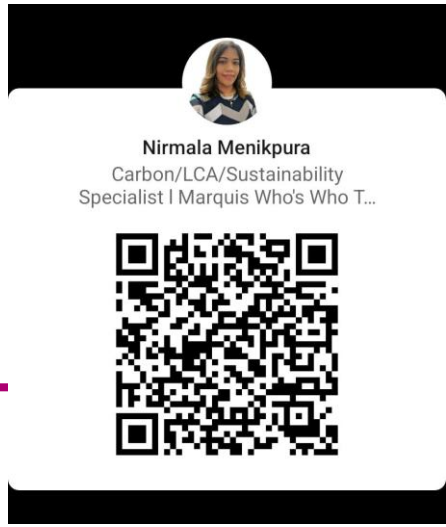
Emission Quantification Tool (EQT): Assessing the Climate Impact from Waste Sector

Dr. Nirmala Menikpura

Senior Research Fellow

Institute for Global Environmental Strategies (IGES) Japan

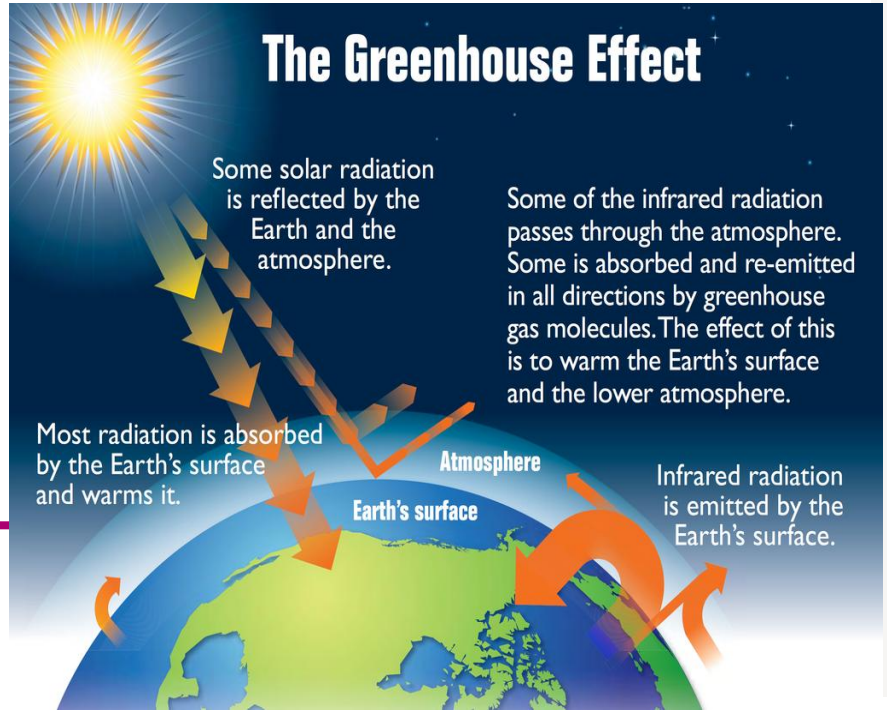
Workshop: Climate Impact Assessment in the Waste Sector Using IGES EQT Version III – 16-17 June 2025
Lahore, Pakistan

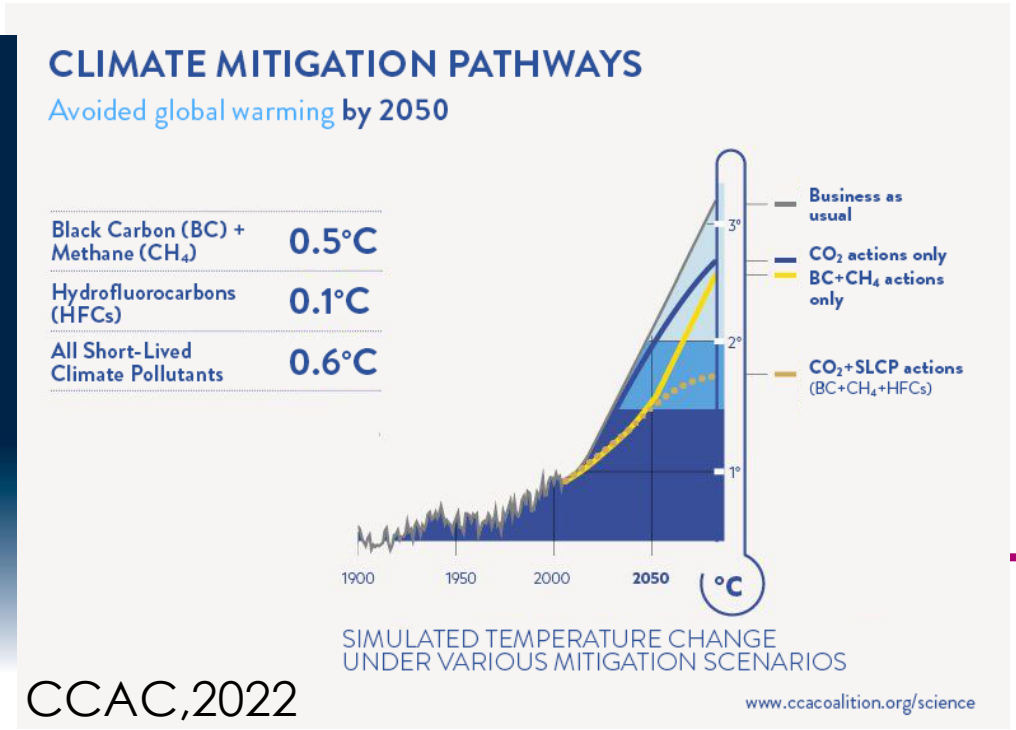


IGES Institute for Global Environmental Strategies

Introduction: Impact of Greenhouse gases (GHGs) and Short-Lived Climate Pollutants (SLCPs) on Climate Change

- Mitigating CO_2, CH_4 and Black Carbon (BC) is very important to achieving the 1.5◦C target by 2050
- SLCPs responsible for up to 45% of current global warming





CCAC,2022

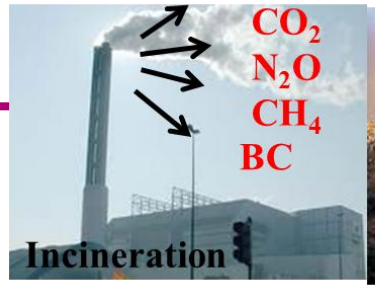
Each step of waste management contribute for GHGs/ SLCPs emissions

