ISKANDAR MALAYSIA
GREENHOUSE GAS INVENTORY 2017

Final Report

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Final Report

ISKANDAR
MALAYSIA

The global release of Iskandar Malaysia's first and second Greenhouse Gas (GHG) Inventory for 2015 and 2016 respectively at COP22 and COP23 marked significant milestones for the development in carbon monitoring and tracking framework for this economic region.

Therefore, it gives me great pleasure to present to you the third report of the Iskandar Malaysia GHG Inventory for the year 2017. Similar to the previous inventories, we continue to use the internationally recognised Global Protocol for Community-scale Greenhouse Gas Emission Inventories (GPC) to monitor and account for GHG emission in Iskandar Malaysia.

Iskandar Malaysia is committed in its effort to reduce the carbon emission intensity by 58% by 2025 and create a greener, more sustainable yet economically dynamic environment. Our effort is also recognised globally as reflected in the Global Covenant of Mayors for Climate and Energy (GCoM), a global coalition of mayors and city leaders who are committed for sustainable local climate action.

I believe in the importance of trans-agency transboundary cooperation especially with our local authorities in achieving our environmental goals. We need to learn from others, leveraging on each other's strengths and weaknesses, and work together to be more effective in managing environmental issues. With such strong support from all key stakeholders, our ambitious but worthwhile target of the greenhouse gas emission reductions can be achieved in a timely and proactive manner.

DATUK ISMAIL IBRAHIM
Chief Executive
Iskandar Regional Development Authority (IRDA)

ISKANDAR MALAYSIA GREENHOUSE GAS INVENTORY 2017

Key Messages:

- Increase 36.8% of greenhouse gas emissions from 2010 to 2017 due to healthy and robust economic growth.
- Increase 5.4% in absolute emissions from 2016, corresponding to high GDP growth of the region.
- Emission intensity reduction of 12.9% from 2010 to 2017.
- The average rate of emissions intensity reduction from 2010 to 2017 is only 1.9%, with this percentage reduction, Iskandar Malaysia can only achieve 25.0% reduction by 2025.
- Review and revise the 2025 reduction target to realistic and achievable target should be considered to be more in line with the Nationally Determined Contribution (NDC) Malaysia by 2030.

To meet the targeted emission intensity reduction of 58% of base year (2010) emissions by 2025, **8.7%** is the average yearly reduction rate required from 2018 onwards

Emissions Intensity (2010-

12.9% reduction from 2010 to

2010	2016	2017
0.2484 $ktCO_2e$/RM million GDP	**0.2189** $ktCO_2e$/RM million GDP	**0.2164** $ktCO_2e$/RM million GDP

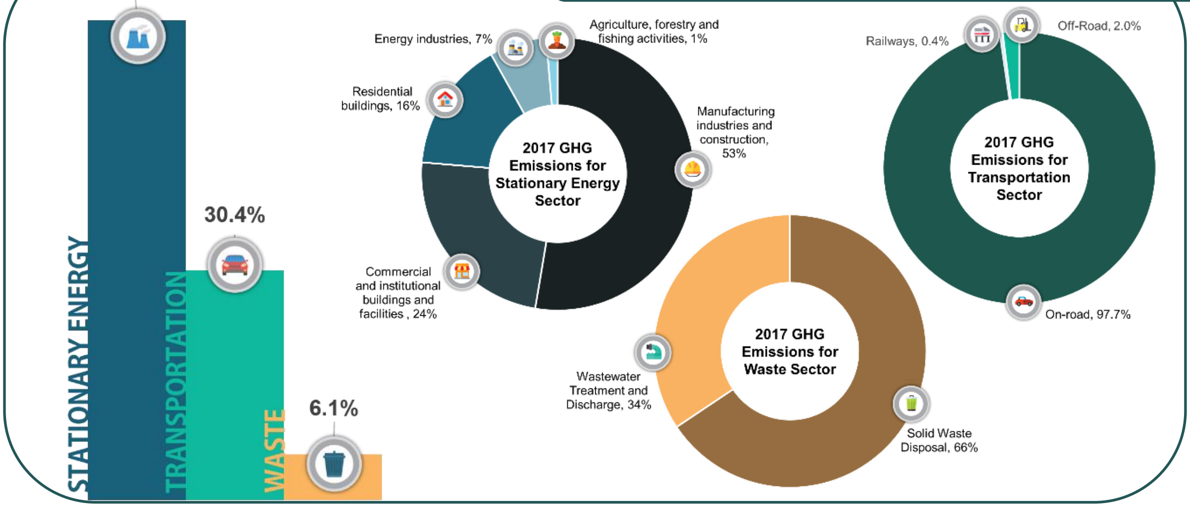
2017 BASIC Absolute GHG

2010	2016	2017
11,839 $ktCO_2e$	**15,373** $ktCO_2e$	**16,200** $ktCO_2e$

↑ 36.8%

↑ 5.4%

2017 GHG Emissions by



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ABBREVIATION

AFOLU	Agriculture, Forestry, and Other Land Use
AR	Assessment Report
BEI	Building Energy Index
BEMRS	Building Energy Monitoring and Reporting System
BOD	Biochemical Oxygen Demand
BUR	Biennial Update Report
CDP	Comprehensive Development Plan
CH4	Methane
COD	Chemical Oxygen Demand
CO2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalent
COP	Conference of the Parties
DB	Sludge Drying Bed
DOC	Degradable Organic Carbon
DOSM	Department of Statistics Malaysia
FFB	Fresh Fruit Bunches
FGD	Focus Group Discussion
FOD	First Order Decay
GAIA	Green Accord Initiative Award
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GPC	Global Protocol for Community Scale Greenhouse Gas Emissions Inventories
GWP	Global Warming Potential
IGES	Institute for Global Environmental Strategies
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
IRDA	Iskandar Regional Development Authority
IWK	Indah Water Konsortium Sdn. Bhd.
JICA	Japan International Cooperation Agency
JST	Japan Science and Technology Agency
KTMB	Keretapi Tanah Melayu Berhad
LCS	Low Carbon Society
LCSAP2025	Low Carbon Society Action Plan 2025
LCSBPIM2025	Low Carbon Society Blueprint for Iskandar Malaysia 2025
MBIP	Majlis Bandaraya Iskandar Puteri

MBJB	Majlis Bandaraya Johor Bahru
MCF	Methane Correction Factor
MDP	Majlis Daerah Pontian
MESTECC	Minister of Energy, Science, Technology, Environment and Climate Change
MGTC	Malaysian Green Technology Corporation
MPKu	Majlis Perbandaran Kulai
MPOB	Malaysian Palm Oil Board
MPPG	Majlis Perbandaran Pasir Gudang
MW	Megawatts
N2O	Nitrous Oxide
NC	National Communication
NCV	Net Calorific Value
NDC	Nationally Determined Contribution
NEB	National Energy Balance
NIES	National Institute for Environmental Studies
NMT	Non-Motorized Transport
OX	Oxidation Factor
POME	Palm Oil Mill Effluent
RE	Renewable Energy
SATREPS	Science and Technology Research Partnership for Sustainable Development
SL	Sludge Lagoon
SRF	Sludge Reception Facility
ST	Energy Commission Malaysia
SWCorp	Solid Waste Management and Public Cleansing Corporation
tCO2e	tonne carbon dioxide equivalent
TNB	Tenaga Nasional Berhad
TOW	Total Organic in Wastewater
TP	Tapak Pelupusan
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UPENJ	Johor Economic Planning Unit
UTM	Universiti Teknologi Malaysia
WWTP	Waste Water Treatment Plant

EXECUTIVE SUMMARY

Introduction

Iskandar Malaysia recognises the importance of sustainable development and has placed much emphasis on promoting a green economy within the region. Under the leadership of Iskandar Regional Development Authority (IRDA), Iskandar Malaysia had released its inaugural comprehensive greenhouse gas (GHG) inventory for 2015 and it was followed by the second GHG inventory for 2016. This is the third Iskandar Malaysia's GHG inventory for the year of 2017. The inventory establishes a basis for assessing GHG emissions in Iskandar Malaysia, which also provides information on mitigation efforts in the economic region.

Iskandar Malaysia was the first in the nation to adopt the respected Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) to account for its GHG emissions. The GPC BASIC reporting compliant inventory was also shared at the 22nd session of the Conference of Parties (COP22) to the United Nations Framework Convention on Climate Change (UNFCCC) which was held in Marrakech, Morocco in 2016 and at COP23 in Bonn, Germany in 2017.

Following the previous two GHG inventories, IRDA is determined to continually update and report Iskandar Malaysia's GHG emissions. This will enable the annual tracking of emissions and document the progress of mitigation efforts toward reducing GHG emissions. This is aligned with the Johor State level, Sustainable Development Plan for 2019-2030 specifically Thrust 1: Implementing Sustainable Development and Thrust 8: Resources Conservation.

This inventory is part of IRDA's initiative under Low Carbon Society Blueprint, which is a comprehensive programme towards realisation of a low carbon society in the economic region. It was also part of an enhanced version of Iskandar Malaysia Comprehensive Development Plan, CDP(ii) (2014-2025) featuring the five Big Moves on achieving Iskandar Malaysia vision of 'A strong and sustainable metropolis of International Standing.' This includes Greening Iskandar Malaysia, aiming to transform Iskandar Malaysia into a green and low carbon region through urbanscape and protection of ecology. This is a further initiative of providing accelerating programmes to safeguarding the natural resources and environment within this economic region.

Iskandar Malaysia –GHG Emissions Reporting Objectives

The internationally recognised standard for GHG accounting and reporting - GPC has been adopted to track and manage the performance of GHG emissions over time in Iskandar Malaysia.

The main objective of Iskandar Malaysia GHG Reporting is to regularly and continuously monitor the current status of GHG emitted within this rapidly developing city/region. Through this effort, the progress of previously implemented actions to reduce GHG emissions could be tracked as well. This is in line with GPC recommendation that cities update their inventory on an annual basis, as it provides frequent and timely progress on overall emissions. In addition, the tracking of carbon emission is complementary to the implementation of the Low Carbon Society Blueprint through the provision of insight into GHG trends in Iskandar Malaysia.

For the 2017 inventory, the specific objectives are:

- Accounting for Iskandar Malaysia's GHG emissions for 2017 calendar year;
- Comparison of 2017 GHG emissions trends and intensity with 2010 as base year; and
- Identification of gaps in data for the accounting of GHG emissions and make recommendations on areas for improvement.

Reporting Framework

Iskandar Malaysia's 2017 GHG inventory continues to adopt GPC as standard to account for its city-wide emissions. This inventory is prepared according to GPC's BASIC level reporting requirements and recommendations.

Greenhouse gases accounted:

Carbon dioxide (CO_2)
Methane (CH_4)
Nitrous oxide (N_2O)

As recommended in the GPC, the latest Global Warming Potentials (GWPs) is used to convert individual GHG emissions into carbon dioxide equivalents (CO_2e) and is acquired from the latest Assessment Report (AR), the Fifth AR (AR5) in the Intergovernmental Panel on Climate Change (IPCC). However, due to the adoption of GWPs from IPCC Fourth Assessment Report (AR4) in the latest national level inventory, the Biennial Update Report (BUR) submitted in September 2018, conversion of Iskandar Malaysia GHG emissions to CO_2e using AR4 GWPs were also calculated for ease of comparison with the latest national level inventory.

The Scopes and City-induced Framework –BASIC Level

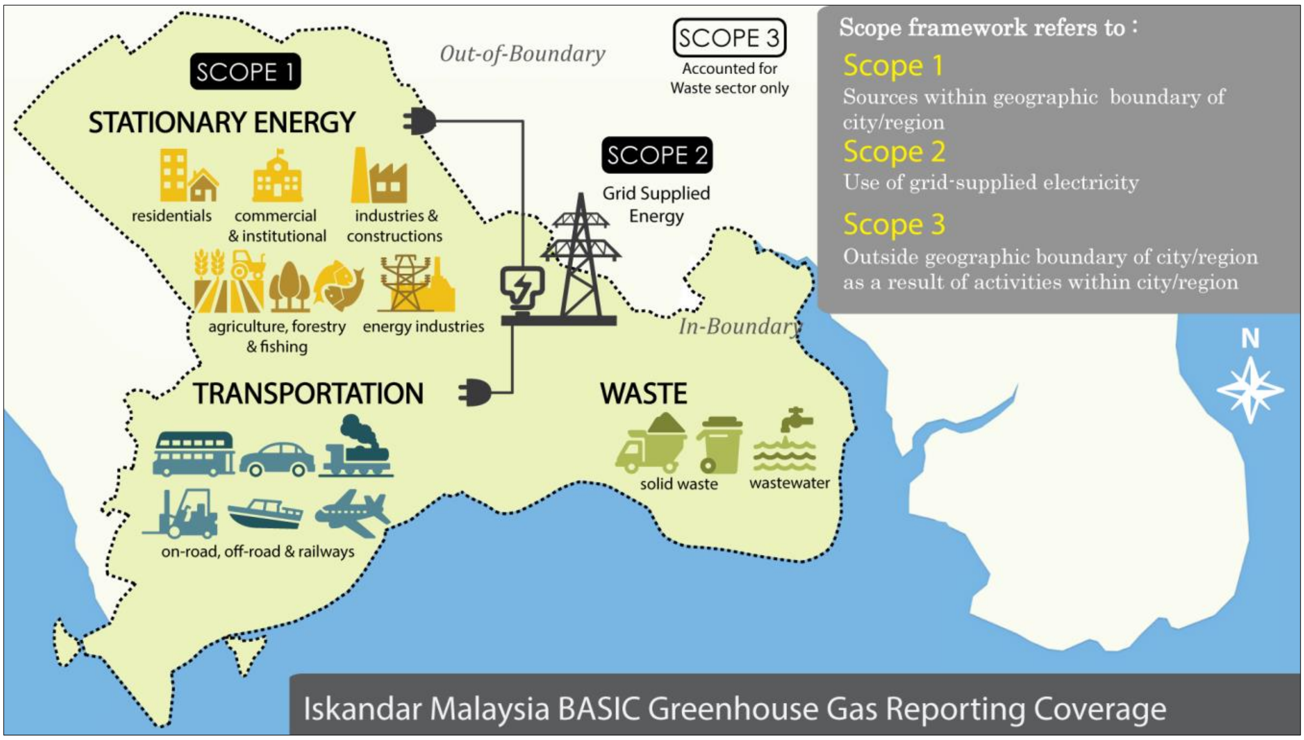

Figure a: *Coverage of Iskandar Malaysia's BASIC GHG reporting*

Methodologies

Fundamentally, GHG emissions are calculated using formula below:

Greenhouse Gas Emissions = Activity data x Emission factor

where activity data is defined as measurable activity taking place in a given time period i.e. a year for Iskandar Malaysia 2017 reporting period. These data may be obtained from i.e. government departments and statistics agencies, sector experts/ stakeholder organisations or directly from operators or local authorities. If the data obtained is not time and geographically specific in correlation to the city boundary, the inventory data can be determined by scaling the available data using suitable scaling factor.

Emission factor depicts the mass of GHG emissions released relative to a unit of activity taken place. Default emission factors can be acquired from international guidelines such as 2006 IPCC Guidelines. However, if local, regional or country-specific emission factors are available, those are recommended to be used as the main concern is to calculate the most accurate amount of GHG released.

With reference to GPC, the 3 sectors required to be accounted under BASIC level reporting are Stationary Energy, Transportation and Waste.

Approaches

Due to the unavailability of primary fuel consumption data within Iskandar Malaysia, secondary fuel consumption data were extracted from National Energy Balance (NEB) 2016, projected to 2017 and scaled down using population or industrial gross domestic product (GDP) to obtain the fuel consumptions for Stationary Energy sub-sectors. Fuel consumption for residential buildings, commercial and institutional buildings and facilities, and agriculture, forestry and fishing activities sub-sectors were scaled down using population whereas manufacturing industries and construction sub-sectors using industrial GDP.

Primary data on fossil fuel and electricity consumption for Energy Industries sub-sector were obtained directly from each power plant within Iskandar Malaysia. Meanwhile, secondary data on electricity consumption for the other Stationary Energy sub-sectors were obtained from Energy Commission Malaysia (ST).

The latest grid emission factor for Peninsular Malaysia was sourced from Malaysia Green Technology Corporation (MGTC) while other relevant emission factors were sourced from 2006 IPCC Guidelines.

The estimation of On-road transportation fuel consumption within Iskandar Malaysia was done similar to Stationary Energy sector. Secondary fuel consumption data were extracted from NEB 2016, projected using average annual growth rate of fossil fuels consumption from 2010-2016 (extracted from NEB 2016) to obtain 2017's national fuel consumption, and scaled down using population as scaling factor.

The primary data of Off-road transportation and Railways fuel consumption were provided by port authorities and airport authority as well as railway operator respectively.

Relevant emissions factors were sourced from 2006 IPCC Guidelines depending on type of fuel used in each sub-sectors.

Emissions due to electricity consumption under Transportation sector were already included elsewhere in Stationary Energy sector.

Primary data of Municipal Solid Waste, Domestic Wastewater and Sludge, and Industrial Wastewater that were generated, disposed and treated within the city boundary were obtained from local authorities, landfill operator, sewage/ wastewater treatment plant operators (i.e palm oil mill and rubber mill owners) and from relevant authorities i.e. Solid Waste Management and Public Cleansing Corporation (SWCorp). When specific data were not available, population and waste discarded rate were used as parameter for the extrapolation.

GHG emissions of Solid Waste Disposal were calculated using First Order Decay (FOD) model while emissions from wastewater treatment plants using Total Organic Degradable Material (TOW) method. Both methods were adopted from 2006 IPCC Guidelines for National Greenhouse Gas Inventories in Volume 5, Chapter 3 and Volume 5, Chapter 6 respectively.

Summary Result of Iskandar Malaysia GHG Inventory 2017

Sector		Total by Scope (million tCO_2e)			Total by City-Induced Reporting Level (million tCO_2e)
		Scope 1 (Territorial)	Scope 2	Scope 3	BASIC
Stationary Energy	Energy use (all I emissions except I.4.4)	3.11	7.18	-	10.28
	Energy generation supplied to the grid (I.4.4)	10.83			
Transportation		4.93	IE	-	4.93
Waste	Generated in the city (all III.X.1 and III.X.2)	0.99		NE for Solid Waste NO for Wastewater	0.99
	Generated outside city (all III.X.3)	0.05			
Total	**Territorial Emissions**	**19.91**			**16.20**
	BASIC Emissions				

Notation Keys:

NE – Not Estimated *NO – Not Occurring* *IE – Included Elsewhere*

– Sources required for BASIC reporting + *– Sources required for BASIC+ reporting*

– Sources required for territorial total but not for BASIC/ BASIC+ reporting (italic) *– Non-applicable emissions*

BASIC emissions figure displayed in above table with a value of 16.20 million tCO_2e, accounts only certain sub-sectors under the 3 main sectors. Those sub-sectors are all in-boundary emission sources that exist in most cities. As the above BASIC emissions figure is based on the latest GWP value from AR5, greenhouse gas emissions of Iskandar Malaysia based on GWP from AR4 were calculated as well for ease of comparison with Malaysia's national level reporting. Territorial total emissions were 19.81 million tCO_2e and total BASIC emissions were 16.10 million tCO_2e when GWPs of AR4 is applied.

Emissions Trends 2010 – 2017

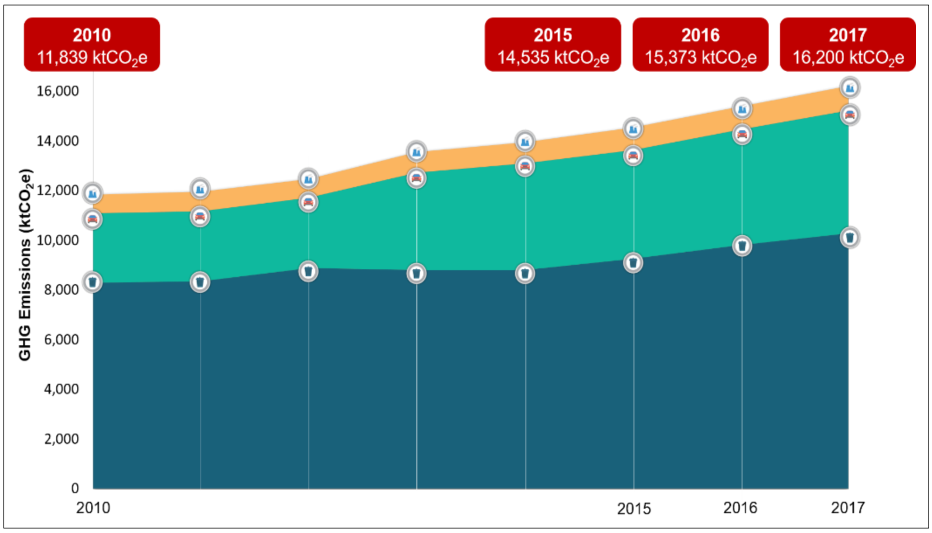

Figure b: Overview of Iskandar Malaysia's GHG emissions

Amount of GHG emissions calculated under BASIC level reporting for Iskandar Malaysia in 2017 were 16.20 million tCO_2e. In 2010, the GHG emissions were 11.84 million tCO_2. This is equivalent to an increase of 36.8% to the base year of 2010 while 5.4% to last year. The average annual growth rate for BASIC emissions is 4.6%.

Iskandar Malaysia emission's escalation since 2010 reflect the ongoing economic development in the economic region. It can also be proven by the growth of its GDP with an increase of 57.1% from 2010 to 2017 and with average annual growth rate of 6.7%.

Sectors Trends 2010 – 2017

Out of the 16.20 million tCO_2e of BASIC emissions, 63.5% of it was largely contributed by Stationary Energy sector with an amount of 10.28 million tCO_2e. This was followed by 4.93 million tCO_2e of Transportation sector which represent 30.4% of overall emissions. The remaining 6.1% was added by Waste sector with an amount of 0.99 million tCO_2e.

This emission proportionating trend where Stationary Energy sector was the largest while Waste was the smallest contributor to the whole emissions existed since the past seven years. However, as shown in Figure b, since 2012 onwards, GHG emissions caused by Transportation sector is slowly increasing. This was mainly contributed by On-road Transportation sub-sector.

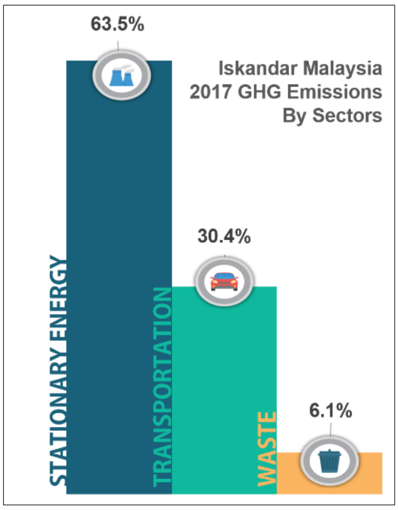

Figure c: *Percentage of GHG emissions by sectors*

Stationary Energy

GHG emissions of Stationary Energy sector arises from fossil fuel combustion and grid-supplied energy consumed within Iskandar Malaysia geographical boundary. Though these emissions sources were accounted in the four sub-sectors under Stationary Energy, the emission sources for Energy Industries sub-sector are a bit different. For Energy Industries sub-sector, the emissions accounted was from energy used (both fossil fuel and grid-supplied energy) in power plant auxiliary operations. Historically since 2010, the average ratio of emissions contribution by the fossil fuel combustion to grid-supplied energy consumption was 30:70.

