Better Climate™ CHALLENGE
U.S. DEPARTMENT OF ENERGY

Greenhouse Gas Emissions Reporting Guidance

MAY 2024

U.S. DEPARTMENT OF ENERGY

The U.S. Department of Energy's (DOE) Better Climate Challenge is a voluntary, market-based platform for organizations to set ambitious, portfolio-wide, operational greenhouse gas (GHG) emissions reduction goals and showcase how they are taking steps to address climate change. Partnering organizations commit to reducing scope 1 and 2 GHG emissions across their U.S. portfolio by at least 50% within 10 years.

You can use this Greenhouse Gas Emissions Reporting Guidance to help set your Better Climate Challenge goal and base year, define your committed portfolio, and annually report progress toward your goal. Better Climate Challenge partners share GHG emissions and energy data across their building/plant portfolio with DOE, including owned and operated fleets. DOE highlights partner progress toward their goals on the Better Buildings Solution Center.

Establishing an accurate GHG inventory is a critical first step to developing a plan to reduce emissions across your organization. This document provides instructional guidance on how to quantify GHG emissions across your organization. Details and example calculations are provided for several types of emission sources. Guidance is aligned with the GHG Protocol Corporate Accounting and Reporting Standard. DOE will update this guidance as necessary to adjust for changes to the standard. Links to the standard and other relevant resources are included throughout the document, with details and web addresses included in Appendix A.

Working together is a core component of the Better Climate Challenge. As a Better Climate Challenge partner, you will have a program team at DOE to help you with your GHG emissions reporting and reduction strategy. Your team will typically include a DOE Sector Lead, an Account Manager, and a Technical Account Manager who is a technical expert. Once you have set your goal and developed your GHG inventory, you can work with DOE to develop and implement a plan to reduce GHG emissions across your portfolio, using the Better Climate Challenge Framework for Greenhouse Gas Emissions Reduction Planning.

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Setting an Emissions Reduction Goal

Better Climate Challenge partners demonstrate leadership by setting ambitious, portfolio-wide, operational greenhouse gas emissions reduction goals. Organizations commit to reducing scope 1 and 2 GHG emissions across their U.S. portfolio by at least 50% within 10 years, without the use of offsets. This section includes details about the requirements associated with Better Climate Challenge goals. Contact DOE with any questions about setting your goal. Exceptions to these requirements may be made on a case-by-case basis.

BETTER CLIMATE CHALLENGE GOAL

Portfolio-wide reduction in GHG emissions of at least 50% in 10 years
or at least 25% for select energy-intensive industries

- Reduction includes scope 1 and 2 emissions
- Base year up to 5 years prior to join date
- Carbon offsets not accepted as a reduction measure
- Absolute targets highly encouraged, intensity-based targets accepted under certain circumstances
- Required to set an energy efficiency target that will contribute to the 50% emissions reduction to encourage prioritizing energy efficiency as part of decarbonization plan

Scope 1 and 2 Emissions:

Better Climate Challenge partners commit to reducing scope 1 and 2 emissions. Emissions are categorized into one of three "scopes" to differentiate between direct and indirect emission sources. The GHG Protocol Corporate Standard (Chapter 4) provides guidance on setting operational boundaries associated with individual facility activities that will determine which scope your emissions fall under. The three scopes are defined as follows:

- **Scope 1 (Direct) Emissions:** GHG emissions from sources that are owned or controlled by your organization are direct or scope 1 emissions. These can include stationary emissions, mobile emissions, fugitive emissions, and process emissions (see details in the Methodology for Quantifying GHG Emissions section). Emissions from the burning of biofuels are reported differently than other emissions, as detailed in the Example Emissions Calculations section.
- **Scope 2 (Indirect) Emissions:** GHG emissions associated with offsite energy sources that serve your facilities are indirect or scope 2 emissions. Grid electricity comes from many diverse sources including coal-fired power plants, natural gas turbines, nuclear power, wind, solar, etc. While not all of these sources release GHGs, 1 MWh of electricity usage on the US electrical grid accounts for approximately 375 kg CO_2e of emissions as of 2020. Indirect emissions from purchased steam, heating, cooling, compressed air, etc., also fall under scope 2. Transmission and distribution (T&D) losses for delivered utilities should not be included in scope 2 emissions to avoid double counting. These losses are accounted for by the distributor in their scope 2 emissions.
- **Scope 3 (Other Indirect) Emissions:** GHG emissions from all other indirect emissions are considered scope 3. These are emissions from actions in your organizational value chain from sources that are not owned or controlled by your organization. Examples of scope 3 activities include supplier and retail operations, extraction and production of purchased materials, transportation of materials, waste generation, travel, and employee commuting.

While not included in the Better Climate Challenge goal, organizations are encouraged to also track and reduce scope 3 emissions across their value chain. Scope 3 emissions can be more difficult to quantify and control but can be significant for many organizations.

The definitions of scope emissions are designed to prevent double counting of emissions between different companies within scopes 1 and 2. When electricity is generated, for example, the organization that burns the fuel to create electricity counts the emissions as scope 1 and the organization that consumes the electricity counts the emissions as scope 2. No two organizations are allowed to claim the same scope 1 emissions from the same burned fuels and no two organizations are allowed to claim scope 2 emissions from the same purchased electricity. These restrictions, however, do not apply to scope 3 emissions. Many companies can report the same emissions in scope 3 when their value chains overlap.

Required Greenhouse Gases

The greenhouse gas emissions included in Better Climate Challenge reduction goals are the same as those covered by the GHG Protocol Corporate Accounting and Reporting Standard (2013 Amendment), in alignment with the United Nations Framework Convention on Climate Change (UNFCC) and the Kyoto Protocol. The gases included are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).

Greenhouse gases warm the earth by absorbing energy and slowing the rate at which the energy escapes to space. Heat energy from the Earth's surface emits infrared radiation towards the atmosphere where it either escapes to space or is reabsorbed by greenhouse gases, trapping that energy in Earth's atmosphere. This trapping of heat energy is known as the greenhouse effect, which is key to keeping the Earth's average temperature and climate suitable for human activity.

Over the last century, increased concentrations of GHGs in the atmosphere have trapped additional heat causing global temperature rise and leading to global climate change. The vast majority of Earth's atmosphere is made up of non-GHG molecules including nitrogen (78%), oxygen (21%), and argon (0.9%). Of the remainder, the most abundant GHGs are water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), ozone (O_3), and various fluorinated gases (CFCs, HFCs, and PFCs). While the first five are naturally occurring, concentrations of all GHGs have been growing significantly since the industrial revolution due to human activity. Tracking and reducing GHG emissions is important for limiting the human impact on climate change.

For scope 2 emissions from grid-purchased electricity, there are two approaches for accounting which are important to consider when setting your emissions reduction goal:

- **Location-based method:** Considers the average emissions intensity of your local electric grid. Emission factors from the U.S. Environmental Protection Agency's Emissions & Generation Resource Integrated Database (eGRID) are typically used to determine location-based scope 2 emissions.
- **Market-based method:** Considers the contractual arrangements your organization uses to procure electricity from specific sources, such as power purchase agreements (PPAs) and renewable energy credits (RECs). Emission factors provided by green power providers or utilities can be used to calculate market-based scope 2 emissions.

Consistent with the GHG Protocol Scope 2 Guidance, you should report scope 2 emissions for electricity to the Better Climate Challenge using both approaches but can choose which approach to use when tracking progress towards your goal. A market-based goal is appropriate for partners that want to take credit for emission reductions from green power purchases. A location-based goal is appropriate for partners focused on energy use reductions. This could include partners that do not pursue offsite green power or those that already use a high percentage of green power in their base year.

Emissions associated with leased building spaces can be considered scope 1 and 2, or scope 3 depending on how your organizational boundary is set (see additional information in the Defining the Committed Portfolio section). Organizations that lease out building space to tenants should still include emissions from leased assets as part of their Better Climate Challenge goal regardless of scope.

Base Year

The preferred base year for the Better Climate Challenge is the most recent calendar year for which data is available when a partner joins the program. A partner may choose any of the five most recent calendar years prior to joining the Better Climate Challenge to capture recent GHG reductions, to align with existing organizational goals, or if a previous year better reflects typical operations. For example, if a partner joined the Better Climate Challenge in June 2023, the base year could be 2022, 2021, 2020, 2019, or 2018. Avoid selecting base years where major events such as large acquisitions, facility closures, or unusual activity levels have significantly impacted emissions. The target goal achievement date is set as 10 years after a partner joins the Better Climate Challenge, or earlier as designated by the partner. In this example, the partner would have until 2033 to achieve their goal. Partners may choose to report their emissions by fiscal year rather than calendar year, if preferred.

Renewable Energy Purchasing and Offsets

Organizations should strive to meet their Better Climate Challenge goal by prioritizing reductions in operational GHG emissions. This can include renewable energy purchasing to reduce scope 2 emissions, such as power purchase agreements (PPAs), virtual power purchase agreements (VPPAs), utility green power products, and unbundled retail renewable energy certificates (RECs). RECs are tradable, non-tangible commodities that represent the environmental benefits of 1 MWh of electricity generated from a renewable energy source. Organizations can claim renewable energy for all of the above options only when RECs have been retired on their behalf.

To be a goal achiever, organizations must meet their scope 1 and 2 reduction goal without using GHG offsets. Offsets are a mechanism that allows organizations to purchase credits for projects that reduce, avoid, or remove emissions external to the organization's boundary. Organizations can decide if offsets make sense for their decarbonization strategy, but may not use offsets toward their Better Climate Challenge goal. Additional details on the differences between RECs and offsets are included in Figure 1 below. Carbon capture and storage is an allowable method to reduce emissions for the Better Climate Challenge as long as it is not a purchased offset.

