GREEN HOUSING

DESIGNING FOR GREATER EFFICIENCY

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Excellence In Design For Greater Efficiencies

Edge

IFC International Finance Corporation
WORLD BANK GROUP

Creating Markets, Creating Opportunities

BUILDING DATA
Location

Location Data

Enter Context Data

Country	Vietnam
City	Ho Chi Minh
Income Category	Lower Middle

Building Data

Enter Building Data

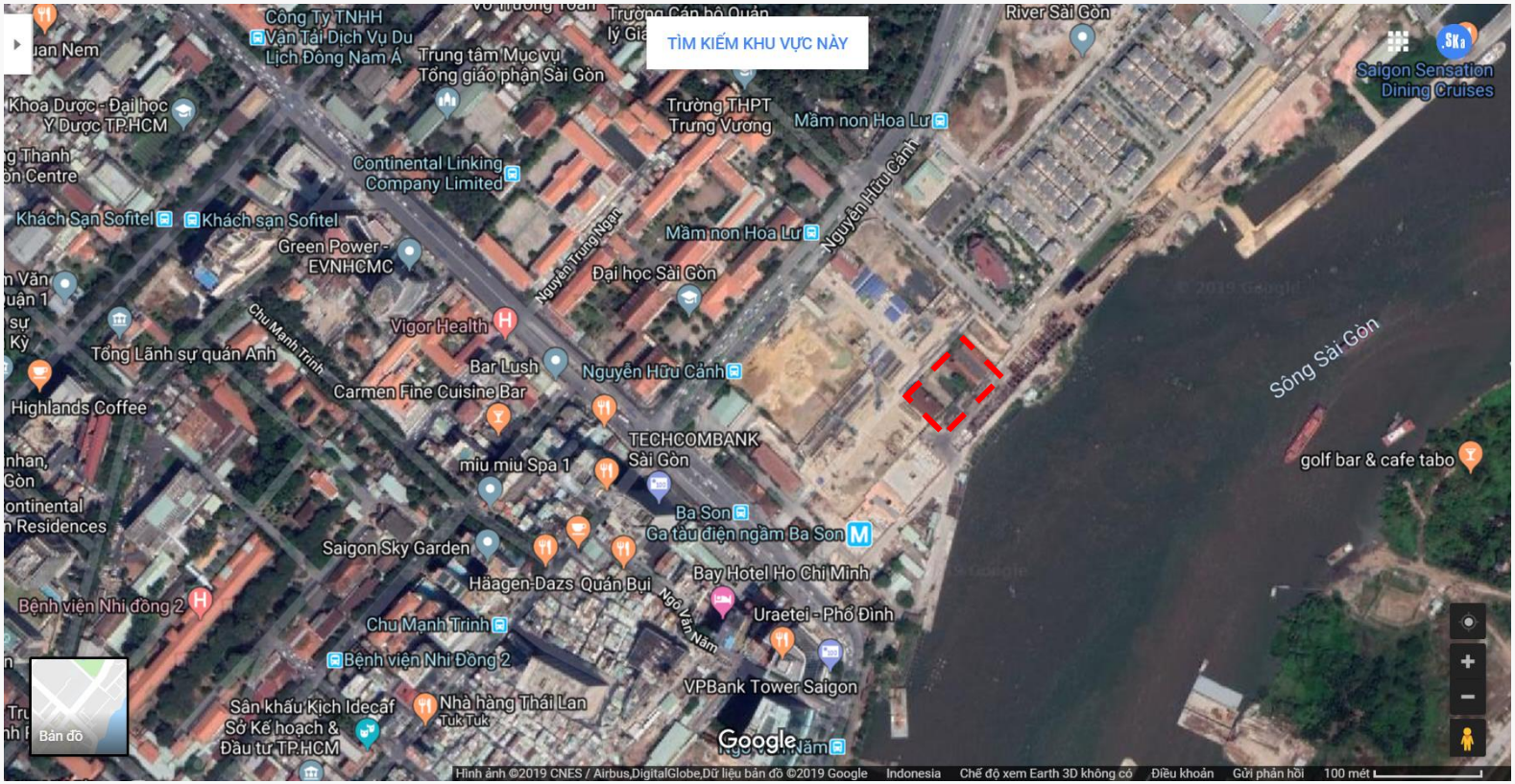
Type of Unit	Flats/Apartments	
Average Unit Area	50	m²
Bedrooms/Unit	2	no.
Floors	7	no.
Units	100	no.
Occupancy (People/Unit)	4	no.

Area Details

	Default	*User Entry*	
Bedroom	19		m²
Kitchen	6		m²
Living/Dining	18		m²
Bathroom	3		m²
Utility, Balcony, Service Shaft**	3.75		m²
Gross Internal Area	50		m²
External Wall Length m/Unit	8		m
Roof Area/Unit	7		m²
Window to Floor Ratio	13.6%		
Common Area/Unit	13		m²

**The Utility, Balcony, Service Shaft (m²) field is equal to the remaining space required to total the Gross Internal Area (m²).