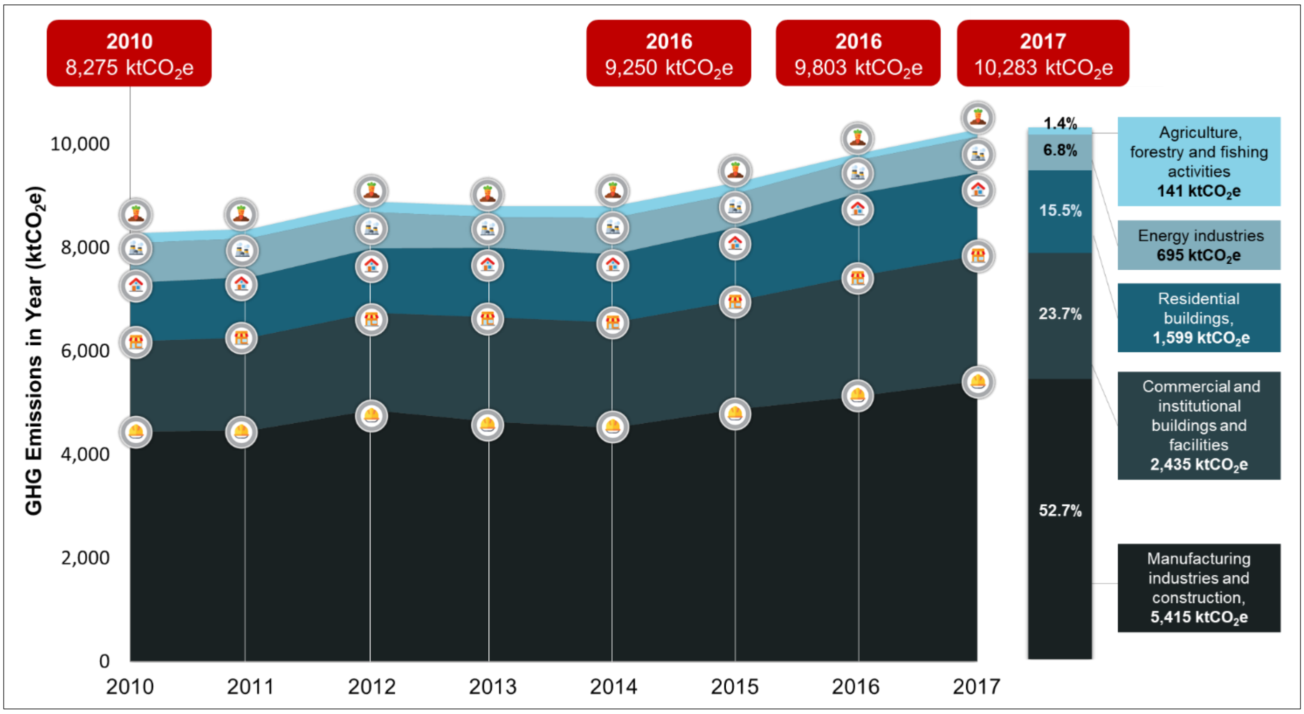

Figure d: *Total GHG emissions for Stationary Energy sector*

GHG Emissions from Fuel/Energy Use

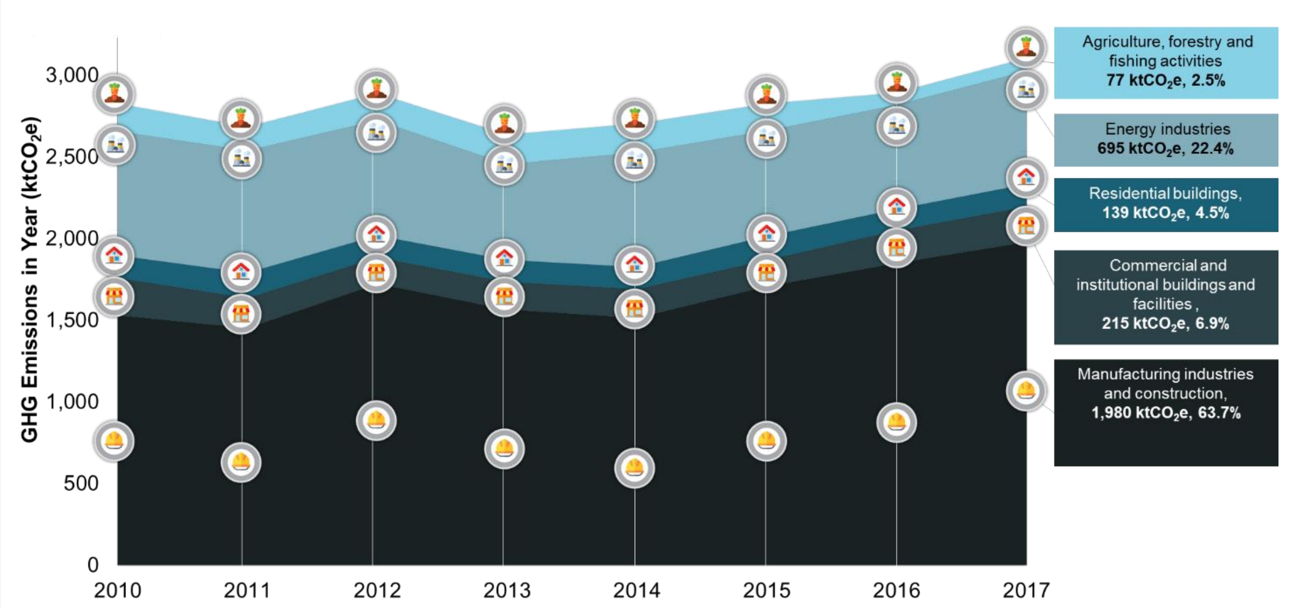

Figure e: *GHG emissions from fuel/energy use in Iskandar Malaysia*

Since 2010 which is the base year for Iskandar Malaysia, the trends in emissions contribution of fuel combustion in Stationary Energy sector are not changing (Figure e). Largest contributor is Manufacturing Industries and Construction sub-sector, held 63.7% in 2017 from the total emissions from fuel/energy used. There was fluctuation of energy use in this sub-sector from 2010-2014 followed by an increase of 16.0% energy usage from 2015-2017. This shows the fluctuations of industrial GDP within Iskandar Malaysia, where the main economic drivers came from manufacturing sectors, namely electrical and electronics, oleochemical, petrochemical and food processing[1].

A significant 22.4% emission contribution came from the fuel/energy used in power plant auxiliary operations by the Energy Industries. Since 2010, the fuel consumption for Energy Industries continues to fluctuate where the emission range is between 0.64 million tCO_2e and 0.76 million tCO_2e averaging 0.69 million tCO_2e. This variation is possibly due to power plant outages incidents leading to decreased power generation activity, hence affecting the auxiliary operations of power plants and lowers the emissions.

Energy use from Agriculture, forestry and fishing activities was quite stagnant from 2010-2015, however since 2016 there was a sharp energy usage reduction in this sub-sector. Though its contribution to total emissions remains the smallest since 2010, there was a significant reduction of 56.2% from its value in 2015-2016. This is most likely due to TNB's effort in the extension of electricity network in the non-urban areas parallel with the government's desire to improve living standards in the social, economic and educational fields[2]. The other reason may be the increase of rural electricity coverage up to 98% which listed as one of the major achievements of 10th Malaysia Plan (2011-2015)[3].

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[1] Promoted Sectors, Iskandar Malaysia Website, http://iskandarmalaysia.com.my/promoted-sectors/#content

[2] Utusan Online, Kemudahan elektrik liputi 99% kawasan pedalaman, http://ww1.utusan.com.my/utusan/Timur/20140630/wt_04/Kemudahan-elektrik-liputi-99-kawasan-pedalaman

[3] Major achievements of the 10th Malaysia Plan, https://www.nst.com.my/news/2015/09/major-achievements-10th-malaysia-plan

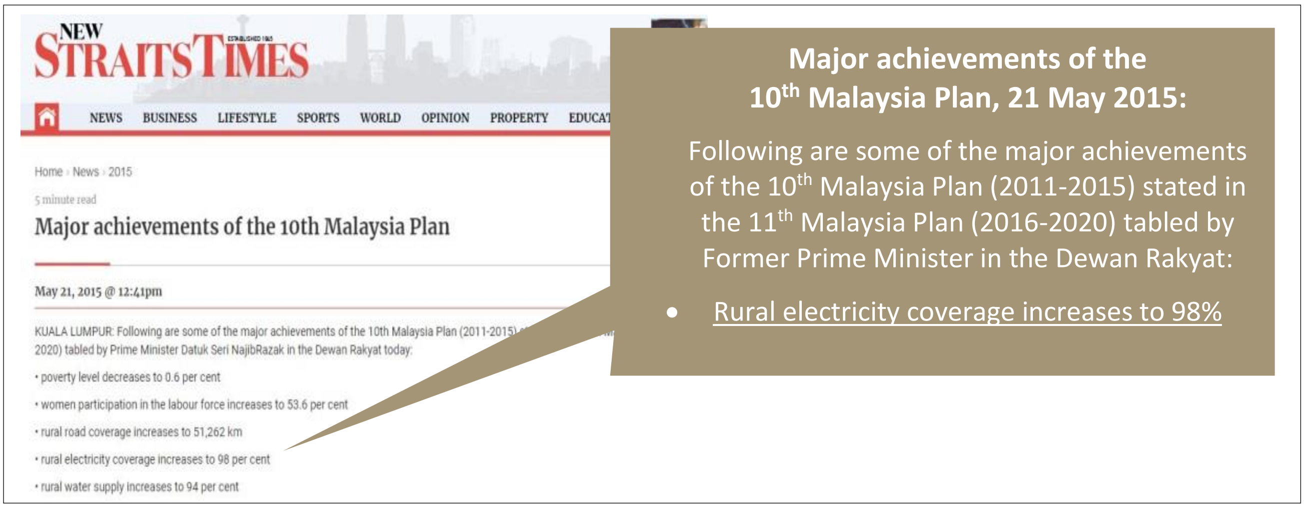


Figure f: *News adapted from New Straits Times, 2015 regarding major achievements of the 10th Malaysia Plan*

GHG Emissions from Grid-supplied Energy Consumption

As depicted from Figure g, each sub-sector emits significant amount of GHG due to the consumption of grid-supplied energy except for Energy Industries. No Energy Industries sub-sector's allocation for the GHG emissions from grid-supplied energy consumption is due to its inclusion in the emissions caused by fuel/energy used.

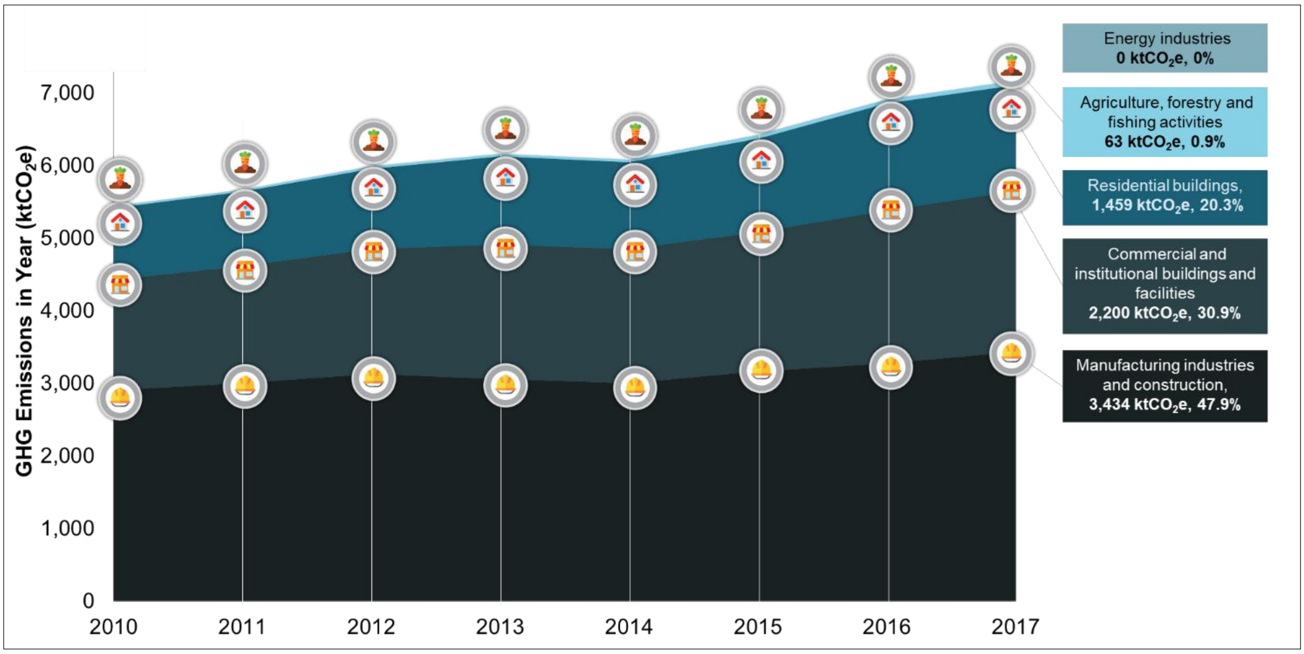


Figure g: *GHG emissions from grid-supplied energy consumption in Iskandar Malaysia*

Manufacturing Industries and Construction has been consistently a large contributor in electricity consumption. Manufacturing is listed as one of the core sectors that has been long established in Iskandar Malaysia and helps in boosting the economy of Iskandar Malaysia[4] as well as Johor GDP. In 2017, Iskandar Malaysia industrial sector contributed to 46.1% out of 38.9% of total Johor GDP. The remaining 61.1% of Johor GDP were attributed to services sector and primary sector with 47.6% and 13.5% respectively[5].

[4] Promoted Sectors, Iskandar Malaysia Website, http://iskandarmalaysia.com.my/promoted-sectors/#content
[5] Economic Indicators, Iskandar Malaysia Website, http://iskandarmalaysia.com.my/economic-indicators/

It is possible these industries contributed substantially to Iskandar Malaysia's GDP and also Johor's GDP, thus leading to an increase of electricity consumption throughout those seven years. The increase of grid-supplied energy emissions of this sub-sector in 2017 was 4.9% with average annual emissions growth rate of 2.5%.

With 5.6% average annual growth rate of grid–supplied energy emissions and an increase of 5.1% relative to 2016, Commercial and Institutional Buildings and Facilities increase of emissions may be caused by the commercial development in intensifying the development journey of Iskandar Malaysia to achieve its vital target to be "A Strong and Sustainable Metropolis of International Standing" by 2025. Since its establishment, numbers of Commercial and Institutional Buildings and Facilities have been developed i.e. LEGOLAND Malaysia, Educity Iskandar Malaysia, Johor Premium Outlets and Medini[6] [7] [8]. The growing amount of these types of buildings and facilities in order to support Iskandar Malaysia's business model is the most plausible reason for the growth of grid-supplied energy consumption in this sub-sector.

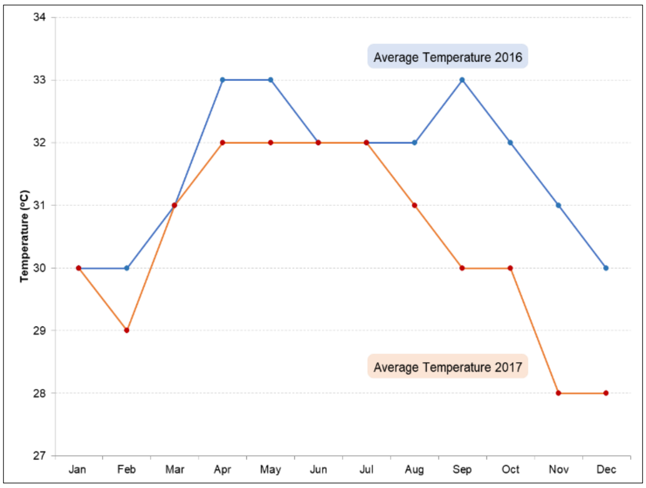


Figure h: *Comparison of Johor Bahru temperature between 2016 and 2017*

Residential Buildings possess average annual growth rate emissions of 5.8%. Relative to 2016, there was a slight decrease of 0.7%. Electricity consumption spike in 2016 due to El Niño effect seems to cause the electricity consumption in 2017 to decrease. The comparison of temperature between the two years is illustrated in Figure h. The emissions of electricity consumption in 2017 was slightly reduced in comparison to 2016 due to the non-occurrence of El Niño event but reflect an increase of 13.4% relative to 2015 likely due to the climate change phenomena.

Transportation

GHG emissions for Transportation sector were contributed by three out of five sub-sectors which are On-road Transportation, Off-road Transportation and Railways sub-sector. Due to lack of information, the other two sub-sectors namely Waterborne Navigation and Aviation sub-sector were not estimated in this inventory. The emissions sources for each sub-sector cover the combustion of fuel including natural gas, petrol, diesel, fuel oil and biodiesel; as well as emissions from the consumption of grid-supplied electricity. However, it should be noted that emissions from grid-supplied electricity for On-road and Off-road Transportation were already included elsewhere (under Stationary Energy), while for Railways sub-sector such emissions did not exist.

According to GPC, CO_2 emissions produced by combustion of material of biogenic origin such as biomass, biofuel, etc. shall be reported separately from the scope and other gases. Therefore, the amount 50,586 tCO_2e belongs to biodiesel emissions under On-road Transportation sub-sector is counted and reported separately under CO_2 (b) column (Refer Detailed 2017 Iskandar Malaysia Greenhouse Gas Inventory – Page 10 main report).

Since the past 7 years, the main emissions contributor of this sector is On-road Transportation. In 2017, GHG emissions amounting 4.93 million tCO_2e is contributed by this sub-sector which apportion 30.4% from the total emissions.

[6] Iskandar Malaysia 10 Year Progress Report, http://iskandarmalaysia.com.my/downloads/IM10%20Progress%20Report_V5.pdf

[7] Updates on Iskandar Malaysia: Challenges and Prospects, http://www.sedia.com.my/sdc10/papers-NCEC/S2-1_IRDA.pdf

[8] Medini Projects, https://www.iskandarinvestment.com/investment-opportunities/medini-projects/

GHG emissions of Off-road Transportation and Railways sub-sector contributed 2.3% to Transportation total emissions with 2.0% and 0.3% respectively while the remaining contributed by On-road Transportation. Off-road Transportation sub-sector shows insignificant variation, while for Railways there was a significant increase of 64.1% in 2016 and further increase of 8.8% in 2017 due to the increasing number of trips for intercity trains according to the data given by railway operator.

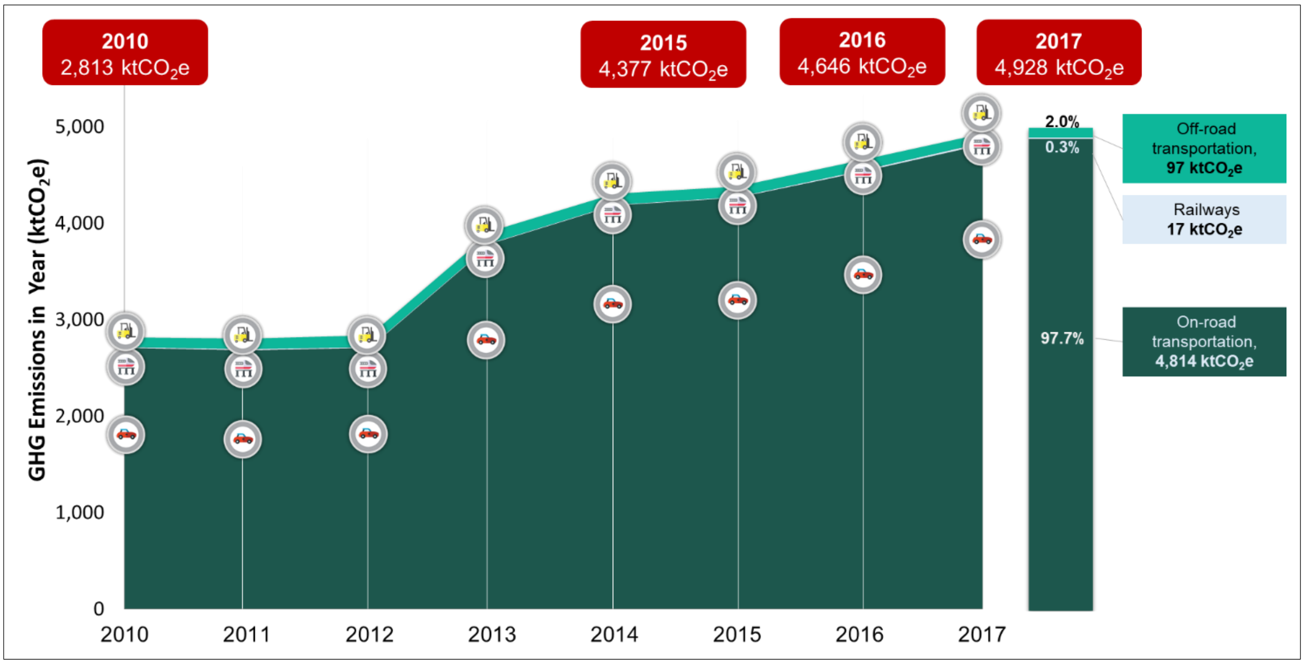


Figure i : *GHG emissions for Transportation sector*

Waste

Solid Waste Disposal and Wastewater Treatment and Discharge are two sub-sectors contributing to GHG emissions of Waste sector. Historically portion of emissions contribution from Waste sector is rather small in comparison with Stationary Energy and Transportation sector with a mere of 6.2% averagely from 2010 to 2017.

In 2017 from a total of 989 ktCO2e of emissions in Waste sector, 65.6% originated from Solid Waste Disposal while the remaining 34.4% was sourced from Wastewater Treatment and Discharge.

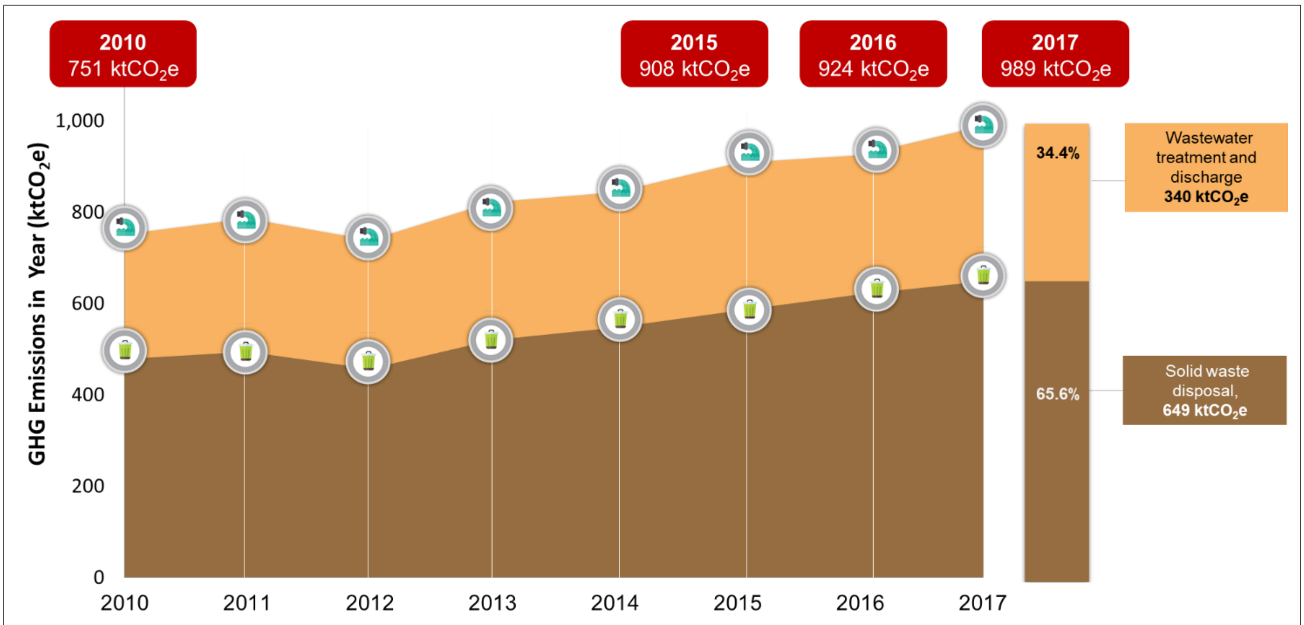


Figure j: *GHG emissions for Waste sector*

GHG Emission Intensity

Iskandar Malaysia's GHG emission intensity by GDP in 2017 was 0.2164 ktCO₂e/RM million at 2010 as constant price. This represents a decrease of 1.2% compared with previous year and 12.9% from its base year, 2010.

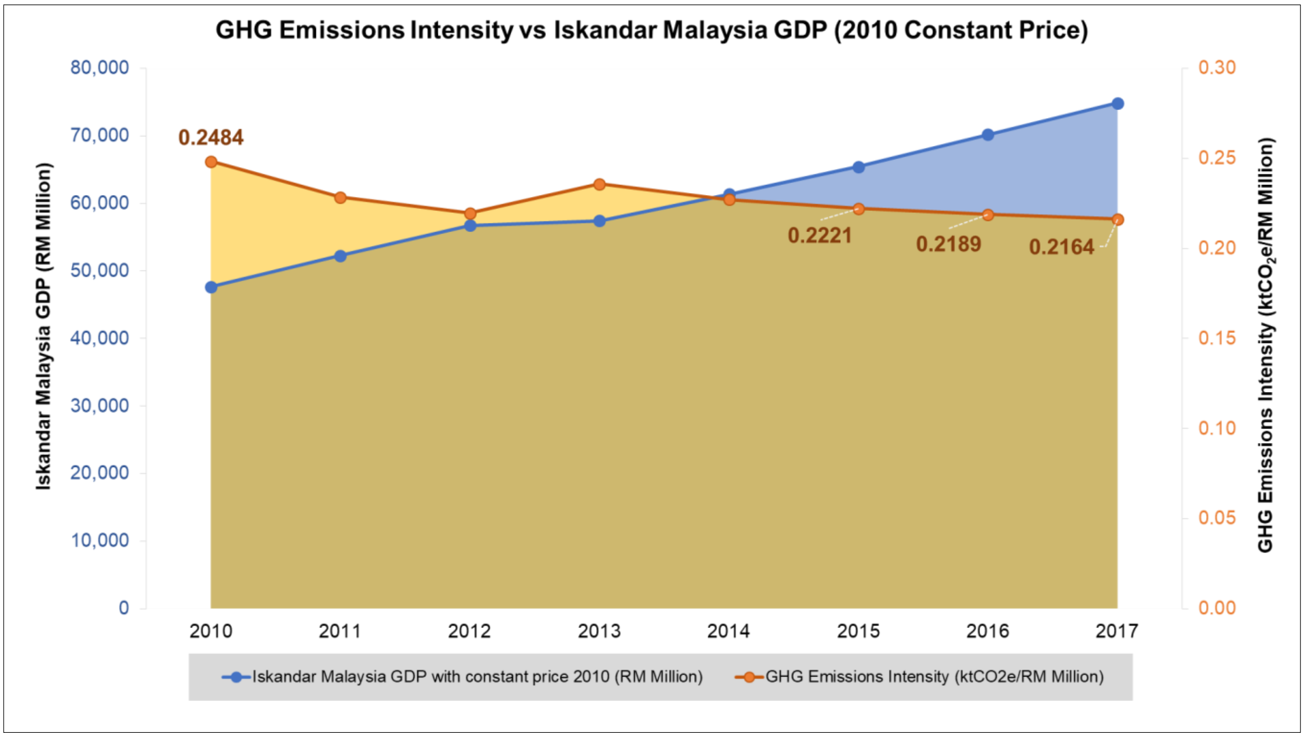
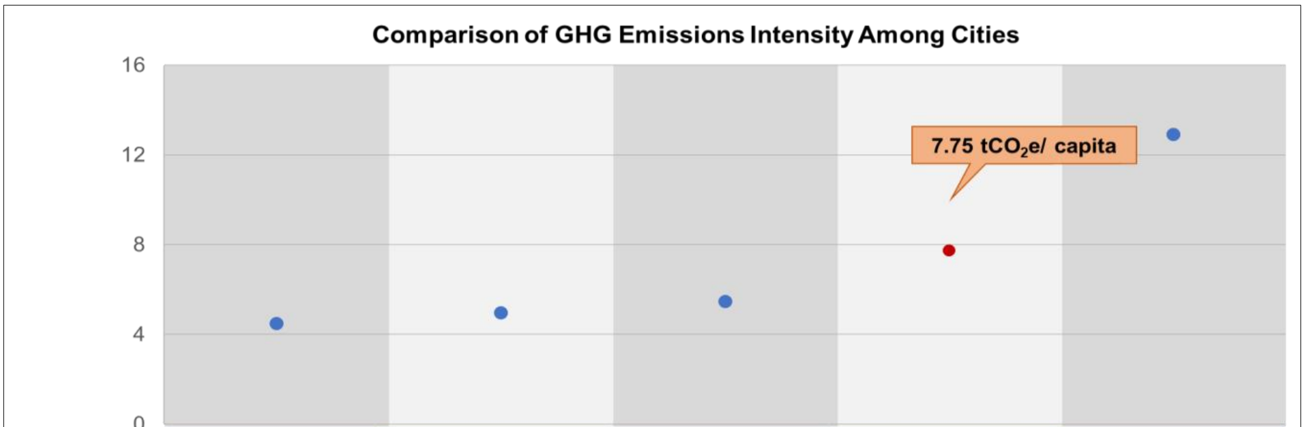


Figure k: All BASIC GHG emission intensity vs Iskandar Malaysia GDP (at 2010 constant price)

Benchmarking

A comparison of GHG emissions between Iskandar Malaysia and selected cities which have disclosed their GHG inventory to Carbon Disclosure Project was made. These cities measured their GHG emissions between years 2013-2017.



