 

Energy Audit Report of Nabajiban, Howrah

Conducted during July-August 2013

Energy Management Department,

Indian Institute of Social Welfare & Business Management

College Square (West)

Kolkata 700073

IISWBM

Acknowledgement

We would like to express our special thanks of gratitude to Brother Paul, Nabajiban, Missionaries of Charity, Howrah who gave us the golden opportunity to visit and do this energy audit work of the existing building, tried to be performed as our worship, which also helped us in doing a lot of research and learn many new things. We experienced a new world while spending our time with the people, especially those are almost rejected and abandoned otherwise by us, the common people. We realized that the innocent hearts are the dwelling place of the Lord. Bereft of their love, cooperation and help, it would not be possible for us to carry out this work and we really spend a very good time with them.

We are also obliged to the staff members of Nabajiban, Missionaries of Charity, Howrah, for the valuable information provided by them in their respective fields. We are grateful for their cooperation during the period of our audit work. We are really thankful to all of them.

BROTHER PAUL OF NABAJIBAN MISSIONARIES OF CHARITY BROTHERS (2^{ND} FROM LEFT) WITH ENERGY AUDIT TEAM OF IISWBM

WEST BENGAL STATE STUDENT-YOUTH SCIENCE FAIR 2013

Youth Services Department, Government of West Bengal

School Education Department, Higher Education Department,
W. B. State Council of Science & Technology, Govt. of West Bengal
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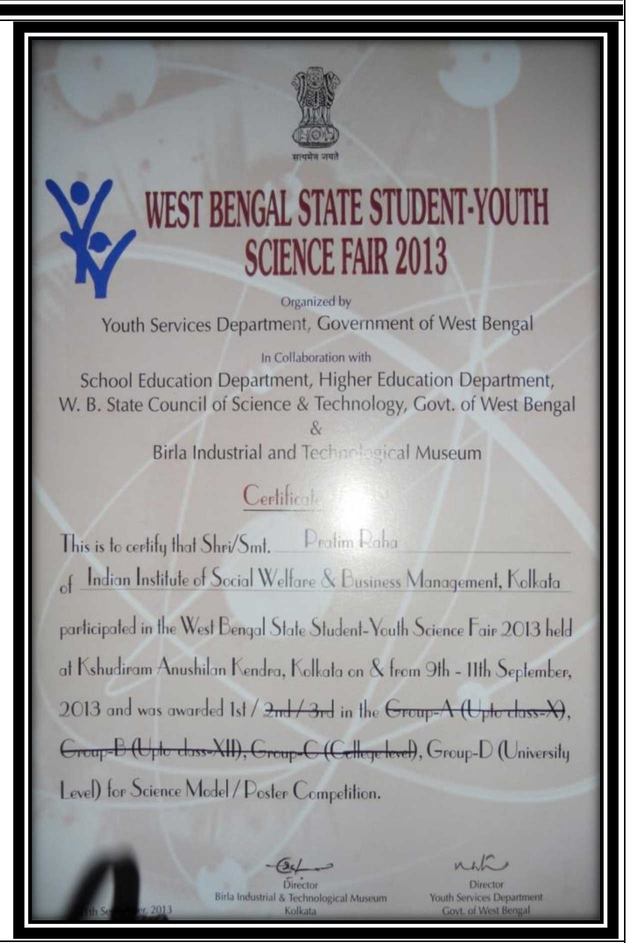

WEST BENGAL STATE STUDENT-YOUTH SCIENCE FAIR 2013

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This is to certify that Shri/Smt. Pratim Raha
of Indian Institute of Social Welfare & Business Management, Kolkata
participated in the West Bengal State Student-Youth Science Fair 2013 held at Kshudiram Anushilan Kendra, Kolkata on & from 9th - 11th September, 2013 and was awarded 1st / ~~2nd / 3rd~~ in the ~~Group-A (Upto class-X)~~, ~~Group-B (Upto class-XII)~~, ~~Group-C (College level)~~, Group-D (University Level) for Science Model / Poster Competition.

Director
Birla Industrial & Technological Museum
Kolkata

Director
Youth Services Department
Govt. of West Bengal

A MODEL ON STUDY BY DIPAYAN & PRATIM THAT GOT 1ST PRIZE AT STATE LEVEL

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1.1 Objective

The Energy Audit would give a positive orientation to the Electricity charge reduction, preventive maintenance and quality control programmes which are vital for control of expenditure and environmentally benign activities. Such an audit programme will help to keep focus on variations which occur in the energy costs, availability and reliability of supply of energy, decide on appropriate energy mix, identify energy conservation technologies, retrofit for energy conservation equipment etc. In general, Energy Audit is the translation of conservation ideas into realities, by lending technically feasible solutions with economic and other organizational considerations within a specified time frame.

The primary objective of Energy Audit is to determine ways to reduce energy consumption to lower operating costs in harmony to the ongoing efforts to improve the standard, quality as well as extent of service even with the limited available resources. Energy Audit provides a "benchmark" (Reference point) for managing energy in the organization and also provides the basis for planning a more effective use of energy throughout the organization, ensuring the maximum possible sustainable use of energy sources.

So, our objective was to identify the areas of Nabajiban, Where we can conserve the energy, minimize the Electricity charge and scope for installation of renewable energy sources.

1.2 Scope of the Study

1.2.1 <u>Electricity consumption & Electricity Billing:</u>

Electrical Equipment:

- Electrical measurements of all major electrical parameters viz., volitreage, current, power factor, kW, frequency etc., of important equipment (fans, lighting, pump etc.), with significant energy consumption using power analyzer.

- Measurements of light intensity using Luxmeter.

Electricity Bill:
Summary for the past year's monthly electricity consumption. Calculation of energy consumption, in kWh. and comments on the same.

Calculation of loads and method to reduce Maximum Demand.

1.2.2 <u>Preparation of report based on analysis of above data:</u>

The report shall provide existing Energy Profile of the unit with percentage share of major equipment/processes, Utility etc., so that it becomes a basic document for future monitoring.

1.2.3 <u>Methodology & Time Schedule :</u>

- Visit was made for study of Nabajiban operations, collecting necessary data and making measurements on important equipment.

- Analysis of the collected data and report preparation is done in Indian Institute of Social Welfare & Business Management, Kolkata.

1.3 Executive Summary

Sl No.	Energy saving measures	Investment in Rs.		Annual savings in Rs./Year	Reasons for implementing the measures	Payback period	Annual Energy Savings
1	Replacement of 60 Watt incandescent lamps by 30 Watt CFL	Rs.2,600/-		Rs. 1,402/-	A 30 Watt CFL can save 50% more energy than a 60 Watt incandescent Lamp & a CFL has an average life span of 8000 hours When the incandescent lamp has an average life span of 1200 hours.	1 year 11 months	259.2 kWh
2	Replacement of conventional Tube Lights(T8) by T5	Rs.15,980/-		Rs.7,417/-	A 28 Watt T5 can save upto50% more energy than a 40 Watt conventional Tube Light(with conventional ballast of 15 Watt) & a T5has an average life span of 35000 hours When the conventional Tube Light has an average life span of 800 hours.	2 years 2 months	1,370.52 kWh
3	Replacement of conventional ceiling Fan by Super Fan	Rs.1,38,000/-		Rs.49,277/-	A 35 Watt Super Fan can save more than 50% energy than a 80 Watt conventional ceiling Fan.	2 years 10 months	9,108 kWh
4	Installation of Rooftop Solar Photo Volitreaic System(With subsidy)	a. For Standalone System	With subsidy 4,38,900/-	Rs.20,320/-	A 3.3 kW Rooftop Solar Photo Volitreaic System with battery is sufficient to fulfill minimum energy requirement.	21 years 8 months	3,756 kWh
			Without subsidy Rs.6,27,000/-			30 years 11 months	
		b. For Grid connected system	With subsidy Rs. 3,64,000/-	Rs.44,575/-	A 2.7 kW Rooftop Solar Photo Volitreaic System without battery is sufficient to minimize the chargeable unit consumption.	9years	
			Without subsidy Rs. 5,20,000/-			12years 10 months	
5	Installation of 1No. of 15 m^3 Biogas Plants	With subsidy Rs. 57,562.50/-		Rs.60,921/-	1No. of 15 m^3 Biogas Plant will save 63 no. of LPG cylinder (approx) per year.	1year	890.6kg
		Without subsidy Rs.87,562.50/-		Rs.60,921/-		1year 6 months	
6	Rain water Harvesting	Rs. 62,756/-		Rs. 1175/-	This system will minimize the requirement of water through the pumping system & it will save 0.596 kWh energy per day.	53 years	217.54 kWh
7	Installation of Solar water heating system	a. ETC Type	With subsidy Rs. 1,40,000/-	Rs. 12, 984/-	It will provide 500 litre hot water per day without using electrical energy.	10years 10 months	2,400 kWh
			Without subsidy Rs.2,00,000/-			15 years 5months	
		b. FPC Type	With subsidy Rs. 1,54,000/-			11 years 11 months	
			Without subsidy Rs.2,20,000/-			17years	

1.4 Introduction

1.4.1 <u>About Nabajiban :</u>

Nabajiban, a home in Howrah run by Missionaries of Charity Brothers for the abandoned and mentally challenged people. Respected Brother Paul is the head of the home. The Missionary of Charity Brother is to be a friend to the poorest people, especially those most rejected and abandoned by others. The brother offers himself as an instrument of God's love and expresses his friendship by comforting and helping the poor in their immediate needs. Their particular mission is to live this life of love by dedicating ourselves to the service of the poorest of the poor Wherever they are found. Why? Each Missionary of Charity responds in a personal way to the discovery of God's love and calling for him / her.

