

Carbon Accounting & Measurement

Technical Documentation

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1. Introduction

Overview of CAM Tool

The Carbon Accounting & Measurement (CAM) tool is a set of configured objects across the modules (Data Sources, Metrics and Publisher) of the Nasdaq Metrio product designed to accurately and transparently calculate Scope 1, 2, and 3 greenhouse gas (GHG) emissions. It streamlines the complex process of GHG accounting, offering significant benefits over manual calculations, including improved accuracy, reduced errors, increased efficiency, and enhanced transparency in reporting.

The CAM tool operates by ingesting data from various sources (referred to as "data sources"), which can include energy and fuel consumption records, waste disposal data, or purchased goods and services information. This raw data then undergoes a series of transformations within the tool using a series of custom calculations, called "metrics," written in Python. These metrics perform calculations, aggregations, and conversions, ultimately leading to the calculation of total Scope 1, 2, and 3 emissions. The final results are presented in a clear and easily understandable format, allowing for comprehensive GHG emission reporting and analysis.

A key feature of the CAM tool is its modular design. Individual metrics can be easily reviewed and audited, ensuring transparency and allowing for adaptation to evolving accounting standards, regulatory requirements and data availability. The tool also enables the tracking of data provenance, meaning the origin and transformations of each data point are meticulously recorded, adding to the overall reliability and auditability of the results. This traceability fosters greater confidence in the reported emission figures. Furthermore, the tool's flexible architecture allows for easy incorporation of new data sources and calculation methods as needed.

Purpose and Scope of the Documentation

The purpose of this documentation is to provide a comprehensive guide for the Carbon Accounting Management (CAM) tool. This document aims to assist users in understanding the functionalities, methodologies, and data sources used by the CAM tool to calculate GHG emissions. By offering detailed explanations and step-by-step instructions, this documentation supports effective implementation and utilization of the CAM tool for accurate carbon accounting.

Scope of the Documentation:

- **Overview of CAM Tool:** An introduction to the CAM tool, its key features, and benefits.
- **Calculation Methodology and Data Sources:** Detailed descriptions of the methodologies used for calculating Scope 1, Scope 2, and Scope 3 emissions, along with the data sources and linkages.
- **Energy Consumption and Estimation:** Explanation of the data transformation process for energy consumption and estimation methods for missing data.
- **Scope 1, 2, and 3 Emissions:** In-depth coverage of the calculation methodologies for each scope of emissions, including examples and best practices.
- **Summary:** A concise summary of the key points covered in the documentation, highlighting the importance of accurate data and the role of the CAM tool in achieving reliable carbon accounting.

This documentation is intended for project managers, sustainability officers, and other stakeholders involved in carbon accounting and environmental management. It serves as a valuable resource for understanding and leveraging the CAM tool to achieve sustainability goals.

Key Features and Benefits

The Carbon Accounting Management (CAM) tool offers a range of features designed to streamline and enhance the process of carbon accounting. These features ensure that organizations can accurately measure, manage, and report their carbon emissions, contributing to their sustainability goals.

Key Features:

- **Comprehensive Data Transformation:** Processes raw data to provide accurate carbon emission metrics, covering all three scopes of emissions (Scope 1, Scope 2, and Scope 3).
- **Detailed Metrics and Data Sources:** Utilizes various metrics and data sources for precise calculations, linking each metric to other metrics or data sources.
- **User-Friendly Interface:** Designed to be intuitive and easy to use, accessible for users with varying levels of expertise in carbon accounting.
- **Customizable Reports:** Allows users to generate customizable reports to meet specific organizational needs and regulatory requirements.
- **Real-Time Data Processing:** Processes data in real-time, enabling continuous monitoring of carbon emissions and prompt decision-making.
- **Embedded Emission Factors Database & Emission Factors Mapping**
- **Embedded Unit Conversions**

Benefits:

