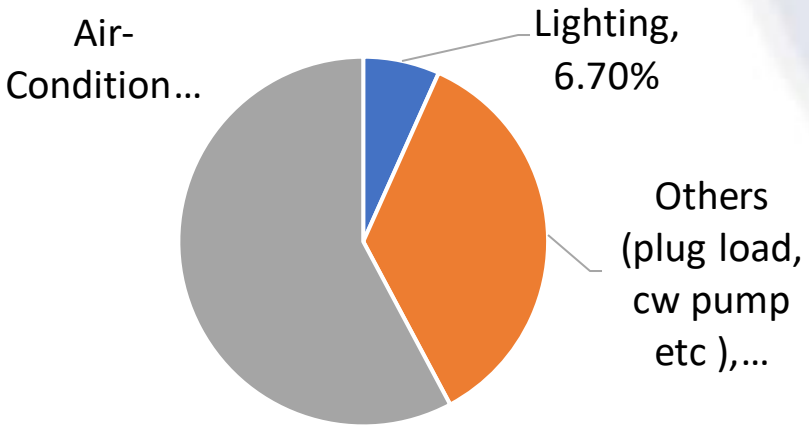
CASE 1

Building : Commercial (Mall)
NFA : 29,564 m2
Location : Terengganu
Tarif : TNB C1
Baseline : 4,716,979 kWh/year
CO2 emission : 3146 CO2e
BEI : 160 kWh/m2/year

Summary of Implemented ESMs

Load Apportionment



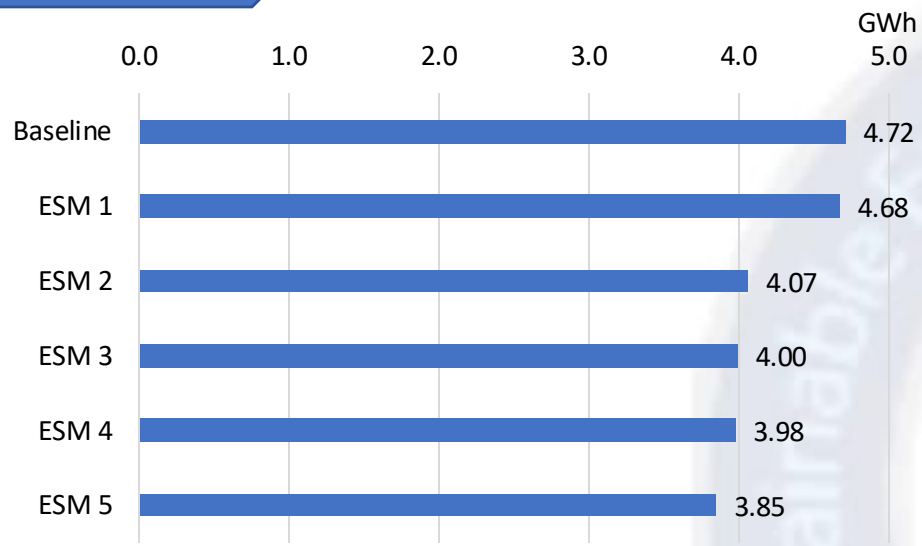
Proposed Energy Saving Measures (ESMs)

ESM No	ESM	Energy Saving (kWh/year)	Cost Saving (RM/year)	Investment Cost (RM)	Saving %	Payback Period (Year)
1	Optimize operation of chillers	480,350	RM175,328	RM350,000	10.18%	1.57
2	Start/stop chillers schedulling	86,688	RM31,641			
3	Cooling tower optimization	42,765	RM15,609		1.84%	
					0.91%	
4	Control infiltration to the air conditioning system	39,000	RM14,235	RM12,500	0.83%	0.88
5	Regulate minimum voltage within allowable voltage	70,755	RM25,825	RM31,500	1.50%	1.22
6	Comprehensive cleaning to the AHUs	15,279	RM5,577	RM15,700	0.32%	2.82
7	Energy Saver or LED Lighting	78,404	RM28,618	RM85,300	1.66%	3
8	Double door system at main entrance	95,590	RM34,890	RM170,000	2.03%	4.87
	Total	**908,831**	**RM331,723**	**RM665,000**	**19.27%**	

Summary of Implemented ESMs

ESM No	Brief Description	Investment Cost (RM)	Saving kWh/year [EMIS]	Saving (RM/year) [EMIS]	Payback Period (Year)	Month completed
1	Reset fresh air intake damper for each AHU to modulate based on CO2 sensor set at 900 p.p.m. Fresh air is supplied based on the set point and this can avoid unnecessary energy usage.	-	39,000	14,235	Immediate	Jan-18
2	Reschedule chiller start/stop. Shorter operating hours lead to saving in energy usage	-	609,803	222,578	Immediate	Jan-18
3	Saving is achieved by reducing higher voltage to match allowable voltage.	-	70,755	25,825	Immediate	Jan-18
4	Clean AHUs' air filter which resulted better air flow thus contribute to energy saving.	-	15,279	5,577	Immediate	Oct-18
5	Replace conventional lights which are high in watt to LED lights with lower in watt. Saving is gained from the difference in the wattage	232,872	127,180	46,419	5.02	Dec-20
	Total	**232,872**	**862,017**	**314,634**		

