Energy Saving of a Commercial Building Jet Airways Godrej, BKC

Akram Ali

ABSTRACT :- As per concern human comfort, HVAC system plays a vital role & it consumes huge energy as well. In this paper energy consumption (i.e. Unit/TR) has been reduced for the month of June as compared to the months of April & May. To achieve this, theoretical & experimental analysis has been done. It has been observed that a great saving has been achieved of 31,368 & 50,491 units and around Rs. 4,17,190 & Rs. 6,71,530 for the month of June w.r.t. April & May respectively.

Data has been recorded from daily chiller load sheet during peak hours (i.e. High cooling demand 8am to 6pm). And as per running hours of chillers and their corresponding pumps , CT fans etc. theoretical calculations have done & simultaneously electricity consumptions have been recorded by means of energy meter for these peak hours.

KEY WORDS :- ACCH, WCCH, performance, consumption saving, comparison between ACCH & WCCH, commercial building.

INTRODUCTION :-

Electricity consumption is the big issue in any buildings such as commercial, residential, hotels, mauls, hospitals etc. There are many departments where electricity is used such as HVAC, Lighting, Plumbing, STP, Lift, Parking etc. As per our observation, it is found that HVAC system is the only section where huge amount of energy is required. It consumes energy around 80% of the entire building load. So better care could save huge amount of energy. [Refer Table 1 & Fig 1]

As we know that the Earth is inclined to 23.5deg & India comes under northern hemisphere which is nearest to the sun during the months April, May & June. During these months cooling demand is maximum & corresponding consumption will be high. So, cooling load analysis have been done for the month of April, May & June during peak hours (i.e. 8am to 6pm).

Analysis have been done with respect to Unit/TR. (i.e. Unit KWH is required to achieve single TR cooling). Previous paper [1] concluded that it is good to run WCCH above 100 TR but due to some limitations, it is not possible to run WCCH below 240 TR for this particular site. As the site has WCCH of 600 TR. So, below 40% load it will be surged. So, it is our compulsion to run ACCH below 40% load of WCCH.

In this paper, we focused to run WCCH only as possible during the peak hours (i.e. 8am to 6pm). And comparison has done among 3 months April, May & June. From previous paper [1], it has been observed that minimum amount of Rs 36,883 or 2773 units/TR in a month can be saved by running WCCH.

BUILDING DEPT.	APRIL			MAY			JUNE		
	30-Apr	1-Apr	UNIT	31-May	1-May	UNIT	30-Jun	1-Jun	UNIT
STP	71029	66848.7	4180.3	75621.6	71156	4465.6	79641.9	75732.2	3909.7
PLUMBING	71.96202	71.21946	18700.6	72.66978	71.971384	22910.1	74.7821	72.67832	21240.3
	148.8746	144.9153		153.7027	148.97397		157.91	153.8342	
	4.365929	3.935801		4.891393	4.3819536		5.36974	4.9094556	
	30.36603	29.17811		31.69103	30.392072		32.9456	31.730484	
	8796.173	7908.037		9829.703	8815.0048		10870	9860.3232	
	7920.41	7141.873		8768.957	7937.4824		9512.96	8793.4984	
	2939.438	2863.019		3077.049	2939.7348		3204.71	3085.583	
	31.33741	29.91134		32.93311	31.337408		34.4206	32.93311	
	40.52196	39.04842		42.0848	40.521964		43.5897	42.084796	

	34.56816	33.07921		36.20832	34.568164		37.7277	36.208315	
	35.21716	33.88079		35.78436	35.217156		36.9289	35.784356	
	962.2796	807.3466		1242.988	969.74952		1520.36	1244.0149	
	75.43238	70.59784		80.58498	75.531448		643.912	80.658014	
	13.21127	11.93396		14.41796	13.228516		15.7402	14.459442	
	24.43717	22.24812		26.84301	24.455474		29.1507	26.885372	
	11.96973	11.06184		12.71954	12.016677		13.5415	12.747833	
	716.176	715.0313		750.7307	716.176		834.611	751.09592	
	1009.396	631.9429		1466.669	1009.3956		2090.18	1471.8529	
LIFT	170.2465	155.7127	18,105.8	185.9357	170.54504	19195.3	200.542	186.28028	17725.6
	119.2626	115.6906		123.1307	119.32615		126.676	123.21226	
PARKING	56.98246	54.53048	5,704.17	59.79058	57.053976	5910.16	62.5037	59.879932	5590.18
	22.07277	21.42726		22.80064	22.08969		23.5138	22.819506	
	12.54174	11.02137		14.11285	12.587178		15.5493	14.158904	
	11.02578	9.939459		11.99037	11.053438		12.9034	12.021692	
LIGHT	644.1759	622.1896	21,986.2	667.8933	644.90048	22992.8	691.257	668.63628	22621.2
HVAC	182.3394	180.2575	2,72,824	222.5022	182.36792	3,38,435	264.271	222.5243	3,95,472
	1015.923	954.5351		1.071393	1.0159379		1.15211	1.0714772	
	271.2534	261.7676		295.9409	271.26036		351.684	296.0581	
	1053.638	982.2677		1.078595	1.0558389		1.10648	1.0815381	
	309.6785	252.411		342.8489	311.64196		344.47	342.86488	
	829.2632	785.4704		947.7187	830.27952		1054.81	951.6882	
	836.8606	832.5317		954.3991	836.87393		1043.52	959.14636	
	112.7201	92.51589		117.4038	112.74248		118.167	117.42161	
	35.45319	32.54819		38.2671	35.557928		41.0535	38.36706	

Table 1 : Load distribution of the entire building.

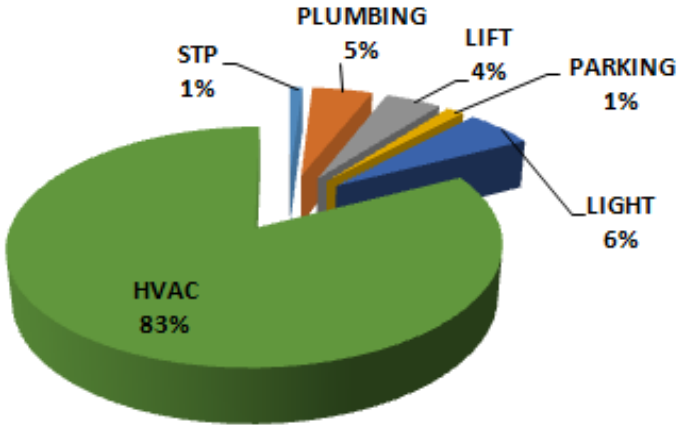

Fig 1 : Load distribution of the entire building.

Different researchers have given different concepts to optimise the overall energy consumption, which will be discussed in literature review.

LITERATURE REVIEW :-

Akram Ali et al. [1], In this paper, performance analysis has done to save energy consumption in between ACCH & WCCH at Godrej BKC Kurla (West) in Maharashtra. Based on I_{kw} both ACCH & WCCH'S (excluding pumps & CT-fans) 15min electrical consumption theoretically calculated & then same was cross checked with the help of energy metre reading, found all the experimental values are near about to theoretical values. On the basis of these experiments, an empirical relation has been developed that shows the performance of both chillers as well as its cost effectivity. ACCH is the best to run till 100TR, beyond it there is a loss of 6units/hr (per 10TR) to run ACCH & minimum Rs.4,48,750 p.a. can be saved by running WCCH. If WCCH is run at 400TR (i.e. at ACCH's full load) then around 72576 units can be saved yearly & in terms of cost Rs. 9,65,268 p.a. can be saved.

Nur Najihah Abu Bakar et al. [2], this paper presents evaluation on class shifting strategy in term of its ability in reducing energy consumption. The study was conducted on selected building in faculty of electrical engineering UTM by using energy efficiency index reading as a baseline in determining waste and saved energy. It can minimize electricity usage by simply shifting occupants into an appropriate room which is design nearly for that amount of capacity. The result from the application of shifting method showed a significant number of energy saving that can be made.

Ahmad Sukri Ahmad et al. [3], this paper presents the energy management program carried out at faculty of electrical engineering UTM. Various energy saving activities were initiated since 2010 and the EEI is used as an indicator of building's energy consumption performance during the energy management programme. This programme has shown encouraging results with a 14% reduction in the electricity bill.

Takefumi Hatanaka et al.[4], In this paper a case study has been performed for the supermizer to control the speed of 3phase ac induction motor, to reduce the energy consumption. Controlling parameter are frequency, speed, load, power factor, current, voltage. As we all know that 3 phase induction motor plays a vital role in HVAC system. AHU, secondary pump, blower everywhere it is used.

