2022 Sustainability Report Appendices

Read our **2022 ESG Framework Results** for our TCFD, SASB and GRI indices ▶

Appendix I | Greenhouse Gas and Energy Inventory Process

Methodology

The GE Greenhouse Gas (GHG) Inventory follows the World Resources Institute/World Business Council for Sustainable Development (WRI/WBCSD) *Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, Revised Edition* (the "Protocol"). GE utilizes the Protocol for all definitions, assumptions, and calculations discussed in this document unless explicitly stated otherwise.

GE reports under the "control" approach for emissions in Scopes 1 and 2, as defined in the Protocol, from sources over which it has operational control. Regarding Scope 3 emissions, GE calculates emissions from the use of sold products in the Vernova and Aerospace businesses as outlined in Appendix II. At a high level, the Protocol defines Scope 1 emissions as direct GHG emissions from sources that are owned or controlled by the company, Scope 2 emissions as emissions from the generation of purchased electricity consumed by the company, and Scope 3 emissions as emissions that are a consequence of the activities of the company but occur from sources not owned or controlled by the company. GE reports this data with the unit of CO_2 equivalent which is the universal unit of measurement to indicate global warming potential of greenhouse gases.

Inventory Scope

The GHG Inventory includes data from individual facilities (primarily manufacturing facilities), additional rooftops (primarily offices, warehouses, and small service shops), and the vehicle and air fleets that GE operates for its own use. The inventory scope is adjusted annually as a result of divestiture, closure or consolidation with other facilities, acquisitions, newly established facilities, or when facilities meet the reporting criteria for the first time.

GE's worldwide operational Scope 1 and 2 GHG emissions are the total of three categories:

- Data from the largest facilities in the Company
- Estimates for small facilities and additional rooftops
- Data from centrally managed mobile sources including fleet and aircraft

GE tracks Scope 3 emissions from the following categories:

- Use of sold products[1] (see Appendix II)

Emission Factors and Global Warming Potentials

GE uses emission factors to determine the GHG emissions from a unit of activity data like fuel consumption. These factors are primarily from the U.S. Environmental Protection Agency (EPA) Mandatory GHG Reporting Rule (40 CFR part 98) to calculate CO_2 emissions for combustion of fuel. The 100-year global warming potential (GWP) for CH_4, N_2O, HFCs, SF_6 and PFCs are also taken from the U.S. EPA Mandatory GHG Reporting Rule (40 CFR part 98). Emissions of CH_4 and N_2O from the combustion of fuels are calculated using emissions factors obtained from EPA Climate Leaders program documents. Other direct emission factors are obtained from WRI and the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report when U.S. EPA factors are not available.

GE uses U.S. EPA eGRID sub-regional average emission factors to calculate indirect emissions resulting from the purchase of electricity in the United States. Indirect emissions resulting from the purchase of electricity outside of the U.S. are calculated using countrywide average factors obtained from the International Energy Agency (IEA). Electricity emissions for the base year were calculated using EPA eGRID and IEA factors available at the time of calculation. Electricity emissions for the current reporting year are calculated using the most recent grid emissions factors available from the EPA and IEA as of the month of April following the reporting year.

GE uses market-based emission factors for Scope 2 calculations. As defined in the Protocol, a market-based method reflects the emissions from electricity that a company has purposely chosen.

Large Sites

GE maintains a GHG Inventory database in a cloud-based environmental management system to collect the necessary detailed inventory data from the following types of facilities:

- Manufacturing facilities
- Power generation and engine/turbine test facilities
- Service and distribution facilities with greater than 50 employees
- Data centers

[1] GE acknowledges that certain GE businesses have individual government requirements for tracking and reporting other Scope 3 categories.

The GHG Inventory database allows each site to enter the quantity of electricity and fuel used by fuel type and the unit of measure based on its own electricity and fuel purchase and/or combustion records as well as data on emissions of other GHGs. The software system calculates emissions, in metric tons of CO_2 equivalents, for each emission category as well as a total for all emission categories.

The software system calculates direct-combustion emissions by multiplying a given quantity of fuel by an emission factor and calculates indirect emissions for electricity that was purchased by multiplying a given quantity of electricity by an emission factor. Direct emissions resulting from the generation of electricity for export off-site are included within direct emissions. The Protocol recommends this approach and instructs companies to report emissions from exported electricity, heat, or steam under supporting information and not to deduct those emissions from company emissions.

