

GREENHOUSE GAS (GHG) INVENTORY GUIDANCE WORKBOOK

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FOREWORD

MUHAMMAD ALI

Chief Executive Officer | TechMaze



As we continue to navigate the complexities of sustainability and environmental responsibility, understanding our impact on the planet is more crucial than ever. At TechMaze, we are committed to reducing our carbon footprint and enhancing our environmental performance through innovative practices and continuous improvements. This report marks a significant step in our journey toward achieving a comprehensive and transparent Greenhouse Gas (GHG) inventory.

I am pleased to present this detailed guide, compiled by our trusted partner, Carbo-X, which outlines the methodology for creating our corporate GHG inventory. By aligning our processes with international standards such as the GHG Protocol and ISO 14064-1, we are taking concrete steps to identify, measure, and reduce our emissions across Scope 1, 2, and 3.

This report not only provides a framework for accurate emissions reporting but also reflects our broader commitment to sustainability and climate action. We recognize the importance of accountability, and this inventory will enable us to better understand the sources of our emissions, set measurable targets, and take informed actions that contribute to a sustainable future.

I look forward to working alongside our team, partners, and stakeholders to implement the recommendations in this report, driving our long-term sustainability goals, and leading by example in our industry.

Thank you for your continued support as we embark on this critical journey.



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ABBREVIATIONS

CH₄ - Methane

CO₂ - Carbon Dioxide

EF - Emission Factor

EPA - Environmental Protection Agency

ESG - Environment, Social, Governance

FAQ - Frequently Asked Questions

GHG - Greenhouse Gas

GWP - Global Warming Potential

HFC - Hydrofluorocarbon

HR - Human Resources

IFRS - International Financial Reporting Standards

IPCC - Intergovernmental Panel on Climate Change

ISO - International Organization for Standardization

KPI - Key Performance Indicator

NF₃ - Nitrogen Trifluoride

N₂O - Nitrous Oxide

PFC - Perfluorocarbon

SECP - Securities and Exchange Commission of Pakistan

SF₆ - Sulfur Hexafluoride



EXECUTIVE SUMMARY

This report outlines a comprehensive methodology for creating a corporate GHG inventory for TechMaze. The purpose of this inventory is to identify, quantify, and report Greenhouse Gas (GHG) emissions in line with internationally recognized standards, such as the GHG Protocol and ISO 14064-1, covering Scope 1, 2, and 3 emissions. TechMaze aims to compile a detailed GHG inventory to improve its environmental performance, identify the main sources of emissions, and determine its carbon footprint.

This guide provides a step-by-step approach, outlining the necessary data sources, methodologies, key performance indicators (KPIs), and potential risks involved in the inventory process. The report also highlights strategies for continuous improvement and the importance of taking informed actions to reduce emissions. By implementing this framework, TechMaze will enhance its sustainability efforts and comply with global reporting standards, thereby contributing to long-term environmental and operational efficiency.



COMPANY'S INTRODUCTION

Based in Islamabad, Pakistan, TechMaze is a new, energetic and inventive private company which provides digital solutions for all size businesses. Web development, App development, Digital Marketing, 3D modeling, Graphics designing and WordPress solutions are its core services. In its pursuit to be a sustainable and innovative company, TechMaze is leading the way by creating its very first corporate Greenhouse Gas (GHG) inventory for promoting sustainability.

OBJECTIVES OF WORKBOOK

Preparation of the GHG inventory is not yet mandatory but can help TechMaze discover inefficiencies, save money, boost reputation, encourage transparency and prepare for future compliance. TechMaze aims to align its environmental strategy with global sustainability standards, and the GHG inventory will serve as a foundational tool to achieve this goal by:



Tracking TechMaze's greenhouse gas emissions from Scope 1, Scope 2 and Scope 3 in accurate and quantifiable measures.



To position TechMaze in compliance with international GHG reporting standards and regulations, thereby making it ready for potential legal requirements, including considering the SECP's upcoming adoption of IFRS Sustainability Disclosure Standards and ESG Disclosure Guidelines (SECP, 2024).



Highlighting key sources of emissions in energy, business travel and procurement etc., so that emissions can be prioritized for reductions.



To improve TechMaze's market position by demonstrating the Company's willingness to support the sustainability of the market and meet consumers' interests in environmentally friendly practices. According to Deloitte (2023), 59% of Gen Z and 60% of Millennials are willing to pay more for sustainable products and services, proving the importance of being sustainable in purchasing choices.