BUILDING DATA
Location



DESIGN
Floor Plan

Site Plan

Floor Plan

DESIGN
Façade

South East Elevation

North East Elevation

South West Elevation

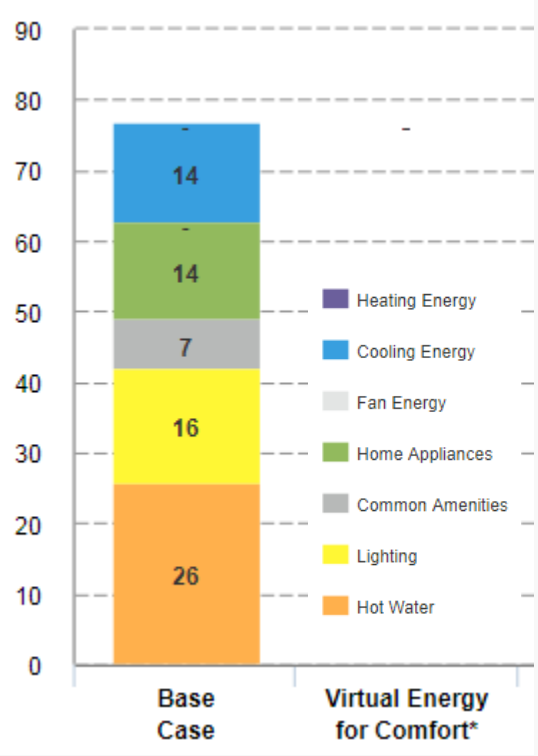
North West Elevation

DESIGN
Building Shape

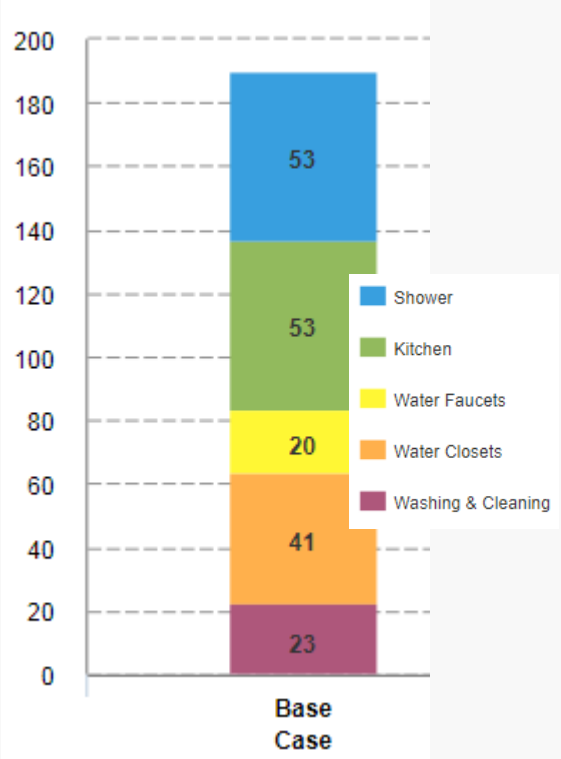
Isometric View

SIMULATION
Initial Use

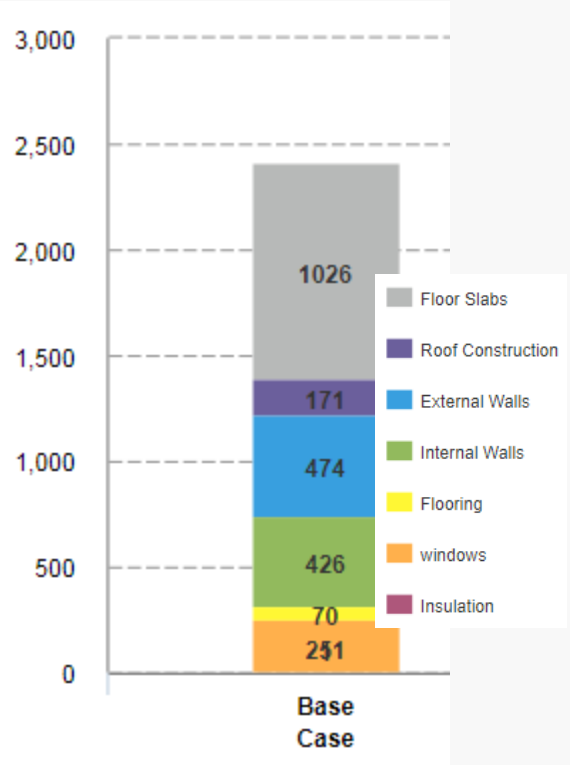
Energy



Water



Material



SIMULATION
Construction Strategy

Materials Efficiency Measures

Choose building material options to achieve savings of at least 20%, indicating thickness.

Ref	Building Material		Improved Case Selection	Proportion %	*Thickness*	*Steel Rebar*
HMM01*	Floor Slabs Upload Document(s)		In-Situ Reinforced Concrete Slab ▼		mm	kg/m²
HMM02*	Roof Construction Upload Document(s)	Type 1	In-Situ Reinforced Concrete Slab ▼	100 %	mm	kg/m²
HMM03*	External Walls Upload Document(s)	Type 1	Common Brick Wall with Internal & External Plast ▼	100 %	mm	
HMM04*	Internal Walls Upload Document(s)	Type 1	Common Brick Wall with Plaster on Both Sides ▼	100 %	mm	
HMM05*	Flooring Upload Document(s)	Type 1	Ceramic Tile ▼	100 %		
HMM06*	Window Frames Upload Document(s)	Type 1	Aluminium ▼	100 %	Single Glazing	

SIMULATION
Construction Strategy

Materials Efficiency Measures

Choose building material options to achieve savings of at least 20%, indicating thickness.