RESULT



Reduction in Energy Usage after each of ESM Implementation

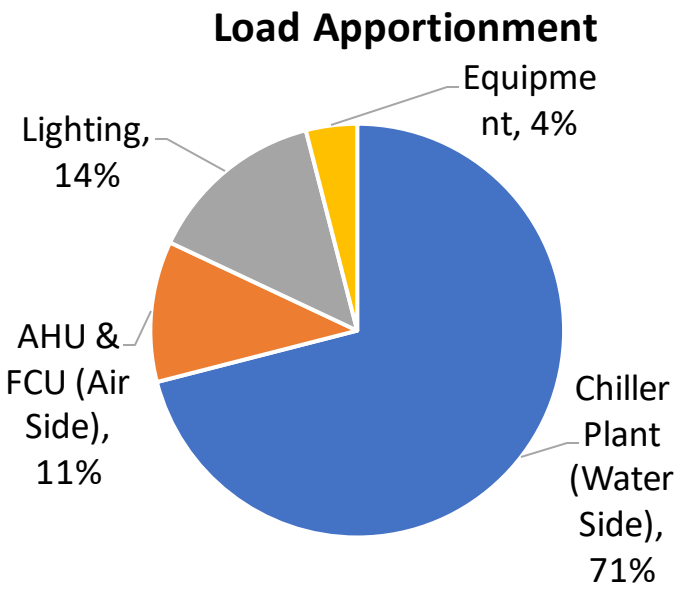
	ESMs Implementation	
	Before	After
BEI	160 kWh/m2/year	110 kWh/m2/year
CO2	3146 CO2e	2169 CO2e

FREE Potential GreenPASS (Operational Carbon) Assessment

Level of achievement (% of CO2e reduction)	Assessment Scheme for Existing Buildings
100% Carbon Neutral	
≥ 70 to < 100	
≥ 50 to < 70	
≥ 30 to < 50	
≥ 10 to < 30	
≥ 1 to < 10	

CASE 2

Building : Commercial (College & University)
NFA : 17,352 m2
Location : Melaka
Tarif : TNB C1
Baseline : 6,416,100 kWh/year
CO2 emission : 3359 CO2e
BEI : 370 kWh/m2/year



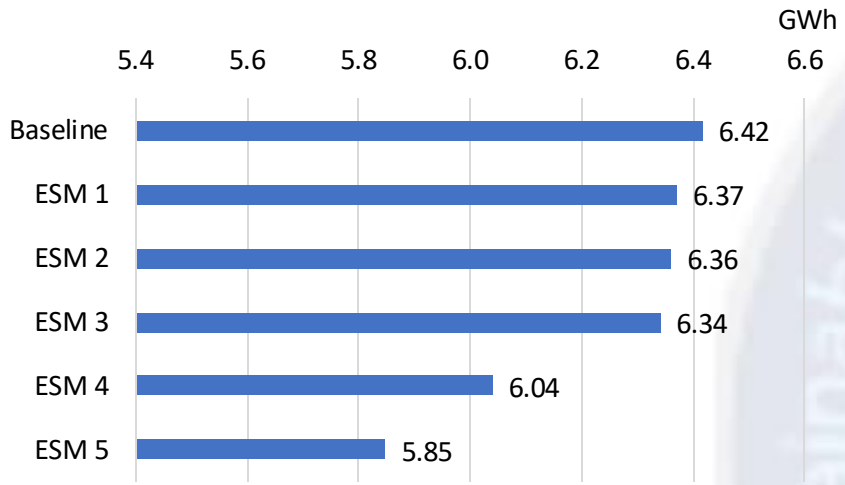
Proposed Energy Saving Measures (ESMs)

ESM No	ESM	Energy Saving (kWh/year)	Cost Saving (RM/year)	Investment Cost (RM)	Saving %	CO2 avoidance
1	De-lamping unnecessary light at FKM	45,550	RM16,626	-	0.71%	32
2	De-lamping unnecessary light at FTK	25,132	RM9,173	-	0.39%	17
3	SEMs setup	56,943	RM20,784	RM50,000	0.89%	40
4	Retrofit FL 18W to LED 10W at FKM	8,448	RM3,854	RM16,500	0.13%	6
5	Retrofit FL 18W to LED 10W at FTK	860	RM392	RM1,680	0.01%	1
6	Comprehensive cleaning AHU at FKM	4,630	RM1,690	RM3,000	0.07%	3
7	Comprehensive cleaning AHU at FTK	2,514	RM918	RM2,000	0.04%	2
8	Transform tariff C1-OPTR		RM16,627	RM3,000	0.00%	0
9	Cooling system- (book gallery 18-21°C) only at FKM	15,379	RM5,613	RM24,000	0.24%	11
10	Comprehensive cleaning cooling tower	1,897	RM692	RM1,100	0.03%	1
11	Install film tinted at FKM	27,345	RM9,981	RM70,000	0.43%	19
12	Retrofit FL 36W to LED 18W at FKM	113,875	RM41,564	RM197,700	1.77%	79
13	Retrofit FL 36W to LED 18W at FTK	62,830	RM22,933	RM109,080	0.98%	44
	Total	**365,403**	**RM150,847**	**RM478,060**	**5.69%**	**254**

