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Report

# Greenhouse Gas (GHG) Inventory for Elna PCB (M) Sdn Bhd

September 2024

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# EXECUTIVE SUMMARY

EeHSSE Associates Sdn Bhd (EeHSSE, formerly known as *EeHSSE Academy Sdn Bhd*) was engaged by Elna PCB (M) Sdn Bhd (Elna PCB) to provide consultancy services on developing a baseline greenhouse gas (GHG) emission inventory for its operations.

## Boundary and Limitations

The GHG boundary was established by reviewing Elna PCB's organizational boundaries and operational controls. Only activities of the production facility located in Prai Industrial Estate, Pulau Pinang was included in this GHG inventory.

## GHG Emission

This report shows Elna PCB's GHG emissions for its base year, i.e. financial year (FY) 2023, with reporting period of 1st January 2023 to 31st December 2023. The GHG emission is segmented into separate totals for Scope 1 and 2, and Scope 3.

The total GHG emission was calculated based on sources that fall under Scope 1 (direct emissions from owned vehicles, fuel consumption in boiler, fugitive losses from refrigerant and fire suppression agent, and emissions from sewage treatment plant), Scope 2 (purchased electricity), and Scope 3 emissions, which included the selected categories of Category 6 – Business Travel (land and air transport) and Category 7 – Employee Commute. A separate line item is presented for direct $CO_2$ emission from biogenic sources.

The total GHG emissions for Scope 1 and 2 amounted to **seventeen thousand and ninety-three (17,093) tons of carbon dioxide ($CO_2$) equivalent**. When Scope 3 is included, it is totalled to seventeen thousand four hundred and six (17,406) tons of $CO_2$ equivalent as shown in table below.

| Scope | Emission (ton-$CO_2e$) | Percentage of Total Scope 1 & 2 Emissions (%) |
|---|---|---|
| Scope 1 – Direct Emission | 515.31 | 2.84 |
| Scope 2 – Indirect Emissions | 16,578.16 | 96.99 |
| Scope 3 – Other Indirect Emissions (selected categories) | | |
| • Business Travel | 7.66 | |
| • Employee Commute | 305.57 | |
| Other Direct GHG data (not included in Scope 1)<br>• Direct biogenic $CO_2$ emissions | 0.31 | |
| **Total Scope 1 and 2** | **17,093.47** | |
| **Total Scope 3** | **313.23** | |
| **Grand Total** | **17,406.70** | |

## Uncertainties

A discussion on the data uncertainties is included in **Section 7** of the report. The overall uncertainty in the data included in the inventory is considered low, except for Scope 3 Category 6.

## Reduction Strategies

Possible GHG reduction opportunities are discussed at high level in **Section 8**. The data required to make detailed assessments of reductions must be developed through a formal process of energy audits, energy management processes, and feasibility studies of potential reduction projects.

# 1 Introduction

EeHSSE Associates Sdn Bhd (EeHSSE, formerly known as *EeHSSE Academy Sdn Bhd*) was engaged by Elna PCB (M) Sdn Bhd (Elna PCB) to provide consultancy services on developing a baseline greenhouse gas (GHG) emission inventory for its operations.

To comply with the Responsible Business Alliance (RBA) Code of Conduct, it is a requirement for Elna PCB to commit to environmental responsibility, to develop GHG management capabilities that include tracking, documenting and publicly reporting energy consumption, all Scope 1 and 2 emissions, and significant Scope 3 greenhouse gas emissions.

This greenhouse gas inventory was completed following the *GHG Protocol* methodology, a global standardized framework jointly established by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). This report describes the emissions and details the inventory of GHG focusing on the main business segment, i.e. the operations of Elna PCB Production Facility in Perai, Penang. Other business operations/ entities within the list of PSA Group Global Brands Manufacture (GBM) were not part of the agreed scope of work.

This report discloses the baseline GHG inventory for financial year 2023 (FY2023), that covers the reporting period from 1st Jan 2023 to 31st Dec 2023. The inventory covered Scope 1 direct emission, Scope 2, and selected categories of Scope 3 indirect emissions, following the *GHG Protocol* definitions.

The approach employed in defining the scope and boundary is shown in **Section 4.** The details of the calculation methodology of the inventory are shown in **Section 5**. The calculation methodology for the GHG inventory has been established by international institutions to ensure that GHG inventories can be used across industries and countries. Practical aspects of preparing the inventory such as availability of data, an understanding of activities that contribute the most to Elna PCB's GHG inventory are discussed in this chapter. The inventory and analysis of emissions breakdown are shown in **Section 6**. As GHG inventory relies on data from the Elna PCB's records and emission factors from third parties, this information is associated with a degree of uncertainty. Uncertainty associated with the GHG inventory justified with robust estimation and documentation is acceptable in accordance with the *GHG Protocol*. In addition, the concept of materiality that is used to determine whether a source of emissions can be excluded from the inventory is applied to sources with relatively small emission. The uncertainty and materiality discussion are shown in **Section 7** of this report. Finally, high level discussion on potential GHG emissions reduction are presented in **Section 8** of this report.

