OTTOTRACTIONS
Energy - Engineering - Environment

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ENERGY AUDIT REPORT

SAFI INSTITUTE OF ADVANCED STUDY

VAZHAYOOR

Executed by

OTTOTRACTIONS
Energy-Engineering-Environment

2019

Accredited Energy Auditor: AEA-33
Empanelled Accredited Energy Auditor: EmAEA-33
Bureau of Energy Efficiency,
Government of India.

Empanelled Energy Auditor: EMCEEA-0211F,
EMC (Energy Management Centre-Kerala.)

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Energy Audit Report
SAFI Institute of Advanced Study

Empaneled Accredited Energy Auditor, AEA 33
Bureau of Energy Efficiency
Government of India

Empaneled Energy Auditor, EMCEEA-0211F,
Energy Management Centre
Government of Kerala.

Authorized Energy Auditor, GEDA/ENC/EAC: Autho/2014/8/103/2316,
Gujarat Energy Development Agency
Government of Gujarat

Empaneled Energy Auditor, India SME Technology Services Ltd
A joint Venture of SIDBI, SBI, Indian Bank, Oriental Bank of Commerce
& Indian Overseas Bank

About OTTOTRACTIONS

OTTOTRACTIONS established in 2005, is an organization with proven track record and knowledge in the field of energy, engineering, and environmental services. They are the first Accredited Energy Auditor from Kerala for conducting Mandatory Energy Audits in Designated Consumers as per Energy Conservation Act-2001. Government of Kerala recognized and appreciated OTTOTRACTIONS by presenting its prestigious “The Kerala State Energy Conservation Award” for the best performance as an Energy Auditor.

Acknowledgment

We were privileged to work together with the administration and staff of SAFI Institute of Advanced Study for their timely help extended to complete the audit and bringing out this report.

With gratitude, we acknowledge the diligent effort and commitments of all those who have helped to bring out this report.

We also take this opportunity to thank the bona-fide efforts of audit team for unstinted support in carrying out this audit.

We thank our consultants, engineers and backup staff for their dedication to bring this report.

Thank you.

B V Suresh Babu
Accredited Energy Auditor
AEA 33, Bureau of Energy Efficiency
For OTTOTRACTIONS

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OTTOTRACTIONS- ENERGY AUDIT						
SAFI INSTITUTE OF ADVANCED STUDY						
Greenhouse Gas Mitigation through Major Energy Efficiency Projects						
Sl No	Projects	Energy saved(Yearly)		Sustainability (Years)	First year ton of CO_2 mitigated	Expected Tons of CO_2 mitigated through out life cycle
		(kWh)	MWh	Years		
1	Energy Saving in Lighting by replacing existing 58 No's T12 (55W) Lamps to 18 W LED Tube	**3172**	3.17	10	2.51	25.06
2	Energy Saving in Lighting by replacing existing 213 No's CFL(15W) Lamps to 9W LED BULB	**1897**	1.90	10	1.50	14.98
3	Energy Saving by replacing existing 239 No's in-efficient ceiling fans with Energy Efficient Five star fans	**10782**	10.78	10	8.52	85.18
Total		**15850**	**16**	**10**	**12.52**	**125**

OTTOTRACTIONS- ENERGY AUDIT						
SAFI INSTITUTE OF ADVANCED STUDY						
Greenhouse Gas Mitigation through Renewable Energy Projects						
Sl No	Projects	Energy saved(Yearly)		Sustainability (Years)	First year ton of CO_2 mitigated	Expected Tons of CO_2 mitigated throughout life cycle
		(kWh)	MWh	Years		
1	Installation of 100kWp Solar Power Plant	**127750**	127.75	26	100.92	2623.99
2	Installation of 15Kg/day Biogas plant	**5647**	5.65	20	4.46	89.22

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Introduction

A detailed energy audit has been carried out at **SAFI Institute of Advanced Study**, Vazhayoor by OTTOTRACTIONS in September 2021. During the energy audit energy saving opportunities has been identified to help improving energy efficiency of the facility. OTTOTRACTIONS is an Accredited Energy Auditor of Bureau of Energy Efficiency and Empaneled Energy Auditor of Energy Management Centre, Government of Kerala. The energy audit has identified energy conservation opportunities and recommended projects to improve energy efficiency of the facility.