1.4.2 <u>About IISWBM :</u>

IISWBM, Kolkata is one of the Premier Management Educational Institutes in Eastern India. The precious journey of the Institute commenced on April 25, 1953 When it was formed by a resolution of the Syndicate of the University of Calcutta. This esteemed Institute initiated the first programme of management education in India. The foundation stones of both buildings were laid by Pandit Jawaharlal Nehru, the then Prime Minister of India and Dr. B. C. Roy, Chief Minister of West Bengal. The institute celebrated its Golden Jubilee in 2003 and the Government of India released a commemorative stamp of IISWBM for the event. To date, no other management institute in India has been accorded this honour.

1.5 Energy Audit Team

Serial No.	Name	Designation
1	Dr. Binoy Krishna Choudhury	Professor, Energy Management Department, IISWBM
2	Mr. Soumen Achar	Laboratory Assistant, IISWBM
3	Mr. Dipayan Sarkar	Student, Energy Management, IISWBM
4	Mr. Pabitra Kumar Maity	Student, Energy Management, IISWBM
5	Mr. Pratim Raha	Student, Energy Management, IISWBM

1.6 Nabajiban's energy requirements

Nabajiban's energy requirements are as follows :

1.6.1 <u>Electrical energy system :</u>

Power Supply Company	CESC
Consumer No.	57042019003
Connected Load	2.7 kVA
Average Actual Demand	525.5
Average Units consumed per month	624.67
Average Monthly Bill per month in Rs. /month	3888.33
Average Power Factor	0.78
Average Rate in Rs./Unit	5.41

1.6.2 <u>Electrical meter's details :</u>
Nabajiban has three meters.

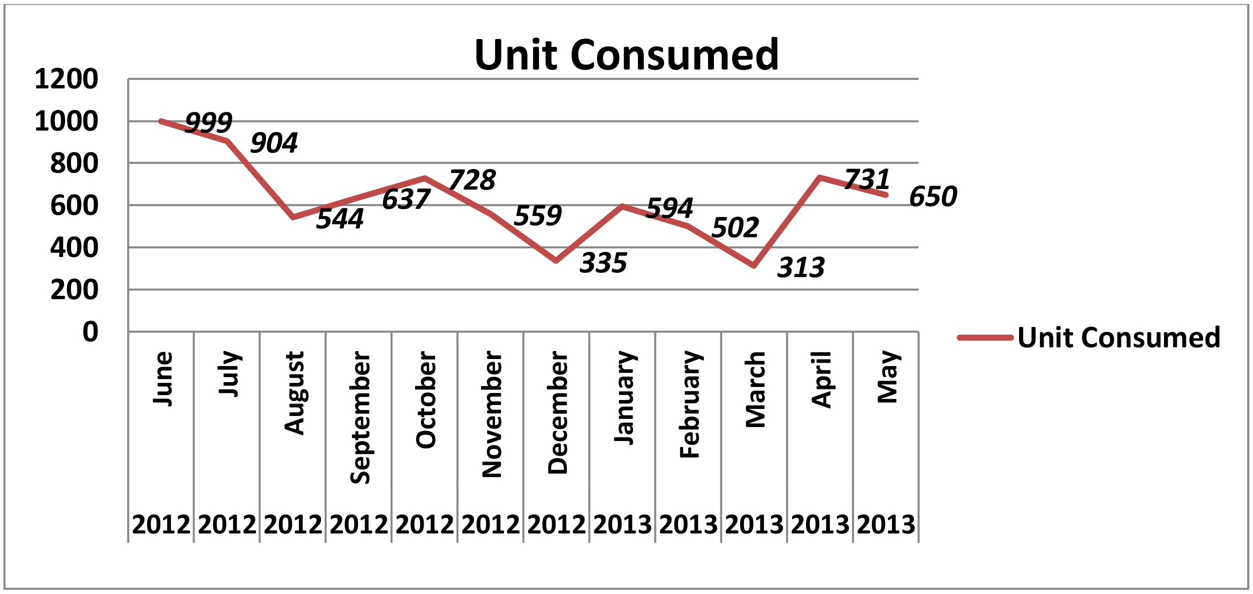
Sl. No.	Meter No.	Rate/Phase
1	0088779	03 P/ Single Phase
2	0539382	02 P/ Single Phase
3	0446189	01 P/ Single Phase

1.6.3 <u>Last 12 month's electricity bill analysis:</u>

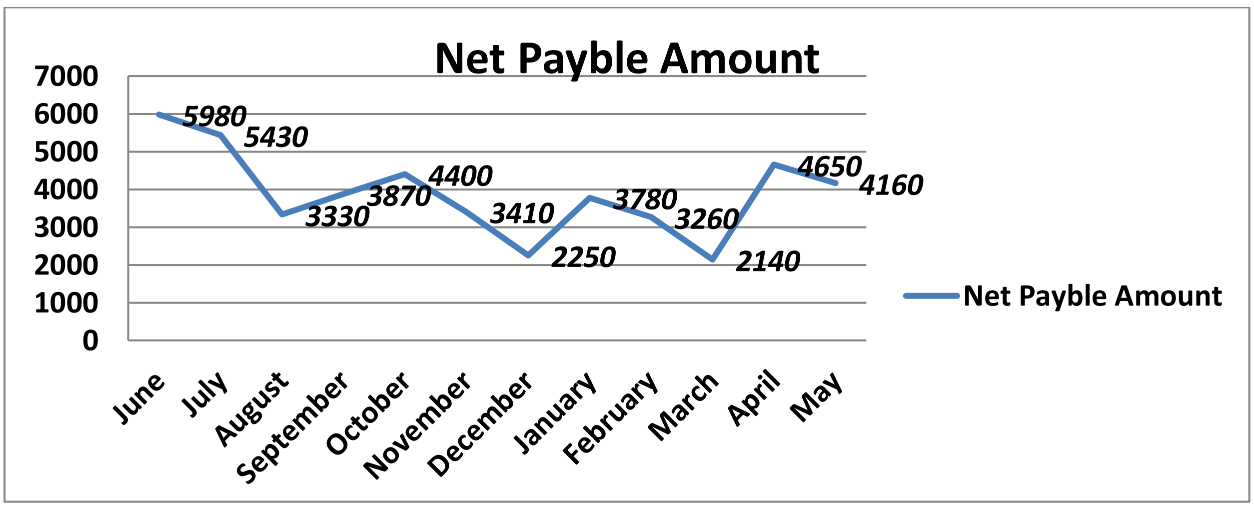
Last 12 Month's Electricity bill of Nabajiban

Year	Month	Unit Consumed	Gross Payable Amount	Discount	Net Payable Amount
2012	June	999	6090	108.74	5980
2012	July	904	5530	98.46	5430
2012	August	544	3390	59.51	3330
2012	September	637	3940	69.57	3870
2012	October	728	4480	79.42	4400
2012	November	559	3480	61.14	3410
2012	December	335	2270	18.77	2250
2013	January	594	3810	32.78	3780
2013	February	502	3290	28.11	3260
2013	March	313	2160	17.84	2140
2013	April	731	4690	40.78	4650
2013	May	650	4200	36.32	4160
Monthly average		624.67	3944.17	54.29	3888.33