# 2 Statement of Intent

This inventory forms part of Elna PCB (M) Sdn Bhd's commitment to measure and manage their greenhouse gas emissions. The baseline GHG emission inventory was developed to establish GHG methodology that can be used on an ongoing basis for the operations and serve as basis in developing short- and long-term environmental planning to meet carbon reduction by the company.

# 3 Organization Description

Elna PCB (M) Sdn Bhd was established in 1994 and became affiliated with Passive System Alliance (PSA) in 2018. Headquartered in Penang, Elna PCB is a leading printed circuit board (PCB) manufacturer, specializing in manufacturing of high-performance PCB and components for various applications, including automotive, industrial, and home appliances. Elna PCB also has a strong focus on research and development in the following aspect:

- Product Feature
- Registration Feature
- Drilling Capability
- Plating Capability
- Solder Mask/ Legend Capability
- Impedance Control Capability
- Surface Finishing

- Material Preference

# 4 GHG Inventory Boundaries

## 4.1 Organizational Boundaries

The organizational boundaries were set with reference to the methodology described in the *GHG Protocol* and *ISO 14064-1:2018* standards. The *GHG Protocol* allows two distinct approaches to consolidate GHG emissions: the equity share and control (financial or operational) approaches. This GHG inventory has adopted the "operational control" consolidation approach, since it best represents the organization structure of Elna PCB. Under the consolidation approach, the company accounts for 100 percent of the GHG Emissions from operations over which it has control.

Based on the agreed scope of work, this report only focuses on production activities at Plot 558, Lorong Perusahaan 4, Prai Industrial Estate, 13600 Perai, Pulau Pinang. The inventory and analysis presented herein exclude any activities associated with the expansion of the new plant that commenced construction in Quarter 4, year 2023.

## 4.2 Operational Boundaries

Operational boundaries refer to which operational activities at a facility included in the inventory. The GHG emissions sources included in this inventory were identified with reference to the methodology in the *GHG Protocol* and *ISO14064-1:2018* standards. As adapted from the *GHG Protocol*, these emissions were classified under the following categories:

- **Direct GHG emissions (Scope 1)**: emissions from sources that are owned or controlled by the company.
- **Indirect GHG emissions (Scope 2)**: emissions from the generation of purchased electricity, heat and steam consumed by the company.
- **Indirect GHG emissions (Scope 3)**: emissions that occur as a consequence of the company's activities but from sources not owned or controlled by the company.

In accordance with *GHG Protocol*, activities that lie under the ownership/ control of Elna PCB and are therefore, quantified for this inventory. The emission sources are further described in **Section 5.2**.

## 4.3 Reporting Period and Base Year

This GHG emissions report reflects the reporting period: 1st Jan 2023 to 31st Dec 2023, which is Elna PCB's fiscal year 2023 (FY23). Considering data completeness, this forms the base year for Elna PCB GHG inventory.

## 4.4 Elna PCB's GHG Team

The GHG emissions assessment at Elna PCB is led by Mr. Elanko A/L Kuppusamy, Human Resource Department. The following personnel contributed to the development of the base year GHG inventory:

- Mr. Lim Choon Keat, Technical (Utility) Department
- Ms. Siti Rohani binti Ahmad, Human Resource Department
- Mr. Dhanabalan A/L V Muniandy, Human Resource Department
- Ms. Nur Batrisyia Hadfina Binti Azmi, Environment, Health and Safety Department
- Mr. Muhammad Haniff Hazwan Bin Ruslan, Technical (Utility) Department
- Mr. Lai Chaw Kong, Information Technology (Electronic Data Processing) Department

# 5 Methodology

## 5.1 Approach

The methodology adopted for conducting the GHG accounting was according to *The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard (Revised Edition)* published by WRI/ WBCSD. Emissions from all sources are calculated by multiplying activity data with the relevant corresponding emission factor.

## 5.2 GHG Data Collection

Data collection methodology varies for different sources and depends on the type of data maintained by Elna PCB. For dataset that are not well maintained or not available, assumptions were made based on best available information with consensus from Elna PCB GHG Team. The data collection sources, methodology, and assumptions made for the assessment are summarized in **Table 5-1** below.

### 5.2.1 GHG Emission Sources

As per the *GHG Protocol*, three "scopes" are defined for GHG accounting and reporting purposes. The specific sources of emissions for Scope 1, 2, and 3 for Elna PCB are shown in **Sections 5.2.2** to **5.2.4** below.

### 5.2.2 Scope 1 Direct Emission Sources

Scope 1 emissions are those occur from sources that are owned or operationally controlled by the company. These are mandatory to be reported by the company. The following are the emission sources under Scope 1:

- Stationary combustion:
  - $CO_2$ emissions from the combustion of gaseous fuels (i.e. natural gas) in the buildings or facilities, from heating equipment (i.e. boiler), and
  - $CO_2$ emissions from the combustion of gaseous fuels (i.e. liquefied petroleum gas) in the buildings or facilities, from heating equipment (i.e. cooking stove) for the preparation of food in the canteen.
- Mobile combustion:
  - $CO_2$ emissions associated with liquid fuel consumption (i.e. petrol and diesel) in transport equipment, i.e. six (6) vehicles owned by the company and assigned to the employees.
- Direct fugitive emissions from anthropogenic systems:
  - Potential leakage of refrigerant from heating ventilation, air conditioning, and refrigeration (HVACR) systems: the five main types of refrigerants used onsite were R-22, R-32, R-410a, R-410b, and R-134a.
  - Potential leakage of suppressant from fixed fire suppression systems: the main suppressant agent was $CO_2$.
- Direct process emissions:
  - Methane ($CH_4$) and $CO_2$ emissions associated with the aerobic sewage treatment system (STP) for Plant 1 and 2. Treatment systems were not equipped with sludge digester. Following requirement in *GHG Protocol*, $CO_2$ from the system is reported as biogenic sources while the methane emission (converted to $CO_2e$) is reported as Scope 1 process emission.

