energy audit report

nikhil isaac selvanandam 0349343 energy and architecture (ARC61904) dr. siti norzaini zainal abidin



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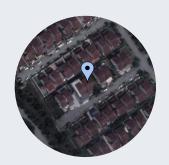
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9 CONCLUSION

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I CLIMATE BASED PROFILE

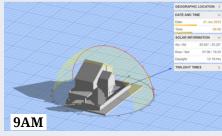
SITE LOCATION PLAN



Location: Rawang, Selangor. **Building Typology: Residential,** Two-Storey Semi Detached **Number of Occupants: 5**

Rawang is a town located in the state of Selangor, Malaysia. It is situated approximately 30 kilometers north of Kuala Lumpur, the capital city of Malaysia.

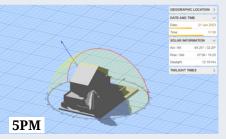
SUN PATH ANALYSIS



In the morning, the sun shines At midday, the sun is still not In the evening, the sun beams at allowing light to pass through and sunlight from the north-east will sunlight will only hit the roof illuminate the rooms of the house. cast a shadow on the surfaces of from this angle. Nevertheless, A shadow is casted facing the the south walls of the house. west.

12PM

from the east side of the house, directly over the house. Hence, the north-west of the house. The



there will be a long shadow casted facing the east of the building.

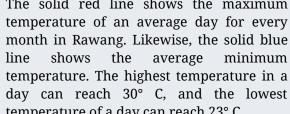
CLIMATE-WEATHER PROFILES



The solid red line shows the maximum

temperature of a day can reach 23° C.

Annual Climate Profile



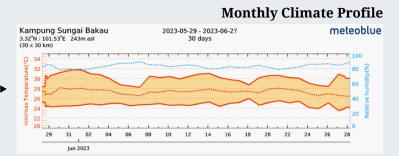
Annual Wind Rose Chart

The wind rose above shows that during this particular sampling period, the wind mainly blew from the north-east, south and also the south-west, with most of the wind coming from the south.

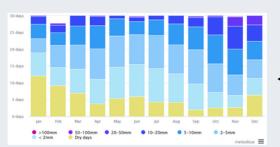
highest temperature that can occur in June 2023 is 32 and the lowest temperature is 23 ° C. Following that, the hottest temperature has a relative humidity of 75%. (June 1st,

2023)

Based on this graph, the



Annual Precipitation Profile



Malaysia is affected by the northeast monsoon and the southwest monsoon. The northeast monsoon occurs from October to March of the following year, which is rainy season. The southwest monsoon occurs from June to September, which is the dry season.

OCCUPANT PROFILE

NIKHIL - ME

Top Consumptions: Air Conditioning and Electronics

Weekday

Weekend

RAVI - FATHER Weekday

Top Consumptions: Air

Conditioning and Television

Weekend

GRACE - MOTHER

Top Consumptions: Air Conditioning and Electronics

Weekday

Weekend

LEGEND

Low Energy Consumption

High Energy Consumption

ISHANA - SISTER

Top Consumptions: Air Conditioning and Electronics

Weekday

Weekend



MATHEW -**GRANDFATHER**

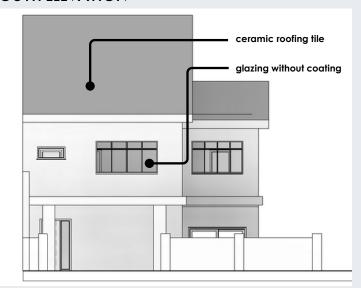
Top Consumptions: Lights and Electronics

Weekday

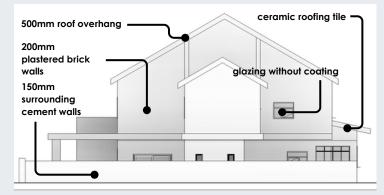
Weekend

2 FACADE STUDIES

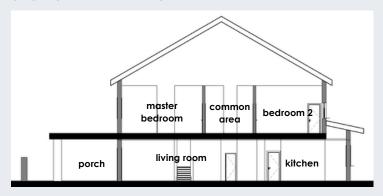
SOUTH ELEVATION



EAST ELEVATION



SECTIONAL ELEVATION



NATURAL ILLUMINANCE STUDIES

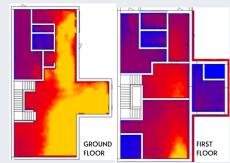


DAYLIGHTING ANALYSIS - 9AM (21/06/23)

Light begins to pass through the building in the morning. The morning sun at 9AM shines from the east, hence most of the sunlight penetrates through the windows in the kitchen and bedroom 2. The lux reading is highest in the kitchen, at 210 lux.

DAYLIGHTING ANALYSIS - 12PM (21/06/23)

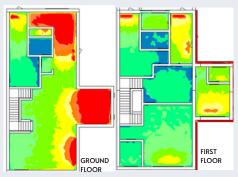
At 12PM, the sun is reaching its highest point and shines on the north side of the building. However, natural light is only able to enter from the windows and sliding doors, therefore those locations are where the higher lux is at this time.



DAYLIGHTING ANALYSIS - 5PM (21/06/23)

At 5PM when the sun is about to set to the west, there is no direct sunlight entering the house. However, sunlight is mostly reflected from wall and roof surfaces, thus the lux reading is a lot lower compared to the readings in the early day time.

INDOOR TEMPERATURE STUDIES



THERMAL COMFORT ANALYSIS - 9AM

When sun rises, temperature starts to increase and sun rays from the north-east hit the corners of the rooms that face towards it through the glass sliding doors as well as the big windows. The rooms are hotter there compared to other rooms in the house. Thus, the rooms that do not receive the natural sunlight are still cool at temperatures of 24-26°C.



THERMAL COMFORT ANALYSIS - 12PM

the 12 pm, at this time the overall house is at its hottest temperature at 25-27°C all around as the sun is at its high point shining directly through the windows and glass sliding doors. At this time of the day, the area won't be very comfortable as it has exceeded the comfortable temperature of 24-26°C. Occupants may turn on the air-conditioners to tackle the heat. first floor is reasonably cool.