Summary of Implemented ESMs

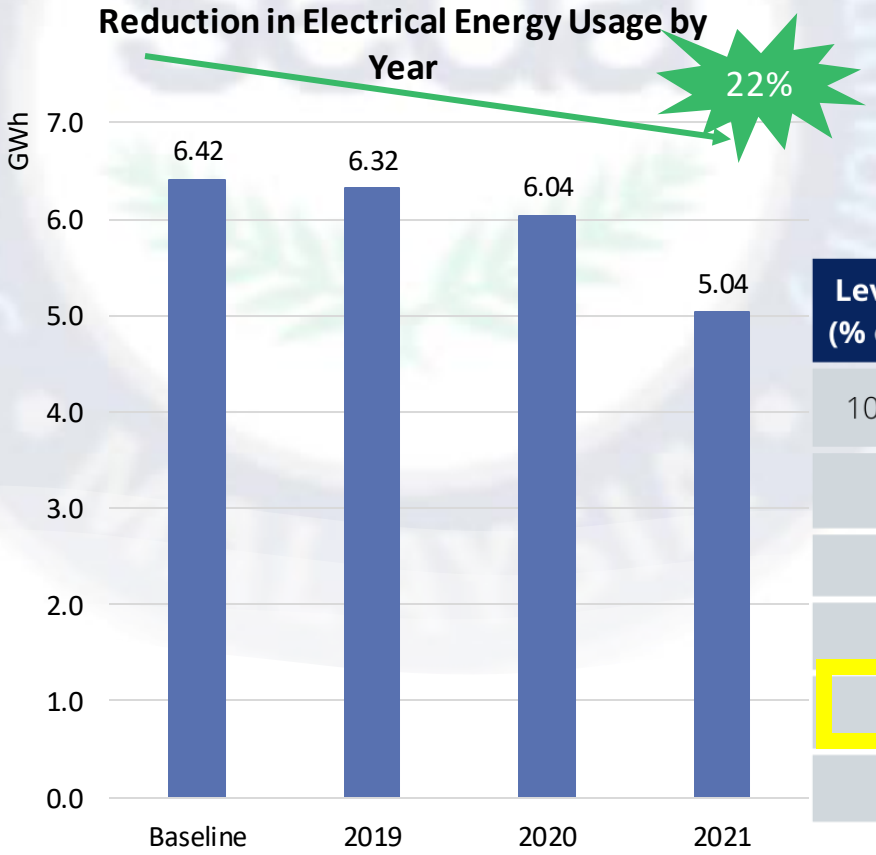
ESM No	Brief Description	Investment Cost (RM)	Saving kWh/year [EMIS]	Saving (RM/year) [EMIS]	Payback Period (Year)	Month completed
1	Maintenance Compressor System - Reprogramming, Repairing and Servicing	24,810	45,900	16,754	1.5	Apr-19
2	Maintenace Chiller System - To supply labour and tools for trouble shooting chiller No.3, emergency attend breakdown call. To replace oil temperature sensor.	2,500	10,300	3,760	0.7	May-19
3	Maintenance Lift System - Replace Main Wire Rope for Lift, Trouble shoot Gear Box and Replace Gasket and oil Seal	24,500	19,238	7,022	3.5	May-19
4	Repair, Retrofit, and Maintenance of cooling towers, pumps, & chillers water systems	733,350	300,730	109,766	6.7	Jan-20
5	Lift System - Monthly Servicing and Maintenance for Lift	277,500	192,378	70,218	4.0	Jan-20
	Total	**1,062,660**	**568,546**	**207,520**		

RESULT



Reduction in Energy Usage after each of ESM Implementation

	ESMs Implementation	
	Before	After
BEI	370 kWh/m2/year	290 kWh/m2/year
CO2	4280 CO2e	3359 CO2e



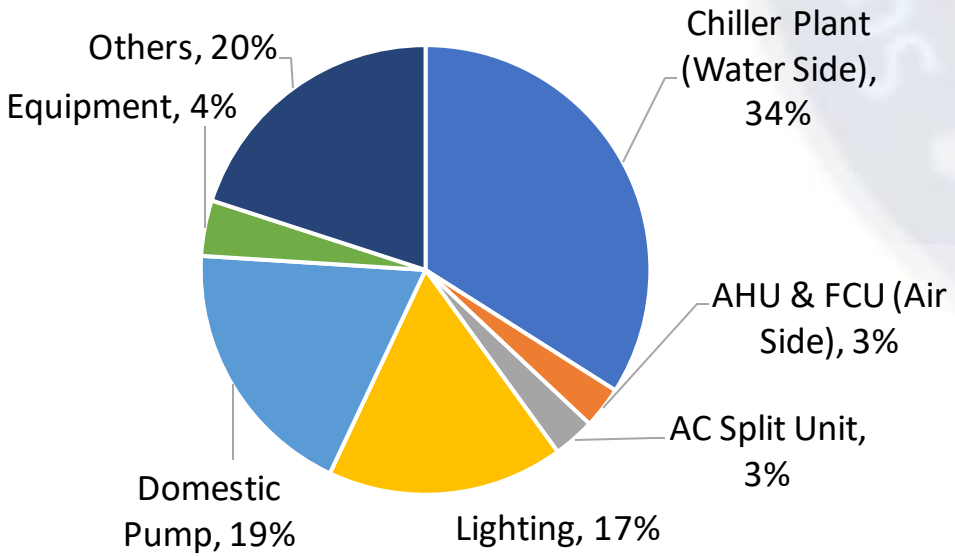
FREE Potential GreenPASS (Operational Carbon) Assessment