FIGURE 1: Differences between RECs and Offsets

Characteristic	RECs	Offsets
Unit of Measure	MWh	Metric Tons CO_2 or CO_2e
Source	Renewable energy generator	Projects that avoid or reduce GHG emissions to the atmosphere
Inventory Reporting	Reduces scope 2 emissions	Offsets scope 1, 2 or 3 emissions, as a net adjustment
Allowed for Better Climate Challenge?	**Yes**	**No**

Absolute vs. Intensity Emissions Reduction Goals

Organizations are strongly encouraged to set goals for absolute GHG emissions reduction since absolute reductions are necessary to mitigate the impacts of climate change. If your organization has a changing portfolio of properties, particularly if the portfolio is growing or shifting to more energy intensive operations, you may be concerned about the challenge of reducing absolute emissions. However, there are multiple decarbonization pathways available including electrification and renewable energy, making it feasible to achieve absolute emission reductions even in a growing portfolio. Additionally, recalculating base year emissions is possible if you are experiencing growth through mergers or acquisitions, making it possible to achieve an absolute emission reduction goal.

Intensity goals involve reporting emissions per square foot, product, or another intensity metric. These types of goals are allowed in the Better Climate Challenge under the following circumstances:

- Approved Science Based Target intensity goals are allowed, excluding financial-based goals.
- Emissions intensity goals with a metric of CO_2e per square foot are allowed for non-industrial partners.

When setting an emissions intensity goal, organizations are encouraged to select a goal that will also result in a decrease in absolute emissions. Partners that select an intensity goal must still report their absolute GHG emissions. They must also report the value of their chosen energy intensity metric (e.g., square feet, production) for each year across the portfolio.

Energy Efficiency Target

An energy efficiency target is key to a cost-effective decarbonization strategy. Partners will identify an energy efficiency target that will contribute towards their 50% GHG emissions reduction. DOE will work with new partners to establish a meaningful yet achievable target. DOE recommends a 20% energy efficiency target, but organizations have flexibility to choose various types of quantitative energy efficiency targets, including goals to achieve absolute energy savings, energy intensity savings, or emissions reduction achieved through energy efficiency.

Organizations involved in the Better Buildings Challenge or Better Plants program with an established energy reduction goal are not required to set an additional energy efficiency target when they join the Better Climate Challenge. Existing Climate Challenge partners may choose to also join the Better Buildings Challenge or Better Plants program and align their efficiency goal with those programs to take advantage of additional recognition opportunities. Organizations that have achieved a previous Better Buildings Challenge or Better Plants goal are encouraged to set a new energy goal to serve as their energy efficiency target.

Achieving Goals and Setting New Goals

Partners that achieve their Better Climate Challenge goals will be recognized for their accomplishments. DOE will support goal achievers with detailing the pathways they pursued to meet their goal and publishing results on the Better Buildings Solution Center. Partners are expected to continue to report emissions data annually for the full 10-year commitment. Given that some goals are achieved in-part through renewable energy procurement, demonstrating continued long-term purchasing is important to showing sustained achievements. Partners may also adjust strategies they utilize to meet their goals, moving toward greater reductions in energy use over time. Partners that continue to report will be recognized for sustained contributions, and will further be recognized if they pass more aggressive thresholds of 75%, 90%, etc.

Defining the Committed Portfolio

Partners in the Better Climate Challenge commit to reducing GHG emissions across their organization. DOE can work with you to define what will be included in your organization's commitment. This section outlines portfolio commitment requirements for the Better Climate Challenge and describes the options for setting an organizational boundary to determine how emissions should be allocated to your portfolio.

Better Climate Challenge Commitment

The Better Climate Challenge asks organizations to commit their **entire U.S. portfolio**. Partners should include only operations within the U.S. and U.S. territories. Partners that report global GHG emissions to other programs should remove foreign assets from their portfolio before sharing data with DOE.

Organizations are asked to include all scope 1 and 2 emissions within their organizational boundary as part of their commitment. This includes **building/plant facilities, fleets, and other non-building assets** (e.g., landfills, streetlights, traffic lights). DOE is available to assist partners with calculating emissions from building/plant facilities or fleets and can help identify solutions and provide technical assistance for reporting and reducing emissions from other non-building asset types. If organizations have assets that they are concerned about including in their commitment, DOE can work with them with the goal of including these assets over time. Exceptions could be approved on a case-by-case basis if the partner and DOE are not able to find a solution. Estimation of emissions is allowed if actual data is not available in accordance with the GHG Protocol. All applicable emissions sources must be reported for a partner to be recognized as a goal achiever, unless it was previously agreed that certain emissions sources are excluded.

While the focus of the Better Climate Challenge is on scope 1 and 2 emissions, partners are asked to include certain scope 3 emissions in their commitment related to the operation of buildings and plants. For example, organizations that lease building space to tenants (common in the commercial real estate and multifamily sectors) should include emissions from leased assets as part of their Better Climate Challenge commitment regardless of scope. Tenant emissions can be considered scope 1 and 2, or scope 3 depending on how your corporate organizational boundary is set (see additional information in the following Organization Boundary section). Similarly, if a franchisor includes franchisees in its Better Climate Challenge commitment, they should report emissions for the franchisees even if they are considered scope 3 emissions based on the franchise agreement and corporate boundary. If your organization lacks control or visibility over specific assets, DOE can review exceptions for certain sources on a case-by-case basis.

Organizational Boundary

Some organizations have simple structures while others may have more complex joint ventures, subsidiaries, partnerships, etc. The structure of your organization influences how emissions from each operation in your portfolio should be counted toward your Better Climate Challenge emissions reporting. The first step in establishing a GHG inventory is to define your organizational boundaries and select an approach to allocate and report your GHG data, as detailed in Chapter 3 of the GHG Protocol Corporate Standard. Figure 2 describes the consolidation approaches outlined in the GHG Protocol and illustrates the distribution of emissions for two sample organizations. The consolidation approach selected should be consistently applied to define your organization's businesses and operations. If your organization wholly owns all its operations, the organizational boundary will be the same no matter which approach is used.

Partners with an established GHG inventory should have already selected an approach to define their organizational boundary. Partners that have not yet defined an organizational boundary are encouraged to consider an operational control approach which aligns with the Better Climate Challenge focus on operational GHG emissions reductions.

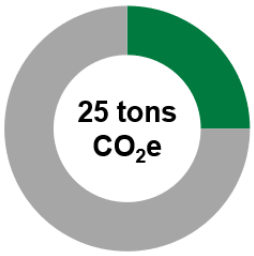
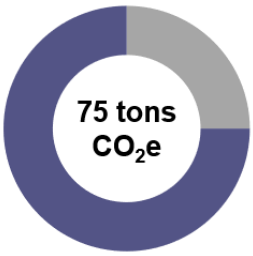
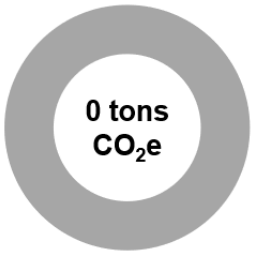
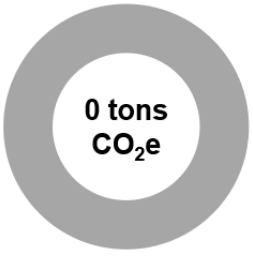
Guidance on applying each consolidation approach to common financial accounting arrangements is included below. Additional details are included in Table 1 of the GHG Protocol Corporate Standard.

- **Subsidiaries:** Parent companies who take on the income, expenses, assets, and liabilities of their subsidiaries can allocate emissions based on an equity share approach or account for 100% of emissions from those subsidiaries using a financial or operational control approach.

- **Affiliates:** Parent companies who have financial or operational influence over another company but do not have a controlling stake can allocate emissions based on an equity share approach or exclude all emissions based on a financial or operation control approach.
- **Joint Ventures:** Emissions from operations under a joint venture can be allocated based on equity share regardless of which consolidation approach is being used.
- **Franchises:** Emissions from franchises can be allocated based on an equity share approach determined by the specifics in a franchising agreement. If a franchise operates with complete financial and operational autonomy, emissions can be excluded from the franchiser's inventory under a financial or operational control approach.
- **Leased Assets:** Under an equity share or financial control approach, lessees only account for emissions from resources that are treated as wholly owned assets. Under an operational control approach, lessees only account for emissions from leased assets that they operate.

Organizations should coordinate to avoid double counting of scope emissions when selecting a consolidation approach. For example, if two organizations have a joint venture but choose different consolidation approaches, some emissions may not be counted by either company or may be double counted by both entities.