28°C

THERMAL COMFORT ANALYSIS - 5PM

At the day ends, the sun sets to the west of the house, therefore the overall house temperature starts decreasing. The kitchen and dining room is still warm at 26°C since the suns rays from the west is reflected off certain wall and roof surfaces and enter through open access points of the house. Despite that, the whole

	PURPOSE AND LAW TO	No. of	ENERGY								TUM	8 (24-H)	DUR FO	(TAMAE	- WEEK	DAY										TOTAL USAGE	TOTAL ENERGY
SPACES	ELECTRICAL APPLIANCES	UNITS	W/h kW/h	00.00	01:00 02:00 0	3:00 04	00 05:0	06:00	07:00	08:00	09:00	10:00	11/00	12:00	13:00	14:00	15:00	16:00	17:00	18/00	19:00	20/00	21/00	22:00	23:00	(HOURS)	CONSUMPTION (KW
iround Floor			75 0.07			-1	-1	-1						1			-	-	4.4							0.775	
or Persh	Automated Main Gate LED Recessed Square Downlight	-	15 0.007		1 2 2	- 2	-	9 1	0.3	0.025	- 3	0.01	- 0		0.02		- 2	- 3	- 0.5	0.2	0.8	0.02	- 0	- 0	- 0	7.1	0.09
	LED Recessed Square Downlight	1/			1 1	- 0	6	0	- 4	0.5	- 1	- 0	- 4	- 0		- 6		- 7	- 2	- 0	0.5		0.2	-	-	5.2	-
	Linear LEO Light	10			1 1	-	6	0 1	1		- 1	- 0	- 4	- 0	-	- 0	- 6	- 1	- 1	- 4	- 0.0	-	0.8	- 1	- 1	3.6	0
Main Living	Certing Pain	1	45 0.04		0.2 0	- 0	0	0 0		- 0	0.31	0.5	-	-	-	- 0	- 0	- 2	- 1	- 0	0.3	1	1	-	- 1	6.35	0.1
Reem	65" Samoung Smart TV		205 0.205		0.2 0	0	0	0 1	0		- 0	- 0	- 0	- 0	- 0	- 0		0	- 0	0	0.5		1	- 1	- 1	5.7	1.1
	Plano Heater		10 00		1 1	1	1	1 1	1	- 1		- 1	- 1	1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	24	
	Air-conditioner		750 0.7		0 0	0	0	0 0	0		- 0	0	0	0	- 0			- 0	- 0	0	- 0	0	- 0		. 0		
	LEO Recessed Square Downlight		5 0.000	- 0	0 0	0	0	0 6	0	. 0	- 0	- 0	0	- 0	- 0	0	0	- 0	- 0	0.6	1	1	0.45	- 0	- 0	3.05	0.0
Dining Reem	Recessed Bound Downlight Tilt Blade		11 000		0 0	0	0	0 0	0		0	0	0	0		0		0	0	0	0	0	0		0	0	
Uning Keem	Delling Fan				0 0	0	0	0 0	0	0	0	0.3	- 1	0.23		0	0.3	0.7	0	0.6	- 1	- 1	0.43	0	0	3.8	0
	Air-conditioner		750 0.75		0 0	0	0	0 6			- 0	0.5		0.25				- 0	- 0	- 0		- 0				1.79	1.3
	LED Recessed Square Downlight		1 0.001		0 0	0	0	0 ;	- 1		- 0	0	9	0		. 0		ç	. 0	- 1	- 1	- 1	- 1	. 0		- 4	
	Linear LEO Light	1			0 0	0	0	0 0	0		- 0	- 0	- 0	- 0	- 6	. 0	. 0	- 0	- 0	- 0	- 0	- 0		- 0	. 0	- 0	
	Refridgerator	_	120 013		1 1	- 1	1	1 1	1	- 1	-	- 1		- 1	1	- 1	- 1	- 1	- 1	- 4		- 1	- 1	1	1	24	
Kitchen	Microwave	-	200 03		0 0	0	0	0 0	0		0.06	0		0	0.05	0		9	- 0	0	0.05	0	0		. 0	0.15	
	CeilingFan	_	45 0.040		0 0		0	0 0	1	0.5	- 0			0.4	0.4	. 0	. 0	- 0	- 0	9.2	1	- 1	1		. 0	5.5	0
	Dine	-	1800 14	-	9 9	- 0	9	0 0	0.2	0.1	- 9	- 0	- 0		- 0	- 0	- 0	- 9	- 9	- 0	0.3	0.5	- 0		- 0	1.1	
	Pressure Cooker	-	1000		9 0	0	9	0 1	0		- 0	. 0	- 0	9		. 0	- 0	- 0	- 9	0		0				- 0	
	LEO Recessed Square Downlight Ceiling Fan	1	41 0.00	-	9 9	- 0	9	9 1		- 0	- 1		- 0		- 0	- 0	- 5	- 9	- 9	- 0	0.5	- 1	1	- 1		3.5	
Guest Bedreem	Air-conditioner	-	750 0.75		1 1	- 0	-	9 1	3 3		- 3				-		- 3	- 3	- 3	- 9		- 2	- 0			- 4	
	Phone Charger	-	10 00		7 7	- 1	1	1 1	1 1	- 1	- 3	- 0	- 0	- 0	- 0	- 0		- 1	- 1	- 1	- 0	- 0	- 0	- 0		10	-
	LED Recessed Square Downlight	-	1 0.00		1 1		-	1		- :	-	0.25	- 0	0.1		- 0	0.3	- 3	- 1	0.1		- 1	- 0	0.5	-	14.15	0.1
Guest	Recessed Round Downlight Tilt Blade		11 0.01		1 1	- 1	1	1 1	1 1	- 1	-	0.25	- 4	0.1	-	- 0	0.2	- 1	- 1	0.1	-	- 1	- 0	0.5		14.15	0.15
Bethreem	Water Payler	_	1790 1.79			-	6	0 0		0.1	0.25		- 0	- 0.1	-	- 0	0.0	- 1	- 2	0.1	-	- 0	0.21		- 4	1.3	2.0
	Washing Machine	_	750 0.7		0 0		6	0 0				- 0	-	-		-	- 1	- 1	- 6	- 0	-	- 0		- 0	- 0		
Laundry Room	LED Recessed Square Downlight		5 0.001		0 0	ò	6	6 6			- 6	- 0	0.5		- 6			d	- 6	ò	à	à	6			0.5	0.
First Floor		_	-			-	-	-	-	_	-	-		_		_			-			-	-				
