SCTE · ISBE

STANDARDS

Energy Management Subcommittee

SCTE STANDARD

SCTE 208 2021

Cable Operator Greenhouse Gas Emissions Data Collection Recommended Practices

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1. Introduction

1.1. Executive Summary

SCTE 208 defines the process and function of performing a carbon footprint analysis based on cable operator greenhouse gas emissions (GHG) to establish and measure a baseline or year over year comparison of emissions by which subsequent audits may be compared.

1.2. Scope

A ***carbon footprint analysis*** is an assessment of an organization's annual operational greenhouse gas emissions in terms of carbon dioxide equivalent. The process consists primarily of a data collection phase whereby operational energy sources are identified and energy use is converted into comparable emissions. An initial analysis establishes a baseline inventory of emissions by which subsequent collections may be compared against year-on-year in a comprehensive carbon emissions reduction plan. The carbon footprint analysis can serve as a reporting mechanism for organizations to communicate their emissions contribution to climate change.

The general trend of many major US and worldwide corporations to collect data and produce greenhouse gas reports suggests that GHG emission management and energy efficiency measures offer a unique business opportunity to increase competitive advantage while adhering to present and future regulations.

Companies in the cable industry, like many other companies who have already made strides in terms of environmental sustainability, can leverage GHG emission management to their advantage by creating stakeholder value and benefitting from cost-savings opportunities.

1.3. Benefits

Creating a carbon footprint analysis report for a carbon reduction plan enables cable operators to measure and compare year over year greenhouse gas emissions performance. Cable operators can position themselves as more socially responsible through the organized and standardized collection of carbon data. Improved operating efficiency and costs can result from setting greenhouse gas emission goals that can be measured based on the SCTE 208 framework. SCTE 208 addresses greenhouse gases that are largely produced by energy consumption and cable operators benefit by:

- Defining macro means of measuring energy usage in a very transparent and reportable structure
- Helping to prioritize the correct data to collect across the various cable operator energy domains such as fleet, operations and supply chain
- Contributing to an industry roadmap for defining reduction targets based on standard data collection sets
- Agencies can look at reports to evaluate performance and ranking as compared to others in similar space (like Dow Jones Indices etc.)

1.4. Intended Audience

Cable operator corporate social responsibility directors/teams, senior management, and energy managers

1.5. Areas for Further Investigation or to be Added in Future Versions

Market-based method of greenhouse gas emissions calculations.

2. Normative References

The following documents contain provisions, which, through reference in this text, constitute provisions of this document. At the time of Subcommittee approval, the editions indicated were valid. All documents are subject to revision; and while parties to any agreement based on this document are encouraged to investigate the possibility of applying the most recent editions of the documents listed below, they are reminded that newer editions of those documents might not be compatible with the referenced version.

2.1. SCTE References

- No normative references are applicable.

2.2. Standards from Other Organizations

- No normative references are applicable.

2.3. Published Materials

- No normative references are applicable.

3. Informative References

The following documents might provide valuable information to the reader but are not required when complying with this document.

3.1. SCTE References

- https://www.scte.org/scteisbe-energy-standards-and-operational-practices-1/

3.2. Standards from Other Organizations

- https://www.globalreporting.org
- http://www.iso.org/iso/iso14000
- https://www.cdp.net/en-US/Pages/HomePage.aspx
- https://www.ftserussell.com/products/indices/ftse4good
- https://www.spglobal.com/esg/csa/indices/index
- http://www.ghgprotocol.org/calculation-tools
- http://www.epa.gov/cleanenergy/energy-resources/calculator.html
- https://ghgprotocol.org /

3.3. Published Materials

- https://www.epa.gov/sites/production/files/2016-03/documents/electricityemissions_3_2016.pdf

4. Compliance Notation

shall	This word or the adjective "***required***" means that the item is an absolute requirement of this document.
shall not	This phrase means that the item is an absolute prohibition of this document.
forbidden	This word means the value specified shall never be used.
should	This word or the adjective "*recommended*" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighted before choosing a different course.
should not	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
may	This word or the adjective "*optional*" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.
deprecated	Use is permissible for legacy purposes only. Deprecated features may be removed from future versions of this document. Implementations should avoid use of deprecated features.

5. Abbreviations and Definitions

5.1. Abbreviations

CDP	carbon disclosure project
CNG	compressed natural gas
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
CPE	customer premise equipment
CSR	corporate social responsibility
CSV	comma separated value
E85	ethanol 85
EPA	Environmental Protection Agency
ERP	Enterprise Resource Planning
ESG	Environmental social governance
EU ETS	European Union Emissions-Trading Framework
GHG	Green House Gas(es)
GJ	giga-joule
GRI	Global Reporting Initiative
GSA	US General Service Administration
HFC	hydrofluorocarbon
IT	information technology
kWh	kilowatt hour
LPG	liquefied petroleum gas
MSO	multiple subscriber operator (cable company)
NGO	non-governmental organization
OpEx	operational expenses

OSP	outside plant
PDF	portable document format
PFC	perfluorocarbon
POC	point of contact
RFP	request for proposal
UK ETS	United Kingdom Emissions-Trading Framework

5.2. Definitions

GHG uncertainty calculator	Method for improving estimations of greenhouse gas data that may be difficult or subject to large variables that would skew data over year to year data collection projects.

6. Unique Cable Operator Situation

Cable operator physical infrastructure is characterized by vast, disaggregated, complicated and asset heavy networks, all of which use energy that translates into carbon emissions that must be quantified in greenhouse gas footprint analysis. The complexity of the physical infrastructure, coupled with the geographic breadth of the network, makes energy data collection very difficult – and existing guidance may not be enough to helpfully instruct a cable operator in the process of an energy or greenhouse gas footprint analysis project.

6.1. MSO Business Description

A large multiple subscriber operator (cable company abbreviated as MSO) delivers video and data services to millions of subscribers across their footprint. This is accomplished via numerous unique cable systems spread across many geographical areas. Each MSO is organized differently, making accounting for carbon potentially challenging. Depending on the MSO, energy accounting may be tied to distinct geographic markets, to operational units, or to customer categories such as residential and commercial. It is important to understand this to ensure data collection is done consistently year over year.

Historically, MSOs have large and complex physical systems that operate in a somewhat de-centralized fashion. Meaning, regional or local teams managed their respective systems without significant corporate oversight. In the last 5-10 years, this has changed significantly. Large and mid-sized MSOs have begun to invest in national infrastructure, such as data centers and network operations centers. They have also moved toward standardizing procedures and have given more functional responsibilities, authority and decision-making to centralized corporate teams. Also, many MSOs are also attempting to consolidate and standardize databases (e.g. data input, data management, reporting) into centrally-accessible warehouses, but this is often a work in progress.

6.2. Infrastructure Description

Energy use from physical infrastructure consists of power consumed by the outside plant (OSP) network and from cable operator real estate portfolio (upstream and leased facilities), which includes both critical and non-critical facilities. The OSP network deploys a large number of distributed power supplies. These power supplies power the optical nodes and RF amplifier equipment used in the network to carry voice, video, and data signals to the subscriber's premise. The real estate portfolio consists of critical facilities, which are headends, hub sites and data centers; and non-critical facilities, which are offices, call centers, warehouses and retail stores. A cable operator's energy footprint is also composed of fuel consumed by staff fleet and company vehicles, as well as business travel (commercial air travel and land travel for

rental cars and reimbursed personal mileage); employee commuting and contracted fleet vehicles (downstream transportation and distribution).

6.3. Management of Energy Data

Cable operators experience data management challenges due complex energy vendor relationships at each organizational level. This challenge is multiplied across vast networks with thousands of utility accounts. As data is primarily housed within the supply-side, not the demand-side, of the energy provider-customer relationship, it can be very difficult to centrally manage energy consumption data. For example, data on electricity consumption at non-critical facilities is kept by the utility provider, and not necessarily by the cable operator, except in cases where electricity bills are managed by a central authority. Due to legacy and non-standard management systems, this data might only exist as paper utility bills, scanned PDF files, or Excel spreadsheets and inventories.

6.4. Data Procurement Challenges

In the cable industry, acquisitions, diversity of business units both vertically and horizontally are typical business attributes. Regional units function separately from one another, and centralized oversight of operations is not necessarily the norm. As such, data procurement can be a huge challenge for the GHG data analysis team from a project management standpoint, as data critical to the reporting is sourced from different points of contact across the company. Specific approaches and recommended methods will be discussed in later sections.

6.5. Limitations of Existing Carbon Data Collection Standards

A number of greenhouse gas data collection methodologies exist that have been developed by non-government originations (NGOs), associations and consultancies that are instructive for conducting analysis for different industries. But due to the unique functional characteristics and business organization of a cable company, existing methodologies intended for use with other industries may not provide enough guidance to conduct a carbon audit in accordance with global standards.

The World Resources Institute's GHG Protocol Initiative is responsible for international data collection standards. Its publication GHG Protocol Corporate Standard outlines international standards for conducting analysis and reporting of GHG emissions – for different sectors and different-sized companies, much as generally accepted financial accounting and reporting principles are intended to apply universally. It provides guidance on accounting and reporting principles; business goals and inventory design; setting organizational and operational boundaries; tracking emissions over time; identifying and calculating emissions; managing inventory quality; emissions reporting and verification; and setting GHG targets. However, it is not intended to be an instructive manual for conducting a full footprint analysis.

Given the physical complexity of MSOs, different sources of energy and emissions information, and the sheer manpower effort required to source and track the required information, a more specific and instructive standard is needed to ensure that data is collected, normalized and reported in accordance with these international standards.

7. End Game Strategy

Across companies in the telecoms and communications industries, a range of carbon reporting strategies are used, reflecting different "end game strategies" for that carbon data collection and reporting. These are driven largely by the intended audience of the carbon data, as different rollups will inform different

data collection and normalization practices. Likewise, completion, consistency and commitment vary across this spectrum of companies, and this detail reflects the materiality of content driven by stakeholder interests.