Making TechMaze's efforts for an environmental aspect clear and transparent to all stakeholders. It fits the SECP's goal of increasing transparency and improving sustainability reporting principles (SECP, 2024).

METHODOLOGY FOR DEVELOPING THE GHG INVENTORY

TechMaze's GHG inventory will follow a structured approach aligned with global standards like the GHG Protocol. The inventory will adhere to key principles of GHG Protocol: A Corporate Accounting and Reporting Standard (GHG Protocol, 2015):

Relevance	Reflecting significant emissions and meeting stakeholder needs.
Completeness	Accounting for all emission sources, justifying exclusions.
Consistency	Using consistent methodologies for comparisons over time.
Transparency	Providing clear documentation and disclosing assumptions.
Accuracy	Ensuring reliable data for decision-making.

This methodology ensures the inventory is comprehensive, accurate, and transparent, helping TechMaze effectively track and reduce its carbon footprint. Key steps in the methodology for developing inventory for TechMaze are shown in Figure 1.

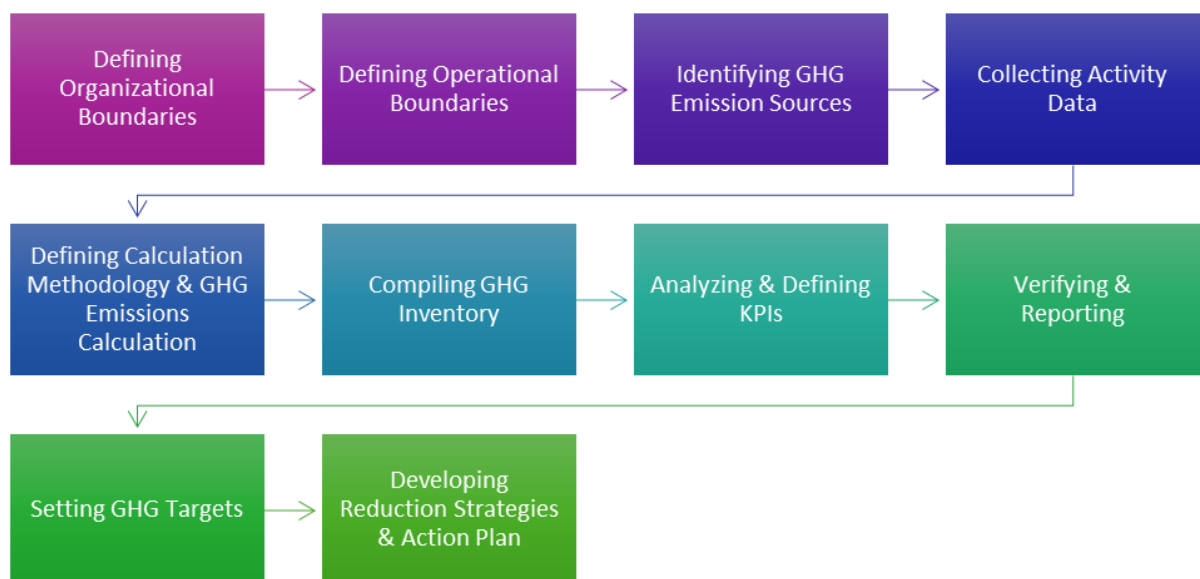


Figure 1: Methodology for developing inventory for TechMaze

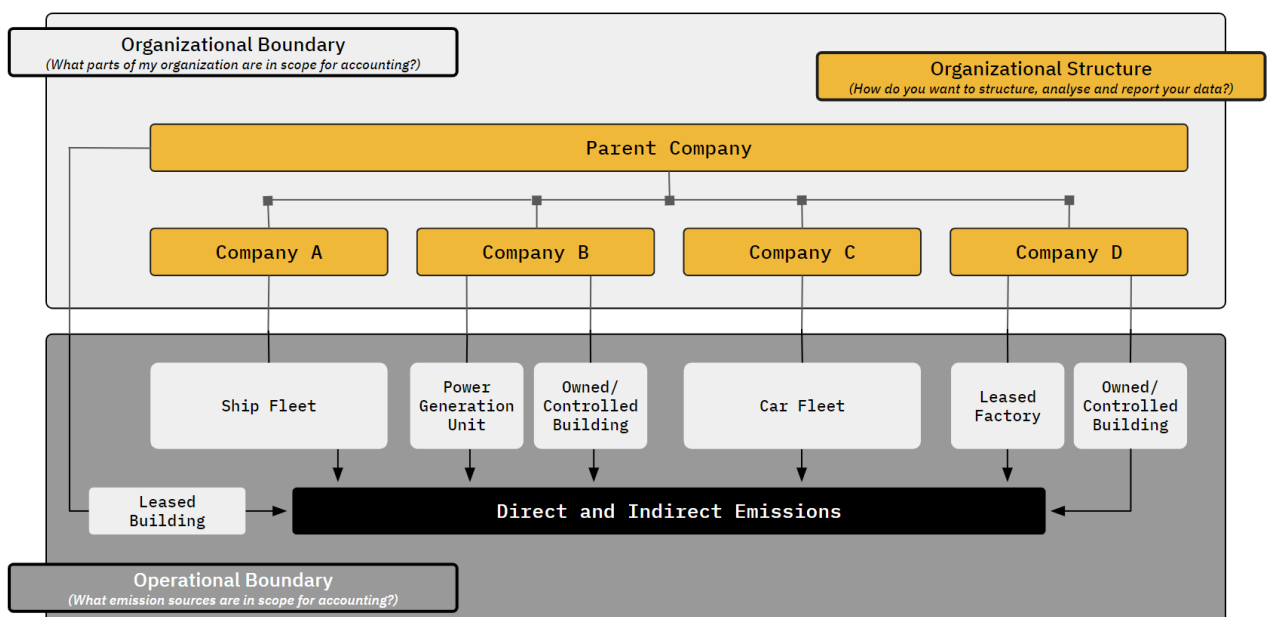
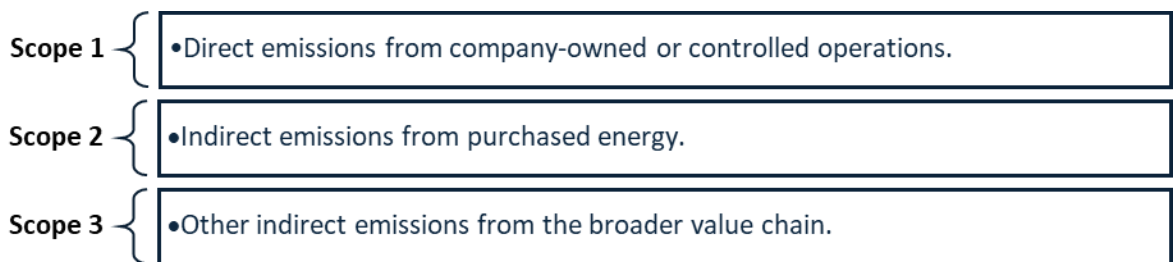
Let's dive into each step one by one:

• Defining Organizational Boundaries

An organizational boundary defines an entity's control over assets, determining its emissions reporting (Persefoni, 2024a). TechMaze will set its boundaries based on the GHG Protocol, using the control approach since it operates with a single headquarters in Islamabad and no subsidiaries. This means TechMaze will account for 100% of GHG emissions from its operations where it has control, either financial or operational. If TechMaze expands or enters joint ventures, it will apply the equity share approach, accounting for emissions based on ownership percentage (EPA, 2024a). This ensures the GHG inventory accurately reflects emissions, with future adjustments as needed.