	LED Recessed Square Downlight		5 0.000		I AI AI	A.	6	el e	J ad	-	- 4	- 4	-	1 4			4	41	- Al	A.	0.6	1 1		0.5	0.15	4.55	0.60
	Linear LED Light				1 3 3	- 1	-	2		- 1	- 3	-	- 0		-	- 0	- 1	- 3	- 3	- 0		- 4	- 0	0.25	0.23	0.25	0.00
Master	CeilingFan	_	45 0.040		1 1	1	1	1 1	1	- 1	-	- 0	- 0	- 0		. 6		- 6	- 6	ò	ò	à	6	1	- 1	12	
Bedreem	Ar-conditioner		850 0.8		1 1	- 1	1	1 1	1 0	- 0	- 6	- 0	- 0	- 0	-	0	- 0	- 4	- 1	0	-	0	0	- 0	-		
action and	Alarm Clark	-	5 0.00		1 1	1	1	1	1	- 1		- 1	-	1		- 1	- 1	-	-	- 1	-	1	- 1	-	- 1	34	
	Phone Charger		20 00		1 1	1	1	1 1	1		- 0	0	0	- 0		- 1	- 1	d	0	ò	0	0	0	0.5	- 1	11.5	
	LEO Recessed Square Downlight		5 0.00		0 0	0	0	0 0.8	0.3		- 0	0	0	0	- 0		- 0	- 6	- 0	0	- 0	0	0.25	- 0		1.1	0.0
Master	Water reater		1050 105		0 0	0	0	0 0.30	0.5		0	0	0	0	0	0	0	- 0	0	0	ò	0	0.15		- 0	1.1	1
Dathreem	Hair Dryer		140 014		0 0	0	0	0 0	0		- 0	0	0	0		0		- 0	- 0	0			0		0		
	LEO Recessed Square Downlight	-	3 0.00		0 0	0	0	0 0	0		- 0	0	- 0	0		. 0	- 0	- 0	- 0	0	- 1	- 1	- 1				0.
Common Area	Air-conditioner		750 0.71	0	0 0	ė.	0	0 0	0		0	0	ò	0		. 0		ė	0	ò	ò	ò	0		. 0	0	
	Water Pump Motor Switch		80 00		1 1	- 1	1	1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	34	
	LED Recessed Square Downlight		5 0.005		0 0	0	0	0 0	0		- 0	. 0	0	0		0		q	0	9		9	0	. 0	. 0	0	
	cinear LEO Light		21 0.00		0 0	0	0	0 (0		. 0	. 0		. 0						٥		. 0	. 0				
	Delling Fan		45 0.04		0 0	9	0	0 0	9		- 9	. 0		. 0		. 0	. 0	- 4	- 0	0		. 0	. 0	. 0	. 0		
Bedream 1	Wall-mounted Fan	-	45 0.00		0 0	0	0	0 0	0				0			. 0				. 0							
	Air-conditioner		750 0.7		0 0	9	0	0 0	9	. 0	- 9	. 0		0	- 0	0	. 0	- 9	- 9	9		. 0	. 0	. 0	. 0	9	
	Laptop Charger	-	250 02		9 9	9	0	0 0	9		- 9	- 0	_ 0	9	- 0	- 0	- 0	- 9	- 9	- 9	- 0	. 0	- 0		. 0	9	
	Phone Charger	-	30 00		0 0	9	0	0 1	9		- 0				- 0	- 0	- 0	- 0	- 0	- 0		9	- 0				
	Table Lamp	-	1 0.00		9 9	- 0	-	0 0		- 0	- 9	- 0	- 0		-	- 0		- 9	- 9	- 9	- 0	9	- 0	- 0	- 0	- 9	
Bathreem 1	LEO Recessed Square Downlight Water Peater	-			9 9	9	0	0 0	9	- 0	- 9	9	- 9	9	- 0	- 0	- 0	- 9	- 9	- 9	- 9	9	- 0	- 0	- 0	9	
	LED Recessed Square Downlight	-	1050 105		9 9	- 0	9	0 1	3 3	- 0	- 3	- 0	- 0		-	- 0	- 2	- 9	- 9	- 9	- 0	9	0.5	0.5	- 0	- 9	0
	Linear LEO Light	-	21 0.00		1 1	- 2	-	2 1	3 3	- 1	- 3	- 1	- 7		-		- 3	- 3	-3	- 3	_	- 7	0.5	9.5	- 7		
	Ceiling Fan	_	45 0.04		3 3	0	0	0 1	3 3	- 0	- 3	- 0	- 0	- 0	- 0	- 0		9.5	- 7	- 4	- 0	- 0	- 0	- 0	- 0	2.5	0.1
Bodream 2	Az-conditioner	_	750 0.7		1 1	-	-	-	1 1	-	-	-	-	-	_	-		0.5	-	0.45	-	-	-	-	-	1.95	1.4
pedream 2	Printer	_	41 0.04		1 3	- 0	6	2 2	3 3	-	-	- 7	-	- 2	-		- 1	- 1	- 1	0.40	-	- 7	- 0	- 0	- 1	1.00	
	Mac Desittop		80 00		0 0	0	0	0 0	0	- 0	- 1	- 0	- 0	0	- 0	0	- 0	0.5	- 1	0.5	- 0	0	0		- 0	- 2	
	Phone Charger	_	20 00		1 2	- 0	-	2 1	3 3	-	-	-	_	-	-	-				- 7.0	$\overline{}$	- 2	-		-		
	LED Recessed Square Downlight		5 0.001		0 0	0	0	0 1	0		0		0						- 0	0	0	0	0				
Bethreem 2	Water reater		1050 1.0		0 0	0	0	0	0	- 0	- 1	- 0	- 0	- 0	-	0	- 0	- 1	- 1	0	- 0	0	0	0	0	- 0	
	LEO Recessed Square Downlight		1 0.001		0 0	0	0	0 0	0		0		0	0	- 0			c	0	0	0	0	0		0		
	Linear LEO Light		21 0.00		0 0	ø	0	0 0	0	ó	ė	ò	ò				p	d	g)	ò	ò	0				ė	
Bedreem 3	Gelling Fan		45 0.04	4	0 0	0	0	0 0	0	- 0	- 0	0	- 0		- 0	. 0		- 0	- 0	- 0	- 0		0	. 0	. 0	- 0	
	Air-conditioner		750 0.71		0 0	0	0	0 0	0		0	0	0	0		0		0	0	0	0	0	0	0		0	
	Phone Charger		20 000		0 0	9	0	0 0	0	. 0	- 0	. 0	- 0	9	0	0		- 9	- 0	9	- 0	9	0	0	- 0	- 0	
Dathreem 3	LEO Recessed Square Downlight		1 0.001		0 0	0	0	0 0	0		0	0	0	0		0		c	0	0	0	0	0		. 0	0	
J	Water reater		1090 101	0	0 0	0	0	0 1	0		. 0	0		0		. 0		0	0	0			0		. 0		
																										TOTAL ENERGY	24.425