Ref	Building Material		Improved Case Selection	Proportion %	*Thickness*	*Steel Rebar*
HMM01*	Floor Slabs Upload Document(s)		Hollow Core Precast Slab ▼		150 mm	kg/m²
HMM02*	Roof Construction Upload Document(s)	Type 1	Hollow Core Precast Slab ▼	100 %	150 mm	kg/m²
HMM03*	External Walls Upload Document(s)	Type 1	Exposed Cored (with Holes) Bricks with Internal F ▼	100 %	150 mm	
HMM04*	Internal Walls Upload Document(s)	Type 1	Cored (with Holes) Bricks with Plaster on Both Si ▼	100 %	150 mm	
HMM05*	Flooring Upload Document(s)	Type 1	Terracotta Tiles ▼	100 %		
HMM06*	Window Frames Upload Document(s)	Type 1	Timber ▼	100 %	Single Glazing	

SIMULATION
Construction Strategy

Hollow Core Precast Slab

Terracotta Tiles

Exposed Cored (with holes)

Timber

SIMULATION
Passive Design Strategy

HME01 - Reduced Window-to-Wall Ratio Calculator

Orientation	Wall Area (m²) Example: 120	Glazing Area (m²) Example: 60	Ratio in %
North			
South			
East			
West			
Northeast	450.00	169.65	37.70
Northwest	930.00	215.10	23.13
Southeast	930.00	297.90	32.03
Southwest	450.00	128.25	28.50
Total	2,760.00	810.90	
		WWR	29.38%

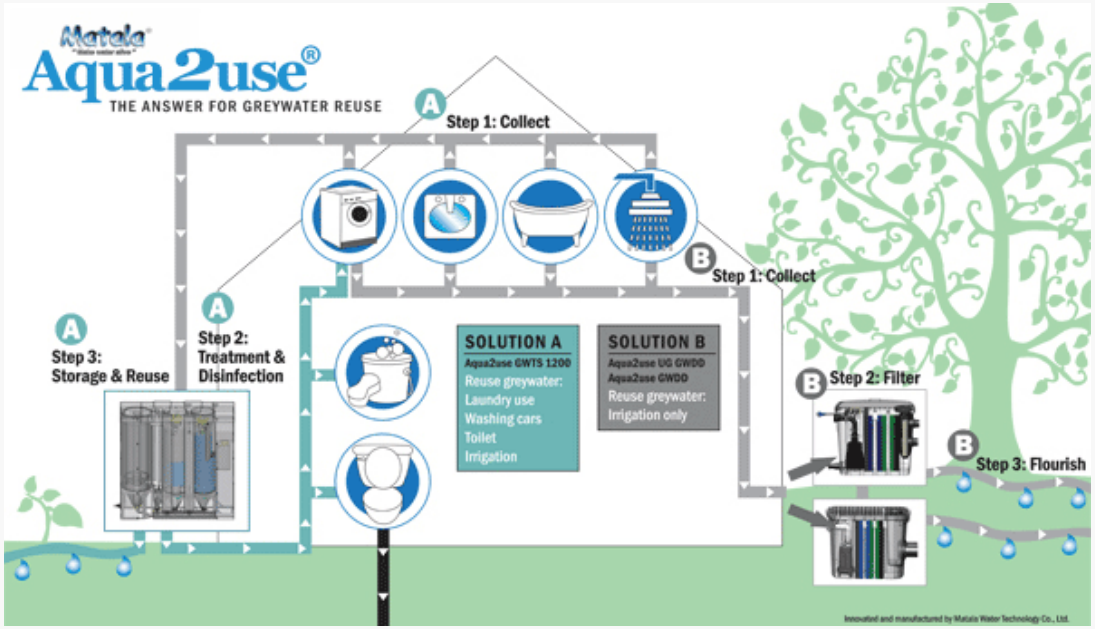
SIMULATION
Passive Design Strategy

Combined Overhang

Window Type	Window Orientation	Window Area (m^2)	Overhang Type	Overhang Depth	AASF
Type 1	Northwest	1.6	Combined Overhang	Dh=H/2 & Dv=W/2 (horiz. overhang=1/2 window ht, vert. overhang=1/	0.6
Type 2	Northeast	1.6	Combined Overhang	Dh=H/2 & Dv=W/2 (horiz. overhang=1/2 window ht, vert. overhang=1/	0.59
Type 3	Southeast	1.6	Combined Overhang	Dh=H/2 & Dv=W/2 (horiz. overhang=1/2 window ht, vert. overhang=1/	0.56
Type 4	Southwest	1.6	Combined Overhang	Dh=H/2 & Dv=W/2 (horiz. overhang=1/2 window ht, vert. overhang=1/	0.57

SIMULATION
Passive Design Strategy

Grey Water Filtration



SIMULATION
Active Design Strategy

High-Efficiency Boiler for Hot Water - Efficiency of 95%

BAXI Luna DUO-TEC Series

Features:
Modulating condensing boilers. Available in Central Heating- 1.33GA, 1.48GA (125, 164 MBH) & Combi- 40GA, 60GA (150, 205 MBH). DHW flow rate 3.9, 5.0 GPM @ 70°F ΔT./td>

