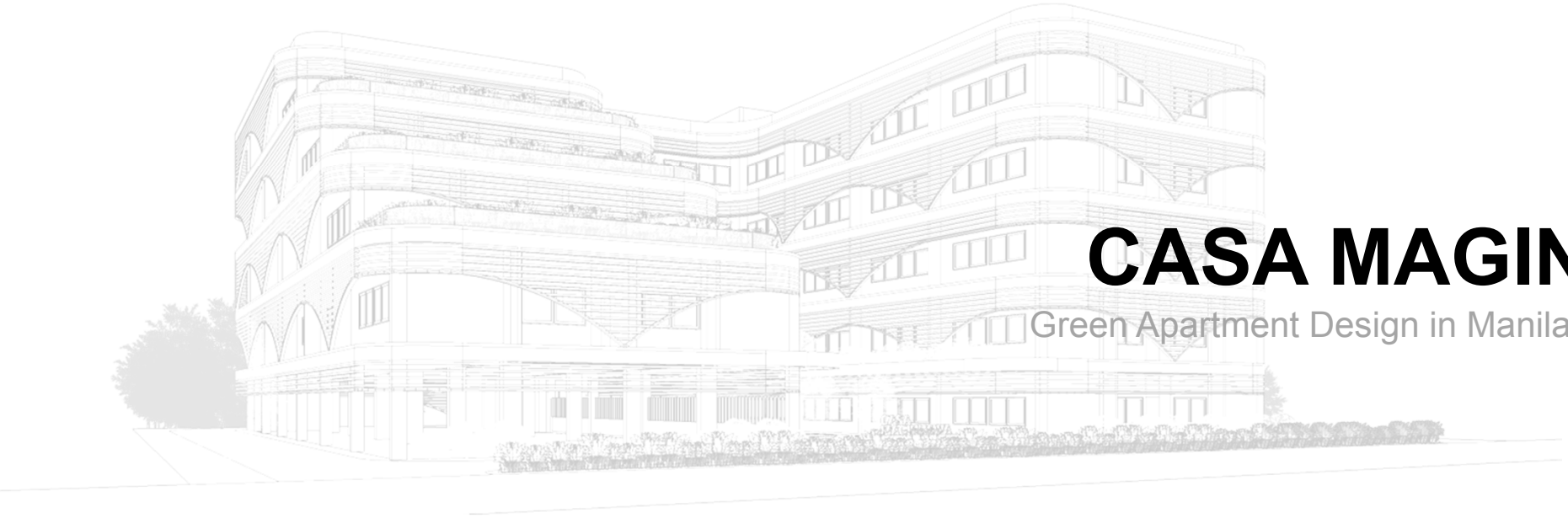


CASA MAGINHAWA

Green Apartment Design in Manila By Edwin Salim

PROJECT CONTEXT | PROFILE

PROJECT BRIEF

- LOW INCOME FAMILY HOUSING
- ZERO NET CARBON
- LOWEST POSSIBLE WATER USE & MATERIAL EMBODIED ENERGY
- DAYLIGHT & NATURAL VENTILATION
- ICONIC ESTHETIC

GREEN, AFFORDABLE, LOCAL DESIGN

- LAND AREA 3600SQM
- 100 HOUSING UNITS @50SQM
- 4 PERSONS IN EACH UNIT
- PARKING SPACES FOR CARS & BIKES

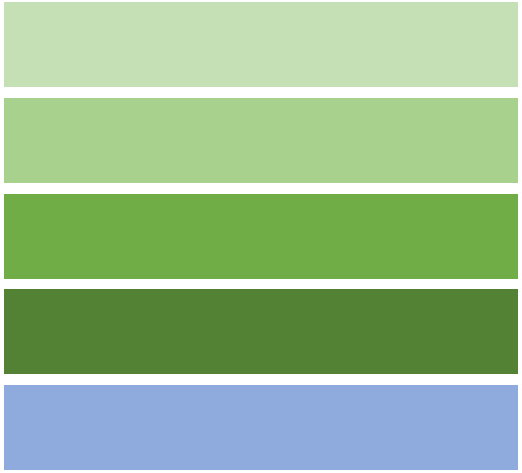
DESIGN | CONCEPT & TRANSFORMATION

FILIPINO CULTURE: WEAVING, FIBERS, PATTERN

"Considered the finest of Philippine textiles, the piña fabric is made from the fibers of the leaves of the red Bisaya pineapple through an arduous process."

MASSING FORM

- 5 Levels Maximum
- Public & Services on Ground Floor
- Dominant white: Reflective colour, less bulkish feeling
- Simple structural form
- Effective-efficient space usage

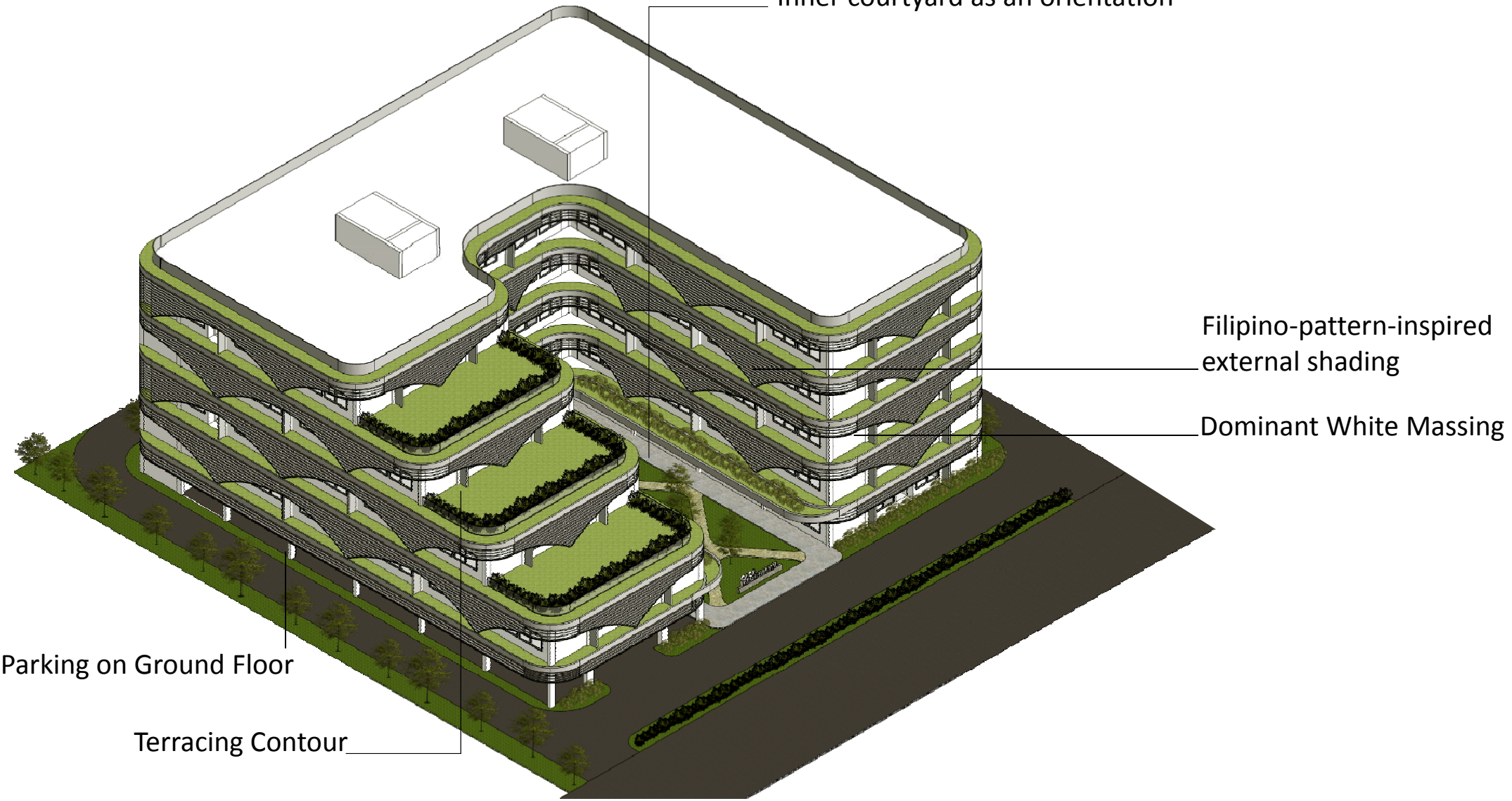


TERRACING CONTOUR DYNAMICS

- Mimicking Rice Terraces preserved in Philippines
- Creating voids to allow better air circulation & natural lighting
- Additional green area

