Climate Pollution Assessment and Mitigation Roadmap

Phase 1

Vianaar Feb 2024

CBALANCE
carbon ▸ cost ▸ community ▸ climate

Contents

CLIMATE EMERGENCY BRIEFING

Second-homes

Second homes are an extravagance that is incompatible with our climate emergency. They represent a perturbingly 'normalized' form conspicuous consumption that in inimical to the universal aspiration of social equity and ecological balance. Along with frequent flying, driving large SUVs, possession of second-homes is now firmly embedded in the climate discourse as the most immediately avoidable form of unjustified, reckless consumption by the elite class of urban societies that have abandoned all notions of living within planetary limits.

Impact on Society

Increase in the land prices/rents (rural or peri-urban gentrification) as people with higher purchasing power buying second homes invade landscapes of placed communities, indigenous people, agrarian societies etc. This can undermine the ability of these communities to organize their own affordable housing and retain ownership of their lands across generations. This then spawns dispossession of enduring ways of being, displacement and migration for a better livelihood. Shift from local economy to service based economy which are temporary opportunities characterized by intense vulnerability, marginalization, inequity and precarities.

Houses in informal settlement in India

Second Home around Mumbai

Impact on Ecological and Human Wellbeing

Construction activity are energy and resource intensive also leading to air pollution, water contamination, change in biodiversity, etc. Local residents in the vicinity of the construction are exposed to increased noise levels leading to sleeplessness, dust pollution, other respiratory issues and diseases caused by construction pollutants.

Climate and social injustices perpetrated by use of non-local construction materials

Construction activities proliferate climate (i.e. emit intense climate pollution) and ecological, harm by shattering circular loops that maintain ecological balance through the principle of 'return', through the use of materials which are extracted (mined) in a manner that permanently depletes the 'commons'. The impact of using non-local material on people, environment, community is explored through the example of Italian marble.

Impact on Society

The workplaces are in the open or underground, isolated, and on high mountains causing much concern for workers safety. The workers in open mines experience temporary blindness, photoconjuctivitis, photokeratitis, dermatitis, etc especially during the summer months because of exposure to macroclimatic conditions and solar radiation. When expensive Italian marble from across the globe is used in a building in India, it may set a reference for aspiration in existing society which over time for certain members of the community add **financial burden and stress in a bid to feel included**.

Impact on Ecological and Human Wellbeing

The processing of raw marble uses copious amount of energy, water resulting in slurry waste which on drying leads to dust pollution and also renders the soil around the mining area infertile. Long strips of land are consumed, and large areas effectively divided into smaller ones (severance). Previous land uses, such as forestry, agriculture, housing and nature reserves, are displaced, and zones adjacent to the new development are rendered unsuitable. Transportation through road, water and air mode has an impact on the environment. As a simple thumb rule - the farther the distance, the greater its impact. Even though marble, once laid, is a durable material, justifying the use of an imported variety, when available locally, may not constitute a sustainable choice.

Concrete related mining

Concrete is the most widely used building material. It is a composite material consisting of cement – an energy intense material, coarse aggregates – obtained by mining or from river or surface stones, fine aggregates – mostly mined from the riverbed and transported to the sites. With such high impact in its production itself we further look into the socio-cultural, environment, health, livelihood, lifestyle changed, political system, etc.

Impact on Society

The base material are mined in the forest, open grounds with rocky strata which results in displacement of tribal communities who are dependent on forest ecosystem, lose access to the forest, leading to illegal mining to make quick money, migration of people to city in search of employment, transition from agrarian to industrialized community, etc.

Impact on Ecological and Human Wellbeing

Cement production contributes significantly to dust particulate emissions leading to air pollution and detrimental impact on human health such as increased severity of itchy eyes, silicosis and other respiratory diseases, chest discomfort, chronic bronchitis, asthma attacks, cardio-vascular, premature death. Water stress in the mined region, loss of soil fertility, loss and change in biodiversity, etc.

Impact on Political Systems

Mining changes the local regional political system as most of the mining areas are concentrated in the tribal areas who are been ignored in the name of national interest and economic development, disruption of social capital due to displacement and exclusions of the communities from their own land and commons leading to illegal mining.

Quarrying of stones

Stone quarrying comprises of the open cast excavation of rocks by drilling, blasting, cutting and excavation to provide raw material for construction activities. Landscape alteration due to soil erosion and river siltation, habitat loss, pollution of land, air and water which provoke health ailments among other issues and the loss of indigenous livelihoods are few of the many unjust impacts of quarrying.

Impact on Society

Livelihood loss has the potential to alter the social dynamics in communities located in around the quarry vicinity. The power dynamics of the regional economy shifts from local communities to the quarry owners due to the loss of local livelihoods which forces people to seek work at the quarries. Bonded labor, sexual assault, disruption to local economic activities – agriculture, cattle rearing are other impacts.

Impact on Ecological and Human Wellbeing

Quarrying leads to air, noise, surface and ground water pollution along with other high risks of mudslides and landslides, damage to house structures located close to quarry, loss/ injury to life during stone blasting. People, workers complain of stress, chest pain, lung diseases such as silicosis, changes in sleep pattern due to prolonged exposure to quarrying activities.

Impact on Political Systems

Quarry workers have no documented evidence of their employment which makes it difficult for them to hold employers responsible when human rights violations occur. Non-existence of trade unions, government regulation deprive people of their fundamental right to freedom of expression and exploitation who are working at the quarry and the community living in the vicinity of the site.

The imposition of a service economy

A service economy is an economy where the main activities are focused on providing services. Second homes, while serving as a getaway place for the owners every once in a while, are also often used to rent out to tourists at the times in which they are not occupied by the owners. The impact of service economy on socio-economic, culture, environment, health, and political system is highlighted here through Tourism industry.

Impact on Society

While service sectors contributes to overall economic development, on the flip the adverse effects includes the displacement of traditional livelihood, increased cost of living, unequal distribution of benefits, commercialization of cultural heritage, commodification and dilution of local tradition and customs.

Impact on Ecological and Human Wellbeing

Tourism industry often requires the development of infrastructure, including hotels, resorts, and transportation facilities which also leads to water pollution, air pollution, land pollution. Increased tourism activities results in higher vehicular traffic contributing to air pollution leading to increased respiratory problems among the local community. Increased use of pesticides and fertilizers leads to long-term health risks such as skin diseases, respiratory disorders, and adverse effects on reproductive health.

Impact on Political Systems

The rise of the service-based economy can have political ramifications that affect the interests of local traditional economies. Large hotel chains often have significant political influence, which can lead to policies that prioritize the interests of the service sector over those of traditional sectors.