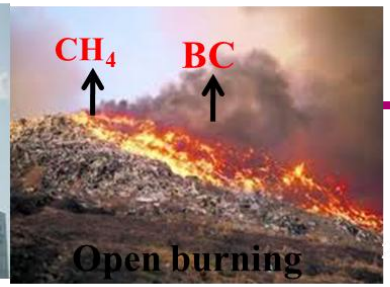
All the activities in waste management emit GHGs and SLCPs throughout the life cycle

Waste Collection and transportation → BC, CO_2, N_2O, CH_4 ← Fossil fuel

Operation activities → Electricity /Fossil fuel → CO_2, N_2O, CH_4, BC

Treatment/final disposal →





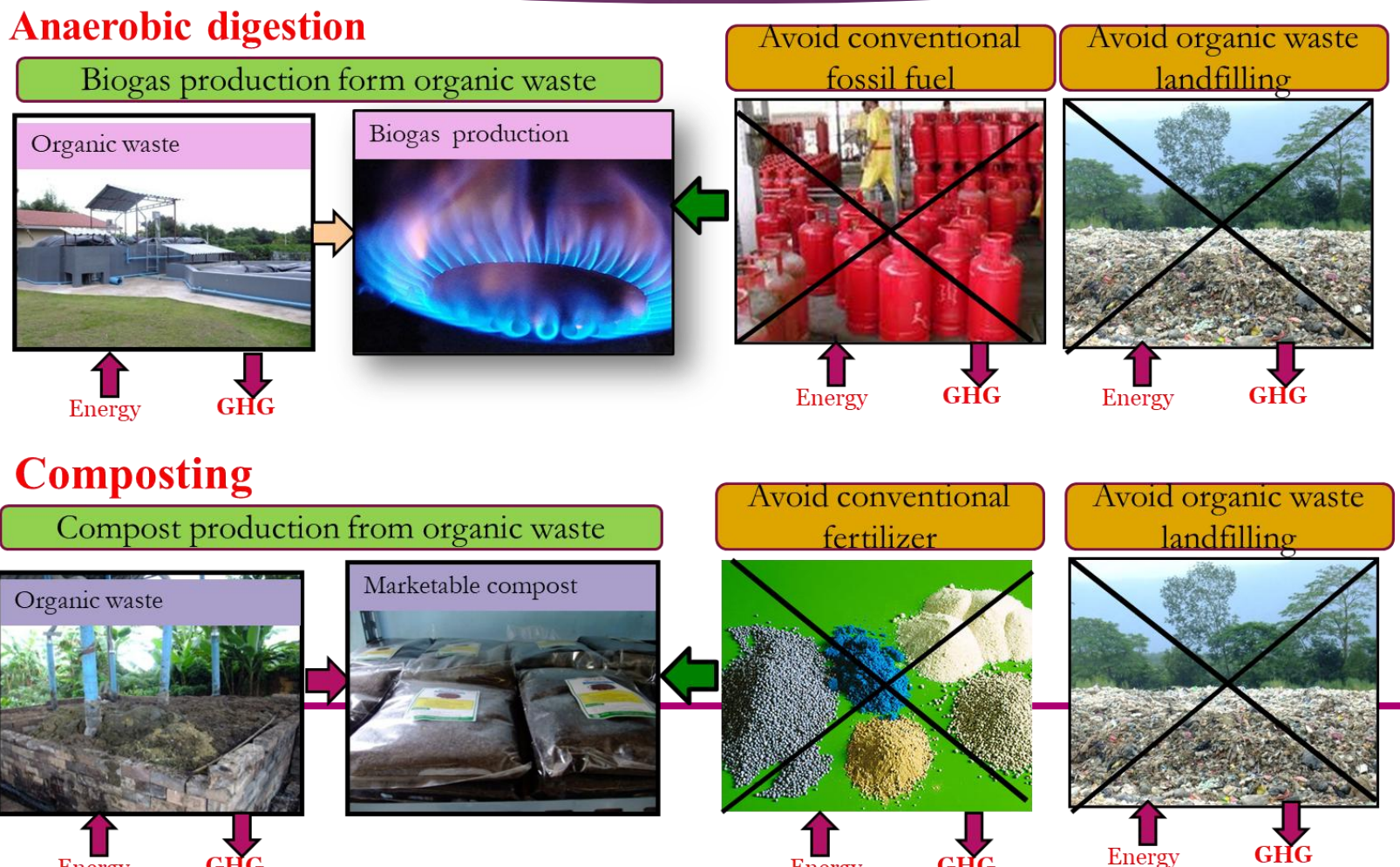
Global Warming Potentials (GWP) of GHGs and SLCPs