DESIGN | HUMAN EYE VIEW

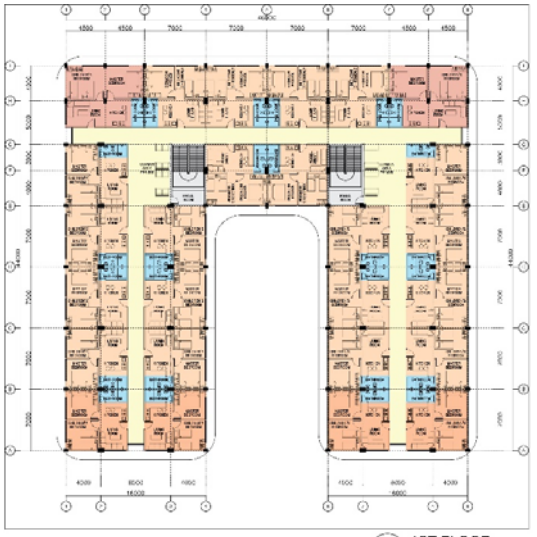
DESIGN | ISOMETRY



DESIGN | VISUALIZATIONS

DESIGN | FLOOR PLANS

GROUND FLOOR
SKALA 0 3 6 9 12m



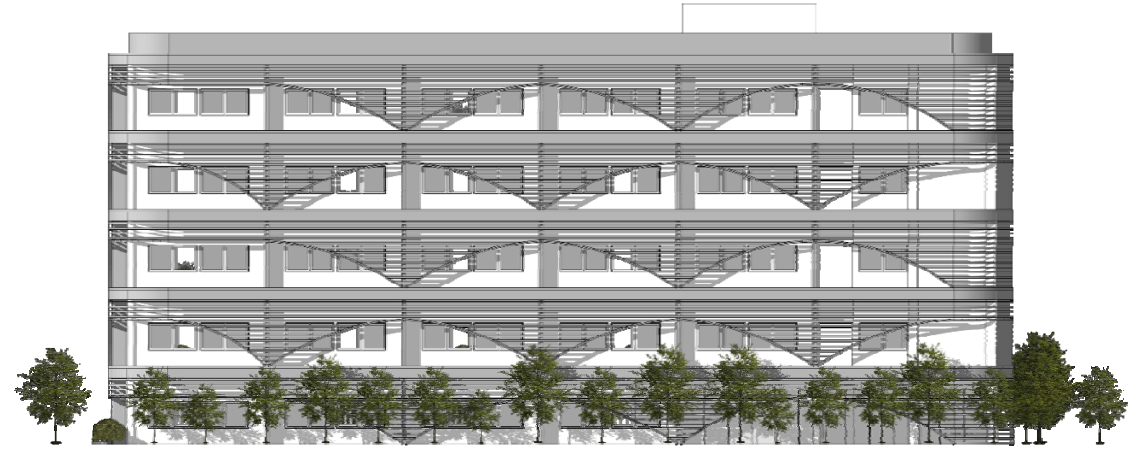
1ST FLOOR
SKALA

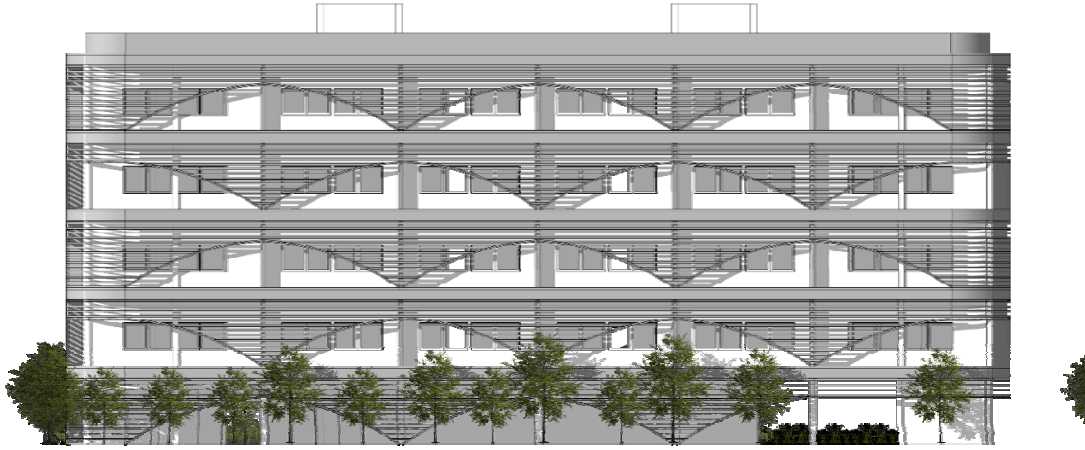
2ND FLOOR
SKALA

3RD FLOOR
SKALA

4TH FLOOR
SKALA

DESIGN | BUILDING ELEVATIONS

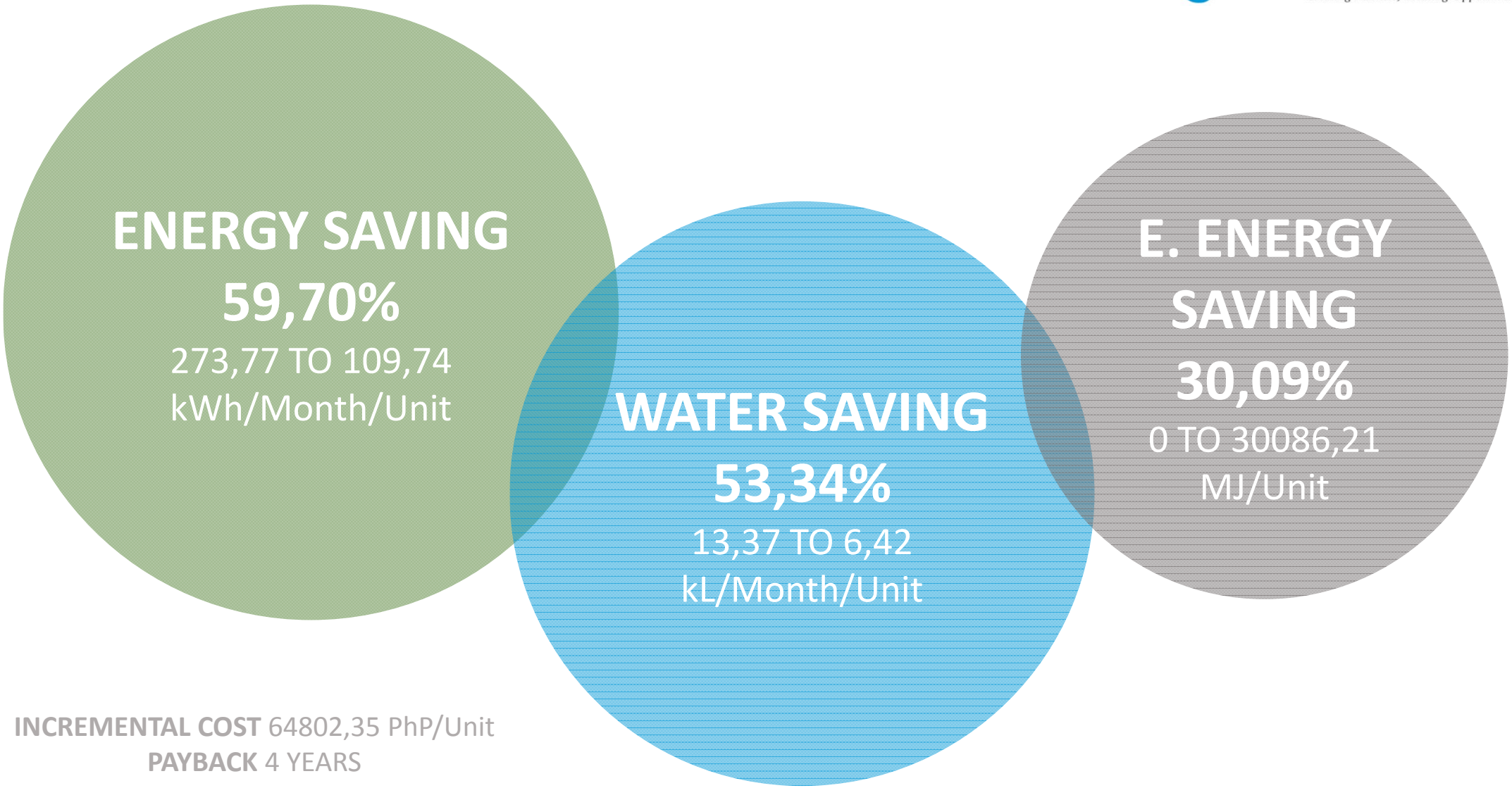




DESIGN | SECTIONS

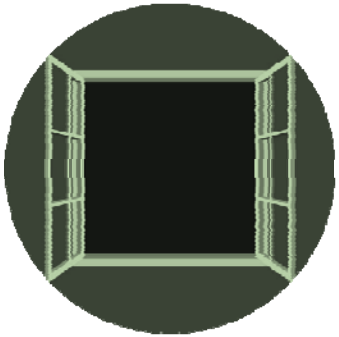
DESIGN | SECTIONS

GREEN DESIGN | OVERVIEW

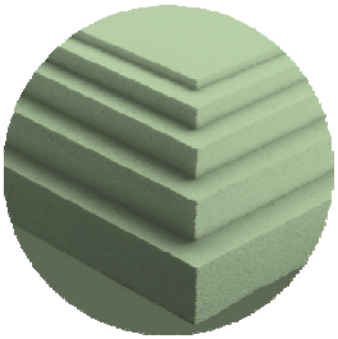


INCREMENTAL COST 64802,35 PhP/Unit
PAYBACK 4 YEARS

GREEN DESIGN | ENERGY



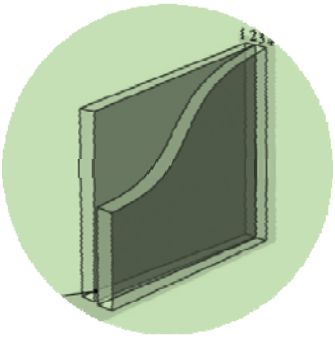
WWR 29%
Effect: 0,19%



EXTERNAL WALLS INSULATION
EPS High Density 32 20mm
Effect: 0,67%

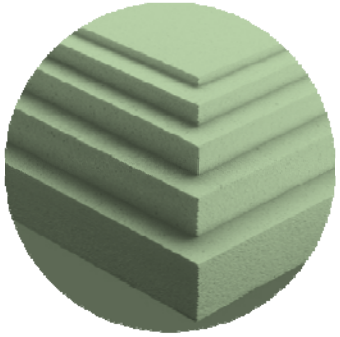
LIGHTING CONTROL COMMON AREA
Effect: 0,71%