	Taipei City (2015)	Taichung City (2015)	Tokyo Metropolitan (2013)	Iskandar Malaysia (2017)	Kaohsiung City (2015)
GHG/capita (tCO_2e)	4.50	4.97	5.48	7.75	12.92
2017 Population	2,683,257	2,799,254	13,760,000	2,090,000	2,776,912
Total GHG Emissions (tCO_2e)	12,114,538	13,668,164	70,733,403	16,197,007	35,900,213
Land Area (km^2)	2,053	2,215	13,572	2,300	2.952

Source: https://www.globalcovenantofmayors.org

Figure l: Benchmarking with other cities

GHG emissions of Iskandar Malaysia were measured based on GPC BASIC level reporting and used the 2006 IPCC Guidelines for National Greenhouse Gas Inventories for its calculation methodology. To ensure reasonable comparison, the selections of the other four cities were based on their adoption of GPC BASIC Framework as well, in the preparation of their GHG inventories.

Iskandar Malaysia GHG emissions intensity per capita was 7.75 tCO_2e/capita in the year of 2017. Rank second highest among those selected cities, Iskandar Malaysia's emissions is relatively high. However, owing to its status as developing city and also relatively lower number of populations in comparison with other cities, it is possible Iskandar Malaysia's emissions intensity falls in this range.

CONCLUDING REMARKS AND WAY FORWARD

As an effort to achieve 58% of Iskandar Malaysia's GHG emission intensity reduction by 2025 from its base year as targeted in The Low Carbon Society Blueprint, GHG inventory for Iskandar Malaysia has been continually developed since 2015. This current inventory is the 3rd GHG inventory aiming to monitor the current GHG emissions status and the effectiveness of the implemented mitigation initiatives within the economic region.

Also, the yearly updated GHG inventory would help policymakers and stakeholders to plan further action plans and strategies towards achieving Iskandar Malaysia's GHG emissions mitigation goal in a timely manner.

As previously detailed, Iskandar Malaysia 2017's territorial GHG emissions were 19.91 million tCO_2e whereas BASIC emissions were 16.20 million tCO_2e. This was an increase of 36.8% GHG emissions from 2010 and 5.4% from 2016. The increase of emissions was owed to Iskandar Malaysia's economic growth since 2010. Iskandar Malaysia's GDP had increased to 57.1% from 2010 to 2017 while to 6.7% from 2016 to 2017.

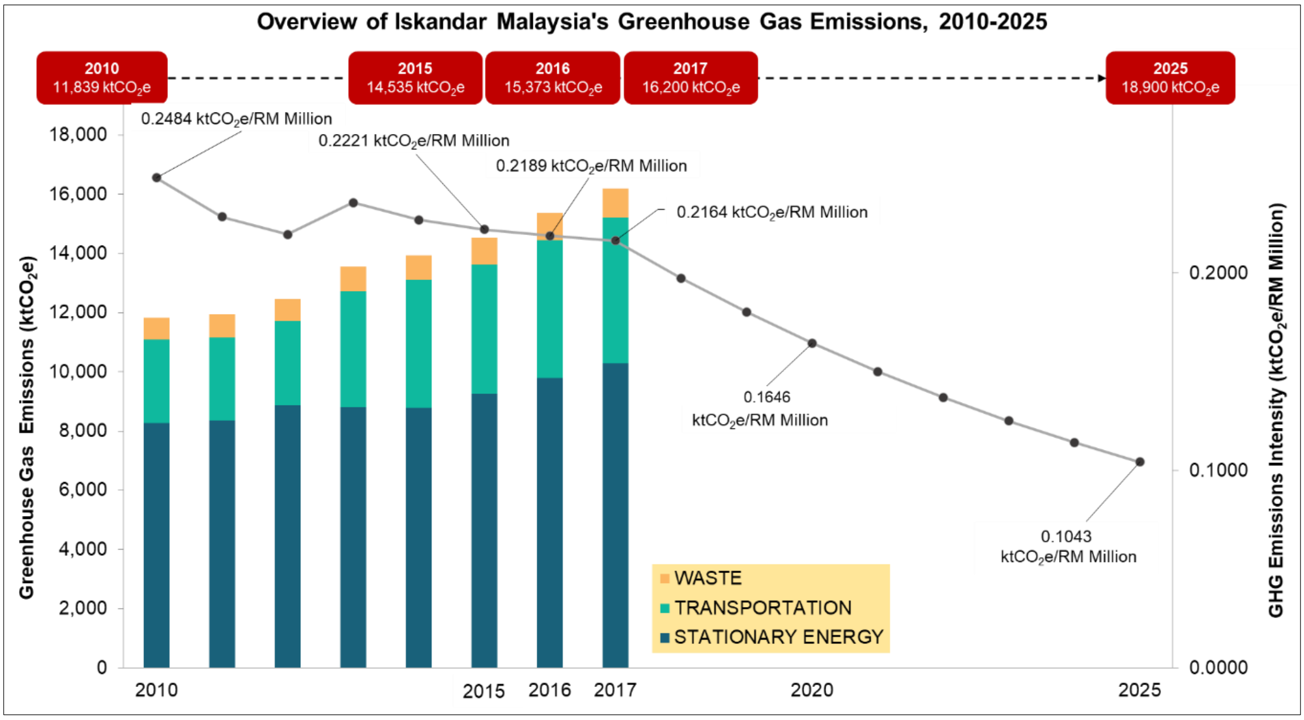


***Figure m:** Towards achieving GHG emissions reductions target*

The base year 2010 GHG emission intensity of GDP was 0.2484 $ktCO_2e$/RM million. Relative to 2017's emission intensity of GDP with a value of 0.2164 $ktCO_2e$/RM million, a significant decrease of **12.9% emission intensity of GDP had successfully been reduced in less than a decade.** While in comparison with

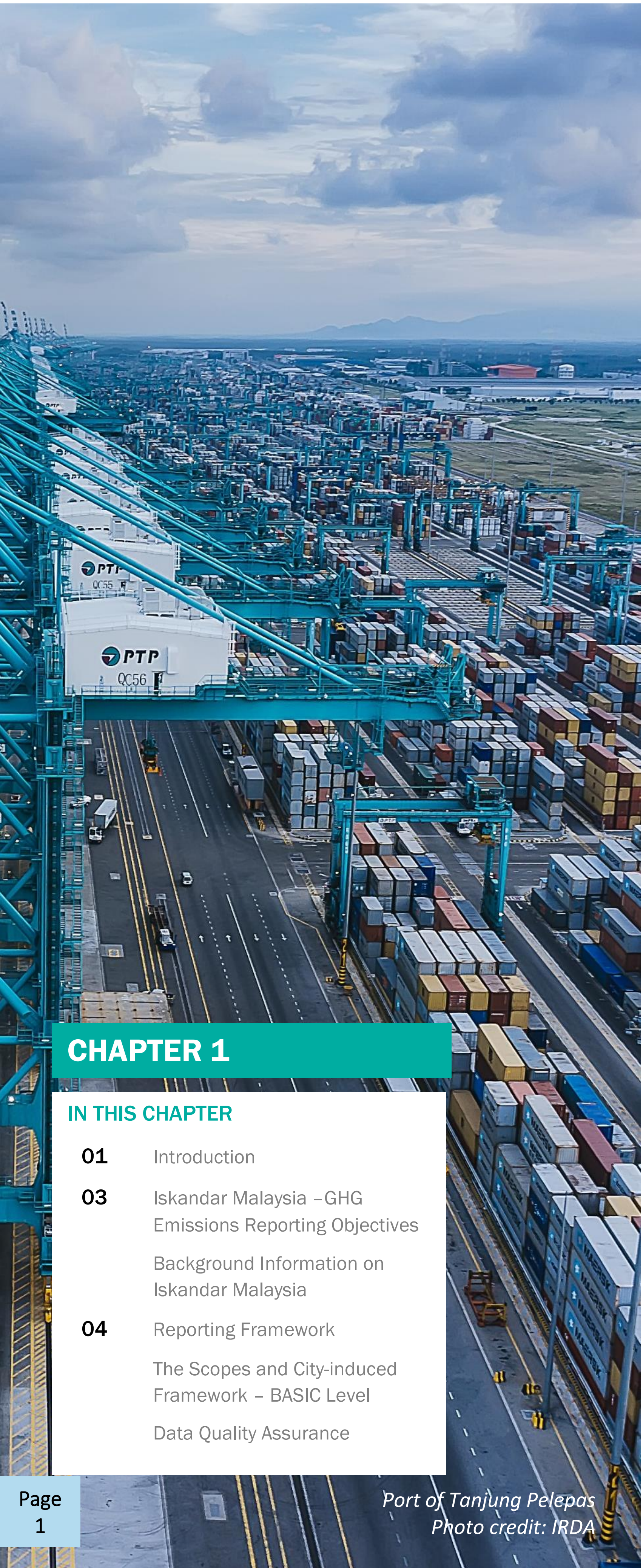
2016 emission intensity of GDP which stands at 0.2189 ktCO_2e/ RM million, there was a reduction of 1.2% in the emission intensity of GDP.

Though various initiatives have been implemented in Iskandar Malaysia to come to this emission intensity reduction value, more efforts and strategies need to be reinforced within the region to meet Iskandar Malaysia's reduction goal by 2025. From 2018 onwards, Iskandar Malaysia is required to reduce its emission intensity at an average of 8.7% yearly as the value of emission intensity need to be 0.1043 ktCO_2e/ RM Million by 2025. By looking at the reduction trend for the past 7 years, the average yearly reduction is only about 1.9%. With this percentage reduction, Iskandar Malaysia only can achieve 0.1863 ktCO_2e/ RM Million by 2025 which is equivalent to 25.0% reduction from the base year, 2010 (Figure 18 main report).

In 2009, the Malaysia government had declared a voluntary reduction of 40% in terms of emission intensity by the year 2020, as compared to the 2005 level. While in 2017 under the Paris Agreement, Malaysia has committed to reduce the emission intensity by 45% by 2030, as compared to the 2005 level. The target was re-pledged due to a reduction of 33% emission intensity between 2005 and 2015. As Malaysia is confident in reaching the target of 40% by 2020, a higher target is set to address global warming and climate change.

Therefore, it is recommended for Iskandar Malaysia to revise the 2025 target and consider following the target set under the Nationally Determined Contribution (NDC) Malaysia by 2030 (i.e. to reduce the emission intensity by 45%).

Kota Iskandar
Photo credit: IRDA



CHAPTER 1

IN THIS CHAPTER

Port of Tanjung Pelepas
Photo credit: IRDA

INTRODUCTION

Iskandar Malaysia recognises the importance of sustainable development and has placed much emphasis on promoting a green economy within the region. Under the leadership of Iskandar Regional Development Authority (IRDA), Iskandar Malaysia had released its inaugural comprehensive greenhouse gas (GHG) inventory for 2015 and it was followed by the second GHG inventory for 2016. This is the third Iskandar Malaysia's GHG inventory for the year of 2017. The inventory establishes a basis for assessing GHG emissions in Iskandar Malaysia, which also provides information on mitigation efforts in the economic region.

Iskandar Malaysia was the first in the nation to adopt the respected Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) to account for its GHG emissions. The GPC BASIC level reporting compliant inventory was also shared at the 22nd session of the Conference of Parties (COP22) to the United Nations Framework Convention on Climate Change (UNFCCC) which was held in Marrakech, Morocco in 2016 and at COP23 in Bonn, Germany in 2017.

Following the previous two GHG inventories, IRDA is determined to continually update and report Iskandar Malaysia's GHG emissions. This will enable the annual tracking of emissions and document the progress of mitigation efforts toward reducing GHG emissions. This is aligned with the Johor State level, Sustainable Development Plan for 2019-2030 specifically Thrust 1: Implementing Sustainable Development and Thrust 8: Resources Conservation.

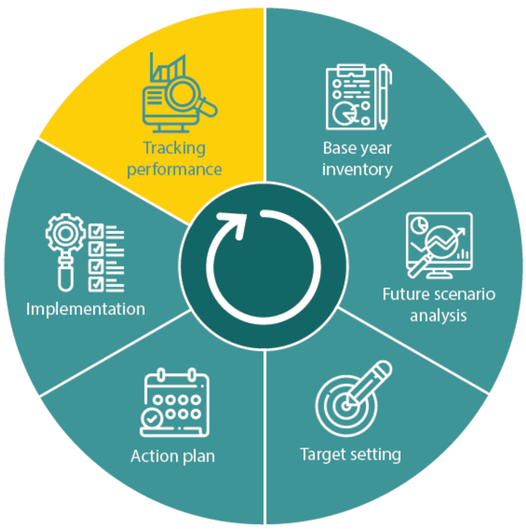
This inventory is part of IRDA's initiative under Low Carbon Society Blueprint, which is a comprehensive programme towards realisation of a low carbon society in the economic region. It was also part of an enhanced version of Iskandar Malaysia Comprehensive Development Plan, CDP(ii) (2014-2025) featuring the five Big Moves on achieving Iskandar Malaysia vision of 'A Strong and Sustainable Metropolis of International Standing.' This includes Greening Iskandar Malaysia, aiming to transform Iskandar Malaysia into a green and low carbon region through urbanscape and protection of ecology. This is a further initiative of providing accelerating programmes to safeguarding the natural resources and environment within this economic region.

The LCSBPIM2025 was officially adopted by IRDA in 2012. It outlines a total of 281 implementation programmes (grouped around three themes – Green Environment, Green Economy, and Green Community) which are projected to reduce Iskandar Malaysia's GHG emission intensity by 58% in 2025 compared to 2005 levels. Several strategic programmes outlined in the LCSBPIM2025 have been implemented since 2013.

IRDA sharing one of their LCS programmes in COP 24
Photo credit: IRDA

The LCSBPIM2025 is a research output of Japan's Science and Technology Research Partnership for Sustainable Development (SATREPS) project called "The Development of Low Carbon Society Scenarios for Asian Region" funded by Japan International Cooperation Agency (JICA) and the Japan Science and Technology Agency (JST). The main research institutions involved in this collaboration are Universiti Teknologi Malaysia (UTM), Kyoto University, National Institute for Environmental Studies (NIES), and Okayama University.

Iskandar Malaysia has now completed all 6 stages of Low Carbon Development Cycle, wherein the Environment Division of IRDA has been constantly tracking the performance of implemented Low Carbon Society (LCS) programmes since 2013. Tracking is essential especially for GHG emissions as it would benefit IRDA in deciding future strategy plan of mitigating actions.



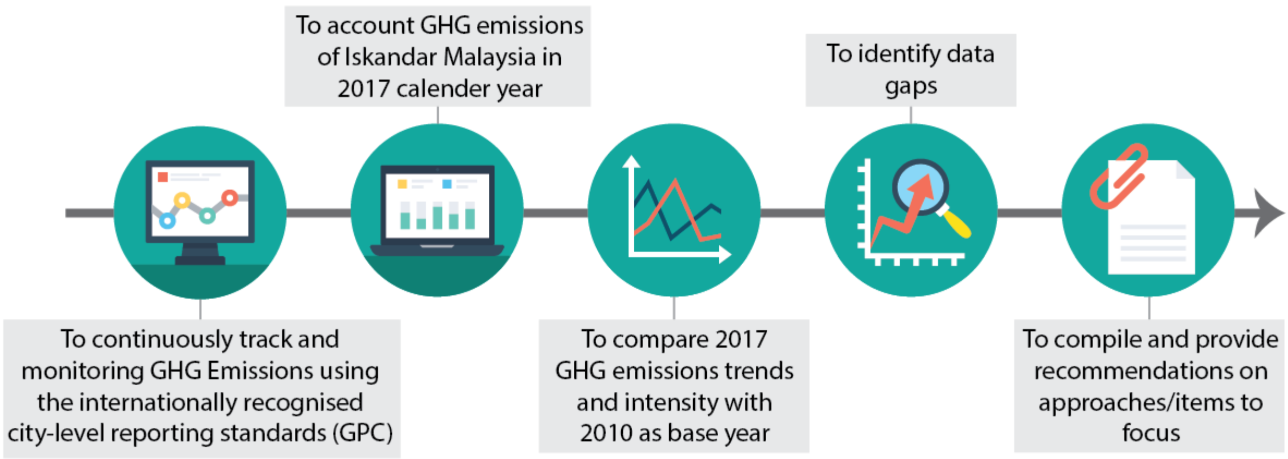
Iskandar Malaysia –GHG Emissions Reporting Objectives

The internationally recognised standard for accounting and reporting GHG - GPC has been adopted to track and manage the performance of GHG emissions over time in Iskandar Malaysia.

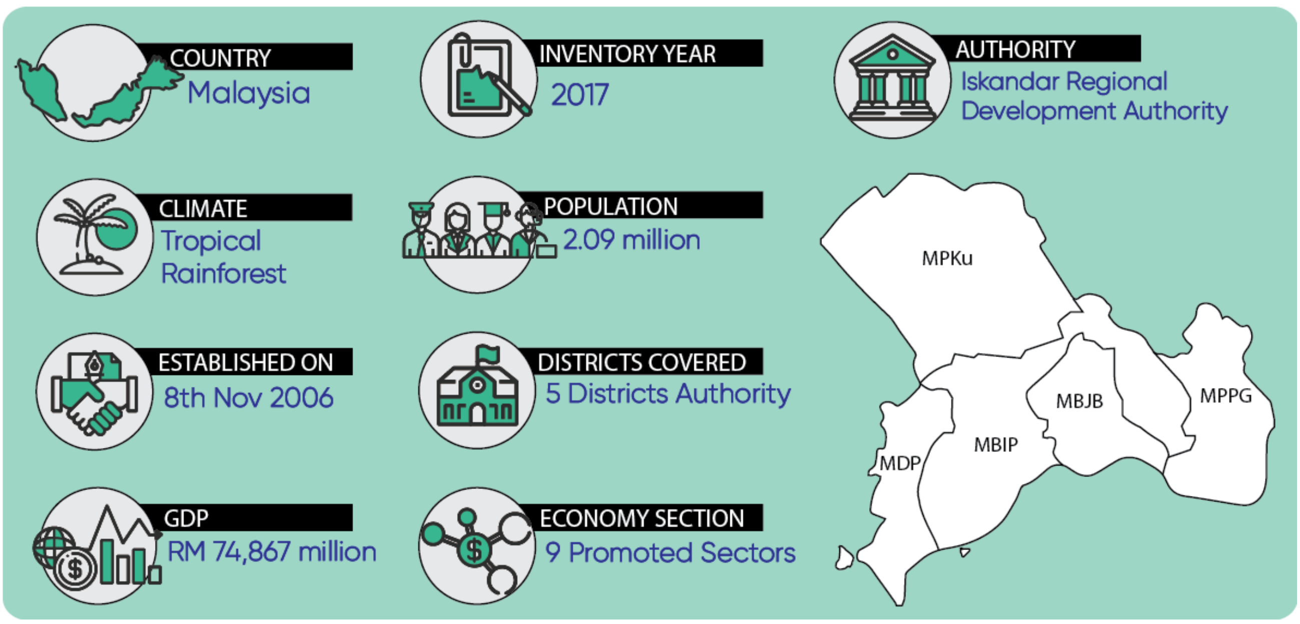
The main objective of Iskandar Malaysia GHG Reporting is to regularly and continuously monitor the current status of GHG emitted within this rapidly developing city/region. Through this effort, the progress of previously implemented actions to reduce GHG emissions could be tracked as well. This is in line with GPC recommendation that cities update their inventory on an annual basis, as it provides frequent and timely progress on overall emissions. In addition, the tracking of carbon emissions is complementary to the implementation of the Low Carbon Society Blueprint through the provision of insight into GHG trends in Iskandar Malaysia.

For the 2017 inventory, the specific objectives are:

- Accounting for Iskandar Malaysia's GHG emissions for 2017 calendar year;
- Comparison of 2017 GHG emissions trends and intensity with 2010 as base year; and
- Identification of gaps in data for the accounting of GHG emissions and make recommendations on areas for improvement.



Background Information on Iskandar Malaysia



Reporting Framework

Iskandar Malaysia's 2017 GHG inventory continues to adopt GPC as standard to account for its city-wide emissions. This inventory is prepared according to GPC BASIC level reporting requirements and recommendations.

GPC requires cities to summarise their emissions using two complementary approaches, namely Scope framework and City-induced framework. Scope framework summarises produced emissions by scope 1, scope 2 and scope 3 according to sectors. Moreover, in this Scope framework the territorial emissions (Scope 1 emissions) need to be summed up and reported separately. City-induced framework on the other hand totals up selected emission sources according to the reporting level chosen by the city – BASIC or BASIC+. For BASIC level reporting, scope 1 and scope 2 emissions were accounted for Stationary Energy and Transportation sector. While for Waste sector, scope 1 and scope 3 were accounted. BASIC+ includes scope 3 emissions of Stationary Energy and Transportation sector and emissions from Industrial Processes and Product Use (IPPU) and Agriculture, Forestry and Other Land Use (AFOLU) in addition to BASIC emissions.

As recommended in the GPC, the latest Global Warming Potentials (GWPs) is used to convert individual GHG emissions into carbon dioxide equivalents (CO_2e) and is acquired from the latest Assessment Report (AR), the Fifth AR (AR5) in the Intergovernmental Panel on Climate Change (IPCC). However, due to the adoption of GWPs from IPCC Fourth Assessment Report (AR4) in the latest national level inventory, the Biennial Update Report (BUR) submitted in September 2018, conversion of Iskandar GHG emissions to CO_2e using AR4 GWPs were also calculated for ease of comparison with the latest national level inventory.

The Scopes and City-induced Framework – BASIC Level

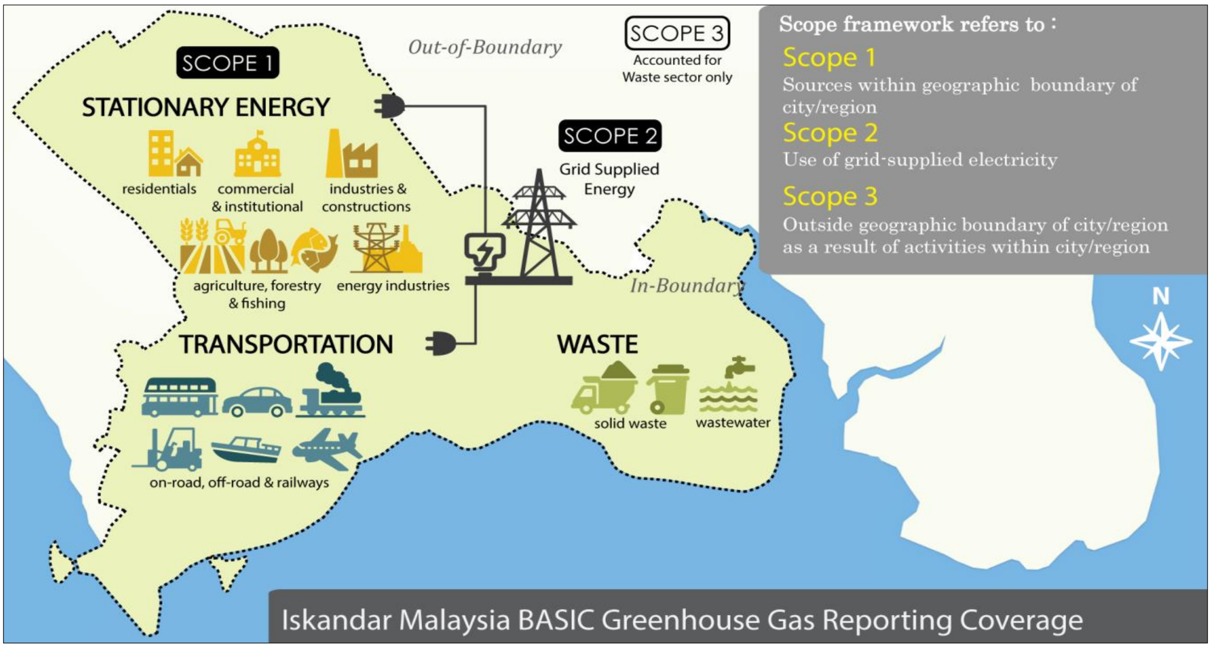


Figure 1: *Coverage of Iskandar Malaysia's BASIC level reporting*

Data Quality Assurance

In the process of developing the Iskandar Malaysia GHG Inventory 2017, several engagements were conducted to ensure the success of the inventory as well as for data quality assurance. This inventory was prepared in close consideration of national level reporting (NC/ BUR) to the United Nations (UN). It should be noted that BUR is Malaysia's National GHG report to the UNFCCC.