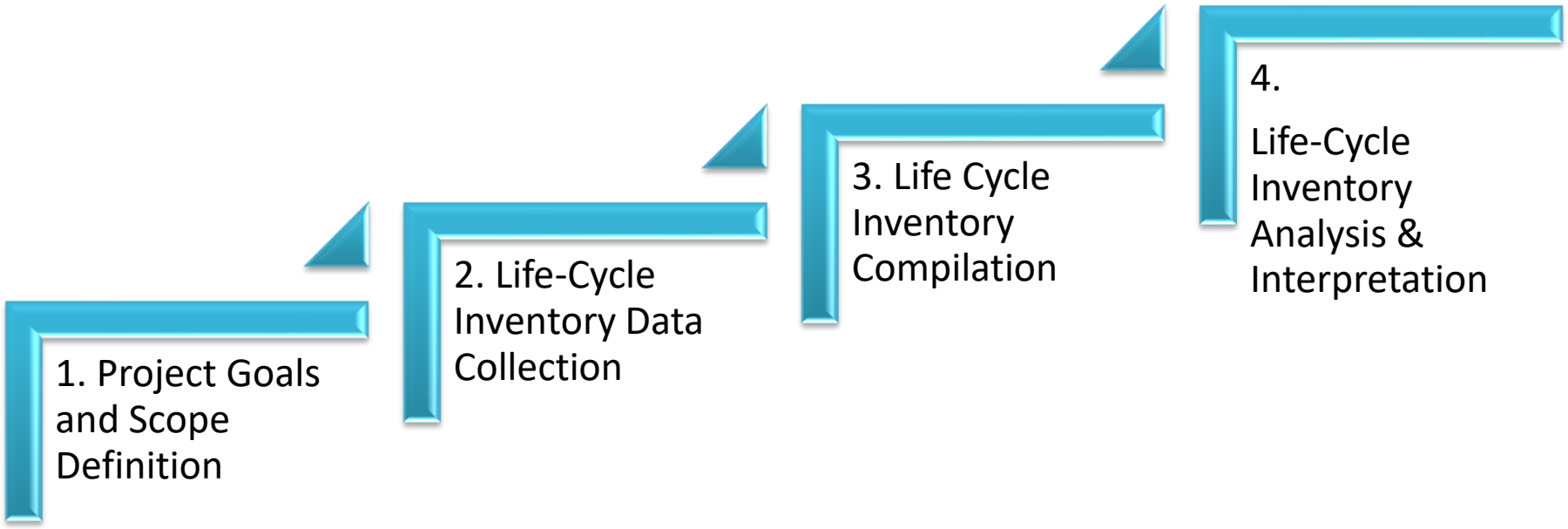
PROJECT INTRODUCTION

Goal & Scope Definition

Goal

- Conducting a Baseline GHG Inventory for year 2022 in accordance with 2006 IPCC Guidelines for GHG Inventories, and WRI's Scope 3 (Corporate Value Chain) Standard.
- Reporting the GHG Inventory through narratives, tables and charts intended to convey the salient outcomes of the climate pollution estimation of the company to senior management.

Process Flow



Protocols and Standards

- Greenhouse Gas Protocol's Product Life Cycle Accounting and Reporting Standard, Scope 3 (Corporate Value Chain) Standard (WRI, WBCSD)
- 2006 IPCC Guidelines for GHG Inventories.
- Life Cycle Assessment (LCA) databases used from openLCA Nexus: Environmental Footprints, EcoInvent and cBalance's Carbon Emission Factor Database.

Scope of Work

- To conduct Scope-3 footprinting in accordance with the indicated boundary below, to identify carbon hotspots across construction operations, construction supply chain and building operations

Life Cycle Stage	Within Boundary?
Material Acquisition and Pre-Processing	Yes
Production	Yes
Distribution and Storage	Yes
Use	Yes
End-of-Life	No

- To enable target setting (ie, GHG mitigation per year) and annual tracking of GHG mitigation achievements towards meeting the Science-Based Target (SBTi's)

Boundary Setting

Scope: Operational Boundary

Emission Scope	Emissions Category	Emissions Sub-category	Within Boundary?
Scope 1	Direct Energy Consumption	Fuel Combustion & Refrigerants	No
		Captive Power Generation	No
Scope 2	Indirect Emissions	Purchased Electricity	No
		Purchased Water	No
Scope 3-1	Purchased goods and services	Production related Procurement	Yes
		Non Production related Procurement	No
Scope 3-2	Capital Goods	Capital goods (Complete LCA)	No
Scope 3-3	Fuel- and energy-related activities	Upstream Emissions of Purchased Fuels, Electricity and T & D Losses	Yes
Scope 3-4	Upstream transportation and distribution	Transportation of Purchased Products from Tier 1 Suppliers & Storage in warehouses	Yes
Scope 3-5	Waste generated in operations	Solid Waste	Yes
		Wastewater & Waste Transportation	Yes
Scope 3-6	Business Travel	Business Travel & Accommodation	No
Scope 3-7	Employee Commuting	Employee Commuting	No
Scope 3-8	Upstream leased assets	Upstream leased assets	No
Scope 3-9	Downstream transportation and distribution	Transportation, Storage in Warehouses & Retail Stores	No
Scope 3-10	Processing of Sold Products	Processing of Sold Products	No
Scope 3-11	Use of sold products	Fuel and Water Consumption	Yes
Scope 3-12	End-of-life treatment of sold products	Waste generation	No
Scope 3-13	Downstream leased assets	Downstream leased assets	No
Scope 3-14	Franchises	Franchises	No
Scope 3-15	Investments	Investments	No

Project Details

Sr. No.	Project Name	Built-up Area (m2)	No. of dwellings
1.	Villa 1	2,175	6
2.	Villa 2	2,560	10
3.	Villa 3	936	6
4.	Villa 4	380	1
5.	Villa 5	374	1
	Total	**6,425**	**24**

CLIMATE POLLUTION ANALYSIS

Table 1 – Activity Data (1)

Emission Category	Activity Group	Activity Sub-Group	Activity Type	Qty.	Units
Miscellaneous	Water	Other_Water	Other_Water	6,480,000	liter
Fuel_and_Energy_Related_Activities_Transmission_and_distribution_(TandD)_losses	Energy	Electricity_TandD_Losses	Grid_Electricity_Losses	1,840,043	kWh
Fuel_and_Energy_Related_Activities_Upstream_emissions_of_purchased_fuels	Energy	Electricity_Upstream_Emissions	Grid_Electricity_Supply_Chain	1,840,043	kWh
Use_of_sold_products	Energy	Electricity	Grid_Electricity	1,725,068	kWh
Upstream_Transportation_and_Distribution_Inbound_Logistics	Mobility	Logistics_and_Freight	MMV	1,469,218	kg-km
Upstream_Transportation_and_Distribution_Inbound_Logistics	Mobility	Logistics_and_Freight	HMV	885,977	kg-km
Use_of_sold_products	Waste	Solid_Waste_Disposal	Unmanaged_Waste_Disposal_Sites	390,600	kg
Purchased_Goods_and_Services	Materials	Construction	Masonry	222,761	Piece
Purchased_Goods_and_Services	Materials	Metals	Steel	131,507	kg
Scope_2_Emissions	Energy	Electricity	Grid_Electricity	114,975	kWh
Upstream_Transportation_and_Distribution_Inbound_Logistics	Mobility	Logistics_and_Freight	MMV	114,503	vehicle-km
Upstream_Transportation_and_Distribution_Inbound_Logistics	Mobility	Logistics_and_Freight	Ship	46,544	kg-km
Use_of_sold_products	Water	Other_Water	Other_Water	43,680	liter

Table 1 – Activity Data (2)

Emission Category	Activity Group	Activity Sub-Group	Activity Type	Qty.	Units
Purchased_Goods_and_Services	Materials	Construction	Cement	43,416	Piece
Upstream_Transportation_and_Distribution_Inbound_Logistics	Mobility	Logistics_and_Freight	HMV	35,684	vehicle-km
Purchased_Goods_and_Services	Materials	Construction	Surface_Finishing	35,567	m2
Upstream_Transportation_and_Distribution_Inbound_Logistics	Mobility	Logistics_and_Freight	LCV	29,396	kg-km
Purchased_Goods_and_Services	Materials	Construction	Surface_Finishing	21,398	m2
Purchased_Goods_and_Services	Materials	Construction	Masonry	21,384	Piece
Purchased_Goods_and_Services	Materials	Construction	Sealants_and_Adhesives	20,020	kg
Purchased_Goods_and_Services	Materials	Construction	Surface_Finishing	20,002	m2
Upstream_Transportation_and_Distribution_Inbound_Logistics	Mobility	Logistics_and_Freight	LCV	17,027	vehicle-km
Scope_1_Emissions	Energy	Fuel_Combustion_Activities	Liquid_Fuels	16,425	liter
Fuel_and_Energy_Related_Activities_Upstream_emissions_of_purchased_fuels	Energy	Fuel_Combustion_Activities	Liquid_Fuels	16,425	liter
Purchased_Goods_and_Services	Materials	Construction	Stone	15,000	Piece
Purchased_Goods_and_Services	Materials	Construction	Cement	11,000	Piece

Table 1 – Activity Data (3)