ENERGY SAVING BULBS COMMON AREA
Effect: 0,98%

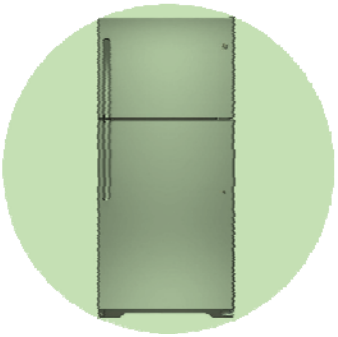


LOW-E COATED GLASS
U-value 3,6 W/m².K
SHGC of 0.44
Effect: 1,94%

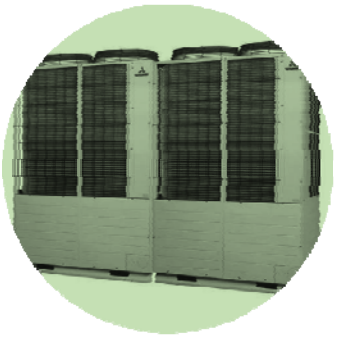
EXTERNAL SHADING
AASF: 0,40
Effect: 1,95%



ROOF INSULATION
EPS High Density 32 200mm
U-value 0,15 W/m².K
Effect: 2,68%

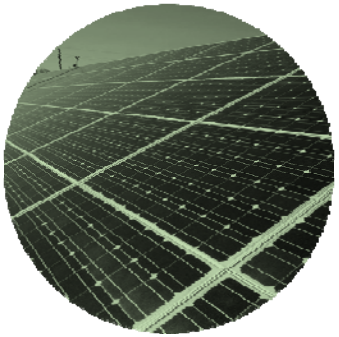


ENERGY EFFICIENT FRIDGE & CLOTHES WASHING
Effect: 3,40%



HVAC SYSTEM
VRF COP 3.7
Effect: 3,61%

ENERGY SAVING LIGHT BULBS
Effect: 8,71%



PHOTOVOLTAICS
40% ENERGY DEMAND
0,6 kWp/Unit
Effect: 29,87%

GREEN DESIGN | ROI ON ENERGY STRATEGIES

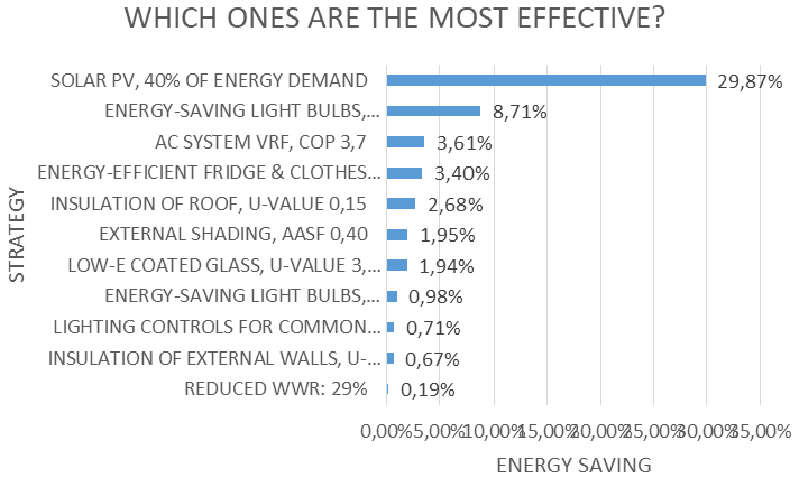
Which Strategies Are Worth Investing In?

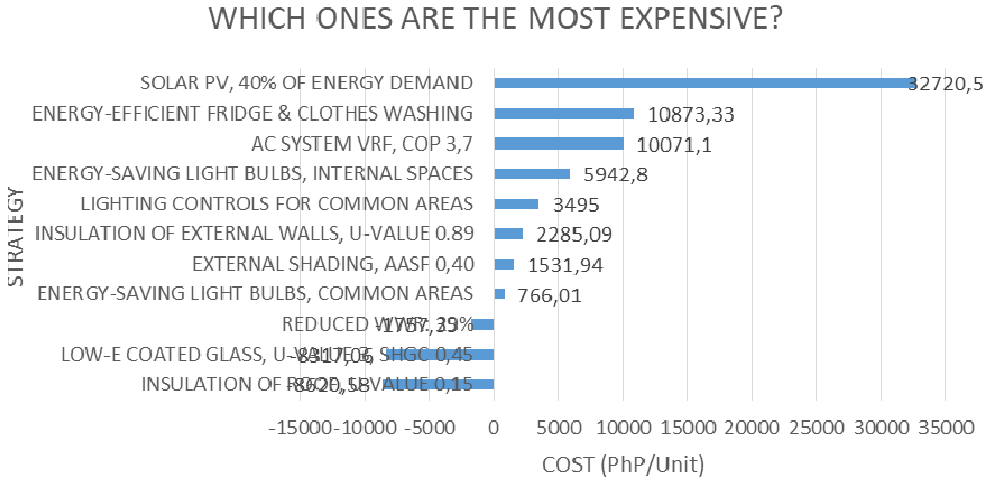
The Most Effective & The Cheapest To Implement

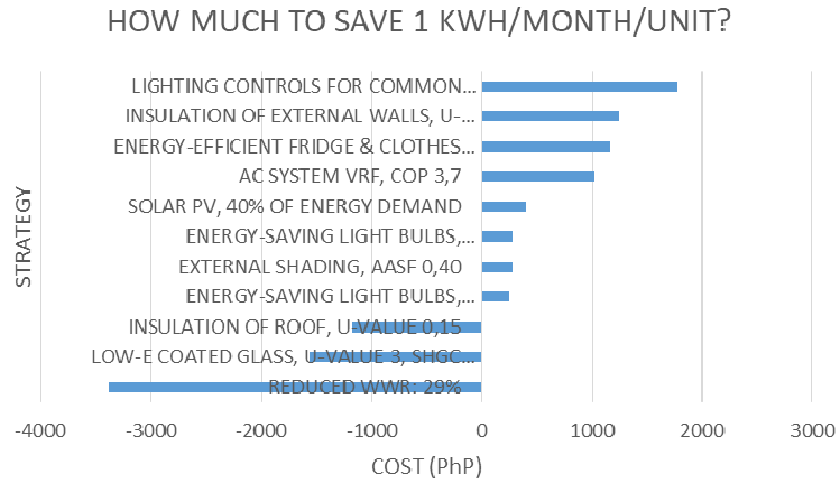
#1 Energy-saving Lightbulbs For Internal Space

