VERISAE

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Sustainability Resource Planning
ENVIRONMENTAL Management

GREENHOUSE GAS EMISSIONS

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A basic overview and understanding of different types of emissions and the methods to calculate total emissions for an organization.

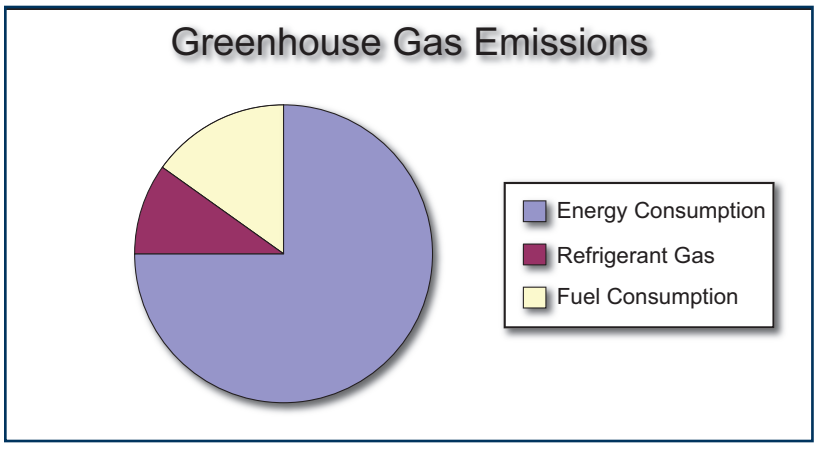
An organization, every organization, emits some level of greenhouse gas emissions. In this paper, the different types of emissions, how they can be calculated, and their current methods of tracking will be evaluated.

Process to determine total emission from a type:

1. Identify emission
2. Identify annual consumption
3. Select appropriate emission factor
4. Calculate CO_2 Emission
5. Convert to Metric Tons
6. Calculate CH_4 and N_2O Emissions
7. Convert to CO_2 equivalent emission
8. Sum all subtotals

EMISSIONS TYPES

GHG Emissions fall under two general headings, Indirect Emissions and Direct Emissions. Underneath these broader headings, there are few specific types of emissions to be considered.



Indirect Emissions

Definition: Indirect emissions are those emissions which occur due to the organization's actions but the actual emissions are produced by sources owned or controlled by another entity.

Under indirect emissions, all electricity use by an organization falls under indirect emissions. This includes purchased electricity, imported steam, district heating, district cooling, and electricity from a co-generation plant.

For the calculation of indirect emissions, there are specific needs to determine overall emissions. They are:

1. Annual energy consumption in kilowatt hours for every meter within the organization. This information can be found from the electric utility bills.
2. The electric grid emissions factor. This factor is determined by the EPA and can be applied to the generation plant, utility company, state and/or power pool region for the area in which the energy was consumed. Because grid emissions fluctuate, the organization should use the most recent calendar year emissions factor or the most recent published figures. The electricity emissions factors can be found from the EPA and/or through the eGRID software supplied by the EPA. Granularity of detail in the reporting of the grid emissions factors is encouraged.
3. In the case of electricity used but the amounts are undetermined because of the lease structure, an estimate of the annual energy use must be made and reported. This can be accomplished through a percent of square footage or through an energy audit in accordance with the guidelines of the reporting authority.
4. If any purchases of green power or renewable energy certificates were purchased, the type of power purchased must be determined and the appropriate electricity emissions factor chosen to calculate CO_2 and non-CO_2 emissions converted to CO_2 equivalent emissions. These emissions are then SUBTRACTED from the overall indirect emissions from electric consumption.
5. In the case of indirect emissions from imported steam, district heating, district cooling and co-generation, the following information will also be needed:
   a. Total emissions of CO_2, CH_4, N_2O from a co-gen facility based upon the fuel input (energy input)
   b. Total electricity production from the co-gen facility's meter readings
   c. Net heat production from the co-gen facility
   d. Calculate emissions attributable to your organization's consumption of head and electricity consumed.
   e. Plant system efficiency
   f. For district cooling, the COP, Co-efficient of Performance, must be obtained. This is used to determine the energy input from the plant.