FIGURE 2: Distribution of Facility Emissions by Consolidation Approach

	Example Portfolio with 100 tons CO_2e	
Organizational Boundary Consolidation Approach	**Organization A** Operator, 25% equity	**Organization B** Financer, 75% equity
Equity Share An organization accounts for GHG emissions from operations according to its share of equity in the operation. This results in GHG emissions being distributed relative to the benefits and risks an organization takes on. Equity share typically aligns with an organization's share of ownership. Where this is not the case, economic interest in the operation can be used to define the organizational boundary, rather than formal legal ownership. **Organization A has 25% equity share in the operation and reports 25% of emissions, Organization B has 75% equity share and reports 75% of emissions.**		
Financial Control An organization accounts for 100% of the GHG emissions from operations over which it has financial control and does not account for emissions from operations in which it owns an interest but has no financial control. Financial control reflects an ability to affect spending and operating policies, even if not directly operating an asset. **Organization B has full financial control and reports 100% of emissions.**		
Operational Control An organization accounts for 100% of the GHG emissions from operations over which it has operational control and does not account for emissions from operations over which it owns an interest but has no operational control. Operational control reflects full authority to implement policies that affect emissions. **Organization A has full operational control and reports 100% of emissions.**		

Emissions Reporting

Better Climate Challenge partners submit emissions and energy performance data to DOE each year. This data is used to document progress toward achieving emissions reduction goals and to recognize partner achievements. Partners will report data on an annual basis for their full 10-year commitment to the Better Climate Challenge. The timeline for annual data submission is as follows:

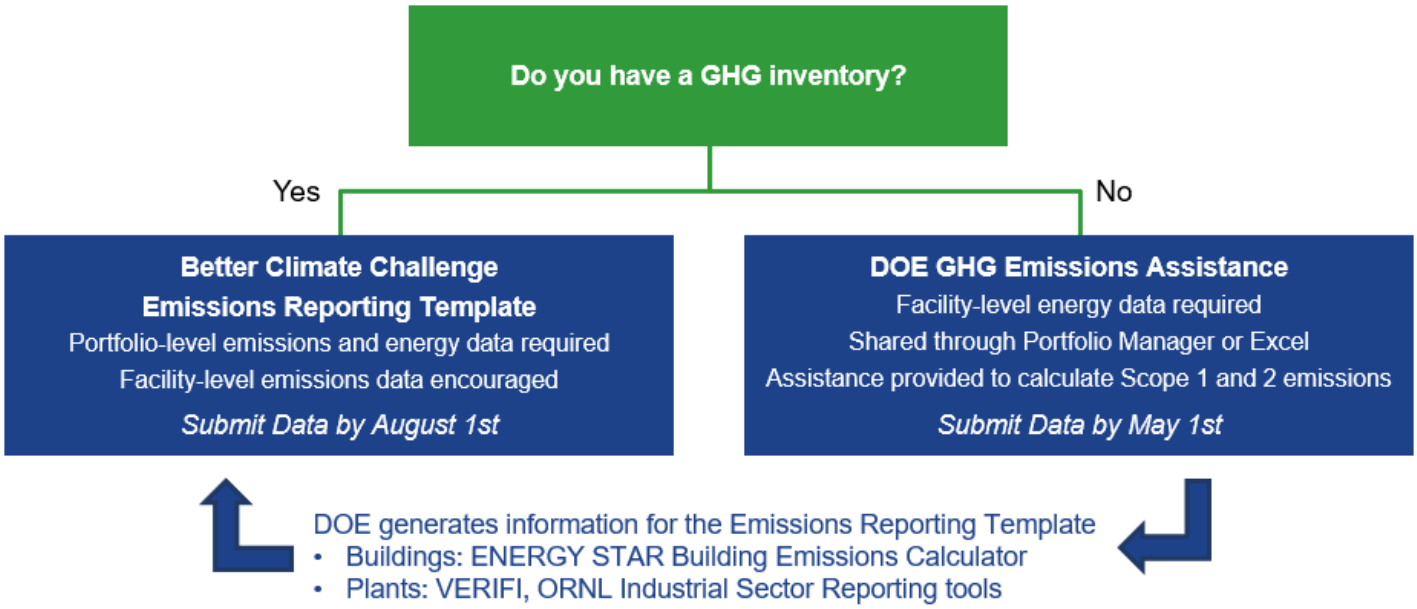
- Partners submitting portfolio-wide energy and emissions data are required to do so by August 1.
- Partners submitting facility-level energy data that require assistance from DOE with emissions calculations are asked to submit data by May 1. DOE will work with partners to finalize emissions data by August 1.

If your data is available early, share it as soon as possible. DOE will review data as it is received to ensure all submissions are complete and ready to be finalized.

Reporting Methods

Partners can report GHG emissions data annually using one of the two options in Figure 3. Partners that have a GHG inventory will report portfolio-level emissions and energy data through the Better Climate Challenge Emissions Reporting Template. Reporting facility-level emissions data through this template is also encouraged. DOE can provide technical support to partners as they complete their inventory and utilize the reporting template. If a partner does not have a GHG inventory, DOE can provide assistance with GHG emissions calculations. In this case, partners will share facility-level energy data, through a shared ENERGY STAR Portfolio Manager account, VERIFI, or another acceptable format (see details on these tools in the Methodology for Quantifying GHG Emissions section). Using the facility-level energy data, DOE can work with partners to generate the portfolio-level emissions data and complete the Better Climate Challenge Emissions Reporting Template.

FIGURE 3: Options for Reporting GHG Emissions



Better Climate Challenge Emissions Reporting Template

Partners will provide the following information on the Portfolio Emissions worksheet of the Better Climate Challenge Emissions Reporting Template.

- **Organization Information:** Your GHG emissions reduction goal, base year, goal year, reporting period (calendar or fiscal year), and whether your goal includes location-based or market-based scope 2 emissions.
- **Section 1: Portfolio Information:** The number of facilities and annual square feet included in your organization's portfolio for each year between the base year and current reporting year. These numbers may vary depending on acquisitions, divestments, consolidation, or new construction/expansion.
- **Section 2: Absolute Emissions (Metric tons CO_2e):** Absolute CO_2 equivalent emissions are broken down by scope. Scope 1 emissions should equal the sum of the subcategories of stationary, mobile, fugitive, and process emissions. Both scope 2 location-based and market-based emissions should be entered. Any applicable scope 3 emissions from leased assets or biogenic carbon emissions from bioenergy sources are also entered in this section. Total emissions are calculated automatically in the template.
- **Section 3: GHG Reductions:** Total emissions reduction and percent reduction from the base year are calculated automatically in the template.
- **Section 4: Total Energy Use for Portfolio:** Total site energy consumption by source for all operations in the partner's Better Climate Challenge portfolio. Electricity consumption should be broken down by renewable generation or purchasing options including PPAs, unbundled RECs, and grid electricity. Other energy sources include natural gas, fuel oils, diesel, hydrogen, etc.
- **Section 5: Energy Use for Vehicles:** Organizations with significant mobile fleet energy use should provide a breakdown of mobile fuel consumption. Mobile energy sources include any electricity, gasoline, diesel, or other fuels used for transportation that were included in Section 4 of the template.
- **Section 6: Energy Efficiency Target Tracking:** Site and source energy use intensity are calculated automatically in the template. Partners may also enter any custom metrics used for their energy efficiency target.

The information requested in the reporting template is standard information associated with a GHG inventory and is similar to data required by other GHG programs and platforms. Where applicable, the template references where relevant fields can be found in the CDP questionnaire.

Metrics Used to Assess Performance Toward the Partner's Goal

- **Emissions Reduction Since Base Year** =
  Base Year Emissions - Reporting Year Emissions
- **% Emissions Savings Since Base Year** =
  Emissions Reduction Since Base Year / Base Year Emissions x 100
- **Annual Emissions Reduction** =
  Reporting Year Emissions - Previous Year Emissions
- **Annual % Improvement** =
  % Emissions Reduction Since Base Year for Reporting Year - % Emissions Reduction Since Base Year for Previous Year

The Better Climate Challenge Emissions Reporting Template includes worksheets to capture additional information:

- **Facility-Level Emissions:** Organizations are encouraged to break out total U.S. scope 1 and 2 emissions by facility on this worksheet. Using this information, DOE can provide more detailed technical assistance and help you determine the best facilities at which to focus your emissions reduction planning. You can identify well-performing and poor-performing facilities in your portfolio, identify best practices to be applied organization-wide, and target resources on facilities where they will provide the greatest return.
- **Emissions Reduction Initiatives:** You can use this worksheet to keep track of scope 1 and 2 emissions reduction initiatives that were active during the reporting year. This will provide information to DOE on pathways you have leveraged to make progress toward your goal. DOE will use this to publicize your successes and can also use it to work with you to identify opportunities for further improvement.
- **Comments:** You should use this worksheet to provide comments or notes to describe your organization's portfolio, inventory, emissions calculation methodology, or emission factors, including current status or any changes from previous years. Data on acquisitions and divestments, facility closures, production changes, or methodology all provides valuable context for GHG emissions changes over time.

DOE GHG Emissions Assistance

If a partner does not have a GHG inventory, DOE can help with calculating GHG emissions. Partners will share the following data with DOE for all facilities within their organizational boundary, for all years in which calculations will be performed:

Data typically needed from all partners requesting GHG assistance:	Additional data needed from some partners if applicable:
Facility energy data (through ENERGY STAR Portfolio Manager, VERIFI, or other acceptable format)	Quantity of green power consumed on site (through Portfolio Manager if data is shared that way)
Property information (name, location, property type, size, activity levels)	Quantity of renewable power purchased and mechanism used (PPA, RECs, etc.)
Acquisition or construction year dates if different from base year	Custom emission factors from utilities or other sources
Disposition or demolition dates	Whole building vs. tenant data (for multifamily properties)
	Energy consumption and emissions data from mobile fleets
	Fugitive or process emissions data

DOE will review the energy data received for completeness and reasonableness of data. Partners will respond to any questions about energy data and make corrections as necessary. DOE will estimate data for any properties that do not have complete whole property data and then complete the necessary GHG emissions calculations. For example, multifamily properties that are missing tenant-paid energy data.

Data Review and Verification

Portfolio-level emissions and energy performance data will be reviewed to ensure completeness. While DOE does not require verification and will not provide emissions verification assistance, partners are encouraged to undergo a verification process to ensure that reported information represents a fair and complete account of GHG emissions from the partner's operations.

