to be of use in the completion of their inventory, those resources would be very important factors to include in creation of our resource.

Within the brochure we sought to include a section describing typical obstacles and ways they were overcome. Although this issue was addressed within the interviews with the verification bodies, those companies could only provide a brief overview of common issues faced. Through the interviews with verified companies we looked to gain concrete examples of which points in the verification process they struggled with.

Ultimately the most important purpose of these interviews was to gain an understanding of the scenario that SMEs face when they look to begin developing a GHG inventory. By understanding what resources they lack, the resources that could benefit them the most, and the problems they faced we were able to understand their viewpoint in the process. When developing the document it was important to include design considerations from the viewpoint of an SME.

3.3 Objective 3: Design and produce the brochure

Using the information gathered from both groups of interviews we sought to create a brochure that provided companies with a head-start in preparing and conducting a GHG inventory. In order to develop this document we needed to compile resources and subsequently organize them in a logical manner.

We looked to gather resources that described the standards used in Costa Rica. We also looked into finding case studies of small companies in other countries with a similar environment to Costa Rica. The steps taken by these companies as well as any spreadsheets or calculation tools used would be important to reference within the brochure. Additionally, the resources discussed by our interviewees were investigated in more depth and the appropriate links found.

Combining the resources gathered and the information taken from both groups of interviews, we needed to design an effective, concise brochure. We compiled this information into a four page brochure. Because of the large number of resources, we also developed a database consisting of these resources to accompany the brochure. This database contained

elaborations of standards as well as additional resources and calculation tools for SMEs to utilize. The brochure and database were designed to be used together with the brochure referencing resources contained on the database.

It was important to make sure the brochure and database contained the resources a SME would need to complete a GHG inventory easily. Our sponsors Sra. Hidalgo and Sr. Perera were the major source of this feedback. The focus was making sure no additional information needed to be provided in the brochure and if any parts could be adjusted or removed. The feedback was not intended to spur a redesign of the brochure, rather to make sure appropriate topics were emphasized and to ensure the documents appealed to users graphically.

3.4 Summary

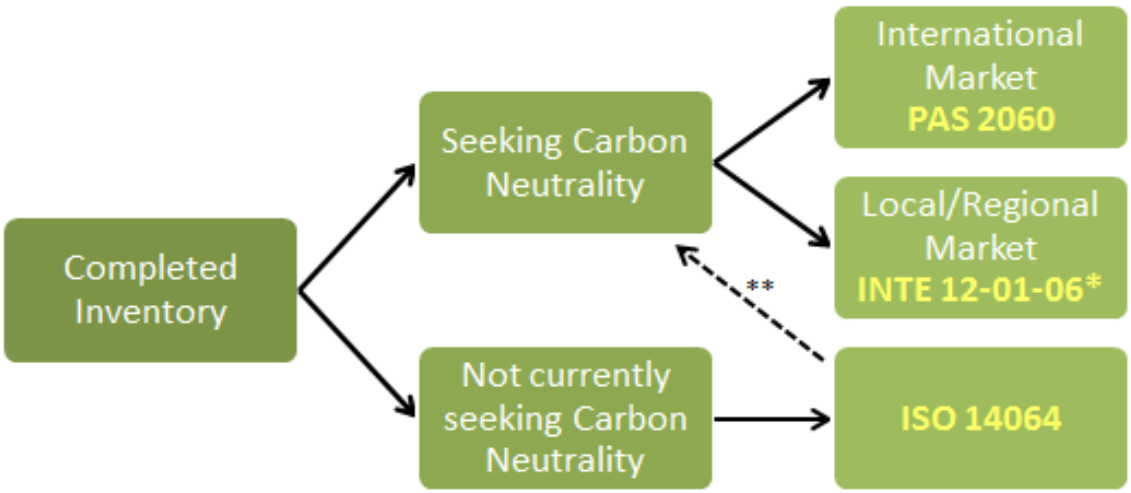
By interviewing representatives from the three verification companies, the information regarding how the verification standards function within Costa Rica was gathered. Similarly we interviewed representatives from both SMEs and companies which assist SMEs with preparing and verifying GHG inventories. Using these data we developed a brochure that would provide SMEs with the resources necessary to understand and coordinate the completion of their own GHG inventory. In addition to our brochure, we compiled both off-line and on-line resources on a database in order to facilitate further preparation of an inventory. In order to ensure our created materials were effective, we consulted our sponsors, Sr. Perera and Sra. Hidalgo, to ensure the brochure did not need further additions or modifications.

4 Findings

This chapter includes the information discovered through the interviews conducted with the companies summarized in Appendix A. The main topics covered were the standards used in Costa Rica and their differences, the most common problems SMEs face when conducting a GHG inventory, and the resources gathered.

4.1 Standards used to Verify GHG Inventories

In Costa Rica, three standards are pertinent for the verification of GHG inventories: PAS 2060, INTE 12-01-06, and ISO 14064 (Solera, 2014; Gonzalez, 2014; Mena, 2014). The company's selection of an inventory standard depends on the company's goals for its GHG inventory (Gonzalez, 2014). Namely, a company must identify whether it seeks to commit to carbon neutrality or not, and whether it seeks carbon-neutral recognition in international or regional markets. The dependence of standards on company goals is shown in Figure 4.



*Unlike the other two standards, INTE 12-01-06 requires two completed inventories for verification—an inventory from a baseline year (the first year of a completed GHG inventory) and one from the current year.

**An ISO 14064-verified inventory may be used as the first step in carbon neutrality certification by PAS 2060 or INTE 12-01-06

Fig. 4 – Decision Tree for Selecting Verification Standard for GHG Inventory

PAS 2060 was the first international carbon neutrality standard to be launched in 2010 (Gonzalez, 2014). Today, it has become the most widely-recognized carbon neutrality standard in the world for organizations; however, PAS 2060 is not commonly requested for inventory verification in Costa Rica (Solera, 2014). Due to its worldwide recognition, organizations seeking

to attract foreign stakeholders, suppliers, and customers may choose to certify carbon neutrality using this standard. Because small-to-medium-sized companies do not typically engage in foreign business, verification by the National Standard is requested by companies in Costa Rica far more often than verification by PAS 2060 (Solera, 2014).

The National Standard (INTE 12-01-06), developed using aspects of PAS 2060 and ISO 14064, is the most suitable carbon neutrality standard for organizations whose business is Costa-Rica-centric. The National Standard is unique in that it allows participation in a potential domestic market for trading carbon offsets among companies (Gonzalez, 2014). If a domestic market was to arise, companies with carbon-neutral certification could receive payments for their reductions (Gonzalez, 2014). The potential emergence of such a market offers Costa Rican SMEs a financial incentive to achieve certification by the National Standard. To date, 14 companies in Costa have been certified as carbon neutral by this standard ("5 More Businesses", 2014). With more participation of companies in the National Standard, and some changes within the Standard, carbon offset trading under the terms of the National Standard "would not have to be limited to just Costa Rican companies" (Gonzalez, 2014). A decree establishing rules for a domestic carbon market program in Costa Rica was signed in September 2013. In February 2014, a Board overseeing the function of a domestic market was formed in the Ministry of Environment and Energy's Department of Climate Change (De Leon, 2014).

Unlike PAS 2060 and the National Standard, ISO 14064 does not comprise requirements for emissions reduction and compensation—it is not a carbon neutrality standard (Gonzalez, 2014). ISO 14064 consists only of requirements for quantifying emissions and reporting inventories. PAS 2060's inventory requirements are exactly the same as ISO 14064 (Solera, 2014; Carbon Clear, 2011), while those of the National Standard are based on ISO 14064 (Solera, 2014; Gonzalez, 2014). An ISO 14064-verified inventory may be used as the basis for PAS 2060 or INTE 12-01-06 carbon neutrality certification (Mena, 2014; INTECO, 2013).

As a result, an inventory verified by ISO 14064 may be the first step towards carbon neutrality certification by PAS 2060 or the National Standard. As ISO 14064 is the basis for emissions inventorying required by the carbon neutrality standards, a company may later pursue carbon neutrality with an ISO 14064 -verified inventory.

4.2 Problems Encountered by SMEs and Solutions

It was crucial for us to relay to SMEs the most common issues companies encounter as they prepare a GHG inventory. Because the verification companies have met with a variety of SMEs, they were able to provide a broad range of observations. In addition to discussing the issues they have seen, they were able to provide a number of suggestions for SMEs to overcome each of these obstacles. These obstacles and solutions were later confirmed by representatives from the SMEs we contacted.

Three major issues were mentioned during the interviews. Interviewees commonly stated that SMEs typically have little understanding of the standards used in Costa Rica. As they look to complete an inventory, SMEs typically lack the knowledge of the steps necessary or how to conduct such inventories. Finally, they don't understand the record-keeping requirements and what emissions they must track.

SMEs seeking a verified inventory must understand each standard and make an informed decision as to which are the most appropriate for their business. Sr. Manuel Gonzalez of INTECO (2014) has seen that typically these companies do not have a clear understanding of the standards used in Costa Rica and how the standards differ. A substantial amount of time is required for SMEs to discern the differences among the three standards (Aguero, 2014). Although the standards are highly technical documents there are resources that discuss each standard in detail. As stated by Sr. Juan Solera of SCS Global (2014) "I believe if you read fully through [each standard] you should be able to have a very good head start."

It was made clear that although SMEs may have an interest in pursuing a GHG inventory they typically do not know where to begin (Duarte, 2014; Gonzalez 2014). If they approach verification companies without the proper understanding of the process they can incur unnecessary delays and extra costs. It was recommended by Sra. Laura Aguero of Azucarera Viejo (2014) that companies have access to GHG methodology tools prior to their attempt to conduct a GHG inventory. In particular she specified an inventory checklist could provide step-by-step guidance for companies as they begin their process.

After understanding the inventory process there may still be clerical issues SMEs encounter that could prevent them from completing their inventory. Often they do not realize that they need to prepare in advance (Mena, 2014). Before conducting an inventory an SME must have a year's worth of records, such as electricity and fuel bills, organized by emission type. Aside from not having the records prepared, companies may not even know they need to track certain emissions. They may use the incorrect emission factors, improperly justify each factor, or present the data inaccurately due to errors in conversions (Gonzalez, 2014; Solera, 2014). The resources to assist SMEs in properly tracking their emissions exist and are publicly available (Blandino, 2014). Sr. Gonzalez (2014) and Sr. Solera (2014) both directed us to documents containing the emission factors specific to Costa Rica provided by the Instituto Meteorológico Nacional. The document provides a list of sector-specific emissions factors and global warming potentials for carbon-dioxide-equivalence conversion (Instituto Meteorológico Nacional, 2013). In addition, spreadsheets through the Dirección de Gestión de Calidad Ambiental (DIGECA) provide templates for tracking and calculating five specific emission factors ubiquitous across all sectors (Blandino, 2014).