This energy audit report complies with the clauses in *Energy Conservation Act, 2001* on mandatory energy audit (**Form 4** [refer regulation 6(2)] guidelines for preparation of energy audit report) and complies with the G.O (Rt) No.2/2011/PD dated 01.01.2011 issued by Government of Kerala on mandatory energy audit.

1.1. General Building details and descriptions

SAFI Institute of Advanced Study (SIAS) is a centre for research and higher education founded in August 29, 2005. It is the academic wing of Social Advancement Foundation of India (SAFI). SIAS is partly residential and is located on a vast campus, 22 Kms away from Calicut City towards Calicut Airport. Along with the management, a dynamic team of teachers and scientists contribute significantly to the fulfillment of the academic programmes. The Institute is housed in a sprawling building in a lush green backdrop and serene and picturesque environment..

SAFI Institute of Advanced study (SIAS) provides rich avenues of teaching, learning and research with excellent infrastructure. SIAS envisages total personality development and generation of manpower capable of providing leadership and direction at the cutting edge in science and technology as well as management, commerce and other areas of humanities studies.

SOCIAL ADVANCEMENT FOUNDATION OF INDIA (SAFI) is a non-profit, registered charitable trust, which came into existence in September 2001. The trust is constituted by educationists, philanthropists and social activists, with the objective of taking up academic and research programmes in the frontier areas of science and technology and humanities in order to produce highly proficient manpower. SAFI is committed to generating skilled manpower capable of providing leadership and direction in the areas of science & technology, commerce, management, information technology, arts and other spheres of studies. SAFI envisages setting up of a Deemed to be University in due course. SAFI Institute of Advanced Study is an endeavour in this direction.

Occupancy Details

Particulars	2018-19
Total Students	1111
Staffs	91
Total Occupancy of the college	1202

For calculating specific energy consumption, the total built-up area is taken into account.

Energy audit team

The Energy Audit team is listed below. Besides this list various domine experts also participated in this project.

1. Suresh Babu B V, Accredited Energy Auditor, AEA 33
2. B. Zachariah, Chief Technical Consultant
3. Abin Baby, Project Engineer
4. Devan J, Project Engineer

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Process description

The energy audit has been carried out at SAFI Institute of Advanced Study, Vazhayoor. The following is the baseline data of this building.

		Form-A									
		BASELINE DATA SHEET FOR GREEN AUDIT									
1	Name of the Organisation	SAFI INSTITUTE OF ADVANCED STUDY									
2	Address (include telephone, fax & e-mail)	Rasiya Nagar, Vazhayoor East P.O. Via Ramanattukara, Malappuram-673633. Kerala, India,+91 483 2880 000 mail@siasindia.org									
2	Year of Establishment	2001									
3	Name of building and total No. of Electrical Connections/building	College (1), Hostel (1)									
4	Total Number of Students	1503									
5	Total Number of Staff	97									
6	Total Occupancy	1600									
7	Total area of green cover (Acre)	10									
8	Type of Electrical Connection	HT	1	LT	0						
9	Contract Demand (KVA) /Connection	90									
10	Average Maximum Demand (KVA)	67									
11	Total built up area of the building (M^2)	15000									
12	Number of Buildings										
13	Average system Power Factor	0.88									
14	Details of capacitors connected	NA									
15	Transformer Details (Nos., kVA, Voltage ratio)	TR 1	TR 2	TR 3	TR 4	TR 5	TR 6				
		NA	-	-	-	-	-				
15	DG Set Details (kVA,)	DG1	DG2	DG3	DG4	DG5	Remarks				
		100	-	-	-	-	-				
16	Details of motors	Rating		Nos.		Remarks					
		5 to 10		NA		NA					
		10 to 50		NA		NA					