Level of achievement (% of CO2e reduction)	Assessment Scheme for Existing Buildings
100% Carbon Neutral	
≥ 70 to < 100	
≥ 50 to < 70	
≥ 30 to < 50	
≥ 10 to < 30	
≥ 1 to < 10	

CASE 3

Building : Commercial (Hospital)
NFA : 22,935 m2
Location : Penang
Tarif : TNB C1
Baseline : 6,198,200 kWh/year
CO2 emission : 4134 CO2e
BEI : 270 kWh/m2/year

Load Apportionment



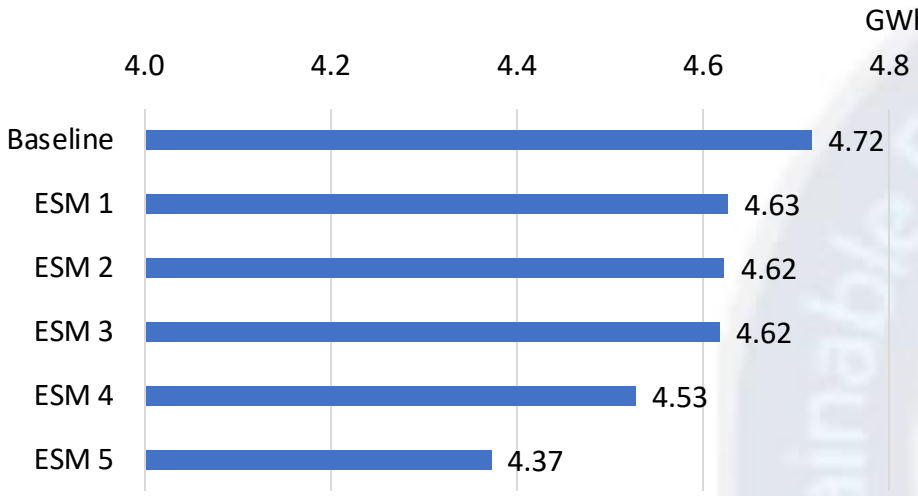
Proposed Energy Saving Measures (ESMs)

ESM No	ESM	Energy Saving (kWh/year)	Cost Saving (RM/year)	Investment Cost (RM)	Saving %	CO2 avoidance
1	Switch-OFF unnessary loads during lunch time	19,834	RM7,239	-	0.32%	14
2	Enable ENERGY SAVING MODE for all personnel	16,210	RM5,917	-	0.26%	11
3	Switch-OFF all portable printer	7,939	RM2,898	-	0.13%	6
4	Minimize number of pinter	37,616	RM13,730	-	0.61%	26
5	Retrofit Fluorescent 18W to LED 9W	42,084	RM15,361	RM19,720	0.68%	29
6	Retrofit CFL 18W to LED 9W	6,205	RM2,265	RM8,400	0.10%	4
7	Retrofit Fluorescent T8 36W to LED 18W	224,637	RM81,992	RM116,625	3.62%	156
8	Retrofit PLC 18W to LED 9W	249,746	RM91,157	RM253,560	4.03%	173
9	Replacement of air conditioning split unit to 5STAR Rating	78,124	RM28,515	RM37,500	1.26%	54
10	Sustainable Energy Management Program	185,946	RM67,870	RM105,000	3.00%	129
	Total	**868,341**	**RM316,944**	**RM540,805**	**14.01%**	**603**

