

Greenhouse Gas Inventory Report

Our Mission:

To provide innovative, clean and efficient energy solutions
for a better tomorrow

For the period: January 1, 2018 to December 31, 2018
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Introduction

The global financial crisis is causing massive economic upheaval, but with the world's governments working together, recovery is now in sight. Yet the threat posed by global warming still requires a major breakthrough in international negotiations and a change in modern lifestyles to slow the rate of warming and avert an ecological catastrophe.

With our corporate mission of "To provide innovative, clean and efficient energy solutions for a better tomorrow", DET strive to do our utmost to help slow global warming and reduce our environmental impact and also believe in fulfilling Delta's CSR goals through sound corporate governance, balancing stakeholder interests and social participation.

Responding to climate change is not only a corporation's social responsibility. How to respond to the threat it poses; and take advantage of the opportunities it offers; is something that businesses must look at seriously in their corporate strategies.

Carbon emissions reporting becoming an important topic, there is an increasing move towards greenhouse emissions reporting and disclosure. DET is looking towards best practice in the area of sustainability reporting. Sometimes the information is included in Annual Reports or in annual Sustainability and Corporate Responsibility reports. The format and composition of the information varies widely.

Greenhouse Gas report illustrates for a typical company the strategy, targets, performance, and benchmarking of how the company is working to reduce its impact on and adapt to climate change. Clearly, in order to produce reliable information for such reporting, and to monitor emissions performance and management actions to achieve reductions during the year, companies will need to consider carefully processes, systems, controls and internal reporting requirements.

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1. Company Profile

Delta Electronics (Thailand) Public Company Limited (hereafter DET) was established in 1988. DET is the world's leading manufacturers and distributors; design and development of: Power Conversion Products (such as Switching Power Supply, Adaptor & Charger, AC-DC / DC-DC converter, Telecommunication / Server Power Supply) ; Magnetic products (such as Transformer, Line Filter, Coil) ; Electronic control units / Vision system for Automotive; EMI Filter; Cooling Fan; MTS (Molding, Tooling and Stamping); Solenoid product; PWB Assembly and Transformer. Its operation has now covered several regions i.e. Europe, Middle East, South America and Asia with a total consolidated sales turnover of approximate USD 1 billion.



Delta Electronics (Thailand) Public Company Limited had approximately 9,840 workers during the 2015-year in its Bangpoo Plant 1 & 5 and Wellgrow Plant 6:

Plant	Location	No. of Employee
Plant 1 & 5	Bangpoo	7,717
Plant 6	Wellgrow	3,452
Total		11,169

2. GHG Management

2.1 Guideline of the report

This emissions inventory report has been prepared and written in accordance with the principles set out by the International Standards Organization (ISO) for the quantification and reporting of Greenhouse Gas Emissions and Removals (ISO14064-1).

2.2 Report Principle and Criteria

According to the report complete, consistent, accurate, relevant and transparent information complied principles.

2.3 Base Year

Setting and Adjustment the base year

Set the base year

Base-year Greenhouse Gas Inventory is annually thereafter, DET shall report the inventory of the preceding calendar year. In 2014, DET had built up several areas which consume high amount of electricity. So DET decided the chosen new base year calculated for this report from January 1, 2014 to December 31, 2014.

Adjust the base year

Amendments to the base year by the implementation team by adjustment the internal and external situation, and report to Top management for approval.