### 5.2.3 Scope 2 Indirect Emission Sources

Scope 2 emissions are those that occur due to purchase of energy (in the form of electricity, steam, heat, and cooling) from the grid or district heating or cooling systems. Scope 2 emissions are also mandatory to be reported. The following are Elna PCB's emission sources under Scope 2:

- Emissions associated with the consumption of electricity via purchases from the grid, separated by two (2) electricity meters.

### 5.2.4 Scope 3 Other Indirect Emission Sources

Emissions which occur due to company activity but are not sources owned or controlled by the company are called Scope 3 emissions. Reporting of these emissions is on a voluntary basis. Based on the relevance of emission activity in the overall company's emissions, the company may choose to include or exclude them from reporting.

The following are the Scope 3 emission categories included in this report:

- Category 6 – Business travel (land travel): Emissions associated with employee's business travel via land transport: the employees conducted majority of business travel via e-hailing car.
- Category 6 – Business travel (air travel): Emissions associated with employee's business travel via third party airlines: the employees conducted some business travel through air. Emissions due to combustion of fuel in aircraft operations were estimated. For the purpose of this report, the air travels for foreign workers engaged by the company, traveling from their home country to Malaysia were also captured as part of Category 6 emission. This emission source shall be continued to be tracked in the subsequent years.
- Category 7 – Employee commute: Emissions associated with commuting (transport of employees from their place of work to their residence). Information for both direct and indirect employees was captured under this category.

Both Category 6 and Category 7 represent the common categories of Scope 3 emission calculations and the company's initial effort in addressing the large coverage of the scope. The inclusion of remaining 13 categories requires detailed analysis/ assessment of their materiality and significance to the operations. The company is committed to further evaluate, track the significant emission sources, and inventorize emissions.

**Table 5-1: Elna PCB Activity Data**

| GHG Emission Source | Data Required | Unit | Data Source | Assumptions/ Estimations Made |
|---|---|---|---|---|
| Fuel combustion, stationary sources<br>• Fuel usage in boiler equipment | Quantity of fuel consumed | $m^3$, GJ | Fuel purchase records provided by the Technical (Utility) Department | No onsite storage of natural gas as supply is via pipeline. Purchase receipt (for natural gas) contains quantity ($m^3$), calorific value (CV) and energy consumption (GJ) of the monthly gas supplies.<br>The quantity of fuel consumed or burned is assumed to be the same as fuel purchased in the reporting period. |

| GHG Emission Source | Data Required | Unit | Data Source | Assumptions/ Estimations Made |
|---|---|---|---|---|
| Fuel combustion, stationary sources<br>• LPG usage in canteen | Quantity of fuel consumed | kg | Fuel purchase records provided by the Human Resource Department. | No beginning and end of FY inventory data was available.<br>The quantity of fuel consumed or burned is assumed to be the same as fuel purchased in the reporting period. |
| Fuel combustion, mobile sources – vehicle diesel and petrol usage<br>• On-road vehicle diesel and petrol usage | Quantity of fuel consumed by company owned vehicles, odometer track record from on-road vehicle | Litre, km | Fuel purchase details and odometer were provided by the Human Resource Department. | The distance travelled and quantity of fuel consumed for on-road vehicle during reporting period is derived from the odometer readings and fuel purchase records of each vehicle from the beginning to the end of reporting period. |
| Refrigerant leakage from HVACR systems | Refrigerant leaked from systems during operations | kg | Refrigerant recharge (top up) details were provided by the Technical (Utility) Department.<br>The recharge was carried out by maintenance contractors as and when required. | Quantity of refrigerant recharged (topped up) and released from retiring equipment without recovery is assumed to be equal to the amount of refrigerant leaked from the system.<br>Refrigerant recharged during reporting period was recorded based on estimation by contractor. This recharge was verified through maintenance receipt records. |
| Leakage from fire suppression system | Suppressant leaked from systems during operations | kg | Suppressant recharge (top up) details were provided by the Environment, Health and Safety (EHS) Department.<br>The recharge carried out by maintenance contractors as and when required. | Quantity of suppressant recharged (topped up) and released from retiring equipment without recovery is assumed to be equal to the amount of suppressant leaked from the system.<br>There was a replacement of existing suppressant during reporting period, it is assumed that the gas was deliberately released upon replacement. |