The Inventory includes sites in Europe and Asia that import steam or hot water from third-party cogeneration plants or district heating plants. Each of these sites determined the quantity and type of fuel needed by the third-party plant to generate the steam or hot water purchased by the site. This quantity of fuel is then multiplied by the appropriate emission factor to determine the indirect emissions from steam or hot water purchases. A default thermal efficiency of 80% is used to calculate the quantity of fuel needed to generate the steam or hot water that was purchased based on guidance provided in the WRI/WBCSD Emission Calculation Tool. Most of the plants use the default thermal efficiency.

Emissions of other GHGs (direct-process emissions of CO_2, CH_4, N_2O, HFCs, SF_6, and PFCs) are entered directly in units of mass and converted to metric tons of CO_2 equivalent using the EPA's published 100-year GWP coefficients. Generally, emissions are based on purchase records and the assumption that all used material was emitted. For certain processes, however, site-specific knowledge of the process and/or emissions factors are used to determine actual emissions.

Because a subset of large facilities is responsible for about 80% of the emissions in this category, GE collects all data from that group of facilities annually. Data for the small facilities is collected less frequently and prorated in interim years based on historical data.

Small Sites

GE does not collect detailed emissions data from worldwide "small" locations due to the difficulty and expense that would be associated with such an effort in comparison to the relative significance of the emissions in GE's overall inventory. The sites that fall into this category are primarily small office facilities but include all locations that do not meet the criteria defined above for "large sites."

Emissions for these small facilities are calculated based on the Commercial Buildings Energy Consumption Survey (CBECS), published by the U.S. Energy Information Administration. Using this tool, GE determines the expected electricity and natural gas usage for a facility based on the type, location, and square footage of the facility. GHG emissions are calculated using this estimate of energy usage and the appropriate emission factor as described above for Large Sites.

Mobile Sources

GE calculates emissions from motor vehicles:

- Centrally managed by third-party contractors globally
- Leased or rented from Penske Truck Leasing, Ryder Logistics, and RXO Logistics in the U.S.
- Owned by GE businesses in the U.S., Canada, and Puerto Rico

In addition, GE calculates emissions from GE-owned or controlled aircraft including the flying test bed (a large airliner used for flight-testing jet engines). Mobile source emissions are calculated by obtaining fuel use and/or vehicle-miles-traveled records and applying appropriate emission factors obtained from the U.S. EPA Climate Leaders guidance documents. CH_4 and N_2O emissions for mobile sources are also calculated using emission factors obtained from the U.S. EPA Climate Leaders program guidance documents. In addition, GE includes emissions from GE-controlled motor vehicles that are refueled on-site at GE Large Sites. The emissions from these vehicles are included in the combustion-of-fuels calculations for Large Sites discussed above.

Sources Not Included

The following GHG emission sources are not included in the Inventory because GE does not have operational control:

- Minority-owned joint ventures
- Energy-generation facilities where GE has a service relationship, but where GE does not have operational control
- Aircraft, motor vehicles, railroad locomotives, etc., owned by GE, but leased to and controlled by others
- Most WRI/WBCSD Scope 3 sources including but not limited to the extraction and production of purchased materials and the transportation of purchased fuels, etc.

The following operational emission sources are not included in GE's GHG Inventory due to very small contributions:

- Motor vehicles controlled by GE but not centrally managed through a third-party fleet contractor, Penske Truck Leasing, Ryder Logistics, or RXO Logistics
- Motor vehicles owned by GE businesses outside the United States, Canada, and Puerto Rico that are not refueled at GE properties
- Leakage of HFCs from GE-owned and -operated air conditioning, refrigeration, and chilling systems
- Remedial activities operationally controlled by GE

Base Year Adjustment

GE established 2019 as a base year for measuring progress toward achieving its GHG emissions-reduction commitments. As outlined in the Protocol, base year GHG- emissions data are adjusted to reflect the changes in GE structure and determine the real change in emissions and energy use of the current portfolio of operations during a given period. Prior interim years are not adjusted except upon discovery of significant error.

All "large sites" as defined above are base adjusted per the Protocol, with acquired sites added and divested sites removed. Individual small sites are not base year adjusted. However, when a GE business is divested or acquired, the small sites from that business are baseline adjusted. Mobile sources are not base adjusted.

Quality Assurance

For Scope 1 and 2, GE is continuing to work toward increasing the accuracy of its GHG Inventory. It has modified its GHG Inventory collection database to simplify it, developed numerous guidance documents and an internal guidance website, and has provided extensive training for internal users on the Inventory. As an added measure, GE periodically performs data-quality reviews on the GHG Inventories, including side-by-side comparisons of GHG emissions across years, to identify and understand the reasons for significant differences (changes in production, fuel, manufacturing processes, etc.). When data-quality issues are identified, research is initiated to analyze and correct gaps where necessary. Internal Audit resources have audited the appropriateness of source data and methodology used to process and report climate change, carbon, and energy data according to industry standard frameworks including TCFD, SASB and GRI based upon the support provided.