- **<u>Graphical representation of last 12 month's energy requirements :</u>**



- **<u>Graphical representation of last 12 month's Electricity charge:</u>**



1.7 Energy & utility system description at Nabajiban

1.7.1 List of utilities :

Serial No.	Name of utility
1	Electricity
2	Liquefied Petroleum Gas (LPG)
3	Water

1.7.2 Brief description of each utility

1.7.2.1 Electricity (Power & Energy Consumption Patterns per day for different loads at Nabajiban, Howrah)

				Details of Load											Dimension of Room		
Floor	Floor Detail	Room No	Room-Name	Type of Load	No. of Load	Wattage (W)	Total Wattage of individual load (W)	Time duration of Daily use (Hours)	Total Energy of individual Daily load (Wh)	Total Power Consump-tion for each room (W)	Total Daily Energy Consump-tion for each room (Wh)	Total Power Consump-tion in a floor (W)	Total Daily Energy Consump-tion in a floor (Wh)	Remarks	Length (M)	Breath (M)	Area (M^2)
First Floor		1	Church Room	CFL	1	30	30	2	60	675	1350	4888	6449.5	daily 2 times for 60 mins	9.3	6.1	56.73
				Tube	3	55	165	2	330								
				Fan	6	80	480	2	960								
		2	Music Room	Tube	1	55	55	0.5	27.5	145	72.5			Daily for 30 mins	15.3	10	153
				Fan	1	90	90	0.5	45								
		3	Dormitory	Tube	2	55	110	0	0	650	0			Occasionally	9.25	6.1	56.42
				Fan	6	90	540	0	0								
		4	Class Room	Tube	3	55	165	3	495	615	1845			3 hours per Day	9.25	6.1	56.42
				Fan	5	90	450	3	1350								
		5	Dining Room	Tube	4	55	220	1	220	680	680			daily for 60 mins	9.56	9.25	88.43
				Stand Fan	2	80	160	1	160								
				Water Purifier	1	300	300	1	300								
		6	Guest Room	Tube	1	55	55	0	0	135	0			Not used regularly			
				Fan	1	80	80	0	0								
		7	Regional Superior Room	Tube	1	55	55	0	0	135	0			Not used regularly			
				Fan	1	80	80	0	0								
		8	Back Passage	Incand escent	1	60	60	0	0	115	0			As per requirement			
				Tube	1	55	55	0	0								
	1 - Lower	9	Brother's Room	Tube	3	55	165	4	660	563	1822			Approximate assumption			
				T5	1	28	28	4	112								
				Table Fan 1	3	80	240	3	720								

				Table Fan 2	1	110	110	3	330								
				Table Lamp	1	20	20	0	0								
	1 - Upper	10	Lavatory				0	0	0	0	0			Minimum Power Consumption			
		11	Kitchen	CFL	1	30	30	2	60	90	180			Lighting loads are used for 2 hrs per Day			
				Incandescent	1	60	60	2	120								
		12	Library	CFL	1	5	5	0	0	85	0			Occasionally			
				Fan	1	80	80	0	0								
	1 - Lower	13	Utility Room	Iron	1	1000	1000	0.5	500	1000	500			Daily for 30 mins			
	1 - Upper	14	Guest Room near Church				0	0	0	0	0			Not used regularly			
Grou-nd Floor		15	Bed Room 1	Fan	3	80	240	10	2400	505	3360	8836	27401.5	Fans for 10, Exhausts for 3 & tubes for 4 hours per Day (approx.)	9.36	5.85	54.756
				Exhaust Fan	1	100	100	3	300								
				Tube	3	55	165	4	660								
		16	Bed Room 2	Fan	8	80	640	10	6400	1260	8480			Fans for 10, Exhausts for 3 & tubes for 4 hours per Day (approx.)	9.36	9	84.24
				Exhaust Fan	4	100	400	3	1200								
				Tube	4	55	220	4	880								
		17	Bed Room 3	Old Fan	3	100	300	10	3000	570	5040			Fans for 10, & tubes for 4 hours per Day (approx.)	9	5.8	52.2
				New Fan	2	80	160	10	1600								
				Tubes	2	55	110	4	440								
		18	Shaded Dining Room	Old Fan	4	100	400	2	800	645	1290			Used for approximately 2 hours			
				New Fan	1	80	80	2	160								
				Tube	3	55	165	2	330								
		19	Playing Room	Old Fan	1	100	100	2	200	625	1250			Used for approximately 2 hours			
				New Fan	2	80	160	2	320								

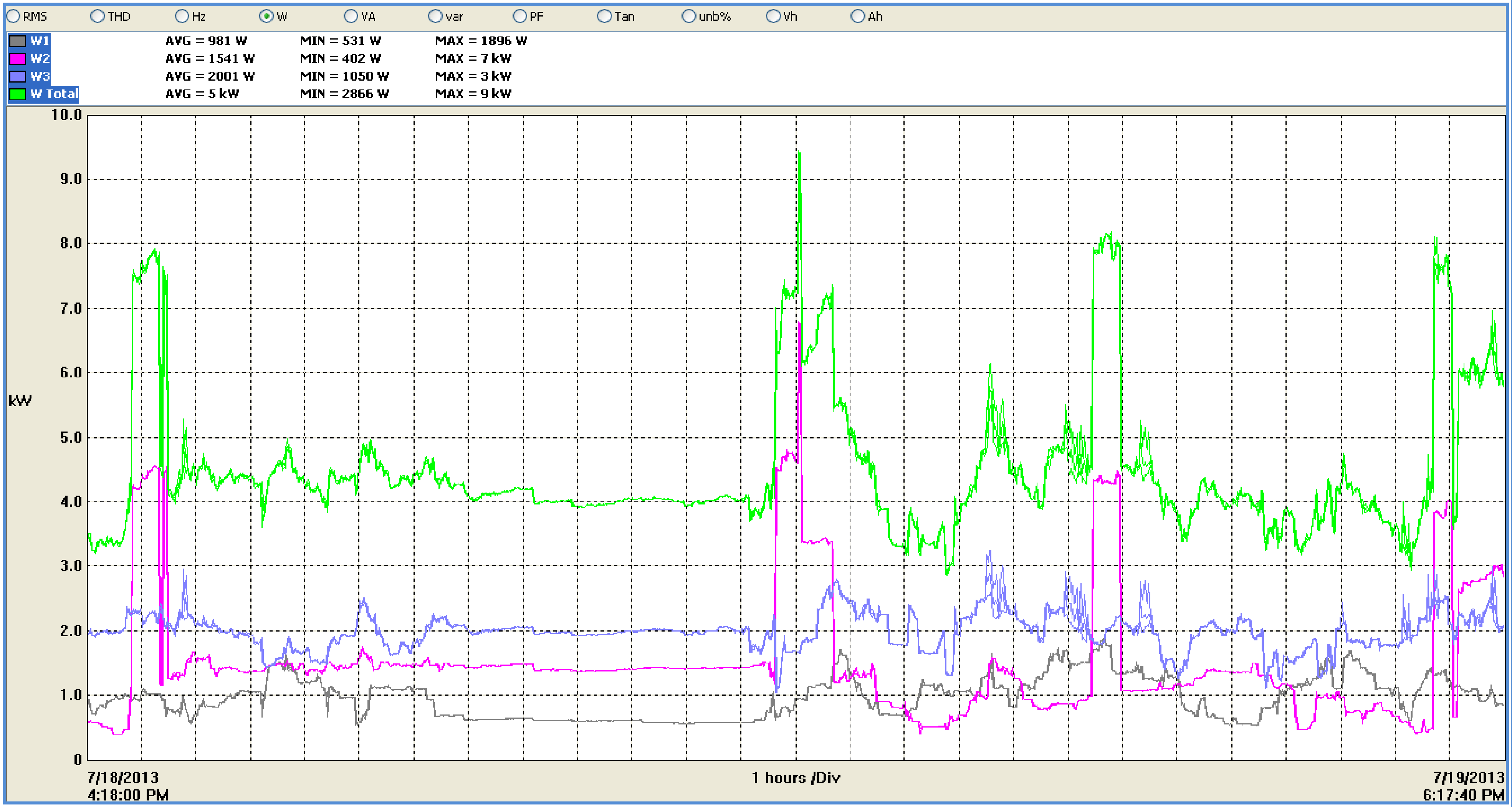
				Exhaust Fan	2	100	200	2	400								
				Tube	3	55	165	2	330								
		20	Kitchen	Incandescent	1	60	60	6	360	195	1170			Daylight is used but, approximately for 1 more hour the lighting loads are used			
				Tube	1	55	55	6	330								
				Fan	1	80	80	6	480								
		21	Children's Bed Room	Table Fan	6	80	480	6	2880	1045	4575			Some beds are unoccupied, so assumption is taken			
				Exhaust Fan	4	100	400	3	1200								
				Tube	3	55	165	3	495								
		22	Pumping Area	Pump	1	1491	1491	1.5	2236.5	1491	2236.5			2 hp motor=1.491KW , The motor runs daily 3 times for 30 mins			
		23	bathroom area	Geyser	1	2500	2500	0	0	2500	0			Used only in winter			
Roof Top		24	Open Terrace	CFL	1	20	20	0	0	20	0	450	0	As per requirement			
		25	Shaded Area	Tube	6	45	270	0	0	270	0						
		26	Lavatory	Incandescent	4	40	160	0	0	160	0						
Stair Case		27	Stair Case	Incandescent	1	60	60	4	240	225	900	225	900	4 hrs per Day			
				Tube	1	55	55	4	220								
				Tube	2	55	110	4	440								
												14399	34751				