7.1. Determine & Prioritize Key Drivers

There are a number of reasons why a cable operator would initiate GHG footprint analysis. For instance, while some operators may choose to conduct GHG emissions footprint analysis from external stakeholder pressure to define and disclose its environmental actions, other companies may choose to use data to identify areas for improvement in its operations and energy use portfolio. Following are examples of key drivers for initiating GHG emissions data collection project:

- *Enterprise-wide Operational Improvements and Associated Savings*– comprehensive greenhouse gas emissions accounting can be used as an operational management tool, uncovering various inefficiencies that, if addressed, could represent cost saving opportunities. Furthermore, the actual cost savings potential from the correction of such inefficiencies can be modeled and quantified with data collected in GHG emissions data collection, and then used to inform future plans for operational improvement to maximize those cost savings.
- *Energy OpEx Savings* —end-users of the GHG data collection results can identify portions of the cable operator operations that function at sub-optimal energy efficiency. The audit report and can be a base management tool for comprehensive plan to reduce energy consumption in both critical and non-critical facilities, uncovering cost savings potential. The data also reveals where prime targets for energy-use improvement and efforts would have the largest effect on both cost savings and emissions reduction.
- *Initial Step in a Comprehensive GHG Emissions Abatement Plan* — an MSO may seek a long-term action plan to manage and reduce the emissions of the organization and its operations. The first step in implementing such a strategy is to conduct a GHG analysis for a baseline year. Baseline data is the foundation for establishing future emissions reductions goals, progress on which is measured with a repeated audit. Baseline audit data also forms the basis on which the efficacy of new energy efficiency projects, and other abatement strategies, will be assessed. See Section 12 for a discussion of the larger abatement process.
- *Corporate Social Responsibility (CSR)* and Environmental Social Governance (ESG)— employees, customers, investors and other stakeholders' expectations of corporate ethics and responsibilities are changing. A CSR report, which has become standard practice among publicly traded companies, allows a company to tell its own story about being a good corporate citizen. The environmental portion of the ESG report would contain similar information pertaining to impacts of company operations on planetary concerns such as global warming.
- *Public Disclosure and Reputation Management* —for companies that understand the importance of reputation management, reporting environmental information through leading disclosure channels and third-party organizations can improve public perception.
- *Brand Differentiation* — as the broadband industry evolves, taking a leadership role on key issues, such as the environment, can improve brand value.
- *Preparedness for Future Regulations* — for MSOs that desire to be prepared for possible regulatory changes including the mandatory auditing and reporting of GHG emissions. This may mean having processes and "muscle-tone" in place that meet these requirements in advance and may result in future savings on outsourcing these activities if processes are already in-place.
- *Attracting environmental social governance* ESG factors are rapidly becoming integral to assessing the quality of a company and thus a vital part of investment bodies' decision-making process. In order to remain competitive in the quest for capital, MSOs must integrate ESG into its business strategies and operations.

7.1.1. *Determine the data collection governance model*

Once it is determined to gather sustainability data either for disclosure (internal or external) or for operational use, a governance model including executive sponsor will be required. The benefit of such a model is twofold. First of all, it will help create a structure of the roles and responsibilities. Secondly, it will help harmonize the data and data collection through a collaborative process, with stakeholders from various business units participating including operations.

7.1.2. *Determine the Internal End-users of the Carbon Data*

There are various organizations within a typical MSO, both at the corporate planning level and the regional/local management level, each responsible for key operational aspects of the business – and each may have different applications for the data resulting from GHG analysis (See Figure 1).

For example, there are corporate outside plant engineers and architects who are responsible for new plant design and implementation, as well as local plant technicians responsible for its maintenance. With fleet operations, vehicle procurement is conducted centrally, but local technical operations teams manage and maintain vehicle fleets on a day-to-day basis.

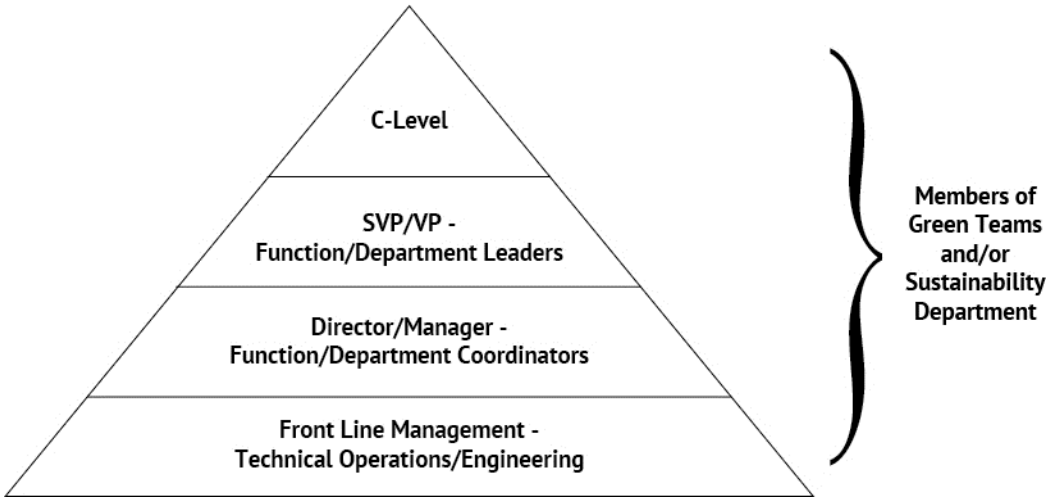

Figure 1 - Management Structure of a Typical MSO

C-level — executives typically may be interested in setting of and progress toward a carbon reduction goal. They set policy around governance and transparency, including public reporting of environmental information.

Function/Department Leaders (SVP/VP) — senior leaders are responsible for program strategy that supports overall corporate objectives. Typically, these include energy- and operational-efficiency initiatives in the MSO's key area of operations—Outside Plant, Critical Facilities, Real Estate Portfolio and Fleet Operations.

Function/Department Coordinators (Directors/Managers) —these leaders are responsible for implementation of projects that improve efficiency, and reduce costs, energy consumption and carbon emissions within their direct area of responsibility.

Technical Operations/Engineering Front Line Management —these employees manage local fleet teams, critical infrastructure and buildings within specified tolerances, while seeking functional improvement to meet energy efficiency or carbon reduction goals.

Green Teams / Sustainability Departments – these employees may or may not exist at a typical MSO, but are increasingly common as corporate energy, environment and sustainability issues take hold. Thee employees are responsible for managing these issues internally. Often these teams are cross-functional and include representatives (volunteer or full-time) from different departments at different verticals.

7.1.3. *Determine Whether Carbon Data will be Voluntarily Disclosed*

The lead data collector *should* determine whether a public disclosure strategy will inform the GHG emissions data collection process – whether driven by the operating region's legislation, by an investor demand, or for corporate reputational risk. At the time of this publication in 2020, there are no regulations in the United States under which a cable operator must report to remain compliant; only energy-producing companies are required to report emissions under US State and Federal disclosure laws.

There are a variety of public disclosure outlets which companies can utilize to voluntarily report GHG emissions data collected:

Voluntary disclosure type 1 – A corporate report that adheres to a sustainability – reporting framework

Among the cable industry, the most common type of public reporting of environmental data is in a Corporate Social Responsibility (CSR) or Corporate Sustainability Report, which is then published on CorporateRegister.com or the company's website. These reports may adhere to a number of standards that request carbon emissions data (this list is not meant to be exhaustive):

Global Reporting Initiative (GRI) G4 Reporting Standards: Reporting guidelines and implementation instructions for preparation of sustainability reports by organizations regardless of their size, location or industry.[1]

AA1000 Global Reporting Standards: Global standard for assessing the credibility and quality of an organization's sustainability reporting.[2]

ISO 14000 Family: Addresses numerous aspects of environmental management through practical tools that organizations can use to identify and control their environmental impact and improve environmental performance.[3]

Voluntary disclosure type 2 – Inquiry responses

A number of rankings agencies and NGOs will submit questionnaires and inquiries for GHG emissions data for purposes of assessing the environmental performance of a company.

Carbon Disclosure Project (CDP): The CDP is an independent, not-for-profit organization working to drive GHG reduction and sustainable water use by business and cities. The Investor CDP questionnaire is sent to companies worldwide requesting data on GHG and carbon emissions, communications and climate-related behavior; the intended audience is investors and the public looking to align corporate performance with environmental stewardship. Having begun in Europe, the NGO is now prominent and well-respected in the U.S. – in 2012 69% of S&P 500 responded to the CDP questionnaire, representing 655 investors with assets of US $78 trillion in 2012.[4]

Sustainalytics,: Sustainalytics is a global leader in ESG and Corporate Governance research and ratings. Over the last 25 years, we have brought together leading ESG research and client servicing professionals to retain that personal touch that has helped us to grow. Today, Sustainalytics supports hundreds of the world's foremost investors who incorporate ESG and corporate governance insights into their investment processes.

Ecovadis: EcoVadis is a provider of business sustainability ratings, intelligence and collaborative performance improvement tools for global supply chains. Ecovadis uses actionable sustainability scorecards to provide detailed insight into environmental, social and ethical risks across 190 purchasing categories and 160 countries.

[1] https://www.globalreporting.org/reporting/g4/Pages/default.aspx

[2] http://www.projectsigma.co.uk/Toolkit/SIGMAGuideToAA1000.pdf

[3] http://www.iso.org/iso/iso14000

[4] https://www.cdp.net/en-US/Pages/HomePage.aspx

Voluntary disclosure type 3 – Disclosure to Financial Indices and Ratings Agencies

Some companies choose to disclose their emissions information alongside their financial information in their annual reports (form 10-K in the US). As such stock exchanges have developed standards to compare companies based on the health of their growth operations with respect to their emissions:

FTSE4Good Index: A series designed to measure the performance of companies that meet globally recognized CSR standards. It can be used for investment, research, reference and as a benchmark index to track performance of investment portfolios.[5]

Dow Jones Sustainability Index: A family of benchmarks for investors who believe sustainable business practices may lead to long-term shareholder value and who wish to reflect their sustainability convictions in their investment portfolios.[6]

Bloomberg (aggregated summary of ESG performance and risk)

ISS (Institutional Shareholder Services)

MSCI (leading provider of critical decision support tools and services for global investment community

Voluntary disclosure type 4 – Disclosure on Requests for Proposals

Often companies will be asked to disclose environmental information on RFPs, or fill out an environmental policy questionnaire, as part of the purchasing company's procurement standards. For example, State, Local and Federal agencies each have environmental purchasing criteria in the United States General Service Administration (GSA) for services purchased by the government. MSOs *should* check to see if their customers require environmental information, including emissions, in their RFPs and assess whether disclosure of this information will be a competitive differentiator.