| GHG Emission Source | Data Required | Unit | Data Source | Assumptions/ Estimations Made |
|---|---|---|---|---|
| Sewage treatment plant | Wastewater generated, BOD concentration | $m^3$, mg/ L | The volume of wastewater generated and inlet BOD concentration were provided by the Technical (Utility) Department | The methodology[1] from EPA was used to quantify total $CH_4$ and $CO_2$ emissions.<br>For the incoming BOD data that was not available, estimated concentration was made from back calculation assuming a 95% efficiency of BOD removal. For the methane correction factor, default values were referenced to IPCC's methodology [2]. |
| Purchased electricity from the grid | Amount of purchased electricity | kWh | Plant 1 and 2 of existing production facility. The electricity meter reading was provided by the Technical (Utility) Department. | Two (2) electricity meters in switch room plant 1 and 2.<br>It was confirmed by the site personnel that construction activities for the new plant did not use electricity from Elna PCB. Construction equipment was powered by fuel supplied by contractors. |
| Business travel by land transport – vehicle distance travelled (vehicles not owned by organization) | Total mileage travelled by employees and type of vehicle | km | Employees' mileage claims for business travels were provided by the Information Technology (Electronic Data Processing) Department. | Emissions were calculated using mileage travelled for e-hailing cars.<br>Emission associated with personnel assigned with company car (and petrol card) was accounted under Scope 1 of mobile combustion |
| Business travel by air transport | Departure and destination airports, class of travel | km | Travelling details maintained by the Information Technology (Electronic Data Processing) Department. | Emissions from flights of different travel distances (short, medium, and long-haul) were calculated using corresponding emission factors.<br>Premium and economy flight classes was considered in the calculation.<br>Due to the unavailability of detailed flight itineraries, flight distance data relied on input from employees during travel claims. |

[1] Greenhouse Gas Emissions Estimation Methodologies for Biogenic Emissions from Selected Source Categories: Solid Waste Disposal Wastewater Treatment Ethanol Fermentation can be referred at https://www.epa.gov/air-emissions-factors-and-quantification/greenhouse-gas-emissions-estimation-methodologies-biogenic
[2] 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

| GHG Emission Source | Data Required | Unit | Data Source | Assumptions/ Estimations Made |
|---|---|---|---|---|
| Employee Commute | Daily commuting distance, mode of transport, and commuting days per reporting period | km, day | Employees' commuting details as provided by the Human Resource Department. | Emissions were calculated using estimated mileage travelled for different vehicles (i.e., using passenger car, motorcycle, and bus), along with the number of commuting days.<br>Employee were categorised into two groups, those associated with direct production were on a 6 working day basis, while those associated with indirect production were on a 5 working day basis.<br>Emission associated with personnel assigned with company car (and petrol card) was accounted under Scope 1 of mobile combustion. |

### 5.2.5 Excluded Activities

The following activities were excluded from the base year GHG emission calculations based on the justifications described below:

- Scope 1 emissions associated with portable $CO_2$ fire extinguisher: hand-held fire extinguishers are considered as miniscule sources which are of very small/ negligible sources.
- Scope 1 emissions from combustion of fuels in genset for power generation during the construction of new plant building: this activity was conducted by the construction contractor, not by Elna PCB.
- Scope 1 emissions associated with the industrial wastewater treatment system. The wastewater treatment system deploys physical-chemical treatment that is not considered as a GHG emission source.

## 5.3 Emission Factors

Emission factors are factors for converting usage of sources of emission into the corresponding GHG emissions. As these are available in a number of published sources, figures from the most reliable sources should be used.

The current inventory utilized a mix of emission factor sources that are most accurate and relevant to the respective emission source. Relevant emission factors for the sources of emission used in this assessment are as follows:

Fuel Combustion

- Emission factors from UK Government GHG Conversion Factors for Company Reporting (2023) was utilized for the calculation of GHG emission (based on the total fuel consumed) from LPG used in cafeteria for cooking.
- Emission factors from US EPA Emission Factors for Greenhouse Gas Inventories (updated April 2022) was utilized for the calculation of GHG emission (based on the total fuel consumed) from natural gas used in boiler.

Emission from Company Owned Vehicles

Emission factors from US EPA Emission Factors for Greenhouse Gas Inventories (updated April 2022) were utilized for the calculation of GHG emission from company owned vehicles running on both petrol and diesel (based on the fuel consumed).

Refrigerant Loss from Heating Ventilation Air Conditioning and Refrigeration (HVACR)

Global Warming Potential (GWP) values for various type of refrigerants specified the US EPA Emission Factors for Greenhouse Gas Inventories (updated April 2022) were utilized to calculate emission for refrigerant loss from HVACR.

Emission from Aerobic Sewage Treatment System

Default values from Greenhouse Gas Emissions Estimation Methodologies for Biogenic Emissions from Selected Source Categories: Solid Waste Disposal Wastewater Treatment Ethanol Fermentation and Intergovernmental Panel on Climate Change (IPCC) 2019 were utilized for the calculation of GHG emission from company operated sewage treatment system.

Emission from Business Travel (Land and Air Transport) and Employee Commute

US EPA Emission Factors for Greenhouse Gas Inventories (updated April 2022) provides emission factors for business travel and employee commuting based on distance travelled.

Table below summarizes the emission factors used in developing the GHG inventory.