3
Energy and utility system description

3.1.1 Electricity

Electricity is purchased from KSEB under HT II (B) GENERAL tariff, the details are given below. One 125 kVA Diesel Generator is in operation at this campus

Electricity Connection Details		
SAFI INSTITUTE OF ADVANCED STUDY		
1	Name of the Consumer	SAFI INSTITUTE OF ADVANCED STUDY Karad
2	Tariff	HT II (B) GENERAL
3	Consumer Numbers	1365520011081
5	Connected Load (kW)	82.2
6	Annual Electricity Consumption (kWh)	134850

3.2. Thermal Energy / Transportation

There seven buses operated from college for transportation. LPG is used for cooking in the canteen and diesel is used to operate Diesel Generators and buses.

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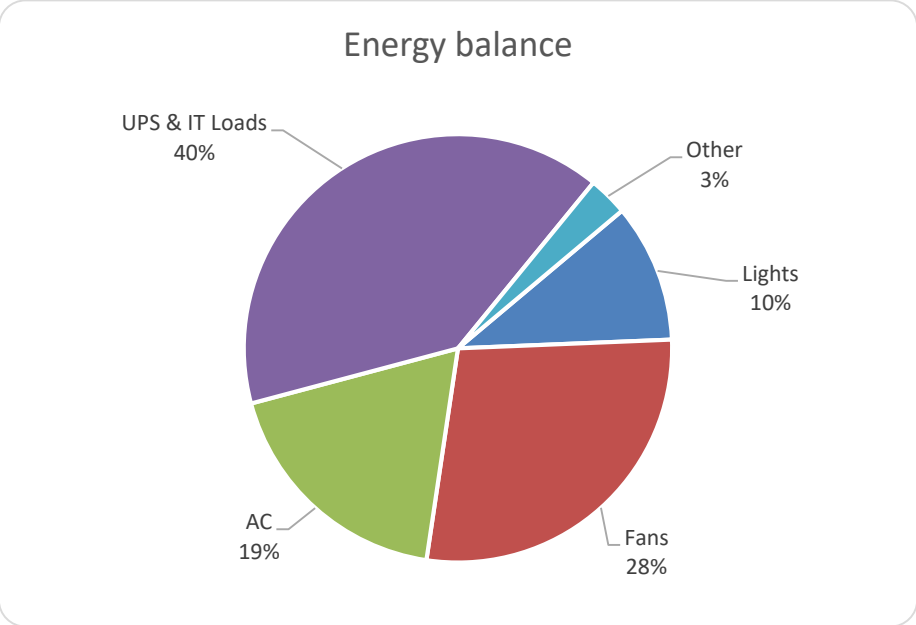
Energy Balance



28 % of the total energy consumed in this facility is used to operate Fans. Lighting uses 3% AC and IT Equipment uses 59%.

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Performance evaluation of major utilities and process equipment's /systems.

5.1. List of equipment and process where performance testing was done.

5.1.1. Electrical System

5.1.2. Lighting & Fans

5.2. Results of performance testing

5.2.1. Electrical System

The average unit cost of electricity is **8 Rs/kWh**. This is taken as the basis for the financial analysis of electrical energy efficiency projects. The information on average energy consumption is taken from the historical electricity bill analysis. The electricity is fed from a centralized substation.