1.7.2.1.1 Load wise total power consumption

Colour Code	Load	particular	Number	watt	Wh	Total Wattage(W)	Total Energy(Wh)
	Light	Table Lamp	1	20	0	3058	6809.5
		CFL	4	85	120		
		Incandescent	8	400	720		
		Tube	47	2525	5857.5		

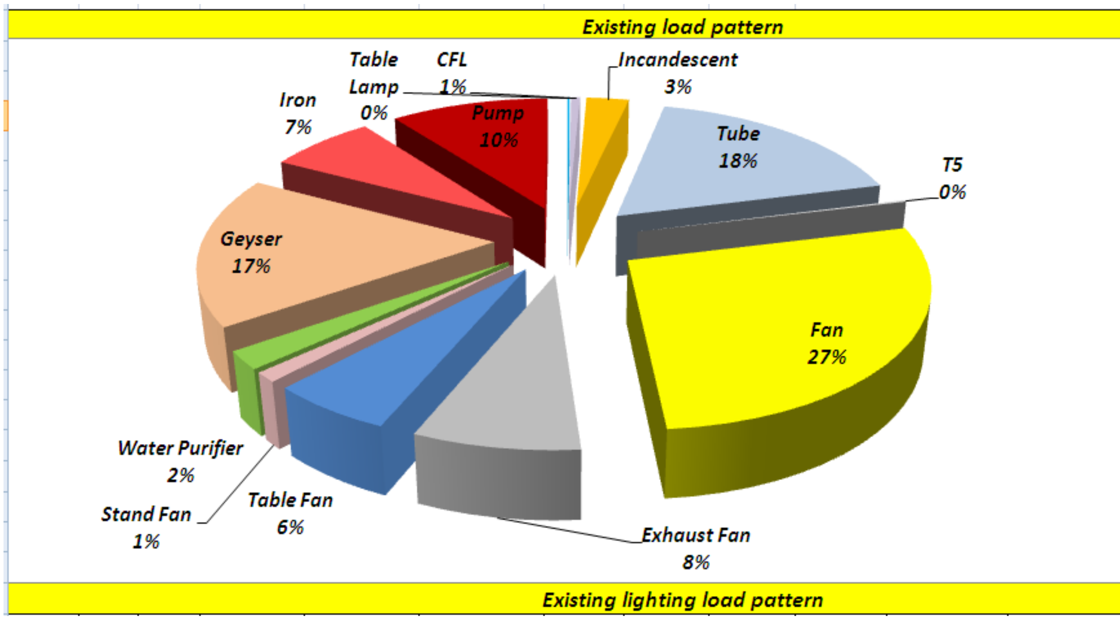
		T5	1	28	112		
	fan	Fan	46	3960	17715	6050	24905
		Exhaust Fan	11	1100	3100		
		Table Fan	10	830	3930		
		Stand Fan	2	160	160		
	others	Water Purifier	1	300	300	3800	800
		Geyser	1	2500	0		
		Iron	1	1000	500		
	Pump	Pump	1	1491	2236.5	1491	2236.5
		Total	134	14399	34751	14399	34751

- **<u>Graphical representation of one day power consumption pattern through Power Analyzer :</u>**



1.7.2.1.2 **Existing load pattern:**

Existing load pattern in pi-chart:

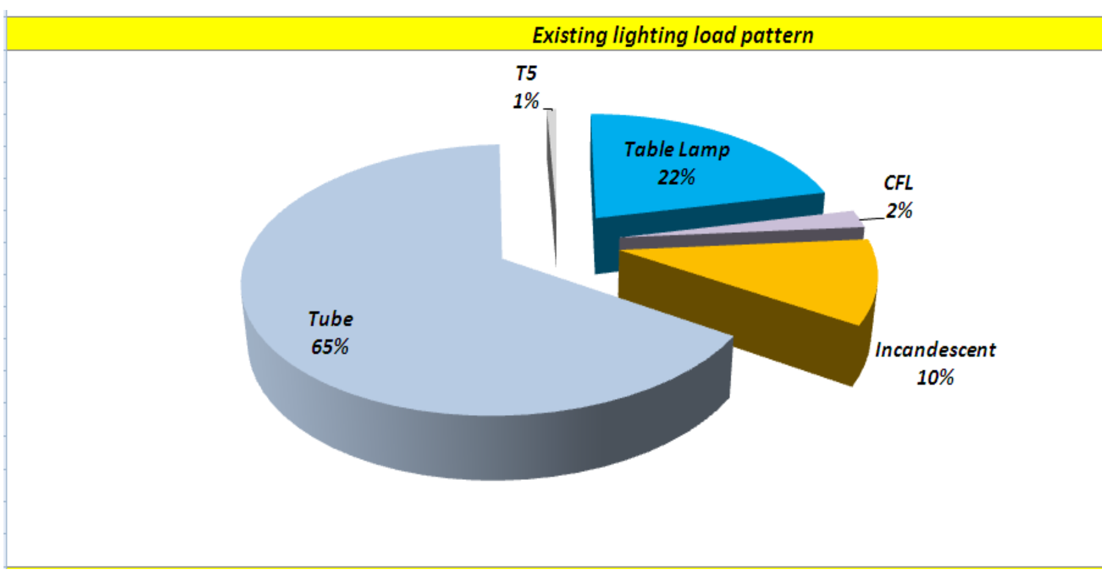


Load	Wattage
Table Lamp	20
CFL	85
Incandescent	400
Tube	2525
T5	28
Fan	3960
Exhaust Fan	1100
Table Fan	830
Stand Fan	160
Water Purifier	300
Geyser	2500
Iron	1000
Pump	1491
Total----------	14399

- ***Total number of equipments & Light: 134***
- ***Maximum power demand : 14399 Watt = 14.4 kilo-Watt(Approximately)***
- ***Maximum energy consumption : 34751Watthour = 34.75 kilo-Watt-hour (Approximately)***

1.7.2.1.2.1 **Significant connected Load with regard to Lights :**

Existing lighting load pattern in pi-chart :



Load	Wattage
Table Lamp	830
CFL	85
Incandescent	400
Tube	2525
T5	28
Total----------	3868

Energy consumption by Incandescent Lamp :

No. of incandescent lamps in Nabajiban = 8
Wattage of each incandescent lamp = 60 Watt
Assuming, on an average each incandescent lamp remains ON for 3 hours.
So, total energy consumption due to incandescent lamp for one month will be,

= (8 x 60 x 3 x 30)Wh
= 43200 Wh = 43.2 kWh

- ***Cost Analysis :***

Electricity charge is Rs. 5.41/- per kWh
So, monthly energy cost due to incandescent lamp = 43.2 x 5.41= Rs. 233.71/-
So, annual energy cost due to incandescent lamp = 233.71 x 12= Rs. 2,804.54/-

Energy consumption by Conventional Tubes :

No. of conventional tubes in Nabajiban = 47
Wattage of each conventional tubes (with ballast) = 55 Watt
Assuming, on an average each conventional tubes remains ON for 3 hours.
So, total energy consumption due to conventional tubes for one month will be

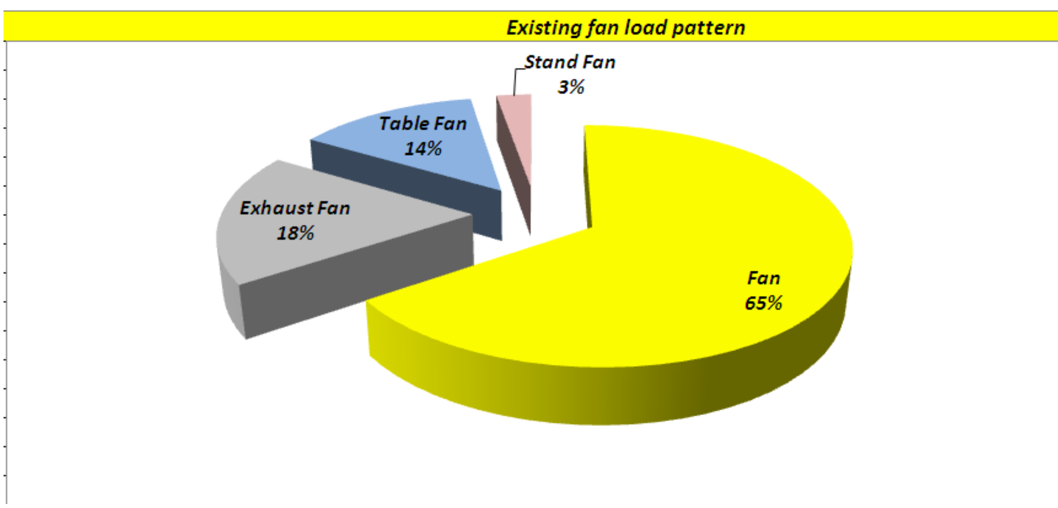
= (47 x 55 x 3 x 30)Wh
= 232650 Wh = 232.65 kWh