Recalculation of the base year's emission

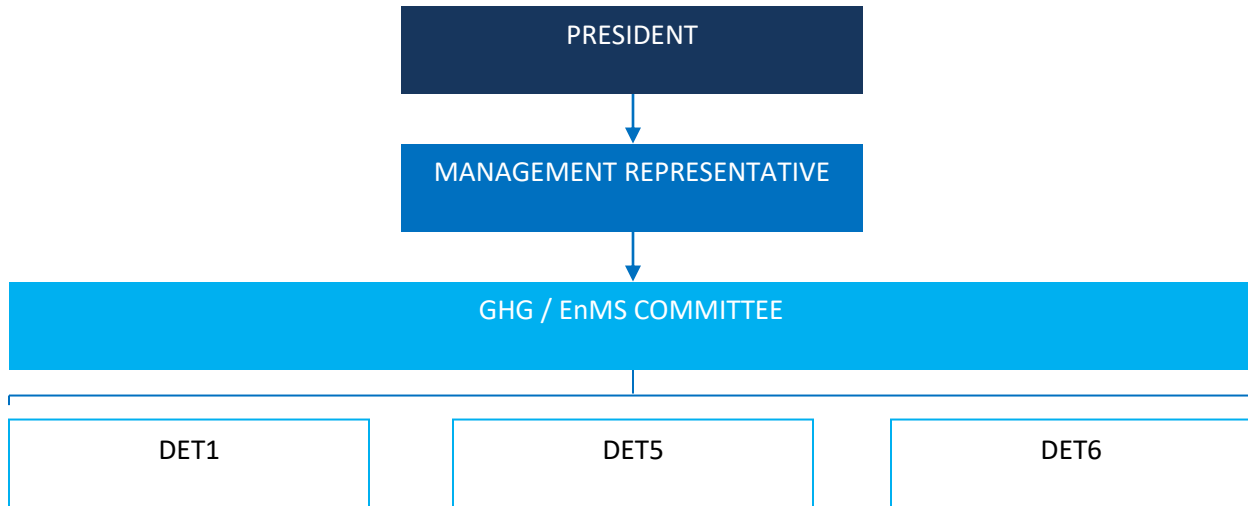
The base year emissions recalculation base-year inventory in the following cases should be re-calculated emissions for more than 5% significance threshold totally:

- When the operation of boundary changes;
- When the source of equity stakeholders / transfer;
- When a change in calculation method.

2.4 Organizational and Operational Boundaries

The company used the operational control-based approach to defining organizational boundaries. Due to the control prescribed nature of the core company, the application of either the control or equity approach is likely to have the same effect. The activity data is gathered from Delta factories in Thailand. The organizational boundary of Delta Electronics (Thailand) PCL. is defined by the purposes of the greenhouse gas (GHG) inventory include core business activities only.

2.5 GHG Organization and Responsibility



Responsibility:

Executive Management Team (Management Representative & GHG / EnMS Committee)

DET's Executive Management Team shall review and ultimately approve DET's annual GHG inventory and Carbon Footprint Report / Strategy. Members of the Executive Management Team will also be responsible for the communication of the Report / Strategy at their plant through meetings and discussions where necessary.

Plant Manager

DET's Plant Manager shall oversee the development of DET's annual GHG inventory and Carbon Footprint Report / Strategy. They shall review DET's annual GHG inventory and Carbon Footprint Report / Strategy, and assume ultimate responsibility for the achievement of targets set.

Concern Department Manager

DET's Manager shall oversee the day-to-day development of DET's annual GHG inventory. They will develop and manage the projects annual communications strategy, arrange documentation to communicate inventory and strategy, arrange and coordinate the project's annual external verification and assurance process.

The Manager shall also provide support to the EMR in the development of DET's annual GHG inventory.

EMR and Plant Representative

DET's EMR, together with members of the Plant Representative Team will gather data from facilities, finance and related dept; and develop an annual GHG inventory with Management Representative. They shall also work cooperatively with external verification and assurance team to allow smooth implementation of process.

DET's Plant Representative shall assist in the provision of data wherever applicable. The team shall ensure the collection of data for annual inclusion in DET's GHG inventory.

2.6 Management Review

As the new base year was set as 2014 for DET reported detailed greenhouse gas emissions, Management Representatives or his assignee shall review and approve Greenhouse Gas Inventory Report. On an annual basis, it shall be reviewed the relevance of DET's performance and the effectiveness of existing monitoring / measurement systems to provide accurate, complete and timely information sets to management team. The latest management review was held in January 24, 2019.

2.7 Verification of Greenhouse Gas Inventory Report

This Greenhouse gas Emissions report has been verified by SGS auditor. A positive assurance report has been given over the assertions and quantifications included in this report.

3. Primary Statement of GHG Inventory

3.1 Greenhouse Gas Emissions Sources

Emissions sources were identified with reference to the methodology described in the Greenhouse Gas Protocol and ISO14064-1:2006. Emissions sources Identification was achieved using specific guidance on Scope 3 factors included in ISO14064-1 Annex B and in the Greenhouse Gas Protocol (WBCSD).

These emissions have then been classified into 3 categories. The definition of each has been adapted from the Greenhouse Gas Protocol; the 3 types of emissions are:

- Direct Emissions (Scope 1): from sources that are owned or controlled by DET.
- Indirect Emissions (Scope 2): from generation of purchased electricity consumed by DET.
- Indirect Emissions (Scope 3): Emissions that occur as a consequence of the activities of DET, but occur from sources not owned or controlled by DET. Inclusions of these are determined on DET's aims of the programme.