Controller:
THINK combustion management system. Two buttons to set up boiler. Technology recognizes Natural or LP & continuously monitors combustion as well as adjusting gas and air flow./td>

Energy-Saving Light Bulbs - Internal Spaces

SIMULATION
Active Design Strategy

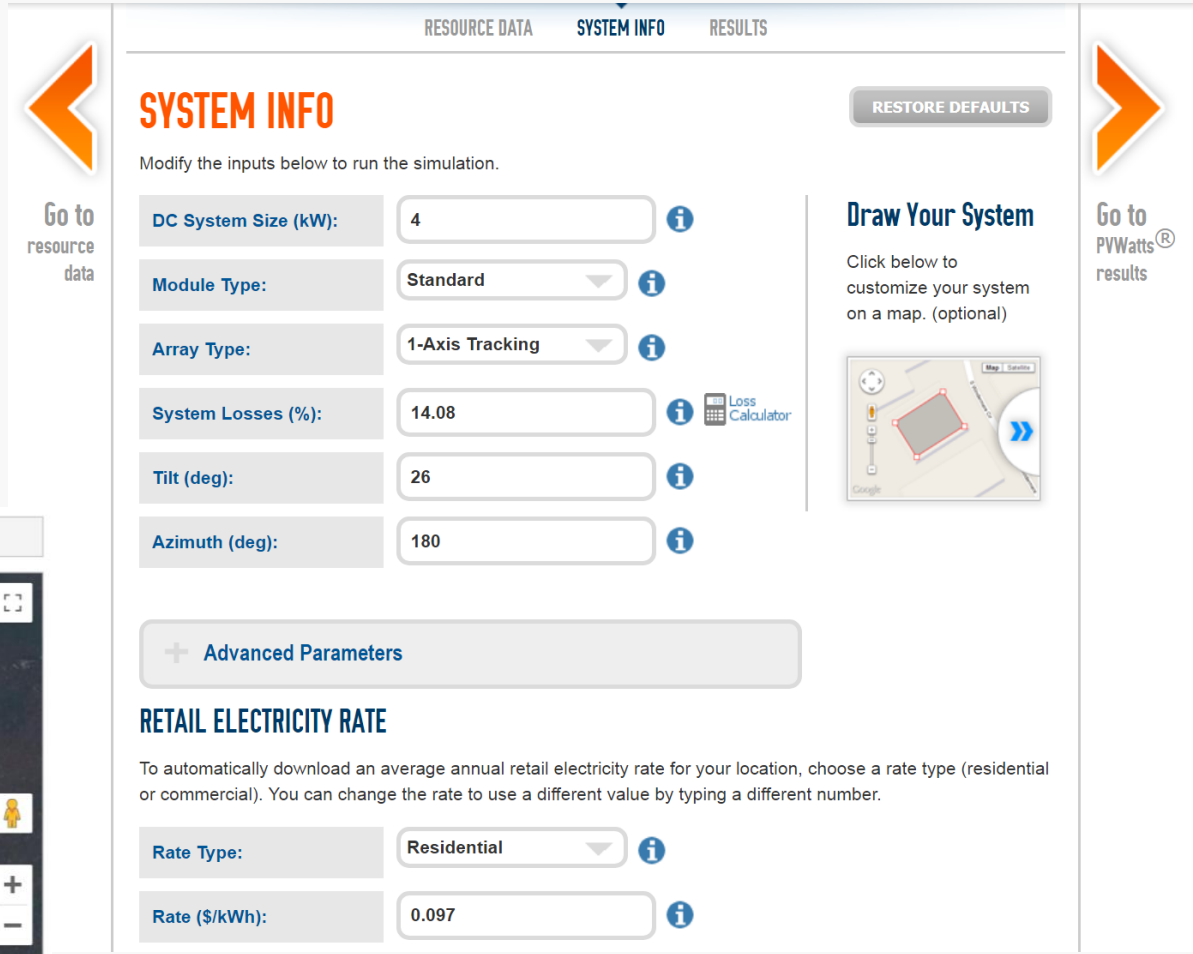
Low-Flow Showerheads - 4.7 L/min

Low-Flow Faucets for Kitchen Sinks - 1.9 L/min

Low-Flow Faucets in All Bathrooms - 1.9 L/min

SIMULATION
Active Design Strategy

- Lat, Lon: 11.25, 97.95
- Musim dingin: 10^0~19^0 + 15^0 = 25^0~34^0
- Musim panas: 10^0~19^0 – 15^0 = 0^0~4^0
- Kemiringan sekitar 26^0



PVWatts® Calculator

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

My Location | *ho chi minh* » Change Location | HELP | FEEDBACK | ALL NREL SOLAR TOOLS

RESOURCE DATA | SYSTEM INFO | RESULTS

Go to system info

RESULTS

Print Results

6,731 kWh/Year*

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Value ($)
January	7.74	707	69
February	8.14	664	64
March	7.74	697	68
April	7.57	656	64
May	4.82	445	43
June	4.33	397	38
July	3.90	371	36
August	4.69	443	43
September	4.80	433	42
October	6.32	573	56
November	7.61	671	65
December	7.28	675	65
Annual	6.25	6,732	$ 653