• Defining Operational Boundaries

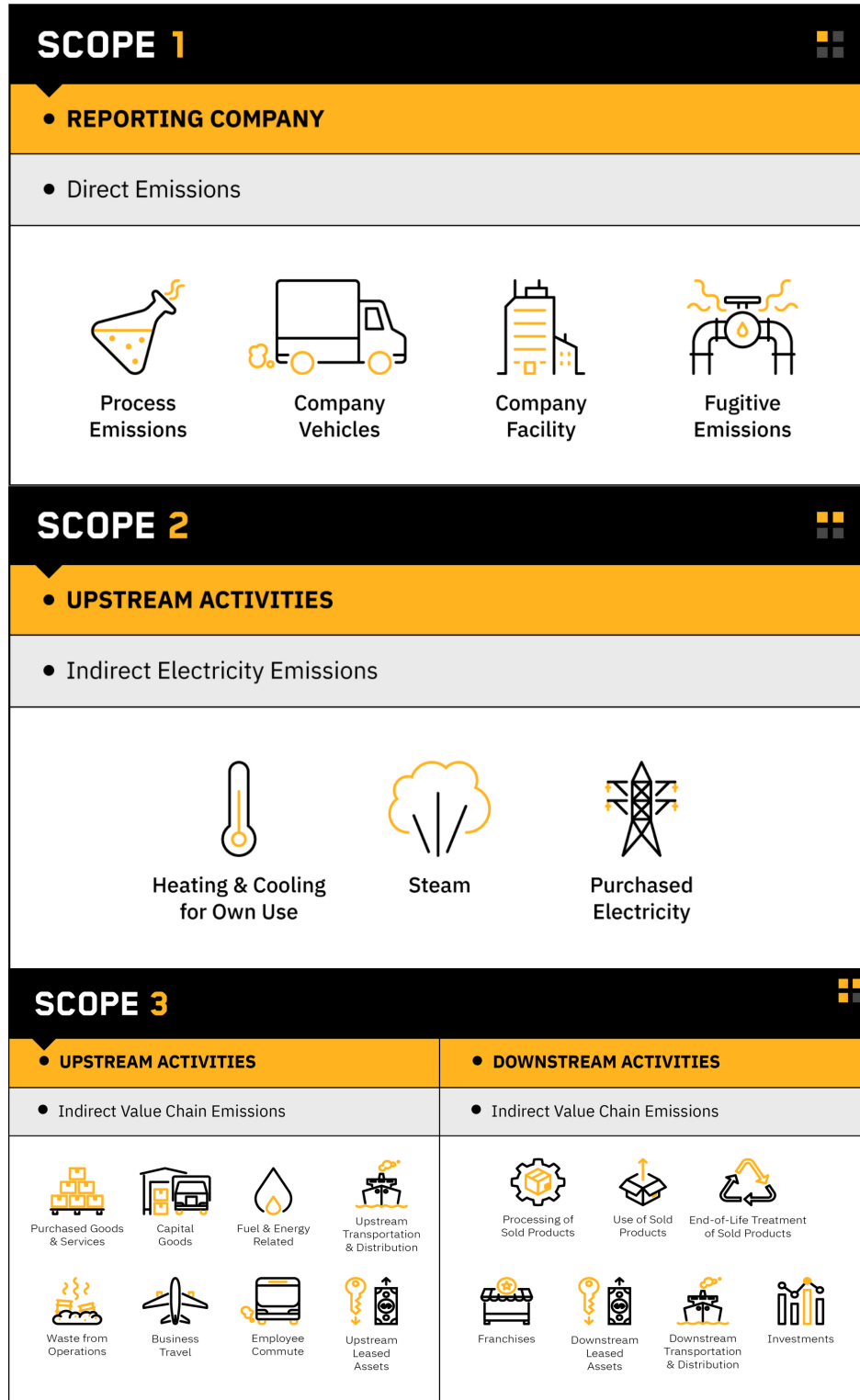
Carbon accounting operational boundaries define the scope and included parameters for an organization to account for its GHG emissions (Persefoni, 2024a). TechMaze will have operational boundaries based on the GHG Protocol (2015), ISO 14064-1 (2018) and include:



Source: Persefoni, 2024

• Identifying GHG Emission Sources

Figures below summarize the various categories of Scope 1, Scope 2, and Scope 3 emissions under the GHG Protocol (GHG Protocol, 2015; Persefoni, 2024b; Persefoni, 2024c).



Source: Persefoni, 2024

- **Identifying GHG Emission Sources**

Since TechMaze primarily offers digital and service-based solutions such as web development, app development, digital marketing, and graphic design, its operations are office-based with no manufacturing or industrial processes. So, the following categories under Scope 1, Scope 2, and Scope 3 are not directly relevant to TechMaze's GHG inventory:

- **Scope 1 (Direct Emissions)**
 - Process Emissions
 - Fugitive Emissions
- **Scope 2 (Indirect Emissions)**
 - Emissions from purchased steam, heat, or cooling
- **Scope 3 (Other Indirect Emissions)**
 - Category 1: Purchased Goods and Services
 - Category 2: Capital Goods
 - Category 3: Fuel and Energy-Related Activities
 - Category 4: Upstream Transportation and Distribution
 - Category 8: Upstream Leased Assets
 - Category 11: Use of Sold Products
 - Category 12: End-of-Life Treatment of Sold Products
 - Category 13: Downstream Leased Assets
 - Category 14: Franchises
 - Category 15: Investments

You can't manage
what you don't
measure.