GHG and Energy Efficiency Projects

GE is focused on generating value and outcomes for our customers, the Company, people, and the planet. One way the businesses measure that value is to track energy efficiency and GHG reduction projects. Each project logged includes descriptive information, projected costs, and estimated GHG and cost savings.

GE businesses may purchase carbon offsets to meet internal goals, however, these reductions are not included in GE's reported emission values.

Appendix II | Scope 3 Use of Sold Products Methodology

In 2021, GE set an ambition to be a net zero company by 2050, including our own operations as well as Scope 3 emissions from the use of sold products. GE's corporate-level Greenhouse Gas (GHG) emissions inventory is based on the GHG Protocol Corporate Accounting and Reporting Standard.[1] As discussed in more detail below, these Scope 3 use of sold product emission calculations are based on a number of complex inputs and assumptions, including significant assumptions that are uncertain because of their forward looking nature, such as how customers choose to use our products in the future. We expect to continue refining our methodology for calculating and our reporting of these emissions as practices in our industries continue to mature and based on changes in trends, assumptions or other factors that may develop over time.

GE Vernova

GE Vernova serves power generation, industrial, government and other customers worldwide with products and services related to energy production. GE Vernova benefits from one of the broadest portfolios in the industry that uniquely positions us to lead the energy transition with products, services and integrated solutions to grow renewable energy generation, lower the cost of electricity and modernize the grid. One third of the world's electricity is generated with the help of GE technology. GE Vernova's portfolio includes power generation technologies (such as gas turbines and steam turbines) which produce direct-use emissions through the combustion of fossil fuels, and power generation technologies (such as wind, hydro, and nuclear), which do not produce direct-use emissions when generating electricity. Our reporting for the use of sold products from these businesses only covers the estimated lifecycle of direct use-phase emissions associated with combustion of fossil fuels in GE power turbines (gas turbines and steam turbines) for products sold in the reporting year.

Estimating CO_2 emissions from use of sold products requires a series of calculations that define how different power turbines are expected to operate over their useful lifetime. Estimated lifecycle emissions are a function of the rate of emissions produced per unit of electricity generated and the amount of electricity a turbine generates over its useful life. Given unique characteristics of each, gas turbines and steam turbine calculations and operating assumptions are estimated using slightly different methodologies as follows.

Gas turbines (both those running as simple cycle peakers or in a combined cycle plant configuration):

Factors that affect the **rate of CO_2 emissions produced per unit of electricity generated** for a gas turbine:

- The fuel being combusted affects the amount of carbon dioxide emissions per unit of fuel utilized. The overwhelming majority of gas turbines GE provides today are utilizing natural gas (or methane CH_4) as their primary fuel, and as such we assume for the purpose of this methodology that all turbines are utilizing natural gas. In the future, gas turbines will increasingly operate on hydrogen or other low or zero-carbon fuels and further segmentation by fuel will be required, but as of today, we determined this assumption to be appropriate. Natural gas produces 53.06 kg of CO_2 for every million British Thermal Units (BTUs) of thermal energy of thermal energy as measured on a higher heating value or HHV basis. **Source: US EPA's "Emission Factors for Greenhouse Gas Inventories website"**.[2])
- GE Vernova has a wide range of heavy duty and aeroderivative gas turbines in its portfolio. The particular gas turbine model and plant configuration (whether a simple cycle peaker, or in combined cycle) affect the efficiency by which it converts a fossil fuel into electricity. Each gas turbine model and configuration are characterized by a performance rating consisting of a base load output and heat rate. Output is a measure of the turbine's full rated power capability (how many megawatts (MW) it can produce at full load). The heat rate is a measure of how much fuel (measured in BTUs on a lower heating value or LHV basis) is required to be combusted to generate a unit of electricity (measured in kilowatt-hours (kWh). Performance ratings of each turbine model are provided in GE Gas Power's annual product catalog. (**Source: GE Gas Power 2021/2022 Product Catalog**.[3])
- The key difference between higher and lower heating values referenced above is that HHV can be determined by bringing all the products of combustion back to the original pre-combustion temperature while allowing any produced vapor to condense. The LHV to HHV ratio is a constant and for natural gas is 1.108. This multiplier must be used to convert the catalog heat rates from a lower heating value (LHV) basis to a higher heating value (HHV) basis. (**Source: The Engineering Toolbox: Fuels – Higher and Lower Calorific Values**)

