TANATAR GREENHOUSE GAS EMISSION CALCULATION COMPARISON REPORT

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STANDARD CHARCOAL GRILL VS INFRARED MIITI

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1. INTRODUCTION

This report has been prepared to present the results of a greenhouse gas emission comparison study conducted between the **Infrared MIITI**, developed by **TANATAR Kalıp Pres İşleri San. ve Tic. Ltd. Şti. (TANATAR)**, and a conventional charcoal grill, based on a **1-hour usage scenario**.

Within the scope of the study, greenhouse gas emissions resulting from both cooking methods were calculated and compared in terms of **carbon dioxide equivalent (CO_2e)**. In the charcoal grill scenario, emissions associated with charcoal consumption were evaluated based on defined assumptions, while in the **Infrared MIITI** scenario, emissions were calculated based on the **electricity consumption of the device**.

This report does not constitute a corporate greenhouse gas inventory. Instead, it represents a **comparative technical assessment** conducted for a specific product and usage scenario. Calculations were performed based on **internationally recognized emission factors** and **widely accepted greenhouse gas calculation methodologies**.

The objective of the report is to quantitatively demonstrate the climate impacts of grill systems operating with different energy sources, to transparently and comparably assess the environmental performance of **TANATAR's Infrared MIITI**, and to present the results in a format suitable for use as a **technical reference document**.

Accordingly, the following sections of the report provide detailed explanations of the study's **purpose, scope, applied methodology, assumptions, and calculation results**.

2. PURPOSE AND OBJECTIVES

The main purpose of this study is to comparatively evaluate the greenhouse gas emissions (CO_2e) generated by the **Infrared MIITI**, developed by **TANATAR Kalıp Pres İşleri San. ve Tic. Ltd. Şti. (TANATAR)**, and a conventional charcoal grill, based on a **1-hour usage scenario**.

Within this framework, greenhouse gas emissions associated with energy consumption for both cooking methods were quantitatively calculated in accordance with **internationally accepted calculation approaches** and presented in a comparable structure. Emissions related to charcoal consumption were considered for the charcoal grill scenario, while emissions related to electricity consumption were considered for the **Infrared MIITI** scenario.

The objectives of the study are summarized as follows:

- To establish a comparable emission calculation approach for the charcoal grill and the **Infrared MIITI**,
- To determine the total CO_2-equivalent greenhouse gas emissions generated by both scenarios for the same usage duration,
- To quantitatively demonstrate the climate impact of the **Infrared MIITI** in comparison to the traditional charcoal grill,
- To present the calculation results in a transparent, traceable, and technically defensible report format,
- To enable the environmental performance of the product developed by TANATAR, namely the **Infrared MIITI**, to be used as a reference technical document.

The purposes and objectives defined within this report do not relate to any legal reporting obligation or the preparation of a corporate greenhouse gas inventory; rather, they are based on a **comparative technical assessment** conducted for a specific product and usage scenario.

3. SCOPE OF THE REPORT

This report defines the scope of the greenhouse gas emission comparison study conducted between the **Infrared MIITI**, developed by **TANATAR Kalıp Pres İşleri San. ve Tic. Ltd. Şti. (TANATAR)**, and a conventional charcoal grill.

The study covers emission calculations performed for both grill types based on a **1-hour usage scenario**. Within the scope of the assessment, only emissions arising during the **use phase** of the grills have been evaluated. For the charcoal grill scenario, emissions related to charcoal consumption have been considered, while for the **Infrared MIITI** scenario, emissions associated with the **electricity consumption of the device** have been taken into account.

In this report, emissions have been calculated and reported in terms of **carbon dioxide equivalent (CO_2e)** based on the multiplication of relevant activity data and emission factors. The study does not aim to separately report individual greenhouse gas components (CO_2, CH_4, N_2O); instead, emissions have been assessed in terms of **total CO_2e**, which is considered more appropriate for the purpose of scenario comparison. Accordingly, particularly for electricity consumption, emissions have been evaluated based on total CO_2e values, and individual gas components have not been disaggregated.

This report does not cover other stages of the product life cycle, such as manufacturing processes, raw material supply, transportation within the supply chain, packaging, storage, maintenance and repair activities, or end-of-life disposal and recycling phases. Furthermore, this study does not constitute a corporate greenhouse gas inventory that includes emissions arising from **TANATAR's facilities or organizational activities**.

The scope of the report is limited to the assumptions and boundaries defined herein and is summarized as follows:

- For the charcoal grill scenario, charcoal consumption during a **1-hour usage period** has been taken as the basis, in accordance with the defined consumption assumption.
- For the **Infrared MIITI** scenario, **1-hour electricity consumption (kWh)** has been considered as the activity data.
- Both scenarios have been structured to ensure comparability by using the **same usage duration**.

The greenhouse gas emission calculation and comparison study conducted within the scope of this report has been prepared with reference to the **fundamental principles defined in ISO 14064-1:2018**. However, this report is not a corporate greenhouse gas inventory prepared in accordance with ISO 14064-1, nor does it constitute a verified report under the standard.

The fundamental principles adopted within the scope of this study are summarized below:

- **Relevance**
  In line with the objectives of the study and the needs of the target users, only relevant emission sources, activity data, and calculation methodologies have been selected.
- **Completeness**
  Within the defined scope and usage scenario of the report, the emission sources identified for comparison purposes have been evaluated using a **CO_2e-based approach** and included in the calculations.
- **Consistency**
  The calculation methods and assumptions have been applied consistently to ensure that different cooking scenarios can be evaluated in a **meaningful and comparable manner**.
- **Accuracy**
  To minimize systematic errors and uncertainties as much as possible, **internationally recognized emission factors** and **widely accepted calculation approaches** have been used.
- **Transparency**
  Calculation methodologies, assumptions, and scope boundaries have been clearly defined, and sufficient information has been provided to enable report users to **correctly interpret the results**.