7.2. Determine whether a full or partial audit will be conducted

The company's strategy and goals will determine if a full or partial audit is necessary. While the GHG protocol does not recommend that firms conduct incomplete data analysis, budgetary or other constraints may limit the cable operator to conducting partial data collection, which could take several forms, depending on the drivers behind conducting the analysis.

For example, if operational efficiency for a specific area of the business is the primary driver (say, fleet management), then an operator may choose to omit Scope 2 data from its audit and focus only on an analysis on Scope 1 fleet data; then crafting an efficiency improvement or carbon abatement plan solely focused on fleet. Similarly, if a comprehensive assessment of its facilities is the driver, then a cable operator may choose to limit its data collection to a portion of Scope 2. If public disclosure, CSR or ESG reports are the most important drivers, but budgets and resources are still constrained, then it may make more sense for an MSO to ensure that resources are allocated to cover all three scopes (to report against CDP, for example) – but conduct a smaller-scale audit on only a sample area of the MSO's operations. Regardless, if the audit is to be in compliance with the GHG Protocol and a partial audit is conducted,

[5] http://www.ftse.com/Indices/FTSE4Good_Index_Series/

[6] http://www.sustainability-indices.com/index.jsp

then missing data from scopes 1 and 2 must be estimated and uncertainty must be reported according to guidelines (see Section 11.2).

7.3. Determine long-term data colelction strategy

When a company undertakes conducting a GHG data analysis project for the first time, it is best practice to set in-place a strategy for measuring and reporting progress over time. Because companies, particularly in the cable industry, often change their operational and financial portfolios with mergers and acquisitions, questions emerge about the scope of a data collection year-over-year. Coupled with the outsourcing and insourcing of contracted fleet and leased real estate, this complicates long-term auditing strategy and means that historical emissions data would have to be recalculated. The GHG protocol offers guidance about such different scenarios, which would necessitate a historical recalculation.

One question answered by the determination of a long-term auditing strategy will be whether the operator chooses to measure emissions year-over-year with an absolute metric or an intensity metric. Absolute metrics are a measure of emissions reductions over time (a cable operator could split this out into emissions reductions over time for specific scopes, or specific emissions-producing operations). Intensity metrics measure emissions reductions over time – relative to a key business metric.

8. Preparing The Company

As outlined in the rest of SCTE 208, GHG emissions data analysis for a large opertor requires the involvement of many stakeholders both internally and externally, resulting in a time-consuming endeavor; the data collection process itself is likely to take months. As such, the analysis process will take dedicated individuals and the supervision of a well-trained project management team. The importance of preparing the company for these steps cannot be overstated.

8.1. Establish Project Plan and Timeline

Because conducting GHG footprint analysis is a time and labor-intensive process at a cable operator, effective project management is critical to successful execution of the project. It is recommended that key individuals have experience in managing teams of up to 100 points of contact. There also must be adequate time given to analysis and reporting.

Phase I: Project Launch and Data Collection

- Establish points of contact (POCs) at corporate and local locations
- Collect data for emissions sources identified (see Section 8.2)

Phase II: Data Analysis

- Reformat and normalize all collected data; convert to CO2e (see Section 8.2)
- Estimate missing data if needed

Phase III: Report Preparation

- Roll up data as required by end-users
- Depending on the type of report, the reporting process may happen in parallel with data analysis

8.1.1. *Align timeline with internal and external reporting requirements*

Careful consideration of stakeholder reporting requirements, both internal and external, *should* inform the timeline of GHG emissions data analysis. For example, CDP's reporting deadlines for the previous year's data are roughly halfway through the subsequent year. Similarly, for internal data reporting, the timeline *should* adhere to a point of contact's typical reporting schedule. For example, a particular team could already roll-up and report it data to a supervisory team every quarter.

8.1.2. *Create & Assign Roles within Company*

Depending on the roles and responsibilities of individuals aligned with the data required, a multi-functional project team *should* be put in place to manage the process. It may be the case for larger MSOs that a similar management infrastructure for energy, environment and sustainability projects already exists – whether as a full-time sustainability team or managed as "Green Teams" with full-time employees as well as on-the-ground volunteers.

The following is an example internal project structure that could be successfully implemented at an MSO:

- **Corporate Sponsor:** The corporate sponsor is crucial to the success of the project in that this person 1) serves as the company leader driving the strategy and objectives of the project as a whole and 2) acts as an authoritative figure to ensure timely participation from the data collection POCs.
- **Program/Project Manager(s):** Project managers are essential to keeping the project organized and on schedule. They can escalate issues as they arise and serve as overarching points of contact to provide consistency in communication across all levels of data collection.
- **Points of Contact:** Data collection is the most time-intensive process associated with a reporting process. Given the quantity of data required it is critical to assign data procurement specialists, or more generally, data collection POCs, to each required data point across the enterprise. These data collectors will likely be those POCs responsible for the data point itself, or they may need to reach out to additional contacts internal or external to the company to complete the request.
- **Data Analysts:** Once the MSO has completed the data collection phase, the MSO team will need to initiate the carbon data analysis phase. Data analysts with carbon accounting subject matter expertise will be required to review the data collected, estimate or model missing energy data, convert all energy data to carbon emissions using the appropriate calculators, run a statistical assessment of uncertainty associated with the carbon audit analysis and finally roll-up the results to be consumed by a broader audience in the report (see Section 7).
- **Communication Experts:** Before, during and after the project, it will be important for communication experts to offer guidance, strategy and support in launching the project, maintaining momentum in data collection, and communicating the results to stakeholders.

8.1.3. *Establish 3rd Party Areas of Support*

It is likely that, given the time commitment and degree of data analysis required for the project, that a third-party consultancy or analyst firm will be. Also, the MSO may choose to have its data collection processes and management procedures audited by a third-party verification or assurance firm (benefits of this include receiving recognition from reporting outlets like GRI or CDP).

8.2. Confirm and Adhere to Carbon Accounting Principles

The standards of the GHG Protocol identify the following key elements of the carbon reporting process (see Figure 2).

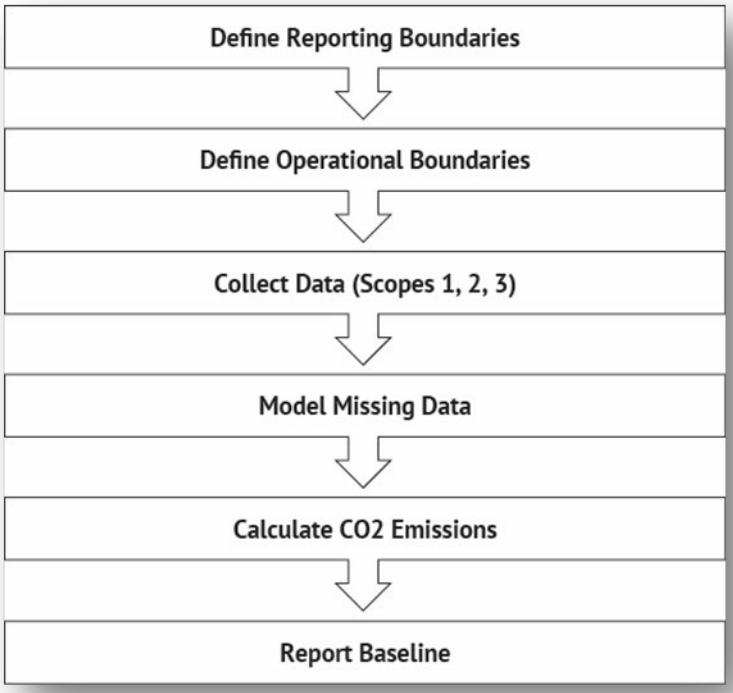

Figure 2 - Elements of the GHG Protocol's Carbon Audit Process

Step 1: Define Reporting Boundaries

The first step in defining reporting boundaries is to establish a reporting base year, which is the year of data collection (or an average over multiple years) against which the company's emissions will be tracked over time.

The next step is to determine whether the cable operator will take an equity *share approach or a control approach* when reporting emissions. The corporate structure of the cable operator and the degree of legal and operational control will differ from company to company; hence, reporting boundaries *should* be established in consultation with a legal representative of the company:

- Under *equity share approach*, the company accounts for GHG emissions from operations according to its share of equity in the operation. This approach reflects economic interest, which is the extent of rights a company has to the risks and rewards flowing from an operation.
- Under control approach, the company accounts for 100 percent of the GHG emissions from operations over which it has control – in other words, the ability of a company to direct the policies of another operation. This approach can be broken down into operational control, in which the organization has the full authority to introduce and implement its operating policies at the operation; or financial control, in which the cable operator has the ability to direct the financial policies of the operation (see Figure 3).