- **Time-saving Automation:** Leverages a robust catalogue of 1000s of verified and regularly-updated global Scope 1, 2 and 3 emissions factors, providing automated mapping to activity data and in-app unit conversions.
- **Easy Estimation:** Includes automated estimation to fill data gaps for key categories of missing activity data
- **Enhanced Accuracy:** Ensures high accuracy in carbon emission calculations, crucial for reliable reporting and compliance with environmental regulations.
- **Comprehensive Coverage:** Provides a complete picture of an organization's carbon footprint, helping to identify areas for improvement and implement effective carbon reduction strategies.
- **Improved Decision-Making:** Offers valuable insights through real-time data processing and customizable reports, supporting informed decision-making.
- **Regulatory Compliance:** Helps organizations comply with environmental regulations by providing accurate and detailed carbon emission reports.
- **Sustainability Goals:** Aids in accurately measuring and managing carbon emissions, helping organizations achieve their sustainability goals and contribute to global efforts to combat climate change.

2. Calculation Methodology and Data Sources

Estimation

The CAM tool includes robust estimation methods to handle missing data in key areas, ensuring that the carbon emission calculations remain accurate and comprehensive. These methods are based on intensities defined in the CBECS (Commercial Buildings Energy Consumption Survey) datasources or custom intensities provided by the user. Furthermore, clients have the flexibility to enter their own estimated values if needed, enhancing the tool's adaptability and precision. The estimation process involves several key steps and conditions:

Logic and Conditions:

- **Identification of Missing Data:** The tool first identifies any missing data points in the energy consumption records due to incomplete data entry, missing energy bills, or other gaps in the data collection process.
- **Selection of Estimation Method:** Depending on the type of missing data, the tool selects the appropriate estimation method based on intensities related to floor surface area, building activity, climate zone, or building size. Estimation can be enabled or disabled at the site level per the user's preference.
- **Application of Intensities:** The tool applies predefined intensities to estimate the missing data, derived from the CBECS datasources or custom intensities provided by the user, and adjusted based on factors such as building activity and climate zone.

- **Calculation of Estimated Values:** The tool calculates the estimated values for the missing data points using the selected intensities, ensuring consistency and accuracy across all data points.

Metrics Used:

- `packages_ghgtool_metric_estimations_energy_consumption_stationary_combustion_natural_gas_cu_ft`: Estimates missing monthly consumption data for natural gas based on intensities related to floor surface area, building activity, and climate zone.
- `packages_ghgtool_metric_estimations_energy_consumption_electricity_energy`: Estimates missing monthly consumption data for purchased electricity based on intensities related to building size and activity.

Data Validation:

By using these estimation methods, the CAM tool ensures that the carbon emission calculations remain accurate and reliable, even in the presence of incomplete data. This approach helps organizations maintain a comprehensive and accurate carbon accounting system.

Energy Consumption

Data Transformation Process:

The CAM tool processes raw data from various sources to provide accurate carbon emission metrics. It ingests energy consumption data and normalizes it into a unified energy dimension, converting different units of energy (e.g., kWh, GJ, MWh) into a default unit for consistency and accuracy. The tool uses custom energy densities to support inter-dimension conversions, ensuring that all energy consumption data is accurately represented in the default unit.

Metrics Used:

- `packages_ghgtool_metric_conversion_factors`: Exposes built-in conversion factors from Metrio's metrics SDK.
- `packages_ghgtool_metric_custom_energy_densities_stationary_combustion`: Normalizes units of custom energy densities for stationary combustion.
- `packages_ghgtool_metric_conversion_stationary_combustion_energy`: Converts energy-based stationary combustion data into the default unit (GJ).
- `packages_ghgtool_metric_conversion_purchased_electricity_energy`: Converts purchased electricity data into the default unit (kWh).
- `packages_ghgtool_metric_energy_consumption_global_monthly_energy`: Consolidates normalized consumption data once converted into energy dimension for all categories from Scopes 1 and 2.
- `packages_ghgtool_metric_energy_consumption_global_yearly_energy`: Aggregates normalized consumption data into an annualized view for all categories from Scopes 1 and 2.