Muhammad Fairuz Abdul Hamid et al.[5], In this paper a study was done to analyze the energy performance of a commercial building in North Peninsular Malaysia in terms of BEI & annual cooling energy. This paper ensures that in a commercial building around 42% of overall building energy consumption is due to HVAC. From the analysis, researcher concluded that around 52.82% & 36.44% of energy respectively can be saved in terms of BEI & annual cooling energy.

Rajesh Tilwani et al.[6], A case study has been performed & found that the office buildings located in India especially in southern region may consume about 55-60% of total energy for air conditioning system alone. Different energy saving proposal was performed to minimize the energy consumption of an office building in which detailed energy audit was carried out, found annual energy saving potential of 231656 KWH, in terms of cost saving, it would be Rs.16.2 Lakhs. In order to achieve this benefit, it requires one time investment of Rs.27.5 Lakhs, resulting the payback period of 1.7years.

Lijie et al.[7], CWS system has been used to enhance the performance of ACCH, moreover in the full storage system the calculated energy consumption of the chiller has been found to be 4% lower than the conventional system. CWS operating with full storage strategy is the optimal choice for the Kuwait climate. Since, both peak power & energy consumption of the chiller can be reduced.

Madhur Behl et al.[8], power consumption of a chiller is highly affected by its COP, which is optimal when the chiller is operated at or near full load. COP is the ratio of total heat removed by the plant to its power consumption. COP varies with load, it will be higher at full load. For a chiller plant, its overall COP can be optimized by utilizing a TES & switching its operation between COP – optimal charging and discharging mode. This paper concluded that green scheduling approach has the potential to reduce the total monthly electricity bill by almost 17% compared to system without TES.

Jun Zhang et al.[9], In this paper Tabu search algorithm has been applied to solve the optimal load distribution strategy problem for the cooling system constituted by multiple chiller water units. Chiller was run at different load by keeping the concept of Cop. In this concept single chiller run to meet the 40% load of entire building.

Zhang Xiaoming et al.[10], COP of ACCH varies, it is high in evening & low in a day time. High COP makes high chilled water with less electricity consumption & vice versa. When ambient air temp gets high, condenser isn't able to work efficiently. So, chilled water produced by chiller will be reduced. In order to maintain chilled water leaving temperature, ACCH's compressor will have to work harder to raise the pressure of refrigerant , which causes more electricity consumption & lower COP performance.

G.P.Maheshwari et al.[11], This paper concluded that WCCH performs more efficiently than ACCH. Daily energy consumption of WCCH is 32% less than that of ACCH.

ABBREVIATIONS :-

- ACCH – Air cooled chiller
- WCCH – Water cooled chiller
- WCPP – Water cooled primary pump
- ACPP – Air cooled primary pump
- SECP – Secondary pump
- WCCP – Water cooled condenser pump
- I_{KW} – Input KW
- BEI – Building energy index
- w.r.t. – With respect to
- CT – Cooling Tower
- TR – Tone Ratio
- KW – Kilo watt
- HVAC – Heat ventilation & air conditioning
- AHU – Air handling unit
- CWS – Chilled water storage
- COP – Coefficient of performance
- TES – Thermal energy storage
- RH – Running hours
- HP – Horsepower

TABLES & GRAPHS :-

DAY	CHILLER	PEAK HOURS										
		08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00
1-Apr	WCCH 1	99	78	82	70	77	78	78	77	72	71	56
	ACCH 5	63.58	50.15	59.6	74.48	77.85	76.48	74.38	73.75	73.5	74.25	49.25
2-Apr	WCCH 1	0	0	0	0	79	76	62	0	0	0	0
	WCCH 2	90	64	71	88	78	76	0	81	71	70	53
	ACCH 3	0	0	0	56.28	0	0	51.7	70.4	66.75	66.8	39.6
	ACCH 5	57.35	50.53	61.5	73.38	0	0	73.18	0	0	0	0
3-Apr	WCCH 1	90	68	70	99	76	77	58	66	76	76	69
	ACCH 3	0	0	0	28.33	0	0	66.95	68.75	79	72	49.5
	ACCH 5	48.05	53.48	56.95	74.48	83.53	66.1	47.23	0	0	0	0
4-Apr	WCCH 1	78	80	74	76	80	82	79	77	75	76	63
	ACCH 3	0	0	55.28	56.45	64.58	62.9	63.03	57.93	60.23	61.7	50.85
	ACCH 5	43.65	0	0	0	0	0	0	0	0	0	0
5-Apr	WCCH 1	80	73	80	78	76	80	83	82	83	71	66
	ACCH 3	59.9	51.4	61.05	63.6	63	64.43	66.2	66.23	66.25	56.1	49.95
6-Apr	ACCH 3	14.45	39.18	55.3	54	61.75	60.65	60.95	64.33	57.85	49	50.3
7-Apr	ACCH 3	14.83	0	0	0	0	0	0	0	0	0	0
	ACCH 5	0	60.63	55.15	63.03	66.08	65.98	63	62.7	63.43	53.05	52.33
8-Apr	WCCH 1	70	70	88	99	87	86	83	84	84	78	63

	ACCH 3	0	0	84.38	79.35	66.25	85.63	84.9	71.03	74.8	73.5	77.45
	ACCH 5	0	63.88	33.9	0	0	0	0	0	0	0	0
9-Apr	WCCH 1	85	77	83	80	90	83	82	82	77	77	71
	ACCH 3	0	0	0	0	83.08	77.2	76.05	76.88	72.75	68.75	69.13
	ACCH 5	75.53	75.48	78.13	79.5	0	0	0	0	0	0	0
10-Apr	WCCH 1	92	93	69	70	75	84	88	82	83	83	65
	ACCH 2	0	51.5	65.25	67.5	78.25	80.25	81	81.48	78.45	81.88	59.18
11-Apr	WCCH 1	99	81	78	77	81	82	84	85	81	77	73
	ACCH 2	54.83	47.63	65.8	65.6	68.5	66.5	81.38	80.7	81.95	75.3	72.43
12-Apr	WCCH 1	82	80	79	82	81	83	88	84	78	83	84
	ACCH 2	71.75	73.25	73.25	72.75	74	78.5	93.25	62.05	66.3	66.8	79.78
13-Apr	WCCH 1	0	0	0	0	0	56	60	58	58	57	0
	ACCH 2	33.5	40.05	57.25	89.55	91.7	0	0	0	0	0	0
14-Apr	ACCH 2	19	20	0	0	0	0	0	0	0	0	0
	ACCH 3	0	0	28.75	27.7	37.25	37.5	35.75	31.7	41.05	63.6	58.85
15-Apr	WCCH 1	92	82	78	74	77	77	79	78	67	69	61
	ACCH 2	63.93	80.25	81.68	78.18	80.18	80.63	75.15	79.75	62.78	64.25	61.1
	ACCH 3	0	0	0	0	0	0	0	59.45	54.58	53	49.85
16-Apr	WCCH 1	100	69	60	65	66	69	65	62	65	57	57
	ACCH 2	73.5	61.75	64	63.75	64.5	62.25	64.25	65.75	61.3	61.83	54.63
	ACCH 3	0	0	0	0	64	63	65	64	55.15	58.75	53.78
17-Apr	WCCH 1	95	68	69	68	66	72	71	70	67	61	61
	ACCH 2	73.25	65.25	71.25	68.25	78.25	78	79.75	75.35	72.2	67.53	69.45
18-Apr	WCCH 1	91	72	73	71	71	75	73	75	73	68	61
	ACCH 2	53.75	57.75	61	64.43	65.75	68.6	63.38	64.28	53.15	54.18	58
19-Apr	WCCH 1	84	77	72	73	80	81	100	78	72	71	65
	ACCH 2	48.25	56.25	67.75	69.75	67.25	84.25	75.25	70.4	68	62.25	58.48
20-Apr	ACCH 2	15.38	54.08	66.45	82.4	85.88	75.23	76.28	67.78	68.15	64.08	58.5
21-Apr	ACCH 3	30.9	32.38	29.78	35.88	40.6	62.5	65.25	66.08	60	49.75	42.6
22-Apr	WCCH 1	75	78	77	73	76	78	90	91	86	85	76
	ACCH 3	54.28	63.3	64.88	62.48	65.7	66.23	87.9	77	75.75	73	74.25
23-Apr	WCCH 1	86	94	82	79	84	85	87	83	82	72	66
	ACCH 2	10.9	32.05	0	0	0	0	0	0	0	0	0
	ACCH 3	97.2	43.93	64.95	57	67.7	81.63	80.75	74.6	75.15	64.88	65.18
24-Apr	WCCH 1	89	88	81	83	85	88	89	83	80	77	69
	WCCH 2	0	0	0	0	0	0	0	0	0	79	72
	ACCH 3	51.95	64.63	64.38	66.85	67.63	93	85.78	70.98	68.5	0	0
25-Apr	WCCH 1	100	62	82	91	71	71	73	70	67	63	62
	WCCH 2	0	0	0	68	69	72	71	67	67	64	63
	ACCH 2	93.9	63.48	0	0	0	0	0	0	0	0	0
	ACCH 3	54.23	45.48	0	0	0	0	0	0	0	0	0
26-Apr	WCCH 2	83	79	78	80	89	77	64	64	64	61	70
	ACCH 1	0	0	0	0	0	0	51.73	48.5	0	0	0
	ACCH 2	61.28	62.33	63.63	66.95	80.68	0	0	0	0	0	0
	ACCH 4	0	0	0	0	0	0	63.48	62.6	62.15	41	66.85
27-	ACCH 2	25.5	38.63	59.85	82.1	85.9	41	56.58	60.35	58.25	49.75	45.93