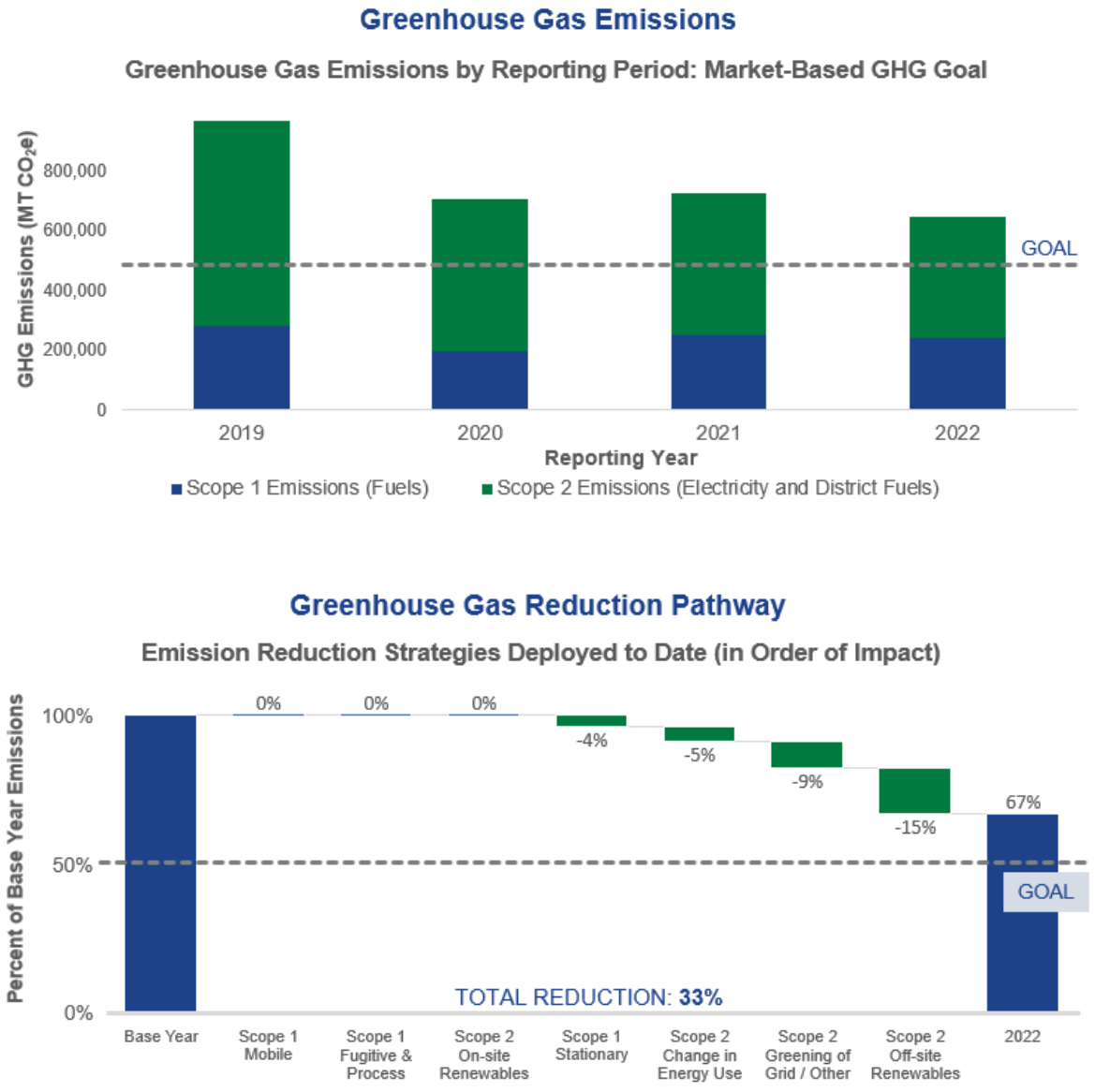
When sharing data with DOE, partners should review the emissions reporting template to check for common errors:

- For scope 1 emissions, provide a breakdown by stationary, mobile, fugitive, and process emissions and make sure they match total scope 1 emissions.
- For scope 2 emissions, provide both market- and location-based emissions (where applicable).
- If mobile emissions are reported for vehicles, provide the associated vehicle energy use in sections 4 and 5 in the Better Climate Challenge reporting template.
- Do not provide scope 3 vehicle emissions (business travel, commuting).
- Ensure that energy data is provided in the units designated in the reporting template.

Displaying Performance Results

A key element of the Better Climate Challenge is recognizing partners for their commitment to reducing emissions and transparently sharing information on their portfolios and progress toward their goals. Data is ready to be displayed on the Better Buildings Solutions Center after it has been collected and reviewed according to the procedures in this guidance. Each partner has an individual profile page that includes their commitments and the progress toward the goal. As shown in Figure 4, two graphs are displayed: (1) a bar chart with annual scope 1 and 2 emissions showing reductions achieved and (2) a waterfall-style graph that shows the emissions reduction strategies employed and their contribution to overall progress. You can work with DOE to develop a short narrative to accompany each graph to tell the story of your organization's portfolio-wide GHG reductions.

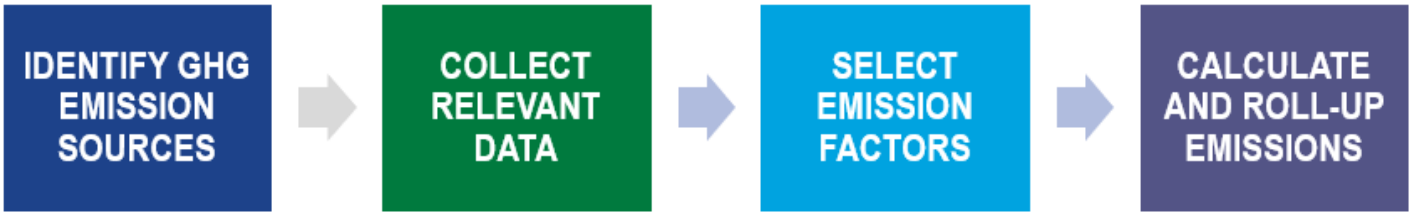
FIGURE 4: Greenhouse Gas Emissions Performance Results



Methodology for Quantifying GHG Emissions

Once your organization has established an organizational and operational boundary, you can calculate GHG emissions by identifying GHG sources, collecting relevant data, selecting emission factors, and calculating and rolling up emissions to the organizational level (see Figure 5). A description of each step is included in this section. Additional guidance can be found in Chapter 6 of the GHG Protocol Corporate Standard.

FIGURE 5: Steps to Quantify GHG Emissions



Identify GHG Emissions Sources

An organization's emissions come from many different sources that are owned or operated by the organization. While CO_2 accounts for the majority of GHG emissions, other gases may have a significant impact. Organizations should start by considering all of the scope 1 emissions released within their organizational and operational boundary, which may include the following:

- **Stationary Emissions:** GHGs from equipment that burns fossil fuels such as natural gas boilers, heaters, furnaces, and diesel generators fall under this category. Emissions from the consumption of primary fuels to produce electricity, steam, heat, or power are also included in stationary emissions.
- **Mobile Emissions:** Emissions from the combustion of fuels in owned or controlled mobile sources such as trucks, trains, ships, airplanes, buses, cars, and forklifts.
- **Fugitive Emissions:** Emissions from the intentional or unintentional release of GHGs from facility equipment. Possible fugitive sources include leaks from joins, seals, packing, or gaskets resulting in the release of GHGs such as hydrofluorocarbon (HFC) refrigerants into the atmosphere.
- **Process Emissions:** Emissions that are the result of a manufacturing process. Examples include CO_2 released during calcination in cement production or perfluorocarbons (PFCs) from aluminum smelting.

Organizations should next identify their scope 2 emissions sources. Electricity is the most common scope 2 source, but some facilities may also have consumption of purchased heat, compressed air, or steam.

Organizations may be inclined to neglect certain emissions sources if they have no material impact due to their small size compared to their total portfolio. However, organizations should make every effort when establishing their GHG base year to quantify all emissions. If it is difficult to gather data for a particular emissions source, using a reasonable estimate for that source is better than entirely excluding it from an organizations inventory.

Collect Relevant Data

To calculate GHG emissions, your organization will need access to accurate energy and fuel consumption data used on site. The Better Climate Challenge Emissions Reporting Template requires annual portfolio-level energy consumption data on many sources, including natural gas, fuel oil, propane, coke, and hydrogen as well as utilities such as electricity (including purchasing agreements), steam, hot water, or cooling. All site energy use data must be converted and reported in a common unit (MMBtu), except electricity which is reported in MWh. Partners can also report facility-level emissions data for more granular feedback on their progress. Your organization should implement a robust and sustainable data collection strategy to ensure that high-quality data is consistently gathered every year.

In addition to energy and fuel consumption data, organizations may need to collect activity data to quantify emissions from certain sources. For example, distance traveled can be utilized to calculate certain types of mobile emissions.

Organizations may have situations where GHG emissions need to be estimated due to a lack of data. Leased facilities might not know their energy use because utilities are included in their rent or a space may be shared with another occupant. Organizations may also have gaps in availability of utility bills. Before reporting any estimated emissions, organizations should make every effort to acquire relevant data. If estimates are necessary, organizations should be transparent about the estimation approach and thoroughly document the procedures used to make the final estimate. Estimates can be made based on floor area, energy costs (if usage is not available), usage from a similar time period at the same facility, or regional/national benchmarks for similar property types.

Select Emission Factors

A significant part of an organization's GHG emissions inventory relies on the selection of appropriate emission factors. The EPA maintains the EPA GHG Emission Factors Hub which was designed to provide organizations with a regularly updated and easy-to-use set of emission factors for GHG reporting. Electricity emission factors included in the EPA GHG Emission Factors Hub come from the EPA eGRID database, which is updated roughly every two years. These factors generally decrease over time due to the "greening of the grid" as more renewable energy sources are incorporated into the generation mix. Organizations are encouraged to use the most current eGRID emission factors when reporting their scope 2 emissions. This means that your organization's scope 2 emissions will decrease as the grid becomes greener over time. The following section on Example Emissions Calculations includes additional details on appropriate selection and use of emission factors by application.