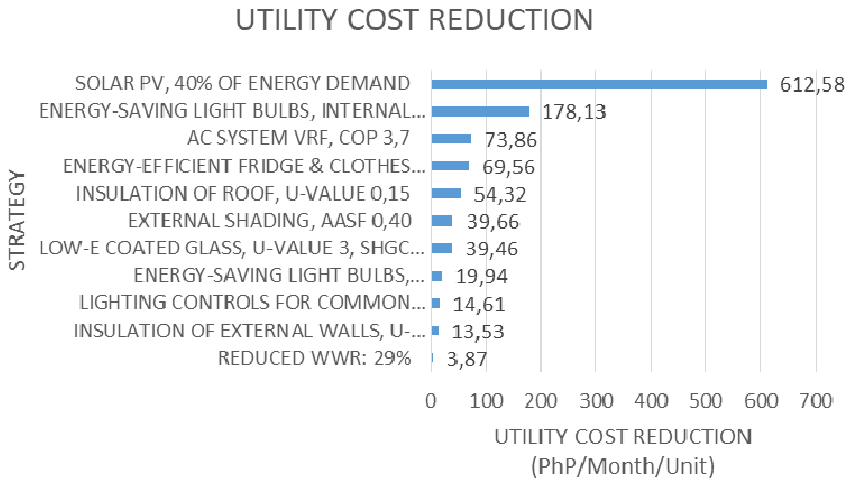
#2 Solar Photovoltaics

#3 Roof Insulation

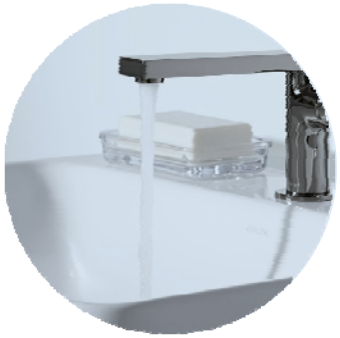








GREEN DESIGN | WATER



LOW-FLOW FAUCETS
ALL BATHROOMS 6L/MIN
Effect: 2,30%

LOW-FLOW FAUCETS
KITCHEN SINKS 6L/MIN
Effect: 10,60%

LOW-FLOW SHOWER HEADS
8L/MIN
Effect: 10,61%

RECYCLED GREY WATER FOR FLUSHING
Effect: 12,60%

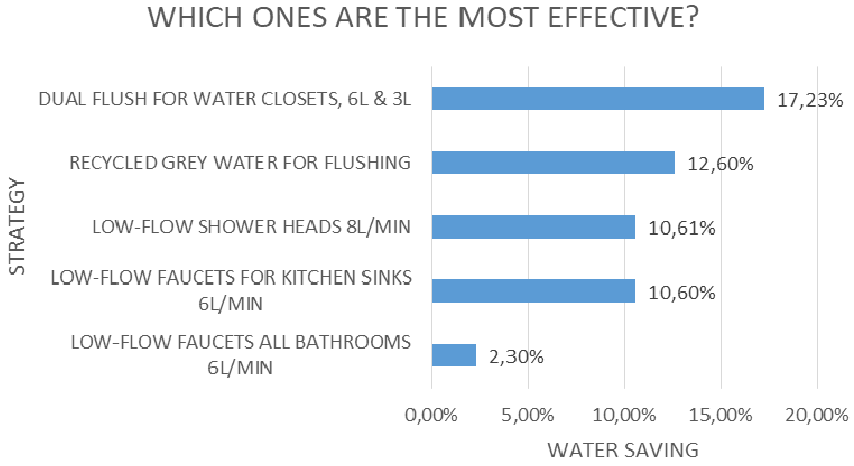
DUAL FLUSH FOR WATER CLOSET
6L & 3L
Effect: 17,23%

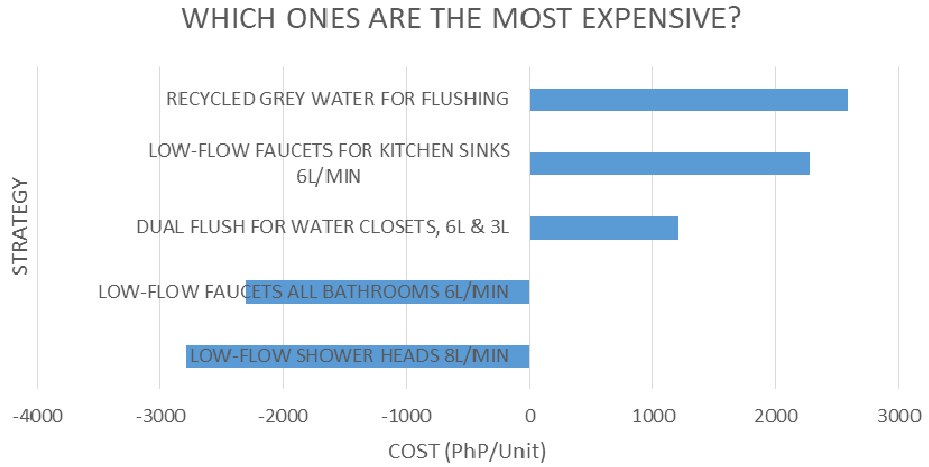
GREEN DESIGN | ROI ON WATER STRATEGIES

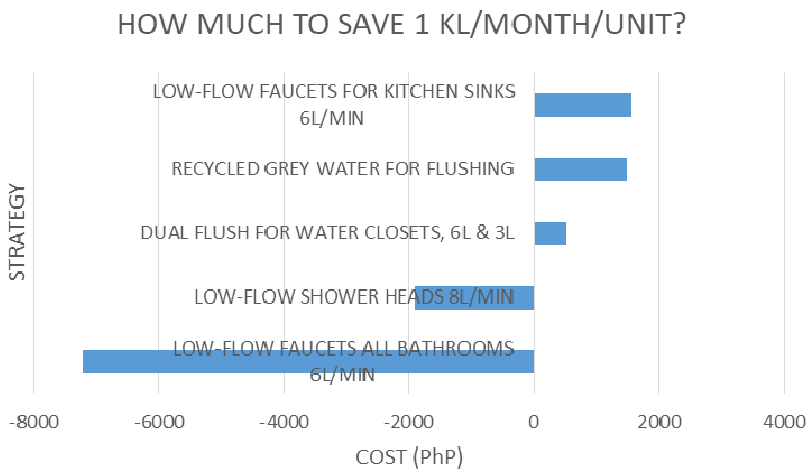
Which Strategies Are Worth Investing In?

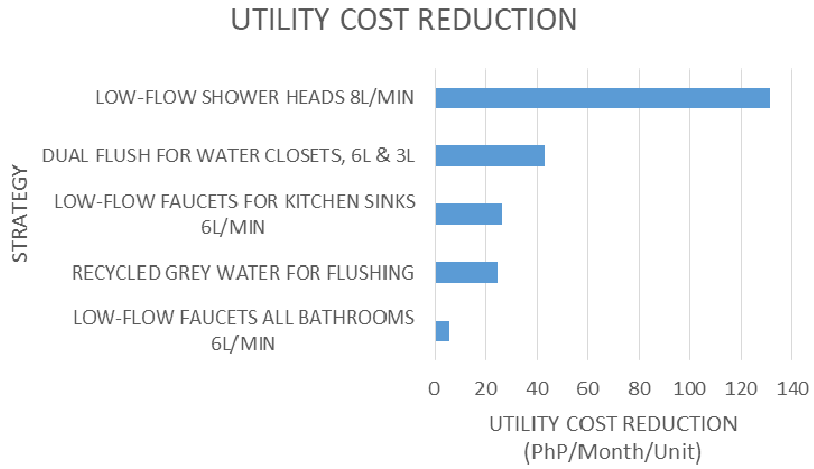
The Most Effective & The Cheapest To Implement

#1 Dual Flush For WC
#2 Low-flow Shower Heads
#3 Low-flow Faucets All Bathrooms
#4 Recycled Grey Water For Flushing
#5 Low-flow Faucets For Kitchen Sinks

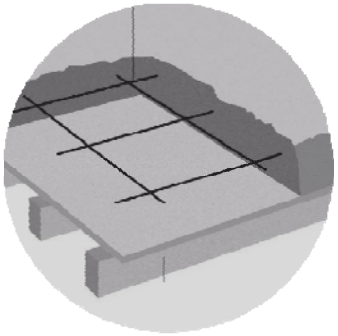




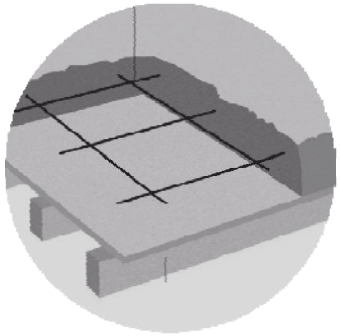




GREEN DESIGN | MATERIAL

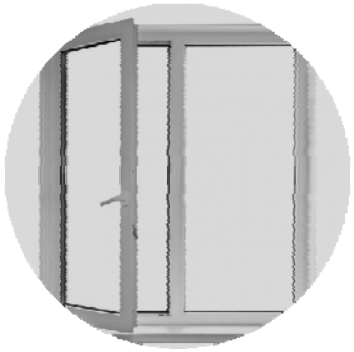


FLOOR SLAB
In-Situ Reinforced
Concrete Slab 120mm
Effect: 23,24



ROOF CONSTRUCTION
In-Situ Reinforced
Concrete Slab 120mm
Effect: 5,93%

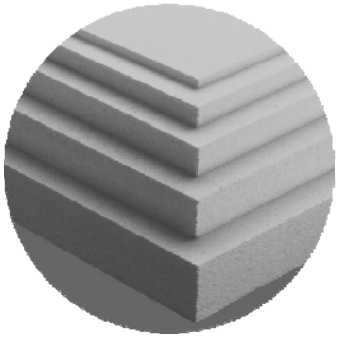
EXTERNAL WALLS
Common Brick With
Internal External P. 150mm
Effect: 4,68%