Kota Iskandar
Photo credit: IRDA

CHAPTER 2

IN THIS CHAPTER

METHODOLOGIES AND APPROACHES

Methodologies

Fundamentally, GHG emissions are calculated using formula below:

Greenhouse Gas Emissions = Activity data x Emission Factor

where activity data is defined as measurable activity taking place in a given time period i.e. a year for Iskandar Malaysia 2017 reporting period. These data may be obtained from i.e. government departments and statistics agencies, sector experts/ stakeholder organizations or directly from operators or local authorities. If the data obtained is not time and geographically specific in correlation to the city boundary, the inventory data can be determined by scaling the available data using suitable scaling factor.

Emission factor depicts the mass of greenhouse gas emissions released relative to a unit of activity taken place. Default emission factors can be acquired from international body such as IPCC. However, if local, regional or country-specific emission factors are available, those are recommended to be used as the main concern is to calculate the most accurate amount of greenhouse gas emissions released.

With reference to GPC, the 3 sectors required to be accounted under BASIC reporting are Stationary Energy, Transportation and Waste.

Stationary Energy

Under Stationary Energy sector, emissions from fuel combustion and electricity consumed within Iskandar Malaysia came from 5 sub-sectors:

i. residential buildings;
ii. commercial and institutional buildings and facilities;
iii. manufacturing industries and construction;
iv. energy industries;
v. agriculture, forestry, and fishing activities.

Fugitive emissions from mining, processing, storage and Transportation of coal as well as emissions from oil and natural gas systems were not accounted in the inventory due to the inexistent of these activities within Iskandar Malaysia city boundary.

Transportation

The coverage of emissions from the sub-sectors under Transportation sector comprises fuel combustion and electricity consumption of On-road transportation, Off-road transportation and Railways within Iskandar Malaysia. Exclusion applies to the emissions from aviation and waterborne navigation due to lack of such information. It is believed that the number of journeys from these two sub-sectors which originate and terminate within the region boundary were insignificant.

Waste

As for the Waste sector, this inventory included the emissions from Municipal Solid Waste, Domestic Wastewater and Sludge, and Industrial Wastewater (from palm oil mills and rubber mill only). The emissions from other industrial wastewater such as manufacturing industries were excluded due to unavailability of data.

Approaches

Stationary Energy

Due to the unavailability of primary fuel consumption data within Iskandar Malaysia, secondary fuel consumption data were extracted from National Energy Balance (NEB) 2016, projected to 2017 and scaled down using population or industrial GDP to obtain the fuel consumptions for Stationary Energy sub-sectors. Fuel consumption for residential buildings, commercial and institutional buildings and facilities, and agriculture, forestry and fishing activities sub-sectors were scaled down using population whereas manufacturing industries and construction sub-sectors using industrial GDP.

Primary data on fossil fuel and electricity consumption for Energy Industries sub-sector were obtained directly from each power station within Iskandar Malaysia. Meanwhile, secondary data on electricity consumption for the other Stationary Energy sub-sectors were obtained from ST.

The latest grid emission factor for Peninsular Malaysia was sourced from MGTC while other relevant emission factors were sourced from 2006 IPCC Guidelines.

Transportation

The estimation of On-road transportation fuel consumption within Iskandar Malaysia was done similar to Stationary Energy sector. Secondary fuel consumption data were extracted from NEB 2016, projected using average annual growth rate of fossil fuels consumption from 2010-2016 to obtain 2017's national fuel consumption, and scaled down using population as scaling factor.

The primary data of Off- road transportation and Railways fuel consumption were provided by port authorities and airport authority as well as railway operator respectively.

Relevant emission factors were sourced from 2006 IPCC Guidelines depending on type of fuel used in each sub-sector.

Emissions due to electricity consumption under Transportation sector were already included elsewhere in Stationary Energy sector.

Waste

Primary data of Municipal Solid Waste, Domestic Wastewater and Sludge, and Industrial Wastewater that were generated, disposed and treated within the city boundary were obtained from local authorities, landfill operator, sewage/ wastewater treatment plant operators (i.e. palm oil mill and rubber mill owners) and from relevant authorities i.e. SWCorp. When specific data were not available, population and waste discarded rate were used as parameter for the extrapolation.

Emissions of Solid Waste Disposal were calculated using First Order Decay (FOD) model while emissions from wastewater treatment plants using Total Organic Degradable Material (TOW) method. Both methods were adopted from 2006 IPCC Guidelines for National Greenhouse Gas Inventories in Volume 5, Chapter 3 and Volume 5, Chapter 6 respectively.

RESULT

BASIC emissions figure displayed in table in page 9 with a value of 16.20 million tCO_2e, accounts only certain sub-sectors under the 3 main sectors. Those sub-sectors are all in-boundary emission sources that exist in most cities. As the above BASIC emissions figure is based on the latest GWP value from AR5, greenhouse gas emissions of Iskandar Malaysia based on GWP from AR4 were calculated as well for ease of comparison with Malaysia's national level reporting. Territorial total emissions were 19.81 million tCO_2e and total BASIC emissions were 16.10 million tCO_2e when GWPs of AR4 is applied.

CHAPTER 3

IN THIS CHAPTER

Bangunan Sultan Ibrahim
Photo credit: IRDA

Summary Result of Iskandar Malaysia GHG Inventory 2017

Sector		Total by Scope (million tCO_2e)			Total by City-Induced Reporting Level (million tCO_2e)
		Scope 1 (Territorial)	Scope 2	Scope 3	BASIC
Stationary Energy	Energy use (all I emissions except I.4.4)	3.11	7.18	-	10.28
	Energy generation supplied to the grid (I.4.4)	10.83			
Transportation		4.93	IE	-	4.93
Waste	Generated in the city (all III.X.1 and III.X.2)	0.99		NE for Solid Waste NO for Wastewater	0.99
	Generated outside city (all III.X.3)	0.05			
Total	**Territorial Emissions**	**19.91**			**16.20**
	BASIC Emissions				

Notation Keys:

NE – Not Estimated *NO – Not Occurring* *IE – Included Elsewhere*

– Sources required for BASIC reporting + *– Sources required for BASIC+ reporting*

– Sources required for territorial total but not for BASIC/ BASIC+ reporting (italic)

–Non-applicable emissions

GPC Basic Framework

BASIC GHG emitted by Iskandar Malaysia in 2017 reporting year was 16.20 million tonnes carbon dioxide equivalent (tCO_2e) while a total of 19.91 million tCO_2e is produced for Iskandar Malaysia territorial emissions. From the five main sectors contributing to GHG emissions, BASIC level reporting account three out of five sectors which are:-

i. Stationary Energy (Scope 1 and Scope 2);
ii. Transportation (Scope 1 and Scope 2); and
iii. Waste (Scope 1 and Scope 3).

The remaining two sectors (i.e. IPPU and AFOLU) are needed for BASIC+ reporting, while Other Scope 3 sector needs to be reported separately if the emission sources are available. Iskandar Malaysia territorial emissions comprise all Scope 1 emissions of Stationary Energy, Transportation and Waste sector. Essentially, Iskandar Malaysia BASIC level reporting only account GHG emissions caused by the activities occur within its geographic boundary.

Detailed 2017 Iskandar Malaysia GHG Inventory

GPC ref No.	Scope	GHG Emissions Source (By Sector and Sub-sector)	Notation keys	Gases (in tonnes)					Data Quality		Explanatory comments (i.e. description of methods or notation keys used)
				CO_2	CH_4	N_2O	Total CO_2e	CO_2 (b)	AD	EF	
I		STATIONARY ENERGY									
I.1		Residential buildings									
I.1.1	1	Emissions from fuel combustion within the city boundary		138,907	11	0.23	139,277		M	L	Scaled down from secondary data based on population ratio
I.1.2	2	Emissions from grid-supplied energy consumed within the city boundary		1,459,279			1,459,279		M	H	Scaled down from secondary data based on population ratio
I.1.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption									Not accounted for BASIC reporting
I.2		Commercial and institutional buildings and facilities									
I.2.1	1	Emissions from fuel combustion within the city boundary		214,720	19	0.57	215,403		M	L	Scaled down from secondary data based on population ratio
I.2.2	2	Emissions from grid-supplied energy consumed within the city boundary		2,219,688			2,219,688		M	H	Scaled down from secondary data based on population ratio
I.2.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption									Not accounted for BASIC reporting
I.3		Manufacturing industries and construction									
I.3.1	1	Emissions from fuel combustion within the city boundary		1,975,045	73	11.04	1,980,020		M	L	Scaled down from secondary data based on industrial GDP
I.3.2	2	Emissions from grid-supplied energy consumed within the city boundary		3,434,491			3,434,491		M	H	Scaled down from secondary data based on industrial GDP
I.3.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption									Not accounted for BASIC reporting
I.4		Energy industries									
I.4.1	1	Emissions from energy used in power plant auxiliary operations within the city boundary		694,756			694,756		H	L	Primary data from power plants
I.4.2	2	Emissions from grid-supplied energy consumed in power plant auxiliary operations within the city boundary	IE								Included elsewhere under Stationary Energy Scope 2
I.4.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption in power plant auxiliary operations									Not accounted for BASIC reporting
I.4.4	1	*Emissions from energy generation supplied to the grid*		10,784,574	125	170.22	10,833,169		H	L	Primary data from power plants
I.5		Agriculture, forestry and fishing activities									
I.5.1	1	Emissions from fuel combustion within the city boundary		76,976	10	0.62	77,432		M	L	Scaled down from secondary data based on population ratio
I.5.2	2	Emissions from grid-supplied energy consumed within the city boundary		63,106			63,106		M	H	Scaled down from secondary data based on population ratio
I.5.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption									Not accounted for BASIC reporting
I.6		Non-specified sources									
I.6.1	1	Emissions from fuel combustion within the city boundary	NE								Not estimated for Iskandar Malaysia Economic Region
I.6.2	2	Emissions from grid-supplied energy consumed within the city boundary	NE								Not estimated for Iskandar Malaysia Economic Region
I.6.3	3	Emissions from transmissions and distribution losses from grid-supplied energy consumption									Not accounted for BASIC reporting
I.7		Fugitive emissions from mining, processing, storage and transportation of coal									
I.7.1	1	Emissions from fugitive emissions within the city boundary	NO								Not occurring in Iskandar Malaysia Economic Region
I.8		Fugitive emissions from oil and natural gas systems									
I.8.1	1	Emissions from fugitive emissions within the city boundary	NO								Not occurring in Iskandar Malaysia Economic Region
II		TRANSPORTATION									
II.1		On-road transportation									
II.1.1	1	Emissions from fuel combustion on-road transportation occurring within the city boundary		4,757,564	1,674	227.46	4,814,115	50,586	M	L	Scaled down from secondary data based on population ratio
II.1.2	2	Emissions from grid-supplied energy consumed within the city boundary for on-road transportation	IE								Included elsewhere under Stationary Energy Scope 2
II.1.3	3	Emissions from portion of transboundary journeys occurring outside the city boundary, and transmision and distribution losses from grid-supplied energy consumption									Not accounted for BASIC reporting
II.2		Railways									
II.2.1	1	Emissions from fuel combustion for railway transportation occurring within the city boundary		15,796	1	6.10	17,436		H	L	Primary data from operator
II.2.2	2	Emissions from grid-supplied energy consumed within the city boundary for railways	NO								Not occuring as the railway transportation in Iskandar Malaysia Economic Region consume diesel only
II.2.3	3	Emissions from portion of transboundary journeys occurring outside the city boundary, and transmision and distribution losses from grid-supplied energy consumption									Not accounted for BASIC reporting
II.3		Waterborne navigation									
II.3.1	1	Emissions from fuel combustion for waterborne navigation occurring within city boundary	NE								Not estimated as lack of such information and it is believed that the number of waterborne navigation trips made within the boundary are insignificant
II.3.2	2	Emissions from grid-supplied energy consumed within the city boundary for waterborne navigation	NE								Not estimated as lack of such information and it is believed that the number of waterborne navigation trips made within the boundary are insignificant
II.3.3	3	Emissions from portion of transboundary journeys occurring outside the city boundary, and transmision and distribution losses from grid-supplied energy consumption									Not accounted for BASIC reporting
II.4		Aviation									
II.4.1	1	Emissions from fuel combustion for aviation occurring within the city boundary	NE								Not estimated as lack of such information and it is believed that the number of aviation trips made within the boundary are insignificant
II.4.2	2	Emissions from grid-supplied energy consumed within the city boundary for aviation	NE								Not estimated as lack of such information and it is believed that the number of aviation trips made within the boundary are insignificant
II.4.3	3	Emissions from portion of transboundary journeys occurring outside the city boundary, and transmision and distribution losses from grid-supplied energy consumption									Not accounted for BASIC reporting
II.5		Off-road transportation									
II.5.1	1	Emissions from fuel combustion for off-road transportation occurring within the city boundary		87,781	5	33.88	96,897		H	L	Primary data from authorities
II.5.2	2	Emissions from grid-supplied energy consumed within the city boundary for off-road transportation	IE								Included under Stationary Energy Scope 2
III		WASTE									
III.1		Solid waste disposal									
III.1.1	1	Emissions from solid waste generated within the city boundary and disposed in landfills or open dumps within the city boundary			23,168		648,717		H	-	Primary data from authorities/operators and extrapolation made based on population and waste generation rate when data are not available
III.1.2	3	Emissions from solid waste generated within the city boundary but disposed in landfills or open dumps outside the city boundary	NE								Not estimated due to lack of such information
III.1.3	1	*Emissions from waste generated outside the city boundary and disposal in landfills or open dumps within the city boundary*			1,807		50,588		M	-	Accounted for solid waste generated in Pontian area (outside Iskandar Malaysia boundary) as the waste are sent to Pekan Nanas Landfill in Iskandar Malaysia boundary
III.2		Biological treatment of waste									
III.2.1	1	Emissions from solid waste generated within the city boundary that is treated biologically within the city boundary	NO								Not occuring in Iskandar Malaysia Economic Region
III.2.2	3	Emissions from solid waste generated within the city boundary but treated biologically outside of the city boundary	NO								Not occuring in Iskandar Malaysia Economic Region
III.2.3	1	*Emissions from waste generated outside the city boundary but treated biologically within the city boundary*	NO								Not occuring in Iskandar Malaysia Economic Region
III.3		Incineration and open burning									
III.3.1	1	Emissions from solid waste generated and treated within the city boundary	NO								Not occuring in Iskandar Malaysia Economic Region
III.3.2	3	Emissions from solid waste generated within the city boundary but treated outside of the city boundary	NO								Not occuring in Iskandar Malaysia Economic Region
III.3.3	1	*Emissions from waste generated outside the city boundary but treated within the city boundary*	NO								Not occuring in Iskandar Malaysia Economic Region
III.4		Wastewater treatment and discharge									
III.4.1	1	Emissions from wastewater generated and treated within the city boundary			12,135	0.37	339,873		H	-	Primary data from operators and extrapolation made based on population and waste generation rate when data are not available.
III.4.2	3	Emissions from wastewater generated within the city boundary but treated outside of the city boundary	NO								Not occurring in Iskandar Malaysia Economic Region
III.4.3	1	Emissions from wastewater generated outside the city boundary but treated within the city boundary			15	0.01	408		M	-	Accounted for wastewater generated in Kota Tinggi and Mersing which send their wastewater to wastewater treatment plants in Iskandar Malaysia boundary
		TOTAL		ALL TERRITORIAL EMISSIONS			19,908,092				
				ALL BASIC EMISSIONS			16,200,490				

Notation Keys:

NE – Not Estimated *NO – Not Occurring* *IE – Included Elsewhere* *AD – Activity Data* *EF – Emission Factor*

– Sources required for BASIC reporting

+ – Sources required for BASIC+ reporting

– Sources required for territorial total but not for BASIC/ BASIC+ reporting (italic)

–Non-applicable emissions

Emission Trends 2010 - 2017

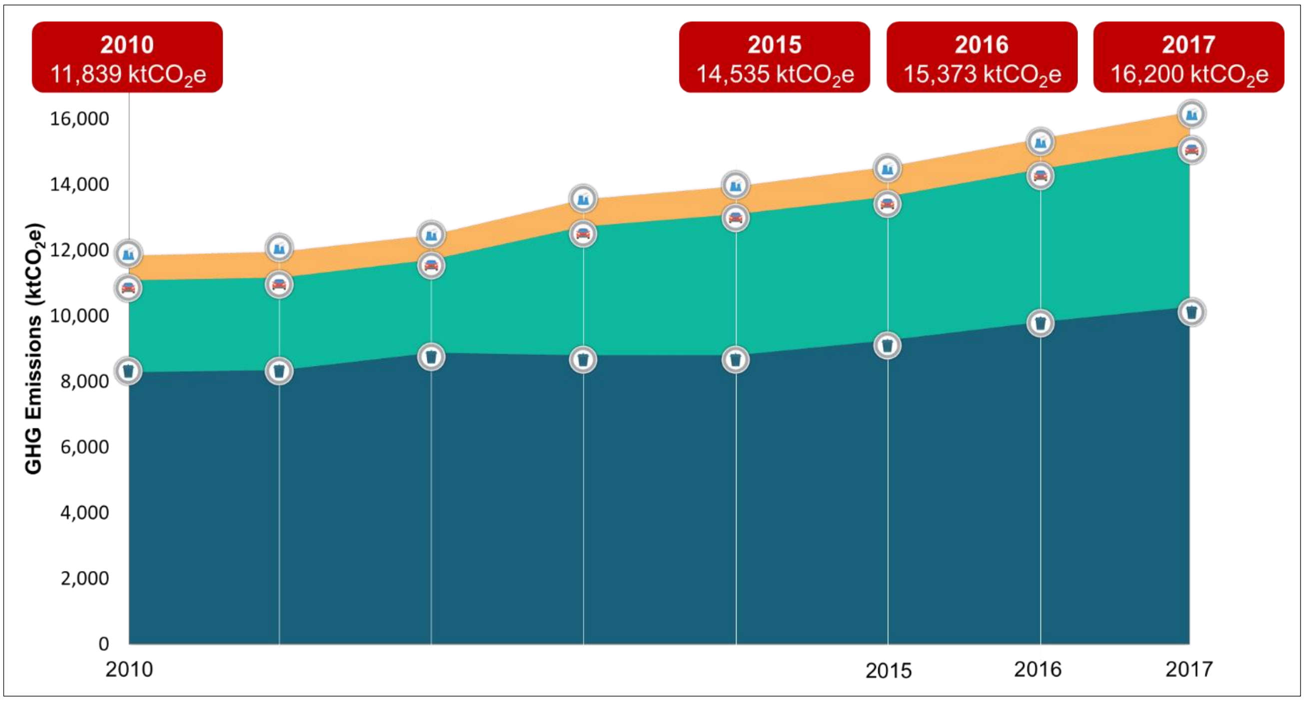


Figure 2: Overview of Iskandar Malaysia's GHG emissions

Amount of GHG emissions calculated under BASIC level reporting for Iskandar Malaysia in 2017 were 16.20 million tCO_2e. In 2010, the GHG emissions were 11.84 million tCO_2. This is equivalent to an increase of 36.8% to the base year of 2010 while 5.4% to last year. The average annual growth rate for BASIC emissions is 4.6%.

Iskandar Malaysia emission's increases since 2010 reflect the ongoing economic development in the economic region. It can also be proven by the growth of its GDP with an increase of 57.1% from 2010 to 2017 and with average annual growth rate of 6.7%.

Sector Trends 2010 – 2017

Out of 16.20 million tCO_2e of BASIC emissions, 63.5% of it was largely contributed by Stationary Energy sector with an amount of 10.28 million tCO_2e. This was followed by 4.93 million tCO_2e of Transportation sector which represent 30.4% of overall emissions. The remaining 6.1% was added by Waste sector with an amount of 0.99 million tCO_2e.

This emission proportionating trend where Stationary Energy sector was the largest while Waste was the lowest contributor to the whole emissions existed since the past 7 years. However, as shown in Figure 2, since 2012 onwards, GHG emissions caused by Transportation sector is slowly increasing. This was mainly contributed by on-road transportation sub-sector where it can be seen in Transportation sub-section (Figure 10).

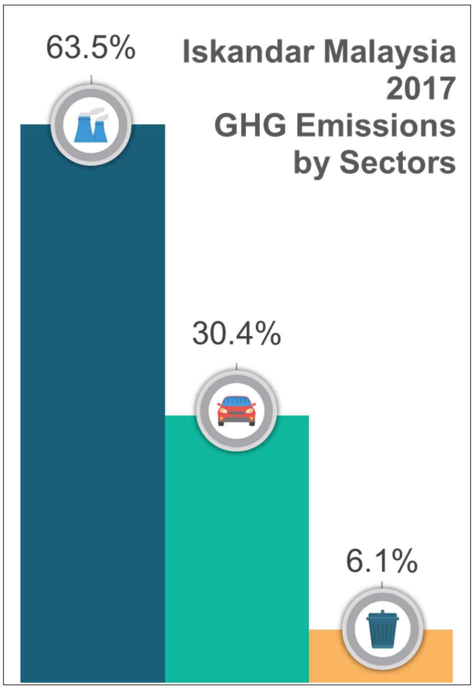
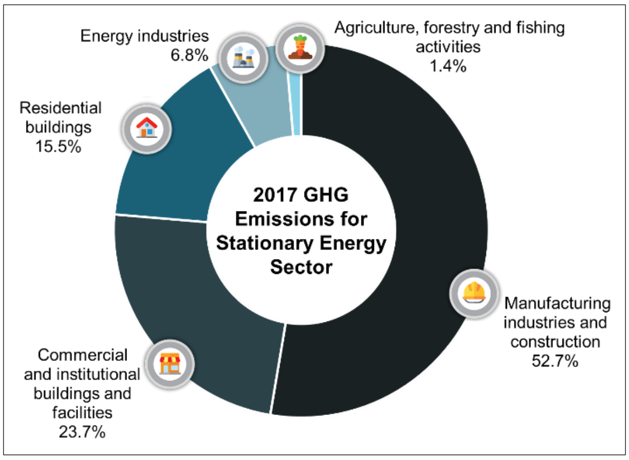


Figure 3: Percentage of GHG emissions by sectors

Stationary Energy

GHG emissions of Stationary Energy sector arises from fossil fuel combustion and grid-supplied energy consumed within Iskandar Malaysia geographical boundary. Though these emission sources were accounted in the four sub-sectors under Stationary Energy, the emission sources for Energy Industries sub-sector are a bit different. For Energy Industries sub-sector, the emissions accounted was from energy used (both fossil fuel and grid-supplied energy) in power plant auxiliary operations. Historically since 2010, the average ratio of emissions contribution by the fossil fuel combustion to grid-supplied energy consumption was 30:70.



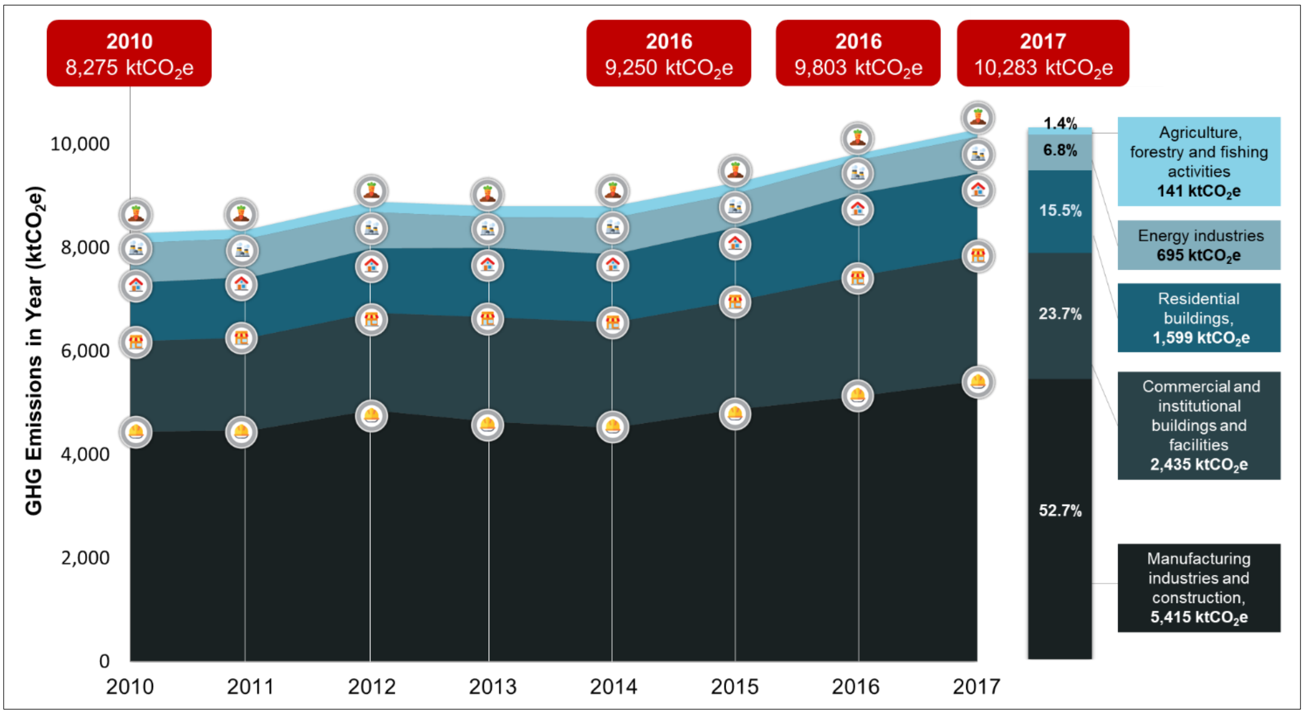


Figure 4: *GHG emissions for Stationary Energy*

As seen in Figure 4, Manufacturing Industries and Construction have the highest proportion of GHG emissions with 52.7%, followed by 23.7% of Commercial and Institutional Buildings and Facilities, 15.5% Residential Buildings, 6.8% Energy Industries and only 1.3% from Agriculture, Forestry and Fishing Activities.