PETER E. DRUCKER



• Collecting Activity Data

After identifying the sources of emissions, the next step is to determine the specific data necessary for accurate GHG calculations. Each data type is overseen by specific stakeholders. To improve efficiency and minimize the risk of errors, it is important to engage directly with these stakeholders. This strategy eliminates the need for intermediaries, ensures faster access to accurate information, and boosts the overall efficiency of the data collection process. The table below outlines the relevant data types, sources, and the departments involved in gathering and managing data for TechMaze's GHG inventory:

Data Type	Data Sources	Scope	Departments/Stakeholders Involved
Gas Consumption (kWh)	Gas bills, cylinders refilling, invoices, gas meters	Scope 1 (Stationary Combustion)	Operations, Finance
Fuel Consumption (L)	Fuel receipts, vehicle logs, fuel providers	Scope 1 (Mobile Combustion)	Operations, Finance
Electricity Consumption	Utility bills, electricity meters	Scope 2	Operations, Finance
Tools for the work (type and number)	Purchase orders, supplier invoices	Scope 3 (Category 1)	Procurement, Finance
Computer equipment and office equipment (type and number)	Purchase orders, supplier invoices	Scope 3 (Category 1)	Procurement, Finance
Waste Disposal	Waste management contracts, waste reports	Scope 3 (Category 5)	Facilities Management, Operations, Waste Management
Business Travel	Travel logs, flight/train tickets	Scope 3 (Category 6)	HR, Travel Coordinator, Finance
Employee Commuting	Employee surveys, HR data	Scope 3 (Category 7)	HR, Employees, Operations

All required data will be collected from the identified stakeholders and departments at TechMaze. This stage is time-consuming and requires careful coordination to prevent delays. Accurate, evidence-backed data (e.g., invoices, calculations) is crucial to minimize errors or uncertainties (GHG Protocol, 2015). Data accessibility will be assessed to anticipate potential issues. If data is inaccessible, decisions will be made whether to approximate it, which lowers reliability, or omit it, reducing effectiveness. All data will be documented and archived to ensure availability for future audits.

• Collecting Activity Data

TechMaze should ensure data accuracy by directly engaging stakeholders from Operations, HR, Finance, and Procurement. To address inconsistencies, regular cross-checks will validate data completeness. If gaps are found, conservative estimates using Tier 1 emission factors or industry averages will be used, with assumptions documented. Over time, data collection procedures will be refined, and departments will collaborate to improve accuracy, supporting continuous improvements in the GHG inventory.

• Defining Calculation Methodology & GHG Emissions Calculation

To ensure the accuracy of TechMaze's GHG inventory, the calculation methodology will follow the guidelines set by the GHG Protocol. The methodology will account for all seven GHGs included in the Kyoto Protocol: CO₂ (carbon dioxide), CH₄ (methane), N₂O (nitrous oxide), SF₆ (sulfur hexafluoride), NF₃ (nitrogen trifluoride), and the HFC and PFC groups (GHG Protocol, 2013).

The emissions for each gas will be converted into a common unit, carbon dioxide equivalent (CO₂e), by incorporating the Global Warming Potential (GWP) of each gas. GWP measures how much heat a GHG traps in the atmosphere over 100 years, compared to CO₂ (EPA, 2024b). This standardization enables easier comparison and reporting of emissions across various sources.

The IPCC defines three tiers for emission calculation based on data availability. Tier 1 uses global average emission factors, Tier 2 uses country-specific or regional factors, and Tier 3 uses site-specific factors based on direct measurements, offering the highest accuracy (IPCC, 2019). Since Pakistan lacks specific emission factors, TechMaze will use Tier 2 based on available research, defaulting to Tier 1 factors where country-specific data is unavailable.

Emissions will be calculated using the following formula:

$$\text{GHG Emissions (tCO}_2\text{e)} = (\text{AD} \pm \text{Uncertainty}) \times (\text{EF} \pm \text{Uncertainty}) \times \text{GWP}$$

Where,

- **Activity Data (AD)** represents relevant activities, such as fuel consumption, energy usage, or business travel.
- **Emission Factor (EF)** corresponds to the activity data.
- **GWP** allows emissions from different gases to be expressed in CO₂e.
- **Uncertainty** accounts for potential variations in the data and emission factors, with IPCC Tier 1 factors typically having a range of uncertainty from ±5% to ±15% for more specific local data (IPCC, 2000).

• Defining Calculation Methodology & GHG Emissions Calculation

Example for calculating the GHG emissions (CO₂e) is illustrated in Figure 2.