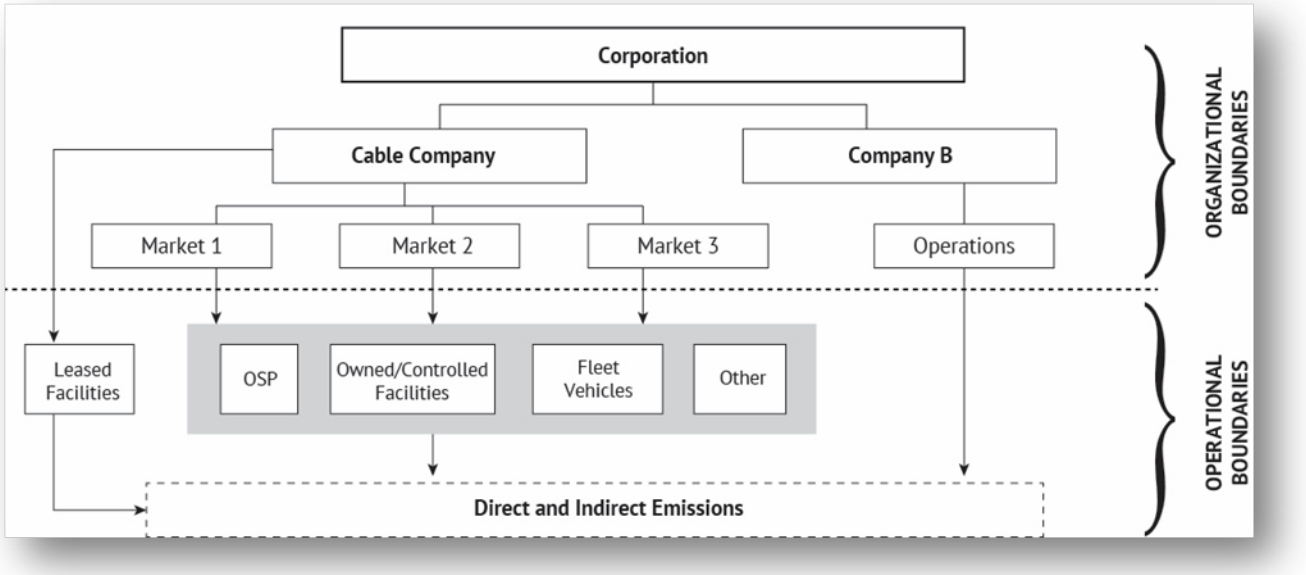

Figure 3 - Organizational and Operational Boundaries of a Fictional MSO

Step 2: Define Operational Boundaries

The GHG Protocol breaks emissions down into three Scopes, and it requires that *Scope 1 (Direct Emissions)* and *Scope 2 (Indirect Electricity Emissions)* are reported in the carbon audit. *Scope 3 (Other Indirect Emissions)* are considered optional. Scope 1 includes combustion of fossil fuels from stationary sources, mobile source combustion (i.e. fleet vehicles), and fugitive emissions from refrigerants. Scope 2 includes purchased electricity for the OSP and facilities, both critical and non-critical. Scope 3 (Other Indirect Emissions) include: employee commuting, employee business travel (land and air travel), contracted fleet operations and waste disposal. For Scope 3, a cable operator may choose to include data on the usage habits, disposal, and energy performance of consumer products, such as customer premise equipment and set-top boxes – but it is unclear the degree to which a cable operator has control over downstream performance of these products, and therefore we recommend excluding them from the collection process. For the latest position on set-top efficiency please refer to https://www.energy-efficiency.us/.

Step 3: Collect Data (Scopes 1, 2, 3)

Data collection involves gathering information from invoices, databases, receipts, utility bills, service contractors, and facility managers about each emissions Scope. Information is also required regarding general facility specifications (i.e. building type, building use, total square feet, etc.) and employee commuting behavior, which can be obtained from an employee survey.

Step 4: Estimate / Model Missing Data

If critical information is missing or unavailable, the recommendation is to return to source documents to generate data models or check additional sources for industry standard figures. Uncertainty regarding estimated or modeled data must be recorded and reported using guidance from the GHG Protocol's Uncertainty principles.

Step 5: Calculate Emissions

Energy usage figures are converted to comparable carbon emissions using industry-standard, energy source-standard, and geography-standard carbon coefficient conversion factors; then all emissions figures are added together from each Scope to generate the total organizational carbon footprint.

Step 6: Report Baseline

A baseline footprint (footprint for the baseline year) is reported in the report, and this baseline will serve as a comparison for all future GHG emissions assessments. However, it is also possible to choose an average of annual emissions over several consecutive years. For example, the United Kingdom Emission Trading System (the UK's emissions-trading framework) specifies an average of 1998–2000 emissions as the reference point for tracking reductions; an average can smooth out unusual fluctuations in GHG emissions that would make a single year's data non-reflective of an MSO's typical yearly footprint.

9. Launching the Project

Project launch will include determining beforehand the audit's inventory boundaries, which will inform the necessary points of contact required for data collection. Also, the auditor must estimate what data is available and the quality of that data, so as to inform a sampling methodology. All steps *should* be conducted with careful and consistent communication with all points of contact.

9.1. Develop Inventory Boundary

The first step in project launch is to draw inventory boundaries at the organizational and operational levels, which are Steps 1 and 2 of the Carbon Accounting Principles (see Section 8.2). For example, an equity share may be appropriate when the MSO's strategic goal is to report its environmental information to a 3rd party that requires measuring the monetary implications of emissions performance, like CDP. In this case, the MSO would report all GHG emissions for which they have an equity in the operations. If an MSO seeks to shed light on energy consumption, OpEx savings and to reduce emissions then the operational control approach will be most useful due to the functional ability of the MSO to directly affect its operations, and realize measurable cost-savings and emissions reductions.

9.2. Determine Sampling Methodology (if necessary)

The accuracy of the report is partially determined by the availability and quality of data. If the data is poor, unavailable or too costly to obtain, sampling can be a useful and acceptable methodology to overcome these obstacles. It is also an efficient way to gain insight into the whole data population while at the same time requiring less money, time and effort than collecting every data point. See Section 10.8 for more information on estimating missing data.

It *should* be noted that uncertainty regarding any estimated or modeled data *should* be recorded and reported using a GHG uncertainty calculator.

9.3. Communicate with POCs Involved in Data Collection Process

In order to obtain the data required on data for each Scope, consistent communication is required with each POC responsible for procuring that data. Depending on the structure of the MSO and where the data is housed, points of contact will be needed across multiple functional areas of the organization, as well as throughout the company's vertical structure (see Figure 4).

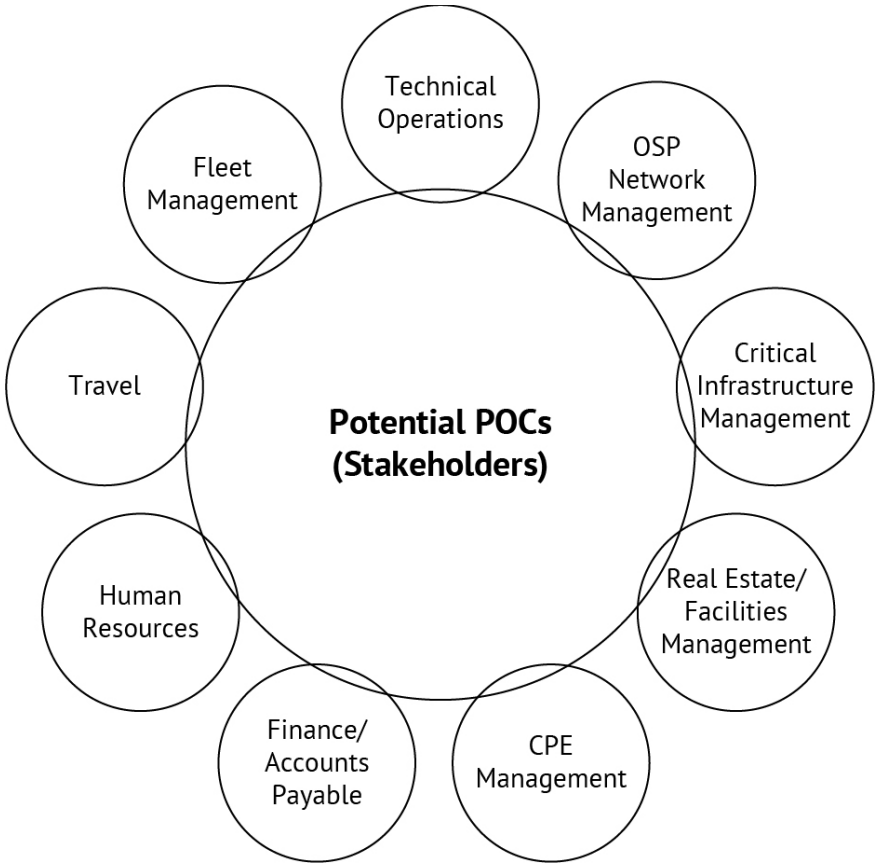

Figure 4 - Potential Points of Contact Needed for MSO Carbon Data Collection*

**This figure is intended to be representative of potential (not exhaustive) POCs throughout an MSO*

For example, generator, refrigerant and other building information about non-critical facilities are likely housed with individuals from real estate or facilities management, while the utility bills for these facilities could be housed in an accounts payable department. Whereas for collecting fleet information, fleet composition and fuel consumption data will be housed in a fleet management department – but a technical operations POC might be necessary to collect the truck roll information necessary to perform the full emissions calculations on fleet emissions.

10. Data Collection

The data collection process is the most labor-intensive portion of the carbon audit process, likely involving sifting through data from legacy systems, non-standard databases and accounting for missing data. To make data collection more manageable, it may be sufficient for certain data sets to pull a representative sample and extrapolate.

The GHG Protocol Corporate Accounting and Reporting Standard provides requirements and guidance for companies and other organizations preparing a corporate-level GHG emissions inventory. The World Business Council for Sustainable Development Greenhouse Gas Protocol methodology groups emissions under three scopes as per the figure below:

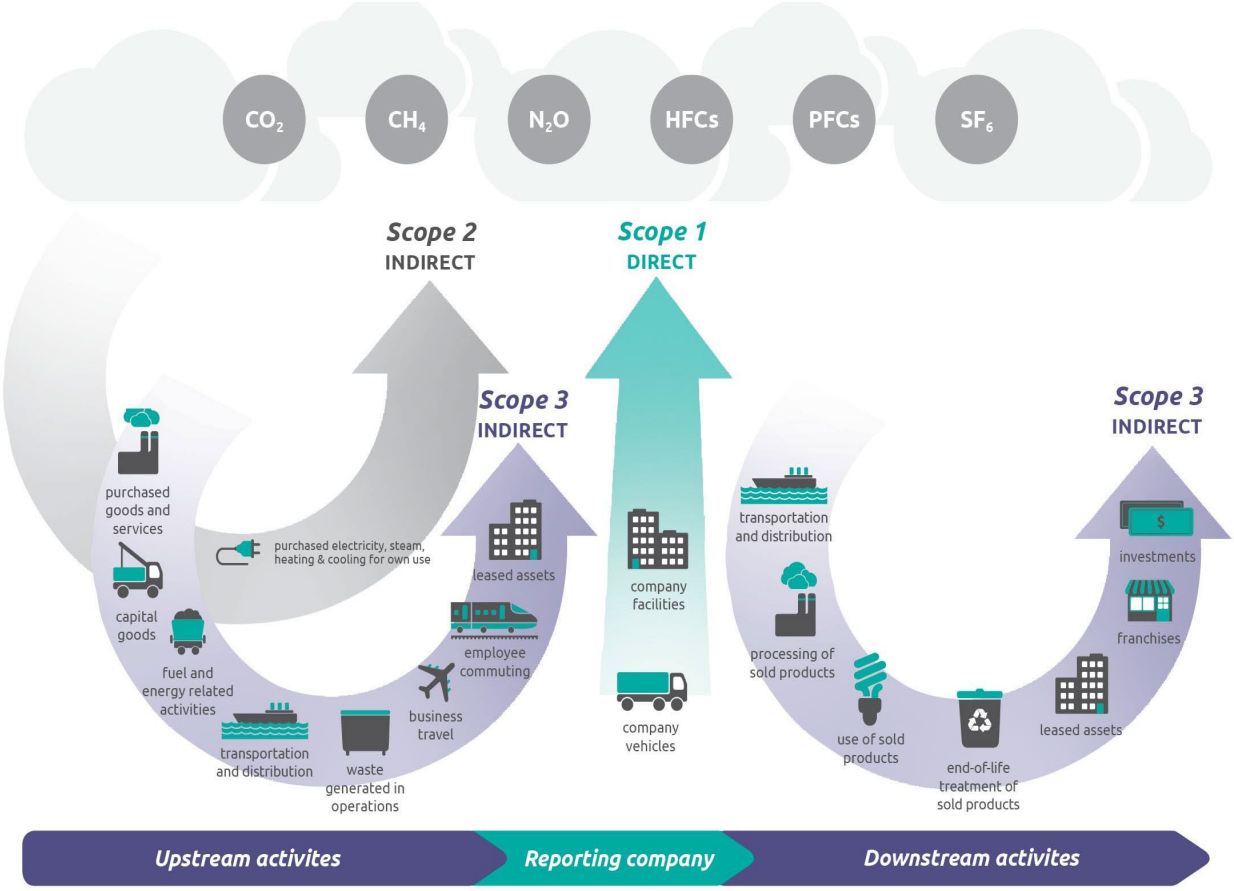

Figure 5 - World Business Council for Sustainable Development Greenhouse Gas Protocol

10.1. Determine the Best Way to Access and Store Data

The auditor will find that there will likely be various databases throughout the company that are used for each data set. The tools and processes chosen to report data will depend upon the information and communication infrastructure already in place, which depends on the detail that is requested from each POC's representative area.

10.1.1. *Function-Specific or Facility-Level Data Warehousing*

The most common scenario encountered is different geographies, functional areas and facility or business-unit levels will have their own databases that house their own relevant data, and do not integrate across the corporation. For example, accounts payable and receivable (which typically house utility bill data) will likely have their own databases that remain housed. The point of contact in each area *should* be able to assist in identifying which database/software is used and which reports are available.

10.1.2. *Advantages of Centralized Data Management for Ease of Access*

The advantages abound for accessing all necessary emissions data from a single source, as data procurement is much of the legwork of a carbon audit. As such, when emissions data is integrated and centrally housed in an enterprise-wide resourcing planning (ERP) system, the

burden of labor is significantly decreased. Such ERP systems can be designed to integrate with other suites of applications throughout a business. Large providers have capabilities to create a bespoke environmental data management solution that integrates with existing repositories (for example, human resources data housed entered directly into the same system as other business practices like real-estate management). Or, more specialized providers can add a-la-carte modules (like fleet management, utility bill tracking) for housing energy data from each of the places data originates – then build ground-up to a full ERP system. Cost of software licensing and implementation fees can be extensive. It is likely that a corporate-driven, top-down data management overhaul will be necessary to enable this ideal scenario.

10.1.3. *Accessing Data from Third-Party Vendors*

While an ideal scenario would be that an auditor can access all necessary data from one place, the reality is likely that data from separate repositories will exist, or that data will be missing or too difficult to procure. A common example is that electricity use data, captured in utility bills across geographies, may not be accurately captured by the MSO. In this case, a third-party data vendor can provide supply-side utility data that can be used to replace or supplement missing utility data.

10.1.4. *The role of Control systems/tools*

With control tools and systems, it is intended to have an overall methodology that can be used to verify the accuracy of the data provided whether it is estimated or potentially invoice based. In certain instances, invoices do not include energy data explicitly and may therefore be unintentionally omitted from the data collection. A control system would help disclose this kind of omissions and estimation. An example of such system is the use of the total hybrid fiber coax outside plant electricity consumption based on the assets deployed and their electricity consumption and the loss of power in the cable. This total *should* be compared to the total electricity consumption of a region or entity.

10.1.5. *Collating Energy Data for Analysis*

Depending on the originating data sources, it is up to the auditor to decide internally how to collate emissions data in one place for rollup and analysis. One possibility is that the auditor can create report templates, to be filled in by POCs that can be exported to a comma separated value file or directly to a relational database. Then, the data may be processed directly in spreadsheet software, or exported to a statistics software package for analysis.

10.2. Collecting and Storing Energy Data from POCs

For an MSO, energy data is organized into to the three different emissions Scopes under the GHG protocol (see Figure 5). Several points of contact will be necessary across the organization to collect the necessary data for a full audit (see section 9.3).

Table 1 - MSO Emissions Summary Table

Scope 1: Direct Emissions			
Emissions Activity	**Emissions Source**	**Fuel Type**	**Unit**
Stationary Combustion	Generators	Diesel; Propane; Natural Gas	gallons
	Heating	Natural Gas	therms
Mobile Combustion	Fleet Vehicles (Staff)	Gasoline; Diesel; E85; CNG[7]; LPG[8]	gallons
	Corporate Aircraft	Jet Fuel (Kerosene Base)	gallons
Fugitive Emissions	Refrigerant	R-22; R-410a; R-407c; R-417a; R-134a	pounds

Scope 2: Indirect Emissions			
Emissions Activity	**Emissions Source**	**Fuel Type**	**Unit**
Purchased Electricity Network	Outside Plant – Power Supplies	Electricity	kWh/Year
Purchased Electricity Facilities	Critical Facilities (Head Ends/ Hub Sites/Data Centers)	Electricity	kWh/Year
Purchased Electricity Facilities	Non-Critical Facilities (Office/Warehouse/ Retail Space)	Electricity	kWh/Year
Purchased Heat and Steam	Non-Critical Facilities (Office/Warehouse/ Retail Space)	Multiple types (converted to either giga-joule (GJ) or kWh)	kWh/Year

[7] CNG = Compressed Natural Gas in gasoline gallon equivalents

[8] LPG = Liquefied Petroleum Gas (Propane) in gasoline gallon equivalents

Scope 3: Other Indirect Emissions*[9]			
Emissions Activity	**Emissions Source**	**Fuel Type**	**Unit**
Travel	Land Travel	Various	miles
	Air Travel	Various	passenger miles
	Charter & Fractional Aircraft	Various	statute miles
	Employee Commuting	Various	miles
Mobile combustion	Fleet Vehicles (Contracted)	Gasoline; Diesel; E85; CNG[10]; LPG[11]	gallons
Purchased Electricity	Leased Non-Critical Facilities (Office/Warehouse/ Retail Space)	Electricity	kWh/year
Waste Emissions	Mixed Municipal Solid Waste	N/A	tons
	Recycling (Mixed) – see SCTE 207	N/A	tons
Customer Premise Equipment energy	CPEs	Electricity	kWh/year

Note, GJ could be used as a level-setting unit of measure for energy related emissions.

10.3. Scope 1: Direct Emissions

Cable operator direct emissions are composed of emissions from stationary combustion, mobile combustion and other fugitive emissions. By far, the largest Scope 1 emissions source at an MSO will be staff fleet and company fuel.

10.3.1. *Stationary Combustion*

In a cable system, on-generators frequently serve as back-up power solutions at hub sites and headends. In case of a power outage, generators will provide emergency power to the critical facility until grid power is

[9] An MSO *may* choose to include metrics around consumer behavior (usage and disposal habits) for its physical products, such as CPEs and set-top boxes, in Scope 3. However, the GHG Protocol recognizes that this data is much more difficult to obtain or model, and thus this outline recommends that it be omitted from a carbon audit.

[10] CNG = Compressed Natural Gas in gasoline gallon equivalents

[11] LPG = Liquefied Petroleum Gas (Propane) in gasoline gallon equivalents

restored. Additionally, facility managers *may* exercise or run these generators as part of a regularly scheduled maintenance program. To accurately account for emissions resulting from generator use, auditors must collect fuel use records for each generator unit at all facilities across the enterprise. Annual fuel use would include both exercise runs and emergency runs.

Data Required	Generator Fuel Consumption: • Detailed equipment inventory list including equipment type, size in kW, type of fuel consumed for each facility. • Estimated total run-time for each unit in reporting year.

Facilities *may* also use natural gas for on-site heating purposes at both critical and non-critical facilities. These can include multi-use/building complexes, offices, cable store retail sites, warehouse facilities, call centers, or headends/hub sites. Typically, annual fuel use data can be obtained from monthly utility bills for each facility.

Data Required	Natural Gas (or Other Heating Fuel) Utility Bills: • 12 months of utility bills or usage information

10.3.2. *Mobile Combustion from Company-Owned Vehicles*

Fuel, in the form of gasoline, diesel, E-85 (an ethanol-gasoline blend), compressed natural gas (CNG) or liquefied petroleum gas (propane) (LPG) consumed in the operation of staff fleet and company vehicles represents the largest portion of Scope 1 emissions. These include company vehicles including vans, light trucks, medium trucks, bucket trucks, bucket vans, passenger cars, and SUVs. To account for these emissions, auditors must collect fuel usage data for each vehicle.

Data Required	Fleet and Company Vehicles Data: • Total fuel consumed in gallons – specify between petroleum gasoline fuel, diesel fuel or other fuel type. • What percent of "fleet" composed of outside contractors, (which will be accounted for in Scope 3)?