The results obtained within the scope of this report are valid only under the **defined assumptions, scope boundaries, and scenarios** described herein.

The contact information of the individuals responsible for the preparation of this **Greenhouse Gas Emission Comparison Report** is provided in **Table 1**.

Table 1 – Contact Information of Responsible Persons

Full Name	Title	E-mail	Phone Number
Fatma ÜNÜGÜR SAKARYA	R&D Researcher	fatmaunugur@tanatar.com.tr	0 537 406 37 35
Alper AKTÖREN	Mechanical Engineer	alperaktoren@temcev.com.tr	0 542 234 89 86

4. ASSESSMENT BOUNDARIES

The assessment conducted within the scope of this report is limited to the comparison of the **Infrared MIITI** and the conventional charcoal grill under a **1-hour usage scenario**.

The evaluation includes only the greenhouse gas emissions arising during the **use phase** of the grills. Within this context:

- Emissions related to charcoal consumption have been considered for the charcoal grill,
- Emissions related to electricity consumption have been considered for the **Infrared MIITI**.

Emissions arising from other life cycle stages—such as product manufacturing processes, raw material supply, supply chain transportation, storage, maintenance and repair activities, and end-of-life disposal or recycling—have not been included within the scope of this study.

The assessment has been carried out within the defined boundaries and assumptions, and the results obtained are valid only within the **usage scenario and assessment boundaries** described in this report.

5. ACTIVITY DATA AND ASSUMPTIONS

The greenhouse gas emission comparison study conducted within the scope of this report has been carried out based on the activity data and calculation assumptions defined for the selected usage scenario.

5.1. Charcoal Grill Scenario

In the emission calculations performed for the charcoal grill, a **1-hour usage duration** has been taken as the basis. In order to calculate emissions associated with charcoal consumption, the following assumption has been applied:

It has been assumed that the charcoal grill consumes **1 kg of charcoal during 1 hour of operation**.

This assumption has been defined to ensure that both scenarios can be compared on the basis of the **same usage duration**.

5.2. Infrared MIITI Scenario

In the emission calculations performed for the **Infrared MIITI**, the **electricity consumption (kWh)** of the device during a **1-hour usage period** has been taken as the activity data.

Within this scope:

- The activity data related to electricity consumption has been defined as the **average electricity consumption of the product over a 1-hour period**,

- The relevant activity data has been obtained from **user input or from the technical specifications of the product**,
- Emissions related to electricity consumption have been calculated by multiplying the activity data by the **appropriate emission factors**.

5.3. Common Assumptions

The following common assumptions have been applied to both scenarios:

- The comparison has been conducted based on the **same cooking duration (1 hour)**,
- It has been assumed that **cooking conditions are similar** throughout the usage period,
- Activity data and emission factors used in the calculations have been considered **constant**.

The defined activity data and assumptions have been established in line with the **comparative objective of the study**, and the results obtained are valid within the framework of these assumptions.

6. CALCULATION METHODOLOGIES

Within the scope of the greenhouse gas emission comparison study conducted in this report, emissions have been calculated based on the multiplication of **activity data** and **emission factors**. The calculation approach has been structured to enable a **comparable evaluation of cooking activities** carried out using different energy sources.

6.1. General Calculation Approach

The general calculation approach applied to both scenarios is as follows:

$$Emission\ (kgCO_2e) = Activity\ Data\ \times\ Emission\ Factor$$

Within this approach:

- *Activity data* represents the energy or fuel consumption corresponding to a **1-hour usage period** for the relevant scenario,
- The *emission factor* represents the greenhouse gas impact per unit of consumption for the relevant energy source.

Calculation results are presented in terms of **carbon dioxide equivalent (CO_2e)**.

6.2. Charcoal Grill Scenario Calculation

In the charcoal grill scenario, emission calculations have been performed based on the **assumed amount of charcoal consumed during a 1-hour usage period**. Emissions related to charcoal consumption have been calculated using the relevant emission factors, taking into account the **CO_2, CH_4, and N_2O** components, and the **total CO_2e value** has been determined.

6.3. Infrared MIITI Scenario Calculation

In the Infrared MIITI scenario, the electricity consumed by the device during a 1-hour usage period has been used as the activity data (kWh). Emissions related to electricity consumption have been calculated using the emission factor defined for electricity, and results have been expressed as total CO_2e.

In this scenario, emissions associated with electricity consumption have been evaluated using a total climate impact approach, and individual greenhouse gas components have not been reported separately.

6.4. Comparison Approach

Emission results calculated for both scenarios have been compared based on the **same usage duration (1 hour)**. Within the scope of the comparison, the following indicators have been evaluated:

- Absolute emission values,
- Differences between scenarios,
- Percentage change.

Through this methodology, the climate impacts of the charcoal grill and the **Infrared MIITI** have been made **directly and clearly comparable**.

7. EMISSION FACTORS AND REFERENCES

The emission factors used in the greenhouse gas emission calculations conducted within the scope of this report have been selected based on **internationally recognized and widely accepted reference sources**. Emission factors have been chosen in a manner that ensures **comparability between the energy consumption** of both scenarios considered in the study.

7.1. Emission Factors for the Charcoal Grill Scenario

The emission factors used in the charcoal grill scenario represent greenhouse gas emissions arising from **charcoal consumption**. Within this scope, the emission factors applied for charcoal include the following greenhouse gas components:

- Carbon dioxide (CO_2),
- Methane (CH_4),
- Nitrous oxide (N_2O).