Electricity Consumption

Electricity Bill Details (2018-19)												
Month	Name of the Consumer				SAFI INSTITUTE OF ADVANCED STUDIES							
	Contract Demand(kVA)				Consumer number & Section			1365520011081				
	Tariff		HT II (B) GENERAL					Karad				
	kWh				kVA			PF	PF Incentive	PF Penalty	Rs (Total)	Rs/kwh
	Z1	Z2	Z3	Total	Z1	Z2	Z3					
Apr												
May	3420	1232	1592	6244	27	29.48	18.93	0.96	-1201.93		70630.65	**11.3**
Jun												
Jul	4194	1456	1982	7632	37	24.06	21.78	0.95	-1219		80095.45	**10.49**
Aug	4478	1714	2158	8350	36	25.62	24.36	0.96	-1612.15		85165.83	**10.20**
Sep	3424	1462	1924	6810	37	24.62	23.16	0.94	-875.44		74959.21	**11.01**
Oct	6314	1814	2734	10862	48	27.6	26.98	0.96	-2061.9		102986.06	**9.48**
Nov	7208	1980	2710	11898	58	27.86	26.3	0.96	-2271.15		110691.61	**9.30**
Dec	7256	2242	2776	12274	49	31.34	26.63	0.96	-2362.39		114065.42	**9.29**
Jan	5718	2076	2656	10450	47.36	27.84	27.16	0.95	-1677.72		100208.41	**9.59**
Feb	5846	2042	2088	9976	49.1	26.77	25.07	0.95	-1623.62		97540.72	**9.78**
Mar	8250	2060	2920	13230	71.47	35.11	28.33	0.96	-2516.58		118628.77	**8.97**
	56108	18078	23540		71			0.955			954972.13	
				9773								

Observations

- PF shall be improved to unity, so that the maximum demand may be controlled.

Diesel

The campus has one Diesel Generator set in operation. The details of DG is given below.

Diesel Consumption Details		
	Total(L)	Cost(Rs)
18-19	260	20800

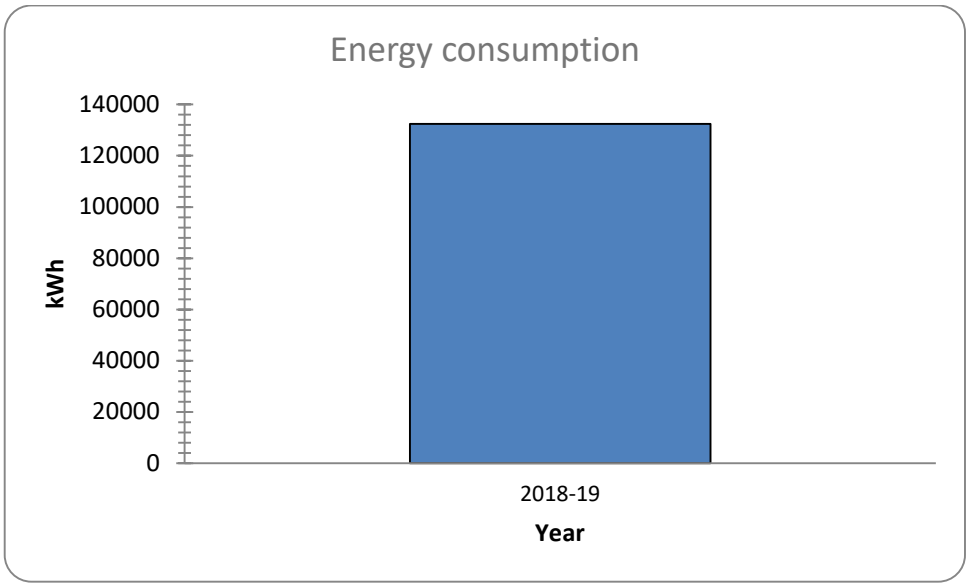
Rating (kVA)	125
P. F	0.8
MFG. Date	30-03-2011
RPM	1500
Frequency (Hz)	50

LPG

LPG Consumption Details	
	2018-19
No Cylinders	45
LPG Consumption in kg	855

Base Line Energy Data		
SAFI INSTITUTE OF ADVANCED STUDY		
		2018-19
1	Electricity KSEB (kWh)	117271
2	Electricity Solar - Off grid (kWh)	0.00
3	Electricity (KSEB + Off grid) kWh	117271
4	Electricity Grid Tied (kWh)	0.00
5	Diesel (L)	260.00
6	LPG (kg)	855.00
7	Biogas (kg)	0.00

Energy Consumption Profile		
Sl No	Fuel	2018-19 (kCal)
1	Electricity	100853232
2	Diesel	2730000
3	LPG	10260000
4	Biogas	-
Total (kCal)		113843232
Total (kWh)		132375.9



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Energy efficiency in utility and process system

The specific energy consumption is normally taken as the ratio of total energy consumed to the total are of building.