Actual Emissions

Scope of Emissions	Emission Sources
Scope 1	<ul style="list-style-type: none"> - Fire Extinguisher (CO₂ type & HFC227ea / FM200 type) - Generator and Fire Pump (Diesel) - Cooling System (HFC134a/R134a & HFC404a/R404a & HFC407c/R407c & HFC32/R32) - Septic Tank (CH₄) - Company Car (Gasoline) / Company Van (Diesel) - Injection and Welding LPG Cylinder (LPG) - Circuit Breaker (SF₆) - Water Drinking Dispenser (HFC134a / R134a) - Forklift (Diesel)
Scope 2	Electricity purchased from other organization used in: <ul style="list-style-type: none"> - Delta Electronics (Thailand) Public Company Limited (Plant 1) - Delta Electronics (Thailand) Public Company Limited (Plant 5) - Delta Electronics (Thailand) Public Company Limited (Plant 6)
Scope 3	<ul style="list-style-type: none"> -Transportation of Raw material & Finished Goods (Ocean and Air Freight only), Bus for employees, Van for employee including Business trip, Ambulance, Transportation of Food & Waste Management Entrepreneur. -Canteen (Liquefied Petroleum Gas) -Industrial & Normal Waste (from Production / Garbage)

Remark:

- No biomass is used in DET operations and therefore no emissions from the combustion of biomass are included.
- No generated electricity from fuel combustion, heat or steam is used in DET operations and therefore no emissions from these sources are included.

3.2 Greenhouse Gas Emissions Inclusions & Exclusions

Scope of Emissions	Emissions Sources
Inclusions:	-Transportation of Raw material and Finished Goods (Ocean and Air Freight only) -Transportation of Business trip by Air Freight
Scope 3	Exclusions: <ul style="list-style-type: none"> -Transportation of Bus for employees, Van for employee including Business trip, Ambulance, Transportation of Food & Waste Management Entrepreneur. -Canteen (Liquefied Petroleum Gas) -Industrial & Normal Waste (from Production / Garbage)

Indirect Emissions (Scope 3)

The emissions are occurred as a consequence of the activities of DET, but occur from sources not owned or controlled by DET; therefore some Indirect Emissions (Scope 3) have been ignored.

3.3 Summary of Greenhouse Gas Emissions

Type of Emissions (Tonnes CO ₂ e*)	2018 Performance
Direct (Scope 1) Emissions:	
- Fire Extinguisher (CO ₂ type)	0.00
- Fire Extinguisher (HFC227ea / FM200 type)	0.00
- Generator (Diesel)	5.26
- Fire Pump (Diesel)	1.22
- Cooling System (HFC134a / R134a)	107.25
- Cooling System (HFC404a / R404a)	0.00
- Cooling System (HFC410a / R410a)	7.25
- Cooling System (HFC407c / R407c)	0.00
- Cooling System (HFC32 / R32)	0.00
- Air Compressor System (HFC407c / R407c)	0.00
- Septic Tank (CH ₄)	0.54
- Company Car (Gasoline)	5.64
- Company Van (Diesel)	33.47
- Injection LPG Cylinder	0.00
- Welding LPG Cylinder	0.00
- Circuit Breaker (SF ₆)	0.00
- Water Drinking Dispenser (HFC134a / R134a)	0.00
- Forklift (Diesel)	88.02
Total Direct (Scope 1) Emissions	248.65
Indirect (Scope 2) Emissions:	
All purchased electricity in owned buildings.	
Total Indirect (Scope 2) Emissions	39,355.96
Total Gross Controlled Emissions (Scope 1 and Scope 2)	39,604.61
Indirect (Scope 3) Emissions:	
- Transportation of Raw material and Finished Goods	
- Transportation of Business trip by Air Freight	
Total Indirect (Scope 3) Emissions	46,264.62
Total Gross Controlled Emissions (Scope 1 - Scope 3)	85,869.29

**Data expressed in carbon dioxide equivalent units.*

Quantity of Greenhouse Gas separated by type of emissions

Area	CO ₂	CH ₄ *	N ₂ O*	HFCs*	PFCs*	SF ₆ *	Ton. CO ₂ -e
Scope 1	131.47	0.77	1.96	114.50	0	0	248.70
Scope 2	39,356.96	0	0	0	0	0	39,355.96
Scope 3	46,264.62	0	0	0	0	0	46,264.62
Total Gross Controlled Emissions	85,753.05	0.77	1.96	114.50	0	0	85,869.28

Note: Greenhouse Gas Emissions Rate follows Global Warming Potential from IPPC GWP2007

3.4 Data Collection Quantification of Methodologies

The next table is shown the details of the sources, the relevant data, and the emission factors, which have been used. All factors have been approved by DET. The amount of CO₂e has been calculated by multiplying the activity data sources by DET by the relevant emission factors. As this is the first year that DET has produced these figures, there are no changes in methodology to report.