Logic and Conditions:

- **Data Validation:** The tool first validates the input data to ensure it meets the required standards and formats. Any discrepancies or errors are flagged for review.
- **Unit Conversion:** The tool converts all energy consumption data into a default unit (e.g., GJ for energy) to maintain consistency across different data sources.
- **Custom Energy Densities:** The tool uses custom energy densities to support inter-dimension conversions, ensuring that all energy consumption data is accurately represented.
- **Normalization:** The tool normalizes the data to account for variations in units and measurement methods, providing a unified energy dimension.
- **Aggregation:** The tool aggregates the normalized data into monthly and yearly views, allowing for comprehensive analysis and reporting.

By accurately processing and transforming energy consumption data, the CAM tool ensures reliable carbon emission calculations, helping organizations manage their carbon footprint effectively.

Scope 1

Scope 1 emissions refer to direct greenhouse gas (GHG) emissions from sources that are owned or controlled by the organization. These emissions typically include those from stationary combustion, mobile combustion, and process emissions. The CAM tool provides a detailed methodology for calculating Scope 1 emissions, ensuring accuracy and consistency in the reporting process.

Data Transformation Process:

The CAM tool processes raw data from various sources to provide accurate Scope 1 emission metrics, ingesting data related to stationary and mobile combustion, as well as other direct emissions, and normalizing it into a unified dimension. This involves converting different units of measurement (e.g., kWh, GJ, MWh) into a default unit for consistency and accuracy. The tool uses custom energy densities provided by the users to support inter-dimension conversions, ensuring that all data is accurately represented in the default unit.

Metrics Used:

- `packages_ghgtool_metric_conversion_factors`: Exposes built-in conversion factors from Metrio's metrics SDK.
- `packages_ghgtool_metric_custom_energy_densities_stationary_combustion`: Normalizes units of custom energy densities for stationary combustion.
- `packages_ghgtool_metric_conversion_stationary_combustion_energy`: Converts energy-based stationary combustion data into the default unit (GJ).
- `packages_ghgtool_metric_conversion_mobile_combustion_volume`: Converts volume-based mobile combustion data into the default unit.
- `packages_ghgtool_metric_scope_1_emissions_mobile_combustion_volume`: Calculates Scope 1 GHG emissions for volume-based mobile combustion.

Calculation Methodology:

- **Data Collection:** The tool collects data from various sources, including energy bills, fuel consumption records, and other relevant documents. This data is then validated to ensure accuracy and completeness.
- **Unit Conversion:** The tool converts all data into a default unit (e.g., GJ for energy) to maintain consistency across different data sources.
- **Emission Factors:** The tool applies predefined emission factors to the normalized data. These factors are derived from reliable sources such as the ClimaTiq database and custom emission factors provided by the user.
- **Calculation of Emissions:** The tool calculates the total Scope 1 emissions by multiplying the normalized data by the corresponding emission factors. The calculations are performed in a way that ensures consistency and accuracy across all data points.

Example Calculation:

For a building with natural gas consumption, the tool would use the energy consumption data (e.g., in kWh) and convert it to the default unit (GJ). It would then apply the appropriate emission factor to calculate the total GHG emissions for that building. The tool ensures that all calculations are transparent and auditable, providing a clear and accurate representation of the organization's Scope 1 emissions.

By accurately processing and transforming data related to direct emissions, the CAM tool ensures reliable Scope 1 emission calculations, helping organizations manage their carbon footprint effectively.

Scope 2

Scope 2 emissions refer to indirect greenhouse gas (GHG) emissions from the consumption of purchased electricity, steam, heating, and cooling. These emissions occur at the facility where the energy is generated, not at the point of use. The CAM tool provides a detailed methodology for calculating Scope 2 emissions, ensuring accuracy and consistency in the reporting process.

Data Transformation Process:

The CAM tool processes raw data from various sources to provide accurate Scope 2 emission metrics, reading in data related to purchased electricity and other energy sources, and normalizing it into a unified dimension. This involves converting different units of measurement (e.g., kWh, GJ, MWh) into a default unit for consistency and accuracy.