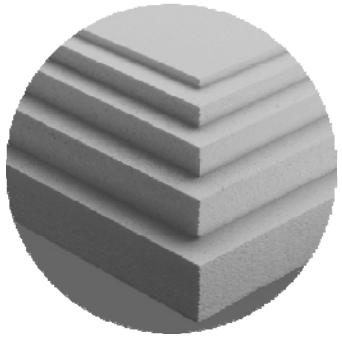
ALUMINIUM WINDOW FRAME
Effect: 0%

FLOORING
Ceramic Tile 100%
Effect: 0%

INTERNAL WALLS
Common Brick With
Plasters on Both Sides 100mm
Effect: 0%

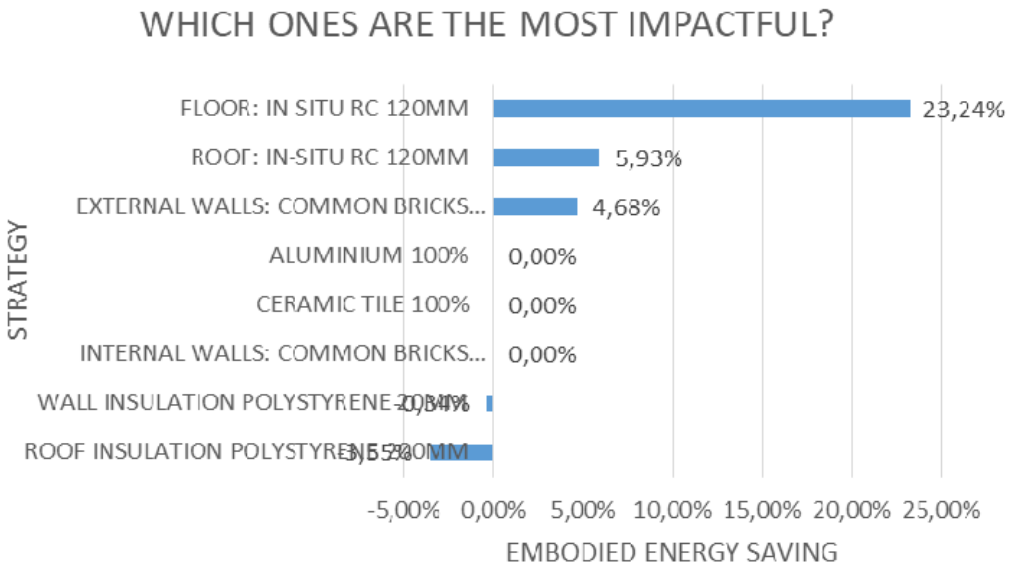


WALL INSULATION
Polystyrene 20mm
U-Value 0,98
Effect: -0,34%



ROOF INSULATION
Polystyrene 200mm
U-Value 0,17
Effect: -3,55%

GREEN DESIGN | ROI ON MATERIAL STRATEGIES



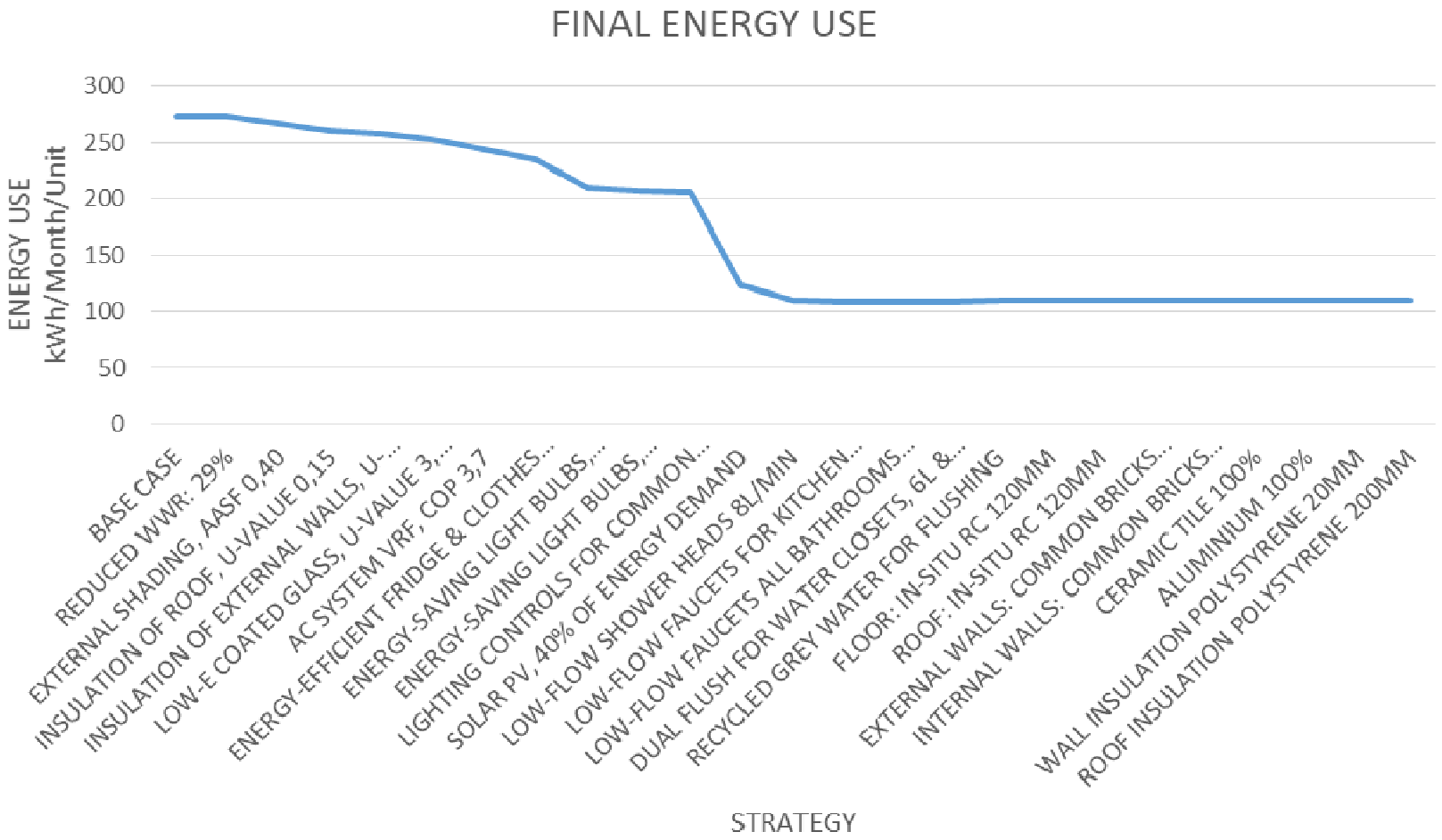
WHICH STRATEGIES ARE WORTH INVESTING IN?
THE MOST EFFECTIVE & THE CHEAPEST TO IMPLEMENT