1 See https://ghgprotocol.org/corporate-standard

2 https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf

3 https://www.ge.com/gas-power/resources/catalog

- Performance ratings are based on a turbine in a new and clean condition, before any effects of non-recoverable performance degradation. Gas turbine efficiency can degrade by as much as 5 to 6% by the end of its useful life. A factor equal to 1.03 is applied to the lifecycle emissions estimate to account for non-recoverable performance degradation (based on the average of 0 degradation when new and max of 6% at end of life). (**Source: GE Gas Power Application Engineering gas turbine non-recoverable performance degradation curve**).
- Gas turbines do not always operate at their full rated load. When operating at part load, the emissions rate per unit of electricity generated will increase. The amount of increase in emissions at part load is a function of the turbine type (high-efficiency F-class and H-class gas turbines vs other frame and aeroderivative gas turbine models) and whether in simple cycle peaking operation or as part of a combined cycle. When operating at 50% of rated power, F-class and H-class gas turbines in simple cycle application have an emissions factor that is 20% higher than when at base load, and in combined applications have an emissions factor that is an estimated 10% higher than when at base load. When operating at 50% of rated power, other gas turbine models in simple cycle application have an emissions factor that is 30% higher than when at base load, and in combined applications have an emissions factor that is 15% higher than when at base load. (**Source: GE Vernova's Gas Power Application Engineering estimates**)
- During startup of a gas turbine, initial emissions can exceed that intensity. Simple cycle gas turbines start quickly so the total emissions during start-up are quite small relative to combined cycle plants. For combined cycle plants, the start-up emissions can be more significant due to longer start-up. If a combined cycle plant averages 8 hour of operation per start over its life, the start-up emissions would increase lifecycle emissions by an estimated 4%. For the purpose of this methodology, we have increased all gas turbine estimated emissions for simple cycle and combined cycles conservatively by this 4% factor. (**Source: GE Vernova's Gas Power Application Engineering estimates**).

Factors that affect the amount of electricity generated for a gas turbine (and thereby its total estimated lifecycle emissions):

- The operating life of a gas turbine can vary significantly. While the physical turbine can last several decades, it may be retired earlier than that based on the power plant economics. Those economics deteriorate sooner on average for gas plants operating in advanced economies which typically exhibit slower demand growth. In developing and emerging economies, typically with higher GDP and electricity demand growth, turbines have longer operating lives. For the purpose of this methodology, gas turbines in advanced economies (OECD countries) are assumed to have a 25-year operating life on average. For gas turbines located in emerging or developed economies (Non-OECD countries), the average operating life is assumed to be 30 years. (**Source: GE Vernova's Gas Power Marketing Estimate**).
- Several factors affect the average annual operating hours and capacity factors for gas turbines, and how they might change over their operating lives. Gas turbine efficiency class (H-class, F-Class, Other), turbine configuration or use (simple cycle peaker vs. combined cycle), and location (advanced economies vs. emerging or developing economies) are the three most significant drivers that are used for the purpose of this methodology. Details of these drivers are described as follows and assumptions quantified in the table below. (**Source: GE Vernova's Gas Power Application Engineering and Marketing Estimate**)
- Larger gas turbines with higher efficiency result in lower variable operating costs and thereby tend to dispatch or run more frequently based on improved economics for plant owners/ operators. GE's turbines are segmented into three main classes in order from largest and most efficient to smaller and lower efficiency. H-class are the largest, most efficient, dispatching most (7HA/9HA), followed by utility F-class (7F/9F/GT26), and then all other frame and aeroderivative turbines (E-class, 6F and aeroderivatives).
  - Combined cycle plant configurations have significantly higher efficiencies than simple cycle peaking turbines and thereby tend to dispatch or run more frequently based on improved economics for plant owners/operators. Over time, however, renewables will increasingly displace a portion of the generation from combined cycle plants mainly, while peakers will still be needed for shorter durations when renewable sources (wind, sun, or water) are not available. As such, combined cycle plants in this methodology have higher average capacity factors now, but are assumed to see lower capacity factors over time. Peakers have lower capacity factors now but are expected to see less deterioration in capacity factors over time.
  - Advanced economies (OECD countries) tend to have lower electricity demand growth rates and higher focus on transitioning to lower carbon sources of generation like renewables when compared with emerging or developing economies (non-OECD countries). The latter also tend to have lower reserve margins, meaning the installed capacity of power plants tend to run more to provide desired system reliability. As such, for the purpose of this methodology, turbines installed in OECD countries are assumed to have slightly lower capacity factors than equivalent turbines/ configurations in non-OECD countries. Additionally, because of the lower electricity demand growth and faster rate of adoption of renewables, the capacity factors in OECD countries over time are assumed to be lower than their counterparts in non-OECD countries. Lastly, for the purpose of this methodology, average lifetime capacity factors are assumed to be the average of their year-1 capacity factors and their capacity factor in the last year of average life.
  - Time spent at part load operation (less than full rated output of the gas turbine) as described in the prior section have higher average rates of emissions (kg/kWh generated). However, time spent at part load means fewer kWhs are generated. Simple cycle peaking plants tend to spend a greater percentage of their operating time at or near full load. Conversely, combined cycle plants tend to spend a slightly higher percentage of operation at part loads (balancing demand and variable renewables). For the purpose of this methodology, it is assumed that the operating profile of a simple cycle peaker is represented by 90% of operating hours at full rated load and 10% at 50% load, while combined cycles are represented by 80% of operating hours at full load and 20% at 50% load.