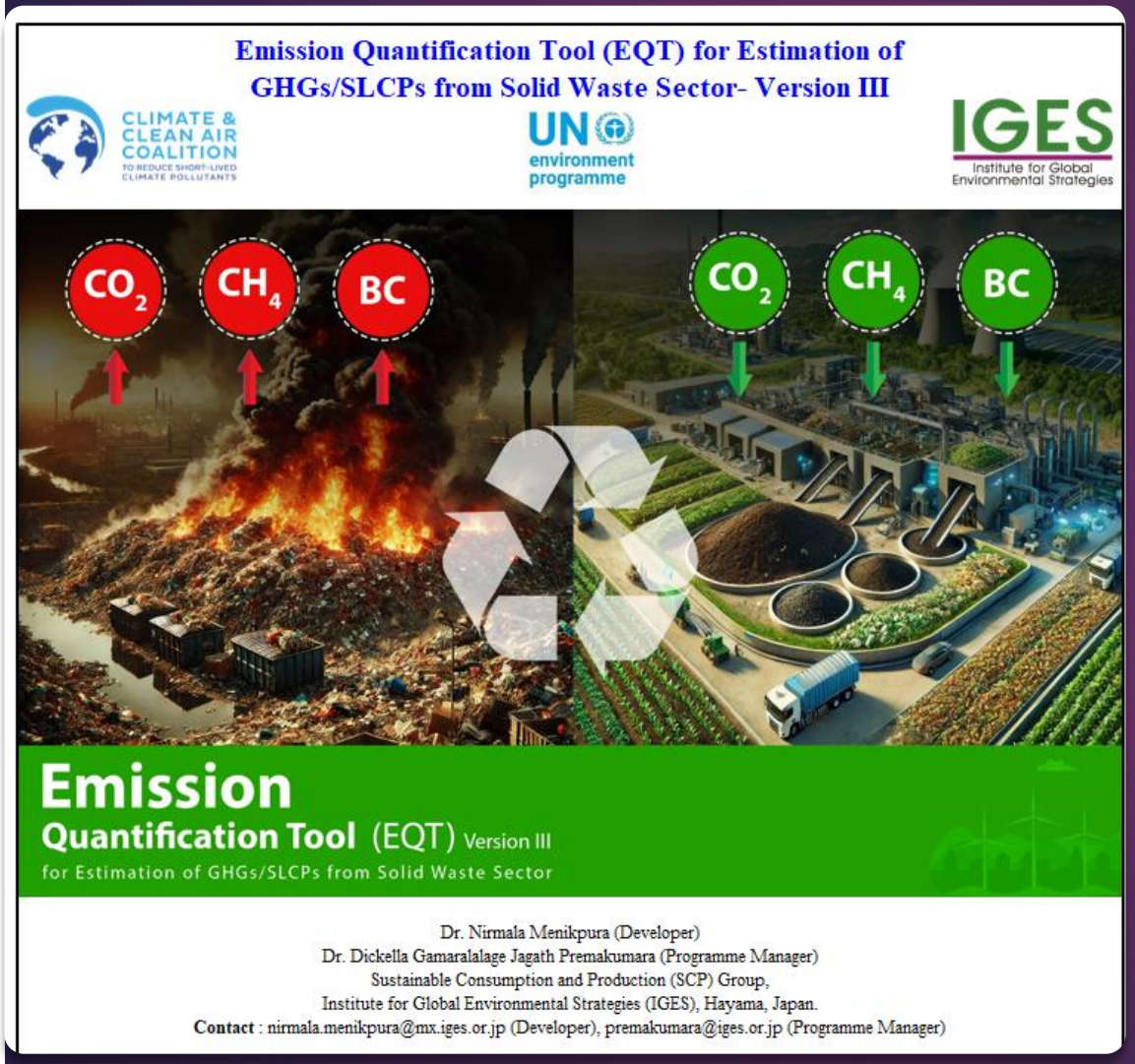
Type of Gas	GWP20	GWP100
CO_2	1	1
CH_4- biogenic	84	28
CH_4-fossil	85	30
N_2O	264	265
BC	2100	590

GWP values of 100-year time horizon has been used in many studies

GWP is presented as $kgCO_2$-eq

Life cycle thinking: A holistic way for quantification of emissions and avoidance





Emissions Quantification Tool (EQT)for assessing the climate impacts from waste sector

Objectives: Emissions Quantification Tool (EQT)

Emission quantification tool

Decision making tool

User Manual

- Undertake a rapid assessment of GHGs and Short-Lived Climate Pollutants (SLCPs) from BAU with alternative solutions and find the most suitable options for the city.
- Keep records and monitor the progress made on mitigating GHGs and SLCPs emissions from chosen waste management options

Evolution of the Development of Emissions Quantification Tool (EQT)

Version I- 2013

- Developed on behalf of **Climate and Clean air Coalition (CCAC)**
- Comprehensive coverage of waste management technologies
- Estimated **GHG & SLCP emissions**
- **User-friendly design**: Help buttons & detailed manual

Version II- 2018

- Expanded landfill scenarios: 3 landfill types per scenario
- Open burning & landfill fire emissions added
- Enhanced recycling emissions, incl. virgin production
- Black Carbon emissions included
- Improved summary & functional unit options
- Reference sheet for transparency

Version III- 2025

- Updated emission factors for electricity & thermal energy
- Simplified input sheets & enhanced user interface
- New sheet for RDF production emissions
- Additional bug fixes
- Upgraded visual design & user help guidance

Features of the Emission Quantification tool : User friendly

- This tool is simple and step by step guidance has been provided to users in all the sheets on how to enter the data and obtain the results
- Special skill is not required and ability to work with excel would be sufficient
- Each and every sheet has designed a way that users can easily move among the sheets , enter the data and obtain the results on their preferred waste treatment options

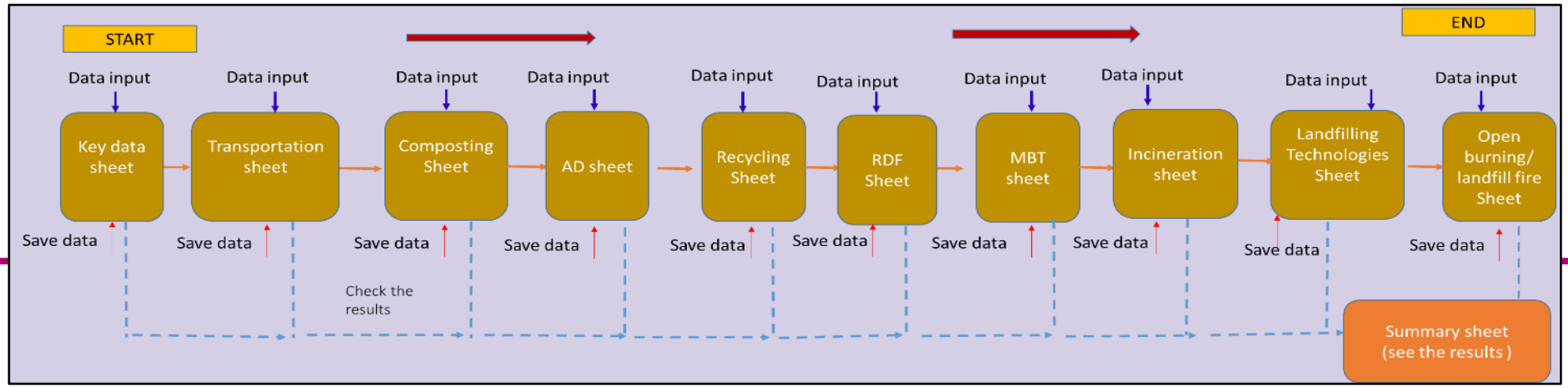
Specifications of (EQT) : Designed to cover both GHGs and SLCPs

- EQT designed to quantify the overall climate impact from waste sector and version III is released in January 2025.
- EQT estimates direct and indirect greenhouse gasses (GHGs) and Short-Lived Climate Pollutants (SLCPs) emissions, including potential emissions avoidance/savings through resource recovery from waste.