Calculate and Roll-up Emissions

Calculating emissions typically involves multiplying energy and fuel use by emission factors to determine emissions associated with each source. Many tools are available publicly and privately to help organizations perform these calculations. Technical assistance is available to Better Climate Challenge partners using the following tools:

- ENERGY STAR Portfolio Manager is an online tool developed by the EPA that benchmarks the energy use of buildings and incorporates metrics to quantify GHG emissions. Portfolio Manager utilizes emission factors from the EPA GHG Emission Factors Hub and applies emission factors by year to energy use data to convert to carbon dioxide equivalent. Users can also create market-based emissions estimates and forecast scenarios with custom emission factors. (Note: this functionality is currently completed through the companion ENERGY STAR Building Emissions Calculator and will be integrated into Portfolio Manager as part of planned upgrades.)
- VERIFI (Visualizing Energy Reporting Information and Financial Implications) is an online tool developed by Oak Ridge National Laboratory that provides an easy-to-use dashboard for tracking, analyzing, and reporting energy use and carbon emissions.

Emissions for the Better Climate Challenge are reported in terms of metric tons of carbon dioxide equivalent (CO_2e). Emissions from all types of GHGs can be expressed in terms of CO_2e by multiplying the amount of each GHG by its Global Warming Potential (GWP) value (see Figure 6). Carbon dioxide equivalents are a convenient metric for tracking emissions because each emissions type is weighted by its relative effect on the environment.

FIGURE 6: Global Warming Potential of Primary Greenhouse Gases

Industrial Sector	Chemical Formula	100-Year GWP (AR5)
Carbon dioxide	CO_2	1
Methane	CH_4	28
Nitrous Oxide	N_2O	265

Global Warming Potential

Different GHGs can have different effects on the Earth's warming based on their ability to absorb energy and how long they stay in the atmosphere. Global Warming Potential (GWP) was developed to allow comparisons of different gases. GWP is the ratio of the amount of energy that 1 ton of a gas will absorb over a given timeframe, compared to how much energy 1 ton of CO_2 would absorb. The GWP values most commonly cited use a 100-year timespan, although 20- and 500-year values can also be found. By definition, CO_2 always has a GWP of 1. Values greater than 1 indicate a GHG traps more energy than CO_2. For example, methane (CH_4) has a GWP of around 20-30 despite only lasting around a decade in the atmosphere before degrading. Methane absorbs so much more energy than CO_2 per ton that it traps more energy over a century despite its short lifespan.

GWP values can change over time based on updated scientific estimates of the energy absorption or lifetime of gases. International GHG reporting standards under the UNFCC now require the use of the GWP values from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5). Many programs are shifting to utilizing the AR5 values shown in Figure 6, including the EPA Greenhouse Gas Emissions Hub which began publishing the AR5 values in 2024. AR4 factors are still in use in some applications, and newer AR6 factors are also available. Tracking emissions by mass is a best practice so that CO_2 equivalents can be recalculated using any GWP values as needed. Consistent with the GHG Protocol, the Better Climate Challenge encourages partners to use GWP values from the most recent Assessment Report, but they may choose to use other IPCC Assessment Reports if needed.

Depending upon an organization's business model, different approaches may be used for gathering GHG emissions data for portfolio level reporting. At some organizations, there is more facility-level involvement in energy and sustainability management, and often facilities have greater insight into appropriate factors or procedures required. In other organizations, a portfolio-level team can better ensure that a consistent methodology is applied across all facilities. Your organization can choose to implement one or more of the following approaches to best fit your reporting requirements.

- Each facility calculates its GHG emissions and reports results to a portfolio-level team, which then aggregates the data for final reporting.
- Each facility reports fuel and energy use data to a portfolio-level team. That team then applies facility-specific emission factors to the data to calculate organizational GHG emissions for final reporting
- All facility energy use is tracked at the portfolio level, and the portfolio-level team applies facility-specific emission factors.

Example Emissions Calculations

This section provides simple guidance on how to calculate emissions from different sources following the methodology described in the previous section. For any cases not discussed here, please work with DOE to determine the best way to calculate emissions from your operations.

Emissions from Stationary Combustion

Stationary emissions are the result of combusting fuel in fixed equipment owned or operated within the facility boundary. Examples of stationary equipment include boilers, heaters, furnaces, ovens, dryers, generators, kilns, flares, oxidizers, or any equipment that burns fuels or waste stream materials on-site. Emissions will depend not only on the type of fuel but also on the technology, efficiency, and age of the equipment. If fuel is stored in a product and not used for on-site combustion, that fuel consumption should be accounted for under scope 3. If actual fuel consumption is not available for onsite backup generators, GHG emissions can be estimated based on hours of operation and typical equipment use.

There are two main methods to estimate stationary GHG emissions:

- **Fuel Input Analysis:** Stationary GHG emissions are determined using the amount of fuel used multiplied by fuel-specific emission factors for each relevant greenhouse gas (typically CO_2, CH_4, and N_2O). See the EPA GHG Emission Factors Hub for appropriate emission factors. Additional guidance can also be found in the EPA GHG Inventory Guidance on Direct Emissions from Stationary Combustion Sources.
- **Direct Measurement of CO_2:** Direct measurement of stationary CO_2 emissions using a Continuous Emissions Monitoring System (CEMS) to find concentration and a flow monitoring system to measure volumetric flow rate. Together, these two values can be used to determine the mass of CO_2 being emitted. Calculating annual emissions is based on the operating time of the unit. To learn more about how to use CEMS to report CO_2 emissions, see the EPA GHG Inventory Guidance on Direct Emissions from Stationary Combustion Sources. Note that CEMS do not typically measure CH_4 and N_2O so organizations should use the fuel input analysis method for those emissions.

Example 1: Estimating Emissions from a Stationary Combustion Source

Organization A operates a natural gas-fired boiler and burns 10,000 MMBtu annually to generate heat. To estimate emissions from this source using the **fuel input analysis method**, the amount of fuel burned is multiplied by the emission factors from Table 1 of the EPA Greenhouse Gas Emission Factors Hub for CO_2, CH_4, and N_2O and the associated AR5 GWP values from Figure 6 to calculate emissions in carbon dioxide equivalent (CO_2e). This result is divided by 1000 kg/MT to express emissions in metric tons CO_2e.

$$10{,}000\ \text{MMBtu} \times \left(\frac{53.06\ \text{kg}\ \mathbf{CO_2}}{1\ \text{MMBtu}} \times \frac{1\ \text{kg}\ CO_2e}{1\ \text{kg}\ CO_2} + \frac{0.001\ \text{kg}\ \mathbf{CH_4}}{1\ \text{MMBtu}} \times \frac{28\ \text{kg}\ CO_2e}{1\ \text{kg}\ CO_2} + \frac{0.0001\ \text{kg}\ \mathbf{N_2O}}{1\ \text{MMBtu}} \times \frac{265\ \text{kg}\ CO_2e}{1\ \text{kg}\ N_2O} \right) \times \frac{1\ \text{MT}}{1000\ \text{kg}}$$

$$= \mathbf{531\ MT\ CO_2e}$$

Emissions from Mobile Combustion

Mobile emissions are the result of the combustion of fossil fuels in transportation equipment such as automobiles, trucks, buses, trains, forklifts, and boats. Emissions will depend on the type and vintage of the vehicle, with newer equipment usually having lower CH_4 and N_2O emissions and non-road vehicles having higher emissions. Organizations should include only emissions from the operation of owned or leased mobile sources that are within their organizational boundary. Employee commute, upstream and downstream third-party transport, and transportation of material should be accounted for under scope 3 emissions. Organizations should also exclude emissions associated with producing fuel or vehicles as part of mobile emissions.

Calculating mobile emissions depends on vehicle type. For non-road vehicles, the amount of fuel used is multiplied by a volumetric CO_2e emission factor. Emissions from on-road vehicles are calculated in two steps: (1) CO_2 emissions from fuel used and (2) CH_4 and N_2O emissions from total miles traveled. Total on-road emissions are the sum of emissions from these two calculations. To estimate mobile emissions, organizations should therefore collect data on vehicle type, fuel type, fuel economy (non-road), distance traveled (on-road), and any associated emission factors.

Example 2: Estimating Emissions from Mobile Sources

Organization B has several types of vehicles in its portfolio that it controls or operates including 10,000 gallons of diesel use from non-road industrial equipment and 20,000 gallons of gasoline use by passenger cars over 500,000 miles of travel in 2019.

Emissions from Non-Road Industrial Equipment

Diesel fuel use is multiplied by emission factors per gallon from the EPA GHG Emission Factors Hub (Table 2 for CO_2 and Table 5 for CH_4 and N_2O for Industrial/Commercial Equipment) and the AR5 GWP values from Figure 6 to calculate emissions in carbon dioxide equivalent. This is divided by 1000 kg/MT to express emissions in metric tons CO_2e.

$$10{,}000 \text{ gal diesel} \times \left(\frac{10.21 \text{ kg } \mathbf{CO_2}}{1 \text{ gallon}} \times \frac{1 \text{ kg } CO_2e}{1 \text{ kg } CO_2} + \frac{0.00042 \text{ kg } \mathbf{CH_4}}{1 \text{ gallon}} \times \frac{28 \text{ kg } CO_2e}{1 \text{ kg } CO_2} + \frac{0.0006 \text{ kg } \mathbf{N_2O}}{1 \text{ gallon}} \times \frac{265 \text{ kg } CO_2e}{1 \text{ kg } N_2O} \right) \times \frac{1 \text{ MT}}{1000 \text{ kg}}$$
$$= \mathbf{104 \text{ MT } CO_2e}$$

Emissions from Gasoline Passenger Cars

Gasoline fuel use is multiplied by the emission factor per gallon for CO_2 (GHG Emission Factors Hub, Table 2). Miles traveled is multiplied by the emission factor per mile for CH_4 and N_2O for 2019 (GHG Emission Factors Hub, Table 3) and the GWP values to generate emissions in carbon dioxide equivalent (CO_2e).

$$20{,}000 \text{ gal gasoline} \times \frac{8.78 \text{ kg } \mathbf{CO_2}}{1 \text{ gallon}} \times \frac{1 \text{ kg } CO_2e}{1 \text{ kg } CO_2} \times \frac{1 \, MT}{1000 \, kg}$$
$$+ 500{,}000 \text{ miles} \times \left(\frac{0.0000051 \text{ kg } \mathbf{CH_4}}{1 \text{ gallon}} \times \frac{28 \text{ kg } CO_2e}{1 \text{ kg } CO_2} + \frac{0.0000014 \text{ kg } \mathbf{N_2O}}{1 \text{ gallon}} \times \frac{265 \text{ kg } CO_2e}{1 \text{ kg } N_2O} \right) \times \frac{1 \text{ MT}}{1000 \text{ kg}}$$
$$= \mathbf{176 \text{ MT } CO_2e}$$

In total, Organization B has approximately 280 metric tons of CO_2e emissions annually from mobile sources.