Similarly, all flights using company-owned aircraft must be reported.

Data Required	Company-owned aircraft data: • Flight details and route information for all trips, including distance, destination, round-trip or one way • What percent of "air travel" occurs on company-owned aircraft, and which occurs on commercial airlines (which will be accounted for in Scope 3)?

10.3.3. *Fugitive Emissions*

Fugitive emissions are direct hydrofluorocarbon (HFC) and perfluorocarbon (PFC) emissions resulting from the manufacturing, servicing and disposal of refrigeration and air conditioning equipment that are owned or controlled by a company. This type of equipment at an MSO is used at data centers, headends, and hub sites where temperatures need to be closely controlled. Fugitive emissions are usually

unintentional as a result of leaking from joints, seals, packing, and gaskets, as well as use of refrigerants in refrigeration and air conditioning equipment. This can be calculated by examining refrigerant uses and determining if optimum replenishment is occurring or if there are leakages.

Data Required	• Detailed equipment inventory list including equipment type (brand), size (tons), type of refrigerant used (i.e. R-22, R-410a), and total full charge of refrigerant (if known) for each facility.
	• Ideal data needed:
	  ○ Refrigerant inventory at beginning of year
	  ○ Refrigerant inventory at end of year
	  ○ Total refrigerant replenishment for reporting year

10.4. Scope 2: Indirect Emissions

Scope 2 emissions are associated with purchased electricity that powers cable networks and facilities. *Scope 2 emissions represent the largest source of GHG emissions for most MSOs.* The amount of electricity consumed (usage data) for Scope 2 emissions typically can be found on electrical utility bills, copies of which *may* be found with the MSO accounts payable department. Otherwise, auditors can contact the utility providers directly to obtain the necessary data or obtain it from a third-party vendor (see Section 10.1).

10.4.1. *Purchased Electricity – Network*

The outside plant (OSP) is an expansive and distributed network of power supplies, fiber cable and coaxial cable. These power supplies are the primary consumers of electricity in the OSP, thus representing the most energy intensive part of an MSO's operation. To calculate the OSP portion of the carbon footprint, auditors *should* collect kilowatt-hour data for each power supply account in the MSO. However, since power supply energy consumption is usually consistent across time, a sampled set of one month will likely be enough to determine the total annual energy consumption. Auditors *should* also collect a power supply asset list for each system to ensure a complete accounting.

Data Required	• Power supply list • 1 month of usage (kilowatt-hours) for each power supply

10.4.2. *Purchased Electricity – Critical Facility*

Critical facilities, which are classified as facilities with critical building purposes related to the network such as head ends, hub sites and data centers, will likely be the second most energy-intensive source of Scope 2 purchased electricity emissions. Since energy consumption varies throughout the year, twelve months of utility bills must be collected to accurately account for critical facility electricity consumption during the baseline year. Doing so will generate the total number of kilowatt-hours used by each site annually. Auditors also *should* collect a real estate portfolio of all critical facilities for each system to ensure a complete accounting.

Data Required	• Critical facility list • 12 months of usage (kilowatt-hours) for each facility

10.4.3. *Purchased Electricity – Non-Critical Facility*

Non-critical facilities, which are classified as facilities with non-network-related building purposes such as offices, warehouses, retail spaces, call centers, communication sites, and news studios, will likely be the third most energy-intensive source of Scope 2 purchased electricity emissions. Since energy consumption varies throughout the year, twelve months of utility bills must be collected to accurately account for non-critical facility electricity consumption. Doing so will generate the total number of kilowatt-hours used by each site annually. Auditors also *should* collect a real estate portfolio of all non-critical facilities for each system to ensure a complete accounting.

If a site is mixed use, auditors *should* collect building square footage information and determine the percent of floor space dedicated to technical operations (critical) versus general operations (non-critical). Doing so will allow energy consumption to be segregated into the appropriate sub-categories.

Data Required	• Non-critical facility list • 12 months of usage (kilowatt-hours) for each facility

10.4.4. *Purchased Heat and Steam*

Purchased heat and steam are typically acquired through a direct line connection with a generating facility. These energy sources are also commonly distributed through a district energy system, which is a grid system covering a limited geography supplying multiple end-users with energy produced by one or more energy generating facilities. Operators *should* quantify and report emissions from heat and steam purchases using appropriate emission factors obtained directly from the suppliers. If factors are not available, the organization can calculate emission factors based on the fuels used for generation and the efficiency of generation.

10.5. Scope 3: Other Indirect Emissions

Scope 3 emissions are comprised of business travel (land and air) emissions, employee commuting, CPE, contracted vehicles and waste emissions. Given that this is an evolving area of carbon accounting and downstream emissions data is much more difficult to collect, reporting of Scope 3 emissions is considered optional by the GHG Protocol.

10.5.1. *Travel*

Business travel by land and air make up a small portion of Scope 3 emissions. For land miles, the ideal data point to use when calculating emissions is fuel gallons by vehicle type. However, it is possible to estimate emissions if distances or fuel expenses are known. To that end, the distance traveled per employee for business by location or market by vehicle type (make/model/year) for the calendar year of the carbon audit is required to calculate Scope 3 business land travel emissions.

For air travel, the distance traveled (miles) for business by commercial or third-party aircraft by location for the calendar year of the carbon audit are required to calculate Scope 3 business air travel emissions.

Data Required	• Business travel receipts via rental cars, charter bus, subway, taxi, train, ferry or any other method of public transportation where the MSO pays the expenses

10.5.2. *Employee Commuting*

Employee commuting will likely contribute the largest portion of the MSOs Scope 3 emissions. To calculate these emissions, employee commuting miles (in a non-company vehicle, or using public transportation) for the calendar year of the GHG emissions report is required. This can be accomplished using an employee survey through HR office.

Data Required	Results from Employee Survey must include: • Employee commuting miles travels • Commuter vehicle details (make, model, year, fuel type, etc.) • Public transportation details (frequency, distance, etc.)

10.5.3. *Waste*

This section covers emissions from third-party disposal and treatment of mixed municipal solid waste, recycling waste and e-waste (i.e. electronic waste from CPE or technical equipment) generated in the MSO's owned or controlled operations in the reporting year. Auditors must contact individual facility managers, or regional managers to obtain necessary data. The auditor also *may* have to contact third-party disposal and treatment contractors to determine waste treatment methodologies for each facility – which must include both critical and non-critical facilities.

Data Required	• Waste service bills or invoices for each facility • Recycling information at each facility (organized by piece count, type and weight of e-scrap to be recycled)

10.5.4. *Mobile Combustion from Contracted Vehicles*

As in vehicles owned by the company fleet, fuel data needs to be captured from vehicles that are leased by the cable operator under third-party contract.

Data Required	Contracted Vehicles Data: • Total fuel consumed in gallons – specify between petroleum gasoline fuel, diesel fuel or other type. • What percent of "fleet" composed of outside contractors?

10.6. Troubleshooting Data Procurement

Data collectors *may* have trouble obtaining all the multitude of data points needed to build the report. For example, if data collectors have trouble accessing electricity bills from a corporate accounting department, it might be necessary to reach out to local regional management offices for the bills. Or, the data team might go directly to the source—the electric utilities—to request billing detail for the past year of electricity service. Generally, it *may* help to think about which departments in the company *may* use the information the teams need and contact them individually.

Another example where the collection team *may* need to troubleshoot data procurement is when looking for real estate details. Real estate listings for multi-use buildings with no specification of building type could prove to be a problem and it *may* be easier to talk directly to the local managers to determine the building breakdown and the square footage for each building type.

10.7. Data Quality Control Check Before Estimation and Conversion

When receiving data for a portion of the GHG emissions report it's helpful to use common sense as a first check to see if everything that was requested has been received before moving on to the analysis portion of the report, as it's much easier to fill data gaps as they arise as opposed to finding that there is data missing that has to be procured at the end of the process.

Possible scenarios include:

- The data team requested vehicle fuel data for multiple regions but received data only located in one sub-area of that region. If the data collectors are not aware of the market characteristics for that region, they might not be aware if all the data is accounted for. The data collection lead can go back to the fleet management department and request data for the missing areas.

- The team examined facility electricity bills in an accounts payable database and noticed there are no electricity bills from June through October, despite having requested bills for the full calendar year. The team can go back to the accounting department and request those months of missing bills, which *may* have been housed in an alternate system – or data can be collected directly from the utility provider.

- A real estate inventory lists multiple critical facilities with zero square footage, which *may* indicate that there is a convention among the real estate team to list plots of land where facilities will be built on in the future. The GHG emissions analysis team can go back to the real estate POC or local managers to find what the actual square footage is for that building or if the facility *should* be classified as "land" and as such disregarded.

10.8. Estimate Missing Energy Data (if needed)

It is unrealistic to expect that all data will be available from each source needed – and as such, estimation of missing data *may* be required (see section 9.2).

Possible scenarios include:

- There are several facilities that are missing electricity bills for the calendar year of the carbon audit. To estimate missing data, the GHG emissions project team could take a yearly average of energy used by each facility and fill in the blanks. They could also take a seasonal average of the energy used by each facility for the missing months of data.

- To save money and time the data collection team used plant characteristics to assess the OSP power supply electricity data instead of auditing every single power supply in the company. An acceptable estimation strategy could be to take a sample of metered power supplies in a region and use that to extrapolate to the entire area using plant characteristics. Since power supplies use a constant and consistent load all year round, the auditor could look at one month of data instead of the whole year and extrapolate for the twelve months of the reporting year.

- The data collection leader discovered that fleet fuel data for contractors is unavailable. An acceptable strategy could be to utilize the existing staff fleet fuel truck roll data and extrapolate to estimate the missing contractor fuel consumption from the total number of contracted truck rolls or the estimated percentage of the fleet operated by contractors.

11. Calculating, Converting and Reporting

After data has been collected, it must be normalized against GHG Protocol standards into emissions – as multiple types of energy usage data, covering the whole enterprise with sources ranging from electricity to gasoline, must all be converted and reported into an equivalent metric so as to compare apples to apples.

11.1. Calculate and Convert to CO2 e Units

Once the energy data has been collected it needs to be combined by energy source and converted to carbon dioxide equivalents (CO_2e). The most common approach for calculating GHG emissions is through the application of documented emission factors, which are calculated ratios across different types of energy sources.