GE Vernova calculates CO_2 emissions from the use of sold products on both a gross and net basis. The gross emissions value projects the life-of-product CO_2 emissions created from combustion of natural gas. The net emissions value recognizes that our turbines are intermediate products and only create emissions when operating as part of a complete power plant system. The net emissions value reflects the emissions amount allocated to GE Vernova based on the average percentage of scope on a plant turnkey CAPEX basis, recognizing that many companies contribute goods and services to the building/ operations of that power plant.

Gross CO_2 emissions are calculated as follows:

$$GHG_{Gross} = \sum_{Turbines\ sold} (Turbine\ Count * Rated\ Output * ((Rated\ Baseload\ Heat\ Rate * \%\ time\ at\ baseload) + (Rated\ Baseload\ Heat\ Rate * 50\%\ part\ load\ factor * \%\ time\ at\ 50\%\ load * 50\%)) * 1.108 \frac{HHV}{LHV} \text{multiplier} * 1.03\ lifetime\ degradation\ factor * 1.04\ lifetime\ startup\ factor * 53.06\ EF_{CO_2} * average\ lifetime\ capacity\ factor * hour - year\ conversion\ factor\ (8760) * average\ lifetime)$$

Where:

- GHG_{total} = Total GHG Emissions in metric tonnes CO_2
- Turbine Count = Number of turbines shipped in year of interest (2022)
- Rated Output = The catalog rated output of the turbine or combined cycle plant (kW)
- Rated Baseload Heat Rate = The rate at which the turbine converts heat energy to electrical energy (Btu/kWh LHV)
- % time at baseload = percentage of assumed operating hours of the plant at full rated load
- 50% part load factor = the multiplier applied to represent higher emissions rate at part load
- % time at 50% part load = percentage of assumed operating hours of the plant at 50% part load
- HHV/LHV conversion = the constant for natural gas to account for heat of vaporization
- Lifetime degradation factor = 3% adder applied to account for average degradation over operating life
- Start Up Emissions Factor = A factor of 4% applied to all plants to recognize higher emissions during plant start up
- EF_{CO_2} = The factor used to convert activity to emissions
- Average Lifetime Capacity Factor = the average % of time the plant is assumed to be operating per year over its lifetime
- Average Lifetime = The expected average years of operation for a plant

Net CO_2 emissions are calculated as follows:

$$GHG_{Net} = \sum_{Turbines\ sold} (GHG_{Gross}) * (allocation\ factor))$$

Where:

- GHG_{Net} = forecast life of product CO_2 emissions after Turnkey CAPEX scope allocation (metric tonnes)
- GHG_{Gross} = gross forecast life of product CO_2 emissions (metric tonnes)
- Allocation Factor = % of average scope of plant turnkey CAPEX

Steam turbines (coal-fired steam plants are included here, nuclear plants which have no direct carbon emissions are excluded, and emissions associated with combined cycle steam turbines were included above in the gas turbine emissions):

The **rate of CO_2 emissions produced per unit of electricity generated** for coal-fired steam plants in this methodology is based on the median lifecycle emissions factor for coal plants as provided by the Intergovernmental Panel on Climate Change (IPCC), which is the United Nations body for assessing the science related to climate change, in their 2018 IPCC Report. The median rate was 820 g CO_2/kWh. (**Source: Intergovernmental Panel on Climate Change (IPCC) in their 2018 IPCC Report**).[4]

Factors that affect the amount of electricity generated for a steam plant (and thereby its total estimated lifecycle emissions):