Specifications of (EQT) : Cover full range of waste management technologies

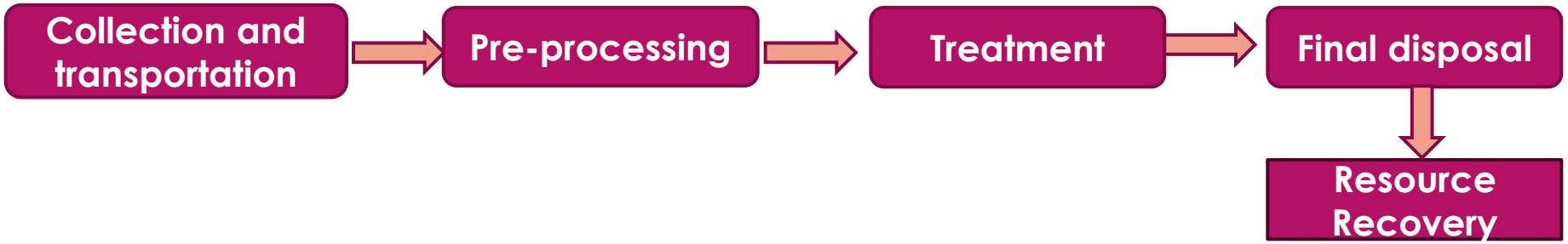
- Tool cover the full range of waste treatment approaches
- Accounts the emissions from relatively basic waste management technologies to advanced technologies in both developing and developed countries

Open dumping → Waste to Energy (WTE)



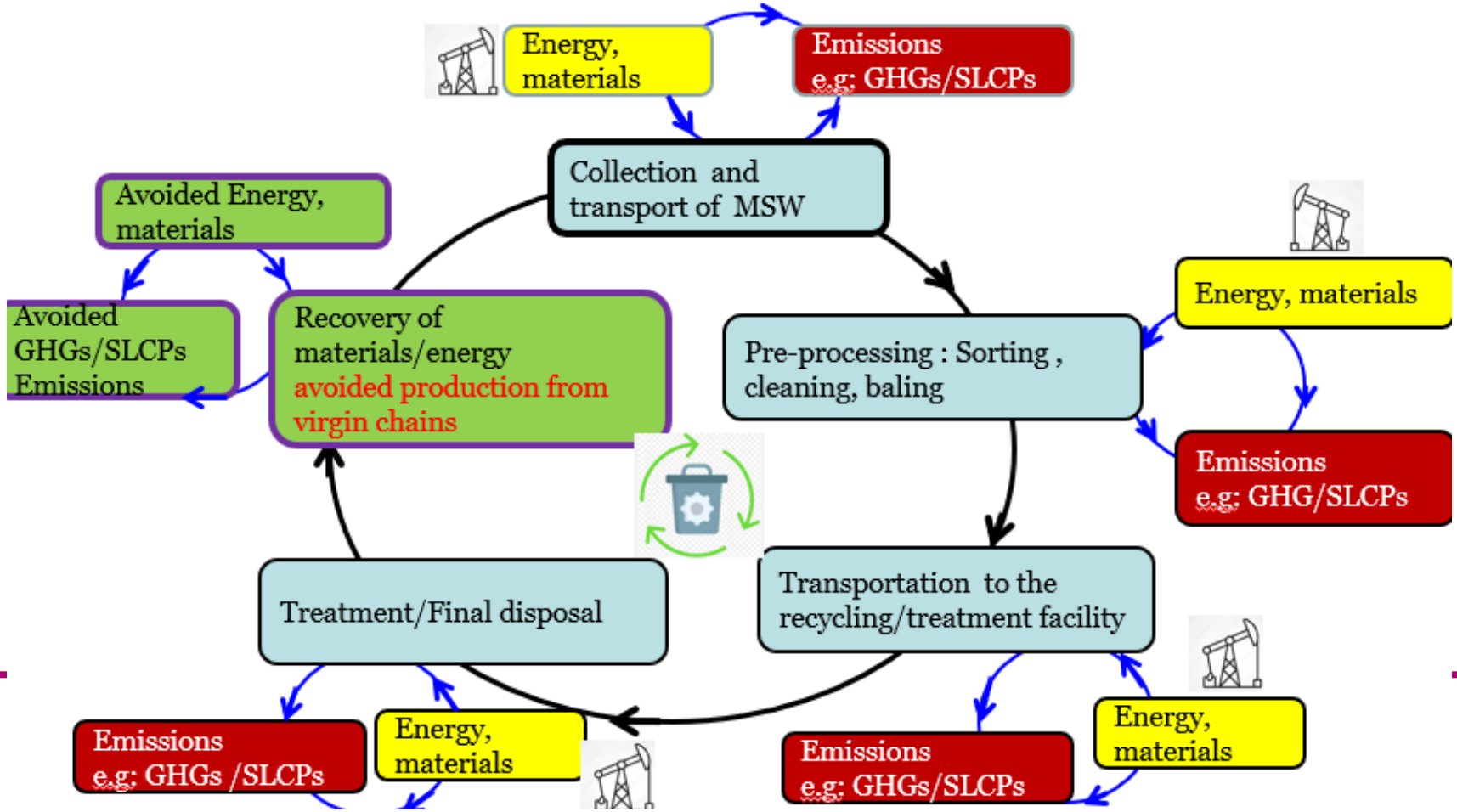
Features: Accounting both GHGs and SLCPs in Life Cycle Assessment (LCA) Perspective

- The tool accounts both SLCPs and other GHGs from waste management considering all the phases of the entire life cycle

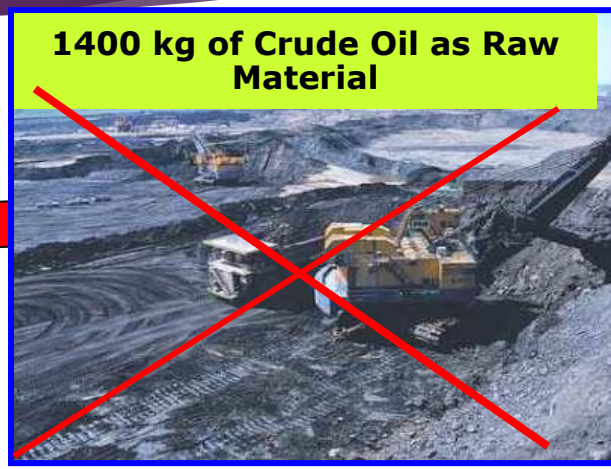


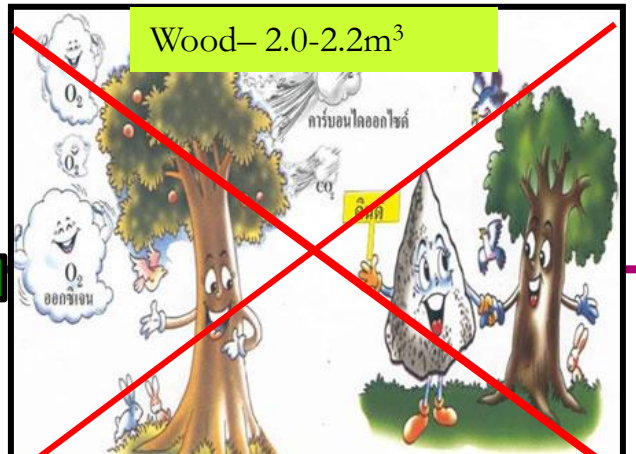
- Both emissions and savings potentials is accounted across the life cycle