Apr	ACCH 3	0	0	0	0	71.75	0	0	0	0	0	0
28-Apr	ACCH 2	25.4	31.85	33.25	40.25	41.25	55.5	58.58	58.48	56.38	53	47.68
29-Apr	WCCH 2	0	0	86	71	73	75	74	68	68	66	63
	ACCH 2	53.4	92.5	0	0	0	0	0	0	0	0	0
30-Apr	WCCH 1	88	70	88	89	87	95	77	72	67	65	55
	ACCH 2	55.13	57.73	90.45	80.5	84.33	83.25	71	63.65	50.9	48.43	43.45
	ACCH 3	63.6	0	0	0	0	0	0	0	52.73	51	39.68

TABLE 2 :- DAILY CHILLERS LOAD SHEET OF APRIL MONTH

DAY	CHILLER	PEAK HOURS										
		08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00
1-May	ACCH 3	33	31	32	30.75	30.5	34.75	35.75	36.68	32.73	29.58	29.8
2-May	WCCH 1	99	80	82	77	82	82	83	83	78	77	74
	ACCH 3	77.48	72.58	74	73.68	78.75	76.25	78.73	73.58	73.48	73.88	68.65
3-May	WCCH 1	83	79	80	75	82	83	85	84	75	75	70
	ACCH 3	48.13	59.53	60.6	65.05	65.75	66.05	79.88	78.75	74.15	71.5	63.83
4-May	ACCH 1	0	0	0	0	0	87	79.53	37.05	0	0	0
	ACCH 2	0	0	0	0	66.5	0	0	0	0	0	0
	ACCH 3	29.25	37.25	56.75	85	0	0	0	0	0	0	0
	ACCH 5	0	0	0	0	0	0	0	0	97.35	84	49.78
5-May	ACCH 1	32.55	31.05	32.18	30.63	40.25	41.43	0	0	0	36	37.25
	ACCH 3	0	0	0	0	0	0	39.9	33.38	33.55	0	0
6-May	WCCH 1	90	83	89	84	89	90	92	89	85	84	50
	ACCH 2	71.5	73.5	81	77.5	90.5	88	82	86.75	83	84.5	0
7-May	WCCH 1	89	93	90	80	89	88	88	83	84	81	78
	ACCH 2	51.6	58.48	55.58	57.18	79.4	81.25	81.05	78	75.2	74.5	74.25
8-May	WCCH 1	87	80	75	77	80	81	84	0	88	86	62
	ACCH 2	53.18	78.43	72.13	75.25	79.25	82.85	81.75	0	74.25	0	0
	ACCH 4	0	0	0	0	0	0	0	0	0	66.5	76
9-May	WCCH 1	83	72	73	73	79	80	78	80	73	70	56
	ACCH 4	48.73	74.95	76.8	74.05	77.5	80.65	80	79.25	76.5	74.5	62.75
10-May	WCCH 1	78	75	78	78	83	82	86	83	81	80	63
	ACCH 4	72.28	71.58	78.25	80.93	80.58	82.25	77.88	76.25	76.28	75.38	53.18
11-May	ACCH 1	34.3	39.7	39.4	58.5	80.5	67.25	56.25	68.03	0	0	0
	ACCH 3	0	0	0	0	0	0	0	0	53.55	54.28	53.95
12-May	ACCH 3	31.58	31.63	32.53	41.18	41.05	41.15	58.1	56.25	49.55	49.48	44
13-May	WCCH 1	95	90	88	86	90	89	94	91	82	70	71
	ACCH 3	79.6	77.18	83.55	83.7	82.4	83.13	83.2	78.25	75.25	73.	66.5

											25	
14-May	WCCH 1	87	86	81	80	77	80	85	97	70	66	64
	ACCH 4	47	54.58	60.5	74.5	66.75	80.9	83.4	77.5	76.68	66.7	64.88
15-May	WCCH 2	79	77	71	75	76	75	88	76	74	69	71
	ACCH 4	0	64.75	64.5	0	0	0	0	95.63	89.68	83.5	80.75
	ACCH 5	0	0	0	67.75	96	89	0	0	0	0	0
16-May	WCCH 1	80	74	72	74	82	77	80	75	79	75	0
	ACCH 4	71.5	72.75	74	78.75	82.75	82.25	84.25	80.75	78.25	73.5	68.75
17-May	WCCH 1	80	73	74	81	91	66	66	68	74	65	74
	ACCH 4	47.25	62.75	65.5	80.75	90	74.5	73.25	68.5	82.4	73.15	80.8
	ACCH 5	0	0	0	0	0	0	0	0	0	39	0
18-May	ACCH 1	0	0	0	59	0	0	0	0	0	99.25	0
	ACCH 2	0	0	0	0	64.68	64.78	0	0	0	0	0
	ACCH 4	40.75	41.48	68.5	67.53	41.73	43.75	92.25	84.73	96.75	0	83.75
19-May	ACCH 3	0	0	0	0	0	0	0	0	0	0	40
	ACCH 4	16.03	31.83	38.53	41.93	61.48	59.85	58.88	56	58.75	58.5	0
20-May	WCCH 1	101	99	73	75	99	74	75	71	74	73	70
	ACCH 1	51.33	99.5	77.23	84.68	93	85.4	87	83.23	79.25	80	0
	ACCH 3	0	0	44.2	49.5	69.75	80.33	73	71.7	73.5	66.75	0
	ACCH 4	0	0	0	0	0	0	0	0	0	0	80
21-May	WCCH 1	88	75	64	73	69	69	71	67	62	63	52
	ACCH 1	0	55.75	61.18	0	0	0	0	0	0	0	0
	ACCH 2	0	0	0	57.9	60.35	63.75	59.75	59.85	54.5	56.75	45.5
	ACCH 4	48.83	66.95	70.3	67.5	73.63	69.5	74.25	67.88	65	57.5	68.25
22-May	WCCH 1	92	87	77	77	82	83	84	0	0	0	0
	WCCH 2	0	0	0	0	0	0	0	99	69	78	79
	ACCH 4	55.1	78.3	73.65	75.63	71.5	84.85	83.5	99.08	64	76.55	74.03
23-May	WCCH 2	86	85	86	80	87	85	86	85	85	84	62
	ACCH 4	53.8	80.25	84.08	80.83	87.08	83	80.25	79.1	79.75	81	72.7
24-May	WCCH 2	68	83	82	83	83	81	86	87	88	88	63
	ACCH 4	68	77.25	78.25	75.5	82.75	79.5	85.25	84.33	83.58	87	74.25
25-May	ACCH 1	0	0	0	0	0	0	0	0	56.45	61.9	66.35
	ACCH 3	0	0	0	0	52	0	0	95.38	0	0	0
	ACCH 4	25.85	67.65	68.68	88.8	67	68.75	55.18	0	0	0	0
26-May	ACCH 1	27.43	29.3	33.88	34.2	50.25	55.5	56.75	62.58	52.28	51.25	48.1
27-May	WCCH 2	73	72	70	82	73	68	71	70	65	68	49
	ACCH 1	78.53	80.85	77.25	80.5	76.45	75.2	72.75	76.95	80.05	75.15	44.9