- ***Cost Analysis :***

Electricity charge is Rs. 5.41/- per kWh
So, monthly energy cost due to conventional tubes = 232.65 x 5.41= Rs. 1,258.64/-
So, annual energy cost due to conventional tubes = 1,258.64 x 12= Rs. 15,103.68/-

1.7.2.3.2 Significant Connected Load with regard to Fan :

Existing fan load pattern in pi-chart :



Load	Wattage
Fan	3960
Exhaust Fan	1100
Table Fan	830
Stand Fan	160
Total-----------	6050

Energy consumption by Ceiling Fan :

No. of ceiling fan in Nabajiban = 46
Assuming, on an average, Wattage of ceiling fan = 85 Watt
Assuming, on an average each ceiling fan remains ON for 10 hours.
So, total energy consumption due to ceiling fan for one month will be = (46 x 85 x 10 x 30) Wh
= 1173000 Wh = 1173 kWh

***N.B.**

Climate data for Howrah

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	26 (79)	29 (84)	33 (91)	36 (97)	36 (97)	34 (93)	33 (91)	33 (91)	33 (91)	32 (90)	30 (86)	27 (81)	31.8 (89.3)
Average low °C (°F)	12 (54)	16 (61)	21 (70)	24 (75)	25 (77)	26 (79)	26 (79)	26 (79)	26 (79)	24 (75)	19 (66)	14 (57)	21.6 (70.9)

**Source - http://en.wikipedia.org/wiki/Howrah*

Assuming, When average temperature is less than 27°C, fans will not be used.
[According to climate report, mid of October to mid of March, (Approximately 5 months) the average temperature (considering average of Maximum & Minimum temperature of a month) remains in-between 19°C - 27°C. So, for five months, fans will not be used.**]**

- ***Cost Analysis :***

Electricity charge is Rs. 5.41/- per kWh
So, monthly energy cost due to ceiling fan = 1173 x 5.41= Rs. 6,345.93/-
So, annual energy cost due to ceiling fan = 6,345.93 x 7 = Rs. 44,421.51/-

Energy consumption by Exhaust Fan :

No. of exhaust fan in Nabajiban = 11
Assuming, on an average, Wattage of exhaust fan = 100 Watt
Assuming, on an average each exhaust fan remains ON for 3 hours.
So, total energy consumption due to exhaust fan for one month will be = (11x 100 x 3 x 30)Wh
= 99000 Wh= 99 kWh

- ***Cost Analysis :***

Electricity charge is Rs. 5.41/- per kWh
So, monthly energy cost due to exhaust fan = 99 x 5.41= Rs. 535.69/-
So, annual energy cost due to exhaust fan = 535.69 x 12= Rs. 6,427.08/-

Energy consumption by Exhaust Fan :

No. of table fan in Nabajiban = 10
Assuming, on an average, Wattage of table fan = 80 Watt

Assuming, on an average each table fan remains ON for 6 hours.
So, total energy consumption due to table fan for one month will be = (10x 80 x 6 x 30)Wh
= 144000 Wh= 144 kWh

- ***Cost Analysis :***

Electricity charge is Rs. 5.41/- per kWh
So, monthly energy cost due to table fan = 144 x 5.41= Rs. 779.04/-
So, annual energy cost due to table fan = 779.04 x 7 (considering the case of ceiling fan)
= Rs. 5453.28/-

1.7.2.2 Liquefied Petroleum Gas (LPG)

In Nabajiban, per month on an average 33, 14.2 kg packed domestic LPG cylinders are needed.
So, per day approximately 33/30 = 1.1 LPG cylinder is required.
Per year it will be, 33x12 = 396 cylinders of LPG

- ***Cost Analysis :***

In India, 9 domestic LPG cylinders are available in subsidized rate per year. So, (396-9) 387 cylinders have to buy in non subsidized rate. So, total cost of energy for cooking will be,

Rs. (9x412.50) + (387x967.00) = Rs. 3,77,941.50 per year.

Per month expense for gas = (3,77,941.50 /12) = Rs. 31,495.13

Where, rate of 14.2 kg packed domestic subsidized LPG cylinder = Rs. 412.50*
Rate of 14.2 kg packed domestic non-subsidized LPG cylinder = Rs. 967.00*

**Source : http://www.iocl.com/Products/Indanegas.aspx accessed on 15/09/2013*

1.7.2.3 Water

1.7.2.3.1 Normal Water Consumption :

Approximately 12,000 litres of water per day is required for Nabajiban. They runs a 2 hp pump for three times in a day for 30 mins time span.

We know, 1 hp = 745.6 Watt.
So, 2 hp = 1491 Watt = 1.491 kW
The pump runs for 1.5 hours in a day , so, total energy required,
1.491 x 1.5 = 2.237 kWh.

- ***Cost Analysis :***

Electricity charge is Rs. 5.41/- per kWh.

So, for pump it will be, 2.237 x 5.41 = Rs. 12.10/- per day.

For 1 month, it will be, 12.10 x 30 = Rs. 363/-

& for one year it will be, 363 x 12 = Rs. 4,356/-

1.7.2.3.2 Hot Water Consumption :

Assuming, daily 200 litres hot water is required.
Initial water temperature= 19^{o}C*
**source: "User's handbook on Solar Water Heaters." , MNRE, UNDP/GEF Solar Water Heating project*
Hot water temperature = 70^{o}C
Mass of 1litre of water =1 kg
So Mass of 200 litres of water= 200 x 1=200kg

We know,

$$\boxed{\mathbf{H} = \mathbf{m} \times \mathbf{s} \times (\mathbf{t_1}-\mathbf{t_0})}$$

Where
H= Energy required to heat the water
m= Mass of water
s= Specific heat of water=1 kcal/kg °C
t_0=Temperature of water at Kolkata in winter
t_1= Temperature of hot water

So, H=200 x 1 x (70-19) kcal =10,200 kcal
So requirement of thermal energy for water heating=10,200 kcal/day
We know, 1 kWh = 860 kcal
Per day Electricity consumption to heat water = 10,200/860= 12 kWh (approx)

Assuming there were two geysers having a conversion efficiency of 90% and that it may be used only six months in a year.
So yearly energy consumption to heat water =(12x180)/.9=2400kWh

- ***Cost Analysis :***

Electricity charge is Rs. 5.41/- per kWh.
So, Annual saving will be=2400 x 5.41=Rs.12,984/-

1.8 Energy conservation measures & recommendations

1.8.1 Electricity

1.8.1.1 Lighting Load

1.8.1.1.1 Replacement of Incandescent Lamps with compact fluorescent lamps (CFLs):

Replacement of Incandescent Lamps with ***compact fluorescent lamps*** **(*CFLs*).** Compared to general-service incandescent lamps giving the same amount of visible light, CFLs use one-fifth to one-third the electric power, and last eight to fifteen times longer. On an average, 30 Watt CFLs can be used.

- ***Cost of installation :***

Price of 30 Watt standard CFL is Rs. 325.00* (Approximately)
**Source-* *http://www.bijlibachao.com/Lights/cfl-bulbs-and-fluorescent-tubes-buying-guide.html*

Replacement cost of 8 incandescent lamps with CFLs = 8x325 = Rs. 2,600/-

- ***Savings Analysis :***

The replacement of an Incandescent Lamp with CFL saves (60-30) = 30 Watt. Assuming, every incandescent Lamp remains ON for 3 hours (on an average) per day, or, 90 hours per month. So, energy savings per month will be, 30x90 = 2,700 Wh = 2.7 kWh.

Energy charge as per electricity bill = Rs. 5.41 per unit.
So, monthly savings= 2.7x5.41 = Rs. 14.60/- for one replacement
So, yearly savings for 8 replacements = 8x14.60x12= Rs. 1,401.60/-

- ***Pay back period :***

We know, **Payback Period =** $\frac{\textbf{Initial Investment}}{\textbf{Savings per year}}$

$$= \frac{2,600}{1,401.60}$$

= 1.85 years =1 year 11 months (approximately)

[* Now ***LED*** bulbs which are more energy efficient than CFLs, available in the market, but due to its high cost, it is not used in residential purpose. So, we are not giving the calculations for LED]

1.8.1.1.2 Replacement of Conventional Tube by T5 :

Replacement of conventional tubes with ***T5.*** T5 fluorescent lamps are thinner, more efficient, and offer a higher intensity of light output than conventional tube lights. On an average 28 Watt T5s can be used.