Emission Category	Activity Group	Activity Sub-Group	Activity Type	Qty.	Units
Purchased_Goods_and_Services	Materials	Construction	Earthwork	10,915	liter
Purchased_Goods_and_Services	Materials	Other_Materials	Lighting_Equipment	8,352	kW
Purchased_Goods_and_Services	Materials	Construction	Surface_Finishing	6,675	m
Purchased_Goods_and_Services	Materials	Other_Materials	Lighting_Equipment	6,120	kW
Use_of_sold_products	Industrial_Processes_and_Product_Use	ODS_Substitutes	Refrigeration_and_Air_Conditioning	5,550	TR-year
Purchased_Goods_and_Services	Materials	Construction	Stone	5,530	m2
Purchased_Goods_and_Services	Materials	Construction	Stone	5,175	m2
Purchased_Goods_and_Services	Materials	Construction	Surface_Finishing	5,050	m2
Purchased_Goods_and_Services	Materials	Metals	Steel	4,750	kg
Purchased_Goods_and_Services	Materials	Construction	Earthwork	4,354	liter
Purchased_Goods_and_Services	Materials	Construction	Stone	4,334	m2
Purchased_Goods_and_Services	Materials	Construction	Surface_Finishing	4,260	m2
Purchased_Goods_and_Services	Materials	Construction	Surface_Finishing	4,180	m2

Table 1 – Activity Data (4)

Emission Category	Activity Group	Activity Sub-Group	Activity Type	Qty.	Units
Purchased_Goods_and_Services	Materials	Construction	Earthwork	4,041	liter
Purchased_Goods_and_Services	Materials	Construction	Surface_Finishing	3,124	liter
Purchased_Goods_and_Services	Materials	Construction	Solid_Surface_Material	2,939	m2
Purchased_Goods_and_Services	Materials	Construction	Stone	2,729	m2
Purchased_Goods_and_Services	Materials	Glass	Other_Glass	2,424	m2
Purchased_Goods_and_Services	Materials	Construction	Surface_Finishing	2,190	m2
Purchased_Goods_and_Services	Materials	Construction	Wood	2,150	m2
Purchased_Goods_and_Services	Materials	Glass	Toughened_Glass	2,117	m2
Purchased_Goods_and_Services	Materials	Construction	Masonry	1,929	Piece
Purchased_Goods_and_Services	Materials	Construction	Masonry	1,929	liter
Purchased_Goods_and_Services	Materials	Construction	Earthwork	1,659	liter
Purchased_Goods_and_Services	Materials	Construction	Surface_Finishing	1,622	m2
Purchased_Goods_and_Services	Materials	Construction	Surface_Finishing	1,502	m2

Table 1 – Activity Data (5)

Emission Category	Activity Group	Activity Sub-Group	Activity Type	Qty.	Units
Purchased_Goods_and_Services	Materials	Plastics	PVC_Pipe	1,328	m
Purchased_Goods_and_Services	Materials	Glass	Plate_Glass	1,328	m
Purchased_Goods_and_Services	Materials	Construction	Stone	1,212	m2
Purchased_Goods_and_Services	Materials	Construction	Surface_Finishing	1,200	Piece
Purchased_Goods_and_Services	Materials	Construction	Surface_Finishing	847	m2
Purchased_Goods_and_Services	Materials	Construction	Solid_Surface_Material	600	m2
Purchased_Goods_and_Services	Materials	Metals	Steel	475	kg
Purchased_Goods_and_Services	Materials	Construction	Plumbing_Hardware	468	Piece
Use_of_sold_products	Waste	Wastewater_Treatment_and_Discharge	Domestic_Wastewater	460	capita-year
Purchased_Goods_and_Services	Materials	Construction	Cement	410	Piece
Purchased_Goods_and_Services	Materials	Glass	Plate_Glass	372	m2
Purchased_Goods_and_Services	Materials	Construction	Other_Construction	363	m2
Purchased_Goods_and_Services	Materials	Construction	Wood	352	Piece

Table 1 – Activity Data (6)

Emission Category	Activity Group	Activity Sub-Group	Activity Type	Qty.	Units
Purchased_Goods_and_Services	Materials	Glass	Toughened_Glass	300	m2
Purchased_Goods_and_Services	Materials	Construction	Earthwork	220	liter
Purchased_Goods_and_Services	Materials	Construction	Thermal_Protection	179	liter
Purchased_Goods_and_Services	Materials	Other_Materials	Electrical_Appliance	148	Piece
Purchased_Goods_and_Services	Materials	Other_Materials	Electrical_Equipment	148	Piece
Purchased_Goods_and_Services	Materials	Metals	Iron	148	Piece
Purchased_Goods_and_Services	Materials	Other_Materials	Electrical_Appliance	124	Piece
Purchased_Goods_and_Services	Materials	Other_Materials	Electrical_Appliance	93	Piece
Purchased_Goods_and_Services	Materials	Metals	Iron	70	Piece
Purchased_Goods_and_Services	Materials	Other_Materials	Electrical_Appliance	63	Piece
Purchased_Goods_and_Services	Materials	Metals	Steel	63	kg
Purchased_Goods_and_Services	Materials	Plastics	PVC_Pipe	58	Piece
Use_of_sold_products	Industrial_Processes_and_Product_Use	ODS_Substitutes	Refrigeration_and_Air_Conditioning	26	TR-year

Table 1 – Activity Data (7)

Emission Category	Activity Group	Activity Sub-Group	Activity Type	Qty.	Units
Purchased_Goods_and_Services	Materials	Other_Materials	Electrical_Appliance	24	Piece
Purchased_Goods_and_Services	Materials	Metals	Iron	24	Piece
Purchased_Goods_and_Services	Materials	Construction	Kitchen_Hardware	24	Piece
Purchased_Goods_and_Services	Materials	Construction	Kitchen_Hardware	24	Piece
Purchased_Goods_and_Services	Materials	Construction	Stone	24	m2
Purchased_Goods_and_Services	Materials	Construction	Plumbing_Hardware	14	Piece
Purchased_Goods_and_Services	Materials	Glass	Other_Glass	12	Piece
Purchased_Goods_and_Services	Materials	Other_Materials	Stationary_Power_Generation	3	Piece
Purchased_Goods_and_Services	Materials	Other_Materials	Stationary_Power_Generation	2	Piece

Climate Pollution Impact

Life-Cycle GHG Emissions from Vianaar LCA Study			
Sr. No	**Emissions Criterias**	**Value**	**Units**
1.	GHG Emissions for all 5 projects	10,877	tons CO2e/lifetime*
2.	GHG Emissions per apartment for lifetime	453	tons CO2e/apt-lifetime*
3.	GHG Emissions per apartment per year	18.1	tons CO2e/apt-year
4.	GHG Emissions per m2 of area	1,693	kg CO2e/m2

Life-Cycle GHG Emissions from Literature Review				
GaBi	SimaPro	Moradabad Institute	**Avg.**	Unit
348	294	784	475.3	kg CO2e/m2

Note:
*Lifetime: Study period of 25 years is considered for LCA assessment.