**Table 5-2: Emission Factors for GHG Inventory**

| Emission Source | Emission Factor | Unit | Reference |
|---|---|---|---|
| Fuel Combustion Stationary Sources – LPG | 2.9393 | ton-$CO_2e$/ 1,000 kg | UK Government GHG Conversion Factors for Company Reporting (2023) |
| Fuel Combustion Stationary Sources – Natural Gas | 0.0531148 | ton-$CO_2e$/ mmBTU | US EPA Emission Factors for Greenhouse Gas Inventories |
| Fuel Combustion Stationary Sources – Diesel | 2.512 | ton-$CO_2e$/ 1,000 litre | UK Government GHG Conversion Factors for Company Reporting (2023) |
| Fuel Combustion Mobile Sources – Petrol Fuel Usage | 2.319683 | ton-$CO_2e$/ 1,000 litre | US EPA Emission Factors for Greenhouse Gas Inventories |
| Fuel Combustion Mobile Sources – Diesel Fuel Usage | 2.69749 | ton-$CO_2e$/ 1,000 litre | US EPA Emission Factors for Greenhouse Gas Inventories |
| Mileage-based (petrol) Passenger car, 2019 | 3.59E-07 | ton-$CO_2e$/ km | US EPA Emission Factors for Greenhouse Gas Inventories |
| Mileage-based (petrol) Passenger car, 2012 | 9.68E-07 | | |
| Mileage-based (petrol) Passenger car, 2009 | 9.68E-07 | | |
| Mileage-based (petrol) Passenger car, 2008 | 1.03E-06 | | |
| Mileage-based (petrol) Passenger car, 2006 | 1.52E-06 | | |
| Mileage-based (diesel) Van, 2013 | 8.00E-07 | | |
| Refrigerant Loss (R-22) | 1,760 | Global warming potential | US EPA Emission Factors for Greenhouse Gas Inventories |
| Refrigerant Loss (R-32) | 675 | | |
| Refrigerant Loss (R-410a) | 2,088 | | |
| Refrigerant Loss (R-410b) | 2,229 | | |
| Refrigerant Loss (R-134a) | 1,430 | | |
| Suppressant Loss ($CO_2$) | 1 | | |
| Purchased Electricity | 0.758 | ton-$CO_2e$/ MWh | Grid Emission Factor (GEF) Malaysia 2021 |
| Business Travel and Employee Commute | | | US EPA Emission Factors for Greenhouse Gas Inventories |
| • Passenger Car/ e-hailing Car Distance | 0.197 | ton-$CO_2e$/ 1,000 km | |
| • Motorcycle Distance | 0.117 | ton-$CO_2e$/ 1,000 km | |
| • Bus | 0.035 | ton-$CO_2e$/ 1,000 km | |

| Emission Source | Emission Factor | Unit | Reference |
|---|---|---|---|
| • Short Haul (< 483 km) | 0.131 | ton-$CO_2e$/ 1,000 km | |
| • Medium Haul (⩾ 483 km, < 3,700 km) | 0.081 | ton-$CO_2e$/ 1,000 km | |

# 6 GHG Inventory

## 6.1 Corporate Level Inventory

The total Scope 1 and Scope 2 GHG emissions for FY23 reporting period of 01 Jan 2023 to 31 Dec 2023 was **17,093.47 ton-$CO_2e$** per year. The selected two categories of Scope 3 emission sources contributed to a total of **313.23 ton-$CO_2e$** per year. These added up to a total of **17,406.70 ton-$CO_2e$** per year. Breakdown of the total emission by scope are presented in **Table 6-1**.

**Table 6-1: Overall GHG Inventory for Reporting Period (FY2023) – All Sources**

| Scope | Emission (ton-$CO_2e$) | Percentage of Total Emissions (%) |
|---|---|---|
| Scope 1 – Direct Emission | 515.31 | 2.96 |
| Scope 2 – Indirect Emissions | 16,578.16 | 95.24 |
| Scope 3 – Other Indirect Emissions (selected categories) | | |
| • Business Travel | 7.66 | 0.04 |
| • Employee Commute | 305.57 | 1.76 |
| Other Direct GHG data (not included in Scope 1)<br>• Direct biogenic $CO_2$ emissions | 0.31 | |
| **Total Scope 1 and 2** | **17,093.47** | |
| **Total Scope 3** | **313.23** | |
| **Grand Total** | **17,406.70** | |

The Scope 1 biogenic $CO_2$ emission contributed from STP accounted for 0.31 ton-$CO_2e$ per year.

## 6.2 Emission Breakdown by Sources

Breakdown/ percentage of the total emission by scope are presented in the table below and **Figure 6-1**.