Many organizations are decarbonizing their vehicle fleets with electric vehicles (EVs). There are various kinds of EVs from all-electric to plug-in hybrid (PHEV) and hybrid electric (HEV) vehicles. While all-electric vehicles do not have scope 1 emissions, HEVs and PEVs still burn fossil fuels in some fashion. Emissions from electricity used to charge EVs should be included in scope 2 while emissions from combustion of fossil fuels in hybrid EVs should be included in scope 1 mobile emissions. Guidelines for traditional internal combustion vehicles apply to any fossil fuels used in hybrid EVs.

The Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool from DOE and the Mobile Combustion GHG Emissions Calculation Tool from the GHG Protocol are helpful tools to estimate emissions from fleets. For technical assistance with strategies to reduce fleet emissions, Better Climate Challenge partners can connect with DOE's Clean Cities Coalition Network, a group of state and local nonprofit organizations that implement alternative fuel, electrification, and other fuel-saving projects.

Emissions from Fugitive Sources

Fugitive emissions are the result of intentional or unintentional release of GHGs directly into the atmosphere from leaks in joints, seals, packings and gaskets, or from equipment in refrigeration systems, wastewater treatment, cooling towers, or gas processing facilities. Fugitive emissions can also include methane leakage from gas transport.

Better Climate Challenge partners should report all fugitive emissions of the seven required GHGs from the operation and disposal of air conditioning and refrigeration equipment (including leaks). Air conditioning and refrigeration equipment historically utilized various Ozone Depleting Substances (ODSs) such as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), although these ODSs are currently being phased out of manufacture and use. Hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) are used as substitutes for regulated ODSs. While fugitive emissions from ODSs are excluded from GHG inventories, they are reported as a separate line item per GHG Protocol guidance. Organizations that switch to HFCs or PFCs may therefore see an increase in their overall GHG emissions.

There are three main methods for estimating GHG emissions from fugitive sources:

- **Screening Method:** GHG emissions are calculated based on the type of equipment being used and an estimated emission factor. Data collection effort for this method is very low but is not very accurate.
- **Purchased Gas Method:** Emissions are based on an inventory of industrial gases, equipment in operation, and the amount of gas used to charge each system. This method is recommended for organizations that maintain their own equipment and requires available data on the total inventory of refrigerants at the beginning and end of each reporting period, purchases during the reporting period, and changes in total equipment refrigerant capacity.
- **Material Balance Method:** Emissions are based on the total inventory of industrial gases, purchases made, and changes in total equipment capacity at the start and end of each billing period. This method is appropriate for entities that do not maintain and track refrigerants and have not retrofitted their equipment.

Additional guidance on fugitive emissions can be found in the EPA GHG Inventory Guidance on Direct Fugitive Emissions from Refrigeration, Air Conditioning, Fire Suppression, and Industrial Gases. Refrigerant tracking functionality is also being added to ENERGY STAR Portfolio Manager as part of planned tool upgrades.

Emissions from Process Sources

Process emissions are the result of physical or chemical processes that occur during production. Examples include CO_2 released during calcination in cement production or perfluorocarbons (PFCs) from aluminum smelting. Organizations with process emissions are required to collect and report data on these emission sources. Figure 7 shows some of the major industrial sectors with process emissions and their sources. Direct measurement of process emissions is preferred, however, estimates with documentation of procedures are also acceptable.

FIGURE 7: Major Industrial Sectors with Scope 1 Process Emissions

Industrial Sector	Example Process Emission Sources
Primary Metals (Aluminum)	Emissions from carbon anode oxidation, electrolysis, and PFC
Primary Metals (Iron & Steel)	Emissions from crude iron oxidation, carbon content of ferro alloys, oxidation, and consumption of carbon electrodes in electric arc furnaces
Chemicals	Catalytic cracking, N_2O byproduct
Cement, Concrete, and Lime	Calcination of limestone
Water and Wastewater Treatment	Aerobic and anaerobic digestion
Semiconductor Production	Gases used in wafer fabrication
Breweries	Fermentation process releases CO_2

Emissions from Purchased Utilities

Electricity that was generated externally has indirect GHG emissions associated with it. For electricity purchased from the grid, **location-based** emissions are calculated by multiplying total consumption by an average emission factor. The EPA eGRID database can be used to identify the subregional CO_2e emission factors for your facilities. "Total output emissions rate"factors in the eGRID tables should be used for GHG inventories and represent average emission factors in your subregion. The "non-baseload output emissions rates" from the eGRID tables are marginal emission factors that may be appropriate for avoided emissions calculations. Average national emission factors can be used if subregional factors are not available.

For **market-based** electricity emission calculations, follow the hierarchy of emission factors in Figure 8. Start by calculating emissions for any energy with attribute certificates (e.g., RECs which are usually zero). Next calculate emissions for any contract electricity purchases using factors listed in the agreements. For any remaining electricity usage, contact your electricity supplier to obtain an average emissions rate for your electricity. If your utility is unable to provide an emission factor, use a residual mix factor for your area such as those from Green-e. Lastly, if regional residual mix factors are unavailable in your area, eGRID subregion or national emission factors can be used to calculate location-based emissions. For additional detail, see Chapter 6 of the GHG Protocol Scope 2 Guidance.

FIGURE 8: Hierarchy for Market-Based Emission Factors

Emissions Factors	Precision
Energy Attribute Certificates (e.g., RECs)	High Precision  Low Precision
Contracts (e.g., PPAs)	
Supplier/Utility Emissions Rates (e.g., Green Tariffs)	
Residual Mix (e.g. Green-e)	
Other grid-average emission factors (e.g., eGRID)	

If your organization consumes renewable electricity generated onsite or off-site with a direct connection and retains the renewable energy credits (RECs), any emissions associated with that electricity use would be zero, for both location-based and market-based emissions. However, if your organization sells the RECs, that electricity is treated as if it came from the grid for location-based emissions and follows the same emission factor hierarchy as in Figure 8 for the market-based emissions. Only the ownership of the renewable attributes affects scope 2 emissions, not ownership of the actual equipment.

The Better Climate Challenge asks partners to provide information on their renewable energy purchases to better understand how organizations are making progress toward their emissions reduction goals. Organizations may utilize on-site self-generation from equipment either owned and maintained by them or a third party. They may purchase off-site green power through systems that have a direct connection or grid transfer, power purchase agreements that involve direct procurement from a grid-connected generator, financial or virtual power purchase agreements, utility green power products or green tariffs, or default delivered renewable electricity from the grid. Some organizations participate in community solar projects that allow multiple customers to subscribe to a portion of a shared renewable electricity system. Unbundled RECs are also available for organizations to purchase in the energy market to help reduce scope 2 emissions. For additional information, see the EPA's summary of Green Power Supply Options. For all the renewable energy options described above, organizations can claim renewable electricity from the grid only when RECs have been retired on their behalf.

RECs should be procured from credible generation sources with attribute data that has been verified by a third party (e.g., Green-e certified for US-based renewable electricity procurement). The owners of the RECs should have exclusive ownership and claims on the certificates. Organizations must source renewable electricity from within the boundary of the market in which they are consuming electricity. The USA, Canada, and Northern Baja California are considered a single market for renewable energy sourcing and reporting. For credible renewable energy benefits claims, generation should occur relatively close to the year a credit is retired. While different certification programs will have different criteria, Green-e requires a 21-month vintage eligibility window for certified sales of renewable energy in a given year.

Example 3: Market-Based Emissions Calculations for Electricity Purchases

Organization C has an onsite photovoltaic system that generates 100,000 kWh/year at its facility in southern California. The organization also purchases 400,000 kWh/year from an off-site wind resource, which it contracts for through a virtual power purchase agreement. Any remaining electricity needs are provided by the local utility.

To calculate both location-based and market-based emissions, electricity consumption in total kWh is divided by 1,000 to convert to MWh, multiplied by the appropriate emission factor from eGRID in lb CO_2e/MWh (details on emission factors included below), and divided by 2,204.6 lb CO_2e/MT CO_2e to report emissions in metric tons CO_2e. This example is intended to illustrate the differences between location-based and market-based emissions calculations and uses emission factors in terms of CO_2e for simplicity of illustration. Best practice is to perform calculations separately for CO_2, CH_4, and N_2O, so that CO_2 equivalents can be re-calculated using any GWP values as needed.

Location-based emissions: Because the organization retains the RECs, there are 0 location-based emissions from the onsite photovoltaic system. Electricity from the offsite PPA is treated as grid power for location-based emissions. Consumption from the offsite PPA and the grid electricity are multiplied by the eGRID emission factor for the CAMX subregion, with a total output emissions rate of 499.278 lb CO_2e/MWh

Market-based emissions: Because the organization retains the RECs, there are also 0 market-based emissions from the onsite photovoltaic system. The electricity from the offsite PPA is 100% renewable and has 0 market-based emissions. For the remaining grid electricity, a custom emission factor of 552 lb CO_2e/MWh from the utility is used to calculate market-based emissions.