As GHG inventorying can be a complicated, drawn-out process, assigning an employee to acquiring the knowledge and ability to carry out the project of a GHG inventory can save time and resources (Gonzalez, 2014; Aguero, 2014). This leader would also be responsible for heading future company projects in *environmental management*—efforts in emission mitigation, sustainability, and other management of environmental impact. Sr. Gonzalez (2014) and Sra. Karla Mena (2014) recommended that this project leader consider a training course by INTECO or EARTH University. With just 16 hours of training, SMEs have been able to take GHG inventories on their own (Gonzalez, 2014).

4.3 Overview of Resources Obtained from Interviews

From our interviews, we were directed to several resources helpful to SMEs seeking to conduct a GHG inventory. Table 1 provides a list of these resources, along with their author and the interview in which they were introduced to the team.

Table 1 – Overview of resources obtained via interviews

Title of Resource	Author(s)	Introduced by
Guide to GHG Inventorying for Offices	WRI & WBCSD	Gonzalez, 2014
GHG Inventory Checklist	US EPA	Gonzalez, 2014
IPCC 2006 Sector-Specific Guides	IPCC	Gonzalez, 2014
IPCC 2006 Sector-Specific Worksheets for Calculation	IPCC	Gonzalez, 2014
IPCC Industrial Tools for Feedstock Emissions	IPCC	Gonzalez, 2014
Cross-Sector Tools for Emission Calculation	Costa Rican Public Sector (PGAI)	Blandino, 2014
Hypothetical Example of Worked-Out Inventory	INTECO	Gonzalez, 2014
Costa Rican Emission Factors	IMN	Gonzalez, 2014
Costa Rican National GHG Inventory	MINAE	Gonzalez, 2014
Brazilian National GHG Inventory	Brazil Ministry of Environment	Gonzalez, 2014
GHG Protocol Reporting Template	GHG Protocol	Gonzalez, 2014
Client Spotlight	SCS Global Services	Solera, 2014
Presentation of Carbon Neutrality Services	EARTH University	Soto, 2014
Overview of GEI Services	INTECO	Gonzalez, 2014

Guide to GHG Inventorying for Offices is a guide for office-based organizations. This was created to supplement the GHG Protocol by the World Resources Institute (WRI) and the World Business Council for Sustainable Development. This guide is targeted at companies without manufacturing activities, and provides step-by-step guidelines on how to develop an inventory of emissions from offices. Companies with manufacturing activities, however, may also use this guide to inventory emissions from offices.

The *GHG Inventory Checklist* presents a list of inventory requirements based on the GHG Protocol. The *Checklist*, a document by the United States Environmental Protection Agency, is designed to help companies conduct internal audits for a prepared inventory (Gonzalez, 2014).

The *IPCC 2006 Sector-Specific Guides* come from guidance for national inventories authored by the Intergovernmental Panel on Climate Change (IPCC). This globally-recognized series of documents outlines inventory methodologies to quantify emissions from sources unique to certain sectors. The sectors covered are: Energy, Industry, Agriculture and Land Use, and Waste Management. These guides are accompanied by the *IPCC Sector-Specific Worksheets for Calculation*, a set of templates for calculating and tabulating emissions data. As with the *Guides*, the *Worksheets for Calculation* provide templates for specific sectors—the same sectors covered in the *Guides*. Along with templates, the *Worksheets for Calculation* also provide a list of equations relevant to inventory. Though some of these equations apply only to national inventories, many are applicable to sector-specific emissions calculation for companies (Gonzalez, 2014). Supplementing the *Guides* and the *Worksheets* is *IPCC Industrial Tools for Feedstock Emissions* – a set of calculation tools specific to the industrial sector. These tools calculate emissions from feedstock—the raw material input for industrial processes.

The *Cross-Sector Tools for Emission Calculation* are Excel™ spreadsheets created by PGAI (Programma de Gestion de Ambientales Instituticion), an environmental program of Costa Rican public-sector institutions such as banks and universities. These tools for calculating emissions are applicable to activities common between all sectors. Unlike the *IPCC 2006 Sector-Specific Worksheets for Calculation*, these tools are interactive—upon input of activity data, emissions quantities are automatically tabulated.

INTECO created *Hypothetical Example of Worked-Out Inventory*, using a fictional food and beverage processing company. This resource works through all the steps of a complete inventory: defining appropriate emissions sources, organizing activity data, calculating emissions, and reporting the inventory as a carbon footprint.

Costa Rican Emissions Factors presents a list of emission factors collected by Costa Rica's National Meteorological Institute (IMN). These emission factors cover activities from a range of sectors, and are unique to Costa Rica from October 2013. These are the most up-to-date IMN emission factors as of the time of this report.

The *Costa Rican* and *Brazilian National GHG Inventories* are templates developed by each country's respective ministries of environment, for creating national-level GHG inventories. These Excel™ spreadsheets comprehensively calculate emissions at a national scale, given activity and population-related data input. Sr. Gonzalez (2014) stated that these spreadsheets contain "all the emission factors from any kind of fuel that you can imagine". However, these fuel emission factors are not easily searchable within the design of the spreadsheets.

The *GHG Protocol Reporting Template* is a template for reporting emissions, based on the GHG Protocol. This Word™ document includes fields not only for emissions data, but also for justifications for the company's definitions of inventory scopes and boundaries.

The last three resources listed in Table 1 serve as an introduction to each of the three verification bodies in Costa Rica: SCS Global Services, EARTH University, and INTECO. Each resource was brought to our attention at the end of their respective verification body interview. *Client Spotlight* provides an overview of client projects that SCS has assisted and verified. These projects are from various parts of the world, highlighting the verification body's international expertise. *Presentation of Carbon Neutrality Services* outlines EARTH's services in helping companies achieve carbon neutrality. *Overview of GEI Services* introduces INTECO and its services for the verification of GHG inventories.

4.4 Summary of Findings

The standards used to verify inventories in Costa Rica are PAS 2060, INTE 12-01-06, and ISO 14064. Out of these three, PAS 2060 and INTE 12-01-06 (Costa Rica's National Standard for Carbon Neutrality) are carbon neutrality standards, while ISO 14064 only provides requirements for quantifying emissions in GHG inventories. PAS 2060 is recommended for companies involved in international markets. INTE 12-01-06 is recommended for companies in Costa Rican markets. ISO 14064 is recommended for companies that are undecided on committing to carbon neutrality.

SMEs encounter a variety of problems that delay their process of completing a GHG inventory. The first issue is that SMEs do not have a good understanding of the differences between the standards used in Costa Rica prior to pursuing a GHG inventory. Often the process of the inventory is unclear to them as well. Finally, although they are interested in completing an inventory, they do not realize that they need to maintain a year's worth of specific records in order to calculate their total emissions.

A variety of numerous resources outlining the inventory process is available publicly. We were recommended a large number of these resources through interviews with the verification bodies, SMEs, and ALIARSE. These resources include checklists for inventories, inventory templates for organization of data, and documents containing emission factors by sector specific to Costa Rica.

5 Deliverable Design

Though national and international resources on GHG inventorying are available to SMEs, without familiarity or comprehension of these resources, SMEs tend to be largely uninformed on key aspects of the inventory process, or about carbon emissions in general (Gonzalez, 2014; Solera, 2014). In order for SMEs to develop in-house proficiency in inventorying their GHG emissions, there is a need for some way to bridge the knowledge gap between them and the available GHG inventory resources (Gonzalez, 2014; Blandino, 2014). Put another way, there is a need to make the *available* resources *accessible* for SMEs.

Our two-part deliverable was designed to address this need. Our database was intended to present nationally- and internationally- recognized resources for each step of the inventory process, and our brochure was intended to outline the information necessary to understand these resources. In this way, the deliverable was set up so that the high-level overview of the inventory process in the brochure directs companies to corresponding detailed information. Due to SMEs' existing difficulties with understanding technical GHG inventory concepts, our brochure and database were designed with a focus on "graphics and simple step-by step-instructions", as recommended by ALIARSE representative Mauricio Blandino (2014).

5.1 Brochure Design

The brochure consists of four pages, outlining five aspects of GHG inventories: motivation and definition, GHG inventory methodology, verification standards, recommendations, and contact information for verification bodies. The brochure can be viewed in Appendix K.

5.1.1 Motivation and Definition

Some organizations decide to track and reduce their GHG emissions "just because they believe" in the global or regional effort to minimize company impact on the environment (Gonzalez, 2014). Completing a GHG inventory is an investment of both money and time, and it is important that SMEs with limited finances and manpower understand the returns on this investment. In Costa Rica, the primary goal for companies seeking an inventory is carbon neutrality, given the country's carbon neutrality goal of 2021 (Solera, 2014). The first section of our brochure is introduces carbon neutrality, the business incentives for pursuing carbon neutrality certification, and defines the GHG inventory as the first step. These business incentives are presented on our brochure in chart form, as shown in Figure 4.

Fig. 5 – Business Incentives from Carbon Neutrality

5.1.2 GHG Inventory Methodology

Next, the methodology of GHG inventories is introduced. The steps for the GHG inventory process are presented in flowchart form, and were sourced from the GHG Protocol *Corporate Accounting and Reporting Standard*. Figure 5 presents this flowchart.

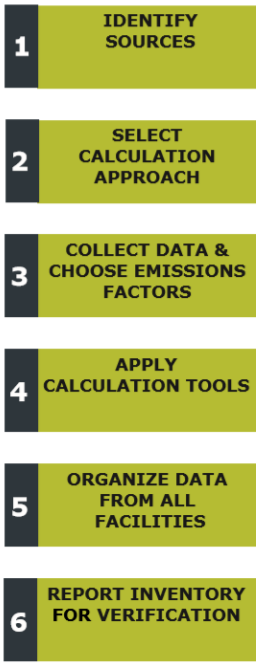


Fig. 6 – Flowchart of GHG Inventory Methodology

5.1.3 Verification Standards

Companies seeking inventory verification must ultimately decide what standard to use for verification (Mena, 2014). To clarify the various standards available for verification, our brochure presents an overview of these standards: PAS 2060, ISO 14064, and Costa Rica's *National Standard*. Along with brief descriptions of each standard (see Appendix K), key information about each standard is presented as a comparative table, as shown in Table 2.