Metrics Used:

- `packages_ghgtool_metric_conversion_factors`: Exposes built-in conversion factors from Metrio's metrics SDK.
- `packages_ghgtool_metric_conversion_purchased_electricity_energy`: Converts purchased electricity data into the default unit (kWh).

- `packages_ghgtool_metric_conversion_scope_2_others_kwh`: Converts scope 2 data other than purchased electricity into the default unit (kWh).
- `packages_ghgtool_metric_scope_2_emissions_electricity_location_based`: Calculates location-based scope 2 GHG emissions for purchased electricity.
- `packages_ghgtool_metric_scope_2_emissions_electricity_market_based`: Calculates market-based scope 2 GHG emissions for purchased electricity.
- `packages_ghgtool_metric_scope_2_others_mtco2e`: Calculates scope 2 GHG emissions for purchased energy consumption data other than purchased electricity.

Calculation Methodology:

- **Data Collection:** The tool collects data from various sources, including energy bills and other relevant documents. This data is then validated to ensure accuracy and completeness.
- **Unit Conversion:** The tool converts all data into a default unit (e.g., kWh for electricity) to maintain consistency across different data sources.
- **Emission Factors:** The tool applies predefined emission factors to the normalized data. These factors are derived from reliable sources such as the ClimaTiq database and custom emission factors provided by the user.
- **Calculation of Emissions:** The tool calculates the total Scope 2 emissions by multiplying the normalized data by the corresponding emission factors. The calculations are performed in a way that ensures consistency and accuracy across all data points.

Logic for Market-Based and Location-Based Emission Factors:

- **Location-Based Emission Factors:** These factors are based on the average emissions intensity of the grid where the electricity consumption occurs. The CAM tool uses location-specific emission factors from the ClimaTiq database or custom emission factors provided by the user. The tool reads in the facility information and assigns the most accurate location-based emission factor available based on the facility's location.
- **Market-Based Emission Factors:** These factors are based on the specific emissions intensity of the electricity purchased by the organization, which can include renewable energy certificates (RECs), power purchase agreements (PPAs), or equivalent certificates in line with GHG Protocol methodology. The CAM tool uses market-based emission factors from the custom emission factors database. The tool reads in the facility information and assigns the market-based emission factor based on the specific electricity purchase agreements in place. If the market-based emissions factors are not provided for some sites, the system will use location-based emissions to fill the gap.

Example:

For a facility with purchased electricity consumption, the tool would use the energy consumption data (e.g., in kWh or other energy unit) and convert it to the default unit (kWh). It would then apply the appropriate emission factor (location-based or market-based) to

calculate the total GHG emissions for that facility. The tool ensures that all calculations are transparent and auditable, providing a clear and accurate representation of the organization's Scope 2 emissions.

Scope 3:

The CAM (Carbon Accounting Management) tool provides a detailed methodology for calculating emissions from all Scope 3 Categories, ensuring accuracy and consistency in the reporting process.

Scope 3 Categories 1 and 2: Purchased Goods and Services, and Capital Goods

Scope 3 Categories 1 and 2 emissions refer to the indirect greenhouse gas (GHG) emissions associated with the production of goods and services purchased by the organization (Category 1) and the production of capital goods (Category 2). These emissions occur upstream in the value chain and are a significant component of an organization's overall carbon footprint.

Data Transformation Process:

The CAM tool processes raw data from various sources to provide accurate Scope 3 Categories 1 and 2 emission metrics. It reads in data related to purchased goods, services, and capital goods, and normalizes it into a unified dimension. This involves converting different units of measurement (e.g., USD, EUR, CAD) into a default unit for consistency and accuracy. The tool uses custom conversion factors to support inter-dimension conversions, ensuring that all data is accurately represented in the default unit.