	ACCH 2	53.18	56.33	54.25	59	0	0	0	0	0	0	0
	ACCH 4	0	0	0	0	75.95	77.85	71.75	72.23	77.23	67.6	43.1
28-May	**WCCH 2**	69	67	68	68	70	69	71	69	68	84	54
	ACCH 1	68.83	77.13	73.35	74.33	77.88	84.3	81	78.3	83.83	71.78	0
	ACCH 4	62	71.08	67.78	69.15	74.23	72.85	81.75	72.48	75.6	77.3	66.63
29-May	**WCCH 1**	0	0	0	0	90	84	85	60	82	80	69
	WCCH 2	64	66	65	66	86	79	77	63	82	81	68
	ACCH 1	0	60.5	60	61.75	0	0	0	0	0	0	0
	ACCH 4	62.5	64.25	66	67.75	0	0	0	0	0	0	0
30-May	**WCCH 1**	0	78	79	81	85	82	85	81	82	78	55
	WCCH 2	70	75	74	75	81	80	79	80	81	0	0
	ACCH 1	76.38	0	0	0	0	0	0	0	0	0	0
	ACCH 4	65.5	0	0	0	0	0	0	0	0	76.78	0
31-May	**WCCH 1**	75	81	65	83	84	86	85	69	79	69	88
	ACCH 4	0	86.5	84	89.25	91.25	90.5	92.25	80	80.25	57.9	66.5

TABLE 3 :- DAILY CHILLERS LOAD SHEET OF MAY MONTH

DAY	**CHILLER**	**PEAK HOURS**										
		08:00	**09:00**	**10:00**	**11:00**	**12:00**	**13:00**	**14:00**	**15:00**	**16:00**	**17:00**	**18:00**
1-Jun	**WCCH 1**	0	0	0	75	0	0	0	0	0	0	0
	ACCH 2	66.13	86.65	84.5	0	68.93	60.43	59.25	58.05	56.33	50.93	44.35
	ACCH 4	0	0	22.83	0	62.63	65.65	61.25	62.78	58.78	60.58	56
2-Jun	**ACCH 2**	19.35	58.63	59.08	63.6	79.98	79.9	82.88	82.48	81.75	82.5	75.75
3-Jun	**WCCH 1**	101	99	74	80	76	74	75	81	73	75	68
	WCCH 2	0	100	0	0	0	0	0	0	79	0	0
	ACCH 2	77.88	95.2	76.85	76.98	79.8	83.18	81.5	74.93	59.5	0	0
	ACCH 4	0	85.48	81.3	75.15	76	79.88	75.5	79.55	0	72.5	67.8
4-Jun	**WCCH 1**	73	75	72	73	76	76	77	77	71	76	64
	ACCH 2	56.5	58.48	63.28	57.55	63.43	60.03	62.45	45.58	61.75	59.23	45.5
	ACCH 4	72	57.9	76.45	73.98	79.23	80.18	78.5	57	77.25	77.9	57
5-Jun	**WCCH 1**	62	76	79	82	85	89	74	60	83	88	85
	ACCH 4	0	0	0	0	0	0	0	65.75	0	0	0
6-Jun	**WCCH 1**	73	77	74	73	80	80	88	87	89	68	86
	WCCH 2	0	0	0	0	0	0	0	80	88	68	80
	ACCH 1	60.78	81.25	75.48	75.18	0	0	0	0	0	0	0
	ACCH 2	0	0	0	0	65.5	66.28	63.75	0	0	0	0
	ACCH 4	63.58	74.08	71	71.78	79.75	80.28	79	0	0	0	0
7-Jun	**WCCH 1**	68	64	86	88	78	70	75	70	70	67	60
	ACCH 1	58.53	59.03	0	0	80.48	76.2	74.6	66.5	75	62.98	0
	ACCH 4	63.3	63.53	80.78	87.18	77.73	71.08	68	64.68	67	69.75	65.18
8-Jun	**WCCH 1**	0	0	0	0	0	0	0	0	0	74	70
	ACCH 1	0	0	68.13	70.23	80.88	75.65	71.73	62.75	0	0	0

	ACCH 4	27.35	73.95	62.9	70.93	72.7	67.5	66.18	58.5	88.25	0	0
9-Jun	ACCH 1	0	0	0	0	0	0	0	39.58	0	0	0
	ACCH 4	33.43	67.2	67.33	65.25	81.25	76.25	86.75	58.75	57.75	62.5	83.25
10-Jun	WCCH 1	96	88	88	88	94	96	99	91	88	87	69
	WCCH 2	0	84	83	81	88	89	95	86	85	81	66
	ACCH 4	71.5	0	0	0	0	0	0	0	0	0	0
11-Jun	WCCH 1	83	91	89	92	97	72	75	98	87	89	64
	WCCH 2	82	88	85	84	96	73	73	98	80	84	67
	ACCH 4	0	0	0	0	0	74.25	75.75	0	0	0	0
12-Jun	WCCH 1	92	83	79	82	86	88	83	80	78	78	64
	WCCH 2	86	81	76	78	81	80	78	76	73	75	66
13-Jun	WCCH 1	98	89	89	83	97	99	98	80	97	75	71
	WCCH 2	96	82	84	83	93	94	92	75	94	74	68
14-Jun	WCCH 1	98	83	89	87	96	99	100	99	95	82	56
	WCCH 2	92	79	82	92	95	94	96	98	88	76	56
15-Jun	WCCH 1	0	75	75	78	69	91	81	86	86	67	70
	WCCH 2	0	0	71	0	72	0	0	0	0	0	0
	ACCH 4	38.25	0	0	0	0	0	0	0	0	0	0
16-Jun	WCCH 2	0	0	0	0	91	84	85	86	0	0	0
	ACCH 1	20	63	64.75	91.5	0	0	0	0	78.23	90.6	93.73
17-Jun	WCCH 1	64	101	99	100	96	82	78	99	93	77	82
	WCCH 2	63	100	92	99	90	77	76	95	88	77	80
	ACCH 4	0	0	57	66	0	64.25	0	0	0	61	0
18-Jun	WCCH 1	98	95	90	95	83	82	76	73	73	73	66
	WCCH 2	83	82	80	90	81	76	86	74	70	72	67
19-Jun	WCCH 1	84	81	79	89	95	101	100	96	95	93	90
	WCCH 2	80	82	81	85	92	99	99	91	90	89	87
20-Jun	WCCH 1	78	85	86	83	90	91	93	90	86	87	75
	WCCH 2	73	82	81	79	87	87	88	88	82	83	74
21-Jun	WCCH 1	86	86	83	86	81	76	92	92	84	83	64
	WCCH 2	84	86	83	82	81	75	87	88	81	81	62
22-Jun	WCCH 1	0	0	0	87	86	87	71	72	71	68	65
	WCCH 2	0	0	0	90	0	0	0	0	0	0	0
	ACCH 1	66.08	94.3	95.83	0	0	0	0	0	0	0	0
23-Jun	WCCH 1	0	0	0	0	0	86	73	64	62	62	62
	ACCH 1	31.05	63.83	65.9	65.5	66	0	0	0	0	0	0
24-Jun	WCCH 1	100	95	90	88	91	92	83	83	83	80	79
	WCCH 2	99	90	88	85	87	87	88	81	81	80	78
25-Jun	WCCH 1	80	86	83	83	82	84	87	85	91	84	80
	WCCH 2	82	80	81	80	79	81	86	84	84	83	77
26-Jun	WCCH 1	84	76	78	79	82	89	93	89	74	81	58
	WCCH 2	82	79	77	77	80	88	87	85	73	78	62
27-Jun	WCCH 1	82	84	85	83	90	87	91	90	99	88	80
	WCCH 2	80	81	81	80	87	87	88	87	97	84	74
28-Jun	WCCH 1	75	0	78	70	71	94	77	76	75	69	68
	WCCH 2	76	87	77	70	71	100	76	77	71	70	68
	ACCH 1	0	0	0	0	0	44.65	0	0	0	0	0

29-Jun	**ACCH 2**	49.38	59.53	55.25	76.83	80.75	85.98	62.38	76.55	72.38	71.88	69.5
30-Jun	**ACCH 4**	52.38	55.25	53.5	61.25	61.5	65	77	76.95	68.48	69.68	69.5