These components have been considered collectively, and emissions have been calculated and reported in terms of **total carbon dioxide equivalent (CO_2e)**.

The emission factors related to charcoal consumption have been obtained from the **DEFRA Greenhouse Gas Conversion Factors (2025)** published by the **United Kingdom Government**.

7.2. Emission Factors for the Infrared MIITI Scenario

In the **Infrared MIITI** scenario, greenhouse gas emissions associated with **electricity consumption** have been calculated using the **grid electricity emission factor**.

Within this context, the electricity emission factor applied in the calculations has been determined based on **electricity generation mix and carbon intensity data published by the International Energy Agency (IEA)** and represents the **total carbon dioxide equivalent (CO_2e)** impact of electricity consumption.

Emissions related to electricity consumption have been evaluated using a **total climate impact approach**, and individual greenhouse gas components have **not been separately disaggregated**.

7.3. References

The emission factors and methodological references used in this report are summarized below:

- **UK Government** – DEFRA Greenhouse Gas Conversion Factors 2025,
- **International Energy Agency (IEA)** – Electricity Emission Factors and Carbon Intensity Data,
- **ISO 14064-1:2018**, *Greenhouse gases – Part 1: Specification with guidance at the organization level* (referenced at the principles level).

The listed references have been used as the basis for **selecting emission factors** and **establishing the calculation methodology** applied within the scope of this report.

8. CALCULATION RESULTS

This section presents the results of the greenhouse gas emission calculations performed for the **charcoal grill** and the **Infrared MIITI** based on a **1-hour usage scenario**. All calculation results are expressed in terms of **carbon dioxide equivalent (CO_2e)**.

8.1. Results of the Charcoal Grill Scenario

In the calculations performed for the charcoal grill, the **assumed amount of charcoal consumed during a 1-hour usage period** has been taken as the basis. Emissions arising from charcoal consumption have been calculated using the relevant emission factors, and the combined impact of **CO_2, CH_4, and N_2O** components has been evaluated in terms of **total CO_2e**.

Table 2 – Emission Results of the Charcoal Grill Scenario (1 Hour)

Emission Type	Emission Results	Description
CO_2 (kg)	2,63200	CO_2 component only
CH_4 ($kgCO_2e$)	0,24035	CO_2e equivalent of CH_4
N_2O ($kgCO_2e$)	0,03260	CO_2e equivalent of N_2O
Total ($kgCO_2e$)	2,90495	CO_2+ CH_4+ N_2O

8.2. Results of the Infrared MIITI Scenario

In the calculations performed for the **Infrared MIITI**, the **electricity consumed by the device during a 1-hour usage period** has been used as the activity data. Emissions related to electricity consumption have been calculated by multiplying the electricity consumption by the **applicable emission factor**, and the results have been expressed in terms of **total CO_2e**.

In this scenario, emissions related to electricity consumption have been evaluated to represent the **total climate impact**, and individual greenhouse gas components have **not been reported separately**.

Table 3 – Emission Results of the Infrared MIITI Scenario (1 Hour)

Emission Type	Emission Results	Description
CO_2 (kg)	0,77792	CO_2 component only
CH_4 ($kgCO_2e$)	0,00000	CO_2e equivalent of CH_4
N_2O ($kgCO_2e$)	0,00000	CO_2e equivalent of N_2O
Total ($kgCO_2e$)	0,77792	CO_2+ CH_4+ N_2O

8.3. Overall Summary of Results

The calculation results obtained for both scenarios have been evaluated on a **comparable basis** using the same usage duration (**1 hour**). The results enable a **quantitative assessment** of the climate impacts of cooking activities performed using different energy sources.

The calculation results are further analyzed in the following section within the scope of the **comparative assessment**, where **scenario-based differences and percentage changes** are evaluated.

9. COMPARISON AND EVALUATION

This section presents a comparative evaluation of the greenhouse gas emissions calculated for the **charcoal grill** and the **Infrared MIITI** based on a **1-hour usage scenario**. The comparison has been conducted using the **total carbon dioxide equivalent (CO_2e)** values calculated for each scenario on the basis of the same usage duration.

9.1. Scenario Based Comparison

The emission results obtained for the charcoal grill and the **Infrared MIITI** scenarios have been compared by considering both the **absolute emission values** and the **percentage change** between the two scenarios.

Table 4 – Scenario-Based Emission Comparison (1 Hour)

Indicator	Charcoal Grill	Infrared MIITI	Difference	Change (%)
Total Emission ($kgCO_2e$)	2,90495	0,77792	-2,12703	-73,22