For example, an important variable impacting the purchased electricity carbon footprint from Scope 2 is the sub regional carbon coefficient used to calculate CO_2 e generated for consumed electricity. An MSO's facilities *may* be geographically contained or spread out across the country, in which case, are subject to a variety of sub-regional carbon coefficients. The EPA eGRID map in Figure 6 details the breakdown of purchased electricity emissions coefficients depending on location in the U.S:

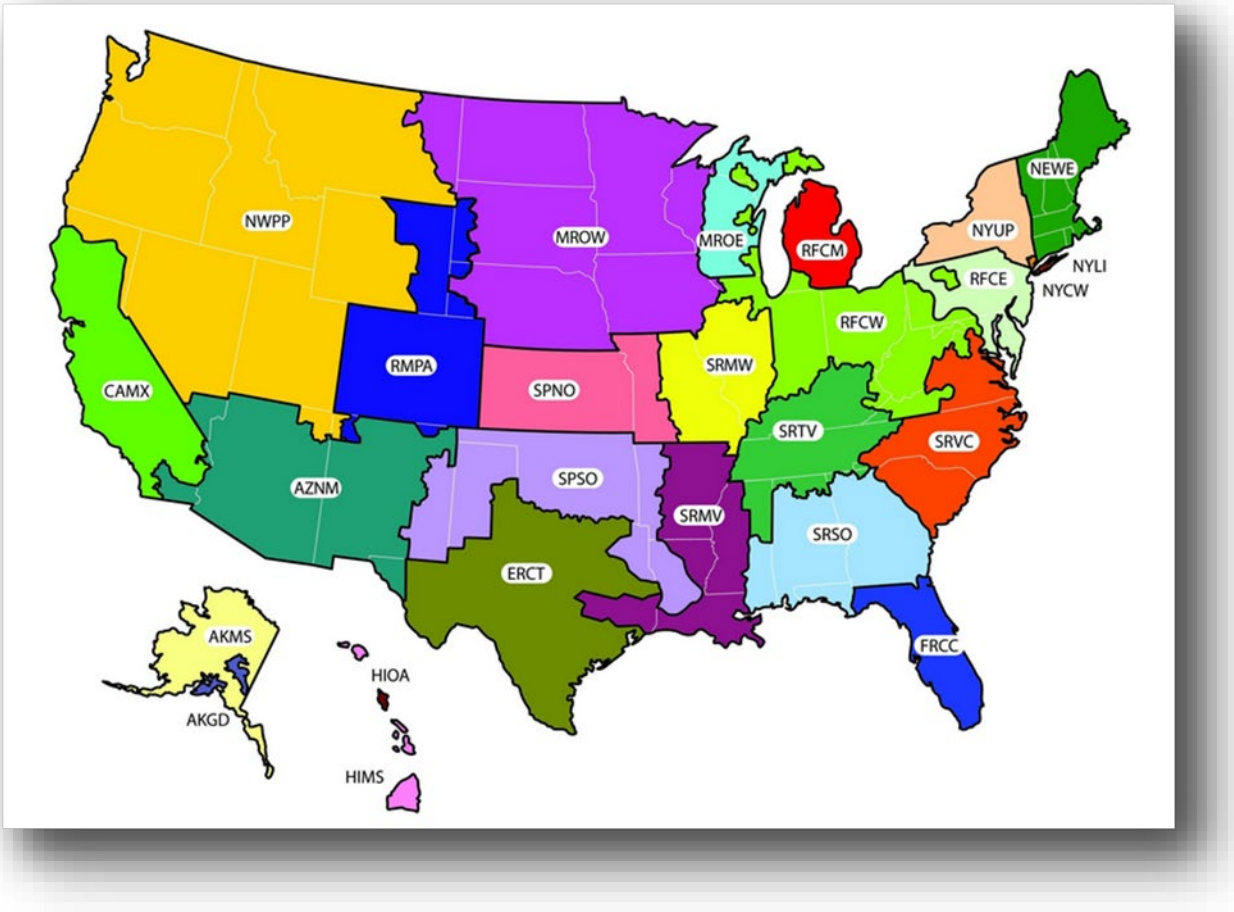

Figure 6 - EPA eGRID Emissions Coefficients for Electricity Consumption in the US

In addition to this EPA tool and the GHG Protocol's calculator (http://www.ghgprotocol.org/calculation-tools), which contains other helpful emissions coefficients, some other available conversion resources include:

- US Environmental Protection Agency (EPA) Greenhouse gas calculator http://www.epa.gov/cleanenergy/energy-resources/calculator.html
- US EPA's WARM calculator for waste emissions conversion (for Scope 3 calculation) http://www.epa.gov/region10/pdf/climate/wccmmf/Reducing_GHGs_through_Recycling_and_Composting.pdf
- DEFRA - The Department for Environment, Food and Rural Affairs. Conversion factors allowing organizations and individuals to calculate greenhouse gas (GHG) emissions from a range of activities, including energy use, water consumption, waste disposal, recycling and transport activities. https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020
- ADD EU Reference here.
- Add Canadian reference here Environmental Canada?.

11.2. Estimations Methodologies

In some cases, actual data *may* not be readily available. Therefore, from a reporting perspective it recommended to make a conservative estimation instead of entering a 'zero' value into the field. It is important as a cable operator to have a clear picture of the environmental impacts when measuring - even if it is a best guess estimate initially until actual data is made available.

In order to ensure a consistent approach to making estimations is applied across the business, there *should* be a hierarchy of recognized data sources such as below. The goal is to move the data gathering processes up this hierarchy as far as is practical and sensible.

What follows is general guidance to establish the principles of data quality. Detailed guidance for certain areas of data collection *may* be established by each company reflecting capabilities and organizational structure.

Table 2 - Guidance to Establish the Principles of Data Qualities of data quality

	Data Source	Example
1	Robust internal data system, which can be reconciled to independent, third party data.	Energy data from electricity meters, either through smart metering or reconciled with consumption collated from invoices, as well as internal financial systems.
2	Trusted, independent third-party data – no internal system.	Information from supplier specifying the amount of energy used. If this information is not provided by the supplier currently a request to the supplier *should* be initiated going forward.
3	Robust internal data system with ability to conduct reasonableness checks.	Consumption data derived from bills in combination with statistics from past years. For example, calculating diesel consumption use amount of diesel purchased for the year in

		question in combination with purchase and stock stats for past years.
4	Partial information system – does not provide complete data but covers a representative sample which provides a reasonable basis for extrapolation.	For locations where there is no specific energy bill provided estimation *should* be based on taking representative locations (both in terms of size and service) fitted with electricity meters and the readings are extrapolated for the sites in question.
5	Incomplete, unreliable data. Not adequate to support internal or external reporting.	In this case, historical data or local industry averages *should* be used to calculate an estimated consumption (based on FTE).

11.2.1. *Estimating Non-financial Information*

In many cases non-financial information (e.g. energy consumption) will be based on third party information (e.g. invoices, consumptions statements or from a company's own information databases). This can be problematic when compiling annual data for group reporting purposes in order to meet the reporting deadlines (i.e. you might only have 11 months of actual data). In such circumstances, it *may* be appropriate to provide an estimation or extrapolation technique to determine the total annual consumption.
Below are 3 techniques that can be used to estimate your full year data:

Techniques for estimating non-financial information:

1. **If consumption tends to be similar month on month**, then a simple calculation can be applied. The same technique can be applied on a weekly or even daily basis.
    - X = 11 month actual consumption
    - X x 12/11 = Annual consumption estimate

2. **If consumption tends to more cyclical in nature** (e.g. the data displays peaks and troughs that are not fixed) then it *may* be appropriate to apply the relative consumption from that period in the previous year.
    - X = 11 month actual consumption
    - Y = December consumption last year
    - Z = Total consumption last year
    - X + (Y/(Z-Y) x X) = Annual consumption estimate

3. **If consumption closely follows a financial or other such indicator** (e.g. revenue), then it *may* be appropriate to extrapolate the consumption based on the financial performance of the last month relative to the year.
    - X = 11 month actual consumption
    - Y = December revenue
    - Z = Total revenue for year
    - X + (Y/(Z-Y) x X) = Annual consumption estimate

Close comparison of actual consumption to the pool of estimated data is recommended. Performing this analysis will aid in deciding if it will be appropriate to use this technique in the future.

All estimation methodologies used *should* be clearly noted and attached to the system being used to ensure review and auditing of the data is made easier.

11.3. Calculate Confidence Interval

The GHG Protocol requires that for emissions data quality management, the auditor must conduct an uncertainty analysis for each portion of estimated data. The GHG protocol instructs that care must be taken throughout the entire data collection and calculation phase to ensure every section has a full and accurate data set and is calculated appropriately. But given time and budgetary constraints, it's very likely that some estimation and/or extrapolation will have to be used in order to get a full picture of the energy usage of the entire enterprise (see Section 10.3). The results of the statistical analysis determine the confidence intervals of the data, allowing one to validate the accuracy of the data (see Table 1).

Data Accuracy	Interval as Percent of Mean Value
High	+/- 5%
Good	+/- 15%
Fair	+/- 30%
Poor	More than 30 %

Figure 7 - Data Accuracy Rating and Corresponding Intervals

Used in the GHG Protocol Uncertainty Tool

The more data points the collection team can use (vs. estimating or extrapolating) the higher the confidence interval will be. For example, if the team used employee commuter data from one city and used that to extrapolate to the entire company, confidence interval would be lower than if they used employee commuter data of every individual employee in the enterprise.

Capturing confidence intervals *may* also be less or more important depending on the end-game usage scenario of the data – for example, if the data is primarily used to audit the efficiency of OSP power supplies to inform an upgrade, the auditor *may* strive for a confidence interval of under 5%. If the cable operator has no plans to upgrade these supplies, a less labor-intensive audit of the supplies could be conducted and a lower confidence interval would be acceptable.

11.4. Roll up Data as Requested by End Users

The data that will be amassed at the completion of a GHG emissions report can be used for crucial insight into the energy usage of the whole enterprise. The data can be rolled up in various ways depending on who the end user is and what they're interested in discovering – this also depends on whether a partial or full audit was conducted.