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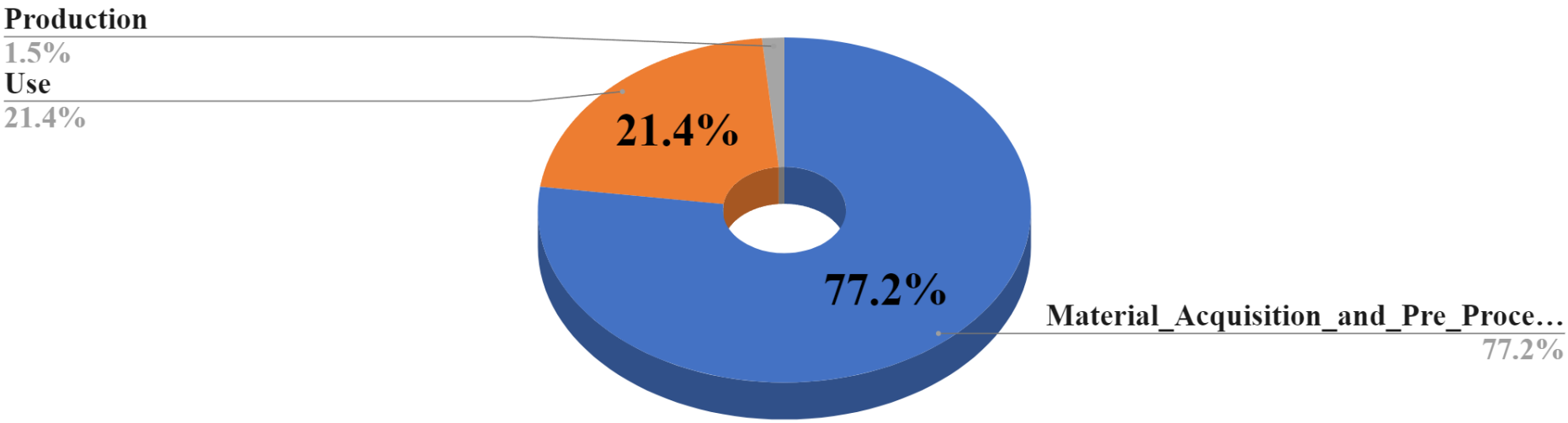
Chart 1 & Table 2 – GHG Emissions Summary by Lifecycle Stages



LIFECYCLE STAGE	EMISSIONS	UNITS	RANK	% CONTRIBUTION	CUMULATIVE %
Material_Acquisition_and_Pre_Processing	349,693	kg CO2e/apt	1	77.2	77.16
Use	96,897	kg CO2e/apt	2	21.4	98.54
Production	6,625	kg CO2e/apt	3	1.5	100
Total	453,214	kg CO2e/apt		100	

Table 3 – GHG Emissions Summary by Activity Group

LIFECYCLE STAGE	EMISSIONS	UNITS	RANK	% CONTRIBUTION	CUMULATIVE %
Materials	293,291	kg CO2e/apt	1	64.7	64.71
Energy	97,552	kg CO2e/apt	2	21.5	86.24
Mobility	28,906	kg CO2e/apt	3	6.4	92.62
Waste	24,008	kg CO2e/apt	4	5.3	97.91
Industrial_Processes_and_Product_Use	5,277	kg CO2e/apt	5	1.2	99.08
Water	4,180	kg CO2e/apt	6	0.92	100
Total	453,214	kg CO2e/apt		100	

Chart 2 – GHG Emissions Summary by Activity Group

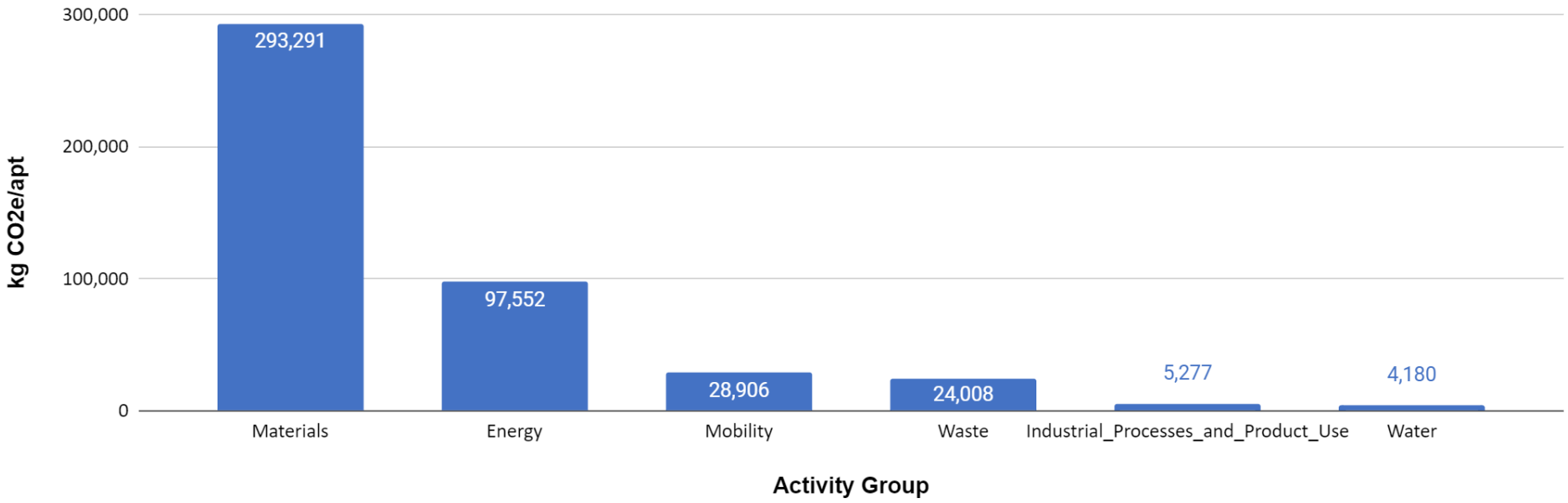


Table 4 – GHG Emissions Summary by Activity Sub-Group

ACTIVITY SUB-GROUP	EMISSIONS	UNITS	RANK	% CONTRIBUTION	CUMULATIVE %
Construction	184,714	kg CO2e/apt	1	40.8	40.76
Electricity	68,235	kg CO2e/apt	2	15.1	55.81
Metals	61,237	kg CO2e/apt	3	13.5	69.32
Other_Materials	47,070	kg CO2e/apt	4	10.4	79.71
Logistics_and_Freight	28,906	kg CO2e/apt	5	6.4	86.09
Solid_Waste_Disposal	23,814	kg CO2e/apt	6	5.3	91.34
Electricity_TandD_Losses	23,221	kg CO2e/apt	7	5.1	96.47
ODS_Substitutes	5,277	kg CO2e/apt	8	1.2	97.63
Other_Water	4,180	kg CO2e/apt	9	0.9	98.55
Fuel_Combustion_Activities	3,643	kg CO2e/apt	10	0.8	99.36
Electricity_Upstream_Emissions	2,453	kg CO2e/apt	11	0.5	99.90
Glass	245	kg CO2e/apt	12	0.1	99.95
Wastewater_Treatment_and_Discharge	194	kg CO2e/apt	13	0	99.99
Plastics	25	kg CO2e/apt	14	0	100
Fugitive_Emissions	0	kg CO2e/apt	15	0	100
Total	453,214	kg CO2e/apt		100	