Summary of Implemented ESMs

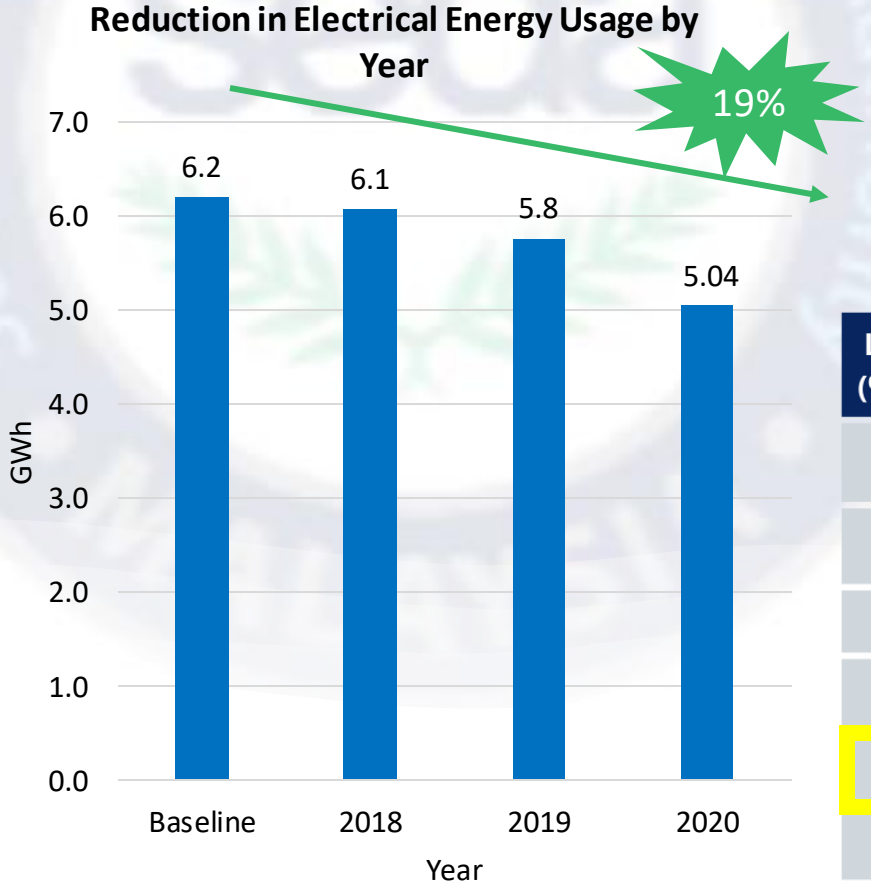
ESM No	Brief Description	Investment Cost (RM)	Saving kWh/year [EMIS]	Saving (RM/year) [EMIS]	Payback Period (Year)	Month completed
1	Optimize Cooling Tower operation by controlling cooling tower fan operation based on recommended set point of Condenser Water Outlet to Chiller.	19,128	90,000	33,300	0.6	Jan-19
2	Install 24-Hours Timer on Fan Coil Unit (FCU).	1,760	3,576	1,356	1.3	Apr-19
3	Install Timer 24-Hours at AHU Special Diagnostic Centre and reschedule timer to OFF at night time.	440	5,580	2,051	0.2	Apr-19
4	Optimize Cooling Tower operation by controlling cooling tower fan operation based on recommended setpoint	19,128	90,000	33,300	0.6	Jan-20
5	Automatic tube cleaning system - Hydroball. The system prevent hot water entering condenser water inlet and prevent temperature increase in cooling water flowing through condenser/hex	60,000	155,520	57,542	1.0	Jan-20
	Total	**100,456**	**344,676**	**127,549**		

RESULT



Reduction in Energy Usage after each of ESM Implementation

	ESMs Implementation	
	Before	After
BEI	270 kWh/m2/year	220 kWh/m2/year
CO2	4134 CO2e	3364 CO2e

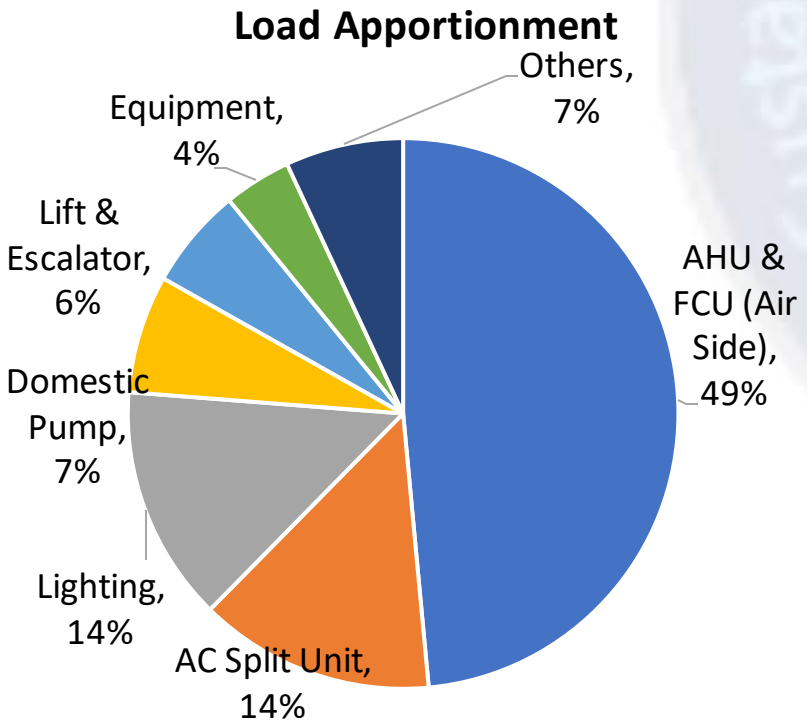


FREE Potential GreenPASS (Operational Carbon) Assessment

Level of achievement (% of CO2e reduction)	Assessment Scheme for Existing Buildings
100% Carbon Neutral	
≥ 70 to < 100	
≥ 50 to < 70	
≥ 30 to < 50	
≥ 10 to < 30	
≥ 1 to < 10	

CASE 4

Building : Commercial (PBT)
NFA : 7,200 m2
Location : Johor
Tarif : TNB C1
Baseline : 1,106,431 kWh/year
CO2 emission : 738 CO2e
BEI : 154 kWh/m2/year