Features: EQT assess the GHG/SLCP savings potentials through resource recovery



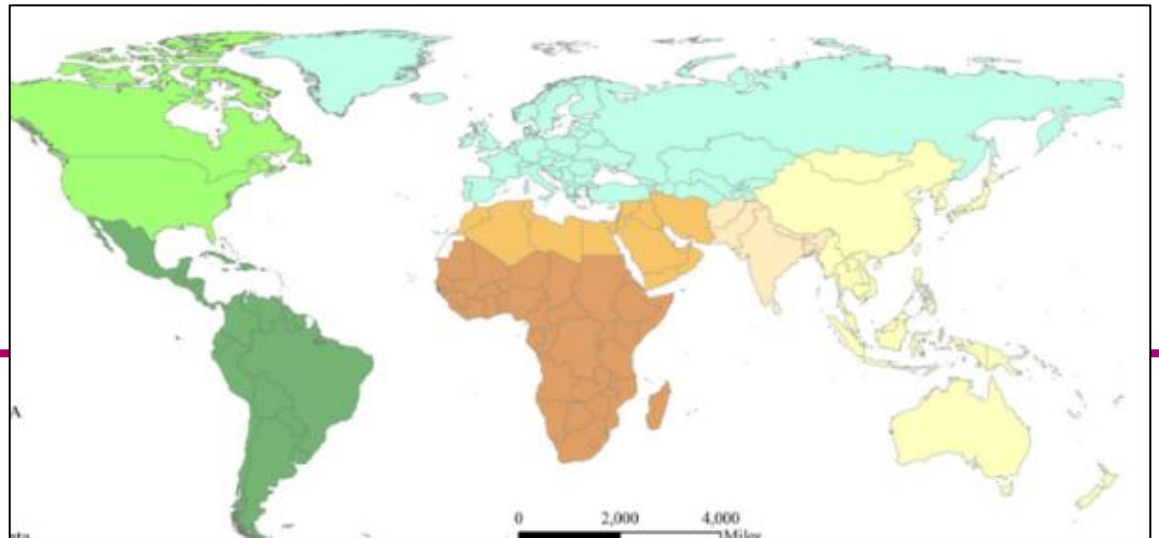
Features: EQT assess the GHG/SLCP emissions and savings potentials through resource recovery





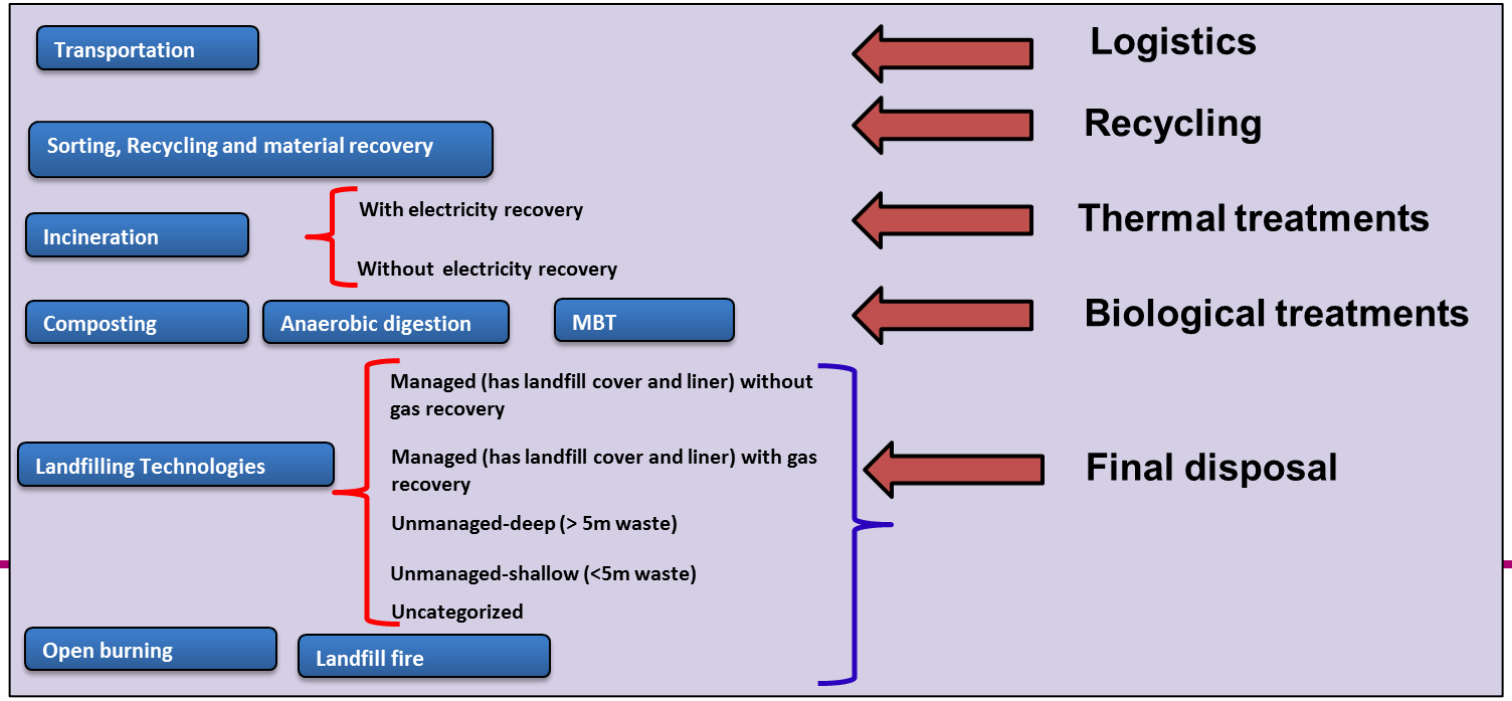
Features: Geographical Coverage

- This tool is designed to cover waste management systems in larger geographical area; Asia, Europe, Latin America, Africa, Mena
- Current version of the EQT covers more than 60 countries in above regions
- You can see the list of countries in the "key data" sheets and more countries can be included into the list in the future.