Emission or Removal Sources	Data Unit	Emission Factors	Global Warming Potential	Factor Sources
Electricity	kWh	0.5821	1.00	TGO Database updated April 30, 2013 with reference to Thailand Grid Mix Electricity LCI Database 2552 (2009)
Diesel (Stationery Combustion)	Liter	CO ₂ = 2.70 CH ₄ = 0.000109 N ₂ O = 0.0000219 CO ₂ e = 2.708	1.00	TGO Database updated April 30, 2013 with reference to IPCC Vol.2 table 2.2, DEDE IPCC Vol.2 table 3.2.1, 3.2.2, PTT
Diesel (Mobile Combustion)	Liter	CO ₂ = 2.70 CH ₄ = 0.000142 N ₂ O = 0.000142 CO ₂ e = 2.7446	1.00	
Gasoline (Mobile Combustion)	Liter	CO ₂ = 2.18 CH ₄ = 0.00104 N ₂ O = 0.000101 CO ₂ e = 2.2376	1.00	
Truck 10 wheels / B5 / 16 tons (No-load)	Km	0.5851	1.00	CFP Guideline; 3 rd Edition
Truck 10 wheels / B5 / 16 tons (Full-load)	Ton-km	0.0529	1.00	CFP Guideline; 3 rd Edition
Truck 6 wheels / B5 / 11 tons (No-load)	Km	0.4882	1.00	CFP Guideline; 3 rd Edition
Truck 6 wheels / B5 / 11 tons (Full-load)	Ton-km	0.0609	1.00	CFP Guideline; 3 rd Edition
Pick-up 4 wheels / 7 tons (No-load)	Km	0.2395	1.00	CFP Guideline; 3 rd Edition
Pick-up 4 wheels / 7 tons (Full-load)	Ton-km	0.2136	1.00	CFP Guideline; 3 rd Edition
LPG (Stationery Combustion)	Kg	CO ₂ = 3.11 CH ₄ = 0.0000493 N ₂ O = 0.00000493 CO ₂ e = 3.1133]	1.00	TGO Database updated April 30, 2013 with reference to IPCC Vol.2 table 2.2, DEDE IPCC Vol.2 table 3.2.1, 3.2.2, DEDE
LPG (Mobile Combustion)	Kg	CO ₂ = 2.77 CH ₄ = 0.00306 N ₂ O = 0.00000986 CO ₂ e = 2.8449	1.00	
Ship Container	Ton-km	0.01	1.00	CFP Guideline; 3 rd Edition
Air (Outbound)	Ton-km	0.57	1.00	HP Global Citizenship Report 2009 (World Resource Institute GHG Protocol)
Sea (In Land)	Ton-km	0.01	1.00	CFP Guideline; 3 rd Edition (Environmental Footprint of Surface Freight Transportation, Lawson Economics Research Inc, 2007)
Refrigerant (HCFC22 or R22)	Kg	1.00	HCFC = 1,810	IPCC2007
Refrigerant (HFC134a or R134a) Refrigerant (HFC404a or R404a) Refrigerant (HFC23 or R23) Refrigerant (HFC407c or R407c) Refrigerant (HFC32 or R32) Fire Extinguisher (HFC227ea or FM200)	Kg	1.00	HFC134a = 1,430 HFC404a = 3,922 HFC23 = 14,800 HFC407c = 1,774 HFC227 = 3,220 HFC32 = 675	IPCC2007 / Guidelines for Utilization of R407c – Tecumseh Products Company (updated in August 2009)
Circuit Breaker (SF ₆)	Kg	1.00	22,800	IPCC2007
Waste (Paper)	Kg	2.93	1.00	CFP Guideline; 3 rd Edition
Waste Water (Industrial)	m ³	0	1.00	IPCC Volume 5 : Wastewater Treatment and Discharge
Waste Water (Domestic) for CH ₄	m ³	0.48	25	IPCC Volume 5 : Wastewater