KEY CONSIDERATIONS

- MAINTENANCE PROBLEMS
- SPECIFIC SKILL TO IMPLEMENT
- MATERIAL AVAILABILITY
- MATERIAL SUSTAINABILITY
- RECYCLABILITY

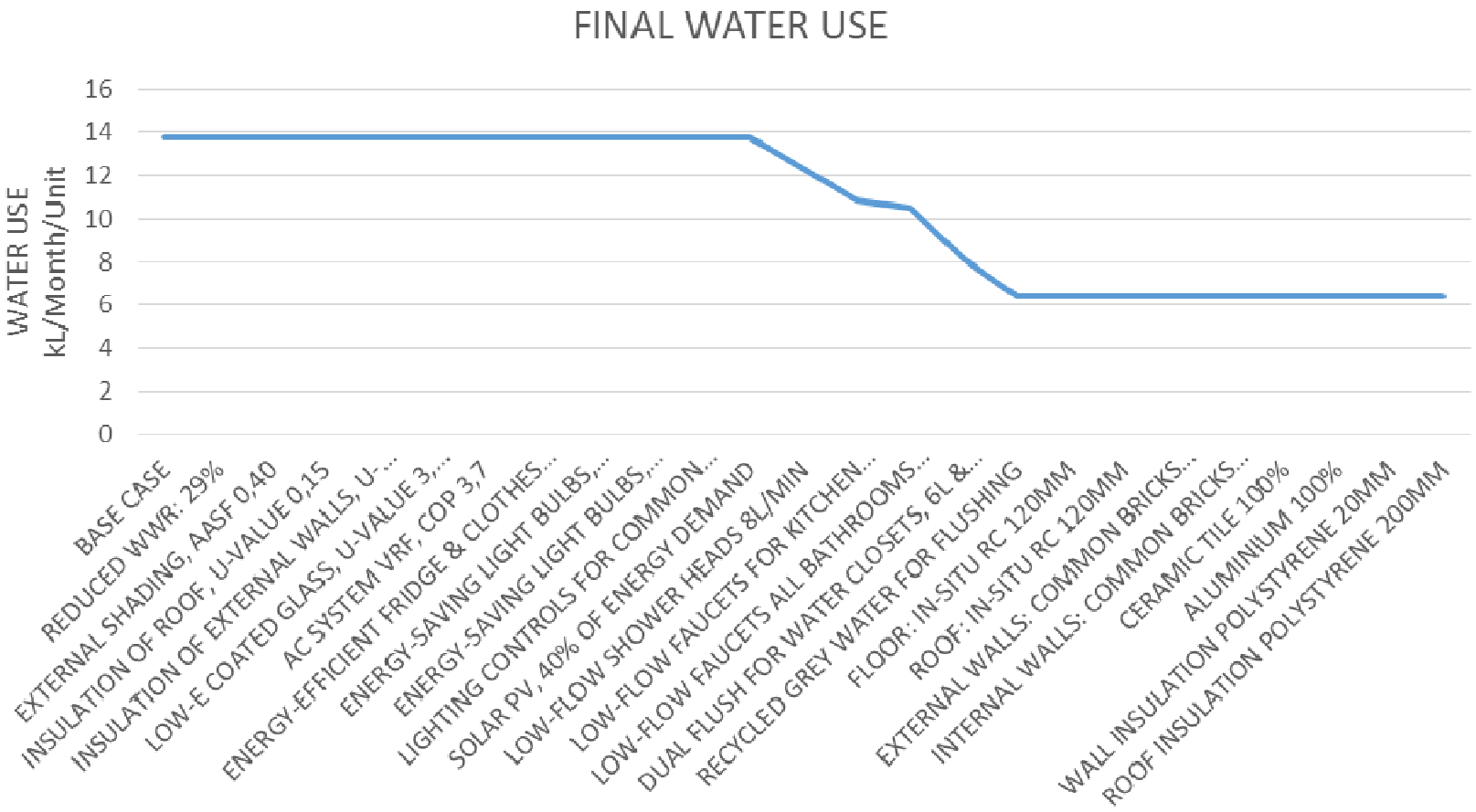
GREEN DESIGN | FINAL ENERGY USE

BASE CASE 273,77 kWh/Month/Unit – **IMPROVED CASE** 109,74 kWh/Month/Unit



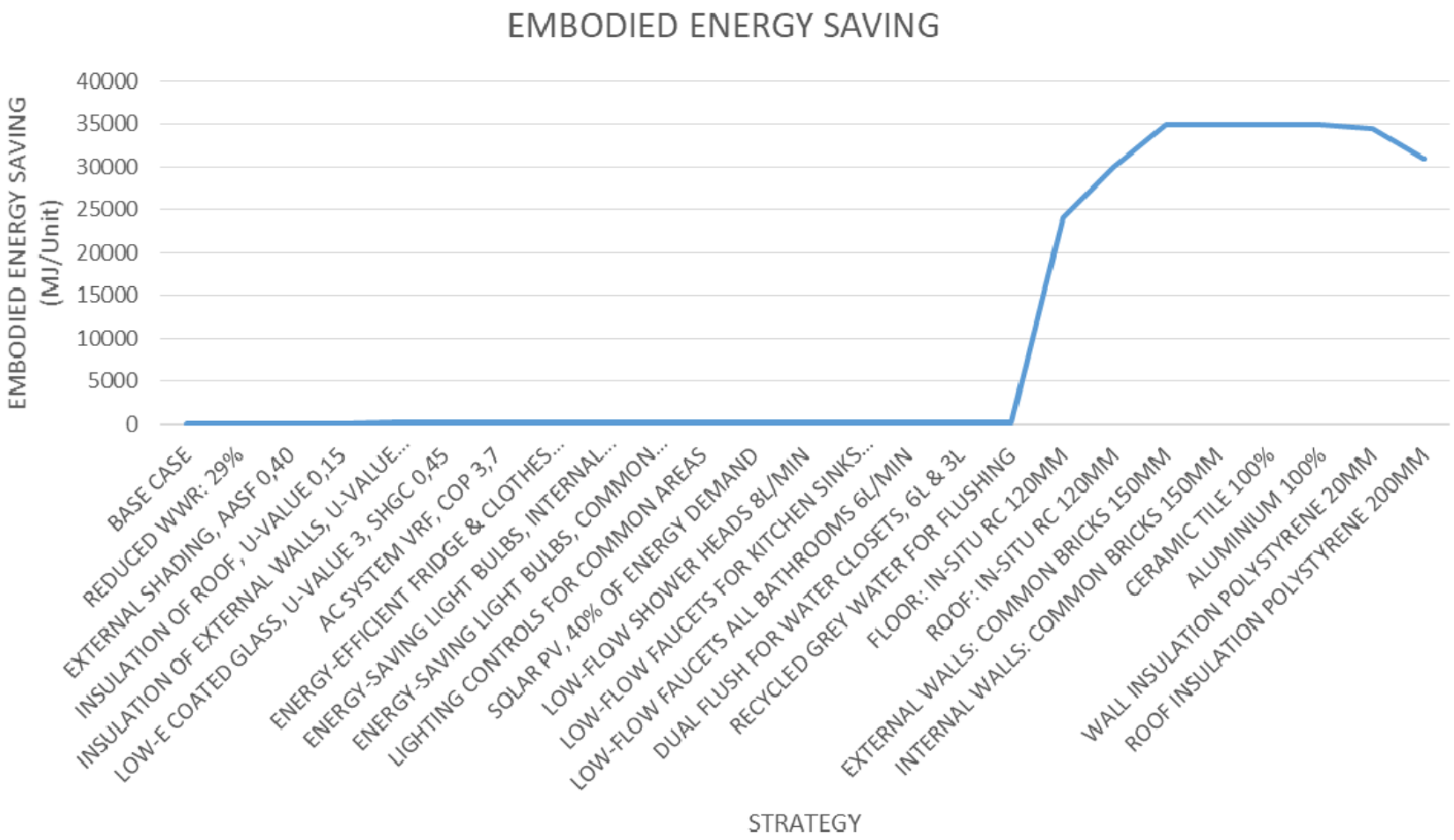
GREEN DESIGN | FINAL WATER USE

BASE CASE 13,37 kL/Month/Unit - **IMPROVED CASE** 6,42 kL/Month/Unit



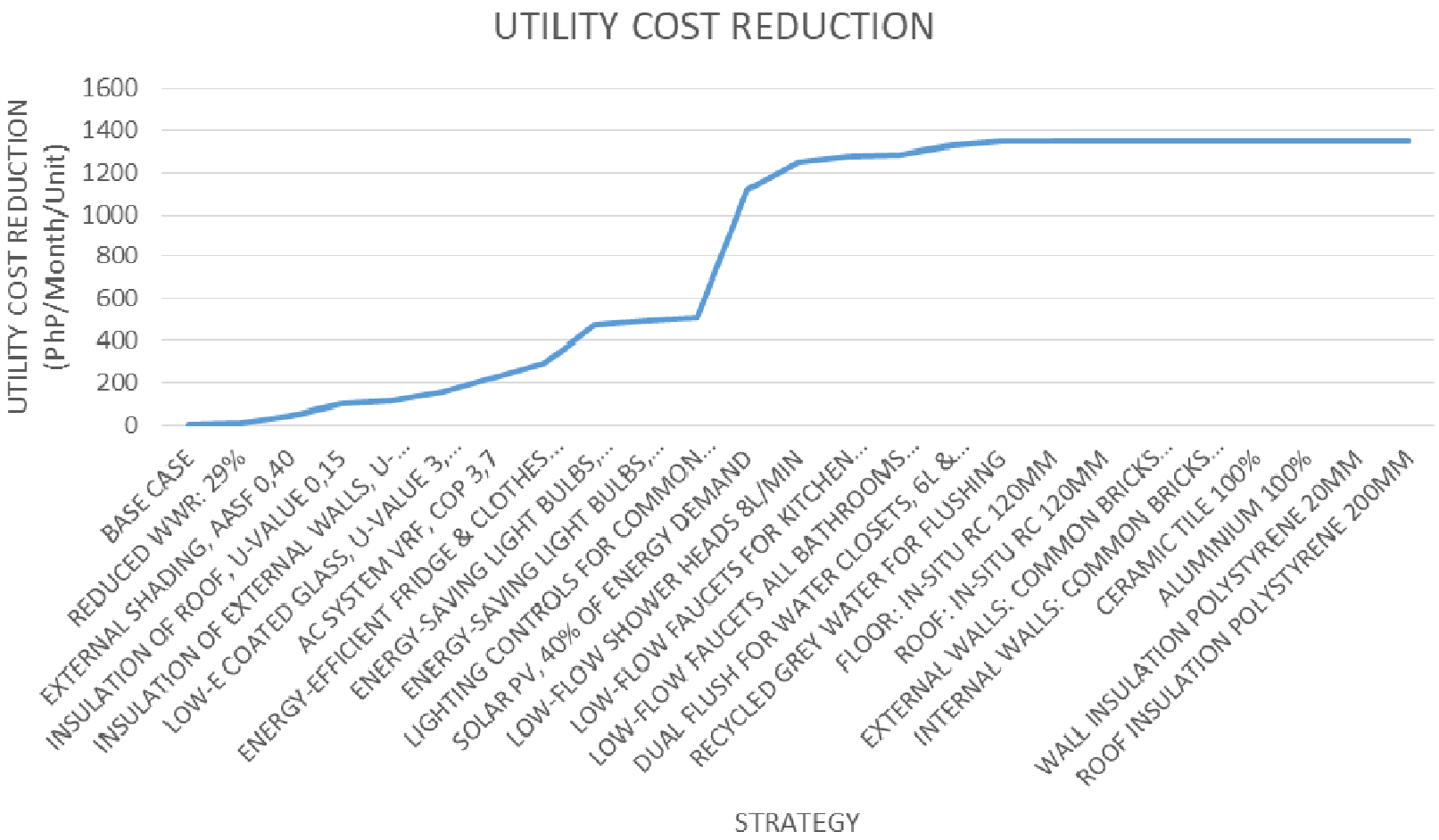
GREEN DESIGN | EMBODIED ENERGY SAVING

BASE CASE 0 MJ/Unit - **IMPROVED CASE** 30086,21 MJ/Unit



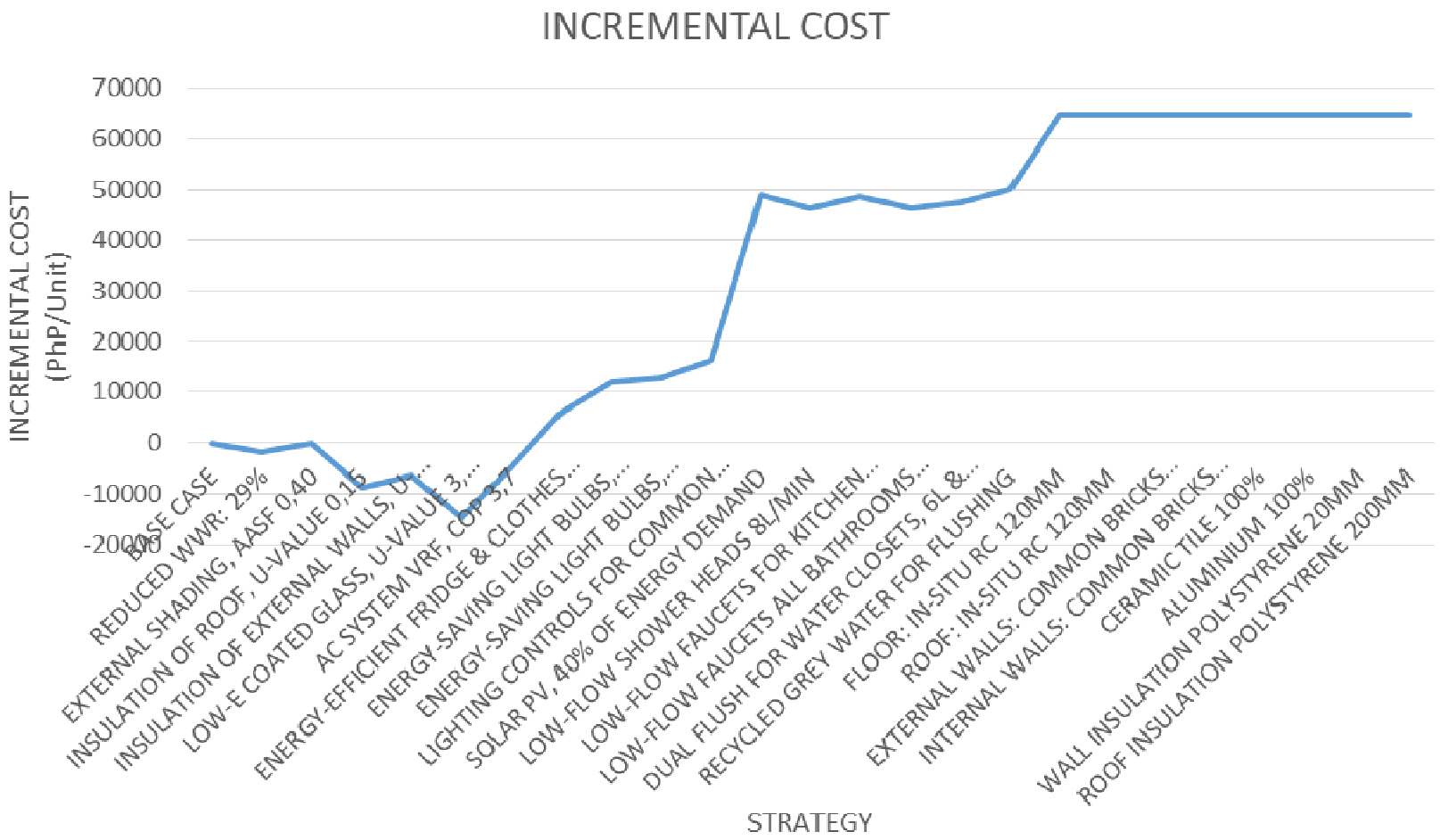
GREEN DESIGN | UTILITY COST REDUCTION

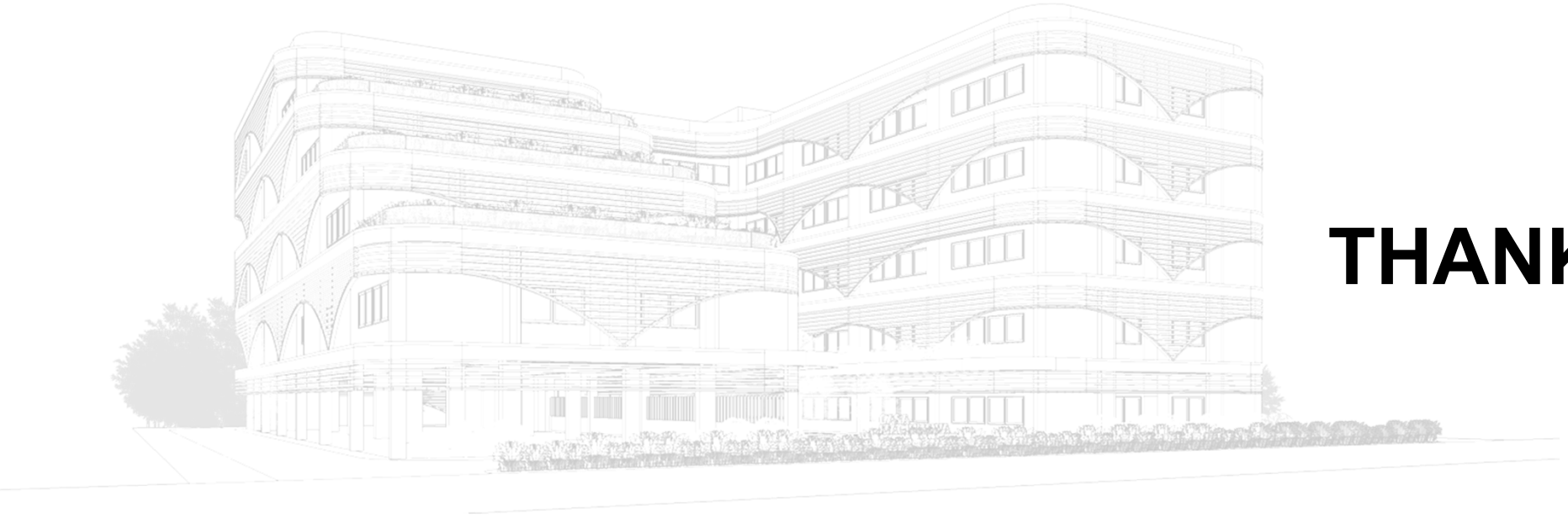
BASE CASE UTILITY COST 2282,17 PhP/Month/Unit



GREEN DESIGN | INCREMENTAL COST

FINAL INCREMENTAL COST 64802,35 PhP/Unit – **PAYBACK** 4 YEARS





THANK YOU

APPENDIX | BASE CASE

Key Assumptions for the Base Case

	Default	User Entry				
Fuel Used for Hot Water	Electric Resistance	Electric Resistance				
Fuel Used for Space Heating	Electricity	Electricity				
Cost of Electricity	7.46		PhP/kWh			
Cost of Diesel Fuel	28.90		PhP/L			