- ***Cost of installation :***

Price of 28 Watt standard T5 is Rs. 340.00* (Approximately)
**Source- http://www.lampspecs.co.uk/Light-Bulbs-Tubes/840-Cool-White_11/T5-28-Watt-840-Philips*

Replacement cost of 47 conventional tubes with T5s = 47x340 = Rs. 15,980/-

- ***Savings Analysis :***

The replacement of a conventional tube (with ballast) with T5 saves (55-28) = 27 Watt.
Assuming, every conventional tube remains ON for 3 hours (on an average) per day, or, 90 hours per month. So, energy savings per month will be, 27x90 = 2,430 Wh = 2.43 kWh.

Energy charge as per electricity bill = Rs. 5.41 per unit.
So, monthly savings= 2.43x5.41 = Rs. 13.15/- for one replacement
So, yearly savings for 47 replacements= 47x13.15x12= Rs. 7,416.60/-

- ***Pay back period :***

We know, **Payback Period =** $\frac{\textbf{Initial Investment}}{\textbf{Savings per year}}$

$$= \frac{15,980}{7,416.60}$$

= 1.94 years =2 years 2 months (approximately)

1.8.1.1.3 Maximum Power Demand by lighting load after replacement

Colour Code	Load	particular	Number	Wattage (W)	Total Wattage (W)
	Light	Table Lamp	1	20	20
		CFL	12	30	360
		T5	48	28	1344
				Total	1724

1.8.1.2 Fan Load

1.8.1.2.1 Replacement of Conventional Fan by Super Fan:

Replacement of conventional Ceiling Fans with ***Super Fans.*** Conventional fan takes approximately 80 watts power per hour , Whereas super fan takes only 35 watts per hour.

- ***Cost of installation :***

Price of 35 Watt standard Super Energy Efficient Fan is Rs. 3,000.00*/- (Approximately)
**Source- http://smehorizon.sulekha.com/india-s-first-remote-controlled-superfan-launched_fmcg-viewsitem_10256*

Replacement cost of 46 conventional fans with Super Energy Efficient Fan = 46x3,000
= Rs. 1,38,000/-

- ***Savings Analysis :***

The replacement of a conventional fan (most are old) with super fan saves (90-35) = 55 Watt. Assuming, every conventional fan remains ON for 10 hours (on an average) per day, or, 300 hours per month. So, energy savings per month will be, 55x300 = 16,500 Wh = 16.5 kWh.

Energy charge as per electricity bill = Rs. 5.41 per unit.
So, monthly savings= 16.5x5.41 = Rs. 89.27/- for one replacement
So, yearly savings for 46 replacements = 46x89.27x12= Rs. 49,277.04/-

- ***Pay back period :***

We know, $$\textbf{Payback Period} = \frac{\textbf{Initial Investment}}{\textbf{Savings per year}}$$

$$= \frac{1,38,000}{49,277.04}$$

= 2.8 years =2 years 10 months (approximately)

1.8.1.2.2 **Maximum Power Demand by major fan load after replacement :**

Colour Code	Load	particular	Number	Wattage (W)	Total Wattage (W)
	fan	Super Fan	46	35	1610
		Exhaust Fan	11	100	1100
		Table Fan	10	80	800
		Stand Fan	2	80	160
				Total	3670

1.8.1.3 Total Maximum Power Demand after replacing major energy inefficient loads by energy efficient loads

Colour Code	Load	particular	Number	Wattage (W)	Total Wattage (W)
	Light	Table Lamp	1	20	20
		CFL	12	30	360
		T5	48	28	1344
	fan	Super Fan	46	35	1610
		Exhaust Fan	11	100	1100
		Table Fan	10	80	800
		Stand Fan	2	80	160
	others	Water Purifier	1	300	300
		Geyser	1	2500	2500
		Iron	1	1000	1000
	Pump	Pump	1	1491	1491
		Total	134		10685

The total power consumption by inefficient loads before replacement was 14399 Watt = 14.4 kW After replacing all major energy consuming energy inefficient loads with energy efficient load, the total power consumption becomes 10685 Watt = 10.69 kW.
So, power savings = 14.4 – 10.69 = 3.71 kW.

- ***Total investment :***

Sl. No.	Load	Amount (Rs.)
1	Investment for 8 CFL Lamps	**2,600/-**
2	Investment for 47 T5s	**15,980/-**
3	Investment for 46 Super Fans	**1,38,000/-**
	Total investment	**1,56,580/-**

- ***Total Savings per year :***

Sl. No.	Load	Amount (Rs.)
1	For 8 CFL Lamps	**1,401.60/-**
2	For 47 T5s	**7,416.60/-**
3	For 46 Super Fans	**49,277.04/-**
	Total Savings	**58,095.24/-**

- ***Pay back period***

If we replace all existing load (including lighting & fan load) with efficient load (including lighting & fan load) then pay back period will be,

We know, $$\textbf{Payback Period} = \frac{\textbf{Initial Investment}}{\textbf{Savings per year}}$$

$$= \frac{1,56,580}{58,095.24}$$

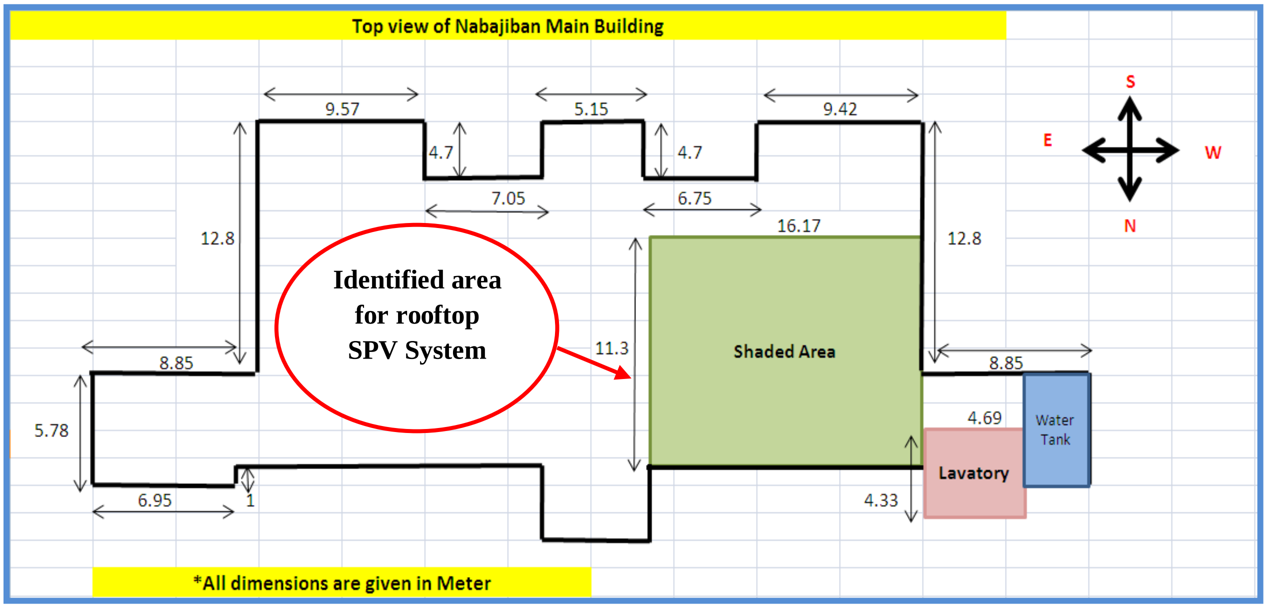
= 2.69years =2 years 9 months (approximately)

Description	Beneficiary contribution(Rs.)	Simple Payback period(approx)
Replacement of 60 Watt incandescent lamps by 30 Watt CFL	2,600/-	1 year 11 months
Replacement of conventional Tube Lights by T5	15,980/-	2 years 2 months
Replacement of conventional ceiling Fan by Super Fan	1,38,000/-	2 years 10 months

1.8.1.4 Installation of Solar Photovolitreaic(SPV) System

At the rooftop of Nabajiban, approximately 182.72 m^2 shaded space and at least 261 m^2 non shaded space is available. Existing shades are south facing, so, installation of solar panels on the shaded area will be a very good option to geneate electricity from renewable energy source.