Table 2 – Comparison of Inventory Verification Standards used in Costa Rica

	INTE 12-01-06 (National Standard)	PAS 2060	ISO 14064
Organization	Instituto de Normas Tecnicas (INTECO)	British Standards Institute	International Standards Organization
Purpose	Carbon Neutrality	Carbon Neutrality	GHG Inventory and Verification
Recognition	Central America	International	International
Gases Considered	7 GHGs identified in Kyoto Protocol	7 GHGs identified in Kyoto Protocol	All GHGs
Required Scopes	Scope 1 Direct Emissions Scope 2 Indirect Emissions	Direct Emissions Scope 2 Indirect Emissions Some Scope 3 Emissions*	Scope 1 Direct Emissions Scope 2 Indirect Emissions
Funding Available	PROPYME / MICIT	PROPYME / MICIT	PROPYME / MICIT

The six comparative properties were selected based on problems and recommendations identified in our interviews: purpose of verification standards, recognition, scopes and emissions to be considered, and funding available for GHG inventory projects.

5.1.4 Recommendations with Links

Next, common issues encountered by verification bodies when attempting to verify company inventories are provided, along with verification bodies' recommendations to address these issues. These are issues that companies can fix before engaging verification services. As several of these recommendations are technical, relevant resources in the database that address these recommendations are listed by name. This listing also provides a direct link between the brochure and the database.

5.1.5 Contact Information for Verification Bodies

For further information about the verification process, contact information from the verification bodies in Costa —SCS Global Services, Earth University, and INTECO—is provided.

5.2 Database Design

A centralized resource that provides "SMEs free access to relevant information, such as calculation tools and data… is the key" for giving SMEs the capacity to conduct GHG inventories without having to incur high expenses, such as from hiring consultants (Gonzalez, April 2, 2014).

In order to provide SMEs access to all of these resources, we created a structured database, which could be accessed either online or on a CD. Figure 5 presents an overview of the layout of the database.

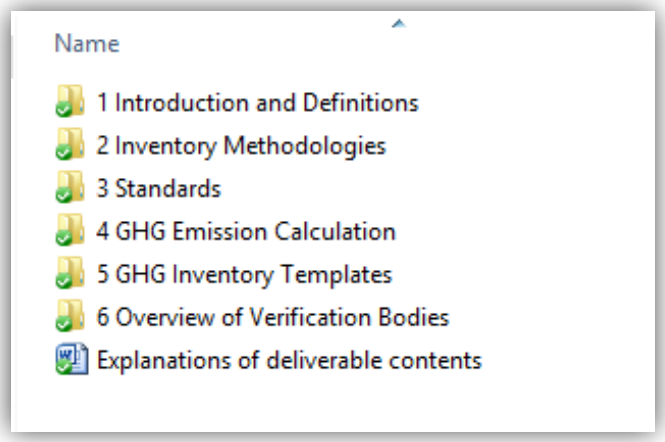


Fig. 7 – Organization of Folders Contained in the Database

5.2.1 Introduction and Definitions

The *Introduction and Definitions* section provides companies with a quick overview of common terminology used in a GHG inventory process. As previously noted, companies often pursue GHG inventories with little knowledge about the process (Gonzalez, 2014; Solera, 2014). The GHG inventory methodologies are highly technical documents and typically contain many terms that may confuse a reader without prior knowledge of their meaning. Therefore it is crucial that these readers have access to a compilation of common terminology before they begin to access such documentation (Gonzalez, 2014).

5.2.2 Inventory Methodologies

Inventory Methodologies, the second folder within the database, contains guides that describe step-by-step processes companies can take during a GHG inventory including checklists, discussions of methods according to sector, and examples. Examples of prior inventories and step-by-step checklists can provide an SME with a solid basis for understanding the inventory process. Guidance on defining emissions scopes and inventory boundaries—an issue SMEs often struggle with—is also included in this folder (Solera, 2014; Gonzalez, 2014).

This guidance document was synthesized by this team from the GHG Protocol *Corporate Accounting and Reporting Standard* (WRI & WBCSD, 2004), and a paper reviewing ISO 14064 (Wintergreen & Delaney, 2007).

5.2.3 Standards

Representatives from all three verification companies mentioned that SMEs have little knowledge of the standards utilized in Costa Rica prior to pursuing a GHG inventory (Solera, 2014; Mena, 2014; Gonzalez, 2014). The third folder of the CD, *Standards,* provides resources outlining each of the three organizational standards used in Costa Rica: INTE 12-01-06 (The National Standard), ISO 14064, and PAS 2060. The requirements for each standard differ slightly, depending on a company's goals in inventorying its emissions. These files provide SMEs with access to the resources that will help them discern which standard is most appropriate for their emissions goals. It is the companies that seek verification that choose the standard for verification (Mena, 2014). Guidance for selecting a standard appropriate to a company's inventory goals is provided as a decision tree. The decision tree, provided in Figure 7, was created by our team based on information gathered from our interviews.

5.2.4 GHG Emission Calculation

Calculating an estimate using emission factors is the recommended method of quantifying emissions for GHG inventories (Solera, 2014; Gonzalez, 2014). Often companies do not know where to find or how to use emission factors in their GHG inventory (Solera, 2014).The next section, *GHG Emission Calculations,* provides calculation spreadsheets, emission factors, and equations a company will need to conduct a GHG inventory. For accurate GHG inventories, it is important that the emission factors used in the calculation are up-to-date, corresponding to activity type, and Costa Rica specific wherever possible. A list of Costa Rica specific emission factors for typical company activities is annually updated by the country's National Meteorological Institute (IMN). The IMN emission factors provided in this section are specific to Costa Rican atmospheric conditions, and are the most up-to-date values at the time of this report. If an appropriate emission factor for a particular company activity is not available on the IMN list, more emission factors are available for free at emissionfactors.com. This comprehensive online resource contains about 26,000 emission factors for a wide range of activities, and is easily searchable by sector and region (Ecometrica, n.d.). This information is provided as a link in our database.

These Excel spreadsheets and data table templates allow SMEs to input their data and receive an output of how each company activity adds to their carbon footprint. The last subsection provides details of equations that are incorporated into the spreadsheets. This allows companies to perform additional calculations if the spreadsheets do not provide all the information they are required to submit as part of their inventory.

5.2.5 GHG Inventory Templates

Using the calculation spreadsheets provided, substantial amounts of data are produced for SMEs to navigate. The fifth section, *GHG Inventory Templates,* contains documents that SMEs can use to tabulate the large amount of emissions data calculated from the spreadsheets. Without these guidelines, the inventory process and calculation of pertinent data could inundate SMEs with no direction of how the data should be organized. In addition to providing tables to organize the data, these templates provide breakdowns by sector to assist in further organizing emissions by type.

5.2.6 Overview of Verification Bodies

The final section in the CD and provides SMEs with a basis for understanding how the three verification bodies in Costa Rica operate. All three of the verification companies provide services to companies before and during a verification process. The resources included are intended to highlight the services available. This section also seeks to elaborate on the information provided in the brochure which includes the contact information for the three verification companies and the verification process.

6 Conclusions and Future Recommendations

The goal of our project was to discover information about the process required to conduct a GHG inventory and compile that information into a resource for SMEs. The focus was on GHG inventories within Costa Rica. We found that the three major standards for verification used in Costa Rica are ISO 14064, PAS 2060, and INTE 12-01-06 (The National Standard). We were also able to find existing resources that explain the standards used in Costa Rica, and outline the process of completing a GHG inventory. SMEs face unique difficulties due to their financial limitations, lack of in-house expertise, and inability to hire a consultant to assist in developing an inventory. Having access to these resources could allow companies to produce a GHG inventory without incurring unnecessary financial burdens. The resources were compiled into a brochure which provides an overview of carbon neutrality, the standards used in Costa Rica, common issues SMEs have faced in the inventory process, and an outline of the resources that are available. Due to the nature and large number of resources gathered, they were placed in a database referenced by the brochure. The brochure and database, used in conjunction with each other, provide SMEs with a starting point on their path towards achieving carbon neutrality.

During the course of our research there were certain recurring topics that were outside the scope of our project. They are, however, important considerations and could provide a starting point for CNP+L to further assist SMEs and prepare for future research projects.

We recommend that if SMEs wish to complete a GHG inventory and obtain verification, CNP+L direct them to funding available through governmental programs.

Our discussions with SMEs revealed that a major concern with conducting a GHG inventory and seeking carbon neutrality were the high costs associated with the process. Many of the companies we met with were only able to accomplish verification through government funding. The funding was given through the government program PROPYME. This is a support program for PyMEs (SMEs) in Costa Rica that provides funding for projects that help SMEs gain competitiveness through improved technical and social development. PROPYME is funded by the Ministerio de Ciencia y Tecnológia (MICIT). PROPYME is available to all micro-, small-, and medium-sized enterprises with projects approved by the Ministry of Economy, Industry, and Commerce (MEIC). The funds provide non-reimbursable support for 80% of a projects cost.

In order to reduce the financial obligations of a high cost project, we recommend CNP+L to encourage SMEs to research the requirements for participating in the project PROPYME. There are specific requirements in the application process before a company can be approved by MICIT and the Consejo Nacional para Investigaciones Cientificas y Technológias (CONICIT).

CONICIT and MICIT worked together to create a guide—Formulario PROPYME—that outlines these requirements and the application process.

We recommend the development of a companion resource, similar to the deliverable of this project, for SMEs seeking to reduce and compensate their emissions.

As discussed in the brochure, completing a GHG inventory is only the first step towards achieving carbon neutrality. After inventorying emissions, the next step is to reduce and offset an equivalent amount through reduction and compensation. These reduction and compensation efforts must bring the company's net carbon emissions to zero. Reduction consists of adjusting a company's processes to lower the amount of emissions released. Compensation utilizes carbon trading to complete indirect reductions through the purchase of carbon credits from any projects that have a negative net carbon emission.

When companies attempt to become carbon neutral, typically reduction efforts are not enough to completely offset their complete carbon emissions. This creates the burden of offsetting the rest through compensation. In our discussion with Sra. Mena of EARTH University, she indicated that when companies seek carbon neutrality, compensation is the most difficult aspect of the process for SMEs to understand (Mena, 2014). In addition to being difficult to understand, there is a high financial cost incurred when compensating emissions (Duarte, 2014). This often will deter companies from completing the process of becoming carbon neutral. As a national carbon-offset-trading market continues to increase, more companies must become aware of the procedures and obstacles within carbon trading. We recommend that CNP+L develop a guide that outlines the carbon credit market as a whole, as well as the requirements within INTE 12-01-06 and PAS 2060.

We recommend that CNP+L develop a recommendation on how SMEs can better market their carbon neutral certification.