Cost of LPG/Natural Gas	40.24		PhP/L			
Cost of Water	17.71		PhP/kL			
CO_2 Emissions g/kWh of Electricity	592		g/kWh			
Window to Wall Ratio	30%		%			
Solar Reflectivity for Paint - Wall	30%		%			
Solar Reflectivity for Paint - Roof	40%		%			
Hot Water Boiler Efficiency	80%		%			
Roof U-value	2.10		$W/m^2.K$			
Wall U-value	1.51		$W/m^2.K$			
Glass U-value	5.70		$W/m^2.K$			
Glass SHGC	0.82		Factor			
AC System Efficiency	2.50		COP			

Monthly Average Outdoor Temperature (deg.C)

	Default	User Entry
Jan	26.7	
Feb	27.4	
Mar	28.7	
Apr	30.1	
May	30.0	
Jun	29.3	
Jul	28.5	
Aug	28.3	
Sep	28.4	
Oct	28.4	
Nov	28.0	
Dec	27.0	
Latitude	15	Deg

RESULTS

Final Energy Use	109.74 kWh/Month/Unit	Operational CO_2 Savings	1.16 tCO_2/Year/Unit
Final Water Use	6.42 kL/Month/Unit	Embodied Energy Savings	30886.21 MJ/Unit
Base Case Utility Cost	2282.17 PhP/Month/Unit	Incremental Cost	64,802.35 PhP/Unit
Utility Cost Reduction	1,351.22 PhP/Month/Unit	Payback in Years	4.00 Yrs.
Energy Savings	197.24 MWh/Year	Water Savings	8811.10 m^3/Year
Embodied Energy in Materials Savings	3088.62 GJ	Aggregate Floor Space Including Multiplier	5500.00 m^2