DC to AC Size Ratio	1.2
Ground Coverage Ratio	0.4

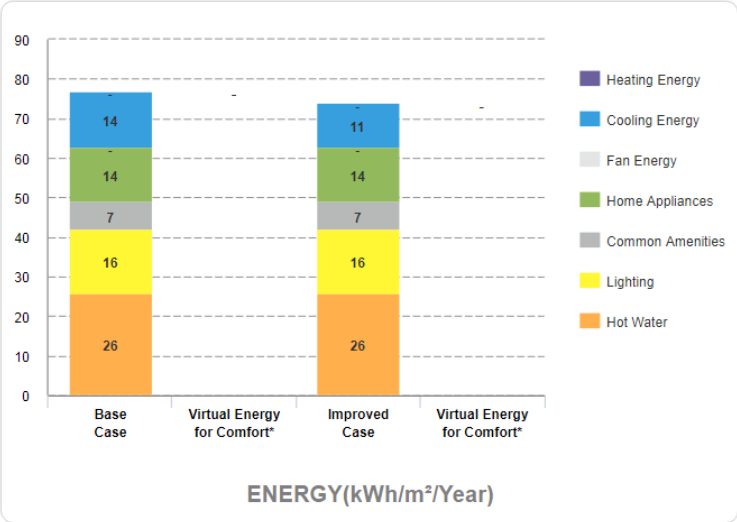
Economics

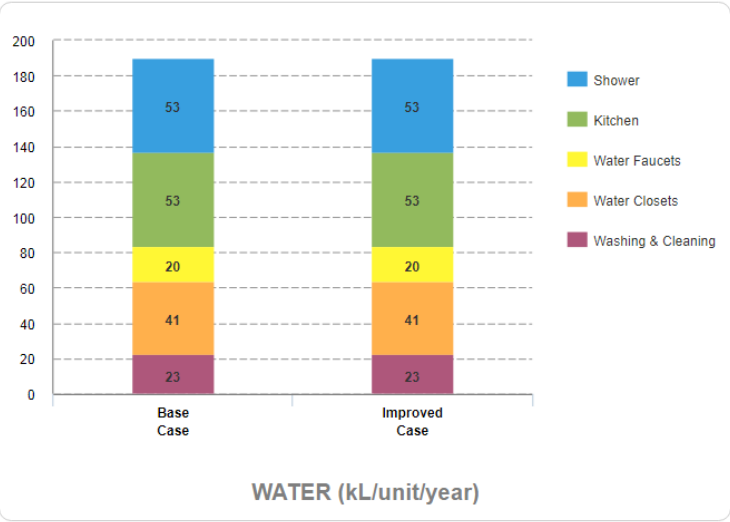
Average Retail Electricity Rate	0.097 $/kWh