In order to gain a positive return on investment, SMEs must understand how their carbon neutral certification will improve their image. When a company achieves carbon neutrality through the INTE standard, they earn the right to use a government-certified carbon-neutrality mark for advertising and marketing. As previously mentioned there is a very high financial cost associated with the complete process of obtaining carbon neutrality. To make this investment worthwhile the company must make sure they have a market strategy prepared for when they achieve the mark of carbon neutrality.

Companies seldom have an understanding of how to utilize the mark of carbon neutrality before they begin conducting a GHG inventory. Sra. Silvia Vindas expressed this sentiment in our conversation with her regarding Beneficio Cerro Alto's process in obtaining a verified GHG inventory. The company successfully achieved the mark of carbon neutrality but

was struggling to integrate the mark into their advertising and marketing efforts (Vindas, 2014). Therefore we recommend that prior to an SME investing a large amount of resources into becoming carbon neutral, CNP+L assist the companies in developing ways they can market and utilize the C-neutral brand for economic gains and to improve their reputation.

We recommend that CNP+L provide resources specific to product level verification and completing product life cycle inventories according to standards such as PAS 2050 and ISO 14044.

Although the focus of our study was organizational level inventories, it is possible for companies to complete product level GHG inventories and obtain a carbon neutral mark for specific products. Two standards available internationally for product level verification are PAS 2050 and ISO 14044. The GHG protocol also provides guidance on product life cycle inventories. Our research indicated that typically companies are more interested in completing organization level GHG inventories; however, for companies exporting goods it may be more beneficial for them to obtain verification for these specific products. Product level inventories were excluded from our study due to the lack of company interest and extremely high cost associated with obtaining product verification. If SMEs export products and would like to pursue product level verification access to resources similar to what we produced for organization level inventories could likewise save them time and financial resources.

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Credit for Figures

Figure 1: Overview of Emission Scopes

http://www.wbcsd.org/web/publications/ghg-protocol-revised.pdf

Figure 2: Steps in Identifying and Calculating GHG Emissions

http://www.wbcsd.org/web/publications/ghg-protocol-revised.pdf

Figure 3: Rathbone Brothers PLC Carbon Footprint Report

http://www.corporateregister.com/

Figure 4: Decision Tree for Selecting Verification Standard for GHG Inventory

Produced by this IQP Team

Figure 5: Business incentives from carbon neutrality

Produced by this IQP team

Figure 6: Flowchart of GHG inventory Methodology

Produced by this IQP team

Figure 7: Organization of Folders Contained in the Database

Produced by this IQP team

Appendices

Appendix A: Summary of All Interviews

Summary of Interviews conducted with various representatives

Company	Type of Company	Representative, Position	Date of Interview	Location
SCS Global	Verification Company	Juan Solera, Director Regional	April 1, 2014	Heredia, Costa Rica
EARTH University	Verification Company	Karla Mena, Asistente Tecnico y Proceso de Verificaciones	March 28, 2014	Guácimo, Costa Rica
INTECO	Verification Company	Manuel Gonzalez, Coordinator de la Unidad de Verificacion de Emisiones de GEI	April 2, 2014	San Jose, Costa Rica
ALIARSE	Organization promoting sustainability	Mauricio Blandino, Director de Proyectos Ambientales	April 10, 2014	San Pedro, Costa Rica
Azucarera El Viejo	Verified SME	Laura Aguero, Jefe Departamento Ambiental	April 14, 2014	San Pedro Costa Rica, Phone Interview
Atemisa Precision	Verified SME	Kelly Duarte, General Manager	April 24, 2014	Heredia, Costa Rica
Beneficio Cerro Alto	Verified SME	Silvia Vindas, Owner	April 24, 2014	Heredia, Costa Rica

Appendix B: Interview Questions for SMEs

Date	Interviewee	Interviewer	Position	Department	Company

Good morning, _____. Thank you for providing us this interview. Do you mind if we record this?

First we will give a little background about ourselves. We are a team of undergraduates from Worcester Polytechnic Institute, Massachusetts USA. We are here in Costa Rica to work with Centro Nacional de Produccion más Limpia (CNP+L), to help small Costa Rican businesses complete greenhouse gas inventories. CNP+L would like us to create a brochure that directs PyMEs to resources for conducting a GHG inventory.

We were hoping to learn more about the processes of taking and verifying a GHG inventory from the perspective of an SME from interviewing a company [conducting a GHG inventory]/ [with a verified GHG inventory]/[that assists SMEs in understanding environmental certifications]. Understanding your experiences and perspective would help us help small businesses like yours successfully complete and verify GHG inventories.

Just to get started, we were wondering if you could give us a background of your experience with conducting a GHG inventory to this point? Have you completed your inventory?

<u>Resources</u>

If yes, what were the resources you found most useful to understanding the process of conducting a GHG inventory?

If a SME was thinking of pursuing a GHG inventory, what would be the most important pieces of advice you would recommend to them before they start?

<u>Obstacles</u>

What have been the biggest issues you encountered while conducting a GHG inventory?

Were you aware of the standards Costa Rica uses (ISO, PAS, INTE) prior to pursuing a GHG inventory?

How did the cost and time commitments impact your company's decision to pursue a GHG inventory?

Appendix C: Interview Questions for Verification Bodies

To maximize our learning from our interviews, we loosely structured our interviews. Given that our subjects had great expertise in inventory verification, relative to us, a loose, flexible, structure was created to provide them the most opportunity to present a large amount of information to us. Instead of preparing specific questions, we aimed to discuss three themes in our interviews. The questions provided serve only as examples.

Date	Interviewee	Interviewer	Position	Department	Company

Good morning ___. Thank you for providing us with this interview. Do mind if we record this?

We are a team of undergraduates from Worcester Polytechnic Institute, Massachusetts, USA. For our third-year university project, we are working with Centro Nacional de Produccion más Limpia (CNPL) in Costa Rica. CNPL would like us to research information on various standards and tools for creating a GHG inventory, and create a document that directs businesses to further resources that may help them conduct a greenhouse gas inventory.

We know that verification is an important step after GHG inventorying. Verification removes the risk of greenwashing, and/or may form a foundation for potential carbon neutrality certification.

We're looking for more information about steps that companies (particularly SMEs) have to go through for verifying their greenhouse gas inventories. Sra. Akira Hidalgo directed us to contact you for your knowledge in third-party verification of GHG inventories. We understand that you are one of the three major bodies in Costa Rica offering inventory verification services.

<u>Standards</u>

What are the standards you commonly use to verify inventories?

What resources are available for SMEs attempting a GHG inventory?

<u>Verification Process</u>

What are some common mistakes you see when verifying company inventories?

How would you recommend SMEs overcome these issues?

What are the costs involved for verification?

What is the typical timeline of verification?

Project

What information or resources would you recommend we include in our deliverable?
May we have the contact information of companies that you have verified?

Appendix D: Transcript of the interview with INTECO representative Manuel Gonzalez

*In this report Appendix D is cited as (Gonzalez, 2014)

We are a team of undergraduates from Worcester Polytechnic Institute, Massachusetts, USA. For our third-year university project, we are working with Centro Nacional de Produccion más Limpia (CNPL) in Costa Rica. They would like to research information on various standards and tools for creating a GHG inventory, and to create a document that helps businesses, especially small businesses, to go towards resources that help them conduct a GHG inventory. We know that verification is an important step after GHG inventorying. Verification may form a foundation for potential carbon neutrality certification. We know that.

So we're looking for more information about steps that companies (especially SMEs) have to go through for verifying and actually doing their greenhouse gas inventories. Sra. Akira Hidalgo directed us to contact you for your knowledge in third-party verification of GHG inventories. We understand that INTECO are one of the three major bodies in Costa Rica that does inventory verification.

Yeah, that's great. So if you don't mind, we'll go ahead and ask you some questions so we get to know how INTECO works.

Sure

So could you maybe provide us with a bit of information about the National Standard, that's used here in Costa Rica? We have done a lot of research on standards, so we just wondered about the National Standard and its specifics.

The National Standard was launched, actually the first version, in 2009. And then, the version we use and know now is from 2011. At that time, in 2009, there were very few standards for carbon neutrality in the world. The British launched their PAS 2060 in 2010. So before then, we didn't have any. It [the National Standard] was a mix with – it had a strong a base with ISO 14064 family of standards. Then, in 2010, when we were able to review more literature, the Standard was enhanced with a lot of the British—the Australians had also standards at that time, especially for the compensation part. We didn't have any requisites for compensation, so, this standard has requisites for compensation…for compensation and reduction—which is different from many other standards. Many standards are either for inventories or projects. But no standard has requisites for compensation, or requisites for reduction. So this standard actually has requisites— that the companies have to meet certain activities to demonstrate that

they are reducing their emissions. So that's a big difference that many other standards were lacking

The other thing is that—one thing that I would say is that so far it's been used only in Costa Rica. However, if certain details are changed, it could be used in…somewhere else. Basically, because it makes references to Costa Rican tools or things…. Like the country program, we have a country program, so it's being used for the country program. The other thing that is very Costa Rican is that it has a definition of Costa Rica unit for compensation, which is similar to what you know as certified emissions reduction (CER), but on a Costa Rican standard. So, it has developed that unit, that unit is equivalent to 1 ton of CO2, but it can be exchanged in a potential domestic market, once Costa Rica develops a domestic market for that. So that's another difference.

This standard can be used for any kind of organization, no matter the size. It cannot be used for product declarations, like EPDs. Its scope is specific for organizations, and it could be a small business.

There's no product life cycle component?

There's no product life cycle component, exactly.

Going off that track, a big part of our project is going to be the focus on greenhouse gas inventories. Does this standard cover how to do a GHG inventory?

Yeah, it covers the requisites. It does not have, like a toolbox, that shows how to. But it does have the requisites. Basically like any other standards, will have requisites that the organization has to set up its organizational boundaries, its operational boundaries…that it has to classify emissions on different scopes—like 1, 2, and 3—the same basics of how to comply with international requisites, of how to develop your inventory. So that is covered in the Standard.

And sort of broadly speaking, how does the National Standard's guidance on inventorying, how is that different from the other standards like ISO, and the GHG Protocol?

The GHG Protocol, I would say is more comprehensive. And it has examples, and shows people how to do it. This Standard does not—it only has requisites. So it only shows the "shalls"—that the organization "shall" commit or comply with.

Great, we'll continue with some of our questions. So, as said before, we're going to be helping SMEs for the most part—so, small-to-medium-sized companies—and part of that summarizing what all the standards are…because they have to pick which standards they want to be certified on. And sometimes they have…big companies have a lot of money, so they can hire consultants. But when you have an SME, who doesn't have those resources,

what would you recommend these SMEs? What kinds of resources are available for them, that they can use?