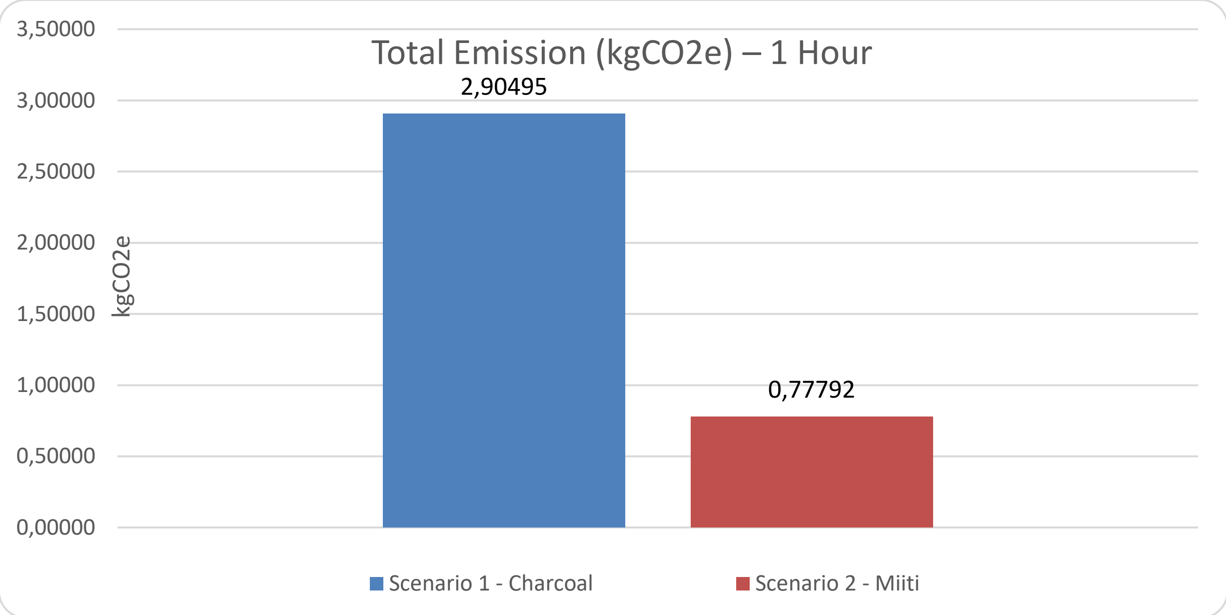
9.2. Evaluation of the Scenario Comparison

According to the results presented in Table 4, the total greenhouse gas emission for the charcoal grill has been calculated as **2.90495 kgCO_2e** for a 1-hour usage period. Under the same usage duration, the total greenhouse gas emission for the **Infrared MIITI** has been determined as **0.77792 kgCO_2e**.

The comparison between the two scenarios indicates that the **Infrared MIITI** results in **2.12703 kgCO_2e lower emissions** compared to the charcoal grill for a 1-hour usage period. This value represents the **absolute emission reduction** achieved.

When the percentage comparison is considered, the use of the **Infrared MIITI** results in approximately **73.22% lower greenhouse gas emissions** compared to the charcoal grill under the same usage conditions.

The graphical representation presented below illustrates the total emission values for both scenarios and supports the numerical comparison results.



9.3. General Interpretation

The numerical results obtained demonstrate that, for cooking activities performed over the **same usage duration**, the **type of energy source used** has a significant influence on greenhouse gas emissions.

In the charcoal grill scenario, emissions arise directly from **fuel consumption**, and the resulting emissions constitute a **substantial climate impact**. In contrast, emissions in the **Infrared MIITI** scenario are associated with **electricity consumption** and are influenced by both the **carbon intensity of the electricity grid** and the **energy efficiency of the device**.

Accordingly, the results clearly indicate that the **Infrared MIITI** produces **significantly lower greenhouse gas emissions**, both in **absolute and relative terms**, compared to the charcoal grill.

Within the framework of the **defined assumptions and assessment boundaries**, this comparison enables a **quantitative, data-driven evaluation** of the environmental performance of the **Infrared MIITI**.

10. CONCLUSION, COMPARISON, AND IMPROVEMENT RECOMMENDATIONS

Within the scope of this report, the results of the greenhouse gas emission comparison conducted between the **Infrared MIITI** and the traditional charcoal grill based on a **1-hour usage scenario** have been presented. The calculations have been performed in a manner that enables the greenhouse gas emissions arising during the **use phase** of both cooking methods to be compared in terms of **carbon dioxide equivalent (CO_2e)**.

According to the calculation results, the total greenhouse gas emission generated by the charcoal grill during a 1-hour usage period has been calculated as **2.90495 $kgCO_2e$**, while the total greenhouse gas emission for the **Infrared MIITI** under the same usage conditions has been determined as **0.77792 $kgCO_2e$**. Based on these values, it has been identified that the **Infrared MIITI** results in **2.12703 $kgCO_2e$ lower emissions** compared to the charcoal grill for a 1-hour usage period. In percentage terms, this corresponds to an emission reduction of approximately **73.22%**.

These results clearly demonstrate that the **energy source used** and the **cooking technology applied** have a significant influence on greenhouse gas emissions during cooking activities performed over the same usage duration. In the charcoal grill scenario, emissions arise directly from **fuel combustion**, resulting in a substantial contribution to total greenhouse gas emissions. In contrast, emissions associated with the **Infrared MIITI** are linked to **electricity consumption** and occur at a considerably lower level.

Within the scope of this study, the calculation results obtained—based on the defined usage scenario and the applicable **electricity grid emission factor**—indicate that emissions from the **Infrared MIITI** are directly related to electricity consumption. Accordingly, **design and operational optimization measures** aimed at reducing the electricity consumption of the device will directly contribute to lowering total greenhouse gas emissions.

In this context, the **rapid heating and efficient cooking characteristics** provided by infrared technology enable the desired cooking performance to be achieved in a **shorter time**. Reaching the required cooking level in a shorter duration reduces the amount of electricity consumed for performing the same cooking task, thereby contributing to a **reduction in greenhouse gas emissions**.

Greenhouse gas emissions associated with electricity consumption depend not only on the **amount of electricity used** but also on the **emission factor of the electricity supply**. Operating the **Infrared MIITI** with electricity sourced from **lower-carbon or renewable energy supplies** would further reduce use-phase greenhouse gas emissions. Since renewable electricity generation typically has **lower emission factors** than fossil fuel-based electricity, the use of low-carbon electricity sources offers additional potential for emission reduction beyond the values calculated in this report.