OTTOTRACTIONS- ENERGY AUDIT		
SAFI INSTITUTE OF ADVANCED STUDY		
Energy Performance Index (EPI)		
Sl No	Particulars	2018-19
1	Total building area (m²)	15000
2	Annual Energy Consumption (kCal)	113843232
3	Annual Energy Consumption (kWh)	132375.9
4	Total Energy in Toe	11.38
5	Specific Energy Consumption kWh/m²	8.83

The Energy Performance Index (EPI) is

8.83 kWh/m²

The benchmark year is taken as 2018-19. All the proposals for energy savings are prepared based on the data during 2018-19.

7

Evaluation of energy management system

Energy management policy

There is no written energy policy available, but environment policy is available which includes energy conservation also. A draft energy management policy is given below. The management may constitute an energy management policy and display the same in the plant to motivate the staff.

SAFI INSTITUTE OF ADVANCED STUDY

ENERGY POLICY

(Draft)

We are committed to optimally utilize various forms of energy in a cost effective manner to effect conservation of energy resources. We are committed to conserve the energy which is a scarce resource with the requisite consistency in the efficiency, effectiveness in the cost involved in the operations and ensuring that production quality and quantity, environment, safety, health of people are maintained. We are also committed to increase the renewable energy share of the total energy we use.

We are also committed to monitor continuously the saving achieved and reduce its specific energy consumption by minimum of 2% every year.

Date ----------

7.1. Energy management monitoring system

- **Energy Management Cell** has to be constituted with an objective to revise action plan for energy conservation thereby reducing the production cost.
- Energy conservation tips/ posters are displayed in crucial points.
- Use of renewable energy has to be encouraged.

7.2. Training to staff responsible for operational and Documentation.

- The staff and students need to be made more aware of the importance of energy saving and management.
- Log books shall be maintained to record Electricity Consumption and Diesel consumption.
- Meter reading shall be taken and compared with KSEB regularly.
- Better operating practices regarding appliances and fixtures should be taught to the staff.

7.3. Best Practices

- Have solid waste management program
- Conducted Green Audit.
- Have different social and environmental clubs
- Installed LED bulbs
- Conducted Energy Conservation Training Programs

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Energy Conservation Measures and Recommendations

Executive Summary					
Consolidated Cost Benefit Analysis of Energy Efficiency Improvement Projects					
SAFI INSTITUTE OF ADVANCED STUDY					
Sl No	Projects	Investment	Cost saving	SPB	Energy saved
		(Lakhs Rs)	(Rs)/Yr	Months	kWh/Yr
1	Energy Saving in Lighting by replacing existing 58 No's T12 (55W) Lamps to 18 W LED Tube	0.17	0.254	8.23	3172
2	Energy Saving in Lighting by replacing existing 213 No's CFL(15W) Lamps to 9W LED BULB	0.23	0.15	18.53	1897
3	Energy Saving by replacing existing 239 No's in-efficient ceiling fans with Energy Efficient Five star fans	5.98	0.86	83.12	10782
	Total	**6.38**	**1.27**	**36.63**	**15850.46**
(The saving are projected as per the assumed operation time observed based in the discussions with the plant officials. The data of saving percentages are taken from BEE guide books and field measurements.)					
Cost Benefit Analysis of Renewable Energy Efficiency Projects					
5	Installation of 100 kWp Solar Power Plant	75.00	10.22	88.06	127750
6	Installation of 15Kg/day Biogas plant	0.2	0.26	9.39	5647
	Total	75.20	10.48	48.73	133397