SPACES	ELECTRICAL APPLIANCES	No. of		NERGY													- WEEKENS									_	TOTAL USAGE	TOTAL ENERGY
	EMCHIDAL ATTENDED	UNITS	W	h kwi	h c	0.00 01.00	02:00 0	3:00 04:0	05:0	06:00	07/00	08:00	09:00	10:00	11.00	12/00	13:00 14	100 15	00 160	17/00	18/00	19:00	20.00	21/00	22:00	23:00	(HOURS)	CONSUMPTION (kW)
Ground Floor										3.1									187									
Car Parch	Automated Main Gate		1	75 0.0	105	0 0	- 0	0	0	0 0	0	0.025	- 0	0.01	- 0	- 0	0.02	0	0	0.5	0.2	- 0	0.02	- 0	- 0	0	0.775	0.090
Car Paren	LED Recessed Lquare Downlight		4	3 00		0 0	0	0	0	0 0	0 0		0	0	0	0	0	. 0	0	0 0	. 0	0.8	- 1	- 1			2.8	
	LEO Recessed Square Downlight	10	.0	5 0.0	X05	0 0	- 0	0	0	0 6	0		- 0	- 0	- 0	- 0	0	0	0	0 0	1	1	1	- 6	- 0	0	3	0.
	Linear LEO Light	11	0	21 00	101	1 0	- 0	0	0	0 6	0	- 0	- 0	- 0	- 0	- 0	0	.0	0	0 0	- 0	0	. 0	0.8	- 1	- 1	5.6	0.7
Main Living	Deling Fan			43 00		1 0.2	- 0	0	0	0 0		- 1	0.35	0.3	- 0			0	0	0 0		0.3	- 1	- 1	1	1	6.31	0.58
Reem	65" Samoung Smart TV			05 0.2		1 0.2	- 0	- 0	0	6 1		- 1	- 6	0.5	- 1	- 1	- 1	0	6	0.25	- 1	1	- 1	- 1	1	- 1	10.95	2.240
	Plano Heater	_			-01	7	-	-1	1	1		1	-	- 1	-	-	-	-	-	1 1	- 1	-	-	-	-	- 1	34	0.
	AP-conditioner	-			73	-3-3		- 3	-	*	-		-3	- 6	-	-			-	:-:	- 3	-	-	-	-			
	LEO Recessed Square Downlight	-	-	5 0.0		- 1	- 7		-	4	1	1 3	- 1		- 4	- 4	-	- 7	-	3 3	0.6	- 1		0.45	-	- 7	3.05	0.08
	Recessed Bound Downight Tilt Blade	-	-	11 00			- 0	- 2	9	9 1	-	1 3	- 1	- 0	- 0	- 2	- 0	- 9	-	9 - 9	2.6	-		0.40	-	- 1	3.00	0.08
Dining Reem		-				9 9	9	- 0	9	9 1	-		- 0		9		- 0	- 0	-	9 9	- 0	- 9	- 0	- 0	-	- 9		
	Ceiling Pan	-		43 0.0		9 9	- 0	9	9	0 0	9	- 9	-	- 1	-	0.21	- 0	- 0	- 0	9 9	. 0	. 0		0.45	-	- 1	5.7	0.21
	Air-conditioner	_	42		75	-9 -9	- 0	- 0		9 1	-			0.5	_	0.25		- 0	-	9 - 9	- 0	_ 0		- 0	-	- 0	1.75	1.55
	LED Recessed Square Downlight	-	-	1 00		0 0	0		0	0 0	9	- 9	- 0			. 0		- 0	- 0	9 9		-				- 0		0.
	Linear LEO Light	1.	2	11 00		0 0	- 0	0	0	0 0	0	- 1	- 0	. 0	. 0	. 0	0	.0	0	0 0	- 0	. 0		. 0	- 0	. 0	- 0	
	Refridgerator		1 1	20 0	12	1 1	- 1	1	1	1 1	1	1	1	1	1	- 1	- 1	1	1	1 1	- 1			1	1		24	2.
Kitchen	Microwave				0.2	0 0	. 0	9	0	0 0	0		0.05	0	9	0	0.03	0	0	0 0	. 0	0.05		0	. 0	0	0.15	
	Ceiling Fan			45 0.0	145	0 0	0	0	0	0 (1	0.5	- 0	- 0	- 0	0.4	0.4	0	0	0 0	0.2	1	- 1	1	0	- 0	5.5	0.4
	Stove		1 14		1.8	0 0	0	0	0	0 0	0.3	0.1	0	0	0	0	0	0	0	0 0	0	0.3	0.5			0	1.1	1.0
	Pressure Cooker		1 16		1	0 0	0	0	0	0 0	0		0	0	0	0	0	0	0	0 0	0	0	0	0	0	0	- 0	
	LEO Recessed Square Downlight	1	6	5 00	005	0 0	0	0	6	0 0			d	à	à	à		0	0	0 0	à	0.5		- 1			2.5	0.0
			3	43 00		0 0	- 0	0	0	0 0		- 1	- 0	- 0	- 0			0	0	0 0	- 0	- 0	-	-	-	- 0	- 0	
Guest Bedreem	Air-conditioner				79	0 4	à	à	6	6		- 1	- 4	- 4	- 4	- 4		6	6	4	A	- 4	- 4	-	-	- 4	- 4	
	Phone Charger				01	4 4	- 0	0	0	0		- 3	- 7	- 0	- 4	- 0	0	0	0	1 1	- 9	- 1			1	- 1		0.0
	LED Recessed Square Downlight	_	+	1 00		-1 -1	- 7	-1	1	1		- 3	0.1	- 1	- 4	- 4	-	-	0.3	3 - 3	0.1	-	-i	-	0.5	- 1	13.3	0.1
Guest		1	1			-1 -1	- 3	- 1	1	1			0.5	- 0	9	9	- 0			3 3		- 1	-	- 0		- 1	15.5	0.14
Bethreem	Recessed Round Downlight Yift Blade Water meater		1 17		73	-1 -1	-	-	1	3	1	0.1	0.3		- 0	- 0		- 0	0.2	9 9	0.1	-	-	- 0	0.5	1		
						1 0	- 0	-	-	-	9	0.1	0.25				- 0	-	-	9 9	0.5	- 0		0.21		- 9	1.5	
Levndry Room	Washing Machine				73	9 0	9	9		1 1	0		- 1	. 0		. 0	- 0	- 0	91	9 0	- 0	. 0		- 0		- 0	- 2	
	LED Recessed Square Downlight		1	5 0.0	XII	0 0	- 0	0	0	0 0		- 1	- 0	1	0.5			.0	- 0	0 0	- 0	. 0	0			. 0	1.5	0.00
First Floor																												
7.5	LED Recessed Square Downlight		9	5 0.0	X15	1 0	0	0	0	0 0	0.4	1	0		- 0	- 0	0	0	0	0 0	0	0.6	- 1		0.3	0.25	4.55	0.200
	Linear LEO Light			11 00	101	0 0	0	0	0	0 0		- 0	- 0			. 0		0	0	0 0					0.25	0	0.25	0.0
Master	Gellingfan			45 0.0		1 1	- 1	1	1	1 1	1	1	-	è	à	ò		6	0	6 6	d	ò	- 0	6	1	1	12	0.