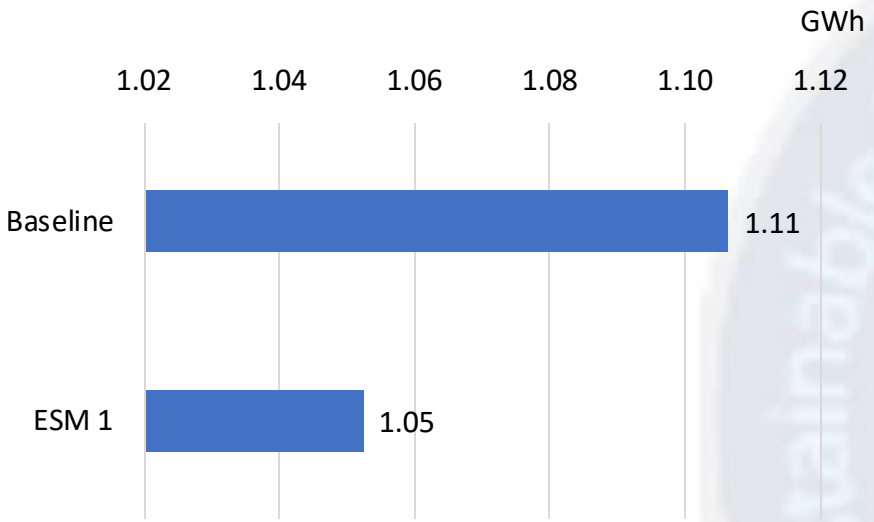
Proposed Energy Saving Measures (ESMs)

ESM No	ESM	Energy Saving (kWh/year)	Cost Saving (RM/year)	Investment Cost (RM)	Saving %	CO2 avoidance
1	Delamping at over lit areas	7,314	RM4,037	RM0	0.66%	5
2	Reduce outside air intake into the building through AHU by throtting down outside air damper manually	4,944	RM2,729	RM0	0.45%	3
3	Replace cooling tower infills and perform cooling tower chemical cleaning	5,159	RM2,848	RM0	0.47%	4
4	Look AHU, replace air filter every 6 month and ensure room is locked (not enetered by unauthorized personnel)	7,415	RM4,093	RM0	0.67%	5
5	Retrofit standard fluorescent lamp to LED	74,412	RM36,268	RM58,800	6.73%	52
6	Use Hydrocarbon Refrigent (R-22) at all ACSU system	28,184	RM15,557	RM49,400	2.55%	20
7	Consider replacing blower motor with Premium Efficiency (IE3) motor type when the motor breakdown	24,717	RM13,644	RM76,375	2.23%	17
8	Retrofit all ACSU into inverter type	75,156	RM41,486	RM148,200	6.79%	52
9	Use Hydrocarbon Refrigent (R-22) at all Water cooled package units	49,435	RM27,288	RM103,500	4.47%	34
	Total	276,735	RM147,950	RM436,275	25.02%	192

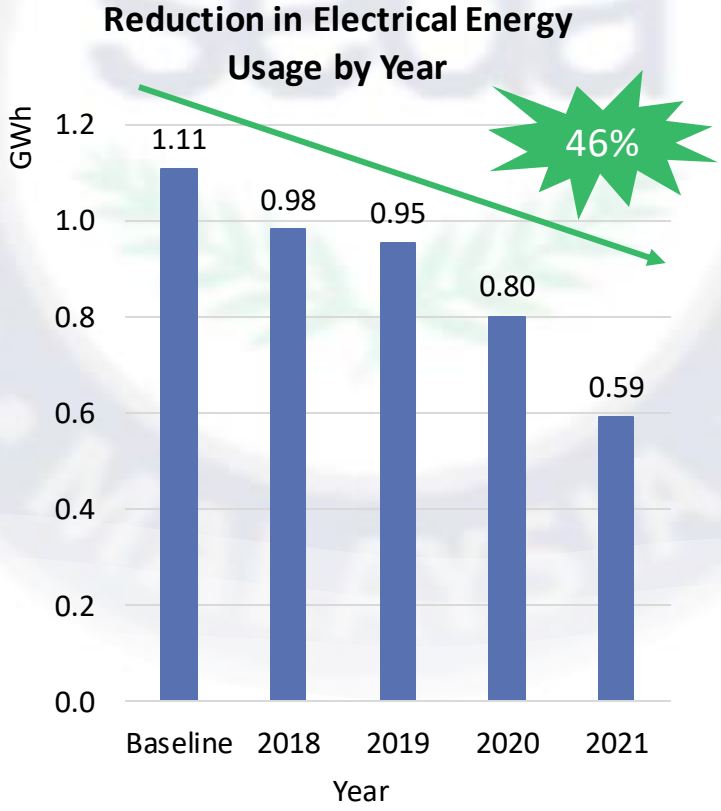
Summary of Implemented ESMs

ESM No	Brief Description	Investment Cost (RM)	Saving kWh/year [EMIS]	Saving (RM/year) [EMIS]	Payback Period (Year)	Month completed
1	Install LED lights : FL 36W(1150 unit) to LED 13W/18W (1150 unit). FL 25W (10 unit) to 18W (10 unit). DL 18W (75 unit) to DL 12W (75 unit)	RM49,950	54,017	RM19,717	2.5	Oct-20
	Total	RM49,950	54,017	RM19,717		