APPENDIX | ENERGY DATA

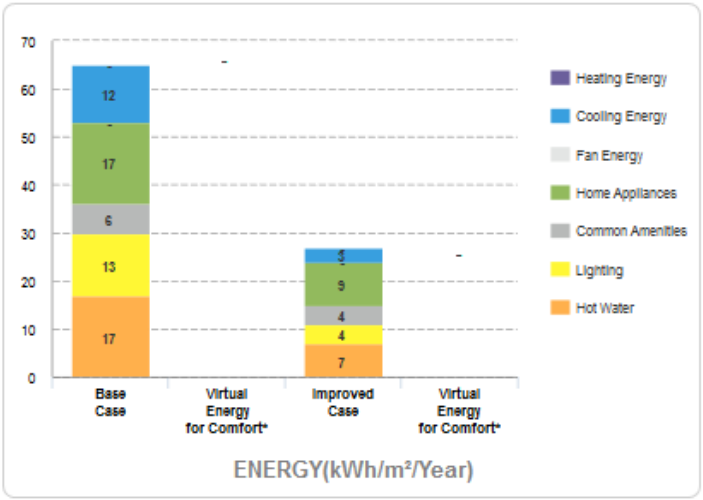
NO	INDICATOR	INCREMENTAL EFFECT										PERSONAL EFFECT									
		FINAL ENERGY USE (kWh/Month/Unit)	FINAL WATER USE (kL/Month/Unit)	OPERATIONAL CO2 SAVINGS (tCO2/Year/Unit)	EMBODIED ENERGY SAVINGS (MJ/Unit)	UTILITY COST REDUCTION (PhP/Month/Unit)	INCREMENTAL COST (PhP/Unit)	PAYBACK (Years)	Energy	Water	Material	Energy Saving	Water Saving	Operational CO2 Saving	Em. Energy Saving	Utility Cost Reduction	Cost	Payback Years	Energy %	Water %	Material %
0	BASE CASE	273,77	13,77	0	0	0	0	0	0,00%	0,00%	0,00%										
1	REDUCED WWR: 29%	273,25	13,77	0	56,24	3,87	-1757,35	0	0,19%	0,00%	0,05%	0,52	0	0	56,24	3,87	-1757,35	0	0,19%	0,00%	0,05%
2	EXTERNAL SHADING, AASF 0,40	267,89	13,77	0,04	56,24	43,53	-225,41	0	2,14%	0,00%	0,05%	5,36	0	0,04	0	39,66	1531,94	0	1,95%	0,00%	0,00%
3	INSULATION OF ROOF, U-VALUE 0,15	260,55	13,77	0,09	56,24	97,85	-8845,99	0	4,82%	0,00%	0,05%	7,34	0	0,05	0	54,32	-8620,58	0	2,68%	0,00%	0,00%
4	INSULATION OF EXTERNAL WALLS, U-VALUE 0.89	258,72	13,77	0,11	133,51	111,38	-6560,9	0	5,49%	0,00%	0,13%	1,83	0	0,02	77,27	13,53	2285,09	0	0,67%	0,00%	0,08%
5	LOW-E COATED GLASS, U-VALUE 3, SHGC 0,45	253,38	13,77	0,14	133,51	150,84	-14877,96	0	7,43%	0,00%	0,13%	5,34	0	0,03	0	39,46	-8317,06	0	1,94%	0,00%	0,00%
6	AC SYSTEM VRF, COP 3,7	243,48	13,77	0,22	133,51	224,7	-4806,86	0	11,04%	0,00%	0,13%	9,9	0	0,08	0	73,86	10071,1	0	3,61%	0,00%	0,00%
7	ENERGY-EFFICIENT FRIDGE & CLOTHES WASHING	234,15	13,77	0,28	133,51	294,26	6066,47	1,72	14,44%	0,00%	0,13%	9,33	0	0,06	0	69,56	10873,33	1,72	3,40%	0,00%	0,00%
8	ENERGY-SAVING LIGHT BULBS, INTERNAL SPACES	210,26	13,77	0,45	133,51	472,39	12009,27	2,12	23,15%	0,00%	0,13%	23,89	0	0,17	0	178,13	5942,8	0,4	8,71%	0,00%	0,00%
9	ENERGY-SAVING LIGHT BULBS, COMMON AREAS	207,58	13,77	0,47	133,51	492,33	12775,28	2,16	24,13%	0,00%	0,13%	2,68	0	0,02	0	19,94	766,01	0,04	0,98%	0,00%	0,00%
10	LIGHTING CONTROLS FOR COMMON AREAS	205,62	13,77	0,48	133,51	506,94	16270,28	2,67	24,84%	0,00%	0,13%	1,96	0	0,01	0	14,61	3495	0,51	0,71%	0,00%	0,00%
11	SOLAR PV, 40% OF ENERGY DEMAND	123,37	13,77	1,07	133,51	1119,52	48990,85	3,65	54,71%	0,00%	0,13%	82,25	0	0,59	0	612,58	32720,57	0,98	29,87%	0,00%	0,00%

APPENDIX | WATER & MATERIAL DATA

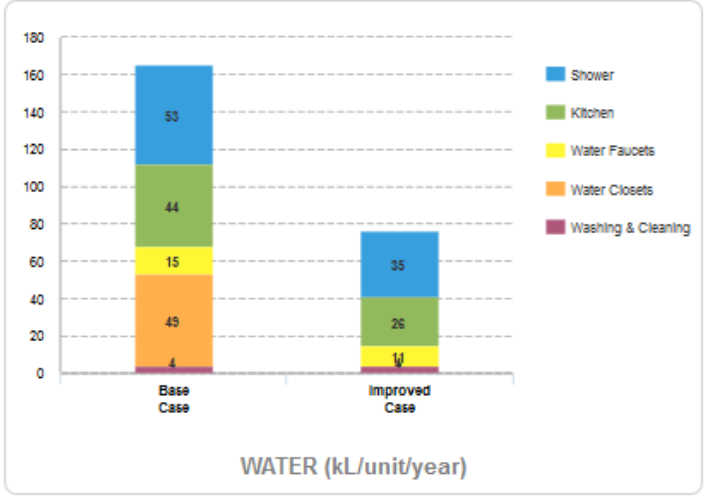
NO	INDICATOR	INCREMENTAL EFFECT										PERSONAL EFFECT									
		FINAL ENERGY USE (kWh/Month/Unit)	FINAL WATER USE (kL/Month/Unit)	OPERATIONAL CO2 SAVINGS (tCO2/Year/Unit)	EMBODIED ENERGY SAVINGS (MJ/Unit)	UTILITY COST REDUCTION (PhP/Month/Unit)	INCREMENTAL COST (PhP/Unit)	PAYBACK (Years)	Energy	Water	Material	Energy Saving	Water Saving	Operational CO2 Saving	Em. Energy Saving	Utility Cost Reduction	Cost	Payback Years	Energy %	Water %	Material %
0	BASE CASE	273,77	13,77	0	0	0	0	0	0,00%	0,00%	0,00%										
12	LOW-FLOW SHOWER HEADS 8L/MIN	109,17	12,31	1,17	133,51	1251,27	46199,76	3,08	59,90%	10,61%	0,13%	14,2	1,46	0,1	0	131,75	-2791,09	-0,57	5,19%	10,61%	0,00%
13	LOW-FLOW FAUCETS FOR KITCHEN SINKS 6L/MIN	109,08	10,85	1,17	133,51	1277,78	48479,57	3,16	59,93%	21,21%	0,13%	0,09	1,46	0	0	26,51	2279,81	0,08	0,03%	10,60%	0,00%
14	LOW-FLOW FAUCETS ALL BATHROOMS 6L/MIN	109,06	10,53	1,17	133,51	1283,52	46171,43	3	59,94%	23,51%	0,13%	0,02	0,32	0	0	5,74	-2308,14	-0,16	0,01%	2,30%	0,00%
15	DUAL FLUSH FOR WATER CLOSETS, 6L & 3L	108,92	8,16	1,17	133,51	1326,59	47377,6	2,98	59,99%	40,74%	0,13%	0,14	2,37	0	0	43,07	1206,17	-0,02	0,05%	17,23%	0,00%
16	RECYCLED GREY WATER FOR FLUSHING	109,74	6,42	1,16	133,51	1351,22	49964,66	3,08	59,70%	53,34%	0,13%	-0,82	1,74	-0,01	0	24,63	2587,06	0,1	-0,29%	12,60%	0,00%
17	FLOOR: IN-SITU RC 120MM	109,74	6,42	1,16	23986,52	1351,22	64802,35	4	59,70%	53,34%	23,37%	0	0	0	23853,01	0	14837,69	0,92	0,00%	0,00%	23,24%
18	ROOF: IN-SITU RC 120MM	109,74	6,42	1,16	30075,51	1351,22	64802,35	4	59,70%	53,34%	29,30%	0	0	0	6088,99	0	0	0	0,00%	0,00%	5,93%
19	EXTERNAL WALLS: COMMON BRICKS 150MM	109,74	6,42	1,16	34876,68	1351,22	64802,35	4	59,70%	53,34%	33,98%	0	0	0	4801,17	0	0	0	0,00%	0,00%	4,68%
20	INTERNAL WALLS: COMMON BRICKS 150MM	109,74	6,42	1,16	34876,68	1351,22	64802,35	4	59,70%	53,34%	33,98%	0	0	0	0	0	0	0	0,00%	0,00%	0,00%
21	CERAMIC TILE 100%	109,74	6,42	1,16	34876,68	1351,22	64802,35	4	59,70%	53,34%	33,98%	0	0	0	0	0	0	0	0,00%	0,00%	0,00%
22	ALUMINIUM 100%	109,74	6,42	1,16	34876,68	1351,22	64802,35	4	59,70%	53,34%	33,98%	0	0	0	0	0	0	0	0,00%	0,00%	0,00%
23	WALL INSULATION POLYSTYRENE 20MM	109,74	6,42	1,16	34520,61	1351,22	64802,35	4	59,70%	53,34%	33,64%	0	0	0	-356,07	0	0	0	0,00%	0,00%	-0,34%
24	ROOF INSULATION POLYSTYRENE 200MM	109,74	6,42	1,16	30886,21	1351,22	64802,35	4	59,70%	53,34%	30,09%	0	0	0	-3634,4	0	0	0	0,00%	0,00%	-3,55%

APPENDIX | EDGE RESULTS

59.70% Meets EDGE Energy Standard



53.34% Meets EDGE Water Standard



30.09% Meets EDGE Materials Standard