Ah, that's a good question. In other countries, probably in other countries, when a country program is launched, it comes with a lot of literature or toolboxes, so SMEs could develop that. We lack of that, so far. The capacity building is extremely important for SMEs. So far, I can tell you our experience, what we've done. Since we started this, I think we have…we were trained on GHG Protocol. And we have accredited instructors for GHG Protocol. So we have trained on how to develop an inventory. I would say, I wish had that data, but I would say perhaps around 500 people. And we've done this by getting grants from international corporations, and all the training has been free.

To SMEs, or…?

Everything. We've had big companies, but there were SMEs there too. And we have examples of SMEs, that, with only little training, they have been able to develop their own inventories. Basically, using a methodology of using an estimate with emissions factors, that has been the most widely used methodology. And with very little training, I would say, 16 hours of training, they have been able to develop their own inventories.

Interesting. Where did they get their emissions factors from?

Costa Rica has developed a webpage, Meterologico IMN. And there's a pdf you can download— its free— and you can get all the emission factors, so its public. The other thing that we recommend a lot is that there is a lot of web-based information that is of public use, it's free. So we actually had like a little wiki, that we shared with all kinds of companies, SMEs. And we give that information to them so they will be able to see that there are a lot of resources that they can use.

Could you give us the website of this wiki?

It's in INTECO…what we do is that we hang it on our webpage. So when we give a seminar, they can download it right away. But if you want, I can give you the information… I have it on a USB. That could something new that has not been developed, that could be a product… to develop an actual wiki for this. So people would have free access to relevant information: calculation tools, data, stuff like that could be really useful. And I think that's the key of how an SME will be able to do this without having to hire consultants, or having high expenses for that.

I don't know if you talked with Akira… another resource that the country has put available to SMEs is funds for this. This year, we are doing the verification of two SMEs that were sponsored by a country grant for technology and these types of initiatives are within the scope of this

grant. So they were able to get the money for CNPL, they were the consultants, they helped the SMEs. And the fund had enough money for them to go to a third-party verification. So that's all being paid for.

That's great. And this is through the national government of Costa Rica?

Yes, it's through national government. It's by the CONICIT, which is the science and technology ministry.

OK. Going off a little bit, off to a different topic, when companies, SMEs, or any big companies come here to INTECO to verify their GHG inventories, what are some common mistakes that you find as a verifying body? Or even obstacles that they face?

Obstacles that they face first…

Sort of things you wish they knew before they came here, and you know, you told them, you're …

Sometimes, I would say, it's a little bit of lack of knowledge, because… on the technical part, I could be very technical on the mistakes that they usually make. But sometimes they don't even have clear how to set up their scopes, on how to develop their inventories. The other thing that we see a lot is a lot of mistakes in units, in conversion of units. A lot of mistakes are made just by converting units, from kilograms to tons, and stuff like that. That's very common.

The drive for a lot of them is, I would say, image. A lot of them come here thinking that, you know, they want to do it. But when they start they know that they don't have the capacities or the knowledge to do it.

So sort of they just want to be carbon neutral so they can use or put the logo, but they have no idea that they have to do maybe a GHG inventory?

Exactly, exactly. They have that drive, they hear this in the news and they say, hey, I want to do it. Then they come here with nothing. So they have to go back and start all over.

What would you say is a typical cost, for a company to verify inventory according to the National Standard?

A small SME, sometimes less than a thousand dollars a year, could be. A large company could be thousands and thousands of dollars. It depends on the amount of sources, the data—verified data is always more difficult. We have examples of companies that have over 800 vehicles in the fleet, and they have to process invoices that are over three or four thousand invoices a month, with all the oil and gas usage. It's difficult. But others are very simple. Like offices. You know, it's electricity, commuting… it's usually much easier.

Would it be possible for us to see, do you maybe have like a…services with how much they are, that you could provide us with?

Like a quote?

Yeah. Or is it something that you would go to the company and then create then?

Yeah, we have… the company has to submit certain information prior. Basically, based upon the amount of tonnes of CO2…and depending on that, and the data, we calculate how much days we would need. However, our base, and I could tell you this, that one verifier-day is about 700 dollars.

OK. And what do you mean by verifier-day?

A verifier-day is a day of a professional, of 8 hours, working, doing the verification on-site.

OK. The reason why I ask this question is just because…we want to create a brochure, or like a digital version we can give SMEs, to connect them to these resources. So we're going to be including verifying companies, because that's one of the steps. So we want to include INTECO in the brochure, as part of, you know, these verifying bodies, you can go to these verifying bodies. Because sometimes they're not even aware of which verifying bodies there are.

One thing that might be important there is the accreditation, the importance that the verifying body will be accredited. In Costa Rica only two of us are accredited right now: EARTH and us. So that should be important in the technical part for making a decision on who am I going to choose.

Another very important issue that companies ask, especially companies that export, is: the recognition of the seal or declaration in foreign markets. They see that as a very important drive; however, since it's a national standard, we also see it as a big challenge on how can we sell the idea or convince foreign countries that this standard actually has value, that this standard is actually demonstrating carbon neutrality on companies. So it could be recognized. If we are able to make this happen, we would have to triple the whole of this unit within the next few weeks. Because all exporters will like to be carbon neutral, because they know their product will be recognized in Europe or in the US… That will be actually like a domino effect.

So after a company takes and verifies an inventory, is there a renewal process to renew the verification, every certain period?

Every year. Inventory has to be checked. Actually it's important to understand that nobody is carbon neutral in real time. A company will only demonstrate that for a specific period of time. They were able to measure all their emissions, they were able to measure all their reductions,

and compensate the residual part. So as for the reporting year, if it was 2013, and we're right now in 2014, we will verify 2013. And it will be that period of 12 months that can be demonstrated on that declaration. It's not in real time, it's not like right now.

It's not the present.

It's not the present. It is for a specific period of time. And that's how we do it.

There are certain very important differences within standards. I recall one that is very important. For example, the British standard states that carbon neutrality is that there is no net increment in the emissions to a baseline period. There is no net increase in emissions from a baseline. That's carbon neutrality for the British, which is very tricky, because that will allow me to have a negative asset on emissions in certain amounts. For example, if in 2012, my company… is my base year. And that year, I emitted, let's say, 20,000 tons a year. That's my baseline. 2013, my company emits 25,000. So, in order to be carbon neutral, we'll beat the net increase for the base, which will be only 5,000. So I only have to work on reducing 5,000 or compensating 5,000, not the 25,000. In the Costa Rican standard, carbon neutrality is for the whole emissions of the previous year. So that means that the company needs to worry about the 25,000 emissions and how to reduce them and how to compensate all of them. Not only the net increase. You can view that definition in the PAS.

And this is PAS 2060, correct?

I think 2060, yeah.

So you would say that the National Standard is probably the most…?

It's more strict, in that sense. Because of the definition of carbon neutrality—it's related to the reporting period. Which, on the other hand, has made companies—I would classify—a small company is a company that emits less than a 100 tons a year. Then we have the next, which would be from a 100 to a 1000. I would say that there would be another third category, up to the 10,000. And after 10,000, over. We have companies that emit, I don't know, 600,000 tons a year. Which is nothing… you know that, there's a cement factory in Mexico that produces half of Costa Rica's emissions. Country.

Wow. One factory?

Just one factory. Just one cement factory, or one steel factory can emit more than this country. Costa Rica itself, we're producing right now, we should be around 14 million tons a year, right now. And, per capita, Costa Rica emits about 2 tons a year. Developed countries, about 17.

So we're not a very intense carbon economy. We have a unique grid for energy. So that makes our intensity low.

Great, thank you. The next question that we have is, would it be possible for us to have the companies that you have verified? Is that public information that we could maybe have access to? Because we plan on interviewing those companies, to see what they have done well.

Sure. You can enter the webpage, that's public information. It's on the webpage. You go to the certification part, and in the part of inventories and carbon neutrality, there's a whole list.

How would you recommend us…who should we contact in the company? Because maybe we get the name of the company, who's usually the person in charge of the carbon neutrality?

Yeah, usually a lot of these companies have what I call "green employees". *laughs* No, no, no .... There are now a lot of environmental engineers and usually the person in charge of the EHS—which is environmental health and safety department—is the one that's usually in charge of this. In terms of SMEs, usually there is somebody that does everything. So I would ask for the person in charge of the inventory. That will be the way to go. And then you will get on the right track.

OK, and then we just have few more questions and then we'll be done with this. One of the questions is, like I said before, we're going to have the brochure, given to SMEs, and we plan on including a quick summary of all the different standards. We plan on including resources such as the verifying bodies, where they can find information. What are some of the things that you would recommend us, that you would find useful for an SME, to include in the brochure, from your experience and your knowledge?

I would include references to all sorts of information, where they can learn how to do it. GHG Protocol published, some years ago, a very small guidance on how to do it. It was called…From 9 to 5: How to calculate, or develop, your inventory. Very simple, with examples. Also more technical references: IPCC has developed incredible amounts of knowledge that can be useful for them. Especially on more technical inventories, like if I'm doing a…if I'm in the steel business, or if I'm in the glass business, I would need more technical information. There is…let me bring you that right away, because it might help me to answer this better. Let me bring you that information right away.

How difficult is it to find this information in Spanish, for these companies? Most of the time it's in English, correct?

All the information that I'll give you is in Spanish.

Oh, great.

OK, this one is called "Compartir GEI". It has all the volumes, in Spanish, of IPCC 2006. So, they could go for energy, industrial processes, agriculture, waste. It has... this was a US program, which was developed by the Climate Leaders. So it's a checklist…when they're ready, this could help them to evaluate themselves, if they have considered all the issues of their inventory correctly…

This is a template used by the GHG Protocol on how to report emissions. It has all the requisites that any company should have. And it's in Spanish. So it's a template that can help them pretty much know exactly what they have to do….

This is an Excel sheet that has…this is from Brazil program. But it has all the emission factors from any kind of fuel that you can imagine. So, all the data is there. It's a good source, it's official.

Then, these are the Costa Rican emission factors. I don't know if it's the last one, or if we have to update it. GHG Protocol for communities… Costa Rican inventory, life cycle reporting… This is that guide I was telling you. It's very simple, I don't know if you've seen it. But it has step-by-step, a little bit of introduction, and then step-by-step, how to develop an inventory. But it's in English.

Is this available online?

On the GHG Protocol website. I still have more information, but this is basically what we have. You can include the GHG Protocol, which is free, and many others. But at least knowing that there are all these references could be very useful for an SME.