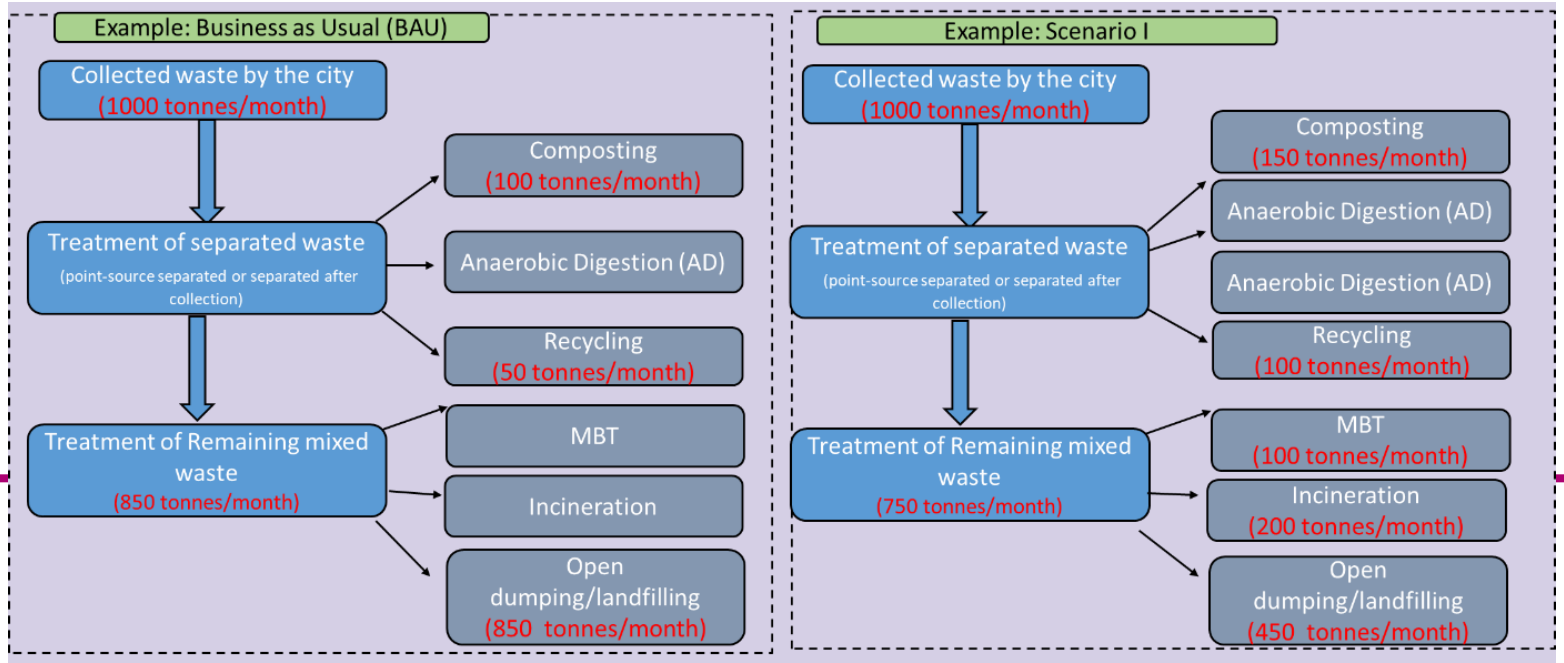
Features: Technology Coverage

- Tool accounts the emissions from relatively basic waste management technologies to advanced technologies with all types of management and resource recovery options



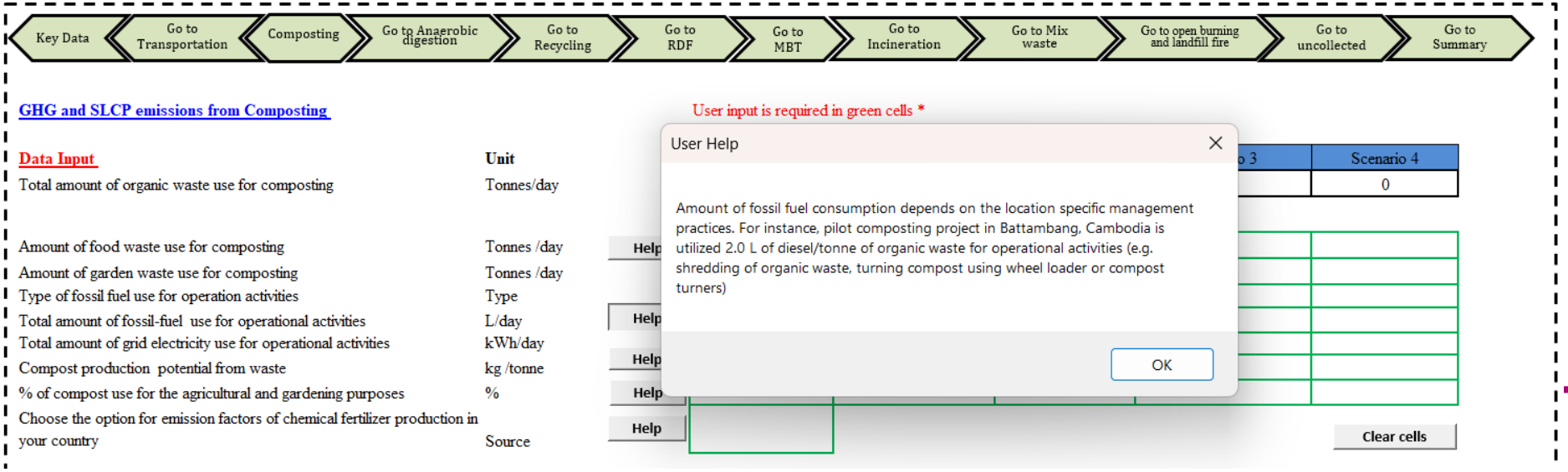
Features: Ability of comparing Business as Usual (BAU) practice with 4 more alternative scenarios

- The key aim of the tool is to support local authorities and cities in quantifying the overall climate impact of their current waste management systems and comparing it with intended future scenarios
- Thus the design allow to compare baseline scenario with 4 more intended scenarios/Future integrated system for enabling decision making.



Features: Flexibility of data entry

- The tool offers flexibility in data entry. If cities have their own data, they can input it to obtain more accurate emissions estimations.
- In the absence of such data, cities can still use the tool by selecting the most appropriate default values provided by the developer for the country or region..