Needless to say, determining indirect emissions can be a laborious process especially when considering multi-site facilities across a wide geographic backdrop.

Direct Emissions

Definition: Direct emissions are those emissions from sources owned or controlled by the organization.

Subtypes: Under direct emissions, the following sub-types fall.

1. Mobile Combustion
2. Stationary Combustion
3. Manufacturing Processes
4. Fugitive Emissions

Mobile Combustion

Mobile combustion sources are non-stationary emitters of GHGs such as automobiles, motorcycles, trucks, off-road vehicles, forklifts, construction equipment, boats, and airplanes. For the calculation and summation of Mobile Combustion Emissions, the following information is needed:

1. Type of vehicles operated by organization
2. Where vehicles are registered
3. Fuel consumption of said vehicles
4. Miles traveled for each type of vehicle
5. Model year of each vehicle

This information can be gathered from bulk fuel purchase records, fuel receipts, and direct measurements of fuel use such as logs of fuel tanks or on-site storage tanks. Furthermore mileage information can be gathered from odometer readings, trip manifests and/or maintenance records. Fuel consumption information can be gathered from the vehicle information or, if that is not available, from the EPA estimates.

Once gathered the same general process for the determination of total emissions is to be followed.

Stationary Combustion

Stationary combustion sources are non-mobiles sources emitting GHGs from fuel combustion. Examples of stationary combustion sources include power plants, refineries, as well as residential and commercial furnaces including unit heaters, and rooftop units.

For the calculation and summation of stationary combustion emissions, the following information is needed:

1. Type of fuel consumed by the organization
2. How much fuel was combusted in the reporting year?

For the majority of commercial facilities, the fuel consumed and combusted will be from heating (furnaces, rooftop units, etc.), cooking and other small uses of combustible fuels and thus the use of continuous emissions monitoring systems or CEMS will not be in place. Thus, the best source for the required information will be from the natural gas or other fuel invoices. Each gas meter from each site should be accounted for and the total fuel consumed for each site should be accounted for and reported.

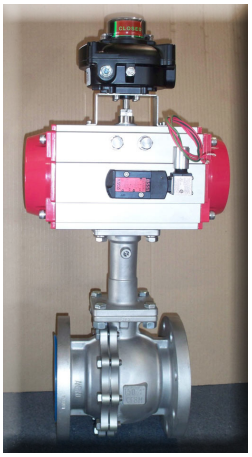
The same process will then used for the determination of total GHG emissions.

Manufacturing Processes

This part of the reporting only applies to companies emitting GHGs in the industrial process. Companies manufacturing acid, aluminum, refrigerants, ammonia, iron, steel, lime, etc. would use this portion of the GHG reporting. Depending on the specific production, a specific protocol has been determined for the reporting of this type of GHG.

Since the large majority of commercial entities are not involved in these types of processes, it will not be discussed in any further detail.

Fugitive Emissions



Fugitive emissions are those emissions resulting from the leak of emissions through different means. For our purposes, this discussion will focus on fugitive emissions from the leaking of refrigeration from air conditioning and refrigeration systems.

For the calculation and summation of fugitive emissions, the following information is needed:

1. Type and quantity of air conditioning equipment
2. Type and quantity of refrigeration equipment
3. The total refrigerant charge for said equipment
4. The actual and/or calculated annual leak rates
5. The types of refrigerant
6. The quantity of refrigerant purchased and used within the systems.

The information for fugitive emissions can be gathered through different estimation methods which have been developed by the US EPA. Also, site audits and surveys can be used to gather this information. The

types of refrigerant can be found during an audit from the boilerplate information on the equipment. The quantity of refrigerant purchased and used within the systems can be found through invoices and maintenance records. The annual leak rates can be calculated by having all of the above information.