That's great. Do you mind if we just copy the entire "Compartir…"?

Yeah, take the whole file.

Lastly, is there any other information you think would be relevant to helping SMEs do inventories, in our brochure?

Well, capacity development is key for that. You know, we need to develop the capacity on how to do it. The other thing would be incentives, a drive for them to do it… relevant information. Some people do this just because they believe it. For an SME, it's very difficult, because, you know, they're struggling with their finances. And, you know, they see this as an expense, not as a benefit. So they definitely need some sort of incentives. And what kind of incentives, besides recognition or image? It's important.

And this is definitely something that the government, as of now…they don't really give incentives, per se?

If a domestic market would begin to perform, I see that there will be a direct financial benefit. Because, let's say I'm an SME, then I develop a project, which I can sell in a domestic market. Then I'll be paid for the reductions. Then, I see an incentive.

You mentioned that one big issue companies face is capacity development. Could you just briefly explain a bit more on what that means?

In terms of that, capacity building is because sometimes an SME does not have somebody that has the knowledge or the training for developing an inventory. So, by lacking of that, it's impossible for them to develop, or reach that goal. So we need to work on that, on how to train them. Even in this subject, it's becoming so relevant that I don't even know if, in university, programs that the department of admissions or energy, for certain careers, it's something that is part of their science.

I heard that, last year, the UK had approved a bill so all the companies that are trading on the stock market, they all have to report their emissions. It's regulatory now. So if you're a public company that's trading on the stock market you have to report your emissions.

I mean especially here in Costa Rica, since the goal of becoming carbon neutral by 2021, it's eventually going to be a requisite, I can imagine, right?

Policymakers started this as a voluntary basis program. I don't know if, within a few years from now, that becomes a requisite. Could be.

So that's all we had. It's really good information. It's going to help CNP+L and all these SMEs, and we thank you for that.

Good, good. Ask Akira about the program, the CONICIT.

How do you spell that?

C-O-N-I-C-I-T

Do you guys have maybe brochures or things like that maybe we can take from here that we could give SMEs, or use that information, such as contact information, that we can put in our brochure, about INTECO?

OK. It's general about INTECO, but we have a bulletin for the carbon neutrality, which is a PDF that…we're trying to be paperless. I'll tell Manuel, my assistant, to send you that, so you can have it.

Perfect. Thank you very much.

You're welcome.

Appendix E: Transcript of SCS Global interview with SCS Global Regional Director Juan Solera

*In this report Appendix E is cited as (Solera, 2014)

So we will start with one of the few first questions if you don't mind. What are some of the standards that SMEs in Costa Rica commonly use or that SCS Global has used to verify GHG inventories.

Well basically two, everything is based on 14064

Correct

And the world resources institute standard. And, that is the baseline that is the standard for companies that are looking for international recognition. Also, as you know there is a Costa Rican norm and that is based on 14064 so basically in the end it goes back to 14064 but for companies looking for Costa Rican authorities recognition we use the rules of the Costa Rican norm

Great, we have also done some other research of the different standards. What do you know about PAS 2050 or how widely used PAS 2050 is in Costa Rica.

Well I don't think PAS 2050 is... there is only one company with PAS 2050 and that is Pacificio Total. I don't think PAS is widely used here. Well you have PAS 2050 or PAS 2060, I think PAS 2060 which is the one more on the organization of carbon neutrality.

Mmhmm

Could have more possibilities, PAS 2050 which is product carbon neutrality. That is a pretty tough one to get the measurements. I don't think there are many success stories in the world using PAS 2050 because as I understand doing the carbon footprint for products is way too difficult

I see

And, way too expensive, and there does not seem anybody willing to pay that extra money for products that can demonstrate they are carbon neutral. That is what I understand, I don't know for sure.

Okay

PAS 2050 and PAS 2060 are according to my understanding the most widely used standards in the world towards carbon neutrality.

Great thank you very much; going onto a different question. Could you tell us about the companies that you have verified their Greenhouse Gas inventories? What are the typical companies that you see that you verify?

Our job has been more with Agricultural projects, companies. And I guess that is because SCS has a long reputation with other standards related to the food and packing industry this type of standards for sustainability. So we are relatively close with companies that work in the food and snack businesses. We have done jobs with coffee, coffee plantations, we have done jobs with bananas, we have started projects with pineapple companies. And, that has been our experience in Costa Rica. Now SCS as a corporation we do have a wide variety of projects starting with delta airlines. We did the carbon footprint it's the first time there is a carbon footprint verification of a major airline. We've done like Levi Strauss and Fruit of the Loom. So SCS as a corporation has done many pretty big projects in many different sectors. In Costa Rica so far it has been so far more agricultural projects.

Thank you. Could you tell us about the cost and the timeline associated with the verification process?

That really depends on a series of factors. It depends on the size of the company it depends on the scope, scope 1 2, scope 1 2 3. It depends on one location multiple locations it depends on the quality systems that the companies have. The quality systems are well established and easy to revise or aren't too well established and are complicated. So there is a huge set of factors that make the project more expensive or cheaper. Typical projects in Costa Rica are between 2 and five thousand dollars average. Time line also it depends, the process is first we do a desk audit. The desk audit, again it depends, on the complexity and the scope of the project but once we receive information in a proper way, it is organized and complete the desk audit may take two weeks, after the desk audit if there are findings those findings are notified to the customer and it will depend on the customer how long it takes to fix or provide additional information or get the corrective actions in place. Once that is done a side visit, a side audit is planned, again and depending on the size of the company and the multiple locations but usually side visits take one to two days unless it is a very complex project or a very big company or there is multiple side visits then it is going to take longer. Again that audit more findings can show up and again those findings are communicated to the customer. The customer needs to provide proof of corrective actions or additional information. Once all the information and all the findings are resolved the whole thing needs to go to a technical review which will again take approximately two weeks. And after that technical review is over if there are no findings, which there usually are not, then the certification is ordered or the verification is granted.

So for example if a small company came up to you, you would stay with the company and maybe do a quota or maybe a budget thing saying how much it's gonna cost,

Right because the way we work we have an application form we will send the company the application form. We ask all the questions with the information we need to have to define the scope, once we receive the application form and have all the information we need to understand the project we will prepare a proposal that will include the timetable that will include pricing that will include methodology will include even the auditors assigned to the project.

Great thank you, so the next question is from your experience what are some of the common mistakes and obstacles that SMEs face when trying to obtain verification, from your perspective?

Again that depends, in Costa Rica what we have found companies try to pursue verification without being ready. They don't have the information systems in place; they don't even understand how to define scope. And usually…the companies sort of feel that….okay let's see as an auditor we are an independent third party that comes to do an audit so we cannot get involved in how to measure we cannot tell them how to think, because that is going to be a conflict of interest. Usually…well not usually, but there is quite a few cases where a company will hire you as an auditor because what they want is for you to come in there and do the audit and you tell them everything to do to pass the audit. They don't want to do the homework themselves they don't want to do the job they need to do. They expect the auditor comes and issues a huge list of things they need to do and that becomes their guide to start doing things. And that has been the case in several circumstances, so that is the biggest difficulty. And usually the whole quality systems and information systems are not ready, the information is not clear or complete the emission factors used are not properly justified. I guess those are the major issues we have found in our projects.

When it comes to verifying GHG inventories that companies have do you see that companies don't even have inventories or they are not able to track their issues well. What do you think would be the issue that companies face the most when it comes to GHG inventories.

Like I said, usually companies want to get the verification way before they are able to do so. They don't have the information system in place they don't understand the standard. I believe that is the biggest concern I believe that companies don't have a clarity on that third party independent position they believe one person can do it all for them. They don't understand they have to do the homework themselves. Reading ISO or reading a guide or getting a consultant or expert to help them also you know they want to get the verification and they are

just starting to measure it they don't have a complete year. That has been the major concern or issue we've found.

Great, like we said before these SME's sometimes don't have resources or money to hire consultants. So for our project we are making a brochure or a tool we can give SME's so they can be better informed as you said before. So going off that what can be some resources companies can use that can benefit we can give in the brochure.

If I was a company starting I would understand ISO 14064 I would read and understand Greenhouse Gas Protocol, I would read the Costa Rica norm. I believe if you read fully through these documents you should be able to have a very good head start. You got a couple web pages to the United Nations, web page for factors to have, emission factors. In Costa Rica Instituto meteriologico does have a lot of emission factors for Costa Rica I think that is an important piece of information for Costa Rican companies. I think that is pretty much it. I also think that if there is a way to open access to companies to other inventories like a public information lab like the Carbon Closure project for example do you know that?

No I don't

The Carbon Closure Project is a Wall Street Project and basically Wall St is asking it's companies to start reporting on their carbon footprint.

Oh I think I did hear that and is that in Britain?

Huh?

Is it the one in Britain where all companies in the stock market have to report their carbon footprint?

It is not mandatory I believe, but it is getting to a point where companies that are reporting on a regular basis their verified carbon footprint is a gives a good image of companies working towards sustainability, and serves that message. And, there is a lot of information about carbon footprint of many and that is something you can look at to better understand what is going on.

Great so when you verify those companies sometimes they don't even have prior knowledge. Do you usually direct them to different resources?

Well the ones I just told you. I tell them you need to learn the ISO 14064, read they The GHG Protocol the Costa Rican Norm read through those webpages and then figure it out. Those are what I usually give them.

How long does the verify status last in terms of renewal process? So when the company becomes verified…

One year.

One year?

Yes you need to verify every year

Does that change with different verification companies or is that the government standard?

That is the usual standard the Costa Rican Norm asks for it yearly as does PAS and GHG. Now it's common practice that the second and third audits are not as thorough if companies don't show any risk. If auditors do not identify any risk associated then you could do the second and third year without the side visit. You get the desk audit you get the documents and you as an auditor see that there is nothing that leads you to believe that something changed dramatically. There is this whole practice that the second and third year are more easy and straight forward. But you should be getting your verification every year. Now I don't know if there are any standards that are for something different. I mean there could be but I don't know, there could be standards that say every five years are good if that what the standards says then every five years is good. But I don't know if that's the case to be honest.

We have about two more questions and then we will be done. One of those questions is I don't know if it is public knowledge but would it be possible for us to see which companies you have worked with before because for our project we plan on interviewing those companies to ask them what they'd think would be good resources. So is there public information you reveal on your website?

Well our webpage there are some of the companies we've done they are not all there but you can certainly check.

I did look at some and it was mostly large companies do you have any small to medium sized?

Honestly I don't have time to go into the states. Mostly I work here, I could ask some of our customers if you can contact them if they are okay and get back to you.