Features: Input data requirement

1. Key Data

Key data: Country/location specific data e.g. basic data, waste composition of generated and collected waste, type of energy consumption, country specific emission factors

2. Technology specific data

Technology specific data: Users are asked to enter technology specific data e.g. waste composition in each treatment, type and amount of fossil fuel used, amount of grid electricity used, amount of resource recovered and potential replacement of conventional resources

Features: Emission factors and default values

- The option has been given to the users to choose either the country/location specific emissions factors or the default values

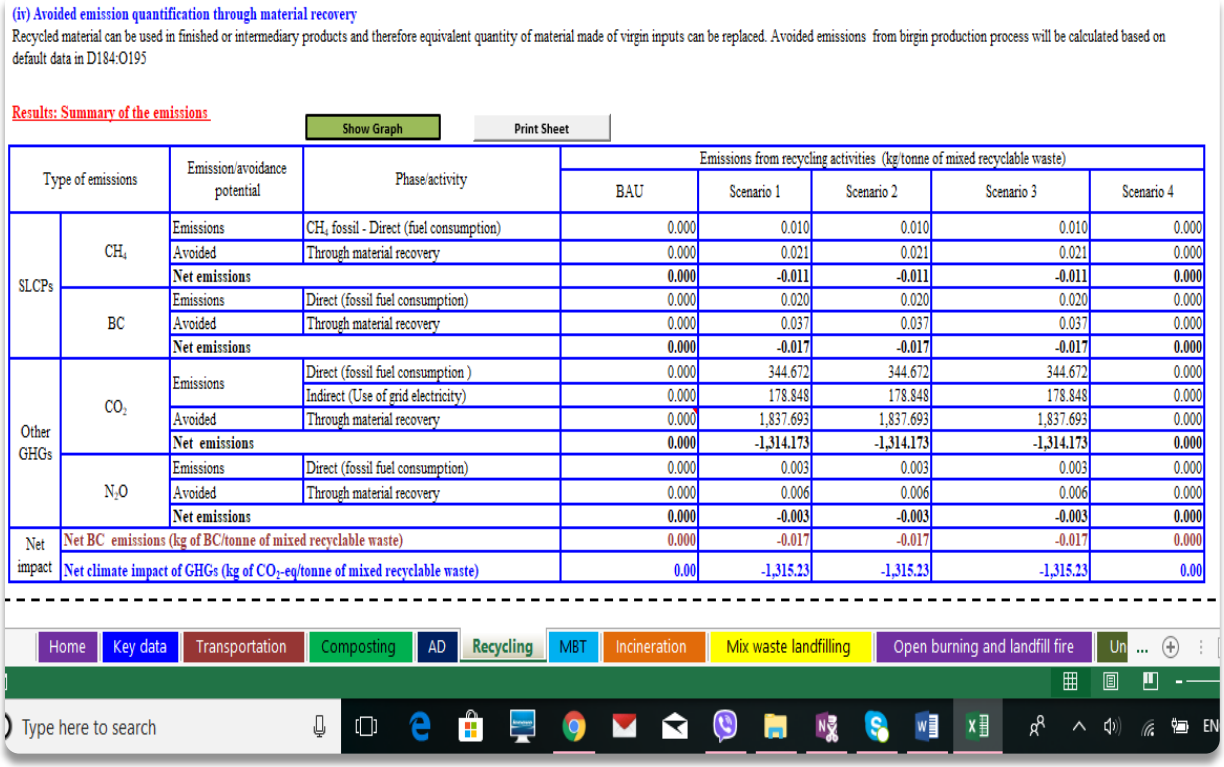
e.g. grid emission factors, calorific values of the fuel, efficiencies of gas and electricity recovery, emission factors for avoided chemical fertilizer production

- Recently published emission factors of GHGs/SLCPs and GWP have been used

Type of Gas	GWP20	GWP100
CO_2	1	1
CH_4- biogenic	84	28
CH_4-fossil	85	30
N_2O	264	265
BC	3200	900

Features: User friendly interface and easy to understand results

- SLCPs and GHGs emissions from individual treatment method is be disaggregated for each pollutant and present per gas
- GHGs and SLCPs emissions and avoided (as a result of resource recovery) potential is displayed
- Net emissions is presented per gas, per tonne of waste
- Net climate impact from BC and other GHGs shows separately



(iv) Avoided emission quantification through material recovery

Recycled material can be used in finished or intermediary products and therefore equivalent quantity of material made of virgin inputs can be replaced. Avoided emissions from birgin production process will be calculated based on default data in D184:O195

Results: Summary of the emissions

Show Graph | Print Sheet

Type of emissions		Emission/avoidance potential	Phase/activity	Emissions from recycling activities (kg/tonne of mixed recyclable waste) BAU	Scenario 1	Scenario 2	Scenario 3	Scenario 4
SLCPs	CH_4	Emissions	CH_4 fossil - Direct (fuel consumption)	0.000	0.010	0.010	0.010	0.000
		Avoided	Through material recovery	0.000	0.021	0.021	0.021	0.000
		Net emissions		**0.000**	**-0.011**	**-0.011**	**-0.011**	**0.000**
	BC	Emissions	Direct (fossil fuel consumption)	0.000	0.020	0.020	0.020	0.000
		Avoided	Through material recovery	0.000	0.037	0.037	0.037	0.000
		Net emissions		**0.000**	**-0.017**	**-0.017**	**-0.017**	**0.000**
Other GHGs	CO_2	Emissions	Direct (fossil fuel consumption)	0.000	344.672	344.672	344.672	0.000
			Indirect (Use of grid electricity)	0.000	178.848	178.848	178.848	0.000
		Avoided	Through material recovery	0.000	1,837.693	1,837.693	1,837.693	0.000
		Net emissions		**0.000**	**-1,314.173**	**-1,314.173**	**-1,314.173**	**0.000**
	N_2O	Emissions	Direct (fossil fuel consumption)	0.000	0.003	0.003	0.003	0.000
		Avoided	Through material recovery	0.000	0.006	0.006	0.006	0.000
		Net emissions		**0.000**	**-0.003**	**-0.003**	**-0.003**	**0.000**
Net impact	Net BC emissions (kg of BC/tonne of mixed recyclable waste)			0.000	-0.017	-0.017	-0.017	0.000
	Net climate impact of GHGs (kg of CO_2-eq/tonne of mixed recyclable waste)			0.00	-1,315.23	-1,315.23	-1,315.23	0.00

Home | Key data | Transportation | Composting | AD | Recycling | MBT | Incineration | Mix waste landfilling | Open burning and landfill fire | Un ...