Chart 3 – GHG Emissions Summary by Activity Sub-Group

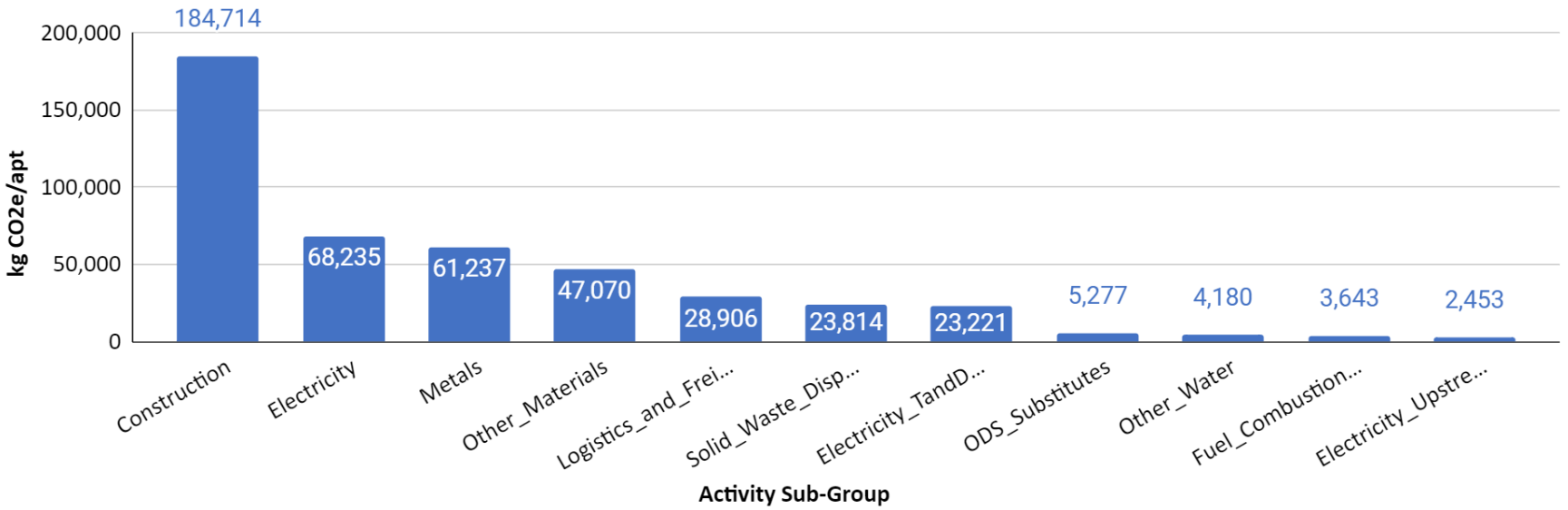


Table 5 – GHG Emissions by Activity Type – Top 10 Contributors

Emission Category	Emissions (kg CO2e/apt-lifetime)	Ranking	% Contribution	% Cumulative
TOTAL	**453,214**		**100%**	**100%**
Cement	95,205	1	21	21.01
Grid_Electricity	68,235	2	15.1	36.06
Steel	59,484	3	13.1	49.19
Electrical_Equipment	42,920	4	9.5	58.66
Masonry	39,486	5	8.7	67.37
Earthwork	30,995	6	6.8	74.21
Unmanaged_Waste_Disposal_Sites	23,814	7	5.3	79.46
Grid_Electricity_Losses	23,221	8	5.1	84.59
MMV	20,194	9	4.5	89.04
Stone	9,573	10	2.1	91.15

Chart 4 – GHG Emissions Summary by Activity Type

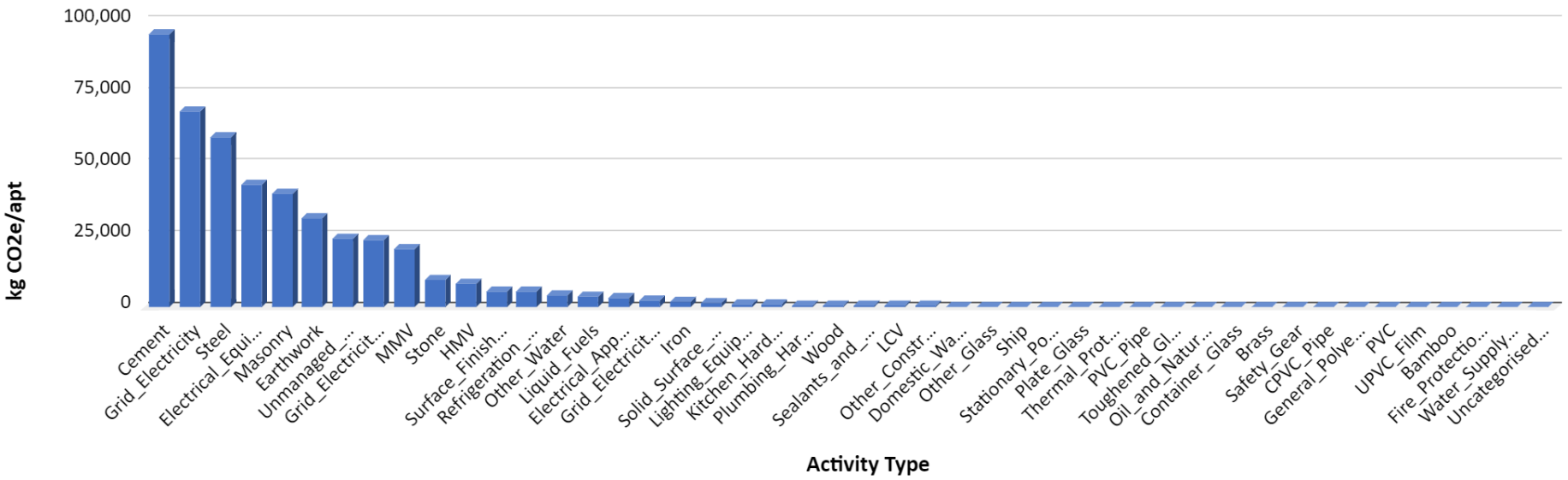


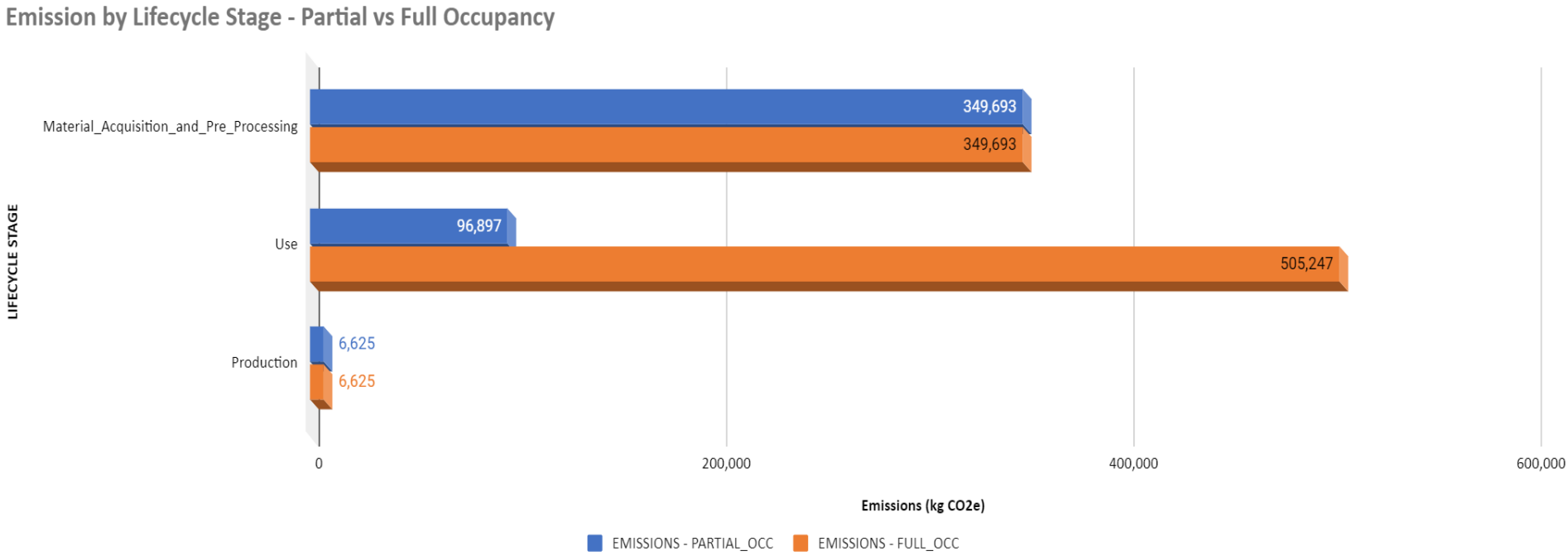
Table 6 – GHG Emissions Summary by Activity Type (1)