TABLE 4A :- DAILY CHILLERS LOAD SHEET OF JUNE MONTH

DAY	**THEORETICAL ANALYSIS**							
	CHILLER PARAMETER					**PUMP PARAMETER**		**TOTAL UNIT**
	CHILLER	**LOAD**	**RH**	**TR**	**I_{KW}**	**PUMP**	**HP**	
01-Jun	**WCCH1**	0.75	1	600	0.6	WCPP1	30	6374.341
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	ACCH2	0.6355	9	400	1.265	ACPP 2	20	
	ACCH4	0.563	8	400	1.265	ACPP 4	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
02-Jun	**ACCH2**	0.69625	10	400	1.265	ACPP 2	20	4268.025
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
03-Jun	**WCCH1**	0.7963	10	600	0.6	WCPP1	30	11620.69
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.895	2	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
	ACCH2	0.7842	8	400	1.265	ACPP 2	20	
	ACCH4	0.7701	8	400	1.265	ACPP 4	20	
						SECP 1	40	
		`				SECP 2	40	
						SECP 3	40	
04-Jun	**WCCH1**	0.7363	10	600	0.6	WCPP1	30	10900.69
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	ACCH2	0.5761	10	400	1.265	ACPP 2	20	
	ACCH4	0.7157	10	400	1.265	ACPP 4	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
05-Jun	**WCCH1**	0.7845	10	600	0.6	WCPP1	30	4587.295
						WCCP1	40	
						CT FAN 1A	20	

						CT FAN 1B	20	
	ACCH4	0.6575	1	400	1.265	ACPP 4	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
06-Jun	**WCCH1**	0.7954	10	600	0.6	WCPP1	30	10274.64
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.79	4	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
	ACCH1	0.7316	3	400	1.265	ACPP 1	20	
	ACCH2	0.651	3	400	1.265	ACPP 2	20	
	ACCH4	0.742	6	400	1.265	ACPP 4	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
07-Jun	**WCCH1**	0.7236	10	600	0.6	WCPP1	30	10302.85
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	ACCH1	0.6916	7	400	1.265	ACPP 1	20	
	ACCH4	0.7074	10	400	1.265	ACPP 4	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
08-Jun	**WCCH1**	0.72	2	600	0.6	WCPP1	30	6304.931
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	ACCH1	0.7155	6	400	1.265	ACPP 1	20	
	ACCH4	0.6536	8	400	1.265	ACPP 4	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
09-Jun	**ACCH1**	0.3957	1	400	1.265	ACPP 1	20	4362.468
	ACCH4	0.6724	10	400	1.265	ACPP 4	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
10-Jun	**WCCH1**	0.8945	10	600	0.6	WCPP1	30	8465.06
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.838	9	600	0.6	WCPP2	30	

						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
	ACCH4	0.715	1	400	1.265	ACPP 4	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
11-Jun	**WCCH1**	0.8518	10	600	0.6	WCPP1	30	9068.2
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.8272	10	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
	ACCH4	0.75	2	400	1.265	ACPP 4	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
12-Jun	**WCCH1**	0.8118	10	600	0.6	WCPP1	30	7939.2
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.7727	10	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
13-Jun	**WCCH1**	0.8872	10	600	0.6	WCPP1	30	8488.92
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.85	10	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
14-Jun	**WCCH1**	0.8945	10	600	0.6	WCPP1	30	8557.68
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.8618	10	600	0.6	WCPP2	30	
						WCCP2	40	

						CT FAN 2A	20	
						CT FAN 2B	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
15-Jun	**WCCH1**	0.778	9	600	0.6	WCPP1	30	4741.415
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.715	2	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
	ACCH4	0.3825	1	400	1.265	ACPP 4	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
16-Jun	**WCCH2**	0.865	4	600	0.6	WCPP2	30	4435.005
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
	ACCH1	0.7168	6	400	1.265	ACPP 1	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
17-Jun	**WCCH1**	0.88272	10	600	0.6	WCPP1	30	9794.966
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.8518	10	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
	ACCH4	0.6206	4	400	1.265	ACPP 4	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
18-Jun	**WCCH1**	0.8218	10	600	0.6	WCPP1	30	8011.2
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.7827	10	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
						SECP 1	40	
						SECP 2	40	

						SECP 3	40	
19-Jun	WCCH1	0.9118	10	600	0.6	WCPP1	30	8708.16
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.8863	10	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
20-Jun	WCCH1	0.8581	10	600	0.6	WCPP1	30	8282.64
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.8218	10	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
21-Jun	WCCH1	0.83	10	600	0.6	WCPP1	30	8135.4
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.809	10	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
22-Jun	WCCH1	0.7587	8	600	0.6	WCPP1	30	4736.654
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.9	1	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
	ACCH1	0.854	2	400	1.265	ACPP 1	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
23-Jun	WCCH1	0.6816	6	600	0.6	WCPP1	30	3802.584

						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	ACCH1	0.5845	4	400	1.265	ACPP 1	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
24-Jun	**WCCH1**	0.8763	10	600	0.6	WCPP1	30	8478.84
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.8581	10	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
25-Jun	**WCCH1**	0.8409	10	600	0.6	WCPP1	30	8197.68
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.8154	10	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
26-Jun	**WCCH1**	0.8027	10	600	0.6	WCPP1	30	7965.12
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.789	10	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
27-Jun	**WCCH1**	0.8718	10	600	0.6	WCPP1	30	8403.96
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.8418	10	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	

						CT FAN 2B	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
28-Jun	**WCCH1**	0.753	9	600	0.6	WCPP1	30	7592.279
						WCCP1	40	
						CT FAN 1A	20	
						CT FAN 1B	20	
	WCCH2	0.7663	10	600	0.6	WCPP2	30	
						WCCP2	40	
						CT FAN 2A	20	
						CT FAN 2B	20	
	ACCH1	0.4465	1	400	1.265	ACPP 1	20	
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
29-Jun	**ACCH2**	0.6912	10	400	1.265	ACPP 2	20	4242.472
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	
30-Jun	**ACCH4**	0.6458	10	400	1.265	ACPP 4	20	4012.748
						SECP 1	40	
						SECP 2	40	
						SECP 3	40	

TABLE 4B :- ESTIMATED UNITS (KWH) OF JUNE MONTH

DAY	**PRACTICAL ANALYSIS**				
	ENERGY METER READING				**TOTAL UNIT**
	PANEL NAME	**08:00**	**18:00**	**CONSUMPTION**	
01-Jun	**ACCH 1**	222.5146	222.5243	9.7	5052.71
	WCCH 1	1.0714	1.071477	77.7	
	WCCH 2	295.9441	296.0581	114.04	
	ACCH 2	1.079084	1.081538	2454.1	
	ACCH 3	342.8577	342.8649	7.16	
	PUMPS & ACCH4	949.3061	951.6882	2382.12	
	ACCH 5	117.4137	117.4216	7.89	
02-Jun	**ACCH 1**	222.5397	222.5494	9.68	3870
	WCCH 1	1.071486	1.071492	6.3	
	WCCH 2	296.0616	296.0647	3.1	
	ACCH 2	1.081885	1.085335	3449.8	
	ACCH 3	342.8761	342.8834	7.28	
	PUMPS & ACCH4	954.4138	954.7994	385.68	
	ACCH 5	117.4343	117.4424	8.16	
03-Jun	**ACCH 1**	223.3285	223.3384	9.86	9771.2
	WCCH 1	1.072132	1.07486	2727.9	
	WCCH 2	296.0689	296.3471	278.2	
	ACCH 2	1.087738	1.091096	3357.4	