Bedream	Air-conditioner		1	10 0	43	1 1	- 1	1	1	1		- 1	- 6	- 0	- 0			0	0	0 0		- 0	- 0	- 0	-	- 0	7	3
acere em	Alarm Clock	_	-	3 00		-1 -7		- 1	1	1		1	-	- 1	-	-	- 1	-1	-1	1 1	-	-	-	-	-	-	34	0
	Phone Charger	-	3		02	-3 -3		- 1	-	3			- 4	-	-	-	- 2	- 1	- 1	3 3	- 4		-	-	0.5	- 1	11.5	0.
	LED Recessed Square Downlight	-	-	3 00		-1-1			1	4	-	0.15	0.5	- 0	- 0	- 2	- 9	-1	-	9 - 9	- 9	- 2		0.25	- 23	- 1	11.5	0.0
Master		-	1 10			-1 -1	- 4		-	9 9	-			-	- 4	- 4		- 5	-1-	3 - 3	- 9	- 4			-	- 1		
Bathreem	Water meater	-			.015	9 9	- 0	9	0	0 0	9	0.15	0.5					- 0	-	0 0	- 0	- 0	- 0	0.15	0	9	0.05	11
	Heir Dryer	_	4		14	9 9	· ·	9	0	0 0	-		0.05	- 9	- 9	- 9	- 0	- 9	-	9 9	- 9	- 9	_ ,	-	-	- 9	0.05	
	LED Recessed Square Downlight	-	6	3 0.0		0 0	- 0	9	0	0 0		- 0	- 41	. 0	. 0	. 0	0	0	0	9 9	- 0	1				- 0		0.0
Common Area	Air-conditioner				75	0 0	. 0	0	0	0 0			0	. 0	0		0	0	0	0 0	. 0	. 0			. 0	. 0	0	
	Water Pump Motor Switch	_	4_		-04	-1 -1	- 1	- 1	1	1				- 1	- 1	- 1	- 1	-1	-	1 1	- 1		- 1	- 1	- 1		34	
	LED Recessed Square Downlight		4	3 0.0	205	0 0	0	0	0	0 0	0	0	- 0	. 0	0	. 0	0	0	0	0 0	- 0	0	- 0	0.2	0.5	0	0.7	0.0
	Linear LEO Light		1	11 00	101	1 1	0.5	0	0	0 0	0		ė.	0	· ·		0	0	0	0 0	ò	. 0		1	1	- 1	5.5	0.11
	Ceiling Fan		E .	43 0.0	143	0 0	0.8	1	1	1 1	1	- 1	- 1	- 1	- 1	- 1	0	0	0	0 0	0	0		0.2		0	10.7	0.48
	Wall-mounted fan		:	45 0.0	tio	1 1	0.5	0	0	0 0		- 0	0	0	0		0	0	0	0 0	0	· o		- 1	- 1	- 1	5.5	0.24
Bedream 1	Air-conditioner		E 7	50 0	75	1 1	- 1	1	1	0 0	0	- 0	- 0		- 0		0	0	0	0 0	0		- 0	- 0	- 1	- 1	7	
	Laptop Charger				23		0	0.5	0	0 0		-	- 4	- 0	- 0	- 0		0	0	0 0	- 0	- 0	- 0	0.35		- 1	4.85	1.10
	Phone Charger				02	6 4	- 0	0	6	0	1	- 2	- 3	- 2	- 7	- 2	0	6	0	3 3	- 2	- 3	- 7		1	- 2		
	Table Lamp	1	1	10 0	-05	1 1	0.5	0	0	0		- 3	- 7	- 4	- 4	- 0		0	0	d d	- 0	- 0	- 4	- 0	1	- 7	45	0.3
		_	-	5 00				-	3	3	1	1 3	- 3		0.5		-	-	-3	1 1	- 7		0.5		-	- 1		0.
Bethreem 1	LEO Recessed Square Downlight	_	5 00			- 1	- 9	-	-	-	9	- 1	- 91	- 9	9.5	- 9	- 0	- 7	-	3 3	9	- 9	0.5	- 0	-	- 9		
	Water reater	-	1 10	8 00	.015	9 0	- 0	- 9	2	1			- 0				- 0	- 0	-	9		- 0			- 0	- 0	- 0	
	LEO Recessed Square Downlight		1			9 9	- 9	9	61	9 1	- 0	- 1	- 9	- 0	- 0	- 0	- 0	- 9	- 9	9 9	- 0	- 0	_ 0	0.5	0.5	- 9		0.
	Linear LtO Light	-		11 00		0 0	0	0	0	0 0	0		0	. 0	. 0		0	0	0	0 0	0	. 0				. 0		
	Ceiling Fan			45 00		0 0	- 0	0	0	0 0	0	- 0	- 4	. 0	. 0	. 0		0	0 0		1	0			. 0	- 0	2.5	
Bedream 2	Air-conditioner				75	0 0	- 0	0	0	0 (0	. 0	- 4	- 0	- 0	9	0	0	0 0	5 E	0.45	. 0			. 0	0	1.95	1.46
	Printer			65 0.0		0 0	0	0	0	0 0	0		0	0	0	0	0	0	0	0 0	0	0				0	0	
	Mac Desittop		E .	0 04	-04	0 0	9	9	0	0 0	0		- 0	- 0	- 0	. 0	0	0	0 0	5 5	0.5	0	- 0	. 0	. 0	0	2	0
	Phone Charger				0.2	0 0	0	0	0	0 0	0	- 0	0	- 0	0		0	0	0	0 0	0	0				0		
	LED Recessed Square Downlight		2	3 00	201	0 0	0	0	0	0 1			d					0	0	0 0	ò	0	0			0		
Bathreem 2	Water reater		1 16		-05	4 4	- 0	0	0	0 1		- 1	- 0	- 0	- 0			0	0	0 0	- 0	- 0	- 0	- 0	- 0	0	- 6	
	LED Recessed Square Downlight			1 00		-3 -3	-	0	6	1	1	1 3	-3	-	- 7	- 2		- 2	-	3 - 3	- 3	- 0	_		-	- 3	- 7	
						7 9		-	-	-	9	- 3	- 0		0		-	-	-	1 0	9	- 0	- 0	- 0	-	9	- 9	
	cinear uto cight			11 00			- 0	9	9	9 1	- 0	- 9	- 0					- 9	-	9 9	- 0	- 0	- 0	- 0	- 0	- 9		0.1
Bedreem 3	Ceiling Fan			45 0.0		_	_	-	4	4	-	-	_		_	. 0		- 0	-	1	-	-4	- 0	- 0		-	18	
	Air-conditioner				179	1 1	1	1	1	0 0	. 0		0	0	0		0	0	0	0 0	0	0	0		. 0	- 1	4	
	Phone Charger				-02	9 9	- 1	- 1	3	3	1	- 1	1	- 6	- 1	. 0	0	0	0	9 9	- 9	. 0		- 0	- 0	0		-
	LED Recessed Square Downlight		2	3 00	201	0 0	0	0	0	0 0	0		0	0	0	- 1	0	0	0	0 0	0	0	0	- 0	0	0	1	0.
			1 10	40 3	on	4 4	-	-				-	_	_								_				_		
Bathream 3	Water reater																											
Bathream 3	Water Heater	_		-	-	- 4 4	9	이	4	4 1	9 9	- 9	9			- 1	- 0	이	미	0 0	0	- 1					TOTAL ENERGY	42,5581