Actually, sorry, we are focusing on Costa Rica.

Okay I can talk to them I've work before for you. And, I can ask them and if they are okay I will send the contact information to you.

If you don't mind that would be very helpful for our project.

That would be great that's all we have for questions.

I do have one last question. Do you maybe have any brochures here or do you have any information we could include in our brochure. For example there are three verifying companies in Costa Rica one is SCS Global, could we include that in our brochure if you have that information.

I am not following

The contact information that maybe we can show companies. Could you share that?

I could email you some brochures.

That would be great.

And also you probably already know, you probably have already met them but the Direccion Cambio Climatico they also do have a webpage where is a lot of information of companies in Costa Rica. So I have in my notes to check if they don't mind, sometimes they don't sometimes they don't.

Yeah sometimes they don't

Then I will send them to the mail of the person that emailed to me.

Appendix F: Summary of Interview with EARTH representative Sra. Karla Mena

*In this report Appendix F is cited as (Mena, 2014)

Due to the length of the interview, the conversation with Sra. Mena was summarized

Our first aim of this interview was to understand the importance of Costa Rica's National Standard and how its implementation compared to that of the international standard (ISO). Sra. Mena pointed out that understanding the National Standard is particularly difficult for small companies who lack resources. EARTH provides a series of classes for these companies that outline the general overview of how carbon neutrality works as well as focus on how to undertake the procedures necessary to inventory their GHGs. It was also mentioned that a good way to help small companies understand how these procedures work is to provide examples of their use. The three procedures necessary to become carbon neutral are to take an inventory of GHGs, adjust operations to reduce GHGs wherever possible, and finally "removing" or "compensating" for the remaining emissions through a series of carbon trading. The following formula was given to us by Sra. Mena to summarize this C-neutral process:

+ Inventory – Reduction – Removal (Compensation) = Carbon Neutral

Within each of these steps is complicated technical information for companies to understand. One important factor that differentiates the National Standard with any ISO standard is the need to find a way to reduce emissions rather than simply using carbon trading to offset the emissions calculated in the GHG inventory. The most important sectors in Costa Rica as seen by Sra. Mena are public transportation, agriculture, and tourism. EARTH's focus is typically on agricultural companies.

The cost factors associated with inventorying a GHG are important considerations for companies to take before beginning the process. We were provided with the estimated price to receive verification. The cost is approximately $1000 per person conducting the verification per day. The number of representatives and number of days needed to complete the verification depend on company size and as such a specific cost cannot be given.

Our next question sought to identify who chose which standards a company would be verified by. Each verification company uses different standards but EARTH in particular utilizes both the National Standard and ISO 14064 part 3 in their verification. The companies that seek

verification are the ones who ultimately decide whether the national or international standards will be used.

An important part of our interview was to understand what issues small to medium size companies typically face when they seek their first GHG inventory. The biggest issue encountered by EARTH is the lack of organization by accountability departments. Typically the companies don't even know what paperwork is required before they begin an inventory. The best workaround for this situation is to provide what information the company will need before they begin the inventory process. In order to do this each emission needs to be organized by type. Common emissions that could be good examples to provide include those from electricity and gasoline. The best way for SMEs to receive this information is to make contact with the verification company and remain in contact through the planning of the verification process.

Appendix G: Summary of ALIARSE Interview with Mauricio Blandino Director of Environmental Protection

*In this report Appendix G was cited as (Blandino, 2014)

Due to the length of the interview, the conversation with Sr. Blandino was summarized

The purpose of meeting with Mauricio Blandino, lead of environmental projects at ALIARSE, was to understand how third-party companies help assist SMEs in the development of GHG inventories.

Prior to discussing the involvement of ALIARSE with SMEs, an overview of the organization was given by Sr. Blandino. ALIARSE works with the Direccion de Cambio Climatico (DCC) to advise companies in the making of GHG inventories. They are funded by DCC and the German company GASAT. Their goal is to spread awareness of the National Program and further the efforts towards helping reach carbon neutrality.

Furthermore, ALIARSE provides technical support in helping companies get through the process of verification. ALIARSE trains companies on technical terms and the importance of managing their carbon footprints. They help companies form GHG committee with the purpose of building capacity in terms of GHG knowledge.

The organization works with companies that vary in sizes. Pertinent to our project, they have worked with SMEs who have as few as 15-20 employees. When discussing the topic of SMEs developing GHG inventories, Sr. Blandino pointed out that one of the main barriers these companies face is the financial burden of having to do everything on their own. Also Sr. Blandino mentioned that the smaller companies typically have trouble with knowing what records are required for them to keep, reiterating what was said by the interviews with the verification companies. Sr. Blandino specified that the resources to facilitate the creation of GHG inventories exist already and linking companies to these resources is an important part of assisting SMEs.

. In terms of the production of a brochure, he mentioned that the information regarding GHG inventories is very technical and the most effective way to relay information to companies that have time constraints (SMEs) is by utilizing graphics and short discussions of information. He mentioned that important sections to include in the brochure are what carbon neutrality is and what benefits a company would gain from achieving carbon neutrality. Because of the high cost and time commitment associated with pursuing carbon neutrality, SMEs must understand what return on investment they could receive.

The conversation transitioned into discussing the different resources that are available for SMEs. Several resources were mentioned, but more emphasis was made on the topic of PGAI. PGAI are public sector institutions that send information concerning GHG emissions to MINAET. Within MINAET, there is a subsector called DIGECA, a technical group of MINAET. DIGECA registers every source of GHG in the public sector. PGAI comes into play by being the program that every public institution uses to report GHG emissions. PGAI offers spreadsheets that are available online for companies to use in the tracking of emissions and development of GHG inventories.

Appendix H: Summary of Interview with Sra. Silvia Vindas from Beneficio Cerro Alto

*In this report Appendix H is cited as (Vindas, 2014)

Due to the length of the interview the conversation with Sra. Vindas was summarized

Beneficio Cerro Alto is a small coffee production company which has just recently obtained a verified GHG inventory and carbon neutrality. Sra. Vindas was able to provide an overview of how SMEs understand the process of preparing to pursue a GHG inventory. During their inventory process they worked with CNP+L who served as their advisors.

The interview began with a discussion of what led the company to seek carbon neutrality. Sra. Vindas indicated that their primary motivations were to improve their company's image and to increase the efficiency of the coffee production. In addition Costa Rica's plan for carbon neutrality played a role in their decision to seek their verification. Even though they are a small company their efforts aid in the ultimate goal of Costa Rica successfully becoming carbon neutral by 2021.

Gathering the proper information was not too difficult for Cerro Alto, as they were assisted by CNP+L. They were able to gather their electric and gas bills easily, needing to prepare a year's worth of these bills. They did, however, have problems with emission specific to coffee production. The furnaces used to dry the coffee had emission factors that proved quite difficult to formalize and present the data for verification. In order to present the data they had, they needed to present specific numbers. Some data were difficult to present in a specific manner. An example of this is tracking the distance their vehicles traveled.

Sra. Vindas noted that the verification process is very complicated and technical. In order to facilitate organizing a GHG inventory she recommended that companies seek some sort of guidance during the process. Managers of SMEs have little time to spend producing a GHG inventory. They need to focus on their business and its difficult to sacrifice time to seek the resources themselves. In order to hire consultants a company must incur a high financial burden. Cerro Alto was able to avoid this cost by being funded through the company CONICIT. Funding of this type is available to SMEs but not to all of them. Therefore, any easy way for these SMEs to avoid a high time and cost commitment would be extremely beneficial to them.

Appendix I: Summary of Interview with Sra. Laura Aguero from Azucarera El Viejo

*In this report Appendix I is cited as (Aguero, 2014)

Due to the interview being in Spanish, the conversation with Sra. Aguero was summarized

Azucarera El Viejo is an agro industrial company that produces around 75 thousand tons of sugar. Azucarera was verified by Earth University in their GHG inventories and sequentially in carbon neutrality. Sra. Aguero, head of the environmental department, was able to provide an overview of the process behind preparing a GHG inventory from beginning to end.

The interview began with a discussion of what led the company to begin tracking their GHG emissions and ultimately seek carbon neutrality. Sra. Aguero indicated that the primary motivations were to improve their company's image and instill the importance of sustainability within the company. In addition Costa Rica's plan for carbon neutrality played a role in their decision to seek their verification.

Azucarera took the initiative of becoming carbon neutral at an early stage compared to several other companies. As a result, the process of becoming verified proved to be a difficult task for them. Sra. Aguero pointed out the difficulties of becoming verified. For instance, Sra. Aguero mentioned the difficulty of having to familiarize herself with all of the standards, especially because the national standard was not available at the moment. Other of the difficulties mentioned included: having to train personnel in regards to tracking emissions, making the "whole" company aware of the process behind becoming carbon neutral, and the lack of resources available.

Sra. Laura Aguero went on to explain that even though the verification process is very complicated and technical, it is possible to achieve if the right measure are taken. During the interview the following recommendations were given in hopes to helping other companies, specifically SMEs, in the development of GHG inventories:

- Creating a standard operating procedure for the process of becoming carbon neutral. Setting up protocols within the company to assure all methodologies are being implemented.
- Providing tools or guides that explain detail how to develop a GHG inventory. Such as documents outlining the whole process of tracking and reporting emissions.
- Creating a checklist which summarizes all of the mandatory requirements needed to complete a GHG inventory.

Lastly, the interview concluded by discussing the importance of verifying GHG inventories and eventually becoming carbon neutral. Emphasis was made on how becoming carbon neutral not helps the environment but also the wellbeing of the company.

Appendix J: Summary of Interview with Sr. Kelly Duarte from Atemisa Precision

*In this report Appendix J was cited as (Duarte, 2014)

Due to the interview being in Spanish, the conversation with Sr. Duarte was summarized

Atemisa Precision is a small manufacturing company that is still in the process of becoming verified. Sr. Kelly Duarte, general manager, was able to provide an overview of how SMEs understand the process of preparing to pursue a GHG inventory. Moreover, he was able to provide an explanation of how a SME perceives reaching carbon neutrality as a tool of competitive advantage. It is also worthwhile to mention that CNP+L is assisting Atemisa Precision in the process of becoming verified.

The interview began with a general discussion of what led the company to seek carbon neutrality. Sr. Duarte, indicated that their primary motivations were to improve their company's image, efficiency, and brand recognition. In addition, Costa Rica's plan for carbon neutrality played a role in their decision to seek their verification. Even though they are a small company their efforts aid in the ultimate goal of Costa Rica successfully becoming carbon neutral by 2021.