- The operating life of a steam turbine can vary significantly. While the physical turbine can last several decades, it may be retired earlier than that based on the power plant economics and/or policy to shift away from coal-fired generation. For the purpose of this methodology, steam turbine operating lives are assumed to average 44 years in India, 38 years in Middle East, and 37 years in Asia Pacific. (**Source: GE Vernova's Steam Power Marketing Estimate**).
- Several factors affect the average annual operating hours and capacity factors for steam plants, and how they might change over their operating lives, but location is the most significant factor. For this methodology, lifetime average capacity factors for coal plants are based on the International Energy Agency's World Energy Outlook 2021. In their Stated Policies Scenario, they forecast average capacity factors for coal plants by region for the time period of 2019-2025. Capacity Factors from this scenario are as follows: Asia Pacific: 55%, India: 54%, China: 53%, Eurasia: 43%. Conservatively, this methodology assumes those capacity factors remain constant for the remainder of their product life. (**Source International Energy Agency's World Energy Outlook 2021, Stated Policy Scenario**)
- GE Vernova calculates CO_2 emissions from the use sold products on both a gross and net basis. The gross emissions value projects the life-of-product CO_2 emissions created from combustion of coal. The net emissions value recognizes that our steam turbines are intermediate products and only create emissions when operating as part of a complete power plant system. The net emissions value reflects the emissions amount allocated to GE Vernova based on the average percentage of scope on a plant turnkey CAPEX basis, recognizing that many companies contribute goods and services to the building/operations of that power plant. For the purpose of this methodology, GE's average scope for coal-fired steam plants is 6% of turnkey CAPEX. (**Source: GE Vernova's Steam Power Marketing Estimate**).

Gross CO_2 emissions are calculated as follows:

$$GHG_{Gross} = \sum_{Turbines\ sold} (Turbine\ Count * Rated\ Output * EF_{CO_2} * average\ lifetime\ capacity\ factor * hour - year\ conversion\ factor\ (8760) * average\ lifetime)$$

Where:

- GHG_{Gross} = Total GHG Emissions in metric tonnes CO_2
- Turbine Count = Number of coal-fired steam turbines shipped in year of interest (2022)
- Rated Output = The rated output of the steam turbine (kW)
- EF_{CO_2} = The factor used to convert activity to emissions 820 (gCO_2/kWh)
- Average Lifetime Capacity Factor = the average % of time the plant is assumed to be operating per year over its lifetime
- Average Lifetime = The expected average years of operation for a plant

[4] https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_annex-iii.pdf (page 7 of 28)

Net CO_2 emissions are calculated as follows:

$$GHG_{Net} = \sum_{\text{Turbines sold}} (GHG_{Gross}) * (\text{allocation factor}))$$

Where:

- GHG_{Net} = forecast life of product CO_2 emissions after Turnkey CAPEX scope allocation (metric tonnes)
- GHG_{Gross} = gross forecast life of product CO_2 emissions (metric tonnes)
- Allocation Factor = % of average GE scope of turnkey coal plant CAPEX

Using these assumptions and calculations:

Net emissions for 2022 are estimated as 320 Mmt of CO_2. This compares against 477 Mmt of CO_2 in 2021 and 506 Mmt of CO_2 in 2019.

Gross emissions for 2022 are estimated as 854 Mmt of CO_2. This compares against 1,759 Mmt of CO_2 in 2021 and 2,552 Mmt of CO_2 in 2019.

GE Aerospace

GE Aerospace designs and produces commercial and military aircraft engines, integrated engine components, electric power, and mechanical aircraft systems. We have an installed base of ~40,900 commercial aircraft engines. In this report we disclose estimated lifecycle direct use-phase emissions associated with combustion of jet fuel in GE and GE partnership[5] regional, narrowbody, widebody, and business jet aircraft commercial engine products installed on aircraft delivered in 2022.[6]

Estimating CO_2 emissions from Use of Sold Products requires a series of calculations that define how different aircraft/engine platforms are expected to operate over their useful lifetime. We develop specific models for each aircraft/engine combination and model passenger and freighter applications separately.[7] Wherever possible, we have used publicly or commercially available data to support our calculations. Additionally, as highlighted in the Developing the Future of Flight section of this report, GE Aerospace has joined the International Aerospace Environmental Group (IAEG) as an active participant in the working group developing a document titled "Guidance for Calculating Civil Aviation Scope 3 Emissions: Category 11 – Use of Sold Products" so that our methodology can align with future industry guidance and approaches as those evolve.

GE Aerospace calculates CO_2 emissions from the use of sold products on both a gross and net basis. The gross emissions value projects the life of product CO_2 emissions created from combustion of jet fuel (including CO_2 associated with production of the fuel) at the aircraft level. The net emissions value recognizes that our engines are intermediate products and only create emissions when operating on an aircraft. The net emissions value reflects the emissions amount allocated to GE Aerospace using GHG Protocol guidance for intermediate products. Only the net emissions values are included in GE's 2022 Sustainability Report.