3 HOURLY ENERGY USAGE LOAD (WEEKDAY & WEEKEND)

The table shows the typical energy consumption in a single weekday and weekend in response to occupants needs and climatic demands. Data was collected between the third and fourth week of the month of June (17/6/2023 - 25/6/2023) for 8 days. A study of the wattage of the appliances, the amount of hours each appliance was used and the total energy consumption was recorded throughout this period.

Weekday Energy Consumption = 24.426kWh (22 days)

Weekend Energy = 42.559kWh (8 days)

Total Monthly Energy Consumption

 $= (24.426 \times 22) + (42.559 \times 8)$

= 537 kWh + 340 kWh

= 877 kWh per month

June Electricity Bill

The bill in June came up to RM383.04, with a total energy consumption of 877kWh. After deductions of tax and reductions from ICPT, the final total of the bill reaches RM380.35 that needs to be paid to TNB.



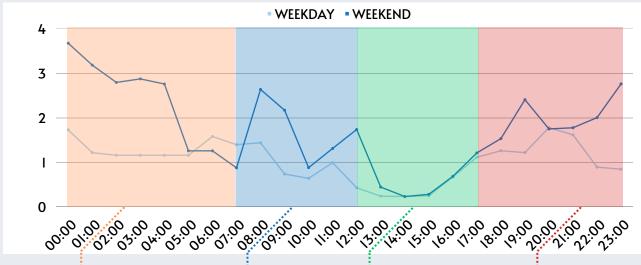
Tariff Blocks & Pro-rate Blocks

1- 200kWh	▲ 201 - 300kWh	▲ 301 - 600kWh	▲ 601 - 900kWh	▲ > 900kWh
200kWh x RM0.21800	100kWh x RM0.33400	300kWh x RM0.51600	277kWh x RM0.54600	0kWh x RM0.57100
RM43.60	RM33.40	RM154.80	RM151.24	RM0.00

Taxes and Bill Reductions

Details		Without ST	With ST	Total
Total of Consumption (877 kWh)	RM	231.80	151.24	383.04
ICPT (-RM0.02/kWh)	RM	-12.00	-5.54	-17.54
Total Usage	RM	219.80	145.70	365.50
Service Tax (6%)	RM			8.74
Kumpulan Wang Tenaga Boleh Baharu (1.6%)	RM			6.13
Total Bill of the Month				380.37

4 ENERGY CONSUMPTION PATTERNS



Gradual Drop

Lower user activity as users head off to sleep. Some appliances are left on overnight and turn off after a timer.

Moderate Consumption

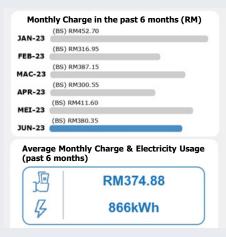
Early risers start using appliances, thus showing a slight spike in energy usage. The rest of the users wake up and continue with their day.

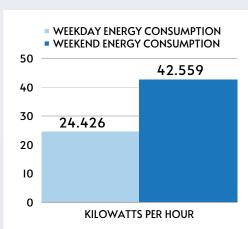
Low Consumption

Users start doing their own activities. This shows different users' usage in appliances, but similarly relatively low usage.

Gradual Rise

Users conclude their day with last minute work completions using their devices. Air-conditioners and lights are used primarily at this time.

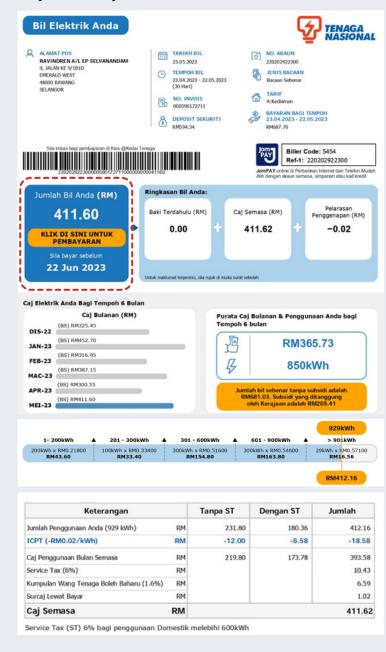




The first graph (next to the bar chart) shows the monthly charge of the electricity bills in the past 6 months. January has the highest monthly electricity bill, with RM452.70 to be paid to TNB. The price of the bills comes up to a mean average of RM374.88, with an average electricity consumption of 866kWh.

According to the bar chart, there is a significant amount of energy usage during the weekends compared to the weekdays. On weekends, the occupants use up to a whopping 42.6 kilowatts per hour of electricity compared to a measly 24.4 kilowatts per hour during the weekdays.

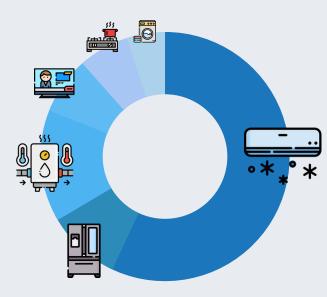
May Electricity Bill



The bill in May came up to RM412.16, with a total energy consumption of 929kWh. This compared to the bill in June shows a slight decrease in price after a month as a result to lower energy consumption.