ACTIVITY TYPE	EMISSIONS	UNITS	RANK	% CONTRIBUTION	CUMULATIVE %
Cement	95,205	kg CO2e/apt	1	21	21.01
Grid_Electricity	68,235	kg CO2e/apt	2	15.1	36.06
Steel	59,484	kg CO2e/apt	3	13.1	49.19
Electrical_Equipment	42,920	kg CO2e/apt	4	9.5	58.66
Masonry	39,486	kg CO2e/apt	5	8.7	67.37
Earthwork	30,995	kg CO2e/apt	6	6.8	74.21
Unmanaged_Waste_Disposal_Sites	23,814	kg CO2e/apt	7	5.3	79.46
Grid_Electricity_Losses	23,221	kg CO2e/apt	8	5.1	84.59
MMV	20,194	kg CO2e/apt	9	4.5	89.04
Stone	9,573	kg CO2e/apt	10	2.1	91.15
HMV	8,144	kg CO2e/apt	11	1.8	92.95
Surface_Finishing	5,584	kg CO2e/apt	12	1.2	94.18
Refrigeration_and_Air_Conditioning	5,277	kg CO2e/apt	13	1.2	95.35
Other_Water	4,180	kg CO2e/apt	14	0.92	96.27
Liquid_Fuels	3,643	kg CO2e/apt	15	0.8	97.07
Electrical_Appliance	3,229	kg CO2e/apt	16	0.71	97.79
Grid_Electricity_Supply_Chain	2,453	kg CO2e/apt	17	0.54	98.33
Iron	1,754	kg CO2e/apt	18	0.39	98.72
Solid_Surface_Material	1,290	kg CO2e/apt	19	0.28	99
Lighting_Equipment	845	kg CO2e/apt	20	0.19	99.19
Kitchen_Hardware	724	kg CO2e/apt	21	0.16	99.35
Plumbing_Hardware	631	kg CO2e/apt	22	0.14	99.49

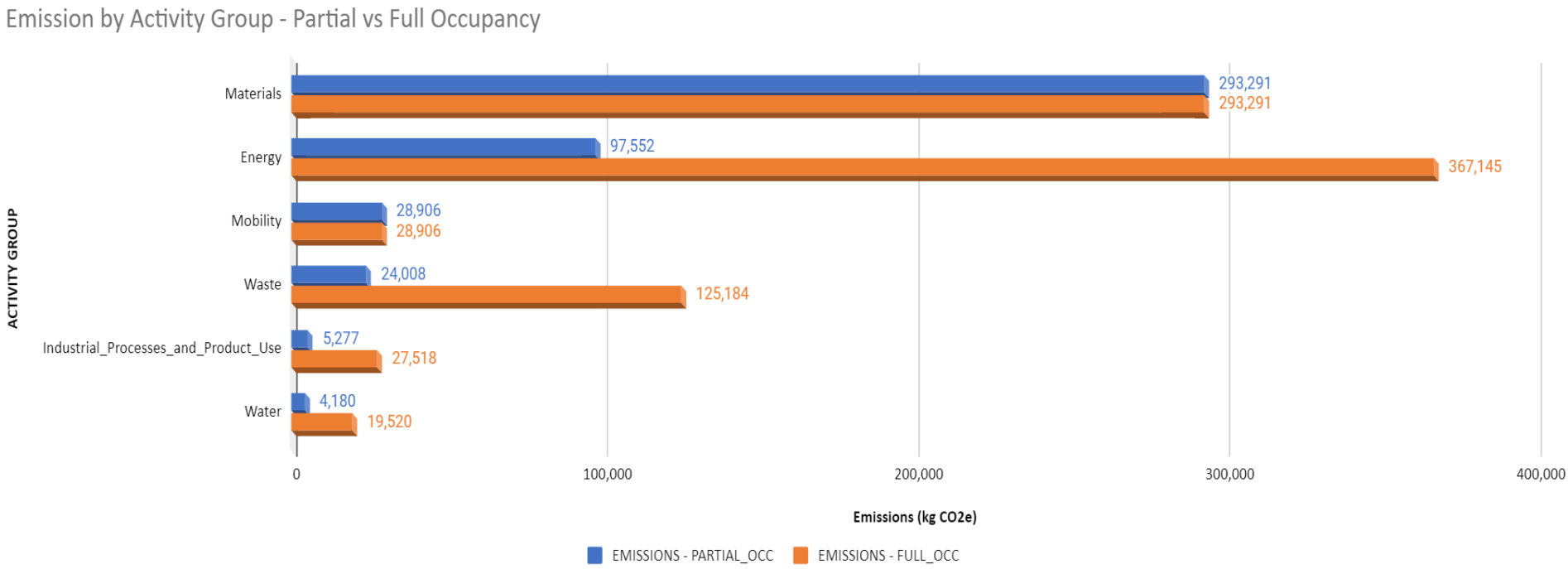
Table 6 – GHG Emissions Summary by Activity Type (2)

ACTIVITY TYPE	EMISSIONS	UNITS	RANK	% CONTRIBUTION	CUMULATIVE %
Wood	461	kg CO2e/apt	23	0.1	99.59
Sealants_and_Adhesives	417	kg CO2e/apt	24	0.09	99.68
LCV	397	kg CO2e/apt	25	0.09	99.77
Other_Construction	314	kg CO2e/apt	26	0.07	99.84
Domestic_Wastewater	194	kg CO2e/apt	27	0.04	99.88
Other_Glass	181	kg CO2e/apt	28	0.04	99.92
Ship	171	kg CO2e/apt	29	0.04	99.96
Stationary_Power_Generation	76	kg CO2e/apt	30	0.02	99.97
Plate_Glass	41	kg CO2e/apt	31	0.01	99.98
Thermal_Protection	33	kg CO2e/apt	32	0.01	99.99
PVC_Pipe	25	kg CO2e/apt	33	0.01	99.99
Toughened_Glass	23	kg CO2e/apt	34	0.01	100
Oil_and_Natural_Gas_Fugitive_Emissions	0	kg CO2e/apt	35	0	100
Container_Glass	0	kg CO2e/apt	36	0	100
Brass	0	kg CO2e/apt	37	0	100
Safety_Gear	0	kg CO2e/apt	38	0	100
CPVC_Pipe	0	kg CO2e/apt	39	0	100
General_Polyethelyne	0	kg CO2e/apt	40	0	100
PVC	0	kg CO2e/apt	41	0	100
UPVC_Film	0	kg CO2e/apt	42	0	100
Bamboo	0	kg CO2e/apt	43	0	100
Fire_Protection_Material	0	kg CO2e/apt	44	0	100
Water_Supply_Material	0	kg CO2e/apt	45	0	100
Uncategorised_Waste_Disposal_Sites	0	kg CO2e/apt	46	0	100

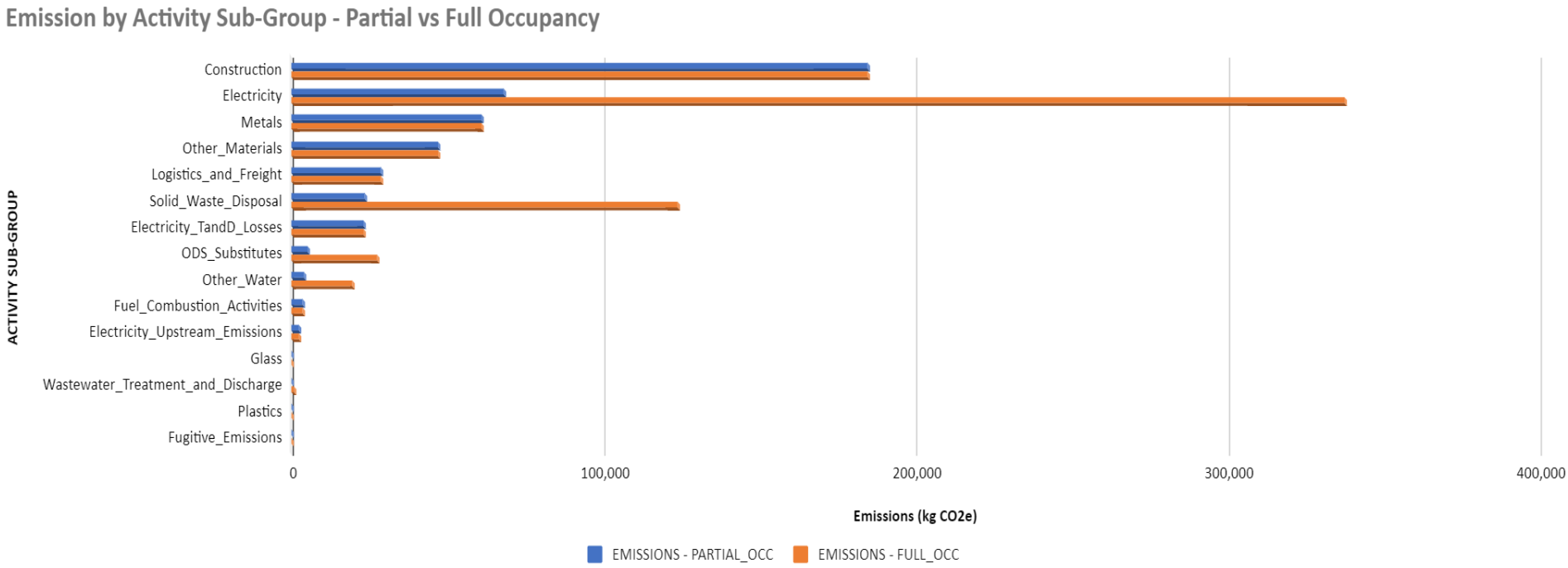
Impact of Occupancy: Lifecycle Stage view