To calculate direct use Scope 3 Use of Sold Products emissions for regional, narrowbody, widebody, and business jet aircraft, we use the following data elements and data sources:[8]

- Establish the number of regional, narrowbody, widebody, and business jet aircraft deliveries in the reported year that are powered by GE and GE partnership engines[9] (**Source = Cirium's Fleet Analyzer tool**)
- Establish the expected useful life of each aircraft/engine combination identified in the aircraft deliveries data set (**Source: historical data on aircraft retirements from Cirium's Fleet Analyzer tool**)
- Establish the average seating configuration for each aircraft/engine combination identified in the aircraft deliveries data set (**Source = Cirium's Fleet Analyzer tool**)[10]
- Construct a summary of overall average utilization and average flights per year for each passenger and freighter aircraft/engine combination identified in the aircraft deliveries data set. (**Source: detailed analysis of FlightRadar24 aircraft flight data**)
- Calculate the Equivalent Still Air Distance (ESAD) for each flight based on origin and destination airports and then calculate the Average Utilization and Weighted Average Flown Distance (ESAD) for each passenger and freighter aircraft/engine combination identified in the aircraft deliveries data set (**Source: detailed analysis of FlightRadar24 aircraft flight data**)
- Using the weighted average flown distances, calculate the fuel burn per flight for each passenger and freighter aircraft/engine combination identified in the aircraft deliveries data set (**Source: GE proprietary fuel burn models**)
- Use a Jet A/A1 fuel lifecycle emissions factor of 3.846 kg CO_2 / kg fuel (accounting for production and combustion) to calculate CO_2 emissions from fuel use (**Source: ICAO**)[11]
- Establish the engine weight to be used in physical allocation calculations (**Source: Federal Aviation Administration Type Certificate Data Sheets**)
- Establish the aircraft weight to be used in physical allocation calculations (**Sources: 1. aircraft Operating Empty Weight from airframer issued airport planning documents[12]; 2. average aircraft seating by aircraft type; 3. average load factor from IATA; 4. average passenger weight plus luggage per FAA guidance; and 5. 50% of fuel weight required to fly the weighted average flown distance**)
- Establish GE ownership percentages to be used in equity share allocation calculations for GE partnership engines[13]

[5] CFM International is a 50-50 joint company between GE and Safran Aircraft Engines. Engine Alliance is a 50-50 joint company between GE and Pratt & Whitney. GE Honda Aero Engines LLC is a 50/50 joint company between GE Aerospace and Honda Aero, Inc.

[6] Reported Scope 3 Use of Sold Products CO_2 Emissions excludes military engines, aeroderivative engines, and general aviation engines.

[7] GE models freighter aircraft using freighter specific data which can be significantly different from data for passenger variants of the same aircraft.

[8] 2019 data is used for multiple data elements to minimize artifacts related to abnormal aircraft usage in 2020-2022 due to the global COVID-19 pandemic.

[9] Spare engines delivered in the reported year are not included in the calculation of gross CO_2 emissions since engines only create emissions when installed on aircraft and installation of a spare engine displaces a previously installed engine.

[10] To calculate the freighter revenue passenger kilometers, GE uses the average seating from the passenger variant of the same aircraft type along with the unique average utilization and flown distance of the freighter variant.

[11] https://www.icao.int/environmental-protection/CORSIA/Documents/ICAO%20document%2007%20- %20Methodology%20for%20Actual%20Life%20Cycle%20 Emissions%20-%20March%202021.pdf. The impact of Sustainable Aviation Fuel (SAF) on emissions is currently excluded from GE Aerospace's calculation on the basis of materiality (less than 1% of total fuel consumed in 2022). Use of SAF is projected to increase significantly in coming years such that modeling of SAF and Jet A/A1 fuel will be appropriate in the future.

[12] The operating empty weights of freighters are different than the passenger variants of the same aircraft type. The payload for freighters is based on a maximum structural payload consistent with the palletized configuration unique to each aircraft type. Calculation of average seating, average load factor, and average passenger weight plus baggage is not required for freighters.

[13] For CFM International, Engine Alliance, and GE Honda Aero LLC products, each partner company has a 50% equity investment in the product and will report 50% of the calculated gross Scope 3 Use of Sold Products emissions.