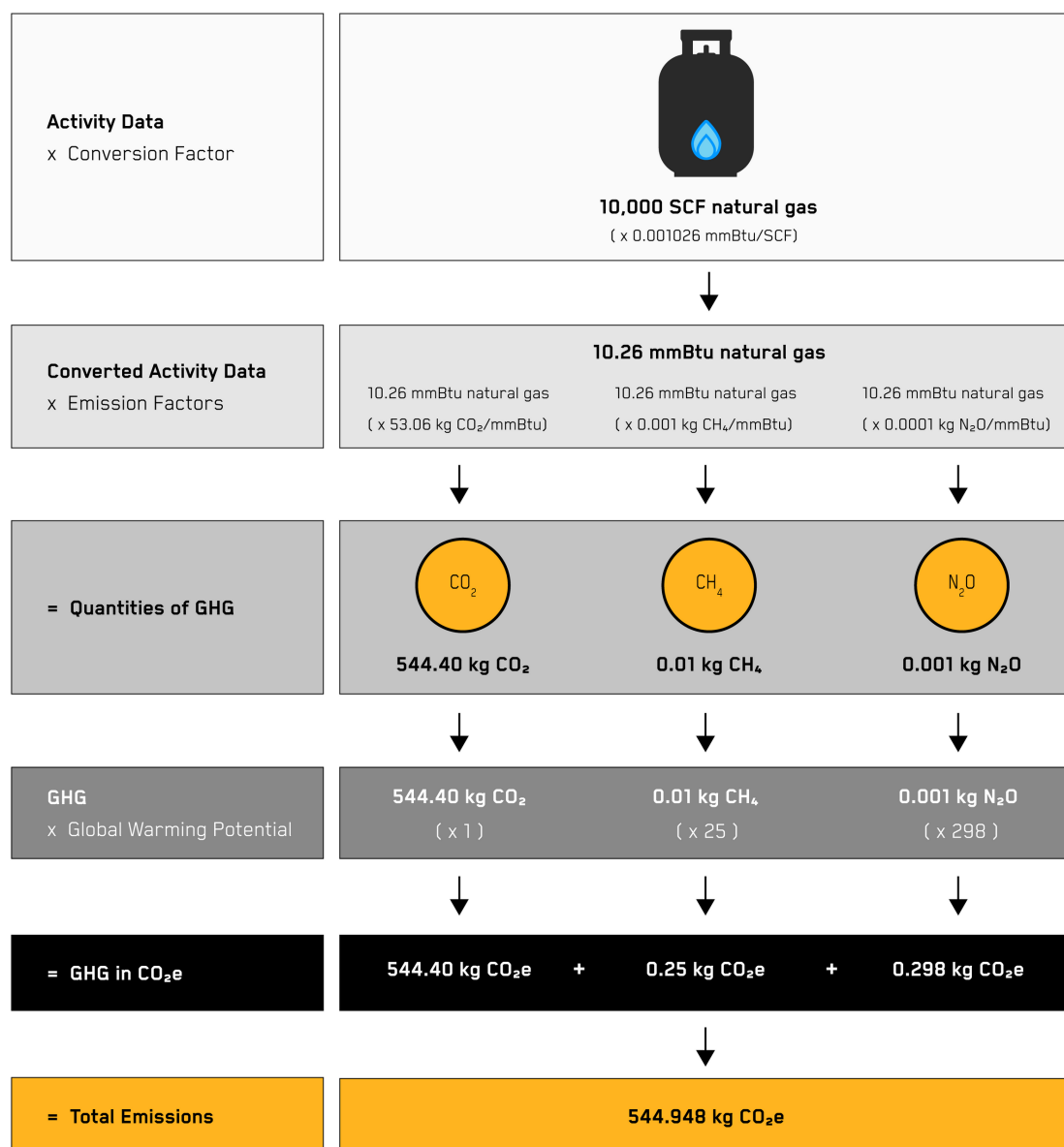
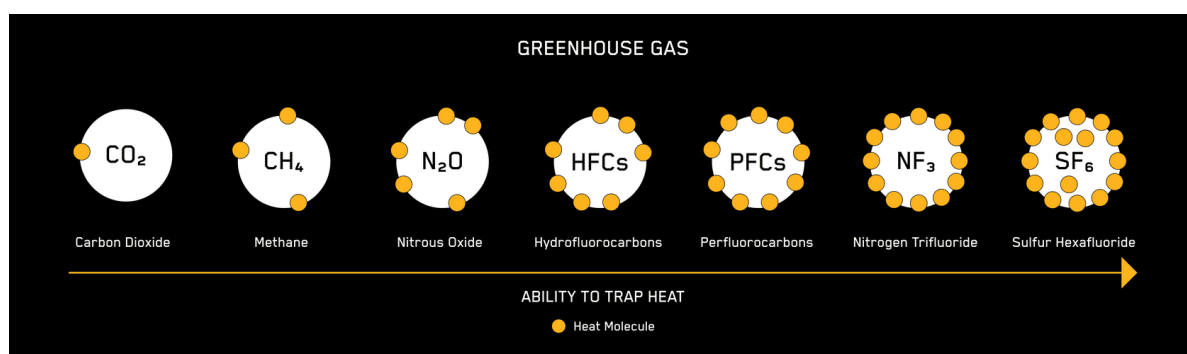