Therefore, the use of electricity with a **lower emission factor**—whether through renewable energy-based supply options or low-carbon electricity tariffs—has the potential to further reduce the greenhouse gas emissions associated with the use of the **Infrared MIITI** beyond the levels calculated in this report.

The evaluations presented in this section indicate that the **Infrared MIITI** has the potential to further improve its environmental performance not only based on the current calculation results, but also through optimizations related to **usage duration, device efficiency, and electricity supply characteristics**. The results of this report are valid within the **defined assumptions and assessment boundaries** and demonstrate, through quantitative data, that the **Infrared MIITI** offers a **significantly lower greenhouse gas emission potential** compared to the traditional charcoal grill. As such, this report serves as a **comparative and technical reference document** supporting the environmental performance of the **Infrared MIITI**.

11.APPENDICES

To ensure transparency and traceability, the reference documents related to emission factors and methodological approaches used in this study, including the **specific sections directly applied in the calculations**, are presented in the appendices.

The documents included in the appendices contain only the pages and sections that are directly relevant to the assumptions, calculation methodologies, and emission factors applied in this report.

The electronic versions of the full reference documents have been shared with the responsible contact person.

Appendix A: DEFRA Greenhouse Gas Conversion Factors 2025 – Relevant Sections

This appendix includes the relevant tables and pages from the **UK Government – DEFRA Greenhouse Gas Conversion Factors 2025** document that provide emission factors for **solid fuels (charcoal)**, including CO_2, CH_4, and N_2O.

Activity	Fuel	Unit	kg CO_2e	kg CO_2e of CO_2 per unit	kg CO_2e of CH_4 per unit	kg CO_2e of N_2O per unit
Solid fuels	Coal (industrial)	tonnes	2395,28994	2370,72000	7,63840	16,93154
		kWh (Net CV)	0,33944	0,33595	0,00109	0,00240
		kWh (Gross CV)	0,32246	0,31915	0,00103	0,00228
	Coal (electricity generation)	tonnes	2225,22448	2213,33000	0,67200	11,22248
		kWh (Net CV)	0,33621	0,33443	0,00010	0,00168
		kWh (Gross CV)	0,31939	0,31770	0,00010	0,00159
	Coal (domestic)	tonnes	2904,95234	2632,00000	240,35200	32,60034
		kWh (Net CV)	0,36549	0,33115	0,03024	0,00410
		kWh (Gross CV)	0,34721	0,31459	0,02873	0,00389
	Coking coal	tonnes	3164,65002	3144,16000	8,46720	12,02282
		kWh (Net CV)	0,37675	0,37431	0,00101	0,00143
		kWh (Gross CV)	0,35790	0,35559	0,00095	0,00136
	Petroleum coke	tonnes	3386,57168	3377,05000	3,83040	5,69128
		kWh (Net CV)	0,35887	0,35786	0,00040	0,00060
		kWh (Gross CV)	0,34092	0,33997	0,00038	0,00057
	Coal (electricity generation - home produced coal only)	tonnes	2221,74670	2209,87000	0,67200	11,20470
		kWh (Net CV)	0,33621	0,33443	0,00010	0,00168
		kWh (Gross CV)	0,31939	0,31770	0,00010	0,00159

Appendix B: ISO 14064-1:2018 – Relevant Sections at the Principles Level

Within this appendix, the relevant clauses and pages of **ISO 14064-1:2018** that are referenced within the scope of this report and that define the following principles are presented:

- **Relevance**,
- **Completeness**,
- **Consistency**,
- **Accuracy**,
- **Transparency**.

The sections included in this appendix form the methodological basis of the study and support the calculation framework applied in the greenhouse gas emission calculation and comparison conducted within the scope of this report.

The documents provided in the appendices are shared to support the technical foundations of the greenhouse gas emission calculation and comparison study presented in this report and constitute sufficient reference material for the interpretation of the results presented herein.

Figure B-1: Cover Page

INTERNATIONAL STANDARD

ISO 14064-1

Second edition
2018-12

Greenhouse gases —

Part 1:
Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals

Gaz à effet de serre —

Partie 1: Spécifications et lignes directrices, au niveau des organismes, pour la quantification et la déclaration des émissions et des suppressions des gaz à effet de serre

Reference number
ISO 14064-1:2018(E)

Figure B-2: Clause 4 – Principles

4 Principles

4.1 General

The application of principles is fundamental to ensure that GHG-related information is a true and fair account. The principles are the basis for, and will guide the application of, the requirements in this document.

4.2 Relevance

Select the GHG sources, GHG sinks, GHG reservoirs, data and methodologies appropriate to the needs of the intended user.

4.3 Completeness

Include all relevant GHG emissions and removals.

4.4 Consistency

Enable meaningful comparisons in GHG-related information.

4.5 Accuracy

Reduce bias and uncertainties as far as is practical.

4.6 Transparency

Disclose sufficient and appropriate GHG-related information to allow intended users to make decisions with reasonable confidence.

5 GHG inventory boundaries

5.1 Organizational boundaries

The organization shall define its organizational boundaries.

The organization may comprise one or more facilities. Facility-level GHG emissions or removals may be produced from one or more GHG sources or sinks.

The organization shall consolidate its facility-level GHG emissions and removals by one of the following approaches:

a) control: the organization accounts for all GHG emissions and/or removals from facilities over which it has financial or operational control;

b) equity share: the organization accounts for its portion of GHG emissions and/or removals from respective facilities.

The consolidation approach shall be consistent with the intended use of the GHG inventory.

NOTE 1 Guidance on applying control and equity share approaches to consolidate facility-level GHG emissions and removals to the organization level is included in Annex A.

Figure B-3: Clause 5 – Reporting Boundaries

The organization may use different consolidation approaches in the case of multiple reporting goals and requirements defined, for example, by the GHG programme, legal contract or different types of intended users.