Energy Saving Proposal Code 785.03	
Installation of 100 kWp Solar Power Plant	
Existing Scenario	
There is a good potential of solar power electricity generation. The availability of sunlight is very high. There are some canopies available in the proposed site, but by having proper trimming of trees this may be avoided. If the SPVs are place in the roof top it will help improving RTTV (Roof Thermal Transmit Value) of the building.	
Proposed System	
It is proposed to have a Solar Power Plant of 100kWp at the beginning stage. The state and central government is pushing and giving good assistance to the installation. It can be installed as an internal grid connected system which is much cheaper than off grid system. Now days the technology provides trouble free grid interactive and connected system. The installation will provide 25yrs trouble free generation with only 20% efficiency loss at the 25th year.	
Financial Analysis	
Proposed Solar installed Capacity (kW)	100
Total average kWh per day expected (3.5kWh/day average)	350.00
Total annual Generating Capacity (kWh)	127750
Cost of energy generated annually Lakhs Rs	10.22
Investment required (INR lakh)(Approx)	75.00
Simple Pay Back (in Months)	88.06
Life cycle in Yrs	25
Total Saving in Life Cycle (Approx) RS lakh	255.50

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal Code EA 822.01	
Energy Saving in Lighting by replacing existing 58 No's T12 (55W) Lamps to 18 W LED Tube	
Existing Scenario	
58 numbers of T12(55 W) lamps were identified during the energy audit field survey in the facility. During discussion with officers it is observed that the average utility of these fittings are of 30%.	
Proposed System	
The existing T12 may be replaced to LED Tube of 18 W in phased manner and the savings will be of 67% (inclusive of improved light output and reduced energy consumption)	
Financial Analysis	
Annual working hours (hr)	2120
No of fittings	58
Total load (kW)	3.19
Annual Energy Consumption (kWh)	4734
Expected Annual Energy saving for replacing all fittings (kWh)	3172
Cost of Power	8.00
Annual saving in Lakhs Rs (1st year)	0.25
Investment required for complete replacements [@Rs 300 per fittings](Lakhs Rs)	0.17
Simple Pay Back (in Months)	8.23

Energy Saving Proposal Code EA 822.02	
Energy Saving in Lighting by replacing existing 213 No's CFL (15W) Lamps to 9W LED BULB	
Existing Scenario	
213 numbers of CFL(15 W) lamps were identified during the energy audit field survey in the facility. During discussion with officers it is observed that the average utility of these fittings are of 30%.	
Proposed System	
The existing CFL may be replaced to LED bulb of 9W in phased manner and the savings will be of 40% (inclusive of improved light output and reduced energy consumption)	
Financial Analysis	
Annual working hours (hr)	2120
No of fittings	213
Total load (kW)	3.20
Annual Energy Consumption (kWh)	4741
Expected Annual Energy saving for replacing all fittings (kWh)	1897
Cost of Power	8.00
Annual saving in Lakhs Rs (1st year)	0.15
Investment required for complete replacements [@Rs 110 per fittings](Lakhs Rs)	0.23
Simple Pay Back (in Months)	18.53

Energy Saving Proposal Code EA 822.03	
Energy Saving by replacing existing 239 No's in-efficient ceiling fans with Energy Efficient Five-star fans	
Existing Scenario	
There are 239 numbers of ceiling fans installed in the facility with minimum 8 hrs a day operation. All are conventional type and most of them are very old.	
Proposed System	
There is an energy saving opportunity in replace the existing fans with new five star labelled fans. The five star labelled fans give a savings up to 38% with higher service value (air delivery/watt).	
Financial Analysis	
Annual working hours (hrs)	2120
Total numbers of ordinary fans	239
Total load (kW)	16.73
Annual Energy Consumption (kWh)	28374
Expected Annual Energy saving, for total replacement(kWh)	10782
Cost of Power (Rs)	8.00
Annual saving in Lakhs Rs (1st year)	0.86
Investment required for a total replacement (Lakhs Rs)[@2500 Rs per Fan for 5 Star Labelled Fans with service value above 6]	5.98
Simple Pay Back (in Months)	83.12