- ***Area available for Solar Photovolitreaic System at rooftop :***

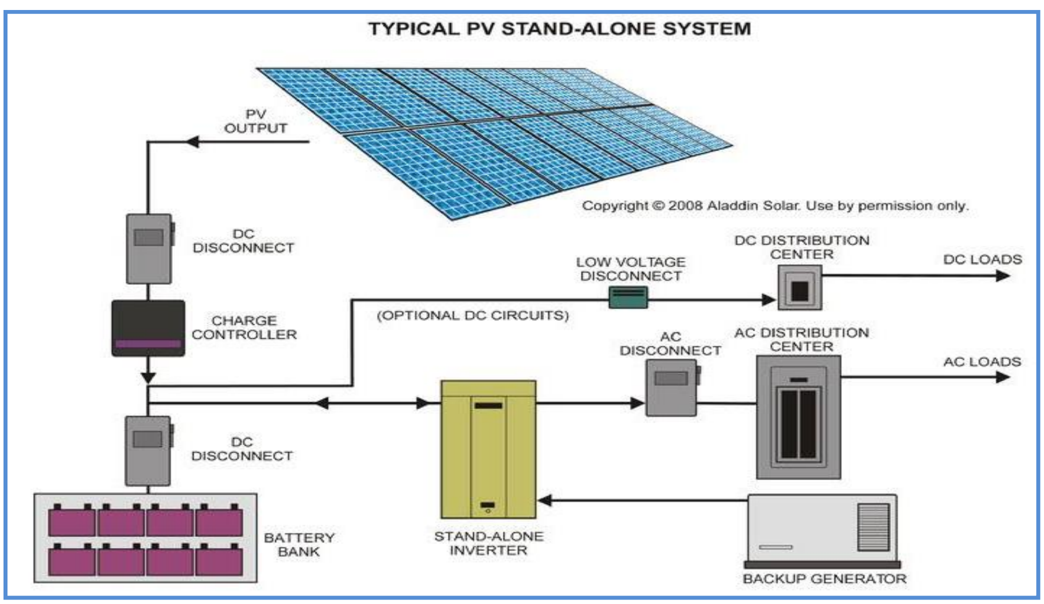


Installation of solar photovotaic system is done in two ways as –

1.8.1.4.1 <u>Model -1, Stand Alone SPV System :</u>

A stand-alone power system (SAPS or SPS), also known as remote area power supply (RAPS), is an off-the-grid electricity system for locations that are not fitted with an electricity distribution system.

<u>A model of Stand Alone SPV System :</u>



The minimum monthly energy consumption at Nabajiban during June, 2012-May 2013 = 313 kWh
Considering average equivalent sunshine hour/day =5 hrs
We get,

The capacity of the power plant = $^{313}/_{(30x5)}$ =2.1 kW (approx)

Further assuming,

Loss due to cloudiness of weather is 20% , so,(Weather) efficiency will be 80%

Loss due to charging and discharging of battery 20% , so, battery system efficiency will be 80%

So, Actual Capacity of the plant should be= 2.1/(0.8x0.8)=3.3KW (Approx)

Average Solar irradiation in Kolkata= 1,000 W/m^2 @ 10% efficiency = 100We/m^2=0.1 kWe/m^2
Area required for installation of Roof top SPV power plant= $^{3.3}/_{0.1}$ = 33 m^2
Area available SPV power plant =11.3x16.17=182.72 m^2
It implies that sufficient area is available to install 3.3kW SPV power plant.

- ***Cost of installation :***

*The benchmark price as fixed up by MNRE Government of India is as follows –

Type of SPV System	Benchmark Price/kWp	CFA/kWp (30%)	Beneficiary contribution/kWp
SPV Plant (With Battery bank having 6 hr autonomy)	Rs. 1,90,000/-	Rs. 57,000/-	Rs. 1,33,000/-

**Source WEBREDA*

- ***Savings Analysis :***

This system requires Battery. Now this system is designed to deliver 313 kWh per month.
Energy charge as per electricity bill = Rs. 5.41 per unit.
So, Savings per month= 313 x 5.41= Rs. 1693.33/-

- ***Pay back period with subsidy :***

Initial investment for 3.3 kW power plant= 3.3x1,33, 000= Rs. 4,38,900/-
Simple Payback period= $^{\text{Initial investment}}/_{\text{savings per month}}$
=4,38,900/1693.33=260 months = **21 years 8 months (approx)**

- ***Pay back period without subsidy :***

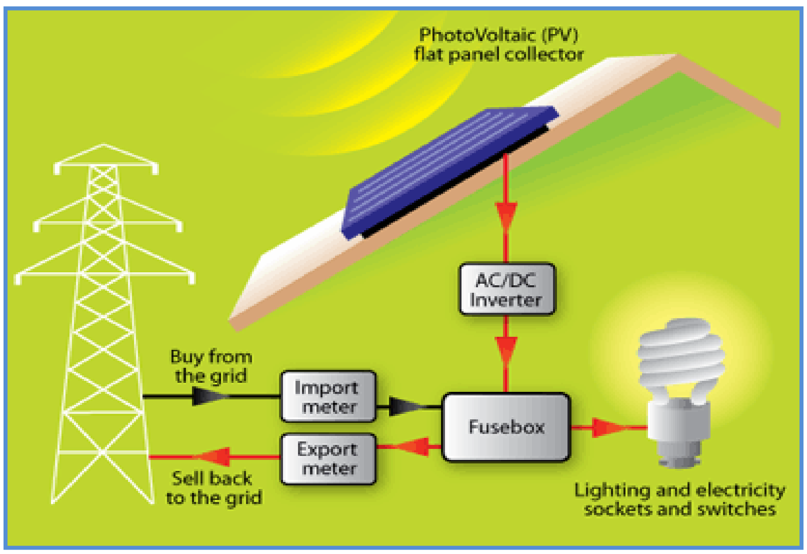
Initial investment for 3.3 kW power plant= 3.3x1,90,000= Rs. 6,27,000/-
Simple Payback period= $^{\text{Initial investment}}/_{\text{savings per month}}$
=6,27,000/1693.33=371 months=**30 years 11 months (approx)**

Description	Beneficiary contribution	Simple Payback period(approx)
Stand Alone Roof Top SPV power plant with subsidy	Rs. 4,38,900/-	21 years 8 months
Stand Alone Roof Top SPV power plant without subsidy	Rs. 6,27,000/-	30 years 11 months

1.8.1.4.2 Model -2, Grid connected SPV System :

Grid-connected photovolitreaic power systems are power systems energized by photovolitreaic panels Which are connected to the utility grid. Grid-connected photovolitreaic power systems consist of Photovolitreaic panels, MPPT, solar inverters, power conditioning units and grid connection equipment. Unlike Stand-alone photovolitreaic power systems these systems seldom have batteries. When conditions are right, the grid-connected PV system supplies the excess power, beyond consumption by the connected load, to the utility grid

A model of Grid connected SPV System :



Average monthly consumption at Nabajiban during June, 2012-may 2013 = 625 kWh(approx)
Considering average equivalent sunshine hour/day =5 hrs
We get,

The capacity of the power plant = $^{625}/_{(30x5)}$ =4.17 kW (approx)

Further assuming,

Loss due to charging and discharging of battery 20% will not be applicable here, because, there will be no requirement of batteries. Only Loss due to cloudiness of weather will be considered in this case. Loss due to cloudiness of weather is 20%, so, (weather)efficiency will be 80%

So, Actual Capacity of the plant should be= 4.17/0.8=**5.2 kW** (Approx)

Average Solar irradiation in Kolkata= 1,000 W/m^2 @ 10% efficiency = 100We/m^2=0.1 kWe/m^2
Area required for installation of Roof top SPV power plant= $^{\mathbf{5.2}}/_{\mathbf{.1}}$= 52 m^2(Approx)
Area available SPV power plant =11.3x16.17=182.72 m^2
It implies that sufficient area is available to install 5.2kW SPV power plant.

- ***Cost of installation :***

  *The benchmark price as fixed up by MNRE Government of India is as follows –

Type of SPV System	Benchmark Price/kWp	CFA/kWp (30%)	Beneficiary contribution/kWp
SPV Plant(without Battery)	Rs. 1,00,000/-	Rs. 30,000/-	Rs. 70,000/-

**Source WBREDA*

- ***Savings Analysis :***

This system does not require Battery.
Now we know, Average monthly consumption at = 625 kWh(approx)
Energy charge as per electricity bill = 5.41 Rs/unit
So, Savings per month from = 625x5.41= Rs. 3381.25/-

- ***Pay back periodwith subsidy :***

Initial investment for 5.2 kW power plant = 5.2x70, 000= Rs. 3,64,000/-
Simple Payback period= $^{\text{Initial investment}}/_{\text{savings per month}}$
=3,64,000/3381.25 = 108 months = **9years (approx)**

- ***Pay back periodwitouth subsidy :***

Initial investment for 2.7 kW power plant = 5.2x1,00,000= Rs. 5,20,000/-
Simple Payback period= $^{\text{Initial investment}}/_{\text{savings per month}}$
=5,20,000/3381.25 = 154 months = **12years 10 months (approx)**