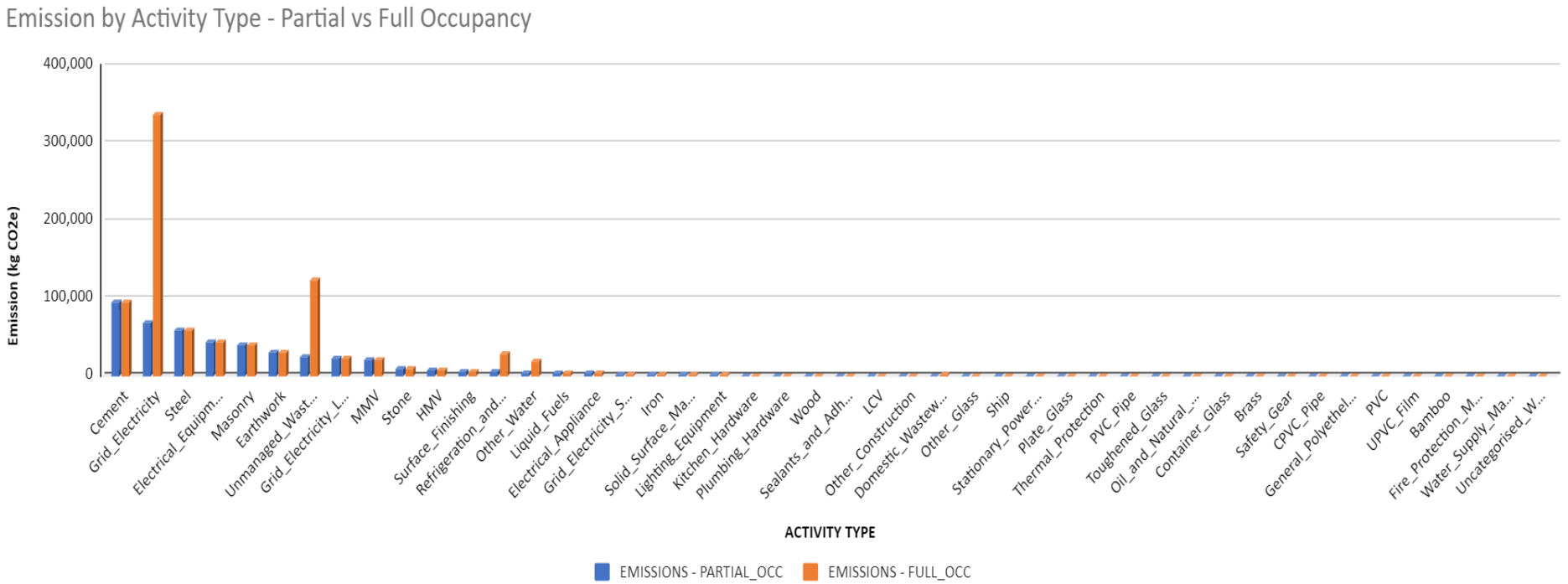
Impact of Occupancy: Activity Group view



Impact of Occupancy: Activity Sub-Group view



Impact of Occupancy: Activity Type view



POTENTIAL USE-PHASE CLIMATE POLLUTION REDUCTION – SCENARIO ANALYSIS

Scenario Modelling: Energy

Electricity emissions and potential savings during the use phase with partial occupancy: per apt-lifetime

Project Name	Built-Up Area (m2)	No. of dwellings	Estimated EPI (kWh/m2-year) - BAU	Estimated EPI (kWh/m2-year) - Intervention	Electricity (kWh/apt/lifetime) - Savings	Emissions (ton CO2e/apt/lifetime)- Savings
Villa 2	2,560	10	56	41	18,411	19
Villa 1	2,175	6	56	41	26,070	27
Villa 3	936	6	56	41	11,219	12
Villa 5	374	1	56	41	26,897	28
Villa 4	380	1	56	41	27,329	28
Grand Total	**6,425**	**24**	**56**	**41**	**Avg.: 21,985**	**Avg. 22.9**

Scenario Modelling: Energy

Electricity emissions and potential savings during the use phase with partial occupancy: per apt-year

Project Name	Built-Up Area (m2)	No. of dwellings	Estimated EPI (kWh/m2-year) - BAU	EPI (kWh/m2-year) - Intervention	Electricity (kWh/apt/year) - Savings	Emissions (tonCO2e/apt/year) - Savings
Villa 2	2,560	10	56	41	736	0.8
Villa 1	2,175	6	56	41	1,043	1.1
Villa 3	936	6	56	41	449	0.5
Villa 5	374	1	56	41	1,076	1.1
Villa 4	380	1	56	41	1,093	1.1
Grand Total	**6,425**	**24**	**56**	**41**	**Avg.: 879**	**Avg.: 0.9**

Scenario Modelling: Water

Water consumption and potential savings during the use phase with partial occupancy: per apt-lifetime

Project Name	Water Consumption (litres/person/day) - Assumed	No. of dwelling units	Water Consumption (litres/person/day) - Stipulated	Water (liters/apt/lifetime) - Savings
Villa 2	260	10	135	8,75,000
Villa 1	260	6	135	8,75,000
Villa 3	260	6	135	8,75,000
Villa 5	260	1	135	8,75,000
Villa 4	260	1	135	8,75,000
Grand Total	**260**	**24**	**135**	**Avg. 8,75,000**

*Source: Water Consumption in Sustainable New Homes

Scenario Modelling: Water

Water consumption and potential savings during the use phase with partial occupancy: per apt-year

Project Name	Water Consumption (litres/person/day) - Estimated	No. of dwelling units	Water Consumption (litres/person/day) - Stipulated	Water (liters/apt/year) - Savings
Villa 2	260	10	135	35,000
Villa 1	260	6	135	35,000
Villa 3	260	6	135	35,000
Villa 5	260	1	135	35,000
Villa 4	260	1	135	35,000
Grand Total	**260**	**24**		**Avg.: 35,000**

*Source: Water Consumption in Sustainable New Homes

Scenario Modelling: Wastes

Annual solid waste generation and avoided emissions during use phase with partial occupancy: per apt-lifetime

Project Name	Waste generation quantity (kg/person/day) - Stipulated	No. of dwelling units	Total waste generated (kg/apt/lifetime) - Stipulated	Organic waste quantity (kg/apt/lifetime)	Emission (kgCO2e/apt/lifetime) - Savings
Villa 2	2.33	10	16,275	6,917	2,421
Villa 1	2.33	6	16,275	6,917	2,421
Villa 3	2.33	6	16,275	6,917	2,421
Villa 5	2.33	1	16,275	6,917	2,421
Villa 4	2.33	1	16,275	6,917	2,421
Average	**2.33**		**16,275**	**6,917**	**2,421**

Scenario Modelling: Wastes

Solid waste generation and avoided emissions during use phase with partial occupancy: per apt-year

Project Name	Waste generation quantity (kg/person/day) - Estimated	No. of dwelling units	Total waste generated (kg/apt/year) - Estimated	Organic waste quantity (kg/apt/year)	Emission (kgCO2e/apt/year) - Savings
Villa 2	2.33	10	651	277	97
Villa 1	2.33	6	651	277	97
Villa 3	2.33	6	651	277	97
Villa 5	2.33	1	651	277	97
Villa 4	2.33	1	651	277	97
Average	**2.33**		**651**	**277**	**97**

Recommendations

A. Electricity:

1. Average potential electricity savings if 3 Star EPI (kWh/m2/year) adopted in per apartment with partial occupancy is 0.9 tons CO2e/year and across all apartment is 5 tons CO2e/year.