Possible scenarios include:

- For example, the energy data can show which region has the most inefficient fleet operations to see where attention *should* be paid to reduce fleet costs. Which regions have higher truck rolls than others? How many areas have return visits to fix the same problem? Can there be changes to the training regimen to improve customer satisfaction and reduce truck rolls altogether? In this case, truck roll data from Scopes 1 and 3 could (owned and leased vehicles, respectively) would be pulled and reported to appropriate technical operations staff to inform efficiency plans.

- Another application of rolled-up data could be to look into the electricity usage of OSP networks across the company to see which regions need to improve efficiency. The engineering department could use that information to get insight into how many power supplies need to be upgraded or replaced with energy-efficient models that will reduce electricity costs. In this case, OSP energy data could be extracted from Scope 2 and disseminated to the appropriate managers, providing insight on best-performing and worst-performing supplies.

- Another application of rolled up data could be to look at how fleet costs change depending on the age and type of vehicle used on truck rolls. The fleet manager could use that information to make cost-effective decisions on which vehicles to upgrade next and which vehicle models would help reduce upfront costs. In this case, fuel efficiency data by make and model of vehicle could be extracted from Scope 1 data, and compared across the fleet to provide insight into best- and worst-performers.

11.5. Report Findings

Once the data has been compiled and calculated, the GHG Protocol requires that a report be written to summarize the findings of the GHG emissions report. The data included and the resultant report will be aligned with the drivers determined in the MSO's "end game strategy" (see Section 7).

11.5.1. *Required Information*

The GHG Protocol requires that the following information be included in an in-compliance carbon audit report:

Description of the company and inventory boundary: The company must make clear which operational and organizational boundaries were included in the audit, as well as the base year used (see Section 8.2). The company must disclose a list of the activities covered if the company reports on Scope 3.

***Information on emissions*:** The company must report on both the total and separate Scopes 1 and 2 emissions calculated separately, including any methodologies used to calculate or measure those emissions. Similarly, the company must explain its rationale behind its base year selection or average, or change from a previous audit. Specific exclusions of emissions sources must also be disclosed.

11.5.2. *Typical Cable Operator Emissions Footprint*

Figure 8 represents the breakdown results of a typical cable operator emissions report.

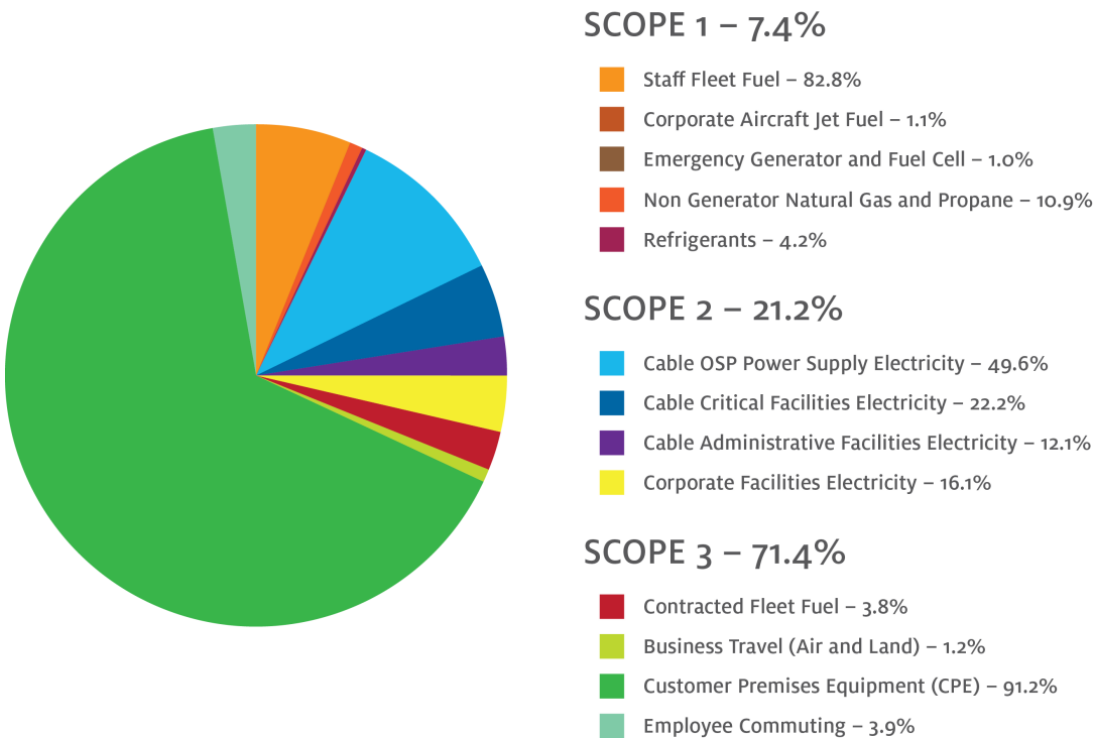

Figure 8 - Footprint of a Typical Cable Operator

Scope 1 emissions will account for just under one-third of an MSO's total footprint, which is by far composed of emissions from the cable operator owned fleet operations. Overall, the largest component of an operator's footprint is Scope 2 emissions, which typically account for just under two-thirds of a total emissions footprint. This is because of the large quantities of purchased electricity used by the OSP power supplies, in addition to the electricity needed to power critical facilities like head ends and hub sites. Non-critical facilities and people-buildings, including office spaces and call centers, each require purchased electricity in order to maintain basic operations. Scope 3, accounting for downstream emissions from throughout the value chain, will majority be comprised of emissions from employee commuting.

12. GHG Emissions Accounting Horizon

While GHG emissions accounting and reporting is often conducted as a company efficiency exercise, it is important to keep an eye on the regulatory and disclosure landscape to anticipate the company's future needs. Fluency in language and processes behind energy audits and carbon emissions *may* also be necessary if questions are asked from the public, customers, investors and other stakeholders. Ultimately, the intention in the audit and emissions community is that the discourse for carbon accounting mirror the standards and processes applied to financial accounting – and like financial accounting, will one day be required of all publicly-traded companies. Furthermore, future emissions reduction requirements are a driver for a comprehensive, long-term carbon abatement strategy – of which an initial carbon audit is the first step.

12.1. The Regulatory Landscape

Currently no emissions reporting standards apply specifically to cable operators in the United States – Federal emissions accounting and reporting laws only are in-place for point-emitters in the power

generation industries. There are local, regional, and global guidelines and influences that can impact approaches to GHG collection needs. .

However, if a cable company operates outside the US, it *may* be subject to regulations requiring emissions audit and disclosure. For example, an operator *may* be required to participate in emissions schemes like the EU ETS and similar country-specific mandatory emissions trading systems. The Paris Climate Agreement that includes science-based approaches to reducing greenhouse gas emissions can be referenced as a guide for reducing targets in line with that pledge.

The general trend in reporting emissions is moving toward stringency, and sustainability experts forecast that in the next few decades, emissions recording and reporting will become law for all industries – just as financial accounting and reporting is required yearly for listed companies. The next step in the legislative landscape will be to require emissions reductions targets, as nations strive to decrease their collective GHG footprints. Section 12.2 addresses how a carbon audit is part of the longer-term goal of improving efficiency and reducing the cable operator's GHG emissions footprint.

12.2. Abatement and Furthering the GHG Emissions Management Process

The establishment of an organizational emissions baseline is merely a first step in the GHG emissions management process (see Figure 9). After a report is compiled, annual emissions are measured and the baseline year's calculations are complete the next step is to set an emissions reduction goal. Then, the operator identifies which areas within their operations that will be the most effective to target with energy efficiency projects and develops abatement strategies as part of a larger GHG emissions abatement target that addresses energy use across operations. The final step is to implement the abatement strategies and re-measure emissions against the baseline year, calculating year-on-year progress to achieving the abatement goal.

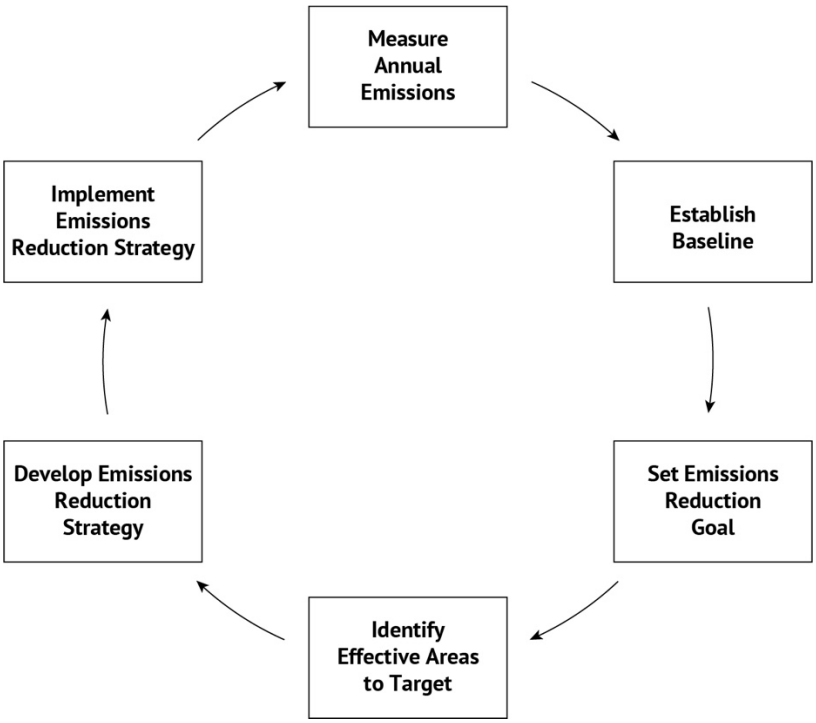

Figure 9 - The GHG Emissions Management Process

Validation and Verification

GHG emissions validation and verification *may* be pursued by an organization for a number of reasons, such as to contribute to their sustainability report, to communicate to their customers, to meet regulatory or investor reporting requirements, or publicly disclose their emission reduction achievements. In many cases, an independent third party is needed to ensure GHG emissions inventory aligns with reporting standards, frameworks and requirements.