5 ENERGY LOAD PROFILE & CORRELATION STUDY

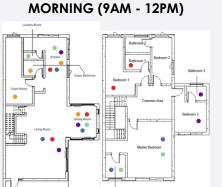
ENERGY COMSUMPTION BY APPLIANCES



Air-conditioners the highest are energy consumption appliance in the house. This is possibly because the house can get rather hot, thus the occupants would have to rely on airconditioning to reach a comfortable temperature.

Air-Conditioner	Energy	Ranking
Master Bedroom	5.95 kWh	1
Bedroom 1	5.25 kWh	2
Bedroom 3	4.5 kWh	3
Bedroom 2	1.4625 kWh	
Refrigerator		
Kitchen	2.88 kWh	4
Water Heater		
Guest Bathroom	2.275 kWh	5
Bathroom 3	2.1 kWh	7
Television		
Living Room	2.24475 kWh	6
Stove		
Kitchen	1.98 kWh	8
Washing Machine		
Laundry Room	1.5 kWh	9
Lauriur y Room	1.2 1/4/11	

OCCUPANT BEHAVIOUR PATTERN - ACTIVITIES IN SPACES



ACTIVITIES: sleeping, watching ACTIVITIES: studying, having ACTIVITIES: dinner, finishing on the phone

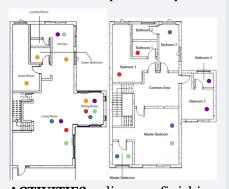
AFTERNOON (1PM - 7PM)



activities in own room, snacking watching TV, sleeping

SISTER GRANDFATHER **EVENING (8PM-2AM)**

FATHER MOTHER



TV, having breakfast, scrolling lunch, watching TV, resting, up work, scrolling on the phone,

FREQUENCY OF USE



The least frequently used rooms in the house are the laundry room, bedroom 1 and bedroom 3 as the room owners are not around during weekdays. As for the most frequently used rooms in the house are the master bedroom, kitchen and guest room as the occupants would be only carry out essentials which are eating and sleeping.

HEAT MAPPING



The thermal comfort study in the previous page shows the kitchen and dining room to be the warmest because these rooms have the biggest access points for sunlight to enter, such as windows and sliding doors. The common area and the bathrooms have a constant cooler temperature as there is hardly access to sunlight in these rooms.

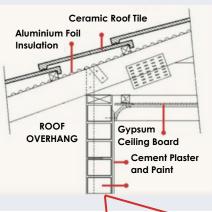
ENERGY CONSUMPTION



The rooms that have the most appliances in the house are the rooms that end up being the highest energy consumption spaces. The reason for that is that air-conditioners in rooms are used frequently. Surprisingly, the guest room has the least energy usage, because the room is at optimal temperature for the elderly occupant.

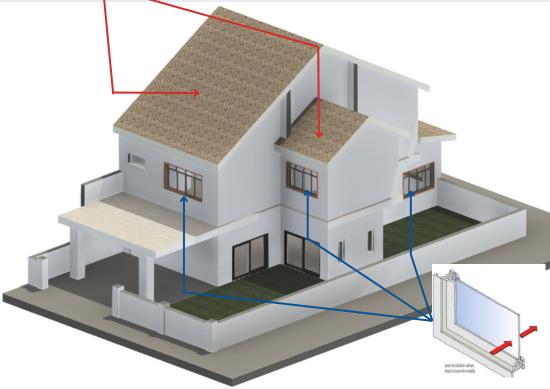
6 OVERALL EXISTING ENERGY PERFORMANCE

BUILDING CONSTRUCTION



MS 2680:2017	IVIO 2000.2017									
Roof Weight Group	Minimum R-value (m^2K/W)	Maximum U-value (W/m^2K)								
Light (under 50kg/m^2)	2.5	0.4								
Heavy (above 50kg/m^2)	1.67	0.6								

ROOF ANALYSIS: The U-value of the roof is quite high for a tile roofing construction, resulting in poor heat conductivity performance. However, changing a house's roof construction is often difficult. As a result, rather than adjusting the roof architecture, methods or tactics to increase the thermal comfort of the house could be passive design solutions.



WINDOW ANALYSIS: The kitchen and dining room, which contain the largest and most windows in the house, are the hottest rooms. This creates a significant increase in the temperature of the inside spaces surrounding them. Some techniques, such as shading devices or replacing single-glazed windows with low-e glass coatings, must be performed in order to minimize heat and improve thermal comfort.

U-VALUE CALCULATION

Brick Walls with Cement Plaster Painted (both sides)

Component - outside to inside	Thickness (m)	Thermal Conductivity (W/mK)	Resistance (m^2K/W)
Outer surface	-	-	0.04
Paint finish	0.001	0.16	0.006
Plastered Clay Brick	0.15	0.807	0.186
Paint finish	0.001	0.16	0.006
Inner surface	-	-	0.12
		Total	0.358
		U-value (W/m^2K)	2.79

A solid brick wall's recommended U-value is roughly 0.18W/m2K - 2W/m2K, indicating that the existing roof U-value is too high and surpasses the optimum value. This will have an impact on heat transfer into the house.

Ceramic Roof Tile Component - outside to T

Component - outside to inside	Thickness (m)	Thermal Conductivity (W/mK)	Resistance (m^2K/W)
Outer surface	-	-	0.04
Ceramic roof tile	0.012	1.298	0.009
Wooden rafter	0.05	0.138	0.362
Air space	-	-	0.18
Aluminium foil insulation	0.004	211	0
Gypsum ceiling board	0.01	0.17	0.059
Inner surface	-	-	0.12
	•	Total	0.77
		U-value (W/m^2K)	1.298

The outcome is higher than the tile roofing's maximum value of 0.4W/m2K. Better thermal comfort can be obtained by lowering the U-value.

Single Glazed Window without Coating

Component - outside to inside	Thickness (m)	Thermal Conductivity (W/mK)	Resistance (m^2K/W)
Outer surface	-	-	0.04
Single Glazed Glass	0.01	1.053	0.009
Without Coating	- 4	-	-
Inner surface	-		0.12
		Total	0.169
		U-value (W/m^2K)	2.79

Uncoated glass windows are notorious for wasting energy. Low emissivity coating (low-e coating) is one of the most common forms of glazing that may significantly minimize heat loss in windows.