GHG Emissions from Fuel/Energy Use

Since 2010 which is the base year for Iskandar Malaysia, the trends in emission contribution of fuel combustion in Stationary Energy sector are not changing (Figure 5). Largest contributor is Manufacturing Industries and Construction sub-sector, held 63.7% in 2017 from the total emissions from fuel/energy used. There was fluctuation of energy use in this sub-sector from 2010-2014 followed by an increase of 16.0% energy usage from 2015-2017. This shows the fluctuations of industrial GDP within Iskandar

Malaysia, where the main economic drivers came from manufacturing sectors, namely electrical and electronics, oleochemical, petrochemical and food processing[9].

A significant 22.4% emission contribution came from the fuel/energy used in power plant auxiliary operations by the Energy Industries. Since 2010, the fuel consumption for Energy Industries continues to fluctuate where the emission range is between 0.64 million tCO_2e and 0.76 million tCO_2e averaging 0.69 million tCO_2e. This variation is possibly due to power plant outages incidents leading to decreased power generation activity, hence affecting the auxiliary operations of power plants and lowers the emissions.

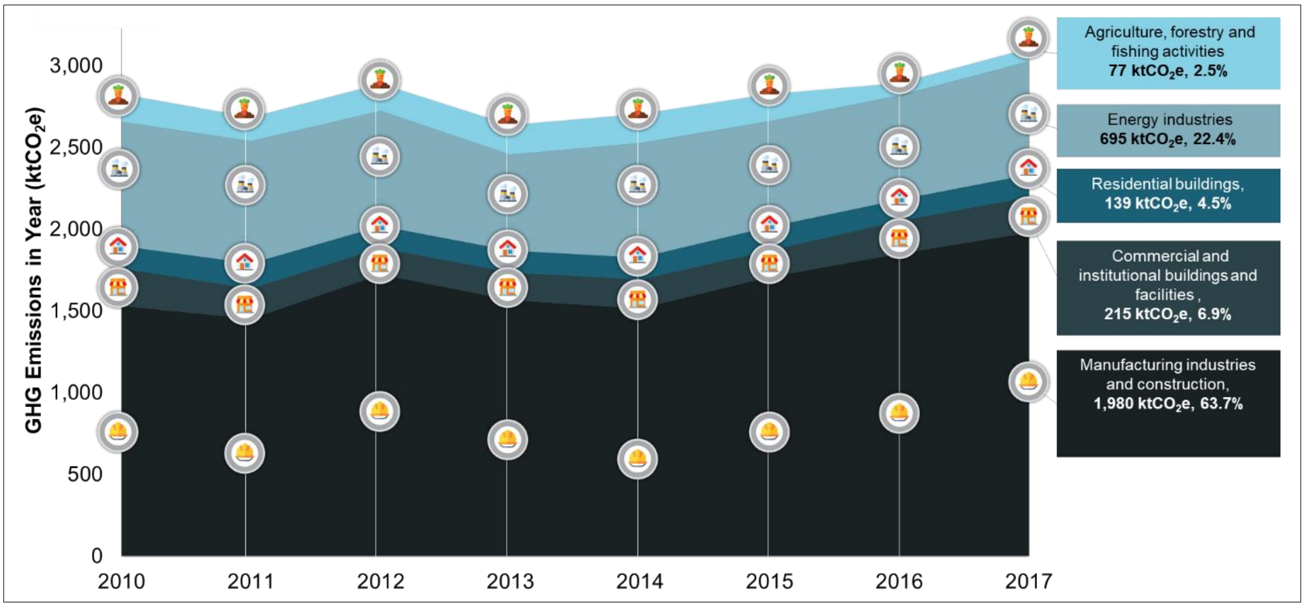


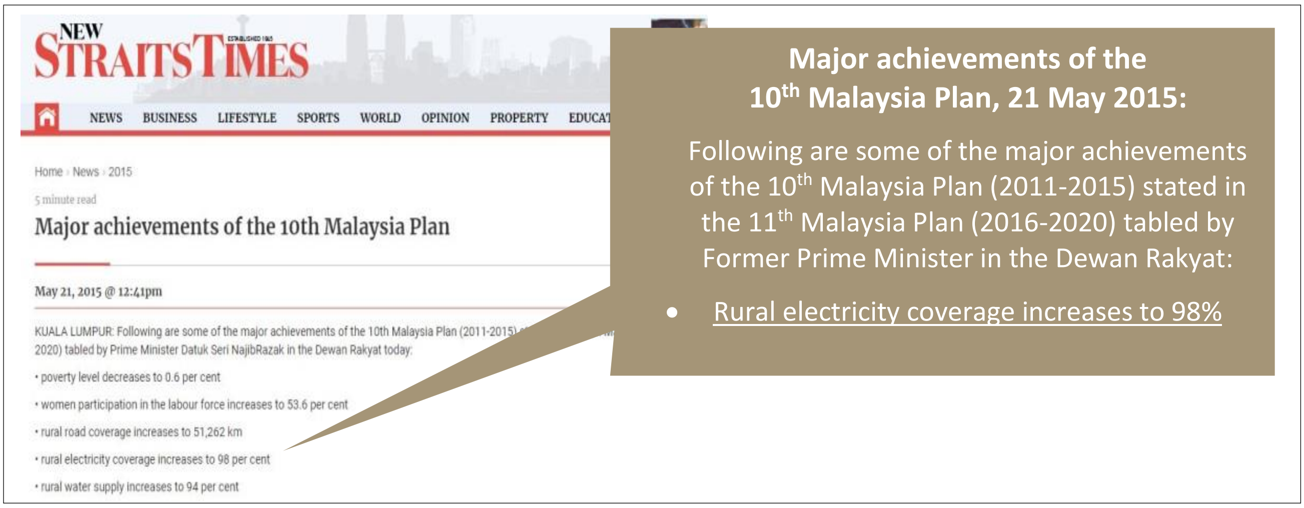
Figure 5: GHG emissions from fuel/energy use in Iskandar Malaysia

Energy use from Agriculture, forestry and fishing activities was quite stagnant from 2010-2015, however since 2016 there was a sharp energy usage reduction in this sub-sector. Though its contribution to total emissions remains the smallest since 2010, there was a significant reduction of 56.2% from its value in 2015-2016. This is most likely due to TNB's effort in the extension of electricity network in the non-urban areas parallel with the government's desire to improve living standards in the social, economic and educational fields[10]. The other reason may be the increase of rural electricity coverage up to 98% which listed as one of the major achievements of 10th Malaysia Plan (2011-2015)[11].

Along with this effort, it opens useful opportunity for the Agriculture, Forestry and Fishing Activities which commonly exist in rural areas, to make use of the electricity supplied by the utilities without depending too much on their generators. This is therefore affecting the usage amount of fuels to run generators which may be their sole option for electricity source previously. The attribution of energy usage in this sub-sector is possibly to operate their vehicles and fuel-consumed machineries and equipment.

GHG emissions from fuel combustion for Commercial and Institutional Buildings and Facilities as well as Residential Buildings show insignificant change in their amount through all the years.

[9] Promoted Sectors, Iskandar Malaysia Website, http://iskandarmalaysia.com.my/promoted-sectors/#content
[10] Utusan Online, Kemudahan elektrik liputi 99% kawasan pedalaman, http://ww1.utusan.com.my/utusan/Timur/20140630/wt_04/Kemudahan-elektrik-liputi-99-kawasan-pedalaman
[11] Major achievements of the 10th Malaysia Plan, https://www.nst.com.my/news/2015/09/major-achievements-10th-malaysia-plan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5 minute read

Major achievements of the 10th Malaysia Plan

May 21, 2015 @ 12:41pm

KUALA LUMPUR: Following are some of the major achievements of the 10th Malaysia Plan (2011-2015) ... 2020) tabled by Prime Minister Datuk Seri NajibRazak in the Dewan Rakyat today.

- poverty level decreases to 0.6 per cent
- women participation in the labour force increases to 53.6 per cent
- rural road coverage increases to 51,262 km
- rural electricity coverage increases to 98 per cent
- rural water supply increases to 94 per cent

Major achievements of the 10th Malaysia Plan, 21 May 2015:

Following are some of the major achievements of the 10th Malaysia Plan (2011-2015) stated in the 11th Malaysia Plan (2016-2020) tabled by Former Prime Minister in the Dewan Rakyat:

- Rural electricity coverage increases to 98%

Figure 6: News adapted from New Straits Times, 2015 regarding major achievements of the 10th Malaysia Plan

GHG Emissions from Grid-supplied Energy Consumption

As shown in Figure 7 each sub-sector emits significant amount of GHG due to the consumption of grid-supplied energy except for Energy Industries.

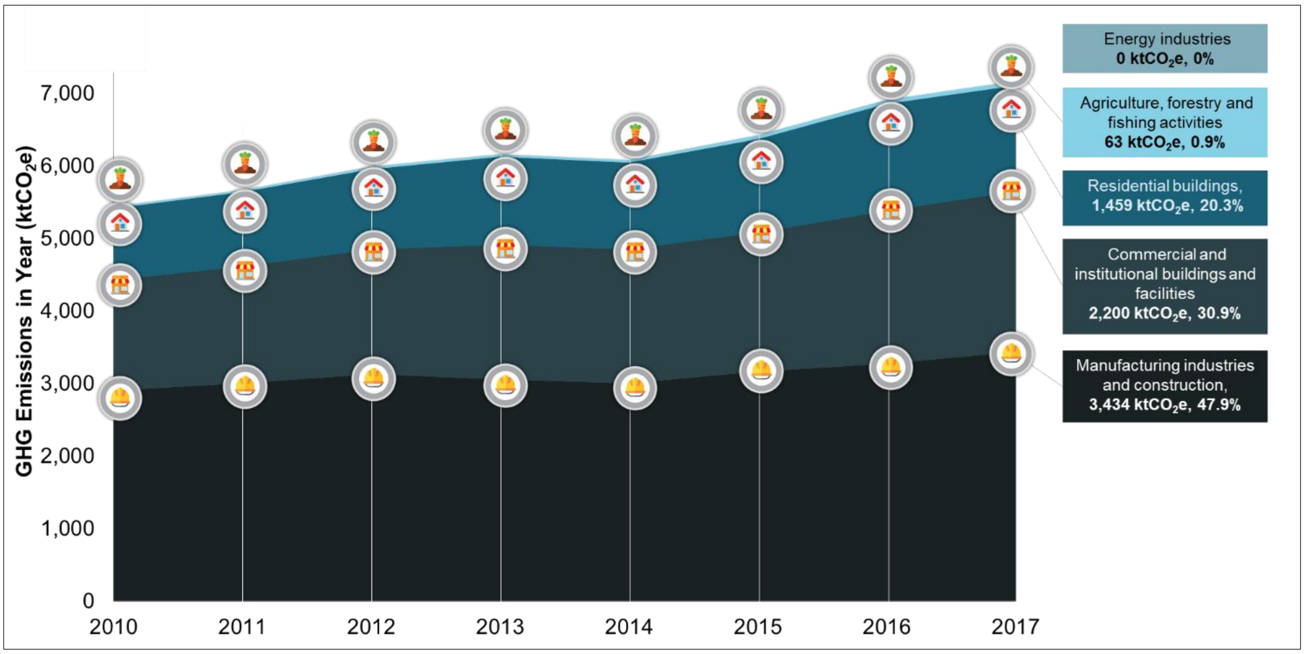


Figure 7: GHG emissions from grid-supplied energy consumption in Iskandar Malaysia

No Energy Industries sub-sector's allocation for the GHs emissions from grid-supplied energy consumption is due to its inclusion in the emission caused by fuel/energy used.

Manufacturing Industries and Construction has been consistently a large contributor in electricity consumption. Manufacturing is listed as one of the core sectors that has been long established in Iskandar Malaysia and helps in boosting the economy of Iskandar Malaysia (Figure 7: GHG emissions from grid-supplied energy consumption in Iskandar Malaysia as well as Johor GDP. In 2017, Iskandar Malaysia industrial sector contributed to 46.1% out of 38.9% of total Johor GDP. The remaining 61.1% of Johor GDP were attributed to services sector and primary sector with 47.6% and 13.5% respectively[12].

[12] Economic Indicators, Iskandar Malaysia Website, http://iskandarmalaysia.com.my/economic-indicators/

It is possible these industries contributed substantially to Iskandar Malaysia's GDP and also Johor's GDP, thus leading to an increase of electricity consumption throughout those seven years. The increase of grid-supplied energy emissions of this sub-sector in 2017 was 4.9% with average annual emissions growth rate of 2.5%.

With 5.6% average annual growth rate of grid–supplied energy emissions and an increase of 5.1% relative to 2016, Commercial and Institutional Buildings and Facilities increase of emissions may be caused by the commercial development in intensifying the development journey of Iskandar Malaysia to achieve its vital target to be "A Strong and Sustainable Metropolis of International Standing" by 2025. Since its establishment, a large number of Commercial and Institutional Buildings and Facilities have been developed i.e. LEGOLAND Malaysia, Educity Iskandar Malaysia, Johor Premium Outlets and Medini[13] [14] [15]. The growing amount of these types of buildings and facilities in order to support Iskandar Malaysia's business model is the most plausible reason for the growth of grid-supplied energy consumption in this sub-sector.

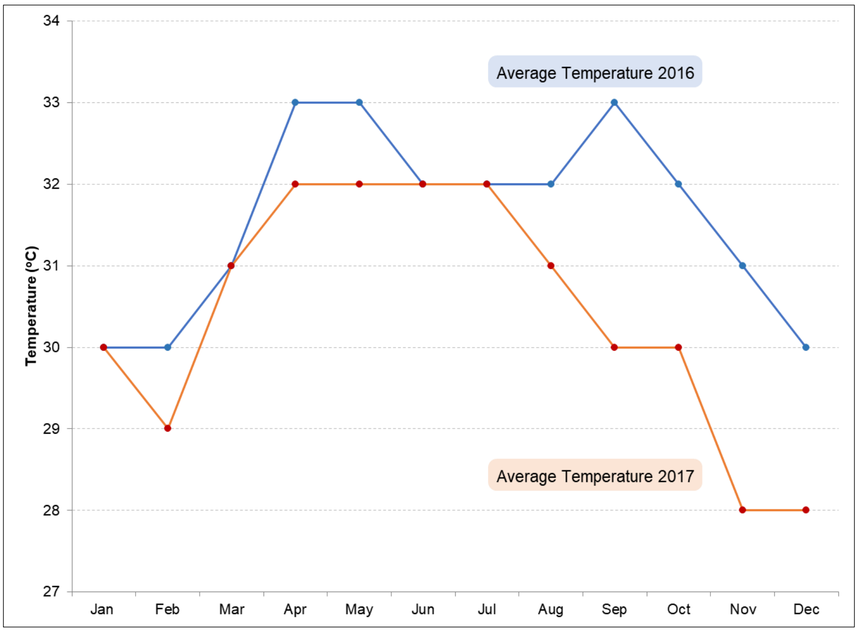


Figure 8: *Comparison of Johor Bahru temperature between 2016 and 2017*

Residential Buildings possess average annual growth rate emission of 5.8%. Relative to 2016, there was a slight decrease of 0.7%. Electricity consumption spiked in 2016 due to El Niño effect seems to cause the electricity consumption in 2017 to decrease. The comparison of temperature between the two years is illustrated in Figure 8. The emission of electricity consumption in 2017 was slightly reduced in comparison to 2016 due to the non-occurrence of El Niño event but reflect an increase of 13.4% relative to 2015 likely due to the climate change phenomena.

The least contributor of grid-supplied energy emissions but possess the highest average annual emissions growth rate of 13.3% and a significant 15.0% increase of emissions in 2017 is Agriculture, Forestry and Fishing Activities sub-sector. This is possibly attributed by the extension of electricity network to non-urban area as previously mentioned in fuel/energy use sub-section.

GHG Emissions from Energy Industries Sub-sector

In addition to the emissions caused by fuel/energy used and consumption of grid-supplied energy for power plant auxiliary operations, GHG emissions from Energy Industries also account the emissions from power generation supplied to the grid. With reference to GPC, only emissions from fuel used in power plant auxiliary operations were accounted in this BASIC reporting inventory, where the fuel was not used directly

[13] Iskandar Malaysia 10 Year Progress Report, http://iskandarmalaysia.com.my/downloads/IM10%20Progress%20Report_V5.pdf
[14] Updates on Iskandar Malaysia: Challenges and Prospects, http://www.sedia.com.my/sdc10/papers-NCEC/S2-1_IRDA.pdf
[15] Medini Projects, https://www.iskandarinvestment.com/investment-opportunities/medini-projects/

for power generation purposes. Emissions due to the grid-supplied power generation activity was calculated separately and accounted under territorial total emissions.

Since 2010, the emissions from auxiliary operations consistently contributes to a small portion of the total Energy Industries' emissions. Up till 2017, the annual average emissions of 7.2% belongs to auxiliary operations emissions while the remaining emissions of 92.8% owned by power generation emissions. In 2017, the emission percentage contribution was 6.0% from auxiliary operations and 94.0% from power generation.

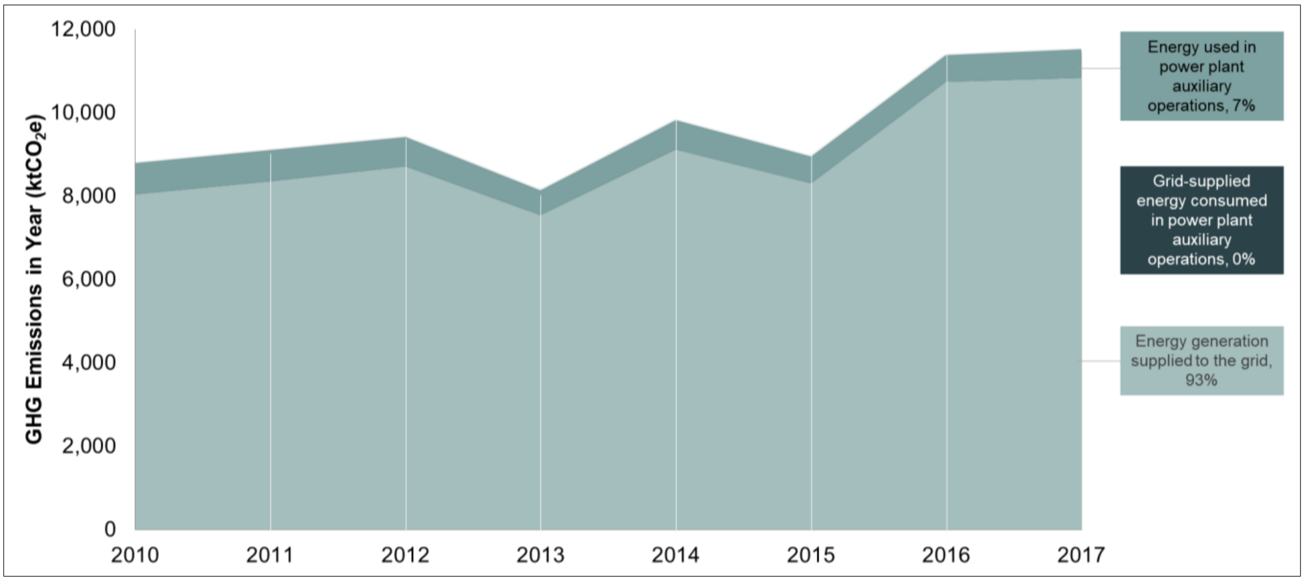


Figure 9: GHG emissions from Energy Industries

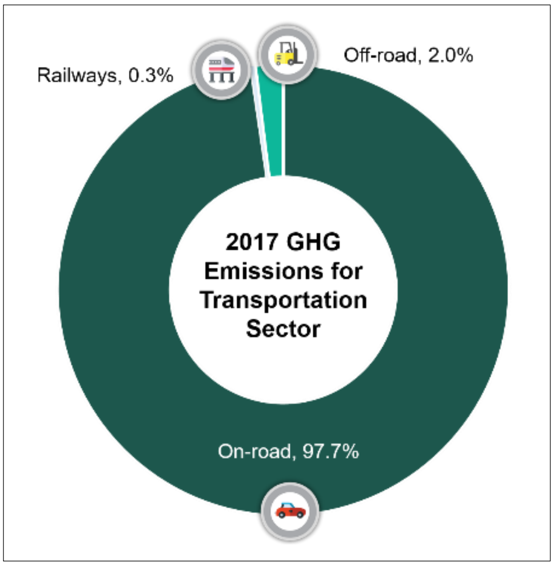
The significant increase in 2016 depicted in Figure 9 is largely attributed to a newly operating power plant commissioned in 2016.

Transportation

GHG emissions for Transportation sector were contributed by three out of five sub-sectors which are:-

i. On-road Transportation;
ii. Off-road Transportation; and
iii. Railways sub-sector.

Due to lack of information, the other two sub-sectors namely Waterborne Navigation and Aviation sub-sector were not estimated in this inventory. The emission sources for each sub-sector cover the combustion of fuel including natural gas, petrol, diesel, fuel oil and biodiesel; as well as emissions from the consumption of grid-supplied electricity. However, it should be noted that emissions from grid-supplied electricity for On-road and Off-road Transportation were already included elsewhere (under Stationary Energy), while for Railways sub-sector such emissions did not exist.



According to GPC, CO_2 emissions produced by combustion of material of biogenic origin such as biomass, biofuel, etc. shall be reported separately from the scope and other gases. Therefore, the amount 50,586 tCO_2e belongs to biodiesel emissions under On-road Transportation sub-sector is counted and reported separately under CO_2 (b) column (Refer Detailed 2017 Iskandar Malaysia GHG Inventory – Page 10).

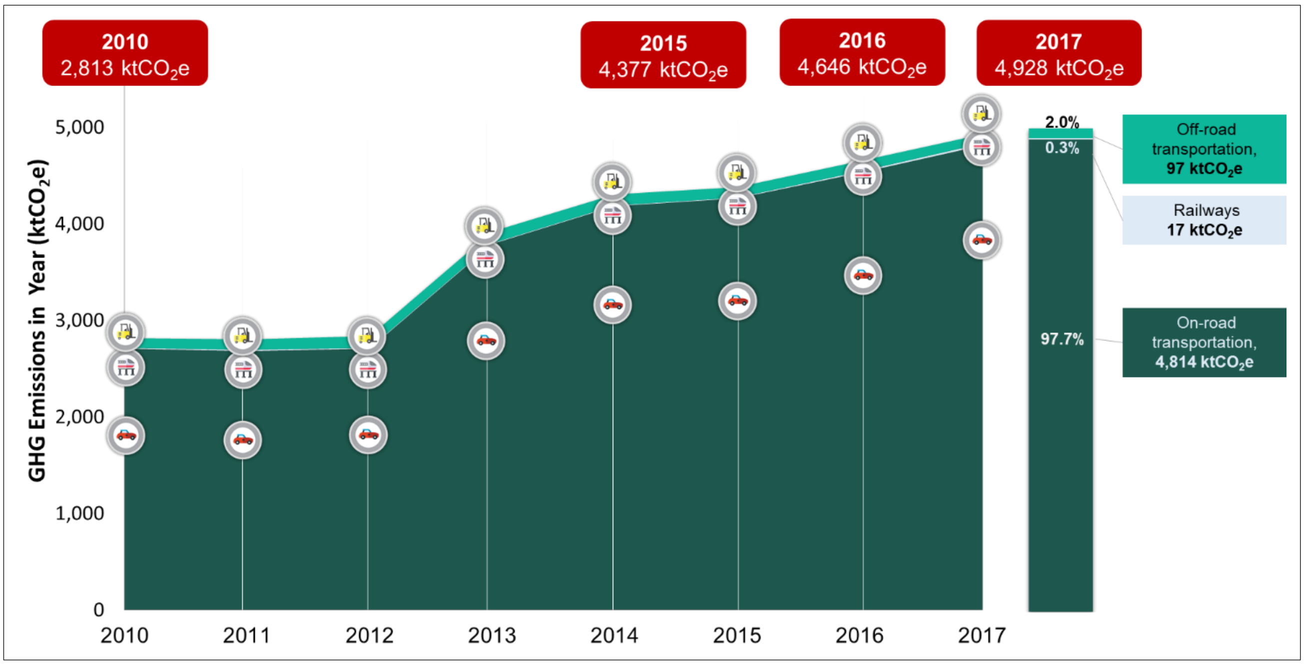


Figure 10: Emissions from Transportation sector

Since the past seven years, the main emissions contributor of this sector is On-road Transportation. In 2017, GHG emissions amounting 4.93 million tCO_2e is contributed by this sector which apportion 30.4% from the total emissions.

GHG emissions of Off-road Transportation and Railways sub-sector contributed 2.3% to Transportation total emissions with 2.0% and 0.3% respectively while the remaining contributed by On-road Transportation (Figure 10). Off-road Transportation sub-sector shows insignificant variation, while for Railways there was a significant increase of 64.1% in 2016 and further increase of 8.8% in 2017 due to the increasing amount of trips for intercity trains according to the data given by railway operator (Figure 11).