**Table 6-2: Overall GHG Inventory for Reporting Period (FY2023)**

| Scope | Emission (ton-$CO_2e$) | Percentage of Total (%) |
|---|---|---|
| Scope 1 – Direct Emission | 515.31 | 2.96 |
| Scope 2 – Indirect Emissions | 16,578.16 | 95.24 |
| Scope 3 – Other Indirect Emissions | 313.23 | 1.80 |

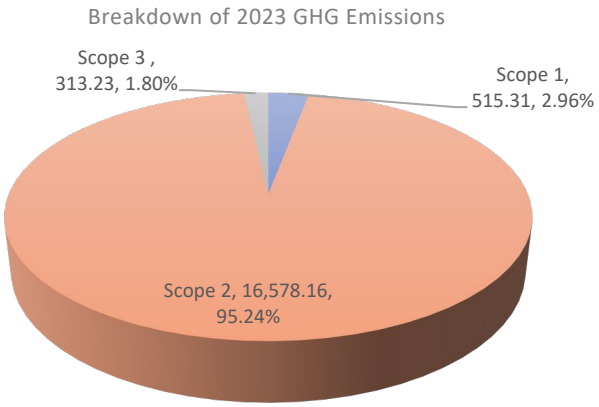


**Figure 6-1: Total GHG Emissions by Scope**

Contributions of emission sources to the total GHG emissions are presented in in **Table 6-3** and figures below.

**Table 6-3: Overall GHG Emissions by Sources**

| Scope | Sources | Emission (ton-$CO_2e$) | Percentage of Total Scope 1 and 2 (%) |
|---|---|---|---|
| Scope 1 – Direct Emission | Stationary Combustion | 486.30 | 2.84 |
| | Mobile Combustion – Company Cars | 25.02 | 0.15 |
| | Refrigerant Loss | 3.52 | 0.02 |
| | Suppressant Loss | 0.405 | 0.0 |
| | Process emission (STP) | 0.057 | 0.0 |
| Scope 2 – Indirect Emissions | Purchased Electricity | 16,578.16 | 96.99 |
| | | | **Percentage of Scope 3 (%)** |
| Scope 3 – Other Indirect Emissions | Business Travel – Land/ Road | 0.20 | 0.06 |
| | Business Travel – Air | 7.46 | 2.38 |
| | Employee Commute | 305.57 | 97.55 |

Based on the completed GHG inventory, Scope 2 emissions of purchased electricity represent the major contributor of GHG emissions, accounting approximately 95.2 % of the total GHG emissions (refer **Table 6-1** above). Under Scope 1, the GHG emission majorly contributed from the combustion of fossil fuels (natural gas) used in boilers.

At the PSA corporate level, based on the information provided by Elna PCB, the total Scope 1 (based on consumption of gasoline and diesel) and Scope 2 emissions for 2023 was amounted to 256,186.6 ton-CO2e. The emissions covered sources from the EMS and PCB business within the China and Taiwan regions. Considering the calculated emission from Elna PCB for Scope 1 and 2 emissions, emissions from the site represent about 6.2% of the total corporate-wide emissions.

# 7 Uncertainty Assessment

Calculation of a GHG emission inventory is both an accounting and a scientific exercise. Preparation of the GHG emission inventory requires the collection of a large quantity of data from various sources and

the use of published emission factors. As a result, uncertainties are inherent in a GHG emissions inventory.

Emissions were calculated by multiplying activity data with emission factors. Therefore, uncertainty in emissions results from uncertainty in activity data as well as uncertainty in emission factors. Uncertainties must be identified in the GHG inventory according to *GHG Protocol*s.

## 7.1 Uncertainty in Activity Data

### 7.1.1 Uncertainty in Scope 1 Activity Data

Fuel Combustion in Stationary Sources

There would be no uncertainty as the quantity of fuel consumed in the stationary sources (i.e. natural gas for boiler and LPG for canteen food preparation) was in the form of fuel purchases, which records were verified by the on-site person-in-charge from Elna PCB.

Fuel Combustion in Mobile Sources (On-road)

Due to the possibility that assigned vehicles may be used for personal purposes and the lack of a scientific method for allocation, the actual estimation of fuel consumption and mileage travelled solely for business purposes cannot be accurately determined. Nonetheless, the uncertainty is low and is expected to have negligible impact on the overall GHG emissions.

Refrigerant and Suppressant Losses

Information on refrigerant losses in kilograms from recharging existing equipment was not available. Therefore, an estimation of refrigerant weight was assumed. Nonetheless, the uncertainty is low and is expected to have a negligible impact on the overall GHG emissions.

### 7.1.2 Uncertainty in Scope 2 Activity Data

Electricity Purchase from Grid

The current Malaysia's grid emission factor (GEF) used is based on data from the year 2021, and is not representative of the reporting period (FY23). The GEF typically changes from year to year (refer to **Table 7-1** below) by approximately 10%, depending on the energy mix of all generating power plants serving the electricity grid during the year. In the events the GEF for 2023 is published, the Scope 2 emission would change accordingly. Should the changes result in the total emissions to exceed the materiality threshold (typically assumed to be 5%), Elna PCB should re-establish their base year numbers.

**Table 7-1: Grid Emission Factor for Peninsular Published by the Energy Commission**

| Year | Grid Emission Factor ($tCO_2e$ / kWh) |
|---|---|
| 2017 | 0.000776 |
| 2018 | 0.000807 |
| 2019 | 0.000780 |
| 2020 | 0.000832 |
| 2021 | 0.000758 |

### 7.1.3 Uncertainty in Scope 3 Activity Data

Business travel by road

Although the travel information was recorded based on the mileage incurred, uncertainty lies on the completeness of record keeping. The current information, which was based on employee's expenses claims, may not have captured other modes of transportation such as the use of taxi or e-hauling services, of which mileage information can only be estimated using tools like Google Maps. Uncertainty of this activity data is considered low to moderate.