CONCLUSION

The gathering and summation of data needed to calculate the total Greenhouse Gas Emissions for an organization can be a daunting task unless the information is readily available and easily procured. Moreover, the information may come from many different parts of the organization thus communication and common systems are paramount to assembling this information with efficiency.

If taken in total, the following list shows all of the information needed to calculate an enterprise wide carbon footprint.

1. Annual energy consumption in kilowatt hours for every meter within the organization.
2. The electric grid emissions factor for each utility, area or power pool where energy is consumed.
3. In the case of electricity used but the amounts are undetermined because of the lease structure, an estimate of the annual energy use must be made and reported.
4. Type of green power purchased and its electricity emissions factor.
5. For co-gen, total emissions of CO_2, CH_4, N_2O from a co-gen facility based upon the fuel input (energy input)
6. Total electricity production from the co-gen facility's meter readings
7. Net heat production from the co-gen facility
8. Plant system efficiency
9. For district cooling, the COP, Co-efficient of Performance, must be obtained.
10. Type of vehicles operated by organization
11. Where vehicles are registered
12. Fuel consumption of said vehicles
13. Miles traveled for each type of vehicle
14. Model year of each vehicle
15. For stationary combustion, the type of fuel consumed by the organization
16. How much fuel was combusted in the reporting year?
17. Type and quantity of air conditioning equipment
18. Type and quantity of refrigeration equipment
19. The total refrigerant charge for said equipment
20. The actual and/or calculated annual leak rates
21. The types of refrigerant
22. The quantity of refrigerant purchased and used within the systems.

Thus, in the most complete scenario, 22 different pieces of information will be required for each location and/or asset across an enterprise. Multiplied by just 100 locations, the task can certainly be daunting.

ABOUT VERISAE

Verisae **(www.Verisae.com)** develops, markets, and licenses **Sustainability Resource Planning (SRP) ™,** an enterprise solution that empowers organizations to make "sustainability actionable". Verisae helps measure, manage and monetize energy costs and carbon emissions. SRP covers the core functions of sustainability needs by combining multiple business processes and systems into one database to use across the enterprise. Our platform improve operational efficiency, make sustainability initiatives actionable, and reduce energy costs carbon emissions for distributed enterprises and energy companies.

ENVIRONMENTAL MANAGEMENT

Carbon Emissions Manager
- Scope 1 & 2 Emissions
- Scope 3 Emissions

Sustainability Project Manager

Water Manager

Waste Manager

ENERGY MANAGEMENT

Energy Supply Manager
- Utility Bill Processing
- Active Energy Response
- Utility Contracts Management
- Energy Spend Manager

Energy Demand Manager
- Real-Time Energy Management
- Active EE Dispatch
- Energy Efficiency Projects

ASSET MANAGEMENT

Service Manager
- Service Provider Management
- Financial Management

Asset Manager
- Facilities Management
- Equipment Management
- Asset Monitoring & Alarming
- Parts & Inventory Management

Procurement Manager
- Rebates & Incentives Management
- Total Capital Planning
- Equipment Procurement

Given the heightened priority of corporate sustainability, Verisae is positioned right now to enable organizations to establish a carbon footprint baseline, outline energy management options, and provide a comprehensive corporate sustainability action plans in a manner of months. All of which can be implemented with metrics in place to highlight bottom-line cost savings and return on investment timelines.

Today, Verisae delivers a broad range of sustainability solutions to over **40 global clients** with a service network of **7,500 third party service providers** consisting of **60,000 application users.** Our integrated sustainability platform actively tracks over **2,100,000 million assets** across **20,000 sites.** We help measure, manage and monetize energy costs and carbon emissions. We are uniquely position to help organizations prove return on investment (ROI) for sustainability initiatives.

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