3.5 References for Emission Factors

- CO₂ Emission Factor Sourced from: Thailand National Data Base
- CO₂ Emission Factor Sourced from: Electricity Generating Authority of Thailand (EGAT) 2011
- ISO14064-1 GHG Part 1: Specification for Quantification, Monitoring and Reporting of Entity Emissions and Removal
- Google Map (<http://map.google.co.th/maps?hl=th&tab=wl>)
- ISO14040 Environmental Management – Life Cycle Assessment – Principles and Framework
- ISO14044 Environmental Management – Life Cycle Assessment – Requirements and Guidelines
- Carbon Footprint Product Guideline (TGO) – 3rd Edition
- Carbon Footprint Organization Guideline (TGO) – July 2011
- AA1000: A Standard for Ethical Performance
- PAS2050: Assessing the Life Cycle Greenhouse Gas Emissions of Goods & Services
- ISO26000: Guidance on Social Responsibility
- IPCC Volume 5: Wastewater Treatment and Discharge
- <http://www.searates.com/reference/portdistance>
- <http://www.timeanddate.com/>
- <https://www.prokerala.com/travel/airports/distance/>

3.6 Uncertainty Management

This Greenhouse Gas Inventory report has been assessed and evaluated the uncertainty rating. The rating is 24 points which focus on Electricity consumption (98% of Greenhouse Gas Inventory). The rating is 18 points which focus on Transportation system (Company’s car and van). The rating is 16 points which focus on Septic Tank (Domestic Wastewater). The rating is 12 points which focus on Fire Fighting System, Diesel used in Electricity Backup System, Refrigerant and LPG used in Welding & Injection Process which has been shown the activity data is moderated data quality which comes from the regular measurement eq. Meter Reading, Purchase Order, etc.; and Emission factors is uncertainty of data quality which comes from Manufacturer to provide coefficient. And the rating is 6 points which focus on Transportation system (Forklift).

Explanation: Greenhouse Gas Inventory and the estimated operation itself on the scientific uncertainty, to achieve the purpose of continuous improvement of data quality, therefore, uncertainty is evaluated. IPCC uncertainty is used in more complex calculation. DET adapts Delta Group Guideline for the model of uncertainty which provided by the way of class distinction specify below.

The uncertainty of inventory operations can be divided into model uncertainty and parameter uncertainty. Since the pattern is more complex uncertainty, therefore, not be included in this assessment of the range of uncertainty. Parameter uncertainty refers to the uncertainty of quantitative parameters. Activity data and Emission factors include the uncertainty of activity data differentiate the following 3 levels:

- Automatic Continuous Measurement
- Regular Measurement (Meter reading, Purchase order)
- Own Estimation

Note: Order of score is 6-1; the higher score the better the response data, the lower score the uncertainty; will Emission Factors in 6 categories:

- Measurement / Material and Energy balance coefficient
- Manufacturer to provide coefficient
- Regional Emission Factors
- National Emission Factors
- International Emission Factors

Value Type	Data Quality Level		
	X=6-5 Points	Y=4-3 Points	Z=2-1 Points
Activity Data	Automatic Continuous Measurement	Regular Measurement (Meter Reading, Purchase Order)	Own Estimation
Emission Factors	A=6-5 Points	B=4-3 Points	C=2-1 Points
	- From Measurement / Quality Factor - Manufacturer to provide coefficient	- Regional Emission Factors - National Emission Factors	International Emission Factors

The qualitative analysis of uncertainty assessment method adopted, in the following table will be divided into 6 overall data quality as the following table:

Rating	Overall Level of Scoring Data	Explanation
First Class	1 - 9	High uncertainty, Data quality is very poor.
Second Class	10 - 18	Uncertainty, Moderate data quality.
Third Class	19 - 27	Slightly uncertainty, Data quality is good.
Fourth Class	28 - 36	Uncertainty is very low, Excellent data quality.

4. Future Opportunity

4.1 Performance Overview and Monitoring

DET shall review the future targets and ensure they remain appropriate for the business and industry, therefore continuously drive DET's performances and associated management reward by planning, implementing and documenting the actions; to monitor Greenhouse Gas Inventory through the meeting to maintain GHG information management quality and; to reduce or prevent Greenhouse Gas Emissions which is apart of Energy Saving project.

The target information is based on estimates and assumptions that are subject to significant inherent uncertainties, which may be difficult to predict and may be beyond control. As with most forward looking information, there can be no assurance that targets will be realized.

4.2 Greenhouse Gas Reduction and Removal

DET will have a management plan in place for managing and reducing emissions by early 2014 with the aim to be carbon emissions reduction by the end of 2020. DET reflects to the Energy Saving Action Plan to reduce the electricity intensity by 30% (Electricity consumed / Revenue) based on 2014 actual by 2020.