sl.no	Installation of 15Kg/day Biogas plant	
1	Capacity of Bio gas plant (Kg/day)	15
2	Average Calorific Value of biogas (kCal/m3)	3500
3	Annual Generation of Biogas Plant	1387.5
4	Daily production of biogas (kCal)	26250
5	LPG Saving in a day (kg)	2.1875
6	Annual LPG Saving (Kg)	405
7	Investment required (in Lakhs)	0.2
8	Annual Cost saving (in Lakhs)	0.26
9	Expected Annual Energy saving (kWh)	5647
10	Simple Pay Back (In Months)	9.39

Technical Supplements

Sl.No	Location	LIGHT					FAN			IT			AC		
		T8	T12	CFL	LED TUBE	LED BULB	CF	WF	EF	PC	Scanner	Printer	1.5	2tr	3tr
1	105			1			4								
2	108						2		1						
3	109			2			4								
4	110			2			6								
5	111			1			2								
6	112			1			2								
7	114			5			8								
8	115			2			2								
9	118		2				2								
10	121			1			4								
11	122			1			4								
12	130			3			2								
13	131			4			6		2						
14	133			1			8								
15	136		1				2						1		
16	201		2	2			2								
17	202			1			4								
18	203			2			6								
19	205			2			2								
20	208-A			1			2								
21	209			1			4								
22	210			1			6								
23	211						2								

24	211b						2									
25	212			2			2									
26	214						3									
27	308			2			3									
28	307						1									
29	305						2									
30	304						1									
31	303						4									
32	302						2									
33	301						2									
34	101		1	2			2			3		1	1			
35	102		2	2			2			3		4	1			
36	103		2	1			2			1		2	1			
37	104		2	1			2						1			
38	106		3	3			6			31			2			
39	107			2			2			2		1				
40	126			3			2		1	1		1				
41	MB lab		5	6			8			2		1	1			
42	store		1	2			1									
43	BT lab		4	4			8									
44	instrument lab		7	6			4			2			2			
45	sickroom			2			1									
46	MCJ lab			1			2			11		1				
47	208		2	1			2			1		1				
48	ft lab		6	1			10			1		1				
49	chemistry lab			4			8									
50	boys bathroom															
51	ladies bathroom															
52	staff washroom															
53	aud 2			6			5									

54	aud 1			4			5								
55	213			1			2		1	1		1			
56	security room														
57	confrence hall		4	8			8						4		
58	Conf. bedroom			2			1						1		
59	principal		1	2			2			1		1	1		
60	306			1			1			1		1			
61	gents bathroom														
62	ladies bathroom														
63	reception								1	2		1			
64	GF main loby								1						
65	micro loby			6											
66	ladies lobby			10											
67	bt lobby			4											
68	first floor lobby			18					1						
69	II floor lobby			9											
70	COO office			6			3			1		1	1		
71	SAFI Office		2						2	2		2			
72	LIB- REFRENCE			12			6								
73	Digital library			10			6			18					
74	lib entrance														
75	Lib - server						1								
76	lib lobby			10			4			1					
77	lib bathroom			6											
78	IS staff room		2				1			1		1			
79	seminar hall		5	2					7						
80	lib - 301			2			2								
81	lib - 302			12			5						4		
82	lib - 304			1			2								
83	lib - staff room econ						2			1					

84	lib- 201		4				4								
85	lib 202						3								
86	lib- eco- bathroom														
87	lib -B- hindi			1			2								
88	lib-B - bathroom														
89	lib- B - 101			1			4								
	TOTAL	**0**	**58**	**213**	**0**	**0**	**239**	**0**	**17**	**87**	**0**	**21**	**21**	**0**	**0**
	W		40	20			80		60	100		140	1200		
		0	2320	4260	0	0	19120	0	1020	8700	0	2940	25200	0	0
	63.56														