RESULT



Reduction in Energy Usage after ESM Implementation



	ESMs Implementation	
	Before	After
BEI	154 kWh/m2/year	82 kWh/m2/year
CO2	738 CO2e	395 CO2e

FREE Potential GreenPASS (Operational Carbon) Assessment

Level of achievement (% of CO2e reduction)	Assessment Scheme for Existing Buildings
100% Carbon Neutral	
≥ 70 to < 100	
≥ 50 to < 70	
≥ 30 to < 50	
≥ 10 to < 30	
≥ 1 to < 10	

CASE 4

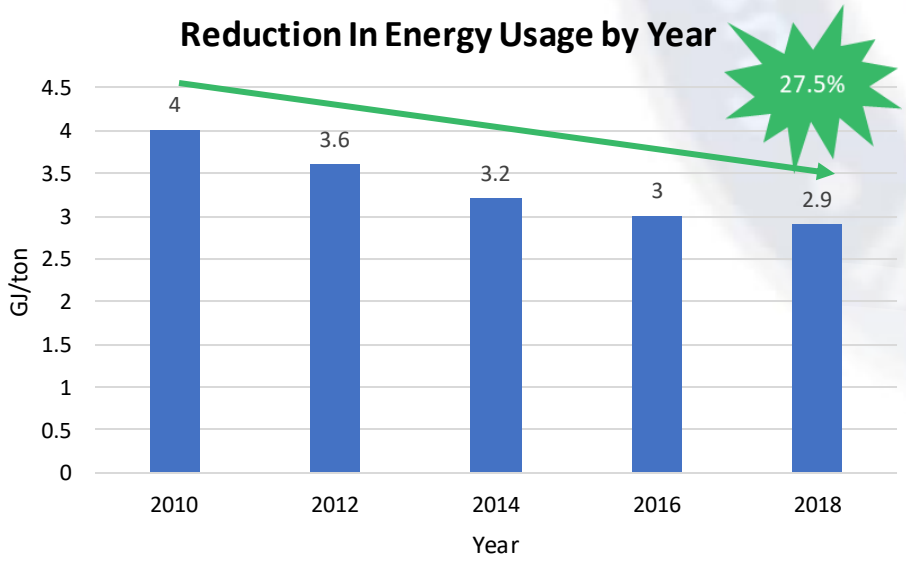
Building : Industry (Food Factory)

Summary of Implemented ESMs

ESM No	ESM Activities	Brief Description	Investment Cost (RM)	Saving GJ/year	Cost Saving (RM/year)	Payback Period (Year)
1	Air Conditioning System	Replace six cooling towers's fans with high efficient fans. Power saved due to its blade's aerodynamic design which is able to deliver same airflow with minimal power	59,100	308	30,515	1.9
2	Operation Control	Optimize chiller's operation. Saving achieved by matching chilled water demand with chiller unit	-	4,511	573,000	Immediate
3	Variable Speed Drive	Installed three units of VSDs to reduce power input to chilled water pumps' motor.	74,000	678	50,000	1.5
4	Boiler	Optimize excess air in boiler. Saving gained by logic controller based on oxygen sensor and trimming for burners in all boilers.	19,400	576	23,300	1.08
5	Motor	Change three 75kW IE1 motors to IE2 high efficient motors	55,500	292	29,000	2.4
		Total	**208,000**	**6,365**	**705,815**	

RESULT

Reduction In Energy Usage by Year

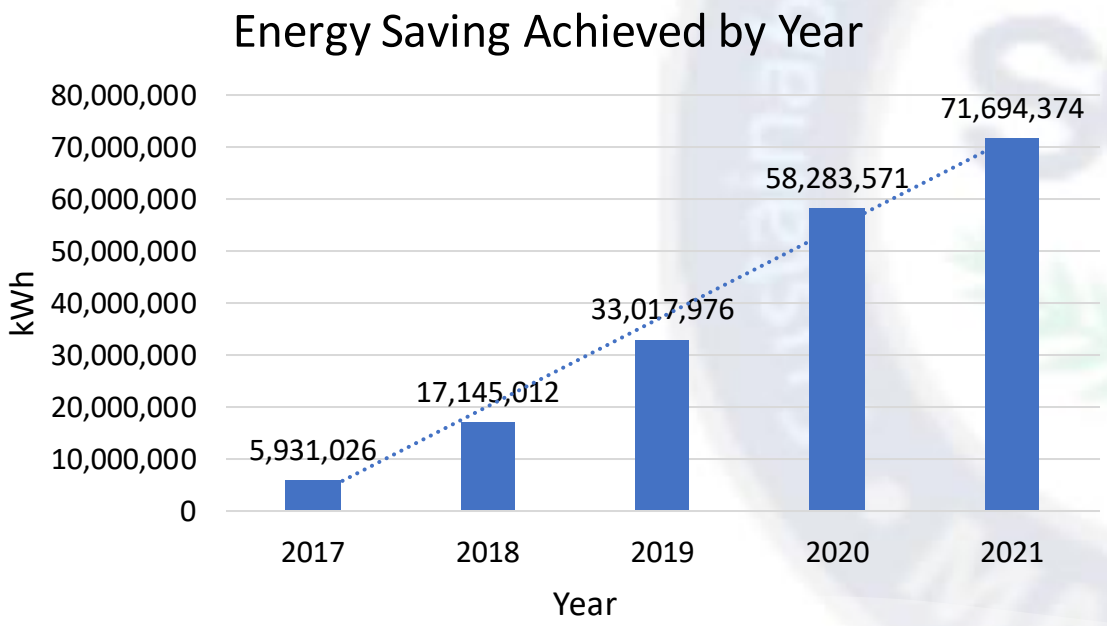


FREE Potential GreenPASS (Operational Carbon)