Performance Metrics

Capacity Factor	19.2%

SIMULATION
Initial Use



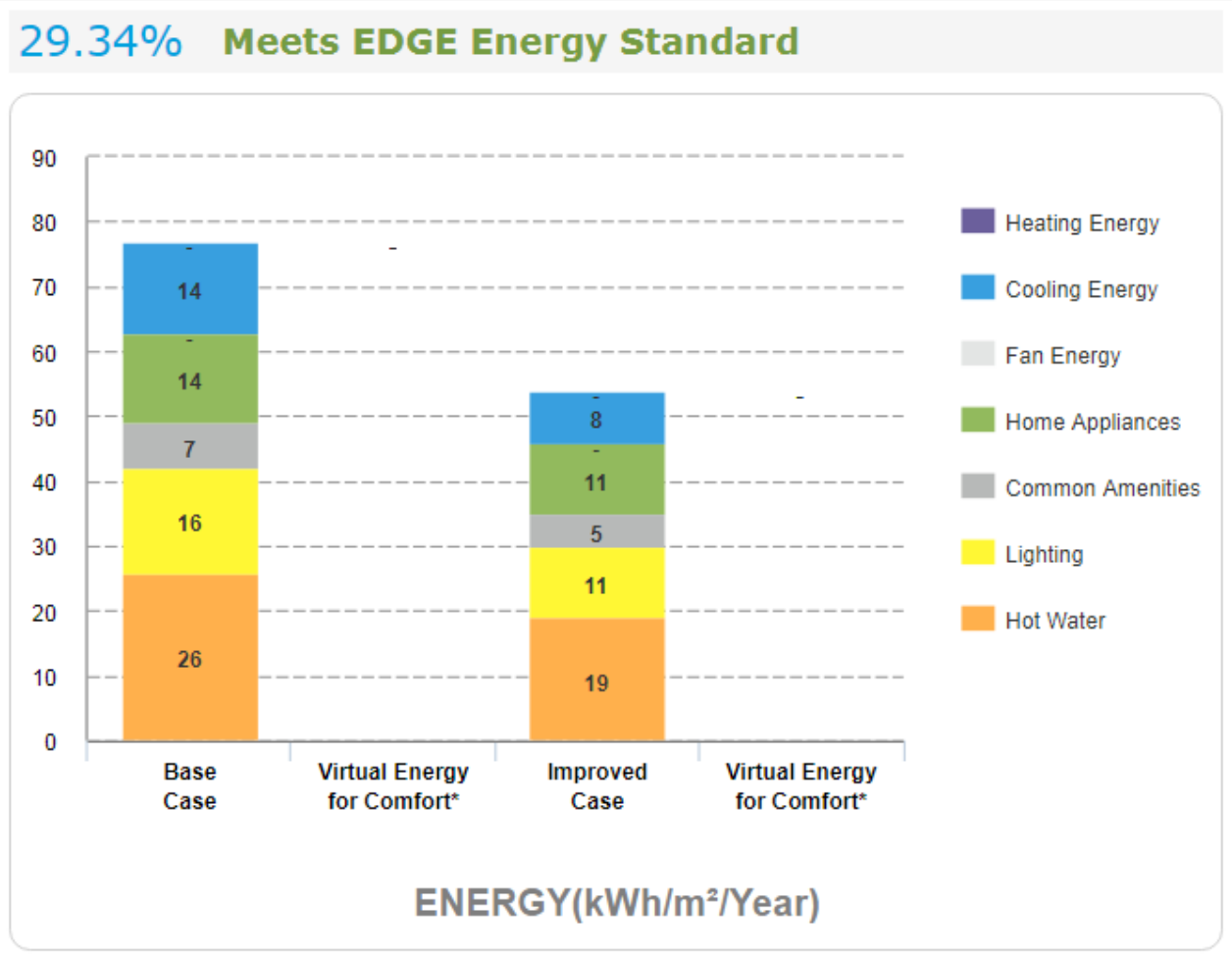


Final Energy Use for 100 units	384,528.00	kWh/Year
Final Energy Use	320.44	kWh/Month/Unit
Final Water Use	15.79	kL/Month/Unit
Operational CO_2 Savings	-	tCO_2/Year/Unit
Embodied Energy Savings	-	MJ/Unit
Base Case Utility Cost	773,801.88	VND/Month/Unit
Utility Cost Reduction	-	VND/Month/Unit
Incremental Cost	-	VND/Unit
Payback in Years	-	Years

SIMULATION
Energy Use

Design Strategies	Embodied Energy Savings (%)	Final Energy Use for 100 units/Year (kWh/Year)	Final Energy Use (kWh/Month/Unit)	Final Water Use (kL/Month/Unit)	Operational CO_2 Savings (tCO_2/Year/Unit)	Embodied Energy Savings (MJ/Unit)	Base Case Utility Cost (VND/Month/Unit)	Utility Cost Reduction (VND/Month/Unit)	Incremental Cost (VND/Unit)	Payback in Years (Years)
Initial	-	384,528.00	320.44	15.79	-	-	773,801.88	-	-	-
Reduced Window to Wall Ratio - WWR of 29.38%	0.14	383,976.00	319.98	15.79	-	52.87	773,801.88	815.51	-532,691.41	
External Shading Devices - Annual Average Shading Factor (AASF) of 0.58	3.65	370,476.00	308.73	15.79	0.11	-	773,801.88	20,955.55	3,049,334.41	12.13
Energy-Saving Light Bulbs - Internal Spaces	5.76	362,388.00	301.99	15.79	0.18	-	773,801.88	33,019.07	2,262,860.75	5.71
Energy-Saving Light Bulbs - Common Areas and External Spaces	2.06	376,596.00	313.83	15.79	0.06	-		11,822.46	763,409.11	5.38
Solar Photovoltaics - 25% of Total Energy Demand	25.00	288,396.00	240.33	15.79	0.78	-	773,801.88	143,387.91	11,651,013.72	6.77
All energy based strategies	33.65	255,120.00	212.60	15.79	1.06	52.87	773,801.88	193,022.54	15,786,549.55	6.82