Figure 1: Sample calculation of GHG Emissions (CO₂e)

Source: Persefoni (2024)



• **Compiling GHG Inventory**

The calculated GHG emissions will be compiled into a comprehensive GHG inventory that categorizes emissions by scope and source. This inventory will serve as the baseline for monitoring progress, setting reduction targets, and reporting to stakeholders. The data will be structured systematically using the GHG management software or Microsoft Excel sheets as the data entry tools.

• **Analysing & Defining KPIs**

As stated in the GHG Protocol (2015), it is possible for companies to create *productivity/efficiency ratios*, e.g., sales per GHG, and *intensity ratios*, e.g., CO₂ emissions per electricity generated. They can also use *percentages* to express current emissions of GHG relative to some base level useful in understanding changes in performance over time. By using these ratios, sustainability performance and developments can be well managed and reported within TechMaze.

To determine the GHG reduction efforts in TechMaze and find out if they are effective or not, TechMaze can establish KPIs that they set out to achieve their sustainability targets. These KPIs will enable them to monitor and analyze the status of the reduction of their carbon footprint. These KPIs can include:

- **Total GHG Emissions (tCO₂e)** to track overall emissions across all scopes.
- **Emissions Reduction (%)** to measure progress against a baseline.
- **Emission Intensity (tCO₂e/Revenue)** to evaluate emissions relative to business growth.

Additional KPIs such as *Energy Efficiency (kWh/Employee)*, *Waste Diverted from Landfill (%)*, and *Employee Commuting Emissions (tCO₂e/Employee)* can help monitor specific operational impacts.

• **Verifying & Reporting Annual Carbon Footprint Results**

TechMaze must ensure that the annual carbon footprint is reviewed by internal and, if needed, external auditors. Data checks should be conducted on a regular basis to achieve the accuracy and integrity of data collected. The public GHG emissions report should follow the scope of the GHG Protocol Corporate Standard and present data clearly, comprehensively and accurately. It should define organizational and operational boundaries and present emissions by gas type in CO₂e. This should also include base year emissions, the methods applied, and other exclusions to increase the credibility of the firm's report to the stakeholders.

- **Set GHG Targets**

To reduce greenhouse gas (GHG) emissions effectively, TechMaze must set clear, measurable, and time-bound reduction targets aligned with internal sustainability goals and global climate commitments. Example targets can include:

- **Short-term:** 10% reduction in Scope 1 and 2 emissions by 2025, focusing on energy efficiency and operational improvements.
- **Medium-term:** 20% reduction in Scope 3 emissions by 2030, through supply chain optimization and sustainable travel.
- **Long-term:** Achieve carbon neutrality by 2050, offsetting remaining emissions through renewable energy investments and carbon credits.

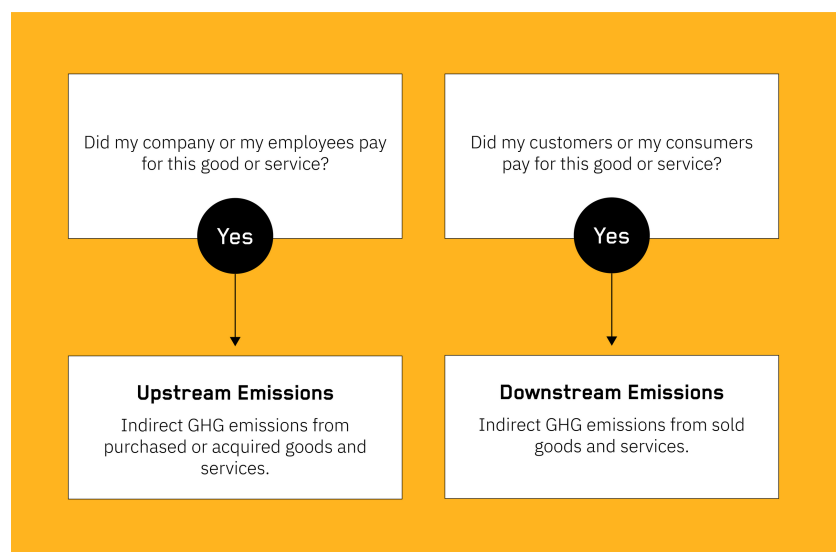
- **Developing Reduction Strategies & Action Plan**