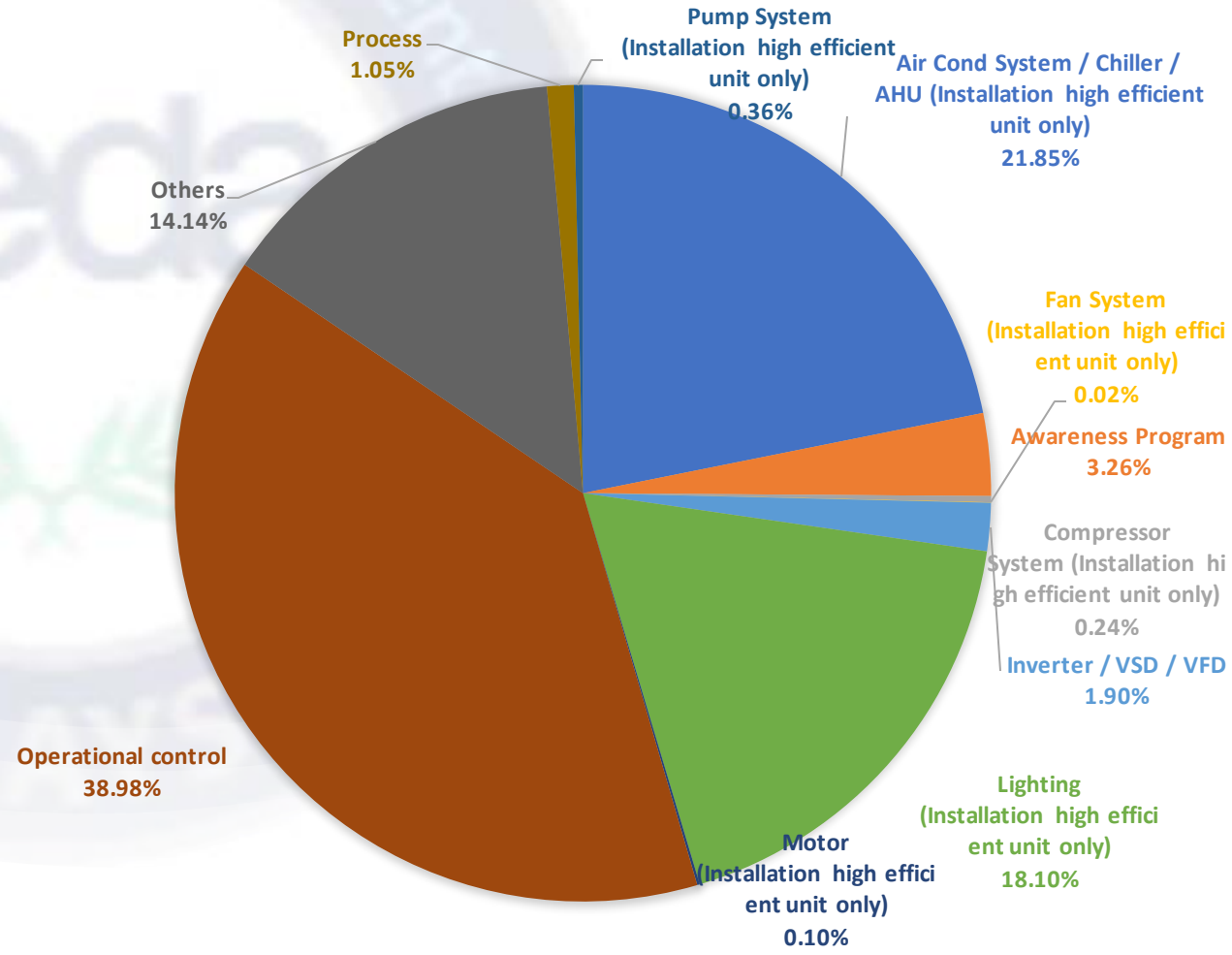
Level of achievement (% of CO_2e reduction)	Assessment Scheme for Existing Buildings
100% Carbon Neutral	
≥ 70 to < 100	
≥ 50 to < 70	
≥ 30 to < 50	
≥ 10 to < 30	
≥ 1 to < 10	

SUMMARY OF ENERGY SAVING FROM COMMERCIAL APPLICATION – EACG RMK11

Total Application : 108 Buildings



Percentage of Energy Saving Based on each of ESMs



SUMMARY OF ENERGY SAVING FROM INDUSTRIAL APPLICATION – EACG RMK11

Total Application : 109 Buildings