Sr. Duarte went on to explain the company's strategy regarding the development of GHG inventories. He began the discussion by noting that CONICIT had funded their company to develop their GHG inventories. Atemisa decided to work with CNP+L and use them as their primary advisors when beginning the process of carbon neutrality. CNP+L's role is to advise Atemisa in the technicalities involved when developing a GHG inventory and advise them on protocols or strategies they can implement.

The discussion transitioned to explaining the difficulties Atemisa Precision has faced and continues to face throughout the process of verification. General Manager, Sr. Duarte, explains that once you start tracking emissions, you find out how much you are actually emitting and as a result you realize how much the company has to compensate. This brings up the issue of having to spend money, which many SMEs don't have. One of the examples mentioned during the discussion was the need of having to invest in electric meters, so that they could track how much electricity they were emitting.

Lastly, Sr. Duarte highlighted the difficulty managers have to face when working for SMEs, as they have to micromanage every aspect of the business. Managers need to focus on their business and its difficult to sacrifice time to learn about the whole process of developing a GHG inventory. Having to learn about standards, accountability of emissions, and tracking paper is not always a top priority for a SME.

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COMPANY GUIDE FOR GHG INVENTORIES

GHG INVENTORY PROCESS

What is Carbon Neutrality

Given Costa Rica's goal of carbon neutrality by 2021, and increasing global awareness of climate change, more companies are seeking to measure, reduce, and offset their greenhouse gas emissions. Measuring emissions, reducing the amount measured and then offsetting the remaining amount is known as carbon neutrality. For a carbon-neutral company, the emissions of the previous year, minus the reduction and offsets from the current year, equals zero.

The first step on the path to carbon neutrality is measuring your greenhouse gas (GHG) emissions. This is done using a greenhouse gas inventory. A GHG inventory takes an account of greenhouse gas emissions released, categorized by emission source. GHG inventories are often called *carbon footprints*, because they typically calculate the amount of emissions in units of equivalent carbon dioxide (CO_2), according to their global warming potential relative to CO_2.

1. IDENTIFY SOURCES
2. SELECT CALCULATION APPROACH
3. COLLECT DATA & CHOOSE EMISSIONS FACTORS
4. APPLY CALCULATION TOOLS
5. ORGANIZE DATA FROM ALL FACILITIES
6. REPORT INVENTORY FOR VERIFICATION

STANDARDS FOR GHG INVENTORY VERIFICATION

Verification of a completed emissions inventory improves the reputation of environmental responsibility in the eyes of customers and stakeholders. Verification is necessary for carbon neutrality certification. GHG inventories must be performed and verified annually. Inventories are verified by a verification body, using a standard. Standards consist of requisites to be fulfilled by the completed inventory. The following are standards used in Costa Rica for verifying organization-level inventories.

ISO 14064

Developed by the International Standards Organization, ISO 14064 is a three-part international standard detailing requisites for emissions inventories, emissions-reduction projects, and inventory verification. ISO 14064 verification does not result in an official label or mark usable for advertising.

PAS 2060

PAS 2060, designed by the British Standard Institute, is the most widely-used standard worldwide for carbon neutrality. PAS 2060 requires reduction and compensation for emissions from an emissions baseline (from the first year of verified inventory). Certification by PAS 2060 does not result in an official label or mark usable for advertising.

INTE 12-01-06

In line with Costa Rica's national initiative for carbon neutrality, INTECO developed the National Standard for Carbon Neutrality. This standard requires demonstration of emissions reduction along with submission of an inventory for verification. The National Standard requires reduction and compensation for total emissions, not just emissions greater than a baseline. Certification by the National Standard allows the use of an official MINAET-approved mark for advertising.

	INTE 12-01-06 (National Standard)	PAS 2060	ISO 14064
Organization	Instituto de Normas Tecnicas (INTECO)	British Standards Institute	International Standards Organization
Purpose	Carbon Neutrality	Carbon Neutrality	GHG Inventory and Verification
Recognition	Costa Rica	International	International
Gases Considered	7 GHGs identified in Kyoto Protocol	7 GHGs identified in Kyoto Protocol	All GHGs
Required Scopes	Scope 1 Direct Emissions Scope 2 Indirect Emissions	Scope 1 Direct Emissions Scope 2 Indirect Emissions Some Scope 3 Emissions*	Scope 1 Direct Emissions Scope 2 Indirect Emissions
Funding Available	PROPYME / MICIT	PROPYME / MICIT	PROPYME / MICIT

WORDS OF ADVICE

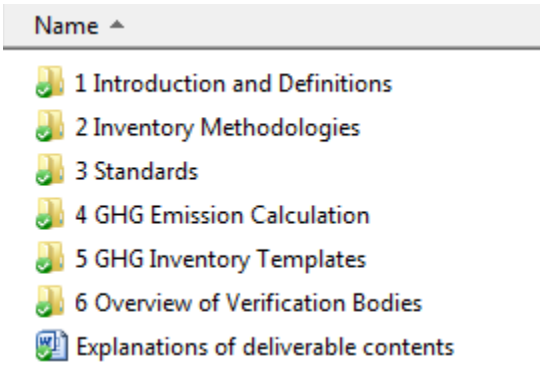
- Read and understand the Standard you are seeking verification through.
  The standards will provide an overview of the types of information you need to have prepared for an inventory.
- Take part in training offered by verification companies to better understand the standards and inventory process.
  Both EARTH and INTECO are certified companies who offer these types of training.
- Assign one person to be the lead in the environmental management.
  This can be a very complex process so dedicating one member to understanding and completing the process can save time and resources.
- Keep in touch with the verification company throughout the verification process.
  They will be able to provide updates and inform what additional information is required.
- Organize a whole year's worth of paperwork.
  Example: if you are seeking verification in 2014, have 2013's paperwork prepared.
- Understand which emissions factors are pertinent for your organization.
  See resources for a document outlining which emissions factors exist.
- Organize emissions by type.
  Example: Diesel and gasoline, although similar, are calculated differently and as such their paperwork must be separate.
- Emissions are calculated using amounts, not cost. Beware of calculation errors in conversions.
  Example: when calculating emissions from electricity, you must first convert the electricity cost to kWh.

RESOURCES FOR GHG INVENTORIES

- Overview of Carbon Neutrality
- SME Guide to GHG Inventories
- Defining Inventory Boundaries
- Cross Sector Calculation Tools
- Sector Specific Calculation Tools
- Costa Rican Emissions Factors and Global Warming Potentials
- GHG Inventory Reporting Template
- GHG Protocol Corporate Accounting and Reporting Standard
- GHG Inventory Checklist
- Worked-out SME Inventory Example
- Uncertainty Calculation Tool
- IPCC Sector-Specific Guides

Appendix L: Layout of the CD portion of the brochure

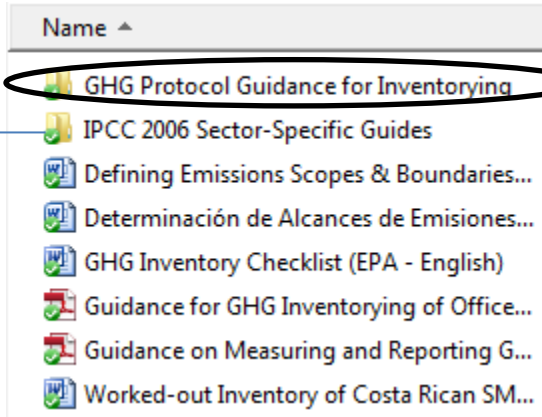
Main Files of CD



1 Introduction and Definitions

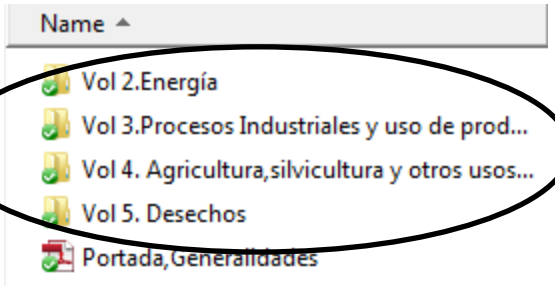
The first volume of IPCC and a general overview of what GHG inventorying is.

2 Inventory Methodologies



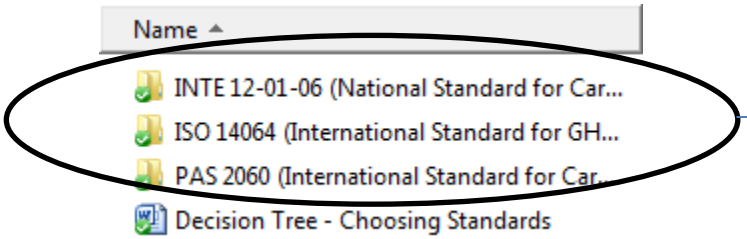
A Guidebook from the GHG Protocol describing how to catalogue GHG emissions.

IPCC 2006 Sector-Specific Guides



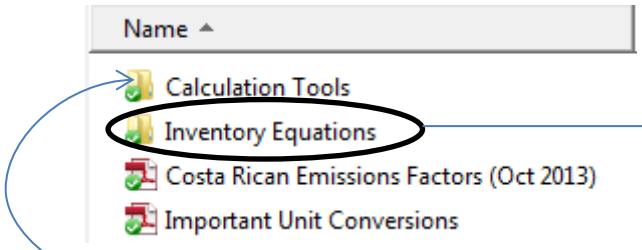
Guidelines for cataloging GHG emissions for specific sectors and emission types from the IPCC

3 Standards



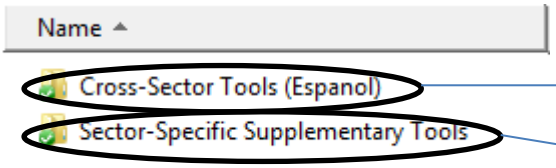
Documents explaining each standard used most by SMEs in Costa Rica.

4 GHG emission calculation



Emission calculation equations provided

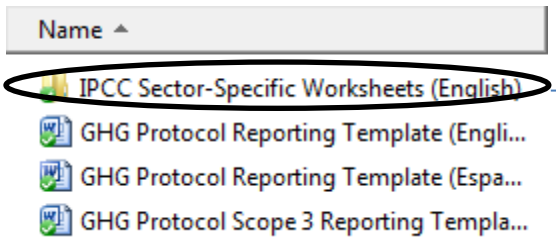
Calculation tools



Tools for calculating emissions for emission types occurring in every sector

Tools for calculating emission for emissions for that are unique to sector type

5 GHG Inventory Templates



Documents to organize types of emission and the sources of emission based on specific sectors.

6 Overview of Verification Bodies