NOTE 2 An organization's GHG emissions and removals are aggregated from facility-level quantification of GHG sources and sinks.

NOTE 3 A GHG sink in one period might become a GHG source in another period or vice versa.

When a facility is owned or controlled by several organizations, these organizations should adopt the same consolidation approach for that facility. The organization shall document and report which consolidation approach it applies.

5.2 Reporting boundaries

5.2.1 Establishing reporting boundaries

The organization shall establish and document its reporting boundaries, including the identification of direct and indirect GHG emissions and removals associated with the organization's operations.

5.2.2 Direct GHG emissions and removals

The organization shall quantify direct GHG emissions separately for CO_2, CH_4, N_2O, NF_3, SF_6 and other appropriate GHG groups (HFCs, PFCs, etc.) in tonnes of CO_2e.

The organization should quantify GHG removals.

5.2.3 Indirect GHG emissions

The organization shall apply and document a process to determine which indirect emissions to include in its GHG inventory.

As part of this process, the organization shall define and explain its own pre-determined criteria for significance of indirect emissions, considering the intended use of the GHG inventory.

Whatever the intended use is, criteria should not be used to exclude substantial quantities of indirect emissions or evade compliance obligations.

Using those criteria, the organization shall identify and evaluate its indirect GHG emissions, to select the significant ones.

The organization shall quantify and report these significant emissions. Exclusions of significant indirect emissions shall be justified.

The criteria to evaluate significance may include the magnitude/volume of the emissions, level of influence on sources/sinks, access to information and the level of accuracy of associated data (complexity of organization and monitoring). A risk assessment or other procedures (e.g. buyer requirements, regulatory requirements, concern of interested parties, scale of operation, etc.) may be used (see ISO 13065). More guidance is provided in Annex H.

The criteria for evaluating the significance may be periodically revised. The organization should retain documented information about the revisions.

5.2.4 GHG inventory categories

GHG emissions shall be aggregated into the following categories at the organizational level:

a) direct GHG emissions and removals;

b) indirect GHG emissions from imported energy;

Figure B-4: Clause 6 – Quantification of GHG Emissions

c) indirect GHG emissions from transportation;

d) indirect GHG emissions from products used by organization;

e) indirect GHG emissions associated with the use of products from the organization;

f) indirect GHG emissions from other sources.

In each category, non-biogenic emissions, biogenic anthropogenic emissions and, if quantified and reported, biogenic non-anthropogenic emissions shall be separated (see Annex D).

The organization should document the above categories separately at the facility level.

GHG emissions should be further subdivided into subcategories consistent with the above categories. An example of subcategories is provided in Annex B.

6 Quantification of GHG emissions and removals

6.1 Identification of GHG sources and sinks

The organization shall identify and document all relevant GHG sources and sinks included in its reporting boundaries. The organization shall include all relevant GHGs.

GHG sources and sinks shall be identified in accordance with the categories defined in 5.2.4.

If the organization quantifies GHG removals, the organization shall identify and document GHG sinks contributing to its GHG removals.

The detail with which sources and sinks are identified and categorized shall be consistent with the quantification approach used.

The organization may exclude GHG sources or sinks for which the contribution to GHG emissions or removals is not relevant. It shall identify and explain why the GHG sources or sinks are excluded in accordance with the categories and any categorical subdivisions included in the report (see 5.2.3).

6.2 Selection of quantification approach

6.2.1 General

The organization shall select and use quantification methodologies that minimize uncertainty and yield accurate, consistent and reproducible results.

The quantification approach should also consider technical feasibility and cost.

NOTE Quantification approach is the process of obtaining data and determining the emissions or removals from a source or sink. GHG emissions or removals can be obtained through measurement or modelling.

The organization shall explain and document its quantification approach and any changes in quantification approach.

6.2.2 Data selection and collection used for quantification

The organization shall identify and document its data for each source or sink classified as direct or indirect emissions and removals. It shall determine and document the characteristics for each relevant data used for quantification (see 5.2.3).

NOTE 1 Data used for quantification include primary data (including site specific) and secondary data.

EXAMPLE Data used for quantification may include the average of truck fuel consumption and its characteristics as the standard to determine fuel consumption.

Figure B-4: Clause 6 – Quantification of GHG Emissions

NOTE 2 In the case of GHG programmes, characteristics of data used for quantification are usually determined by the programme operator.

Annex C provides guidance on the selection and collection of data used for quantification.

6.2.3 Selection or development of GHG quantification model

Except in the case of measurement of emissions and removals, the organization shall select or develop models for the quantification approach.

A model is a representation of how the source or sink data used for quantification are converted into emissions or removals. A model is a simplification of physical processes that has assumptions and limitations.

The organization shall explain and document the justification for the selection or development of the model, considering the following model characteristics:

a) how the model accurately represents the emissions and removals;

b) its limits of application;

c) its uncertainty and rigour;

d) the reproducibility of results;

e) the acceptability of the model;

f) the origin and level of recognition of the model;

g) the consistency with the intended use.

NOTE Several types of models make use of activity data multiplied by emission factors.

6.3 Calculation of GHG emissions and removals

The organization shall calculate GHG emissions and removals in accordance with the quantification approach selected (see 6.2).

The period for which GHG emissions and removals have been calculated shall be reported.

The organization shall convert the quantity of each type of GHG to tonnes of CO_2e using appropriate GWPs.

The latest IPCC's GWP should be used. If not, justification shall be provided. The GWP time horizon shall be 100 years. Other GWP time horizons may be used, but reported separately.

NOTE GWP might be part of a model (including emissions factors).