Business travel by air

Due to the unavailability of detailed flight itineraries, flight distance data relied on inputs from employees during travel claims. Additionally, some flight distance data did not capture the transit airport between the departure and destination airports, resulting in moderate to high uncertainty for this activity data.

Employee Commute

Although the daily commute information was requested by Elna PCB to their employees, uncertainty lies in the relevancy of distance information, which may fail to capture the actual commuting distance. Tools like Google Maps tend to calculate the shortest distance, which may not completely reflect the actual commuting distance of employees. The commuting day can be cross-referenced with human resource department database and therefore uncertainty of this activity data is considered low to moderate.

## 7.2 Uncertainty in Emission Factors

The GHG inventory utilizes a mix of emission factor sources that are considered to be the most accurate and relevant to the respective emission source. Emission factor for purchased electricity was obtained from "Grid Emission Factor (GEF) in Malaysia, 2017-2021"[3] published by the Energy Commission at the Malaysia Energy Information Hub (MEIH) website. The GEF is the generation weighted-average greenhouse gas emission per unit of net electricity generation[4] of all generating power plants serving the electricity grid[5]. While the published GEF is currently widely adopted by organizations for Scope 2 emission calculation, the most recent data was only available for the year 2021.

## 7.3 Materiality

Materiality is a concept that is employed in the preparation of the GHG inventory to ensure that emission that could impact the overall GHG inventory are carefully considered in the inventory preparation. If an emission source does not contribute significantly to overall Scope 1 and 2 inventory, it may be excluded. No specific materiality threshold was defined in the development of Elna PCB GHG inventory, even though some of the GHG sources fell below a typical material threshold of 5%.

# 8 GHG Reduction Possibilities

One of the key drivers for the development of GHG emission inventory is to enable the organization to understand the activities that generate the highest percentages of GHG emissions. This will allow the organization to prioritize GHG reductions efforts on the most significant contributors to their GHG

[3] Grid emission factor for Malaysia referred at https://meih.st.gov.my/documents/10620/cdddb88f-aaa5-4e1a-9557-e5f4d779906b
[4] Net Electricity Generation = Gross Electricity Generation – Electricity Own Use
[5] https://meih.st.gov.my/publications [https://meih.st.gov.my/documents/10620/384e88c1-b782-49a1-8dff-74c836b3a3f7]

inventory. As the impact of climate change is recognized globally, it has become evident that much work is needed to reduce GHG emissions. The path forward is shown in **Figure 8-1** below.

Carbon avoidance projects contribute to climate action by preventing carbon that would have been released into the atmosphere. The hierarchy of carbon avoidance focuses on energy conservation and energy efficiency followed by carbon removal projects.

- Energy conservation relies on people cutting back on activities that consume energy – by turning off lights or driving less or using appliances less often.
- Energy efficiency harnesses technology to help avoid or reduce energy wastage so that you perform the same tasks but with a lower energy and hence, carbon footprint.
- Finally, carbon avoidance includes replacing energy from sources with high GHG emission factors with cleaner energy. This could be installing solar photovoltaics on structures or building a wind farm to lower reliance on fossil fuels.
- Carbon removal projects, like the name suggests, remove carbon from the atmosphere. Broadly speaking, they are split into 2 categories: natural carbon removals, like tree planting which sequesters carbon as the trees grow, and technological carbon removals, for example, direct air capture.

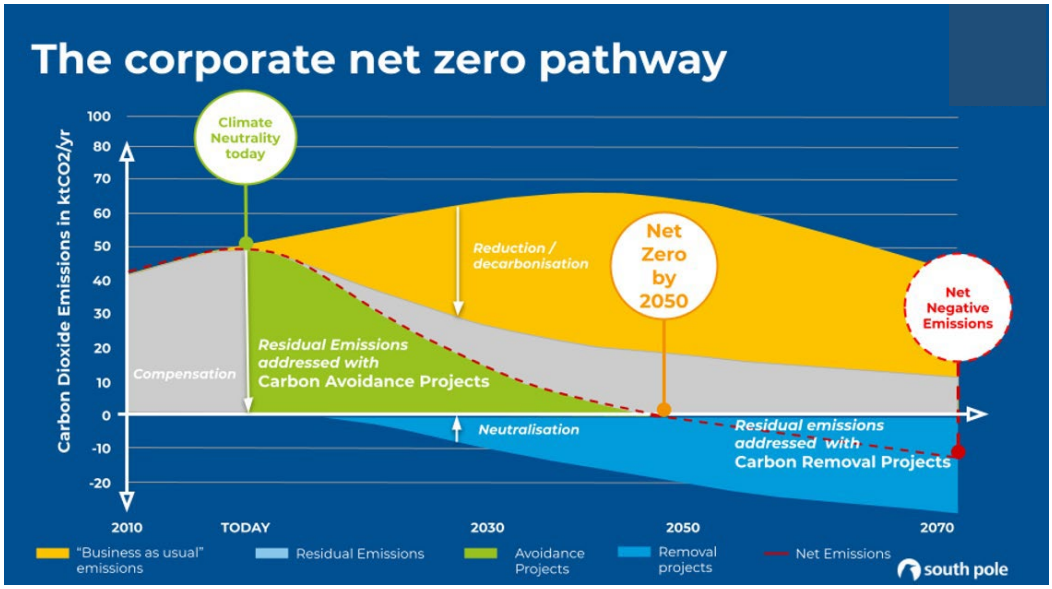


**Figure 8-1: Net Zero Pathway**

Based on the outcome of GHG emission calculation, activities that generate the highest percentages of GHG emissions is Scope 2 – Purchased Energy. Structured energy management system shall be considered aimed in reducing emissions from Scope 2, which will include the following components:

1. Energy audit – a survey conducted by an Energy Auditor to determine how much energy the manufacturing processes and supporting services use and identify ways to reduce energy consumption. This is an examination of the energy consumption of the equipment or system to ensure that energy is being used efficiently.
2. Energy management system – adopt internationally recognized energy management system such as ISO 50001 that provides organizations with a framework to manage and improve energy performance. The energy management system will help organizations efficiently use energy resources, reduce energy consumption and costs, and decrease greenhouse gas emissions.
3. Energy conservation – energy conservation is the reduction in the consumption of electricity or fuel usage without significant investment in new equipment. This would also involve creating awareness among the employees in practicing energy conservation actions.

4. Energy efficiency – energy efficiency involves improvement from the type of machinery and equipment used at the site. Energy audit would identify machinery/ equipment that is energy intensive and offer solutions for using them in energy efficient manner. Engineering improvement or replacement of certain equipment may be required to achieve the goal. Feasibility study will be required to assess capital investment requirement, economic benefits, and potential emission reduction.
5. Renewable energy – installing renewable energy such as rooftop solar system reduces reliance of electricity from the grid and thereby reducing Scope 2 emission. However, this option's impact depends on having large roof spaces. As solar irradiation varies through the day and depends on weather conditions, the energy output will be less than the peak rated KW output. Roof space available for solar photovoltaics (PV) also competes with other utilities such as HVAC, plumbing vents, etc. This option needs to be explored further in the future. The installation of solar PV requires a detailed assessment of roof orientation and space availability.

Based on the information provided by Elna PCB, it is our understanding that the site has implemented the following as its initial efforts in reducing energy consumption:

- Usage of LED lighting
- Installation of inverter type motor and air conditioning system
- Replacement of old equipment with new ones with higher productivity and energy saving features during low utilization of the equipment
- Plan for installation of solar panel

To allow demonstration of actual GHG emission reduction that can be achieved through these initiatives, engineering calculations shall be conducted. For future/ upcoming initiatives, these calculations would allow determination of the expected percentage of reduction.

The initiatives, to large extent is inline with the PSA corporate initiatives which include:

- Electrification to reduce onsite energy generation
- Use of LED lighting and zoning of plant areas based on utilization of the area
- Realtime monitoring of energy usage and use of energy saving devices/ equipment
- Promoting energy conservation among workers
- Increase the use of green energy

In terms of PSA corporate-wide reduction target, recognizing the fact that productivity will be increasing in the future, the corporation has committed to a year-on-year reduction of total annual absolute emission by more than 1%.

# 9 Conclusions

EeHSSE followed the *GHG Protocol* for compiling an accurate and verifiable inventory of Elna PCB corporate operations' baseline greenhouse gas (GHG) emissions for the reporting period of 1st January 2023 to 31st December 2023. In summary, the Scope 1 and 2 GHG emissions from Elna PCB's operations resulted in **17,093.47** tons of $CO_2$ equivalent. When the selected Scope 3 categories are included, the overall emissions totalled to **17,406.70** tons of $CO_2$ equivalent.

This report provides a summary of the GHG inventory for Elna PCB for the base year FY 2023. **Sections 1** through **7** off the report defines the organizational boundary used in the preparing the inventory, the emission sources included and those excluded, the emission by scope and source, GHG emission analysis, and uncertainties in the activity and emission factor data used. **Sections 8** discusses potential GHG reduction. It can be concluded from the results that Scope 2 purchased energy emissions is the significant among the emission sources. The opportunities to bring down GHG emission due to electricity consumption shall be the main focus in future initiatives. Elna PCB shall develop the capability for a comprehensive data management system to improve and update the inventory on an ongoing basis.

This report presents the outcomes of the agreed-upon scope for the GHG inventory and represents the initial step of the Elna PCB in greenhouse gas management. It should be noted that order to fully comply

with the RBA Code of Conduct 8.0 requirement in addressing significant Scope 3 greenhouse gas emissions, Elna PCB will need to further assess and expand the GHG inventory to include other categories that are significantly contribute to overall GHG emissions. The site is committed to further analyze/ assessing the materiality/ significance of the remaining Scope 3 categories, track and inventorize total emissions. Achieving meaningful reductions will require focused commitment and resource allocation from Elna PCB. Pursuing these goals of reducing GHG emissions should support the company's bottom line through lower operating costs and its Environmental, Social, and Governance commitments.

## Appendix A

## GHG Inventory Database (provided in MS Excel spreadsheets)