TechMaze should implement strategies and action plans to achieve its GHG reduction targets. Key strategies can include:

- Adopting energy-efficient technologies to reduce Scope 2 emissions.
- Promoting public transport, carpooling, and investing in electric vehicles for the fleet to reduce Scope 1 and 3 emissions from transportation.
- A zero-waste policy can be implemented, with enhanced recycling programs to minimize waste sent to landfills (Scope 3).
- Promoting remote work and sustainable commute options can help address Scope 3 emissions from employee travel.

An action plan should be developed, outlining milestones, timelines, responsible departments, and the necessary resources to effectively implement these strategies

HOW TO DIFFER BETWEEN UPSTREAM AND DOWNSTREAM EMISSIONS?



Source: Persefoni, 2024

IMPLEMENTATION PLAN

Proposed implementation plan for developing and reporting GHG emissions in TechMaze is as follows:

Phase	Tasks	Milestone	Timeline	Responsible Team
1. Planning and Preparation	- Form a GHG accounting team. - Identify data requirements, sources, and stakeholders. - Select tools and methodologies (e.g., IPCC Tiers, GHG Protocol).	Project initiation and data framework established.	1-2 months	GHG Team Lead, Department Heads
2. Data Collection and Inventory Development	- Gather data for energy, travel, procurement, etc. - Apply emission factors and calculate total emissions. - Address data gaps using assumptions.	Completed GHG inventory with baseline data.	2-3 months	Operations, Finance, HR, Procurement
3. Analysis and Target Setting	- Analyze emissions data to identify hotspots. - Define short, medium, and long-term reduction targets. - Develop KPIs for tracking.	GHG reduction targets and KPIs finalized.	1 month	GHG Team / Sustainability Consultant
4. Strategy Development and Action Plan	- Develop strategies (e.g., energy efficiency, waste reduction, sustainable transport). - Assign responsibilities, timelines, and resources.	Action plan approved by leadership.	1 month	GHG Team Lead, Senior Leadership Team
5. Implementation and Monitoring	- Implement reduction strategies. - Monitor KPIs and track progress. - Conduct regular reviews for alignment.	Initial progress evaluation report.	Ongoing (quarterly reviews)	Operations, Department Representatives
6. Verification and Reporting	- Conduct internal reviews and, if needed, third-party verification. - Prepare and publish	Annual GHG report published.	Annually	GHG Team Lead, External Auditor

RISKS AND CONTROLS

TechMaze may face several risks in its journey to reduce emissions, which need to be managed through effective controls:

Risks	Description	Control
Regulatory Risks	Changes in regulations may impact reporting or require further emissions reductions (Wada et al., 2021).	Monitor regulatory developments to stay compliant.
Data Quality Risks	Uncertainty in data or incomplete collection may lead to inaccurate reporting (Nguyen et al., 2023).	Implement strict data collection and verification procedures.
Supply Chain Risks	Reducing Scope 3 emissions is challenging due to limited control over suppliers.	Develop sustainability criteria and collaborate with suppliers.
Operational Risks	Energy consumption or operations may not align with reduction targets (Immink et al., 2018).	Conduct audits to identify inefficiencies and ensure alignment with reduction strategies.

DATA LIMITATIONS AND RECOMMENDATIONS

While compiling the GHG inventory, data limitations may arise, particularly for Scope 3 emissions. It is recommended to collaborate with departments to improve data collection or use estimates, ensuring transparency (Brander & Bjørn, 2023). If country-specific emission factors are unavailable, use Tier 1 or Tier 2 factors from reliable sources like the IPCC or local research, with documented assumptions. Mugarura et al. (2021) suggest using global or regional equations when local data is scarce. Further, there may be uncertainties, particularly regarding indirect emissions; hence, uncertainty should be estimated, and lowest possible estimates should be used (Ometto et al., 2014).

CONCLUSION

Reducing GHG emissions is critical for long term sustainability and global climate goals and is central to TechMaze's commitment. The company can reduce its carbon footprint by developing a GHG inventory, setting reduction targets, and implementing strategies. KPIs are therefore to be monitored regularly; the risks and data limitation need to be addressed. TechMaze can now be a responsible and forward-thinking organization with support of senior leadership, able to drive sustainability initiatives.

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