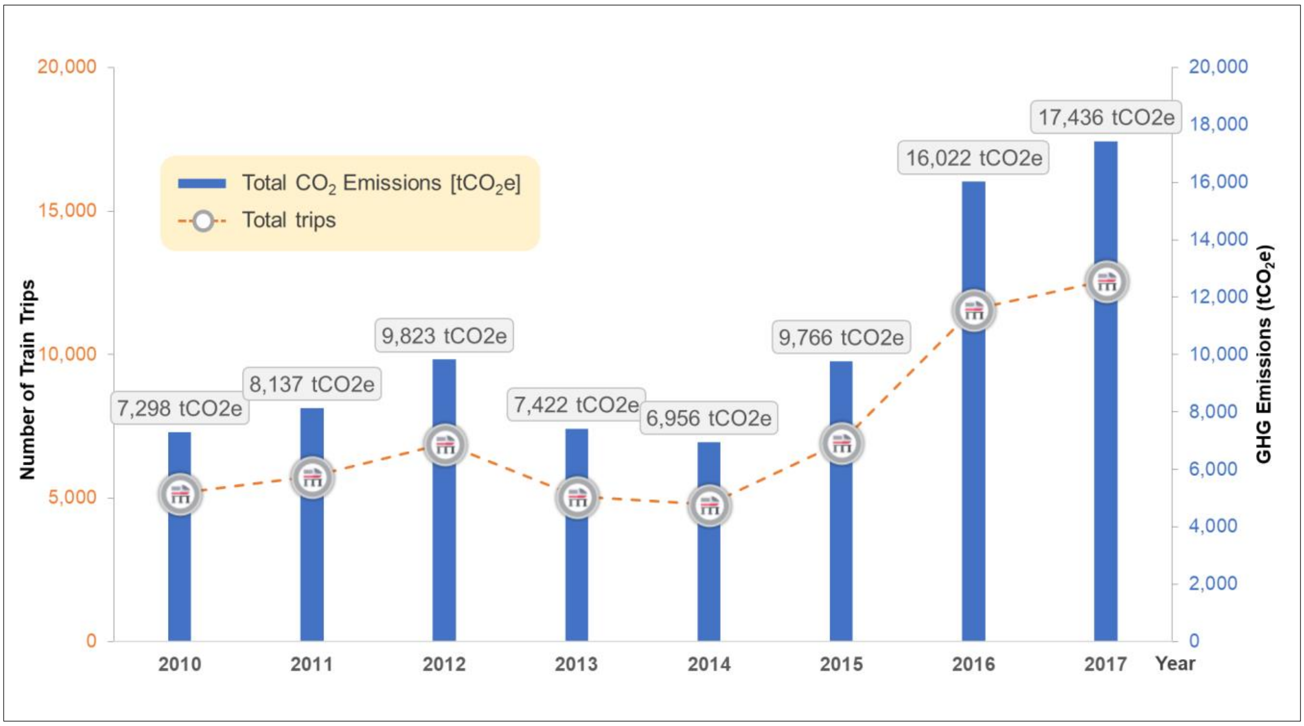


Figure 11: Number of train trips vs Railways GHG Emissions

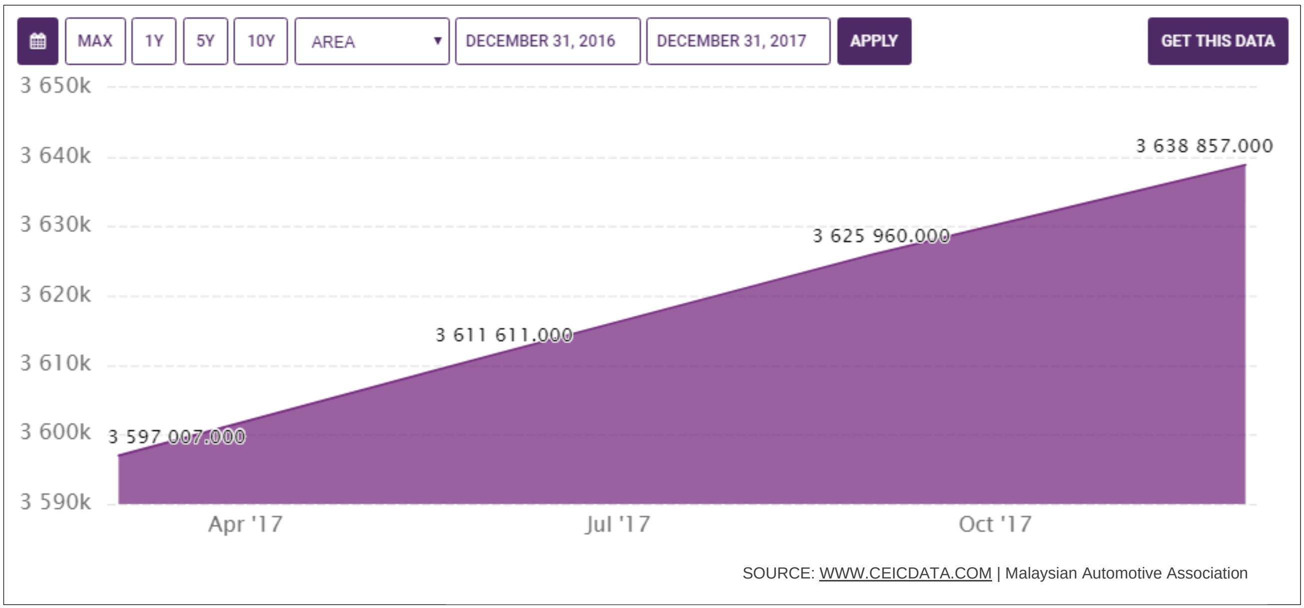


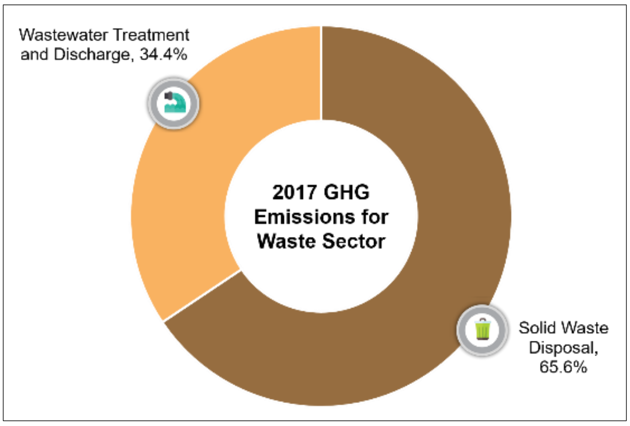
Figure 12: Number of registered motor vehicles in Johor state

On average, since 2010 to 2017, the emission growth rate of On-road sub-sector is 9.3%. Meanwhile, the increase of emissions in 2017 relative to 2016 is 6.3%. Factors responsible for this emissions rise are the likely population growth and the improvement of living standard of people in the economic region that cause the number of vehicles to rise. As reported by Malaysia Automotive Association, the number of registered motor vehicles in 2017 increased 1.2% from 2016 (Figure 12). Therefore, Iskandar Malaysia population which make up 57% from total Johor population in 2017 would indirectly contribute to the total amount of vehicles in Johor, thus increasing the fuel consumption's emission.

Waste

Solid Waste Disposal and Wastewater Treatment are two sub-sectors contributing to GHG emissions of Waste sector. Historically portion of emission contribution from Waste sector is rather small in comparison with Stationary Energy and Transportation sector with a mere of 6.1% averagely from 2010 to 2017.

In 2017 from a total of 989 ktCO_2e of emissions in Waste sector, 65.6% originated from Solid Waste Disposal while the remaining 34.4% was sourced from Wastewater Treatment and Discharge (Figure 13).



Though the GHG emissions from Wastewater Treatment remain largely unchanged since 2010 with average annual growth rate of emission 3.4%, starting 2016 there was significant decrease in emissions with a percentage decrease of 5.9% but increased 11.7% in 2017. The likely reason for the decrease in previous year was the upgrade in wastewater (sewerage) treatment technology used. According to data obtained, the use of centralised aerobic treatment plant in 2016 had increased while treatment methods using anaerobic reactors and anaerobic shallow lagoons had decreased in comparison to 2015. However, the emissions in 2017 increased due to the increment of population growth compared with previous year.

The increased annual production from industrial (palm oil and rubber mill) resulted in the increment of emissions from their wastewater.

The increase of GHG emissions from solid waste disposal since 2010 with average annual growth rate of 4.6% roughly resembles the average population growth in Iskandar Malaysia.

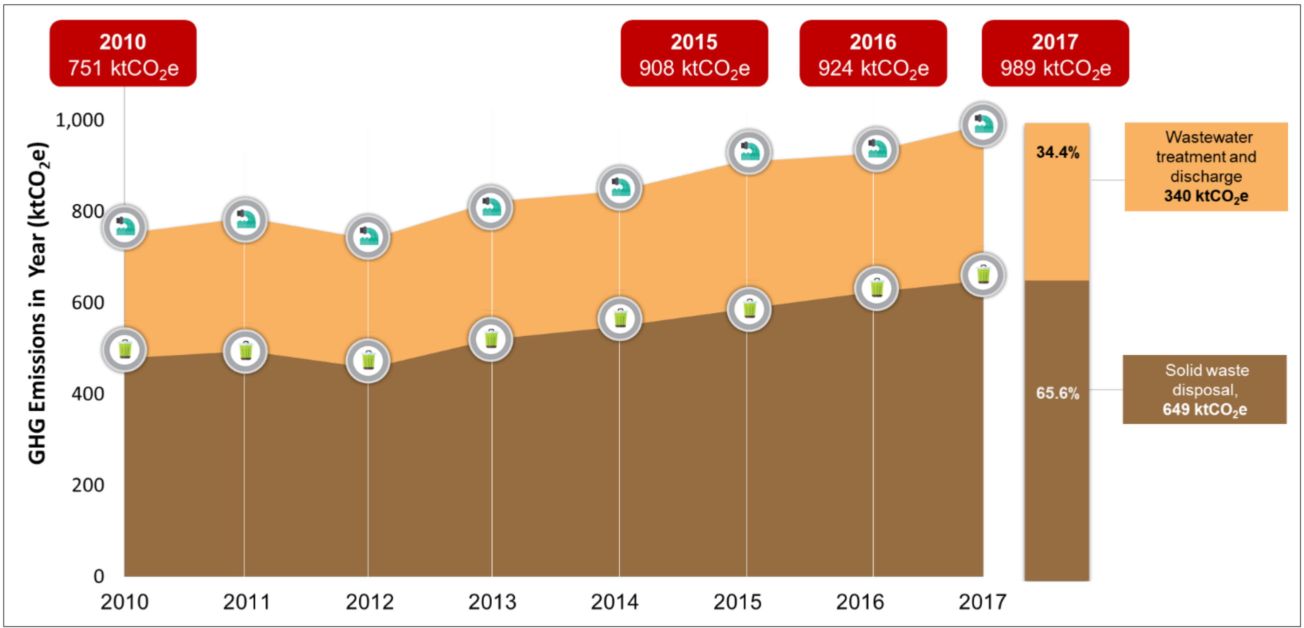


Figure 13: GHG emissions from Waste sector

Emission Intensity

Iskandar Malaysia emission intensity by GDP in 2017 was 0.2164 ktCO2e/RM million at 2010 as constant price. This represents a decrease of 1.2% compared with previous year and 12.9% from its base year, 2010 (Figure 14).

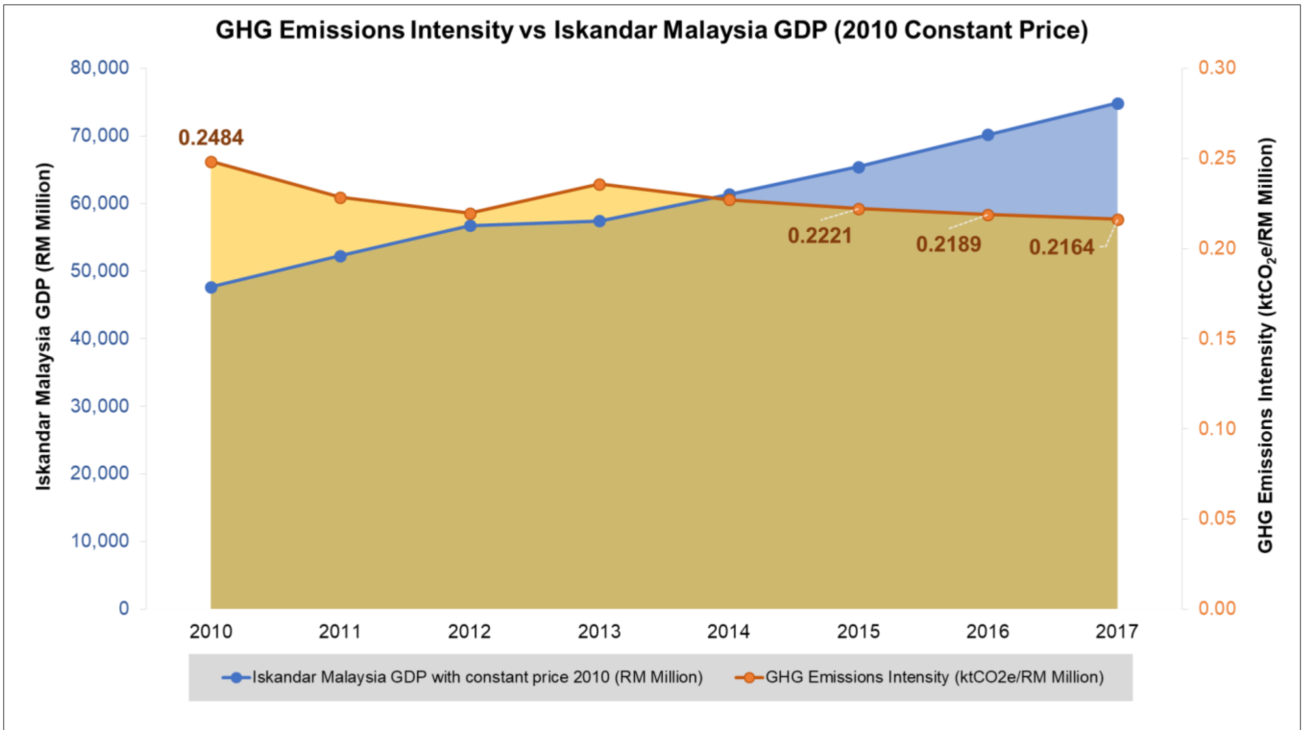
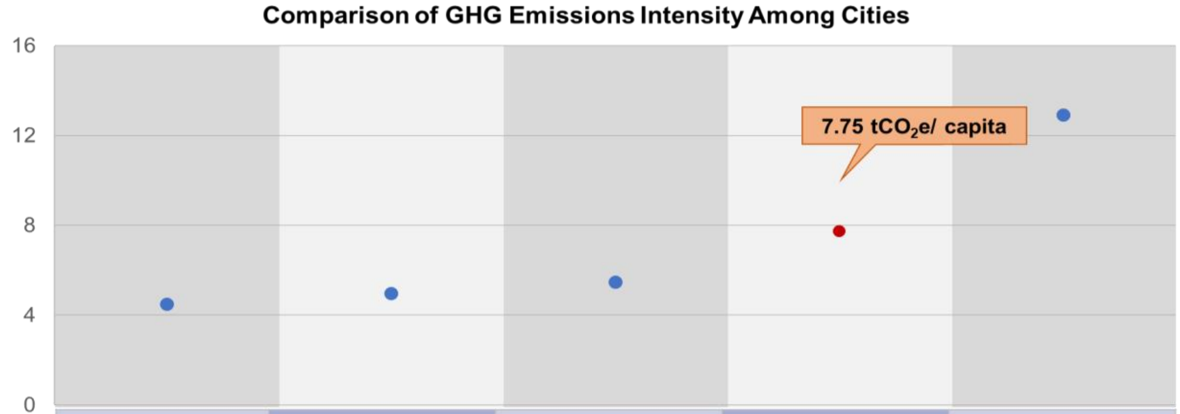


Figure 14: All BASIC emissions intensity vs Iskandar Malaysia GDP

Benchmarking



	Taipei City (2015)	Taichung City (2015)	Tokyo Metropolitan (2013)	Iskandar Malaysia (2017)	Kaohsiung City (2015)
GHG/capita (tCO_2e)	4.50	4.97	5.48	7.75	12.92
2017 Population	2,683,257	2,799,254	13,760,000	2,090,000	2,776,912
Total GHG Emissions (tCO_2e)	12,114,538	13,668,164	70,733,403	16,197,007	35,900,213
Land Area (km^2)	2,053	2,215	13,572	2,300	2.952

Source: https://www.globalcovenantofmayors.org

Figure 15: *Benchmarking with other cities*

A comparison of GHG emissions between Iskandar Malaysia and selected cities which have disclosed their GHG inventory to Carbon Disclosure Project was made. These cities measured their GHG emissions between years 2013 to 2017 (Figure 15).

GHG emissions of Iskandar Malaysia were measured based on GPC BASIC level reporting and used the 2006 IPCC Guidelines for National Greenhouse Gas Inventories for its calculation methodology. To ensure reasonable comparison, the selections of the other four cities were based on their adoption of GPC BASIC Framework as well, in the preparation of their GHG inventories.

Iskandar Malaysia GHG emissions intensity per capita was 7.75 tCO_2e/capita in the year of 2017. Rank second highest among those selected cities, Iskandar Malaysia's emissions is relatively high. However, owing to its status as developing city and also relatively lower number of populations in comparison with other cities, it is possible Iskandar Malaysia's emissions intensity falls in this range.

GHG Emissions Reduction Initiatives

As seen under Results Chapter, GHG emissions from Stationary Energy Sector dominate more than 60% from the total emissions of Iskandar Malaysia since 2010. And from that 60%, nearly 70% of it coming from total electricity usage of its sub-sectors. In 2017, efforts in reducing electricity consumption were continued by conducting following initiatives:

- Green Accord Initiative Award (GAIA)
- Building Energy Monitoring and Reporting System (BEMRS)
- Mini Hybrid Hydro Project in Pontian District (under LCSAP2025)

Aside from above efforts, further low carbon initiatives have also been implemented in Iskandar Malaysia region that includes:

- Low Carbon Society Action Plan 2025 (LCSAP2025)
- Iskandar Malaysia Green Portal
- Masterplan and Guideline on Connected Pedestrian Walkway and Cycle Lane in Iskandar Malaysia

Green Accord Initiative Award (GAIA)

GAIA is an initiative by IRDA that honours outstanding organisations or buildings in Iskandar Malaysia who have contributed towards the adoption of sustainable design, planning, retrofitting and operation in the built environment or buildings. GAIA 2017 is the second-year award on the recognition of company's journey and commitment on sustainability towards achieving a low carbon Iskandar Malaysia by 2025.

Building Energy Monitoring and Reporting System (BEMRS)

With a target to achieve at least 70% of new buildings to be certified green in Iskandar Malaysia by 2025, IRDA and the local authorities are planning to use the BEMRS to track the progress and achievement of mitigation actions carried out by individual building owners.

BEMRS is a tool for measuring building energy performance as well as to track and monitor the GHG emissions through achievements of the building energy-saving programme. The development of BEMRS in Iskandar Malaysia is through collaboration between the Tokyo Metropolitan Government, Mizuho Research Institute, Japan Energy Institute and the Institute for Global Environmental Strategies (IGES)[16].

BEMRS assessment template developed for Iskandar Malaysia may help parties involved to gain a better understanding of energy usage pattern, building energy index (BEI) and a no-cost quick win countermeasure to save building energy and utility bills[16].

Mini Hybrid Hydro for Ramsar Tanjung Piai's Office by Pontian District Council

The Mini Hybrid Hydro pilot is the result of a collaboration between Pontian and Toyama City under the Future City Initiative. The first floating hybrid mini hydro system in Asia was installed on 21 February 2018 with a capacity of 1,000W.

The floating mini hydro system uses relatively gentle river wave action and this power is then transferred to a hybrid power supply, with solar panels providing additional power. The project is generating renewable energy (RE) round-the-clock, as there will be continuous river flow, and its water sources are from the sea and land.

This pilot project was also expected to be an attraction and showcase for the Tanjung Piai National Park for environmental education and tourism purposes.

Figure 16: *IRDA Chief Executive Datuk Ismail Ibrahim, Toyama Mayor Masashi Mori and Pontian District Council President (YDP) Hj. Kamalluddin b. Hj. Jamal signing the plaque at the launching of the floating hybrid mini hydro generator*[17]

Low Carbon Society Action Plan 2025 (LCSAP2025)

The LCSAP2025 for five Local Authorities within Iskandar Malaysia namely Johor Bahru City Council (MBJB), Iskandar Puteri City Council (MBIP, previously known as Johor Bahru Tengah Municipal Council), Pasir Gudang Municipal Council (MPPG), Kulai Municipal Council (MPKu) and Pontian District Council (MDP) were developed to ensure effective implementation of LCSBPIM 2025 at local level.

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16 http://iskandarmalaysia.com.my/calling-developers-property-owners-go-green-win-3rd-iskandar-malaysia-green-accord-initiative-award-gaia-2018-2019/

17 Sources: Mohamed Hirsham Azmi (Pontian), https://malaysiaaktif.my/malaysiaaktif2/?p=41218

Each set of LCS Action Plan is a specific document for each local authority area, highlighting different low carbon initiatives or programmes considering each council's strengths and potentials as well as their distinctive economic, social and environmental characteristics.

Photo credit: IRDA

Iskandar Malaysia Green Portal

The establishment of Iskandar Malaysia's Green Portal focuses on promoting the natural environment and a LCS awareness to the public. This portal aims to become a platform for the authorities to explain all current issues and phenomena happening in Iskandar Malaysia, for instance the LCS project updates and events announcement. This provides opportunities for the public to participate in the building of LCS in their community. Through the portal, the public will have better access to, and understanding of, environment-related information, thus encouraging them to live a low carbon lifestyle.

Photo credit: alchemyrider

Masterplan and Guideline on Connected Pedestrian Walkway and Cycle Lane in Iskandar Malaysia

This document established goals, objectives and benchmarks that will improve safety and expand mobility options as well as increase non-motorised trips within Iskandar Malaysia by 2025 and also provides strategy for developing the necessary infrastructure and policy in a community to create environment where walking and cycling are safe, practical, enjoyable and viable transportation choices for citizens. It identifies the existing Non-Motorised Transport (NMT) route and recommends the NMT route to be developed and retrofitted without compromising the safety environmental aspect.

Puteri Harbour
Photo credit: IRDA

CHAPTER 4

IN THIS CHAPTER

CONCLUDING REMARKS AND WAY FORWARD

As an effort to achieve 58% of Iskandar Malaysia's GHG emission intensity reductions by 2025 from its base year as targeted in the LCSBPIM2025, GHG inventory for Iskandar Malaysia has been continually developed since 2015. This current inventory is the third GHG inventory aiming to monitor the current GHG emissions status and the effectiveness of the implemented mitigation initiatives within the economic region.

Also, the yearly updated GHG inventory would help policymakers and stakeholders to plan further action plans and strategies towards achieving Iskandar Malaysia's GHG emissions mitigation goal in a timely manner.

As previously detailed, Iskandar Malaysia 2017's territorial GHG emissions were 19.91 million tCO_2e whereas BASIC emissions were 16.20 million tCO_2e. This was an increase of 36.8% GHG emissions from 2010 and 5.4% from 2016. The increase of emissions was owed to Iskandar Malaysia's economic growth since 2010. Iskandar Malaysia's GDP had increased to 57.1% from 2010 to 2017 while to 6.7% from 2016 to 2017.

The base year 2010 emission intensity of GDP was 0.2484 $ktCO_2e$/RM million. Relative to 2017's emission intensity of GDP with a value of 0.2164 $ktCO_2e$/RM million, a significant decrease of **12.9% emission intensity of GDP had successfully been reduced in less than a decade.** While in comparison with 2016 emission intensity of GDP which stands at 0.2189 $ktCO_2e$/ RM million, there was a reduction of 1.2% in the emission intensity of GDP.

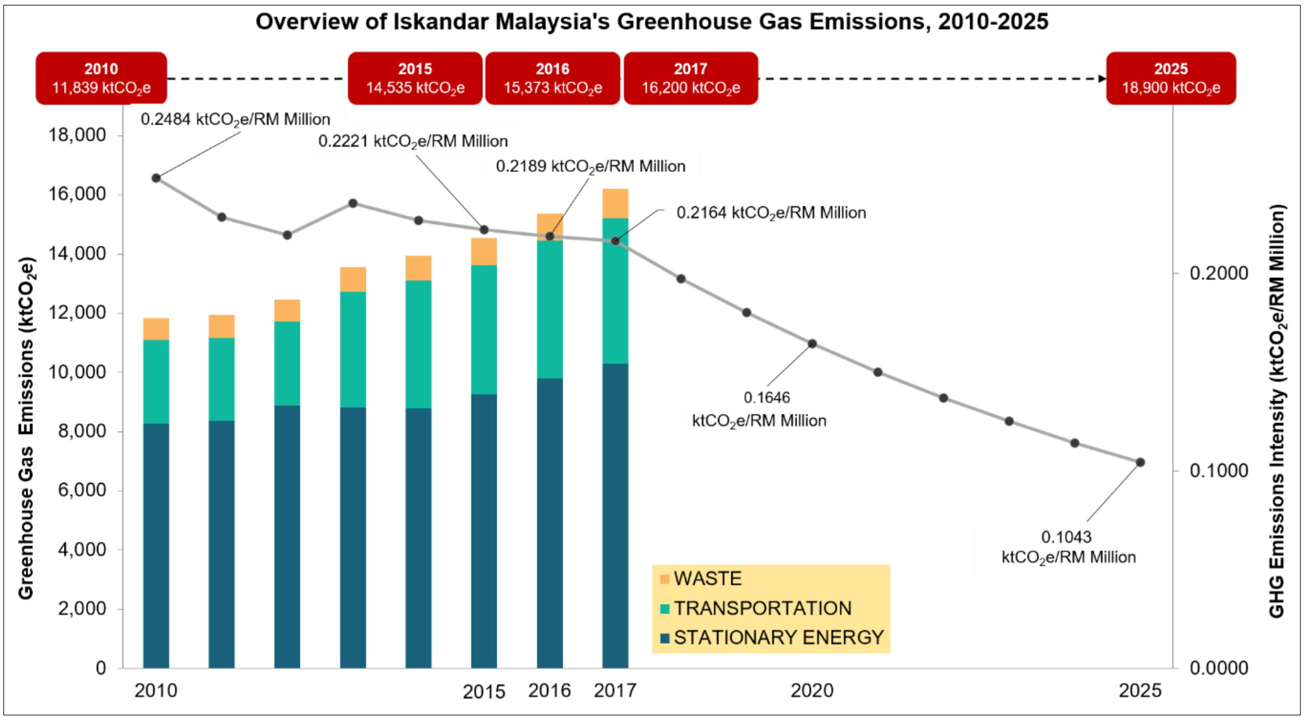

Figure 17: Towards achieving GHG emissions reductions target

Though various initiatives have been implemented in Iskandar Malaysia to come to this emission intensity reduction value, more efforts and strategies need to be reinforced within the region to meet Iskandar Malaysia's reduction goal by 2025. From 2018 onwards, Iskandar Malaysia will need to reduce its emission intensity at an average of 8.7% yearly as the value of emission intensity need to be 0.1043 $ktCO_2e$/ RM Million by 2025. By looking at the reduction trend for the past seven years, the average yearly reduction is only about 1.9%. With this percentage reduction, Iskandar Malaysia can only achieve 0.1863 $ktCO_2e$/ RM Million by 2025 which is equivalent to 25.0% reduction from the base year, 2010 (Figure 18). Therefore, it is recommended to revise the 2025 target and consider following the target set under the National Determined Contribution (NDC) Malaysia by 2030.