Gross CO_2 emissions are calculated as follows:

$$GHG_{Gross} = \sum_{Aircraft} \textit{(Aircraft count * lifetime * fuel burn per flight at the weighted avg flown distance * jet fuel emissions factor * number of flights per year)}$$

Where:

- GHG_{Gross} = Gross forecast life of product CO_2 emissions (metric tonnes)
- Aircraft count = regional, narrowbody, widebody, and business jet aircraft deliveries in the reported year powered by GE or GE partnership engines
- Lifetime = the expected years of operation of an aircraft/engine combination
- Weighted average flown distance = calculated from overall average utilization and average flights per year
- Fuel burn per flight = estimated fuel burn from modeling of the weighted average flown distance using GE's proprietary fuel burn models
- Use a Jet A/A1 fuel lifecycle emissions factor of 3.846 kg CO_2 / kg fuel to account for CO_2 emissions from production and combustion
- Number of flights per year = average annual utilization for each aircraft/engine combination being modeled

Net CO_2 emissions are calculated as follows:

$$GHG_{Net} = \sum_{Aircraft} (GHG_{Gross}) * \text{(physical } \textit{allocation factor}) * \text{(equity share allocation factor))}$$

Where:

- GHG_{Net} = forecast life of product CO_2 emissions after allocation factors applied (metric tonnes)
- GHG_{Gross} = gross forecast life of product CO_2 emissions (metric tonnes)
- Physical Allocation Factor = weight of the engines divided by the weight of the aircraft
- Equity Share Allocation Factor = GE ownership percentage in partnerships (applicable only for GE partnership products)

This allocation methodology is consistent with the GHG Protocol Technical Guidance for Calculating Scope 3 Emissions.[14]

New Unit Carbon intensity metric is calculated as follows:

Step 1 – Calculate Revenue Passenger Kilometers (RPK) for passenger aircraft

$$RPK = \sum_{Aircraft} \textit{Aircraft count * lifetime * weighted average flown distance * } 1.11 \textit{ (to convert flown distance in nautical miles to the Great Circle Distance in miles) * } 1.60934 \textit{ (to convert miles to kilometers) * number of flights per year * average number of seats (pax equivalent for freighters) * average load factor}$$

Step 2 – Calculate Carbon Intensity Metric

Carbon Intensity Metric = $(GHG_{Net}) \div RPK$

Using these assumptions and calculations:

Net emissions for 2022 are estimated as 34 Mmt of CO_2. This compares against 45 Mmt of CO_2 in 2019.

Gross emissions for 2022 are estimated as 580 Mmt of CO_2. This compares against 693 Mmt of CO_2 in 2019.

[14] See https://ghgprotocol.org/sites/default/files/standards/Scope3_Calculation_Guidance_0.pdf

Appendix III | Water Inventory

Methodology

GE's water-use inventory process follows the reporting principles articulated by the World Resources Institute/World Business Council for Sustainable Development (WRI/ WBCSD) in its Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, revised addition. For the operational inventory, GE follows the "control" approach and includes freshwater use from "criteria sites" over which the company has operational control.

Inventory Scope

GE collects water-usage data from its top water-consuming sites, called "criteria sites." Criteria sites are those that have used 15 million gallons or more of water per year, at any point in time. This approach captures approximately 90% of GE's total freshwater consumption.

Water usage captured includes potable, process, and sanitary water, as well as once through cooling water from freshwater sources. Sites that withdraw salt/brackish water for once-through cooling purposes are not included in the reported values. Instead, GE focuses on freshwater sources, based on the rationale that those sources pose a greater environmental impact than salt/brackish water use.

The inventory scope is adjusted annually due to divestiture, closure or consolidation with other facilities, acquisitions, newly established facilities or when facilities meet the reporting criteria for the first time.

Management

To collect the necessary water-use-inventory data, GE maintains a greenhouse gas (GHG) and water inventory database. The database is integrated with GE's Large site greenhouse gas and energy inventory processes. GE facilities use the database to enter quantities of water withdrawn from each of the following source categories:

- Public/commercial
- On-site groundwater well
- Rainwater
- Fresh surface water
- Brackish surface water or seawater

Water withdrawn for the purpose of once-through cooling is entered into a separate category in the database so that these cooling water sources may be tracked. The system also apportions water use into source category, business unit, site, country, and region.

Quality Assurance

To increase the accuracy of the water-use inventory, GE has simplified the database to reduce the opportunity for error. In addition, GE provides guidance documents, an internal guidance website, and extensive training related to the water inventory and the use of the tool. Finally, GE performs data-quality reviews on the water-use inventory, including side-by-side comparisons of water-use data to identify and understand the reasons for significant differences (such as changes in production, changes in processes, water-use-reduction projects, or other factors). Data anomalies are identified, analyzed, and corrected where necessary through this process. If significant deviation in water use emerges, a third-party environmental engineering consulting firm may be engaged to validate restated water use values.