	ACCH 3	342.8934	342.9009	7.48	
	PUMPS & ACCH4	955.4748	958.8568	3382	
	ACCH 5	117.4548	117.4631	8.36	
04-Jun	**ACCH 1**	223.3536	223.3632	9.68	9096.46
	WCCH 1	1.075427	1.078056	2629.8	
	WCCH 2	296.3508	296.3533	2.5	
	ACCH 2	1.091446	1.094333	2887.5	
	ACCH 3	342.9121	342.9194	7.36	
	PUMPS & ACCH4	962.1262	965.6775	3551.28	
	ACCH 5	117.4755	117.4838	8.34	
05-Jun	**ACCH 1**	223.378	223.3874	9.38	4141.25
	WCCH 1	1.07838	1.081194	2814.6	
	WCCH 2	296.3564	296.3597	3.34	
	ACCH 2	1.094498	1.094506	8	
	ACCH 3	342.9301	342.9376	7.48	
	PUMPS & ACCH4	968.5479	969.838	1290.08	
	ACCH 5	117.4958	117.5042	8.37	
06-Jun	**ACCH 1**	224.1565	225.9553	1798.84	9542.13
	WCCH 1	1.08177	1.084599	2829.2	
	WCCH 2	296.3635	297.5119	1148.34	
	ACCH 2	1.094558	1.095283	724.1	
	ACCH 3	342.9486	342.9596	10.96	
	PUMPS & ACCH4	972.8072	975.8295	3022.32	
	ACCH 5	117.5165	117.5249	8.37	
07-Jun	**ACCH 1**	229.3794	232.6118	3232.44	10056.1
	WCCH 1	1.085236	1.087812	2576.4	
	WCCH 2	297.5636	297.5667	3.08	
	ACCH 2	1.095605	1.095616	11.1	
	ACCH 3	342.971	342.9808	9.8	
	PUMPS & ACCH4	977.0062	981.2186	4212.4	
	ACCH 5	117.5376	117.5485	10.88	
08-Jun	**ACCH 1**	232.6223	235.5037	2881.36	5875.24
	WCCH 1	1.087818	1.088305	486.9	
	WCCH 2	297.5698	297.5725	2.64	
	ACCH 2	1.095625	1.095641	16.5	
	ACCH 3	342.989	343.008	18.96	
	PUMPS & ACCH4	983.2423	985.7027	2460.4	
	ACCH 5	117.5577	117.5662	8.48	
09-Jun	**ACCH 1**	235.5186	236.0365	517.92	3440.1
	WCCH 1	1.088406	1.088411	5.6	
	WCCH 2	297.577	297.5797	2.74	
	ACCH 2	1.095653	1.095662	8.5	
	ACCH 3	343.0187	343.0267	8	
	PUMPS & ACCH4	988.4826	991.3712	2888.56	
	ACCH 5	117.5783	117.587	8.78	
10-Jun	**ACCH 1**	236.324	236.3647	40.72	7142.26
	WCCH 1	1.089094	1.092125	3030.8	

	WCCH 2	297.6501	300.3875	2737.38	
	ACCH 2	1.095682	1.095691	9.4	
	ACCH 3	343.0443	343.1233	78.96	
	PUMPS & ACCH4	994.4457	995.6832	1237.52	
	ACCH 5	117.5994	117.6069	7.48	
11-Jun	**ACCH 1**	236.3807	236.39	9.36	7990.01
	WCCH 1	1.092749	1.095832	3083	
	WCCH 2	301.1719	304.0912	2919.32	
	ACCH 2	1.09813	1.098138	7.9	
	ACCH 3	343.135	343.1424	7.4	
	PUMPS & ACCH4	996.7255	998.6802	1954.72	
	ACCH 5	117.62	117.6283	8.31	
12-Jun	**ACCH 1**	236.4047	236.4147	10	7482.53
	WCCH 1	1.095998	1.099102	3103.8	
	WCCH 2	304.947	307.8883	2941.26	
	ACCH 2	1.098532	1.09854	7.9	
	ACCH 3	343.1528	343.1608	7.92	
	PUMPS & ACCH4	1000.694	1002.097	1402.8	
	ACCH 5	117.64	117.6488	8.85	
13-Jun	**ACCH 1**	236.4309	236.4405	9.54	7398.51
	WCCH 1	1.09953	1.102557	3027.2	
	WCCH 2	308.823	311.7773	2954.3	
	ACCH 2	1.098552	1.09856	7.8	
	ACCH 3	343.1719	343.1792	7.28	
	PUMPS & ACCH4	1004.601	1005.985	1384.2	
	ACCH 5	117.6613	117.6695	8.19	
14-Jun	**ACCH 1**	236.4688	236.479	10.16	4365.98
	WCCH 1	1.103162	1.106619	3457.1	
	WCCH 2	312.0484	315.3545	3306.14	
	ACCH 2	1.098779	1.098787	8.3	
	ACCH 3	343.1898	343.1977	7.92	
	PUMPS & ACCH4	1008.115	1009.597	1482	
	ACCH 5	117.6813	117.6903	9.03	
15-Jun	**ACCH 1**	236.4943	236.5883	94	4295.27
	WCCH 1	1.106694	1.109525	2830.7	
	WCCH 2	315.3714	315.6656	294.28	
	ACCH 2	1.098799	1.098807	8.2	
	ACCH 3	343.208	343.2157	7.64	
	PUMPS & ACCH4	1012.435	1013.487	1052	
	ACCH 5	117.7018	117.7103	8.45	
16-Jun	**ACCH 1**	237.0884	239.7468	2658.38	4365.98
	WCCH 1	1.10993	1.110458	528.4	
	WCCH 2	315.6693	316.1203	451.02	
	ACCH 2	1.09882	1.098863	43.5	
	ACCH 3	343.2272	343.247	19.72	
	PUMPS & ACCH4	1016.244	1016.9	656.3	
	ACCH 5	117.7233	117.732	8.66	

17-Jun	ACCH 1	243.3296	243.3403	10.72	9331.57
	WCCH 1	1.110773	1.114053	3279.6	
	WCCH 2	316.3366	319.6991	3362.46	
	ACCH 2	1.098874	1.098831	43.2	
	ACCH 3	343.2569	343.2653	8.4	
	PUMPS & ACCH4	1017.496	1020.162	2666.2	
	ACCH 5	117.7433	117.7906	47.39	
18-Jun	ACCH 1	243.3542	243.3647	10.52	7980.4
	WCCH 1	1.114922	1.118316	3393.8	
	WCCH 2	319.7843	322.9397	3155.44	
	ACCH 2	1.098894	1.098903	8.6	
	ACCH 3	343.2753	343.2832	7.96	
	PUMPS & ACCH4	1022.383	1023.778	1394.9	
	ACCH 5	117.8015	117.8107	9.18	
19-Jun	ACCH 1	243.3794	243.3897	10.28	8475.77
	WCCH 1	1.11836	1.121884	3524.1	
	WCCH 2	323.6633	327.0598	3396.48	
	ACCH 2	1.098914	1.098923	8.6	
	ACCH 3	343.2936	343.3016	8.08	
	PUMPS & ACCH4	1025.817	1027.229	1411.9	
	ACCH 5	117.8222	117.9385	116.33	
20-Jun	ACCH 1	243.4975	243.5071	9.6	7686.38
	WCCH 1	1.122421	1.125654	3232.9	
	WCCH 2	328.1117	331.225	3113.26	
	ACCH 2	1.098934	1.098943	8.3	
	ACCH 3	343.3124	343.3201	7.72	
	PUMPS & ACCH4	1029.262	1030.568	1306	
	ACCH 5	117.9505	117.9591	8.6	
21-Jun	ACCH 1	246.8116	246.8777	66.1	7765.88
	WCCH 1	1.126443	1.129656	3213.5	
	WCCH 2	331.4979	334.5128	3014.96	
	ACCH 2	1.098955	1.098963	8.4	
	ACCH 3	343.331	343.339	7.96	
	PUMPS & ACCH4	1031.309	1032.755	1446	
	ACCH 5	117.9713	117.9803	8.96	
22-Jun	ACCH 1	250.4498	251.4232	973.44	4502.6
	WCCH 1	1.129854	1.131928	2073.5	
	WCCH 2	334.3492	334.7728	423.52	
	ACCH 2	1.098975	1.099128	153.6	
	ACCH 3	343.3492	343.4276	78.36	
	PUMPS & ACCH4	1033.305	1034.096	791.6	
	ACCH 5	117.9917	118.0003	8.58	
23-Jun	ACCH 1	254.7341	256.89	2155.86	4771.25
	WCCH 1	1.132164	1.13386	1696.2	
	WCCH 2	334.7762	334.7795	3.36	
	ACCH 2	1.09914	1.09915	10.2	
	ACCH 3	343.4382	343.5379	99.64	