		Location-Based Emissions		Market-Based Emissions	
	Annual kWh	**Emission Factor (lb CO_2e/MWh)**	**Total Emissions (MT CO_2e)**	**Emission Factor (lb CO_2e/MWh)**	**Total Emissions (MT CO_2e)**
Onsite PV	100,000	0	0	0	0
Offsite PPA	400,000	499.278	91	0	0
Grid Electricity	250,000	499.278	57	552	63
TOTAL	**750,000**		**148**		**63**

For other purchased utilities such as steam or chilled water, reach out to your utility provider for assistance in finding an appropriate emission factor. Dividing the generating system's total emissions by fuel input can be used to estimate your emission factor. Similarly, dividing your usage by the system efficiency can provide an estimate of the required fuel input from which emissions can be estimated. If information is not available from your provider, the Historical Greenhouse Gas Emissions Factors that are used in ENERGY STAR Portfolio Manager include emission factors for purchased utilities.

Emissions from Combined Heat and Power

Facilities that purchase electricity from a combined heat and power (CHP) system should report emissions from only the delivered portion of electricity. The owner of the CHP system will account for all direct emissions associated with running the system in their scope 1 emissions and should be able to provide an appropriate emission factor for consumers purchasing any generated electricity.

If a facility owns and operates a CHP system that is included within the facility boundary, the facility will report the scope 1 emissions associated with the fuel input to the CHP system. The energy generated by the system (e.g., electricity and heat) is already accounted for by the fuel input. If the facility is using biomass or biogas as the input fuel, they should account for CH_4 and N_2O emissions under scope 1 and direct CO_2 emissions from the system under the biogenic emissions category, as described in following section on biofuels.

For organizations that own CHP systems, the most significant emissions benefit typically comes from displaced grid emissions. Organizations can account for these savings through the GHG Protocol for Project Accounting using marginal emission rates. Project accounting results are reported separately from the inventory-based emissions reporting used for the Better Climate Challenge.

Emissions from Use of Biofuels

Biofuel is defined as any organic matter used for energy (i.e., biological material available on a renewable basis). Biofuels are only renewable if they are sustainably sourced and certified whenever possible. If there are no certifying organizations available, organizations should be cautious of any sustainability claims. As the demand for biofuel increases to help reduce GHG emissions in hard-to-abate sectors, stronger policy and regulation are key to driving demand and sustainability for this fuel type. Organizations should be aware of the environmental impact and the source of the biofuel they are using. Change in indirect or direct land use due to the production of biofuel can lead to higher overall emissions. Biofuel crop production must not be in direct competition with existing land use and should not displace agricultural or pastureland without moving these activities to other land. Changes in biodiversity, water table, and soil erosion should be avoided when sourcing production of biofuel.

Emissions from stationary equipment or mobile equipment that burns bio-derived fuels (e.g., biogas and biomass) are reported differently than those that use fossil fuels. Direct CO_2 emissions from combustion of biofuels are recorded separately from scope 1 emissions under an independent biogenic emissions category. Biogenic CO_2 emissions are reported in a separate line item in the Better Climate Challenge Emissions Reporting Template and are not included in the total emissions tracked for a partner's goal. Other GHG emissions from biofuel combustion, like CH_4 and N_2O, are still counted in scope 1 and should be converted to CO_2e equivalents using their GWP values. This same accounting method applies to waste-derived and byproduct fuels with only combustion emissions counted and excluding any "offsets" from the use of waste-derived fuels. Blended fuels such as E10 (10% ethanol and 90% gasoline) used for mobile equipment contain emissions from both fossil and bio sources. Organizations should report both types of CO_2e emissions in the appropriate categories based on fuel content.

Example 4: Estimating Emissions from Biofuels

Organization D generates dry wood chips as part of their production process and burns 20,000 MMBtu annually to generate additional heat for another process.

Biogenic CO_2 Emissions

Direct CO_2 emissions from combustion of the wood chips are calculated by multiplying the amount of fuel use by the emission factor from the EPA Greenhouse Gas Emissions Factors Hub for CO_2 and the associated GWP values (AR5) from Figure 6 to generate emissions in carbon dioxide equivalent (CO_2e), which is divided by 1000 MT/kg to express emissions in metric tons CO_2e. This is reported as biogenic CO_2 emissions, separate from scope emissions.

$$20{,}000\ \text{MMBtu} \times \left(\frac{93.8\ \text{kg}\ \mathbf{CO_2}}{1\ \text{gallon}} \times \frac{1\ \text{kg}\ CO_2e}{1\ \text{kg}\ CO_2}\right) \times \frac{1\ \text{MT}}{1000\ \text{kg}} = \mathbf{1{,}876\ MT\ CO_2e}$$

Other GHG Emissions from Biofuel Combustion

CH_4, and N_2O emissions are calculated using a similar process, with the emission factors for CH_4, and N_2O. These emissions are reported as part of scope 1 emissions.

$$20{,}000\ \text{MMBtu} \times \left(\frac{0.0072\ \text{kg}\ \mathbf{CH_4}}{1\ \text{MMBtu}} \times \frac{28\ \text{kg}\ CO_2e}{1\ \text{kg}\ CO_2} + \frac{0.0036\ \text{kg}\ \mathbf{N_2O}}{1\ \text{MMBtu}} \times \frac{265\ \text{kg}\ CO_2e}{1\ \text{kg}\ N_2O}\right) \times \frac{1\ \text{MT}}{1000\ \text{kg}} = \mathbf{23\ MT\ CO_2e}$$

Accounting for Portfolio or Data Changes

Organizations undergo changes over time including growth, mergers, outsourcing, etc. Data tracking procedures can also change over time, resulting in more accurate data or improved methodologies. Better Climate Challenge partners should evaluate their portfolio and methodology each year before reporting their progress. A partner should recalculate base year emissions if they experience a significant change to the inventory boundary, underlying data, or methods for calculating emissions. The Better Climate Challenge follows the guidance in the GHG Protocol Corporate Standard (Chapter 5) for recalculating base year emissions, which is summarized in Figure 9.

FIGURE 9: Accounting for Portfolio or Data Changes

GHG Protocol Guidance for Recalculating Base Year Emissions	
Should recalculate to reflect structural or data changes	**Should** not recalculate to reflect organic growth/decline
▶ Mergers, acquisitions, and divestments	▶ Increases or decreases in production output
▶ Outsourcing/insourcing of emissions-related activities	▶ Changes in product mix
▶ Changes to the calculation methodology or improvements in the accuracy of emissions data	▶ Closures/openings of operating units that are owned or controlled by the organization
▶ Identification of previous errors in base year emissions data	

Setting a Significance Threshold

An organization should develop a policy on when and how it will recalculate base year emissions and apply that policy in a consistent manner. Organizations should determine and disclose a "significance threshold" that triggers a base year recalculation. A best practice is a threshold of 5% change in portfolio emissions or lower. The threshold may be triggered by one significant change or multiple minor changes.

Structural Changes to an Organization

There are two main types of structural changes that can affect your GHG portfolio:

- **Acquisitions, Mergers, or Insourcing:** If your organization has combined with existing operations, emissions from those operations should be added to your GHG portfolio for all years including the base year. This will result in an increase in your overall GHG emissions portfolio.
- **Divestments or Outsourcing:** If your organization has divested or outsourced operations within its organizational boundary, emissions from those operations should be removed from your GHG portfolio for all years including the base year. This will result in a decrease in your overall GHG emissions portfolio.

Partners that outsource key operations outside their corporate boundary (typically resulting in a decrease in scope 1 and 2 emissions) are encouraged to keep tracking those emissions under their scope 3 portfolio. Outsourcing can streamline a process but does not guarantee that total emissions associated with production have decreased. By continuing to track emissions from outsourced operations, organizations can monitor and influence emissions throughout their supply chain.

Organic Growth or Decline

Normal growth or decline refers to increases or decreases in productivity, changes in production mix, closures, and openings of operating units of facilities that are owned or controlled by an organization. These changes may cause increases or decreases in absolute emissions over time but do not trigger an adjustment in previous emissions reporting. If changes are independent of the addition or removal of business from the organizational boundary, then changes are treated as natural variations in GHG output. Common examples include expansion or consolidation of existing facilities, new construction, closure of existing facilities, and adding or removing production lines.

Unexpected events such as accidents or disasters that result in facilities being taken offline would also be treated as organic decline, so no adjustment to the GHG inventory is required. This may appear as a temporary reduction in portfolio GHG emissions which would increase upon return to normal operations.

Updating Methodology or Emission Factors

An organization should recalculate base year emissions if there are changes to the emissions calculation methodology or improvements in the accuracy of emissions data. For example, an organization was previously estimating data but actual measured data became available. Another example is the availability of more appropriate GHG emission factors.

Better Climate Challenge partners should report emissions each year using the most current GHG emission factors available. Partners are not required to update previously reported data when more timely factors are released, but they may choose to do so if the organization would prefer more accurate data. If using data from eGRID, for example, an organization reporting 2022 emissions data would likely use eGRID 2021 emission factors that were released in early 2023. Similarly, if this organization was reporting 2023 emissions and now eGRID 2022 was available, they should use eGRID 2022 for their 2023 emissions data. They could also choose to revise their 2022 emissions data with the newly available 2022 factors but are not required to do so. This same approach applies to custom emission factors from utilities or residual mix emission factors from Green-e.

Base Year Recalculation

If an organization has experienced a change that triggers a base year recalculation, it should keep detailed records on what changes occurred and when. Recalculation is only required for the base year emissions, but partners are encouraged to also recalculate any other reporting years that are affected by the change. If any other reporting years are significantly affected and are not recalculated, the program will no longer display those results on the Better Buildings Solution Center.

To report a recalculated base year or other submissions years to the Better Climate Challenge, an organization can submit an Emissions Reporting Template with revised data, along with information explaining the need for the changes in the "Comments" worksheet. In addition to the change in base year emissions, organizations can communicate changes in their square footage or facility commitment to DOE.