The organization shall quantify biogenic emissions or removals in accordance with Annex D.

The organization shall quantify emissions or removals from imported electricity that is consumed by the organization, and of exported electricity generated by the organization, in accordance with Annex E.

Specific guidance concerning emissions or removals from agriculture is provided in Annex G.

6.4 Base-year GHG inventory

6.4.1 Selection and establishment of base year

The organization shall establish a historical base year for GHG emissions and removals for comparative purposes or to meet GHG programme requirements or other intended uses of the GHG inventory.

Figure B-4: Clause 6 – Quantification of GHG Emissions

Base-year emissions or removals may be quantified based on a specific period (e.g. a year or part of a year where seasonality is a feature of the organization's activity) or averaged from several periods (e.g. several years).

If sufficient information on historical GHG emissions or removals is not available, the organization may use its first GHG inventory period as the base year.

In establishing the base year, the organization:

a) shall quantify base-year GHG emissions and removals using data representative of the organization's current reporting boundary, typically single-year data, a consecutive multi-year average or a rolling average;

b) shall select a base year for which verifiable GHG emissions or removals data are available;

c) shall explain the selection of the base year;

d) shall develop a GHG inventory for the base year consistent with the provisions of this document.

The organization may change its base year, but shall justify any change to the base year.

6.4.2 Review of base-year GHG inventory

To ensure the representativeness of the base-year GHG inventory, the organization shall develop, document and apply a base-year review and recalculation procedure to account for substantial cumulative changes in base-year emissions resulting from:

a) a structural change in reporting or organizational boundaries (i.e. merger, acquisition or divestiture), or

b) a change in calculation methodologies or emission factors, or

c) the discovery of an error or a number of cumulative errors that are collectively substantial.

The organization shall not recalculate its base-year GHG inventory to account for changes in facility production levels, including the closing or opening of facilities.

The organization shall document base-year recalculations in subsequent GHG inventories.

7 Mitigation activities

7.1 GHG emission reduction and removal enhancement initiatives

The organization may plan and implement GHG reduction initiatives to reduce or prevent GHG emissions or enhance GHG removals.

If implemented, the organization should quantify GHG emission or removal differences attributable to the implementation of GHG reduction initiatives.

NOTE GHG emission or removal differences resulting from GHG reduction initiatives are usually reflected in the organization's GHG inventory, but can also result in GHG emission or removal differences outside GHG inventory boundaries.

If quantified and reported, the organization shall document GHG reduction initiatives and associated GHG emission or removal differences separately, and shall describe:

a) the GHG reduction initiatives;

b) the spatial and temporal boundaries of the GHG reduction initiatives;

c) the approach (appropriate indicators) used to quantify GHG emission or removal differences;

Figure B-7: Annex E – Treatment of Electricity

Annex E
(normative)

Treatment of electricity

E.1 General

This annex provides requirements and guidance for the treatment of imported electricity consumed by the organization and of exported electricity generated by the organization.

The requirements and guidance described below for electricity also apply to imported and exported heating, steam, cooling and compressed air.

E.2 Treatment of imported electricity

E.2.1 General

Emissions from imported electricity consumed by the organization shall be quantified by the organization using the location-based approach by applying the emission factor that best characterizes the pertinent grid, i.e. dedicated transmission line, local, regional or national grid-average emission factor. Grid-average emission factors should be from the emissions year being reported, if available, or from the most recent year if not. Grid-average emission factors for imported consumed electricity shall be based on the average consumption mix of the grid from which electricity is consumed.

Emission factors may also include other indirect emissions associated with generation of electricity, such as:

— transmission and distribution losses;

— other life cycle processes used in generating the electricity such as extracting, transporting and processing the fuel, and/or the processes used in producing the capital equipment for generating the electricity.

The inclusion of those indirect emissions should be quantified, documented and reported separately (see B.4.1).

NOTE The location-based approach is a method to quantify indirect emissions from energy based on average energy generation emission factors for defined geographic locations, including local, subnational or national boundaries.

E.2.2 Additional information

When using contractual instruments in the procurement of its electricity, an organization may use the market-based approach, provided the contractual instruments comply with the following quality criteria:

— convey the information associated with the unit of electricity delivered together with the characteristics of the generator;

— is ensured with a unique claim;

— is tracked and redeemed, retired, or cancelled by or on behalf of the reporting entity;

— is as close as possible to the period to which the contractual instrument is applied and comprises a corresponding timespan;

Şekil A-8: Annex E – Treatment of Electricity

— is produced within the country, or within the market boundaries where consumption occurs if the grid is interconnected.

For operations located in small island developing states (SIDS), a market-based approach may be used to quantify GHG emissions related to electricity consumption for such processes, irrespective of grid inter-connectivity.

NOTE 1 SIDS are defined by the United Nations[22].

When the organization uses those contractual instruments for GHG emission attributes, including renewable energy certificates, these transactions shall be documented and reported separately (see Clause 9).

NOTE 2 Contractual instruments are any type of contract between two parties for the sale and purchase of energy bundled with attributes about the energy generation, or for unbundled attribute claims.

EXAMPLE Contractual instruments can include energy attribute certificates, RECs, GOs, PPAs, green energy certificates, supplier specific emission rates, etc.

NOTE 3 The market-based approach is a method to quantify the indirect emissions from energy of a reporting organization based on GHG emissions emitted by the generators from which the reporting organization contractually purchases electricity bundled with contractual instruments, or contractual instruments on their own.

E.3 Treatment of exported electricity

The term "exported" refers to electricity that is supplied by the organization to users outside the organizational boundaries.

Direct GHG emissions from electricity generated and exported or distributed by the organization may be reported separately, but shall not be deducted from the organization's total direct GHG emissions.