2. Average savings for apartment-lifetime with partial occupancy is 23 tons CO2e and across all apartment is 114 tons CO2e

B. Water:

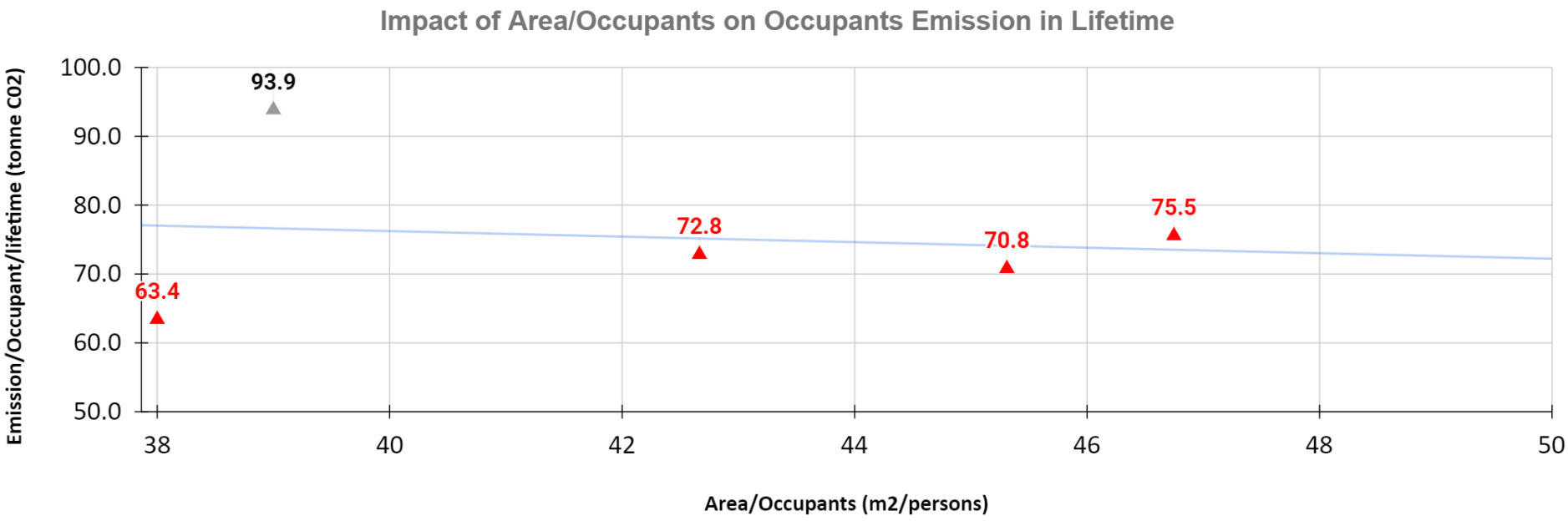
1. Average potential water savings achieved if Ministry of Housing and Urban Affairs (MOHU) water standard adopted in per apartment with partial occupancy is 35,000 liters/year and across all apartment is 1,75,000 liters/year.

2. Average savings for apartment-lifetime with partial occupancy is 8,75,000 liters and across all apartment is 43,75,000 litres

Additional Analysis – Impact of Area per Occupants (1)

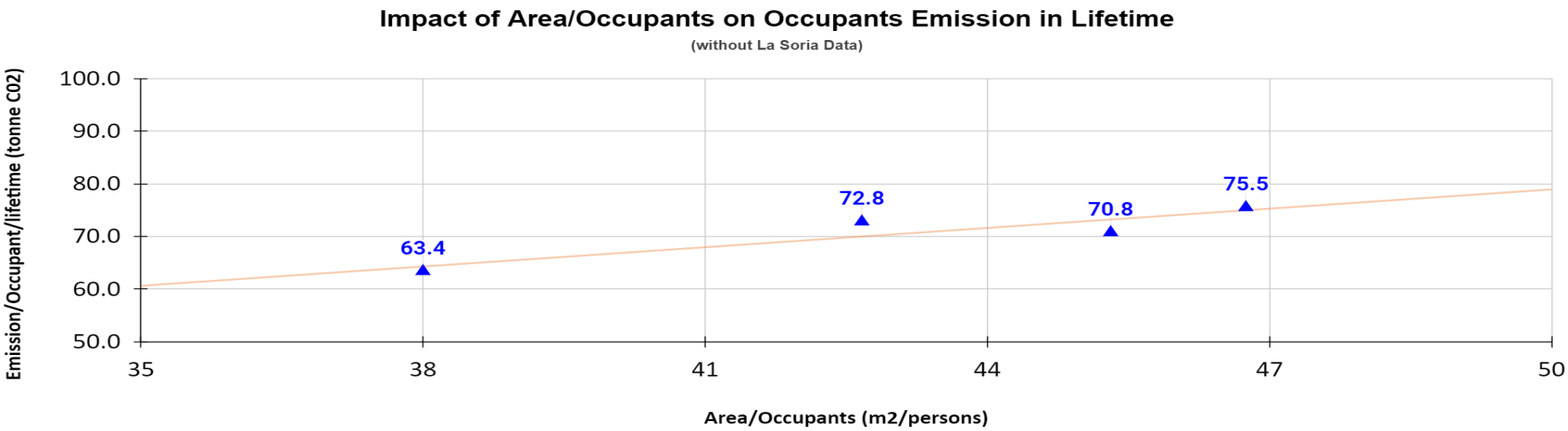
Project Name	Builtup_ Area/Project	Nos. of Villas/Project	Area/Villa	Occupants /Villa	Occupants/ Project	Nos. of Bedrooms/ Dwelling	Area/Bedroom	Area /Occupant	GHG Emissions/Villa /lifetime
Units	m2	Nos.	m2/villa	persons/villa	persons/project	Nos.	m2	m2/person	tonne C02e/villa/lifetime
Villa 4	380	1	380	10	10	5	76	38	63.4
Villa 3	936	6	156	4	24	2	78	39	93.9
Villa 2	2,560	10	256	6	60	3	85.3	42.7	72.8
Villa 1	2,175	6	363	8	48	4	90.6	45.3	70.8
Villa 5	374	1	374	8	8	4	93.5	46.8	75.5

Additional Analysis – Impact of Area per Occupants (2)



Inference: From above chart, we can that there is an outlier point (93.9) and it is for project 'La Soria'. After analyzing the given dataset, one possible reason for this outlier could be that the input quantity data for few activities, are heavier on 'La Soria' side than other projects (Few Eg: Corian Bianco stones, Texin Tiles, Sand). Hence this trend cannot be taken to be true.

Additional Analysis – Impact of Area per Occupants (3)



Inference: From the above chart the outlier data point has been removed and can observe that a gentle upward trend is being created and see that as area/occupants increases, the corresponding emissions (i.e. negative climate impact) of occupants also increases. However, with the limited data points available for this analysis, we cannot confirm this trend fully. However, we think, in later phases, as we work with bigger datasets, this trend would most likely to be amplified.

And hence, the 'right-sizing' of space-use per capita (i.e. sq.ft. area per resident) and concomitant structural transformations that facilitate the adoption of best-practices by residents for waste reduction , water and energy conservations at source in 'Use' phases, will become vital for Vianaar to authentically address its climate impact.