Type here to search

Features: Key indicators measure enable for decision making

- The summary sheet displays the summary of SLCPs and GHG emissions from BAU practice and alternative scenarios in both table and graphs format
- User can choose the unit of measurements based on their preferences
- The tool facilitates to measure the climate impact from scenarios for four types of functional units
    - 1.Emissions per tonne of generate waste
    - 2.Emissions per tonne of collected waste
    - 3.Emissions from yearly generated waste
    - 4.Emissions from yearly collected waste

Features: User-friendly summary sheet with clear and easy-to-understand overall results

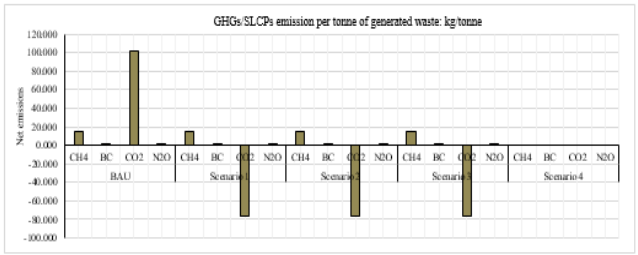
- Net GHGs/BC emissions from individual treatment method and chosen scenarios have shown in table as well as in graphical format

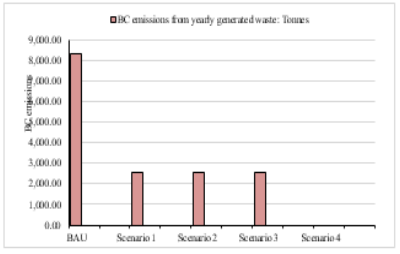
Please choose the prefered 'Unit' for emissions estimation — Calculate emissions from yearly generated waste

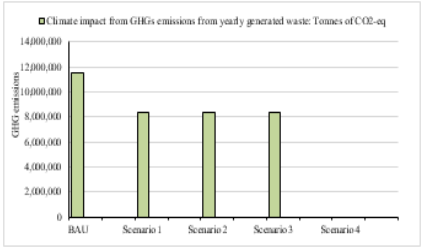
Summary of net GHG/SLCP emissions from waste management

Description	Technology	Unit	BAU				Scenario 1				Scenario 2				Scenario 3				Scenario 4			
			CH_4	BC	CO_2	N_2O	CH_4	BC	CO_2	N_2O	CH_4	BC	CO_2	N_2O	CH_4	BC	CO_2	N_2O	CH_4	BC	CO_2	N_2O
Waste collection and transportation by the	Transportation	kg /tonne (unit ' kg ' used here to show the magnitude of small amount of emissions)	0.000	0.003	3.362	0.000	0.000	0.001	3.026	0.000	0.000	0.001	3.026	0.000	0.000	0.000	2.690	0.000				
Treatment for separated waste	Composting						3.333	0.001	-0.360	0.282	3.333	0.001	-0.360	0.282	3.333	0.001	-0.360	0.282				
	Anaerobic digestion																					
	Recycling						-0.011	-0.017	-1,314.173	-0.003	-0.011	-0.017	-1,314.173	-0.003	-0.011	-0.017	-1,314.173	-0.003				
Treatment for mixed waste	MBT																					
	Incineration																					
	Landfilling		37.515	0.000	0.000	0.000	28.879	0.000	0.000	0.000	28.879	0.000	0.000	0.000	28.879	0.000	0.000	0.000				
	Open burning/landfill		3.700	0.650	172.982																	
Uncollected waste	Open burning/scattered		3.871	0.325	86.431		8.021	0.325	86.431		8.021	0.325	86.431		8.021	0.325	86.431					
GHGs/SLCPs emission per tonne of generated waste:		kg/tonne	14.652	0.370	101.037	0.000	15.580	0.114	-76.736	0.048	15.580	0.114	-76.736	0.048	15.580	0.113	-77.072	0.048	0.000	0.000	0.000	0.000
BC emissions from yearly generated waste:		Tonnes	8,321.93				2,559.72				2,559.72				2,538.23				0.00			
Climate impact from GHGs emissions from yearly generated waste:		Tonnes of CO2-eq	11,503,868.49				8,376,236.23				8,376,236.23				8,368,551.49				0.00			

Recommendation: As fas as BC emissions is concerned, Scenario 3 has the lowest emissions and which seems to be the best option for your city
As fas as other GHGs emissions is concerned, Scenario 3 has lowest net GHG emissions. Technological options used in this scenario seems to be the most appropriate choices for the city







AD | Recycling | MBT | Incineration | Mix waste landfilling | Open burning and landfill fire | Uncollected waste | Summary | User guide | Figures

This is the ultimate results that you need for policy and decision-making process

Climate Change | Ecosystems | Governance | Green Economy | Sustainable Consumption and Production | Sustainable Societies | SDGs

The Emission Quantification Tool (EQT) was developed by the **Institute for Global Environmental Strategies (IGES)** as a science-based tool designed to empower policymakers and practitioners to estimate emissions, plan climate-friendly systems, and monitor achievements. Initially launched in 2013 in collaboration with the **Climate and Clean Air Coalition - Municipal Solid Waste Initiative (CCAC-MSWI)**, the EQT was one of the pioneering tools for measuring both greenhouse gas (GHG) and short-lived climate pollutant (SLCP) emissions in the waste sector.

Since its launch, the EQT has undergone continuous improvement based on user feedback and evolving national and global requirements. In 2018, Version II introduced significant updates to enhance functionalities and usability. The latest **Version III, released in 2025** in partnership with the **UNEP International Environmental Technology Centre (UNEP-IETC)**, includes advanced features to further support GHG and SLCP quantification at both city and national levels.

This tool is available to users free of charge. To help us understand how it is being used and to improve future versions, we kindly ask you to complete this short survey. Your cooperation allows us to track usage across sectors and regions, and to ensure the tool continues to meet user needs.

Download User's Manual - Emission Quantification Tool (EQT) for Estimating Short Lived Climate Pollutants (SLCPs) and Other Greenhouse Gases (GHGs) from Waste Sector (PDF 2.9MB)

Emission Quantification Tool (EQT) Version III
Download
for Estimation of GHGs/SLCPs from Solid Waste Sector

- Introduction
- The Emission Quantification Tool (EQT): Driving Climate Action in Waste Management
- What is the Emission Quantification Tool (EQT)?
- What are the Key Features of the EQT?
- Why Use the EQT?
- Contact

How to download EQT ?

Let's move to the EQT

THANK YOU

NIRMALA MENIKPURA, PhD

Senior Fellow, Institute for Global Environmental Strategies (IGES)

Email: nirmala.menikpura@mx.iges.or.jp

IGES Institute for Global Environmental Strategies