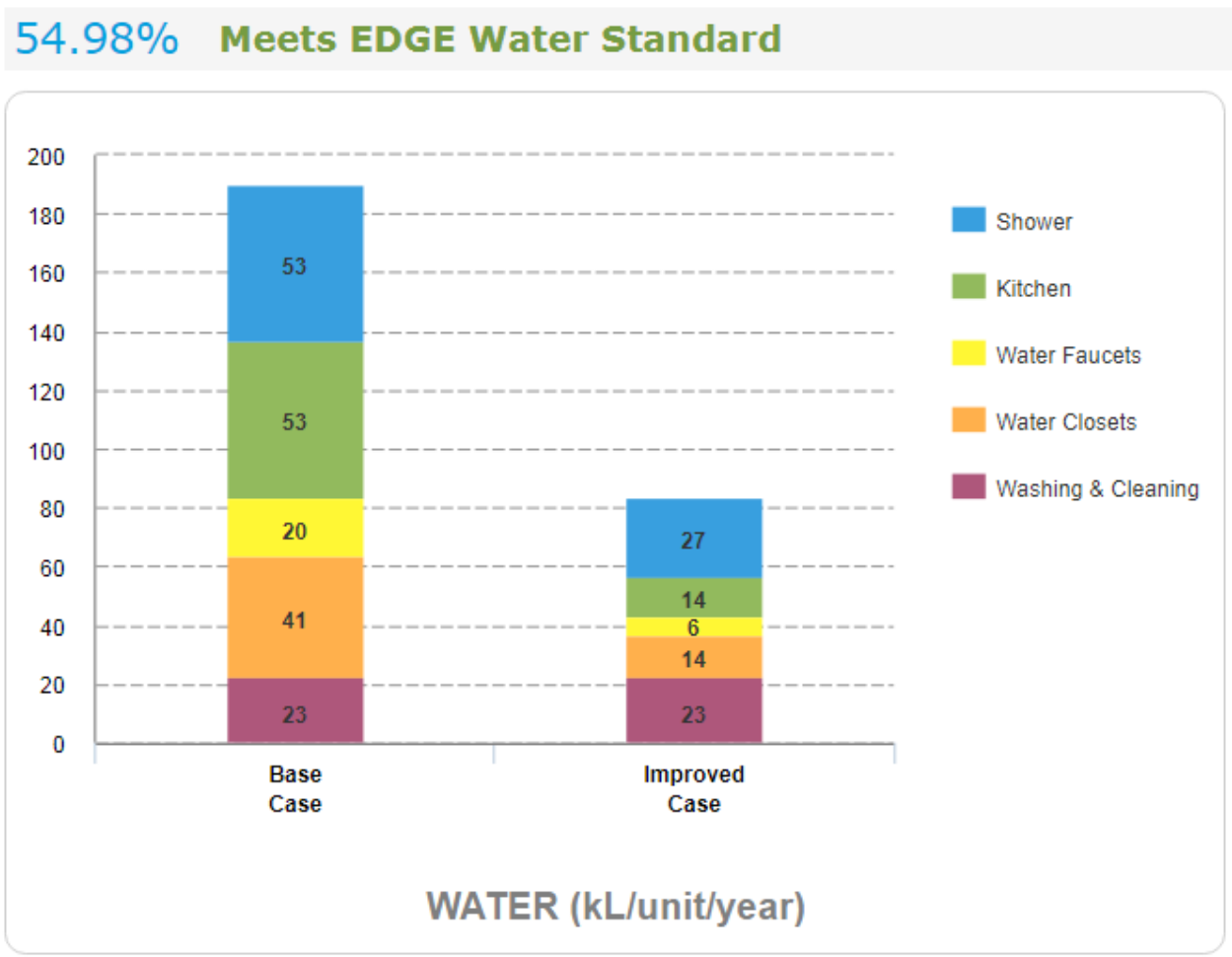
SIMULATION
Energy Use



SIMULATION
Water Use

Design Strategies	Embodied Energy Savings (%)	Final Energy Use for 100 units/Year (kWh/Year)	Final Energy Use (kWh/Month/Unit)	Final Water Use (kL/Month/Unit)	Operational CO_2 Savings (tCO_2/Year/Unit)	Embodied Energy Savings (MJ/Unit)	Base Case Utility Cost (VND/Month/Unit)	Utility Cost Reduction (VND/Month/Unit)	Incremental Cost (VND/Unit)	Payback in Years (Years)
Initial	-	384,528.00	320.44	15.79	-	-	773,801.88	-	-	-
Low-Flow Showerheads - 4.7 L/min	13.25	322,356.00	268.63	13.70	0.51	-	773,801.88	119,274.68	201,635.50	0.14
Low-Flow Faucets for Kitchen Sinks - 1.9 L/min	20.18	383,856.00	319.88	12.60	0.01	-	773,801.88	41,424.51	1,129,635.35	2.27
Low-Flow Faucets in All Bathrooms - 1.9 L/min	7.27	384,288.00	320.24	14.65	-	-	773,801.88	14,909.66	1,129,635.35	6.31
Recycled Grey Water for Flushing	21.57	386,700.00	322.25	12.39	-	-	773,801.88	39,962.05	1,718,299.20	3.58
All water based strategies	54.98	322,308.00	268.59	7.11	0.51	-	773,801.88	202,911.36	1,001,093.18	0.41