Metrics Used:

- `packages_ghgtool_metric_conversion_scope_3_cat_1_and_2_usd`: Converts spend-based scope 3 categories 1 and 2 (purchased goods and capital goods) data into the default unit (USD)
- `packages_ghgtool_metric_scope_3_cat_1_and_2_mtco2e`: Calculates spend-based scope 3 GHG emissions for categories 1 and 2 consumption data (purchased goods and capital goods)

Calculation Methodology:

The CAM tool uses a systematic approach to calculate Scope 3 Categories 1 and 2 emissions. The methodology involves several key steps:

- **Data Collection:** The tool collects data from various sources, including purchase records, invoices, and other relevant documents. This data is then validated to ensure accuracy and completeness.
- **Unit Conversion:** The tool converts all data into a default unit (e.g., USD) to maintain consistency across different data sources.
- **Emission Factors:** The tool applies predefined emission factors to the normalized data. These factors are derived from reliable sources such as the ClimaTiq database and custom emission factors provided by the user.

- Calculation of Emissions: The tool calculates the total Scope 3 Categories 1 and 2 emissions by multiplying the normalized data by the corresponding emission factors. The calculations are performed in a way that ensures consistency and accuracy across all data points.

Example Calculation:

For a company with purchased goods and services, the tool would use the spend data (e.g., in USD) and convert it to the default unit (USD). It would then apply the appropriate emission factor to calculate the total GHG emissions for those purchases. The tool ensures that all calculations are transparent and auditable, providing a clear and accurate representation of the organization's Scope 3 Categories 1 and 2 emissions.

Scope 3 Category 6: Business Travel

Scope 3 Category 6 emissions refer to the indirect greenhouse gas (GHG) emissions associated with business travel activities undertaken by employees of the organization. These emissions occur upstream in the value chain and can be a significant component of an organization's overall carbon footprint.

Data Transformation Process:

The CAM tool processes raw data from various sources to provide accurate Scope 3 Category 6 emission metrics. It reads in data related to business travel activities and normalizes it into a unified dimension. This involves converting different units of measurement (e.g., km, USD, passenger-km) into a default unit for consistency and accuracy.

Metrics Used:

- packages_ghgtool_metric_conversion_scope_3_cat_6_km: Converts distance-based scope 3 category 6 (business travel) data into the default unit (km)
- packages_ghgtool_metric_conversion_scope_3_cat_6_passenger_km: Converts passenger-distance-based scope 3 category 6 (business travel) data into the default unit (passenger-km)
- packages_ghgtool_metric_conversion_scope_3_cat_6_usd: Converts spend-based scope 3 category 6 (business travel) data into the default unit (USD)
- packages_ghgtool_metric_scope_3_cat_6_mtco2e: Calculates total scope 3 GHG emissions for category 6 consumption data (spend-based, distance-based, and passenger-distance-based business travel)

Calculation Methodology:

The CAM tool uses a systematic approach to calculate Scope 3 Category 6 emissions. The methodology involves several key steps:

- Data Collection: The tool collects data from various sources, including travel records, invoices, and other relevant documents. This data is then validated to ensure accuracy and completeness.
- Unit Conversion: The tool converts all data into a default unit (e.g., km, USD, passenger-km) to maintain consistency across different data sources.

- **Emission Factors:** The tool applies predefined emission factors to the normalized data. These factors are derived from reliable sources such as the ClimaTiq database and custom emission factors provided by the user.
- **Calculation of Emissions:** The tool calculates the total Scope 3 Category 6 emissions by multiplying the normalized data by the corresponding emission factors. The calculations are performed in a way that ensures consistency and accuracy across all data points.

Example Calculation:

For a company with business travel activities, the tool would use the travel data (e.g., in km, USD, passenger-km) and convert it to the default unit. It would then apply the appropriate emission factor to calculate the total GHG emissions for those activities. The tool ensures that all calculations are transparent and auditable, providing a clear and accurate representation of the organization's Scope 3 Category 6 emissions.

Scope 3 Category 15: Investments

Scope 3 Category 15 emissions refer to the indirect greenhouse gas (GHG) emissions associated with the organization's investments. These emissions occur upstream in the value chain and are a significant component of an organization's overall carbon footprint.

Data Transformation Process:

The CAM tool processes raw data from various sources to provide accurate Scope 3 Category 15 emission metrics. It reads in data related to investments and normalizes it into a unified dimension. This involves converting different units of measurement (e.g., USD) into a default unit for consistency and accuracy.