	PUMPS & ACCH4	1034.688	1035.483	795.6	
	ACCH 5	118.0124	118.0228	10.39	
24-Jun	**ACCH 1**	259.2803	259.2906	10.32	8044.41
	WCCH 1	1.134302	1.137736	3434.6	
	WCCH 2	334.9709	338.1948	3223.94	
	ACCH 2	1.09916	1.099169	8.8	
	ACCH 3	343.5469	343.555	8.16	
	PUMPS & ACCH4	1036.041	1037.39	1349.5	
	ACCH 5	118.033	118.0421	9.09	
25-Jun	**ACCH 1**	261.4611	261.4716	10.42	7772.19
	WCCH 1	1.138485	1.141774	3289.4	
	WCCH 2	338.3374	341.4129	3075.52	
	ACCH 2	1.09918	1.099189	8.7	
	ACCH 3	343.5654	343.5737	8.28	
	PUMPS & ACCH4	1038.076	1039.447	1370.6	
	ACCH 5	118.0537	118.063	9.27	
26-Jun	**ACCH 1**	263.9271	263.937	9.88	7429
	WCCH 1	1.142478	1.145567	3088.5	
	WCCH 2	341.5344	344.5193	2984.88	
	ACCH 2	1.0992	1.099209	8.3	
	ACCH 3	343.5838	343.5916	7.8	
	PUMPS & ACCH4	1040.095	1041.416	1320.9	
	ACCH 5	118.0743	118.0831	8.74	
27-Jun	**ACCH 1**	263.9524	263.9623	9.86	7520.71
	WCCH 1	1.146198	1.149231	3032.7	
	WCCH 2	344.7939	347.889	3095.1	
	ACCH 2	1.101448	1.101585	137.1	
	ACCH 3	343.6023	343.6106	8.36	
	PUMPS & ACCH4	1042.117	1043.347	1230.1	
	ACCH 5	118.095	118.1024	7.49	
28-Jun	**ACCH 1**	263.9779	264.2188	240.88	6756.71
	WCCH 1	1.149675	1.152069	2394.1	
	WCCH 2	348.4594	351.2339	2774.56	
	ACCH 2	1.101597	1.101605	8.3	
	ACCH 3	343.6208	343.6287	7.88	
	PUMPS & ACCH4	1046.212	1047.535	1322.1	
	ACCH 5	118.1157	118.1246	8.89	
29-Jun	**ACCH 1**	264.235	264.2454	10.42	4517.96
	WCCH 1	1.152085	1.152092	7	
	WCCH 2	351.6734	351.6765	3.08	
	ACCH 2	1.101969	1.105881	3912.2	
	ACCH 3	343.6397	343.7822	142.52	
	PUMPS & ACCH4	1049.745	1050.178	433.4	
	ACCH 5	118.1367	118.1461	9.34	
30-Jun	**ACCH 1**	264.2604	264.2714	10.92	2979.7
	WCCH 1	1.1521	1.152107	7.1	
	WCCH 2	351.6806	351.6838	3.2	

	ACCH 2	1.106472	1.106481	9
	ACCH 3	344.4615	344.4698	8.28
	PUMPS & ACCH4	1051.874	1054.806	2931.9
	ACCH 5	118.1576	118.1669	9.3

TABLE 4C :- ACTUAL UNITS (KWH) OF JUNE MONTH

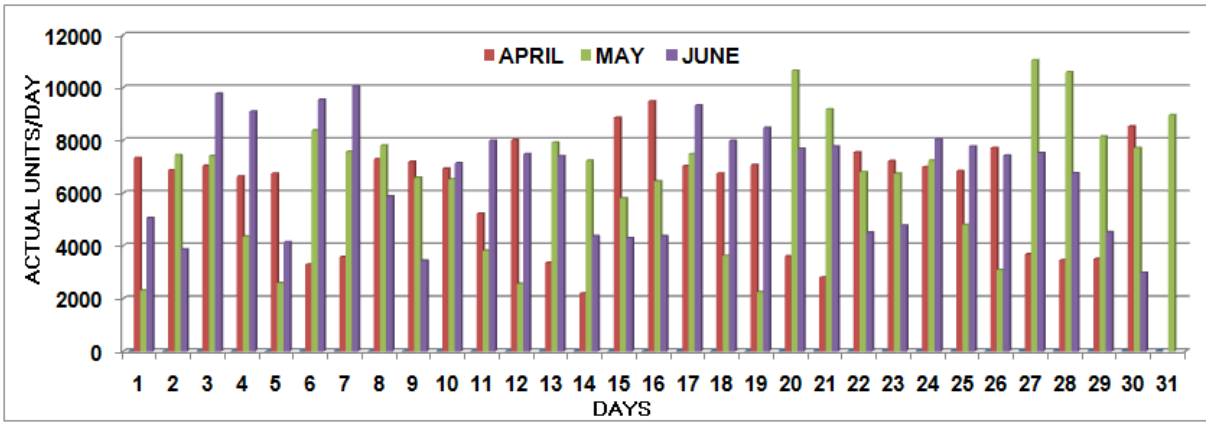

Fig 2 : Actual Units/Day Of Months April, May & June have been recorded by means of Energy Meter.

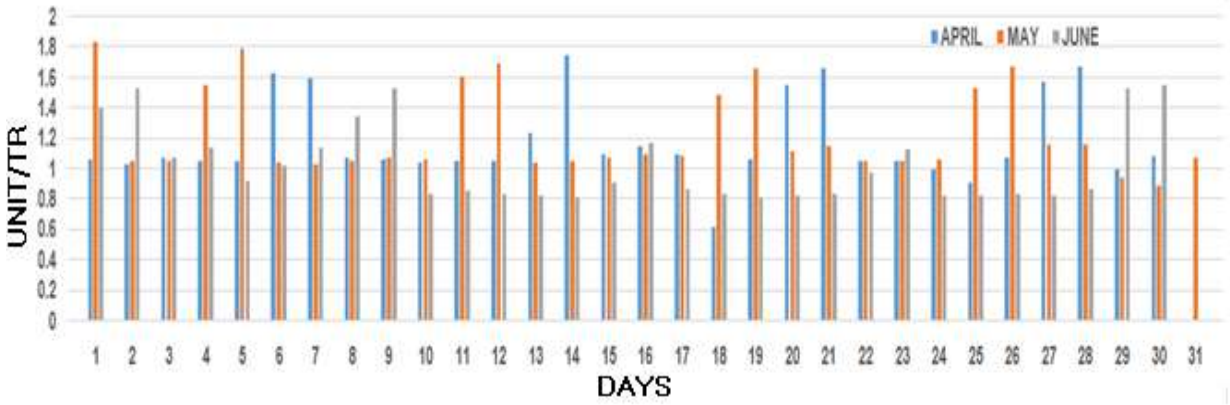

Fig 3 : THEORETICAL (UNIT/TR) ANALYSIS OF MONTHS APRIL, MAY & JUNE.

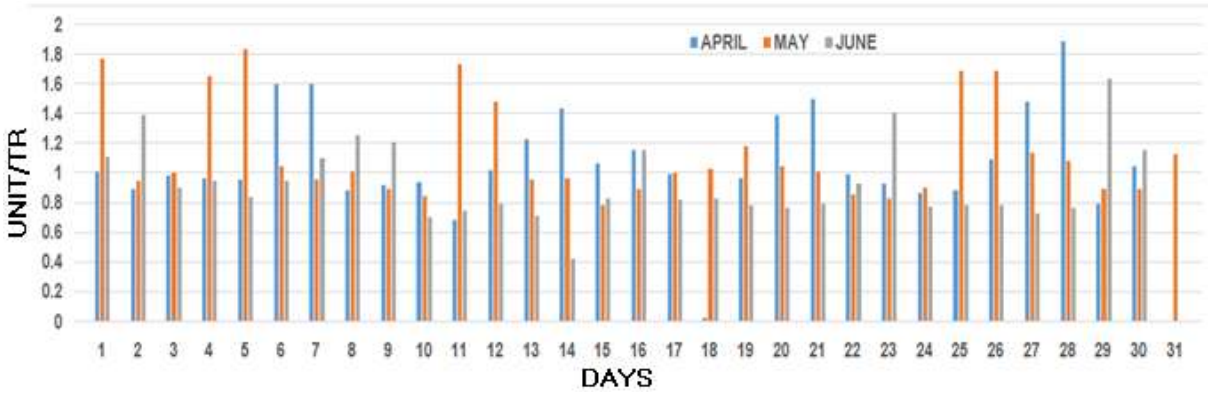

Fig 4 : PRACTICAL (UNIT/TR) ANALYSIS OF MONTHS APRIL, MAY & JUNE.