7 ENERGY SYSTEM & ENERGY SAVING POTENTIAL

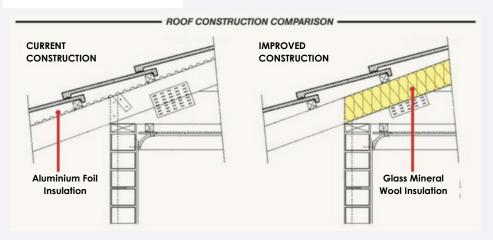
ENERGY SAVING STRATEGIES

GLASS MINERAL WOOL FOR ROOF CONSTRUCTION

ISSUE: The outcome is higher than the tile roofing's maximum value of 0.4W/m2K. A strategy must be implemented in order to reduce the U-value.



Mineral wool insulation is one of the materials that saves energy in use and reduces the need for combustion of fossil fuel. It helps to restrict heat transfer through building envelopes thus reducing the demand for space heating and cooling energy.

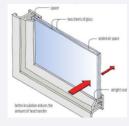


Glass mineral wool has a slightly lower U-value compared with aluminium foil, which means the more slowly heat is able to transmit through it, and so the better it performs as an insulator.

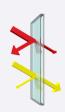
Component - outside to inside	Thickness (m)	Thermal Conductivity (W/mK)	Resistance (m^2K/W)
Outer surface	-	-	0.04
Ceramic roof tile	0.012	1.298	0.009
Wooden rafter	0.05	0.138	0.362
Air space	-	-	0.18
Glass Mineral Wool	0.09	0.035	2.571
Gypsum ceiling board	0.01	0.17	0.059
Inner surface	-		0.12
	•	Total	3.341
		U-value (W/m^2K)	0.299

DOUBLE GLAZED WINDOW

ISSUE: Big single glazed without coating windows on west facade caused an increase of internal temperature.



Double glazed windows are highly efficient, reducing your heat loss or gain by up to 30% when compared to single glazed windows. Double glazing works much like woolen clothing and fiberglass botts. It traps air between the two layers.

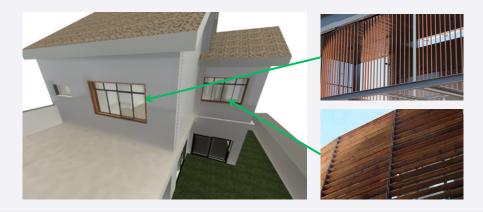


Component - outside to inside	Thickness (m)	Thermal Conductivity (W/mK)	Resistance (m^2K/W)
Outer surface	-	-	0.04
Outer layer of glass	0.01	1.053	0.009
Air space		-	0.18
Inner layer of glass	0.01	1.053	0.009
Inner surface		-	0.12
	io)	Total	0.358
		U-value (W/m^2K)	2.786

EFFECTIVE FACADE SHADING DEVICE

ISSUE: Big single glazed windows without any kind of shading devices on west facade causes an increase of internal temperature.

Study shows that the intergration of louver shading devices in a building leads to indoor comfortable thermal conditions and may lead to significant energy savings, by comparison to a building without shading devices.



7 ENERGY SYSTEM & ENERGY SAVING POTENTIAL

PASSIVE COOLING STRATEGIES

EVAPORATIVE COOLING POND

ISSUE: Internal temperature tends to get high at noon around 11AM until 3PM.

By adding some water features, it can pre-cool air before entering the house. As water evaporates it draws large amounts of heating from the surrounding air. Thus, become an effective passive cooling method.





Occupant Behavior Strategy:

Opening the front door every once in awhile to let natural ventilation flows into the space.

STRATEGIC LANDSCAPING

SURROUNDING VEGETATION

ISSUE: High internal temperature

Planting trees and other vegetation lowers surface and temperature by providing shade and cooling through evapotranspiration. Trees and vegetation that directly shade the house can decrease the needs for air conditioning, making it more comfortable and reducing the energy bill.







ENERGY SAVING EQUIPMENT

CEILING FAN & WALL-MOUNTED FAN

ISSUE: High energy consumption and amount bill per month.

A ceiling fan is a mechanical fan mounted on the ceiling of a room or space, usually electrically powered, that uses hub-mounted rotating blades to circulate air, they cool people effectively by increasing air speed.

On average, ceiling fans can help save

4 - 8%

on cooling costs when combined with an air conditioner.

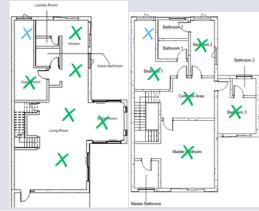
LEGEND

- X Wrongly Placed Fan
- X Correctly Placed Ceiling Fan
- X Correctly Placed Wall Fan

CURRENT PLACEMENT



IMPROVED PLACEMENT



Occupant Behavior Strategy:

By adding ceiling-mounted fan in several spaces of the house, occupants can be less reliant to air-conditioners and reduce the energy consumption.

RENEWABLE ENERGY SOURCE

GRID CONNECTED PV SYSTEM

ISSUE: High energy consumption and amount of bill per month.

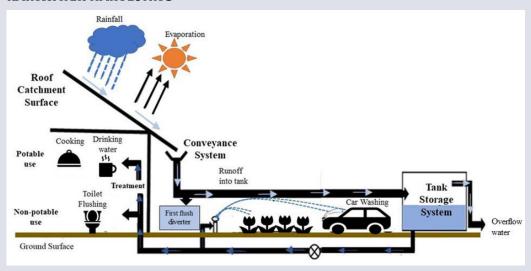
These Grid Connected PV Systems have solar panels that provide some or even most of their power needs during the day time, while still being connected to the local electrical grid network during the night time.



8 WASTE & WATER MANAGEMENT

WASTE & WATER MANAGEMENT STRATEGIES

RAINWATER HARVESTING



Rainwater harvesting is the practice of collecting and storing rainwater for various uses, such as irrigation, gardening, and non-potable household tasks. In Malaysia, where water scarcity and conservation are important considerations, rainwater harvesting is gaining popularity as an environmentally friendly solution.

EFFICIENT FIXTURES



DUAL FLUSH TOILET

Dual-flush toilets use for less water than regular toilet because they use different ways to flush away liquid and solid waste.

TOUCH FREE

The sensors will shut off immediately when not in use, thus eliminating that risk of water wastage when a user fails to turn the tap off.



9 CONCLUSION

An energy audit is a review of the energy-consuming equipment or system to ensure that it is being utilized efficiently. Energy audit activities are required to establish appropriate procedures to be made to utilize energy effectively in order to ensure energy sustainability in the future.

Based on all of the observations made in this report, the house has a lot of potential for improvement in order to maximize energy saving measures to minimize energy consumption and electricity.

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