Metrics Used:

- `packages_ghgtool_metric_scope_3_cat_15_mtco2e`: Calculates scope 3 GHG emissions for category 15 data (investments)

Calculation Methodology:

The CAM tool uses a systematic approach to calculate Scope 3 Category 15 emissions. The methodology involves several key steps:

- **Data Collection:** The tool collects data from various sources, including investment records and other relevant documents. This data is then validated to ensure accuracy and completeness.
- **Unit Conversion:** The tool converts all data into a default unit (e.g., USD) to maintain consistency across different data sources.
- **Emission Factors:** The tool applies predefined emission factors to the normalized data. These factors are derived from reliable sources such as the ClimaTiq database..
- **Calculation of Emissions:** The tool calculates the total Scope 3 Category 15 emissions by multiplying the normalized data by the corresponding emission factors. The calculations are performed in a way that ensures consistency and accuracy across all data points.

Example Calculation:

For a company with investments, the tool would use the investment data (e.g., in USD) and convert it to the default unit. The tool ensures that all calculations are transparent and auditable, providing a clear and accurate representation of the organization's Scope 3 Category 15 emissions.

By accurately processing and transforming data related to investments, the CAM tool ensures reliable Scope 3 Category 15 emission calculations, helping organizations manage their carbon footprint effectively.

3. Emission Factors Management

Nasdaq Metrio Carbon Accounting Module (CAM)

The Nasdaq Metrio Carbon Accounting Module (CAM) provides a comprehensive system for managing and updating Greenhouse Gas (GHG) Emission Factors. The key aspects of emission factors management include:

Data Sources

Emission Factors Database

A comprehensive database of emission factors for the main GHG gases (CO₂, CH₄, N₂O) sourced from the Climatiq database. The database includes over 40,000 emission factors and is integrated into the tool.

Mapping of Activities with Emission Factors

An adaptable data source where users can view and modify the mapping of activities with their respective emission factors. Nasdaq Metrio provides a default mapping, which is customizable by the client or Project Manager.

Integration of Custom Emission Factors

The CAM tool allows clients to enter custom emission factors, ensuring that GHG emission calculations can be adapted to specific client use cases. When an activity is mapped in both data sources (custom and general) for the same year and location, the tool prioritizes the custom emission factor.

Understanding Climatiq's Data Changes

Climatiq's database undergoes regular updates, which are transferred into the Nasdaq Metrio tool by adding new emission factors to the general database. Changes do not impact previously imported versions and calculated results, as only additions are made, not modifications.

When an emission factor is modified in Climatiq, it is replaced with a new emission factor that has a new ID. The old emission factor is removed from Climatiq's database but retained in the Nasdaq Metrio database if it is being used in previous reports.

Emission Factors Update Protocol

Scheduled Updates

Nasdaq Metrio provides the latest emission factors released by Climatiq twice per year (January and July) as which points new emission factors are added to the account by the Nasdaq Metrio team.

Emission Factor Mapping

Each update includes an Excel file with an updated "Suggested Mapping." The project team verifies which updates are appropriate for the account and uploads the selected mapping updates. Metrio does not automatically update or integrate this mapping into the account to avoid affecting previously calculated/disclosed results.

Documentation and Communication

For every update, Metrio provides release notes, documentation, and a new mapping. The Project Manager collaborates with the client to review and add the suggested mapping into the account.

This section provides a clear and concise overview of how emission factors are managed within the Nasdaq Metrio CAM tool, ensuring accurate and consistent GHG emissions reporting.

Summary

In this documentation, we have covered the comprehensive methodology for the Carbon Accounting Management (CAM) tool, which is designed to help organizations accurately measure and manage their carbon emissions. The importance of accurate data cannot be overstated. Reliable carbon accounting depends on the precision and completeness of the data collected and processed. The CAM tool ensures that all data is accurately transformed, normalized, and validated, providing a robust framework for carbon emission calculations. By using detailed metrics and data sources, the CAM tool helps organizations achieve reliable carbon accounting, enabling them to make informed decisions and contribute to sustainability goals.