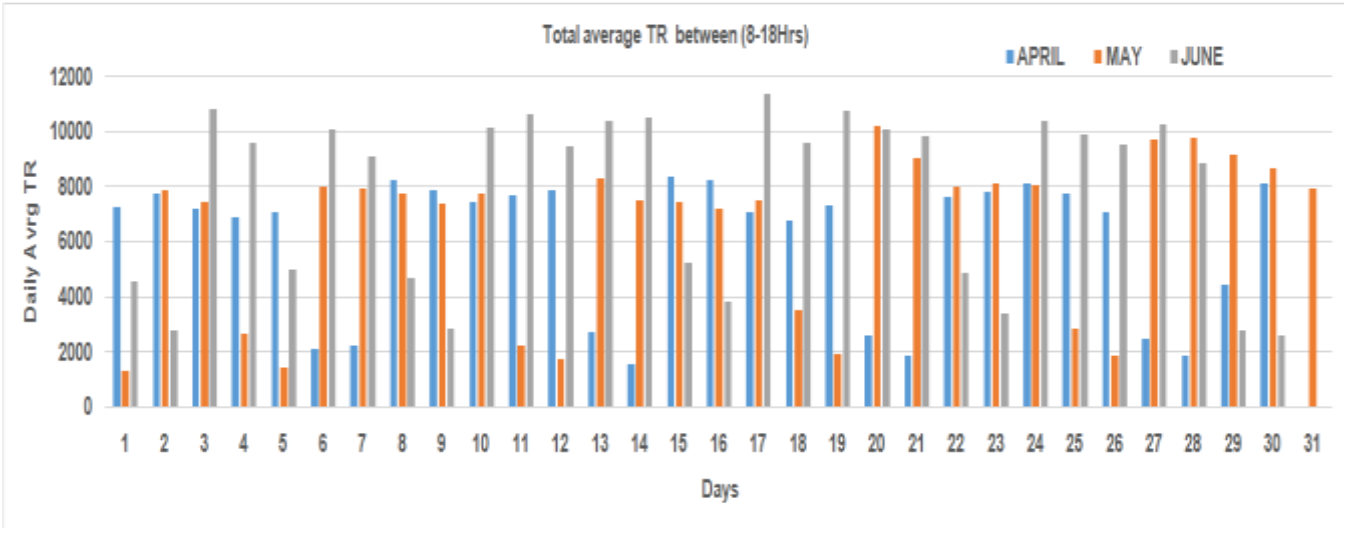

Fig 5 : DAILY AVRG TR OF THREE MONTHS APRIL, MAY & JUNE .

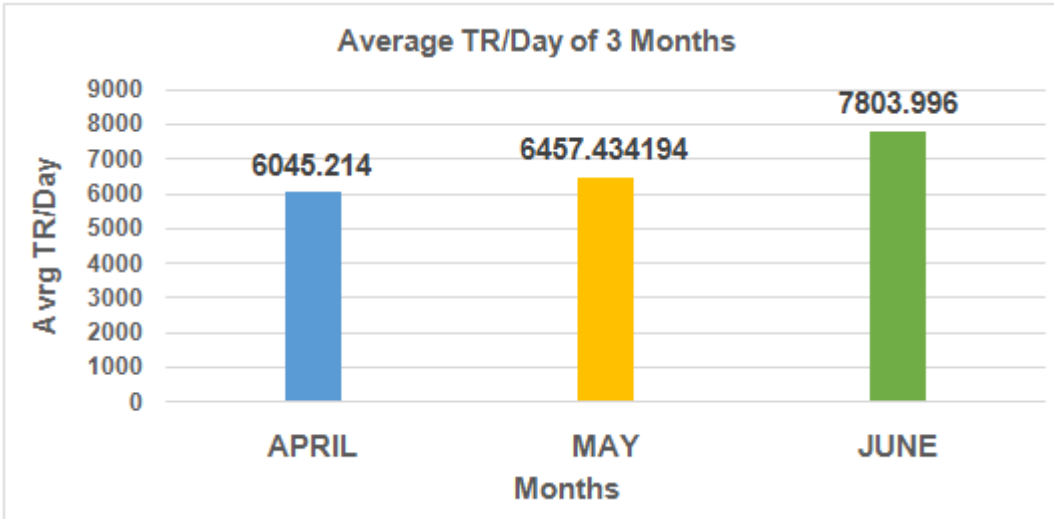

Fig 6 : TOTAL AVRG TR/DAY OF THREE MONTHS APRIL, MAY & JUNE.

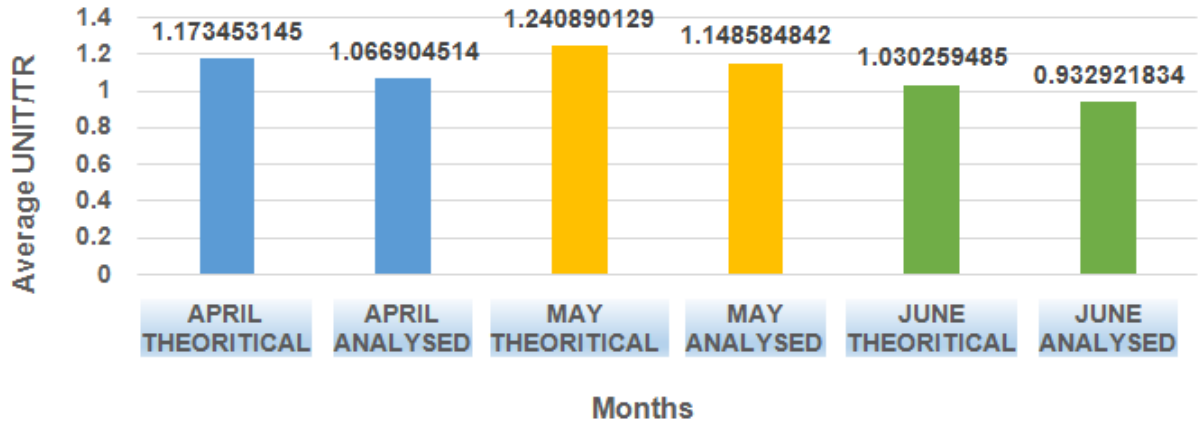

Fig 7 : COMPARISON BETWEEN THEORTICAL & ACTUAL AVRG UNIT/TR OF THREE MONTHS APRIL, MAY & JUNE.

RESULT :-

It is observed from the Fig 2,3,4,5,6&7 cooling demand was high in the month of June and low in the month of April. It is found that theoretical values are higher than practical values. It is because theoretical calculations have done by considering complete peak hours (i.e. 8am to 6pm) but during practice as load reduces chillers & their corresponding pumps were putout to save consumption. It can be seen that average Unit/TR for the month June is comparatively lower than the others. (i.e. theoretically 1.030 & practically 0.932 achieved)

Conclusion :-

ACCH & WCCH both plays a vital role in their respective applications. ACCH is mostly preferred where there is a shortage of water (especially in Gulf), lack of space, low maintenance is required & easy to operate otherwise WCCH is the best option to save energy. A great saving has been achieved of 31,368 & 50,491 units and around Rs 4,17,190 & Rs 6,71,530 for the month of June with respect to April & May respectively.

Reduction of Unit/TR of June w.r.t. April		Total units saving of June w.r.t. April		Rs/ Unit	Total savings in Rs for June w.r.t. April	
Theoretical	Actual	Theoretical	Actual	13.3	Theoretical	Actual
0.1431937	0.133983	33524.48	31368.01		445875.6	417194.5
Reduction of Unit/TR of June w.r.t. May		Total units saving of June w.r.t. May			Total savings in Rs for June w.r.t. April	
Theoretical	Actual	Theoretical	Actual		Theoretical	Actual
0.2106306	0.215663	49312.82	50491		655860.5	671530.3

Table 7: Lookout of energy savings of June w.r.t. April & May.

Reffrences :-

i. Akram Ali, “Consumption optimization of a commercial building, considering the performance of air & water cooled chiller”, IJRASET, ISSN: 2321-9653, Vol. 7, Issue I, Jan 2019.
ii. Nur Najihah Abu Bakar, Muhammad Yusri Hussan, “Identification building energy saving using energy efficiency index approach”, IEEE International conference power & energy 978-1-4799-7297-5/14.
iii. Ahmad sukri Ahmad, Muhammad Yusri Hassan, “Energy efficiency measurements in a Malaysian public university, IEEE international conference on power & energy 978-1-4673-5019-8/12.
iv. Takefumi Hatanaka, “Supermizer energy saving system for 3phase AC induction motors”, IEEE 0-7803-2423-4/95.
v. Mohd Fairuz Abdul Hamid, Nor Azuana Ramli, “An analysis of energy performance of a commercial building using energy modelling”, IEEE 978-1-5386-3935-1/17.
vi. Rajesh Tilwani, C. Sethuraman, “Energy saving potentials in buildings through energy audit. A case study in an Indian building”, IEEE international conference on Technology advancement in power & energy 978-1-4799-880-6/15.
vii. Lijie , “The impact of using chilled water storage systems on the performance of air cooled chillers”, IEEE 978-0-7695-4031-3/10.
viii. Madhur Behl, Truong, “Green scheduling for energy efficient operation of multiple chiller plants”, IEEE 1052-8725/12.
ix. Jun zhang, Kanya zhang, “Application of Tabu search Heuristic algorithms for the purpose of energy saving in optimal load distribution strategy for multiple chiller water units”, IEEE 978-1-4244-6789-1/10.