Appendix A: Resources

GHG Inventory Development

The **Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard** (World Business Council for Sustainable Development and the World Resources Institute, Revised Edition, 2004) provides requirements and guidance for companies and other organizations preparing a corporate-level GHG emissions inventory. A 2015 revision includes the **GHG Protocol Scope 2 Guidance**, which standardizes how corporations measure emissions from purchased or acquired electricity, steam, heat, and cooling.

https://ghgprotocol.org/corporate-standard
https://ghgprotocol.org/scope-2-guidance

EPA's GHG Inventory Development Process and Guidance (EPA, 2022). EPA's Center for Corporate Climate Leadership has developed GHG inventory resources to complement the GHG Protocol Corporate Standard that provide specific guidance on GHG calculation methodologies and emission factors. Resources include a **Simplified Guide to Greenhouse Gas Management for Organizations**, and the following documents with methods to calculate and report emissions from scope 1 and scope 2 sources:

- Direct Emissions from Stationary Combustion
- Direct Emissions from Mobile Combustion Sources
- Indirect Emissions from Purchased Electricity
- Direct Fugitive Emissions from Refrigeration, Air Conditioning, Fire Suppression, and Industrial Gases

https://www.epa.gov/climateleadership/scopes-1-2-and-3-emissions-inventorying-and-guidance
https://www.epa.gov/climateleadership/scope-1-and-scope-2-inventory-guidance

GHG Calculation Tools

GHG Protocol Calculation Tools and Guidance (World Business Council for Sustainable Development and the World Resources Institute, Revised Edition) provides cross-sector and sector-specific tools to develop GHG inventories, including a tool for Stationary Sources and a tool for Transport or Mobile Sources.

https://ghgprotocol.org/calculation-tools-and-guidance

ENERGY STAR Portfolio Manager (EPA) is a tool that benchmarks the energy use of buildings and incorporates metrics to quantify GHG emissions. Users can create location-based and market-based emissions estimates and forecast scenarios with custom emission factors. Note that market-based emissions estimates and forecast scenarios are currently completed through the companion ENERGY STAR Building Emissions Calculator and will be integrated into Portfolio Manager as part of planned upgrades.

https://www.energystar.gov/benchmark
https://portfoliomanager.energystar.gov/buildingEmissionsCalculator/

VERIFI (Visualizing Energy Reporting Information and Financial Implications) is tool from Oak Ridge National Laboratory that provides an easy-to-use dashboard for tracking, analyzing, and reporting energy use and carbon emissions.

https://verifi.ornl.gov/

EPA's Simplified GHG Emissions Calculator (EPA) is designed to help small business and low emitter organizations estimate and inventory their annual GHG emissions. The Excel calculator will determine the direct and indirect emissions from all sources at an organization when activity data are entered into the various sections of the workbook for one annual period.

https://www.epa.gov/climateleadership/simplified-ghg-emissions-calculator

AFLEET: Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool (Argonne National Laboratory) is a tool developed for DOE Clean Cities stakeholders to estimate fuel use, GHG emissions, air pollutant emissions, and cost of ownership of light-duty and heavy-duty vehicles.

https://greet.es.anl.gov/index.php?content=afleet

Greenhouse Gases

Overview of Greenhouse Gases (EPA, 2015) provides background on greenhouse gases and how they contribute to climate change.

https://www.epa.gov/ghgemissions/overview-greenhouse-gases

Greenhouse Effect 101 (National Resources Defense Council, 2019) provides an overview of GHGs and the greenhouse effect.

https://www.nrdc.org/stories/greenhouse-effect-101

GHG Emission Factors

GHG Emission Factors Hub (EPA) was designed to provide organizations with a regularly updated and easy-to-use set of default emission factors for organizational greenhouse gas reporting.

https://www.epa.gov/climateleadership/ghg-emission-factors-hub

Emissions & Generation Resource Integrated Database (eGRID) (EPA) is a comprehensive source of data on the environmental characteristics of almost all electric power generated in the United States. eGRID average electricity emissions rates are typically used for greenhouse gas inventories.

http://www.epa.gov/egrid

Historical Greenhouse Gas Factors, 2000 - present (EPA) is a useful spreadsheet resource with the historical GHG factors used in ENERGY STAR Portfolio Manager to convert to CO_2e. Additional details are included in the Portfolio Manager Technical Reference on Greenhouse Gas Emissions and the Building Emission Calculator Technical Reference.

https://www.energystar.gov/buildings/tools-and-resources/historical-greenhouse-gas-factors-2000-present

Green-e Residual Mix Emissions Rates Tables (Green-e) can be used to calculate the GHG emissions associated with untracked and unclaimed U.S.-based sources of electricity, based on location of consumption.

https://www.green-e.org/residual-mix

GHG Protocol Required Greenhouse Gases in Inventories (World Business Council for Sustainable Development and the World Resources Institute, 2013) is an amendment to the GHG Protocol Corporate Standard that provides details on the greenhouse gases required to be included in inventories as well as the GWP values, to be in alignment with the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. GHG Protocol also publishes a list of Global Warming Potential Values.

https://ghgprotocol.org/corporate-standard (Under Supporting Documents)

Understanding Global Warming Potentials (EPA) provides GWP definitions and frequently asked questions

https://www.epa.gov/ghgemissions/understanding-global-warming-potentials

Green Power

Green Power Supply Options (EPA) includes definitions of different green power supply options and related tools and resources.

https://www.epa.gov/green-power-markets/green-power-supply-options

Renewable Energy Certificates (EPA) includes definitions of RECs and related tools and resources, including a fact sheet on Offsets and RECs: What's the Difference?

https://www.epa.gov/green-power-markets/renewable-energy-certificates-recs

Renewable Energy Certificates Overview (DOE) provides an overview of RECs procurement and accounting.

https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/RECs_Overview_.pdf

GHG Emissions Reduction

Framework for Greenhouse Gas Emissions Reduction Planning (DOE), developed through the Better Climate Challenge program, provides guidance to organizations seeking to reduce GHG emissions across their portfolio.

https://betterbuildingssolutioncenter.energy.gov/decarbonization/erp

Appendix B: Definition of Terms

The following definitions apply to the DOE Better Climate Challenge. Certain terms may have different definitions in other methodologies or contexts.

Absolute Target	A climate goal seeking to reduce GHG emissions by a set amount. Absolute targets are critical to achieving climate objectives outlined in the Paris Climate Agreement.
Base year	A reference point that allows organizations to measure performance of GHG emissions reduction programs.
Bioenergy	Energy derived from organic material known as biomass that can be processed to create fuels for transportation, heat, electricity, and products.
Boundaries	Accounting frameworks used for establishing, tracking, and reporting emission GHG portfolios. Boundaries can be based on geography, organization, or operations.
Carbon Dioxide Equivalent (CO_2e)	A standardized metric used to measure the effects of various GHGs on the environment based on their global warming potential (GWP).
Decarbonization	The reduction of greenhouse gas emissions to mitigate the worst scenarios associated with global climate change.
Emission Factor	A factor used to estimate GHG emissions from a unit of consumption such as kWh of electricity, gallons of fuel burned, etc.
Equity Share	An approach for setting corporate GHG portfolio boundaries based on an organization's share of equity in business operations.
Financial Control	An approach for setting corporate GHG portfolio boundaries based on an organization's financial control of business operations.
Fluorinated Gas(es)	Manmade chemicals used in industrial applications that contain fluorine, are gases near room temperature, and have high global warming potential (GWP).
Fugitive Emissions	Emissions from the intentional or unintentional release of GHGs. Typical sources include leaks from HVAC equipment, emissions from production equipment, etc.
GHG Inventory	A complete list of GHG emission sources and associated emissions collected using a standardized methodology.
GHG Protocol	A standardized global framework for measuring and managing GHG emissions for public and private organizations.
Global Warming Potential (GWP)	The amount of heat absorbed by a GHG in the atmosphere expressed as a ratio of the heat that the same mass of carbon dioxide (CO_2) would absorb over a given period.
Greenhouse Gases (GHGs)	Naturally occurring or manmade gases in Earth's atmosphere that trap heat and contribute to the greenhouse effect.
Intensity Target	A climate goal seeking to reduce GHG emissions relative to an economic output metric. Note that intensity targets do not guarantee absolute emissions reduction.
Location-based Emissions	Scope 2 (indirect) emissions calculated based on the average generation mix of the local grid where the usage occurred.

Market-based Emissions	Scope 2 (indirect) emissions calculated based on contractual agreements made by the consumer for their electricity.
Mobile Combustion	The burning of fossil fuels by transportation equipment including cars, trucks, airplanes, ships, etc.
Offset	Tradable, non-tangible commodities that represent the effects of projects that reduce the amount of GHGs in the atmosphere. Offsets can be applied to any scope emissions but may not be recognized by reporting programs.
Operational Control	An approach for setting corporate GHG portfolio boundaries based on an organization's operational control of business operations.
Process Emissions	Emissions from the chemical or physical transformation of materials that release GHGs (e.g., CO_2 from calcination in cement production, perfluorocarbons from aluminum smelting).
Renewable Energy	Energy derived from natural sources that are replenished at the same or greater rate than they are consumed. Sources include solar, wind, hydro, and geothermal energy.
Renewable Energy Credits (RECs)	Tradable, non-tangible commodities that represent the environmental benefits of one MWh of electricity generated from a renewable energy source. RECs can only be used to reduce scope 2 emissions.
Scope Emissions	Three categories of GHG emissions used for data collection that are based on which entities are responsible for the GHG emissions. Scope 1 emissions are direct emissions, scope 2 are indirect emissions, and scope 3 are emissions from the value chain.
Stationary Combustion	The burning of fossil fuels to generate electricity, steam, or heat by fixed equipment like boilers, furnaces, ovens, etc.

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DOCUMENT AVAILABILITY

Online Access: US Department of Energy (DOE) reports produced after 1991 and a growing number of pre-1991 documents are available free via https://www.osti.gov. The public may also search the National Technical Information Service's National Technical Reports Library (NTRL) for reports not available in digital format.

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