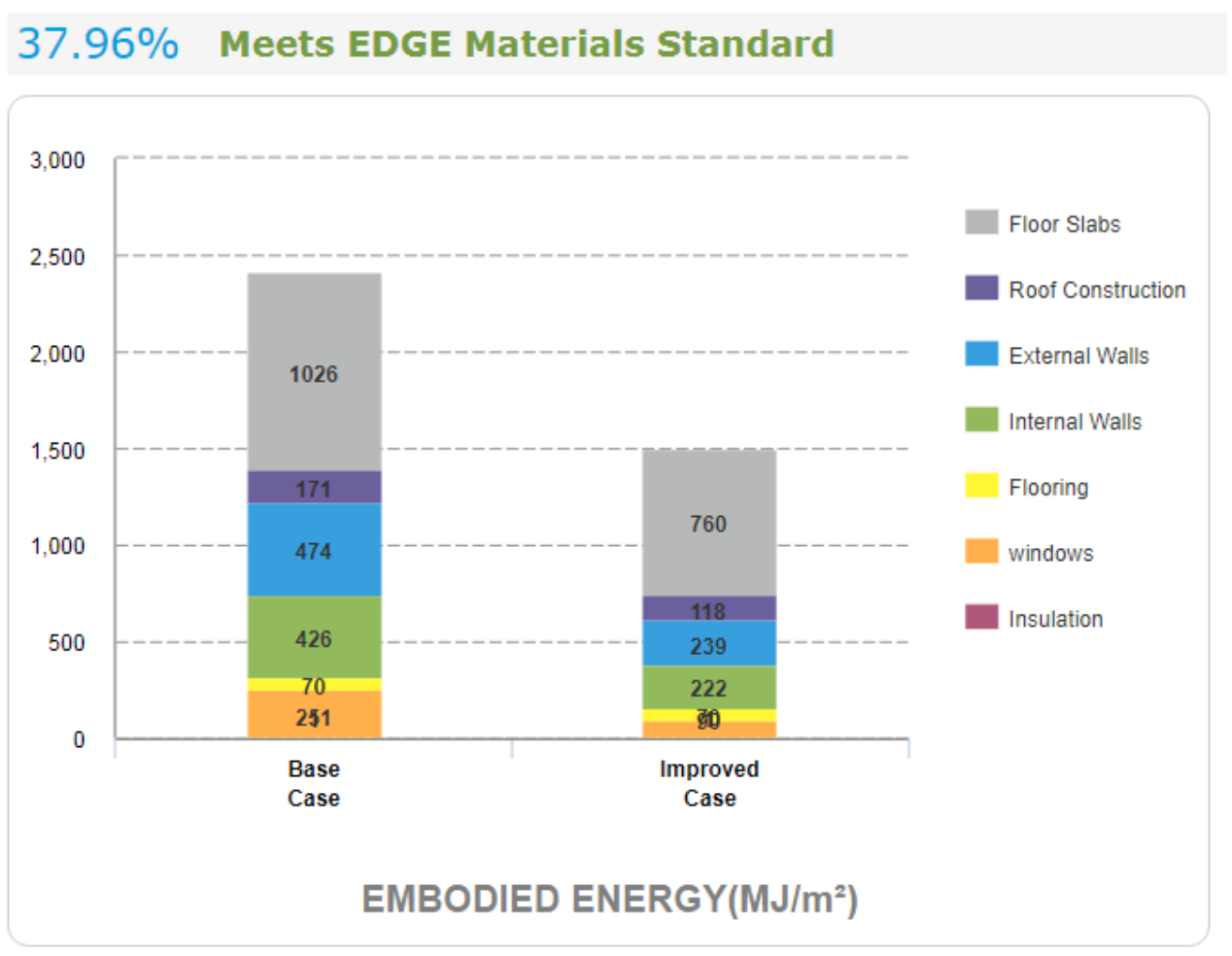
SIMULATION
Water Use



SIMULATION
Material Use

Design Strategies	Embodied Energy Savings (%)	Final Energy Use for 100 units/Year (kWh/Year)	Final Energy Use (kWh/Month/Unit)	Final Water Use (kL/Month/Unit)	Operational CO_2 Savings (tCO_2/Year/Unit)	Embodied Energy Savings (MJ/Unit)	Base Case Utility Cost (VND/Month/Unit)	Utility Cost Reduction (VND/Month/Unit)	Incremental Cost (VND/Unit)	Payback in Years (Years)
Initial	-	384,528.00	320.44	15.79	-	-	773,801.88	-	-	-
Floor Slabs - Hollow Core Precast Slab	11.01	384,528.00	320.44	-	-	14,372.74	773,801.88	-	-	-
Roof Construction - Hollow Core Precast Slab	2.19	388,176.00	323.48	-	-	2,858.37	773,801.88	-	-	-
External Walls - Exposed Core (with Holes) Bricks with Internal Plaster	9.38	386,160.00	321.80	-	-	12,253.37	773,801.88	-	-	-
Internal Walls - Cored (with Holes) with Plaster on Both Sides	8.40	384,528.00	320.44	-	-	10,971.15	773,801.88	-	-	-
Window Frames - Timber	6.63	384,528.00	320.44	-	-	8,662.73	773,801.88	-	-	-
All material based strategies	37.96	388,536.00	323.78	-	-	49,568.43	773,801.88	-5,988.61	1,560,553.37	-

SIMULATION
Material Use



SIMULATION
Mixed-Strategy Use

Design Strategies	Embodied Energy Savings (%)	Final Energy Use for 100 units/Year (kWh/Year)	Final Energy Use (kWh/Month/Unit)	Final Water Use (kL/Month/Unit)	Operational CO_2 Savings (tCO_2/Year/Unit)	Embodied Energy Savings (MJ/Unit)	Base Case Utility Cost (VND/Month/Unit)	Utility Cost Reduction (VND/Month/Unit)	Incremental Cost (VND/Unit)	Payback in Years (Years)
Initial	-	384,528.00	320.44	15.79	-	-	773,801.88	-	-	-
All energy & water strategies		208,452.00	173.71	7.11	1.44	52.87	773,801.88	372,731.21	14,902,303.78	3.33
All energy & material strategies		259,092.00	215.91	15.79	1.02	49,100.73	773,801.88	187,103.43	18,022,447.00	8.03
All water & material strategies		327,576.00	272.98	7.11	0.46	49,118.36	773,801.88	195,040.79	3,070,834.10	1.31
All strategies		212,424.00	177.02	7.11	1.44	9,100.73	773,801.88	366,812.10	17,138,201.22	3.89

SIMULATION
Final Use

Homes	Hospitality	Retail	

RESULTS

Final Energy Use	177.02	kWh/Month/Unit	Operational CO_2 Savings	1.40	tCO_2/Year...
Final Water Use	7.11	kL/Month/Unit	Embodied Energy Savings	49100.73	MJ/Unit

Base Case Utility Cost	773801.88	VND/Month...	Incremental Cost	17,138,201.	VND/...
Utility Cost Reduction	366,812.10	VND/Month...	Payback in Years	3.89	Yrs.