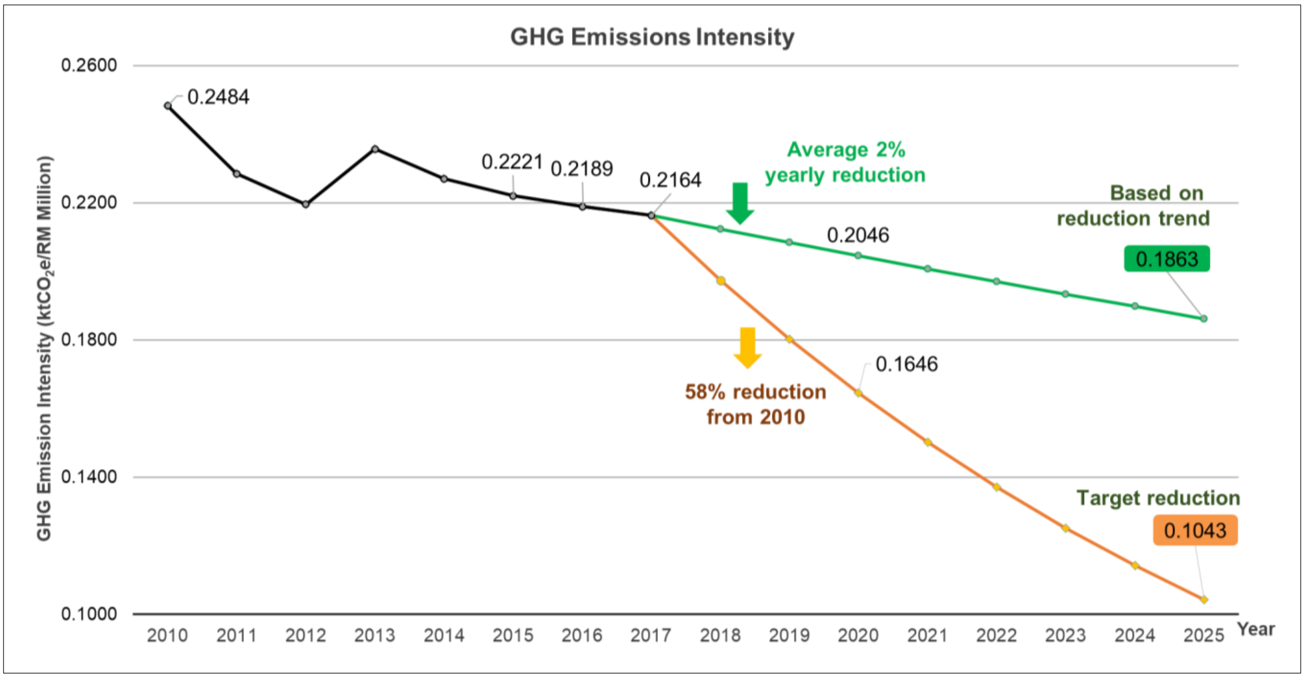

Figure 18: Iskandar Malaysia GHG emissions intensity

In 2009, the Malaysia government had declared a voluntary reduction of 40% in terms of emission intensity by the year 2020, as compared to the 2005 level. While in 2017 under the Paris Agreement, Malaysia has committed to reduce the emission intensity by 45% by 2030, as compared to the 2005 level. The target was re-pledged due to a reduction of 33% emission intensity between 2005 and 2015. As Malaysia is confident in reaching the target of 40% by 2020, a higher target is set to address global warming and climate change.

Therefore, it is recommended for Iskandar Malaysia to revise the 2025 target to consider following the target set under the NDC Malaysia by 2030 (i.e. to reduce the emission intensity by 45%).

Iskandar Malaysia is a region which is still undergoing its development phase and will further intensify its development throughout the years towards 2025. Increasing level of emissions in the upcoming eight years towards 2025 cannot be avoided as further development growth will be taking place. This report, therefore, recommends that IRDA focuses attention on LCS programmes that will have higher GHG emissions reduction.

Moving forward, the challenges faced during data collection also has to be noted as discussed during the Focus Group Discussion (FGD) held on 16 January 2019. Data limitation especially on the fuel consumption was the obvious data gaps in this inventory. National data was scaled down to obtain Iskandar Malaysia's fuel consumption. As an effort to improve this data gap, every year during the data collection phase, data collection team would try to collect region-specific and real-time data from relevant authorities to improve the accuracy of the calculated GHG emissions emitted within the region. This could be done through Iskandar Malaysia's Urban Observatory.

Figure 19: Focus Group Discussion held on 16 January 2019 at M-Suites Hotel, Johor Bahru

Also, it is recommended that future inventories should be GPC BASIC+ where it accounts the following emissions in addition to the BASIC emission sources:

- Industrial Processes and Product Use (IPPU)
- Agricultural, Forestry and Land Use (AFOLU)
- Transboundary transportation

The BASIC+ level reporting would provide a more comprehensive understanding of GHG emissions from Iskandar Malaysia to track and monitor progress of mitigation efforts in the future.

In conclusion, tremendous efforts have been done by IRDA and the five local authorities towards addressing climate change in Iskandar Malaysia. The LCSBPIM2025 and the LCSAP2025 for the five local authorities continue to be implemented and make effective changes to the urban and rural environments compared to ten years ago when the economic region started. People's awareness on climate change and global warming and the necessary actions needed to be carried out are evident in Iskandar Malaysia. It is heartening to note that GHG emissions have reduced again though more intensive effort must now be done to reduce further.

Appendix 1: Default Values and Emission Factors

General Data

1. Population

Population (million)	2010	2011	2012	2013	2014	2015	2016	2017
Malaysia	28.59	29.06	29.51	30.21	30.71	31.19	31.63	32.05
Peninsular Malaysia	22.75	23.10	23.42	23.87	24.28	24.67	25.00	25.32
Johor	3.36	3.40	3.45	3.47	3.56	3.61	3.65	3.70
Iskandar Malaysia	1.62	1.68	1.74	1.81	1.87	1.95	2.02	2.09

Source:
1. *Malaysia, Peninsular Malaysia & Johor Population 2010 – 2017: Department of Statistics Malaysia, http://pqi.stats.gov.my/searchBI.php*
2. *Iskandar Malaysia Population 2010 – 2017: Unit Perancang Ekonomi Negeri Johor (UPENJ)*

2. GDP at constant price 2010

Year	2010	2011	2012	2013	2014	2015	2016	2017
Total GDP (RM Million)								
Peninsular Malaysia	672,787	709,029	752,858	789,216	838,940	881,462	920,164	974,129
Johor	74,102	78,946	84,050	87,974	93,654	98,889	104,480	110,937
Iskandar Malaysia	47,667	52,256	56,731	57,431	61,370	65,433	70,215	74,867
Industrial GDP (RM Million)								
Peninsular Malaysia	294,877	304,571	320,975	331,438	350,082	366,559	376,304	395,321
Johor	38,968	40,912	43,319	45,051	48,226	51,235	53,669	56,687
Iskandar Malaysia	21,533	23,147	25,177	25,026	27,159	29,036	31,429	33,963

Source:
1. *Peninsular Malaysia & Johor GDP 2010 – 2016: Department of Statistics Malaysia, https://www.dosm.gov.my/v1/uploads/files/1_Articles_By_Themes/National%20Accounts/GDPbyState/Table%20Publication%20GDP%202010-2016.pdf*
2. *Peninsular Malaysia & Johor GDP 2017: Department of Statistics Malaysia, https://www.dosm.gov.my/v1/uploads/files/1_Articles_By_Themes/National%20Accounts/GDP%20by%20State%202017/The%20Performance%20of%20State's%20Economy%2C%202017.pdf*
3. *Iskandar Malaysia GDP 2010 – 2017: Unit Perancang Ekonomi Negeri Johor (UPENJ)*

Note:
1. *GDP for Peninsular Malaysia including Supra State (Supra State covers production activities that are beyond the centre of predominant economic interest for any state)*
2. *The added total may differ due to rounding*
3. *GDP for Iskandar Malaysia 2010 - 2012 are adjusted to 2010 constant price to ensure consistency in data, with Consumer Price Index obtained from Bank Negara Malaysia*
4. *GDP for Peninsular Malaysia & Johor in 2017 was calculated using 'GDP by state and kind of economic activity, 2017 at constant 2010 prices - Annual percentage change'*

APPENDIX 1

Default Values

1. Net Calorific Value (NCV)

Type of Fuel	Net Calorific Value (NCV) (TJ/Gg)
Natural Gas	48.0
Petrol	44.3
Diesel	43.0
Fuel Oil	40.4
LPG	47.3
Kerosene	43.8
Coal & Coke	18.9
Biodiesel	27.0

Assumption:

1. *Source of fuel for fuel oil is assumed to be residual fuel oil*
2. *Source of fuel for kerosene is assumed to be other kerosene*
3. *Source of fuel for coal & coke is assumed to be sub-bituminous coal*

Source:
2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, Page 1.18 – 1.19, Table 1.2

2. Global Warming Potential (GWP)

Type of Gas	Global Warming Potential (GWP)
CO_2	1
CH_4	28
N_2O	265

Source:
IPCC Fifth Assessment Report 2014 (AR5)

3. Default Values for Industrial Wastewater

Parameter	Value Applied
Maximum Methane Producing Capacity (B_o) for anaerobic deep lagoon (depth > 2m)	0.25 kg CH_4/kg COD
Methane Correction Factor (MCF)	0.8

Source:

1. *Maximum methane producing capacity (B_o): 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 6, Page 6.12, Table 6.2*
2. *Methane Correction Factor (MCF): 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 6, Page 6.21, Table 6.8*

4. Default Values for Solid Waste

Parameter	Value Applied
Methane Generation Rate Constant (k)	
-k $_{paper/textile}$	0.07
-k $_{wood}$	0.035
-k $_{garden/park\ waste}$	0.17
-k $_{food\ waste/sewage\ sludge}$	0.4
Oxidation Factor (OX)	
-Managed landfill	0.1
-Unmanaged landfill	0.0
Fraction of Methane (CH_4)	0.5
Fraction of Degradable Organic Carbon ($DOC_{f,y}$)	0.5
Methane Correction Factor (MCF)	
- Managed landfill	1.0
- Unmanaged landfill	0.8
Degradable Organic Carbon (DOC)	
-Wood and wood products	43%
-Pulp, paper and cardboard (other than sludge)	40%
-Food, food waste, beverages and tobacco (other than sludge)	15%
-Textiles	24%
-Garden, yard and park waste	20%
-Glass, plastic, metal, other inert waste	0%
-Nappies	24%

Source:

1. *Methane generation rate constant (k): 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 3, Page 3.17, Table 3.3, Default value for Tropical (MAT > 20°C), Moist and Wet (MAP ≥ 1000mm)*
2. *Oxidation factor (OX): 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 3, Page 3.17, Table 3.25*
3. *Degradable Organic Carbon (DOC): 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 2, Page 2.14, Table 2.4*
4. *Fraction of Methane (CH_4): 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 3, Page 3.26*
5. *Fraction of Degradable Organic Carbon ($DOC_{f,y}$): 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 3, Page 3.13*
6. *Methane Correction Factor (MCF): 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 3, Page 3.14, Table 3.1*

APPENDIX 1

5. Default Values for Domestic Wastewater

Parameter	Value Applied
Maximum Methane Producing Capacity (B_o)	
-Centralized, aerobic treatment plant	0.6
-Anaerobic reactor	0.6
-Anaerobic shallow lagoon	0.6
-Sludge Drying Bed (DB)	0.6
-Sludge Lagoon (SL)	0.6
-Sludge Reception Facility (SRF)	0.6
Methane Correction Factor (MCF)	
-Centralized, aerobic treatment plant	0.0
-Anaerobic reactor	0.8
-Anaerobic shallow lagoon	0.2
-Sludge Drying Bed (DB)	0.2
-Sludge Lagoon (SL)	0.8
-Sludge Reception Facility (SRF)	0.0
Actual influent BOD in sewage sludge	668 mg/L
Correction factor for industrial BOD discharge in sewers	1
Fraction of Nitrogen in protein (FNPR)	0.16 kg N/kg protein
Fraction of non-consumption protein (FNON-CON)	1.4
Fraction of industrial and commercial co-discharged protein (FIND-COM)	1.25
Nitrogen removed with sludge (NSLUDGE) default value	0
Emission factor for N_2O	0.005 kg N_2O-N/kg N
Emissions from wastewater plants default value for N_2O	0 kgN_2O/year
Actual Influent TKN Concentration in sewage sludge	84 mg/L
Nitrogen removed with sludge	0 kg

Source:

1. *Maximum methane producing capacity (B_o) for domestic wastewater: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 6, Page 6.12, Table 6.2*
2. *Methane Correction Factor (MCF): 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 6, Page 6.21, Table 6.8*
3. *Actual influent BOD in sewage sludge: UiTM's sampling & analysis*
4. *Fraction of Nitrogen in protein (FNPR): 2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 5, Chapter 6, Page 6.25, Equation 6.8*
5. *Fraction of non-consumption protein (FNON-CON): 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 6, Page 6.27, Table 6.11*
6. *Fraction of industrial and commercial co-discharged protein (FIND-COM): 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 6, Page 6.27, Table 6.11*
7. *Emission factor for N_2O: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 6, Page 6.27, Table 6.11*
8. *Actual influent TKN concentration in sewage sludge: UiTM's sampling & analysis*

Emission Factors

1. Stationary Energy

Type of Fuel	CO_2 (kg/TJ)	CH_4 (kg/TJ)	N_2O (kg/TJ)
Residential and Agriculture/Forestry/Fishing/Fishing Farms			
Natural Gas	56,100	5.0	0.1
Petrol	69,300	10.0	0.6
Diesel	74,100	10.0	0.6
Fuel Oil	77,400	10.0	0.6
LPG	63,100	5.0	0.1
Kerosene	71,900	10.0	0.6
Commercial / Institutional			
Natural Gas	56,100	5.0	0.1
Diesel	74,100	10.0	0.6
Fuel Oil	77,400	10.0	0.6
LPG	63,100	5.0	0.1
Manufacturing Industries & Construction			
Natural Gas	56,100	1.0	0.1
Petrol	69,300	3.0	0.6
Diesel	74,100	3.0	0.6
Fuel Oil	77,400	3.0	0.6
LPG	63,100	1.0	0.1
Kerosene	71,900	3.0	0.6
Coal & Coke	96,100	10.0	1.5
Energy Industries			
Natural Gas	56,100	1.0	0.1
Diesel	74,100	3.0	0.6
Fuel Oil	77,400	3.0	0.6
Coal & Coke	96,100	1.0	1.5

Assumption:

1. *Source of fuel for petrol is assumed to be motor gasoline*
2. *Source of fuel for fuel oil is assumed to be residual fuel oil*
3. *Source of fuel for kerosene is assumed to be other kerosene*
4. *Source of fuel for coal & coke is assumed to be sub-bituminous coal*

Source:

2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 2, Page 2.16 – 2.23, Table 2.2 – 2.5

APPENDIX 1

2. Transportation

Type of Fuel	CO_2 (kg/TJ)	CH_4 (kg/TJ)	N_2O (kg/TJ)
On-road Transportation			
Natural Gas	56,100	92.0	3.0
Petrol	69,300	33.0	3.2
Diesel Oil	74,100	3.9	3.9
Fuel Oil	77,400	3.0	0.6
Biodiesel	70,800	3.0	0.6

Assumption:

1. *Source of fuel for petrol is assumed to be motor gasoline (uncontrolled for CH_4 & N_2O)*
2. *Source of fuel for fuel oil is assumed to be residual fuel oil*
3. *CH_4 and N_2O emission factor of fuel oil and biodiesel are assumed to be the same as Stationary Combustion emission factors*

Source:

1. *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, Page 1.23 – 1.24, Table 1.4*
2. *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 3, Page 3.21, Table 3.2.2*

3. Grid

Year	Grid Emission Factor (tCO_2e/MWh)
2010	0.760
2011	0.747
2012	0.741
2013	0.742
2014	0.694
2015	0.694
2016	0.694
2017	0.694

Assumption:

2015, 2016 and 2017 grid emission factor are assumed to be the same as 2014, as 2014 is the latest grid emission factor available

Source:

National grid EF from Grid Connected Electricity Baselines in Malaysia: 2013 & 2014, NCCDM 2-2015, Malaysian Green Technology Corporation

Appendix 2: Calculation Remarks

Data input and assumptions used for the calculation are tabulated below:

GPC Ref.	Scope	Basic Reporting	Activities	Remarks (i.e. Data Input / Assumptions / Notation Key)
I	Stationary Energy			
I.1	Residential Buildings			
I.1.1	1	✓	Emissions from fuel combustion	***Data Input:*** 1. Natural gas, petroleum products and coal consumption data for Peninsular Malaysia was extracted from NEB 2010 - 2016. Data for 2017 was projected using average annual growth rate of fuel consumption from NEB 2016, Page 70, Table 26. 2. Fuel consumption for Iskandar Malaysia was estimated from the consumption of Peninsular Malaysia, using population as a scale down factor. 3. Fuel consumption by sectors in Peninsular Malaysia was estimated using the formula: $\boldsymbol{Fuel\ consumption} = \frac{Consumption\ of\ product\ in\ Peninsular\ Malaysia\ (thousand\ barrels)}{Consumption\ of\ product\ in\ Malaysia\ (thousand\ barrels)} \times Consumption\ of\ product\ for\ all\ sectors\ in\ Malaysia\ (ktoe) \times \frac{Consumption\ of\ product\ for\ the\ particular\ sector\ in\ Malaysia\ (ktoe)}{Consumption\ of\ product\ for\ all\ sectors\ in\ Malaysia\ (ktoe)}$ 4. Fuel GHG emissions was calculated using the formula: $\boldsymbol{Fuel\ GHG\ Emissions} = Fuel\ consumption \times Emission\ factor\ of\ the\ fuel\ (CO_2, CH_4\ and\ N_2O) \times NCV\ of\ the\ fuel \times GWP$ ***Assumption:*** 1. Fuel emission factors and NCV for: a. Petrol is assumed to be motor gasoline b. Fuel oil is assumed to be residual fuel oil c. Kerosene is assumed to be other kerosene d. Coal & coke is assumed to be sub-bituminous coal ***Source:*** ○ Fuel consumption data for Peninsular Malaysia 2010 – 2016: NEB 2010 – 2016 ○ Malaysia, Peninsular Malaysia, Johor population 2010 – 2017: Department of Statistics Malaysia (DoSM), http://pqi.stats.gov.my/searchBI.php ○ Iskandar Malaysia population 2010 – 2017: UPENJ ○ Fuel emission factors: 2006 IPCC Guidelines for National GHG Inventories, Page 2.22 – 2.23, Table 2.5 ○ Net Calorific Value (NCV): 2006 IPCC Guidelines for National GHG Inventories, Page 1.18 – 1.19, Table 1.2 ○ GWP: IPCC AR4 2007& IPCC AR5 2014
I.1.2	2	✓	Grid-supplied energy consumed	***Data Input:*** 1. Grid-supplied energy consumption data was obtained from ST for the whole Johor State. 2. Grid-supplied energy consumption for Iskandar Malaysia was estimated from the consumption of Johor, using population as a scale down factor. 3. GHG emissions from grid-supplied energy consumption was calculated using the formula: $\boldsymbol{Grid\ GHG\ emissions} = Grid\ consumption \times Grid\ emission\ factor\ for\ Peninsular\ Malaysia$ ***Assumption:*** 1. Grid emission factor for 2015, 2016 and 2017 were assumed to be the same as 2014, as 2014 is the latest grid emission factor available.

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GPC Ref.	Scope	Basic Reporting	Activities	Remarks (i.e. Data Input / Assumptions / Notation Key)
				Source: ○ Grid-supplied energy consumption Johor 2010 – 2017: ST ○ Johor population 2010 – 2017: DoSM, http://pqi.stats.gov.my/searchBI.php ○ Iskandar Malaysia population 2010 – 2017: UPENJ ○ Grid emission factor for Peninsular Malaysia 2010 – 2014: MGTC
I.1.3	3	×	Transmission and distribution losses from grid-supply energy	Not accounted under BASIC Reporting
I.2	Commercial and Institutional Buildings and Facilities			
I.2.1	1	✓	Emissions from fuel combustion	Same as I.1.1 Residential Buildings
I.2.2	2	✓	Grid-supplied energy consumed	Same as I.1.2 Residential Buildings
I.2.3	3	×	Transmission and distribution losses from grid-supply energy	Not accounted under BASIC Reporting
I.3	Manufacturing Industries and Construction			
I.3.1	1	✓	Emissions from fuel combustion	***Data Input:*** 1. Natural gas, petroleum products and coal consumption data for Peninsular Malaysia was extracted from National Energy Balance 2010 - 2016. Data for 2017 was projected using average annual growth rate of fuel consumption from National Energy Balance 2016, Page 70, Table 26. 2. Fuel consumption for Iskandar Malaysia was estimated from the consumption of Peninsular Malaysia, using industrial GDP as a scale down factor. 3. Fuel consumption by sectors in Iskandar Malaysia was estimated using the formula: $\textit{Fuel consumption} = \textit{Fuel consumption of Peninsular Malaysia} \times \frac{\textit{Iskandar Malaysia Industrial GDP at 2010 constant price}}{\textit{PeninsularMalaysia Industrial GDP at 2010 constant price}}$ 4. Fuel GHG emissions in Iskandar Malaysia was calculated using the formula: $\textit{Fuel GHG Emissions} = \textit{Fuel consumption} \times \textit{EF of the fuel } (CO_2, CH_4 \textit{ and } N_2O) \times \textit{NCV of the fuel} \times GWP$ ***Assumption:*** 1. Fuel emission factors and NCV for: a. Petrol is assumed to be motor gasoline b. Fuel oil is assumed to be residual fuel oil c. Kerosene is assumed to be other kerosene d. Coal & coke is assumed to be sub-bituminous coal 2. Iskandar Malaysia GDP 2010 – 2012 were adjusted to constant price 2010 to ensure consistency in data, using Consumer Price Index obtained from Bank Negara Malaysia. ***Source:*** ○ Fuel consumption data for Peninsular Malaysia 2010 – 2016: NEB 2010 - 2016 ○ Malaysia GDP by state and kind of economic activity 2010 – 2016: DoSM, https://www.dosm.gov.my/v1/uploads/files/1_Articles_By_Themes/National%20Accounts/GDPbyState/Table%20Publication%20GDP%202010-2016.pdf ○ Malaysia GDP by state and kind of economic activity, 2017 at constant 2010 prices - Annual percentage change': DoSM,

GPC Ref.	Scope	Basic Reporting	Activities	Remarks (i.e. Data Input / Assumptions / Notation Key)
				https://www.dosm.gov.my/v1/uploads/files/1_Articles_By_Themes/National%20Accounts/GDP%20by%20State%202017/The%20Performance%20of%20State's%20Economy%2C%202017.pdf ○ Iskandar Malaysia GDP by kind of economic activity 2010 – 2017: UPENJ ○ Fuel emission factors: 2006 IPCC Guidelines for National GHG Inventories, Page 2.22 – 2.23, Table 2.5 ○ NCV: 2006 IPCC Guidelines for National GHG Inventories, Page 1.18 – 1.19, Table 1.2 ○ GWP: IPCC AR4 2007 & IPCC AR5 2014
I.3.2	2	✓	Grid-supplied energy consumed	***Data Input:*** 1. Grid-supplied energy consumption data was obtained from ST for the whole Johor State. 2. Grid-supplied energy consumption for Iskandar Malaysia was estimated from the consumption of Johor, using industrial GDP as a scale down factor. 3. GHG emissions from grid-supplied energy consumption was calculated using the formula: $\textit{Grid GHG emissions} = \textit{Grid consumption} \times \textit{Grid EF for Peninsular Malaysia}$ ***Assumption:*** 1. Grid EF for 2015, 2016 and 2017 were assumed to be the same as 2014, as 2014 is the latest grid EF available. ***Source:*** ○ Grid-supplied energy consumption Johor 2010 – 2017: ST ○ Malaysia GDP by state and kind of economic activity 2010 – 2016: DoSM, https://www.dosm.gov.my/v1/uploads/files/1_Articles_By_Themes/National%20Accounts/GDPbyState/Table%20Publication%20GDP%202010-2016.pdf ○ Malaysia GDP by state and kind of economic activity, 2017 at constant 2010 prices - Annual percentage change': DoSM, https://www.dosm.gov.my/v1/uploads/files/1_Articles_By_Themes/National%20Accounts/GDP%20by%20State%202017/The%20Performance%20of%20State's%20Economy%2C%202017.pdf ○ Iskandar Malaysia GDP by kind of economic activity 2010 – 2017: UPENJ ○ Grid emission factor for Peninsular Malaysia 2010 – 2014: MGTC
I.3.3	3	×	Transmission and distribution losses from grid-supply energy	Not accounted under BASIC Reporting
I.4	Energy Industries			
I.4.1	1	✓	Emissions from energy used in power plant auxiliary operations	***Data Input/Notes:*** 1. Auxiliary electricity consumption for each power plants were obtained from the operators respectively. 2. GHG emissions from energy used in power plant auxiliary operations was calculated using the formula: $\textbf{\textit{GHG emissions from energy used in power plant auxiliary operation}} = \textit{Auxiliary electricity consumptions} \times \textit{Grid EF}$ ***Assumptions:*** 1. It was assumed that all power plants obtained their auxiliary electricity consumption from their own generation, and not from grid-supplied energy. 2. Due to data unavailability of auxiliary electricity consumption for Sultan Iskandar Power Station, it is assumed that the power plant efficiency to be 47% and its auxiliary consumption is 9.92% of its gross energy generation consumption.