Appendix C: Calculation Details – Standard Charcoal Grill

In this study, greenhouse gas emissions for the standard charcoal grill were calculated based on a **1-hour usage period**. The activity data and emission factors used in the calculations are summarized below.

Activity Data:

- **Charcoal consumption:** 1 kg/hour

Emission Factors (DEFRA, 2025):

- **CO_2:** 2.632 $kgCO_2$/kg charcoal
- **CH_4:** 0.24035 $kgCO_2e$/kg charcoal
- **N_2O:** 0.03260 $kgCO_2e$/kg charcoal

Calculation Approach:

Emission ($kgCO_2e$) = Activity Data × Emission Factor

Total greenhouse gas emissions calculated within this scope:

- **Total CO_2e =** 2.632 + 0.24035 + 0.03260
- **Total Emission =** 2.90495 $kgCO_2e$

These calculations are presented in detail in the **"Standard Charcoal Grill"** worksheet of the **"TANATAR Greenhouse Gas Emission Calculation Comparison.xlsx"** file provided together with this report.

SCENARIO 1: STANDARD CHARCOAL GRILL

Standard Charcoal Grill – 1-Hour Emission Calculation (DEFRA 2025)

Inputs	Value	Unit	Description
Assumption: Charcoal consumption (kg/hour)	1,00	kg	It is assumed that a standard charcoal grill consumes 1 kg of charcoal per hour.

Component	DEFRA Emission Factor ($kgCO_2e$/tonne)	Conversion (tonne -> kg)	Factor ($kgCO_2e$/kg)	Note
CO_2	2632,00000	/1000	2,63200	$kgCO_2$ (CO_2 component)
CH_4	240,35200	/1000	0,24035	$kgCO_2e$ (CH_4 component)
N_2O	32,60034	/1000	0,03260	$kgCO_2e$ (N_2O component)
Total (CO_2e)	**2904,95234**	**/1000**	**2,90495**	Total CO_2e

Results – 1 Hour (assuming 1 kg of charcoal)

Component	Result	Unit	Note
CO_2 (kg)	2,63200	kg	CO_2 component only
CH_4 contribution ($kgCO_2e$)	0,24035	$kgCO_2e$	CO_2 equivalent of CH_4
N_2O contribution ($kgCO_2e$)	0,03260	$kgCO_2e$	CO_2 equivalent of N_2O
Total ($kgCO_2e$)	**2,90495**	$kgCO_2e$	CO_2 + CH_4 + N_2O

Sources and Notes
Reference: Defra GHG Conversion Factors 2025 / Fuels / Coal (domestic) (tonnes)
Note: The CH_4 and N_2O columns in the DEFRA table are already provided in CO_2e terms (GWP applied). Therefore, no additional GWP factor has been applied.

Appendix D: Calculation Details – Infrared MIITI

Greenhouse gas emissions for **Infrared MIITI** were calculated based on the amount of electricity consumed by the device during a **1-hour usage period**.

Activity Data:

- **Electricity consumption:** 1.76 kWh/hour

Emission Factor:

- **Electricity emission factor:** 0.442 kgCO_2e/kWh *(Source: International Energy Agency – Electricity Emission Factors)*

Calculation Approach:

Emission (kgCO_2e) = Electricity Consumption × Electricity Emission Factor

Total greenhouse gas emissions calculated within this scope:

- **1.76 kWh × 0.442 kgCO_2e/kWh**
- **Total Emission =** 0.77792 kgCO_2e

Emissions related to electricity consumption were evaluated using a **total climate impact approach**, and individual greenhouse gas components were not disaggregated.

These calculations are presented in detail in the **“Infrared MIITI”** worksheet of the **“TANATAR Greenhouse Gas Emission Calculation Comparison.xlsx”** file provided together with this report.

SCENARIO 2: INFRARED MIITI

Infrared Miiti – 1-Hour Emission Calculation (IEA 2025)

Inputs	Value	Unit	Description
Assumption: Electricity consumption (kWh/hour)	1,76000	kWh	To be provided by the customer: total electricity consumption for 1 hour (kWh), based on an energy meter or device label/measurement.

Component	IEA Emission Factor (kgCO2e/kWh)	Conversion	Factor (kgCO2e/kWh)	Note
CO_2	0,44200	-	0,44200	Electricity – CO_2 component (if applicable)
CH_4	0,00000	-	0,00000	Electricity – CH_4 component (CO_2e, if applicable)
N_2O	0,00000	-	0,00000	Electricity – N_2O component (CO_2e, if applicable)
Total (CO_2e)	**0,44200**	-	**0,44200**	Grid electricity total (CO_2e)

Results – 1 Hour (based on assumed electricity consumption)

Component	Result	Unit	Description
CO_2 (kg)	0,77792	kg	CO_2 component only
CH_4 contribution (kgCO_2e)	0,00000	kgCO2e	CO_2e equivalent of CH_4
N_2O contribution (kgCO_2e)	0,00000	kgCO2e	CO_2e equivalent of N_2O
Total (kgCO_2e)	**0,77792**	kgCO2e	CO_2 + CH_4 + N_2O

Sources and Notes
References: IEA Emission Factors 2025
Note: The activity data on this page is intended to be entered by the customer.
Note: The emission factor of 0.442 kgCO_2e/kWh used for electricity-related emission calculations is based on country-specific electricity generation mix and carbon intensity data published by the International Energy Agency (IEA).
Note: There is no internationally accepted emission factor data specifically for CH_4 and N_2O components of electricity consumption. Electricity emission factors are therefore provided as total CO_2e values, and the total emission is considered as CO_2e.