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GPC Ref.	Scope	Basic Reporting	Activities	Remarks (i.e. Data Input / Assumptions / Notation Key)
				3. It is assumed that the emission factor for power plant is the same as grid emission factor due to data unavailability. Note that this assumption is conservative. 4. Grid EF for 2015, 2016 and 2017 were assumed to be the same as 2014, as 2014 is the latest grid EF available. 5. Tg Bin Energy has no meter to measure auxiliary electricity consumption. It is assumed there is no auxiliary electricity consumption for Tg Bin Energy. ***Source:*** ○ Efficiency and auxiliary consumption of Sultan Iskandar Power Plant estimated using power generation and unit sold to TNB: 2014 Performance and Statistical Information on Electricity Supply Industry in Malaysia, Page 11, Table 2.
I.4.2	2	✓	Emissions from grid-supplied energy consumed in power plant auxiliary operations	IE under Scope 2 Stationary Energy sector
I.4.3	3	×	Transmission and distribution losses from grid-supplied energy used in power plant auxiliary operations	Not accounted under BASIC Reporting
I.4.4	1	✓	Emission from energy generation supplied to the grid	***Data Input:*** 1. Fuel consumption by each power plants were obtained from the operators respectively. 2. YTL Power Station in Pasir Gudang was not in operation since October 2015 due to expired PPA, hence there are no fuel consumption for energy generation since then. 3. Average annual growth rate of fuel consumption from National Energy Balance 2015, Page 68, Table 26 was used for backcasting when data was not available. 4. Total GHG emissions for Energy Industries in Iskandar Malaysia was calculated using the formula: $\mathbf{Fuel\ GHG\ Emissions} = (Fuel\ consumption\ of\ power\ plants\ in\ Iskandar\ Malaysia \times Emission\ factor\ of\ fuel \times NCV\ of\ fuel \times GWP) - (GHG\ emissions\ from\ energy\ used\ in\ power\ plant\ auxiliary\ operation)$ ***Source:*** ○ Fuel emission factors: 2006 IPCC Guidelines for National GHG Inventories, Page 2.22 – 2.23, Table 2.5 ○ NCV: 2006 IPCC Guidelines for National GHG Inventories, Page 1.18 – 1.19, Table 1.2 ○ GWP: IPCC AR4 2007 & IPCC AR5 2014
I.5	Agriculture, Forestry and Fishing Activities			
I.5.1	1	✓	Emissions from fuel combustion	Same as I.1.1 Residential Buildings
I.5.2	2	✓	Grid-supplied energy consumed	Same as I.1.2 Residential Buildings
I.5.3	3	×	Transmission and distribution losses from grid-supply energy	Not accounted under BASIC Reporting
I.6	Non-Specified Sources			
I.6.1	1	✓	Emissions from fuel combustion	NE
I.6.2	2	✓	Grid-supplied energy consumed	NE
I.6.3	3	×	Emissions from transmission and	Not accounted under BASIC Reporting

GPC Ref.	Scope	Basic Reporting	Activities	Remarks (i.e. Data Input / Assumptions / Notation Key)
			distribution losses from grid-supply energy	
I.7	Fugitive Emissions from Mining, Processing, Storage and Transportation of Coal			
I.7.1	1	✓	Fugitive emission from mining, processing, storage and transportation of coal within the boundary	NO
I.8	Fugitive Emissions from Oil and Natural Gas System			
I.8.1	1	✓	Fugitive emissions from oil and natural gas system within the city boundary	NO
II	Transportation			
II.1	On-road Transportation			
II.1.1	1	✓	Emissions from fuel combustion	***Data Input:*** 1. Natural gas and petroleum products consumption data for Peninsular Malaysia was extracted from NEB 2010 - 2016. Data for 2017 was projected using average annual growth rate of fuel consumption from NEB 2016, Page 70, Table 26. 2. Fuel consumption for Iskandar Malaysia was estimated from the consumption of Peninsular Malaysia, using population as a scale down factor. 3. Fuel consumption by sectors in Iskandar Malaysia was estimated using the formula: $\textbf{Fuel consumption in Iskandar Malaysia} = \textit{Fuel consumption of Peninsular Malaysia} \times \left(\frac{\textit{Iskandar Malaysia Population}}{\textit{Peninsular Malaysia Population}}\right)$ 4. Fuel GHG emissions in Iskandar Malaysia was calculated using the formula: $\textbf{Fuel GHG Emissions} = (\textit{Fuel consumption of Iskandar Malaysia} \times \textit{Emission factor of fuel} \times \textit{NCV of fuel} \times \textit{GWP})$ ***Assumption:*** 1. Fuel EF and NCV for: a. Petrol is assumed to be motor gasoline (CH_4 and N_2O are assumed to be uncontrolled) b. Fuel oil is assumed to be residual fuel oil c. CH_4 and N_2O EF of fuel oil and biodiesel are assumed to be the same as Stationary combustion EF ***Source:*** ○ Fuel EFs: 2006 IPCC Guidelines for National GHG Inventories, Volume 2, Chapter 1, Page 1.23 – 1.24, Table 1.4 ○ Fuel EFs: 2006 IPCC Guidelines for National GHG Inventories, Volume 2, Chapter 3, Page 3.21, Table 3.2.2 ○ NCV: 2006 IPCC Guidelines for National GHG Inventories, Volume 2, Chapter 1, Page 1.18 – 1.19, Table 1.2 ○ GWP: IPCC AR4 2007 & IPCC AR5 2014
II.1.2	2	✓	Grid-supplied energy consumed	IE under Scope 2 Stationary Energy sector

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GPC Ref.	Scope	Basic Reporting	Activities	Remarks (i.e. Data Input / Assumptions / Notation Key)
II.1.3	3	×	Transboundary journeys occurring outside the city, and T&D losses from grid-supplied energy use	Not accounted under BASIC Reporting
II.2	Railways			
II.2.1	1	✓	Emissions from fuel combustion	***Data Input:*** 1. Number of trips for cargo and intercity train, diesel consumption and train distance for 2011 – 2017 were obtained from KTMB. 2. Data for 2010 were backcasted using the percentage growth of no. of trip annually. 3. Fuel GHG emissions was calculated using the formula: $\textbf{Fuel GHG Emissions} = (Fuel\ consumption\ of\ Railways \times EF\ of\ fuel \times NCV\ of\ fuel \times Density\ of\ fuel \times GWP)$ ***Assumption:*** 1. It was assumed that the diesel consumption and train distance are the same as 2011 – 2015 data. ***Source:*** ○ Fuel EFs: 2006 IPCC Guidelines for National GHG Inventories, Volume 2, Chapter 3, Page 3.36, Table 3.3.1 ○ NCV: 2006 IPCC Guidelines for National GHG Inventories, Volume 2, Chapter 1, Page 1.18 – 1.19, Table 1.2 ○ Density of diesel: http://www.sabenajadi.com/downloads/PETRONAS%20HIGH%20SPEED%20DIESEL.pdf ○ GWP: IPCC AR4 2007 & IPCC AR5 2014
II.2.2	2	✓	Grid-supplied energy consumed	NO as the railways in Iskandar Malaysia consume diesel as fuel only.
II.2.3	3	×	Transboundary journeys occurring outside the city, and T&D losses from grid-supplied energy use	Not accounted under BASIC Reporting
II.3	Waterborne Navigation			
II.3.1	1	✓	Emissions from fuel combustion	NE as lack of such information and it is believed that the number of waterborne navigation trips made within the boundary are insignificant
II.3.2	2	✓	Grid-supplied energy consumed	NE as lack of such information and it is believed that the number of waterborne navigation trips made within the boundary are insignificant
II.3.3	3	×	Transboundary journeys occurring outside the city, and T&D losses from grid-supplied energy use	Not accounted under BASIC Reporting
II.4	Aviation			
II.4.1	1	✓	Emissions from fuel combustion	NE as lack of such information and it is believed that the number of aviation trips made within the boundary are insignificant
II.4.2	2	✓	Grid-supplied energy consumed	NE as lack of such information and it is believed that the number of aviation trips made within the boundary are insignificant
II.4.3	3	×	Transboundary journeys occurring outside the city, and T&D losses from grid-supplied energy use	Not accounted in BASIC reporting
II.5	Off-road Transportation			
II.5.1	1	✓	Emissions from fuel combustion	***Data Input:*** 1. Fuel consumption was obtained from Johor Port, Tanjung Pelepas Port and Senai Airport for their off-road transportation consumption. 2. Fuel GHG emissions was calculated using the formula:

GPC Ref.	Scope	Basic Reporting	Activities	Remarks (i.e. Data Input / Assumptions / Notation Key)
				$\textbf{Fuel GHG Emissions} = (Fuel\ consumption\ of\ Off\ Road \times Emission\ factor\ of\ fuel \times NCV\ of\ fuel \times Density\ of\ fuel \times GWP)$ ***Source:*** ○ Fuel EFs: 2006 IPCC Guidelines for National GHG Inventories, Volume 2, Chapter 3, Page 3.36, Table 3.3.1 ○ NCV: 2006 IPCC Guidelines for National GHG Inventories, Volume 2, Chapter 1, Page 1.18 – 1.19, Table 1.2 ○ Density of diesel: http://www.sabenajadi.com/downloads/PETRONAS%20HIGH%20SPEED%20DIESEL.pdf ○ GWP: IPCC AR4 2007 & IPCC AR5 2014
II.5.2	2	✓	Grid-supplied energy consumed	IE under Scope 2 of Stationary Energy sector
II.5.3	3	×	Transboundary journeys occurring outside the city, and T&D losses from grid-supplied energy use	Not accounted in BASIC reporting
III	Waste			
III.1	Solid Waste Disposal			
III.1.1	1	✓	Emissions from solid waste generated in the city and disposed in landfills/open dumps within the city	***Data Input:*** 1. Waste composition data for Tapak Pelupusan (TP) Seelong for 2015 was obtained from SWCorp. 2. Amount of waste received in TP Seelong and TP Pekan Nanas (2010 – 2017) was obtained from Local Authorities, SWM Enviro Sdn Bhd and SWCorp. Data from SWCorp was used in this calculation. 3. Amount of waste received in TP Tanjung Langsat (2010 – 2016) was obtained from MPPG while 2017 from SWCorp. 4. Municipal waste disposal rate (1970 – 2009) for respective landfill was calculated from the actual disposal rate from 2010 – 2017. 5. Growth rate for the municipal waste disposal rate is assumed to increase 2% every 3 years. 6. Annual total amount of waste discarded to landfill for TP Ulu Tiram, TP Kempas, TP Lima Kedai, TP Mega Ria, and TP Tahana were estimated using the formula: $Total\ amount\ of\ waste\ discarded = Population\ in\ Iskandar\ Malaysia \times Waste\ disposal\ rate\ (kg/capita/day)$ 7. All the solid waste was assumed to be discarded at landfills. 8. Waste composition at all landfills was assumed to be the same as TP Seelong. 9. The emissions from waste disposal model the actual emissions generated in each reporting year. This includes emissions from both operating and closed landfills. 10. GHG emissions was calculated based on Tier 2 FOD method from IPCC 2006, Volume 5, Chapter 3. 11. Zero delay where average decomposition started at the beginning of month 7 was assumed. ***Source:*** ○ Default values for DOC in disposal year: 2006 IPCC Guidelines for National GHG Inventories, Volume 5, Chapter 2, Page 2.14, Table 2.4. ○ Default value of the fraction of DCO which decomposes (DOC_f): 2006 IPCC Guidelines for GHG Inventories, Volume 5, Chapter 3, Page 3.13 ○ Default values of Methane Correction Factors (MCF): 2006 IPCC Guidelines for GHG Inventories, Volume 5, Chapter 3, Page 3.14, Table 3.1 ○ Default value of CH_4 in generated landfill gas (F): 2006 IPCC Guidelines for National GHG Inventories, Volume 5, Chapter 3, Page 3.15 ○ Default values of oxidation factor (OX): 2006 IPCC Guidelines for National GHG Inventories, Volume 5, Chapter 3, Page 3.15, Table 3.2

APPENDIX 2

GPC Ref.	Scope	Basic Reporting	Activities	Remarks (i.e. Data Input / Assumptions / Notation Key)
				○ Default values of methane generation rate (k): 2006 IPCC Guidelines for National GHG Inventories, Volume 5, Chapter 3, Page 3.17, Table 3.3, Default value for Tropical (MAT > 20°C, Moist and Wet (MAP ≥ 1000mm) ○ GWP: IPCC AR5 2014
III.1.2	3	✓	Emissions from solid waste generated in the city but disposed in landfills/open dumps outside the city	NO
III.1.3	1	✓	Emissions from waste generated outside the city and disposed in landfills/open dumps within the city	Same as III.1.1 Solid Waste Disposal for solid waste from MDP (77% of the area is outside Iskandar Malaysia boundary) as the waste are sent to TP Pekan Nenas which is within Iskandar Malaysia boundary.
III.2	Biological Treatment of Waste			
III.2.1	1	✓	Emissions from solid waste generated in the city that is treated biologically in the city	NO
III.2.2	3	✓	Emissions from solid waste generated in the city that is treated biologically outside the city	NO
III.2.3	1	✓	Emissions from waste generated outside the city boundary but treated within the city	NE
III.3	Incineration and Open Burning			
III.3.1	1	✓	Emissions from waste generated and treated within the city	NE
III.3.2	3	✓	Emissions from waste generated within but treated outside the city	NE
III.3.3	1	✓	Emissions from waste generated outside the city boundary but treated within the city	NE
III.4	Wastewater Treatment and Discharge			
III.4.1	1	✓	Emissions from wastewater generated and treated within the city	***Data Input:*** Municipal Wastewater 1. Emissions from municipal wastewater were estimated based on the total volume of wastewater treated by each public treatment plants. 2. CO_2, CH_4 and N_2O were accounted for WWTP for Scope 1, but CO_2 emissions were excluded because they are considered as biogenic origin and are not required to be included in the total emissions. 3. The available data on population for each of the Local Authorities are for year 2010. Therefore, the population in each Local Authorities for 2005 – 2009 and 2011 – 2017 were calculated using the ratio of population in 2010. 4. It was assumed that only 23% of population under MDP is within Iskandar Malaysia Region (calculated using the total population in Pontian 2010 with the total population in Pontian under IM 2010). 5. To calculate CH_4 emissions: a. Organically degradable material in domestic wastewater were estimated b. Methane emission factor for domestic wastewater were estimated c. CH_4 emissions from domestic wastewater were estimated 6. To calculate N_2O emissions: a. Nitrogen in effluent were estimated

GPC Ref.	Scope	Basic Reporting	Activities	Remarks (i.e. Data Input / Assumptions / Notation Key)
				7. Emission factor and emissions of indirect N_2O emissions from wastewater were estimated. *Source:* o Data of population equivalent, BOD and treatment methods: IWK for MPKu, MBIP and MDP. o Data of population equivalent, and type of STP (2016): MBJB and MPPG o Default value of correction factor for industrial BOD discharged in sewers – uncollected: 2006 IPCC Guidelines for National GHG Inventories, Volume 5, Chapter 6, Page 6.14. o Default maximum CH_4 producing capacity for domestic wastewater: 2006 IPCC Guidelines for National GHG Inventories, Volume 5, Chapter 6, Page 6.12, Table 6.2. o Default values for Methane Correction Factor (MCF) for domestic wastewater: 2006 IPCC Guidelines for National GHG Inventories, Volume 5, Chapter 6, Page 6.13, Table 6.3 Industrial Wastewater 1. Emissions from industrial wastewater treatment were estimated based on industrial production data and wastewater outflows treated by each treatment plant. 2. Only emissions from palm oil mills and one of the rubber mill in Iskandar Malaysia region were taken into account of this inventory due to data unavailability. 3. Data of FFB, capacity, volume of POME and organic loading BOD. COD were obtained from the palm oil mills (Hadapan Palm Oil Mill, Masai Palm Oil Mill, Sedenak Palm Oil Mill, Kulai Oil Palm Mill) and rubber mill (Chip Hong Rubber Sdn. Bhd.) respectively. Where there is no COD data from Masai POM and Kulai POM, it was assumed that the degradable organic component for COD is 51,000 mg/L[18] *Source:* o Default value for density of CH_4, Fraction of CH_4 in the biogas: Tools for Project and Leakage Emissions from Anaerobic Digesters (Version 01.0.0). o Default Maximum CH_4 producing capacity (B_o) for industrial wastewater: 2006 IPCC Guidelines for National GHG Inventories, Volume 5, Chapter 6, Page 6.12, Table 6.2. o Methane Correction Factor (MCF) for industrial wastewater – anaerobic deep lagoon: 2006 IPCC Guidelines for National GHG Inventories, Volume 5, Chapter 6, Page 6.21, Table 6.8 o The COD for wastewater from rubber processing was assumed to be 8,750mg/L[19] Municipal Wastewater and Industrial Wastewater 1. When accounting for CH_4 emissions, information needed are: a. Quantity of wastewater generated b. Wastewater and sewage treatment method c. Source of wastewater and its organic content (For municipal wastewater, it is estimated based on population of Iskandar Malaysia served. For industrial wastewater, it is estimated based on industrial sector of Iskandar Malaysia) 2. Formula used in calculation for CH_4 is as follow: $CH_4\ emissions = \sum i\,[(TOW_i - S_i)EF_i - R_i]^{10^{-3}}$ *At where* **TOW_i** = organic content in wastewater For domestic wastewater: total organics in wastewater in inventory year, kg BOD/ yr For industrial wastewater: total organically degradable material in wastewater from industry I in inventory year, kg COD/yr **EF_i** = emission factor, kg CH_4 per kg BOD/ kg CH_4 per kg COD

[18] http://www.mpob.gov.my/palm-info/environment/520-achievements#Mill
[19] http://www.ajol.info/index.php/ajb/article/download/92237/81690

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<tr><th>GPC Ref.</th><th>Scope</th><th>Basic Reporting</th><th>Activities</th><th>Remarks (i.e. Data Input / Assumptions / Notation Key)</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
SS_i = organic component removed as sludge in inventory year, kg COD/yr or kg BOD/yr
R_i = amount of CH_4 recovered in inventory year, kg CH_4/yr
i = type of wastewater
For domestic wastewater: income group for each wastewater treatment and handling system.
For industrial wastewater: total organically degradable material in wastewater from industry in i inventory year, kg COD/yr
$$TOW_i = P \ x \ BOD \ x \ I \ x \ 365$$
$$EF_i = B_o \ x \ MCF_i \ x \ U_i \ x \ T_{i,j}$$
At where
TOW_i = For domestic wastewater: total organics in wastewater in inventory year, kg BOD/yr
P = City's population in inventory year (person)
BOD = City-specific per capita BOD in inventory year, g/person/day
I = Correction factor for additional industrial BOD discharged into sewers
EF_i = Emission factor for each treatment and handling system
B_o = Maximum CH_4 producing capacity
MCF_j = Methane correction factor (fraction)
U_i = Fraction of population in income group i in inventory year
$T_{i,j}$ = Degree of utilisation (ratio) of treatment/discharge pathway or system, j, for each income group fraction i in inventory year
3. Formula used in calculation for N_2O emissions is as follow:
$$N_2O \ emissions = [(P \times Protein \times F_{NPR} \times F_{NON-CON} \times F_{IND-COM}) - N_{SLUDGE}] \times EF_{EFFLUENT} \times \left(\frac{44}{28}\right)^{10^{-3}}$$
At where
P = Total population served by the water treatment plant
Protein = Annual per capita protein consumption, kg/person/yr
$F_{NON-CON}$ = Factor adjust for non-consumed protein
F_{NPR} = Factor of nitrogen in protein
$F_{IND-COM}$ = Factor for industrial and commercial co-discharged protein into the sewer system
N_{SLUDGE} = Nitrogen removed with sludge, kg N/yr
$EF_{EFFLUENT}$ = Emission factor for N_2O emissions from discharged to wastewater in kg N_2O-N per kg N_2O
44/28 = The conversion of kg N_2O-N into kg N_2O
4. GWP is obtained from IPCC AR5, GHG Protocol

<u>Municipal Sludge</u>
1. Emissions from municipal sludge treatment were estimated based on the total volume of sludge treated by each treatment plant.
2. Three different types of sludge treatment processes were accounted in this inventory: Sludge Drying Bed (DB), Sludge Lagoon (SL) and Sludge Reception Facility (SRF).
3. The fraction of population in income group in inventory year for each STP, U = 1.
4. The degree of utilisation of treatment/discharge pathway or system for each income group fraction in inventory year for each STP, T = 1
5. It was assumed that there is no CH_4 recovered in all treatment system and all sludge facilities did not have ammoniacal nitrogen removal facility. According to DEU (2006), 0.04kg of BOD is removed as sludge from a person a day.

Source:
6. EFs for each treatment methods: IPCC 2006.
7. Total volume of sludge by treatment methods within Johor: IWK (2014 – 2017).
8. Default values for MCF for domestic sludge: 2006 IPCC Guidelines for National GHG Inventories, Volume 5, Chapter 6, Page 6.13, Table 6.3
</td></tr>
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GPC Ref.	Scope	Basic Reporting	Activities	Remarks (i.e. Data Input / Assumptions / Notation Key)
III.4.2	3	✓	Emissions from wastewater generated within but treated outside the city	NO
III.4.3	1	✓	Emissions from waste generated outside the city boundary but treated within the city	Same as III.4.1 Wastewater Treatment and Discharge for wastewater generated in Kota Tinggi and Mersing which send their wastewater to wastewater treatment plants in Iskandar Malaysia boundary.
IV	Industrial Processes and Product Uses (IPPU)			
IV.1	1	×	Emissions from industrial processes occurring in the city boundary	NE
IV.2	1	×	Emissions from product use occurring within the city boundary	NE
V	Agriculture, Forestry and Other Land Use (AFOLU)			
V.1	1	×	Emissions from livestock	NE
V.2	1	×	Emissions from land	NE
V.3	1	×	Emissions from aggregate sources and non-CO_2 emission sources on land	NE
VI	Other Scope 3			
VI.1	1	×	Other Scope 3	NE

Appendix 3: Focus Group Discussion (FGD)

A Focus Group Discussion (FGD) on Iskandar Malaysia GHG Inventory 2017 was held on 16th January 2019 at Hotel M Suites, Johor Bahru. The discussion was actively attended by roughly 40 participants from government agencies, university, NGO, as well as private sectors such as utilities, ports, power plants and palm oil mills.

Discussion and inputs from FGD are summarised as below:

Topic	Discussions and Outcomes
Stationary Energy	• Data improvement by Energy Commission (ST) – Data was still collected at national level; survey for improvement has been conducted for Manufacturing, Commercial and Residential sub-sector but yet for Transportation survey due to high cost and it requires internal and external expertise. ST informed that other cities such as Bandar Baru Bangi also requesting for disaggregated data and ST has forwarded their request to the data provider i.e. TNB HQ. Further discussion between ST and IRDA need to be conducted. ST also highlighted that they only able provide power sector data as per licensed; other information such as petrol pumps data may available from KPDNKK. • New TNB Pasir Gudang Energy power plant to be included in future inventory.
Transportation	• There are 3 types of inter-city train in Johor (JB-Tampin, JB-Tumpat, and JB-Woodlands). It was clarified that the emissions from JB-Woodlands trips only accounted emissions within Iskandar Malaysia boundary.
Solid waste	• Inconsistency of solid waste data received from SWM, SWCorp and Local Authorities. It was clarified that the data provided by the landfill operators was the total received waste amount (from residential, commercial and industrial) while the data provided by SWCorp and Local Authorities only the municipal solid waste pay by the government (from residential and commercial). • It is decided that SWCorp should be the data custodian and data should be collected from SWCorp. SWM shall provide the total received waste amount to SWCorp.
Wastewater	• Big gap in wastewater data. More effort needs to be done to discuss with DoE on this matter. • SEDA suggested to have an agency for data collection in the future which acts as data centre. Iskandar Malaysia's Urban Observatory (IMUO) is setting up their data centre.
Grid emission factor	• The draft 2015 grid emission factor still pending with the endorsement from the ministry. Thus, the latest grid emission factor available (i.e. 2014) is used.
Power plant emission factor	• TNBR informed that the emission factor for power plant is still in the developing phase and is yet to be ready for use. • National emission factor will be adopted into future accounting and reporting once it is released.
Emission target	• IRDA informed that it is targeted that 20% of buses will be EV buses by year 2020. All the buses operated in Iskandar Malaysia will be adopted into Iskandar Malaysia Bus Rapid Transit plan and aiming to convert all the buses into EV bus by 2027. New double tracks train operates with grid-supplied will be introduced by 2023/2024. The GHG emissions reduction is yet to be calculated as it is still in the designing phase. However, impact on emission intensity may not be seen before 2025. • IRDA shall consider reset it's GHG emissions reduction target to 2030 and it should not lower than the national target 58%. The efforts on achieving the emission target need to be quantified.

Data quality and data verification	• The data sharing sensitivity shouldn't be an issue as only aggregate data for specific sources are required and not individually. • There is no 3rd party to verify the data other than Eco-Ideal's team. The data verification is done internally. However, several engagements were conducted, in close consideration of national level reporting (NC/BUR) to UN.
Improvement	• It is suggested to put more advertisement banners/stickers on public transport to promote Iskandar Malaysia's GHG mitigation/ reduction initiatives. • It is also suggested that the data analysis and results to be circulated to stakeholders before the FGD.

Disclaimer

The findings, interpretations and conclusions expressed in this inventory were based, in whole or in part, on information and data provided (including third party data) and made available, which is beyond the control of IRDA and its Consultant. The team has used its best endeavour to process data, information and observations in the most professional and qualified manner but does not give warranty whatsoever, including without limitation, as to the availability, accuracy, completeness or reliability of the information or data included in this inventory, and expressly disclaim all liability for any damage or loss resulting from usage of, or reliance on this inventory or the information and data provided via this inventory.

Arch of Istana Bukit Serene
Photo credit: IRDA

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ISKANDAR MALAYSIA GREENHOUSE GAS INVENTORY 2017

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