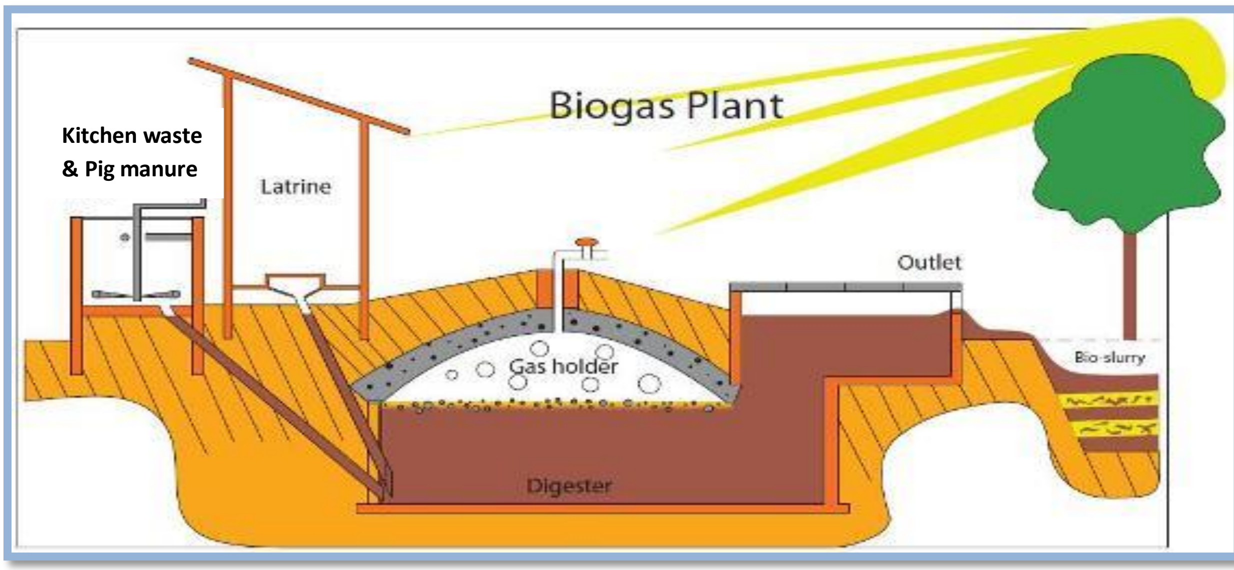
Description	Beneficiary contribution	Simple Payback period(approx)
Grid connected SPV power plant with subsidy	3,64,000/-	9 years
Grid connected SPV power plant without subsidy	5,20,000/-	12 years 10 months

1.8.2 Liquefied Petroleum Gas (LPG)

1.8.2.1 <u>Installation of Biogas Plant :</u>

Nabajiban has the 90-100 residents in their home. So, the kitchen waste is huge. So, mini bio gas plant with food waste can be economical for them because approximately 33 LPG cylinders are used per month for cooking at Nabajiban.The bio-gas produced from food waste, decomposable organic material and kitchen waste, consisting of methane and a little amount of carbon di oxide is an alitreernative fuel for cooking gas (LPG).

<u>A model of Biogas Plant :</u>



- ***<u>Amount of waste requirement :</u>***

On an average, one human produces 0.998kg of urine and 0.227 kg of fecal matter or a total of 1.224 kg waste in one day.

Assuming that the average density of human waste slurry is 1000 kg/m^3,
The volume of human waste slurry generated per day for 100 people will be
=(1.224 x 100) /1000 m^3=0.1224 m^3

Now , the digester has to store the slurry for 60 days.

The volume of slurry of 60 days will be = 60 x 0.1224 m^3=7.344 m^3
To accommodate the biogas equal amount of storage capacity is required.
So,the final volume of the digester will be =7.344 x 2=14.68 m^3=15 m^3(Approx)

- ***Cost of installation :***

According to the Ministry of New and Renewable Energy, Estimated cost for instaling a 4 m^3 plant is Rs.23,350/-. So, for 15 m^3 plant ,estimated cost will be, 87,562.50/-. (Without any subsidy)

But Ministry of New and Renewable Energy Rs. 8,000/- for installing 4 m^3 plant.

For 15 m^3 plant subsidy amount will be approximately Rs. 30,000/-

Then after subsidy, beneficiary contribution will be, Rs. [(87,562.50– 30,000)] **= Rs. 57,562.50/-**

**Source* *http://www.mnre.gov.in/schemes/decentralized-systems/schems-2/*

- ***Savings per Year :***

The usable energy one human produces in one day is == 1102.2 kJ/day = 263.4kcal/day
For 100 persons total energy produced=263.4x100 =26340kcal
Curently,(1.1x14.2) kg = 15.62 kg LPG supplies the fuel for 100 persons in a day.
Calorific value of LPG=10800kcal/kg
So,total energy required for cooking=10800x15.62kcal=168696kcal
So after instalation of the Biogas plant LPG required per day= (168696-26340)/10800
=13.18kg
So, per day savings=(15.62-13.18)kg=2.44kg
So annual savings=2.44x365=890.6kg=63 no. of LPG cylinder.(Approx)
So annual monetary saving=63x967= Rs. **60,921**/-

- ***Pay back period :***

We know,

$$\textbf{Payback Period} = \frac{\textbf{Initial Investment}}{\textbf{Savings per year}}$$

Payback period with subsidy will be, $= \frac{57{,}562.50}{60{,}921}$

= 1year (approximately)

Payback period without will be, $= \frac{87{,}562.50}{60{,}921}$

= 1 year 6 months (approximately)

Description	Beneficiary contribution	Simple Payback period (approx)
Biogas plant without subsidy	Rs. 87,562.50/-	1 year
Biogas plant with subsidy	Rs. 57,562.50/-	1year 6months

1.8.3 Water

1.8.3.1 Normal Water

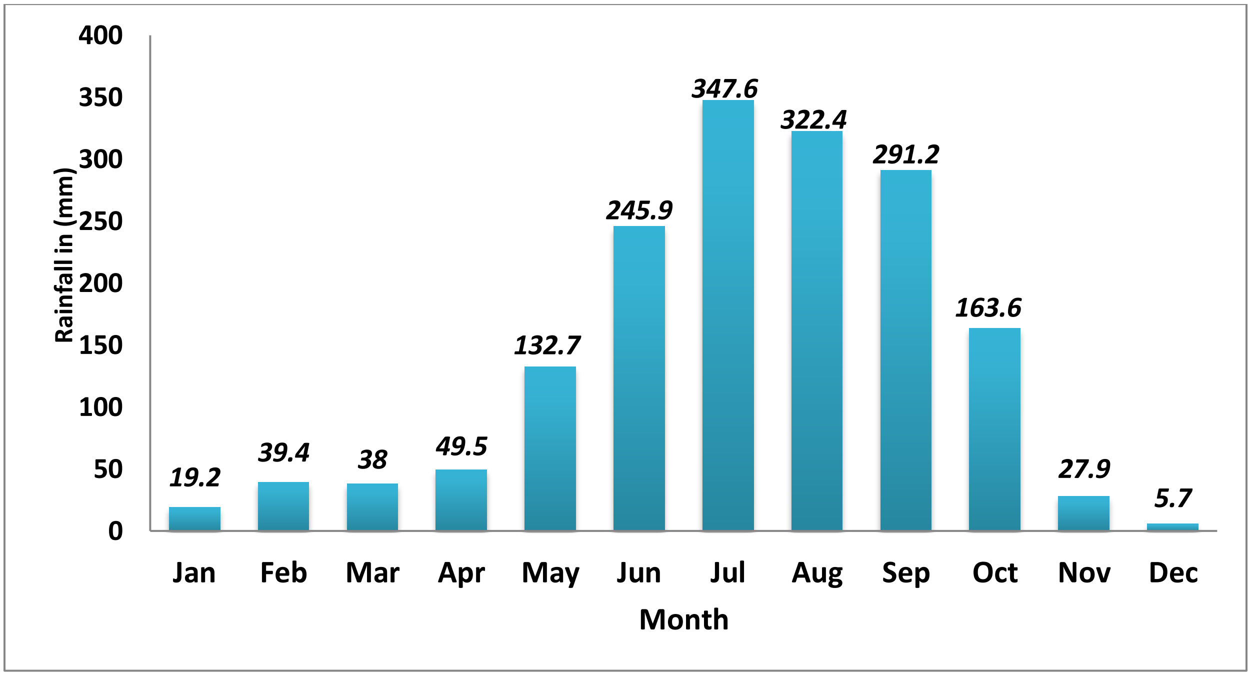
1.8.3.1.1 <u>Installation of Rooftop Rain Water Harvesting system :</u>

Water harvesting is the deliberate collection and storage of rainwater that runs off on natural or manmade catchment areas. For domestic rainwater harvesting, the most common surface for collection is the roof.

<u>A model of Rooftop Rain Water Harvesting system:</u>

Average rainfall at Howrah :

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall in mm(inches)	19.2 (0.756)	39.4 (1.551)	38 (1.5)	49.5 (1.949)	132.7 (5.224)	245.9 (9.681)	347.6 (13.685)	322.4 (12.693)	291.2 (11.465)	163.6 (6.441)	27.9 (1.098)	5.7 (0.224)	1,683.1 (66.267)



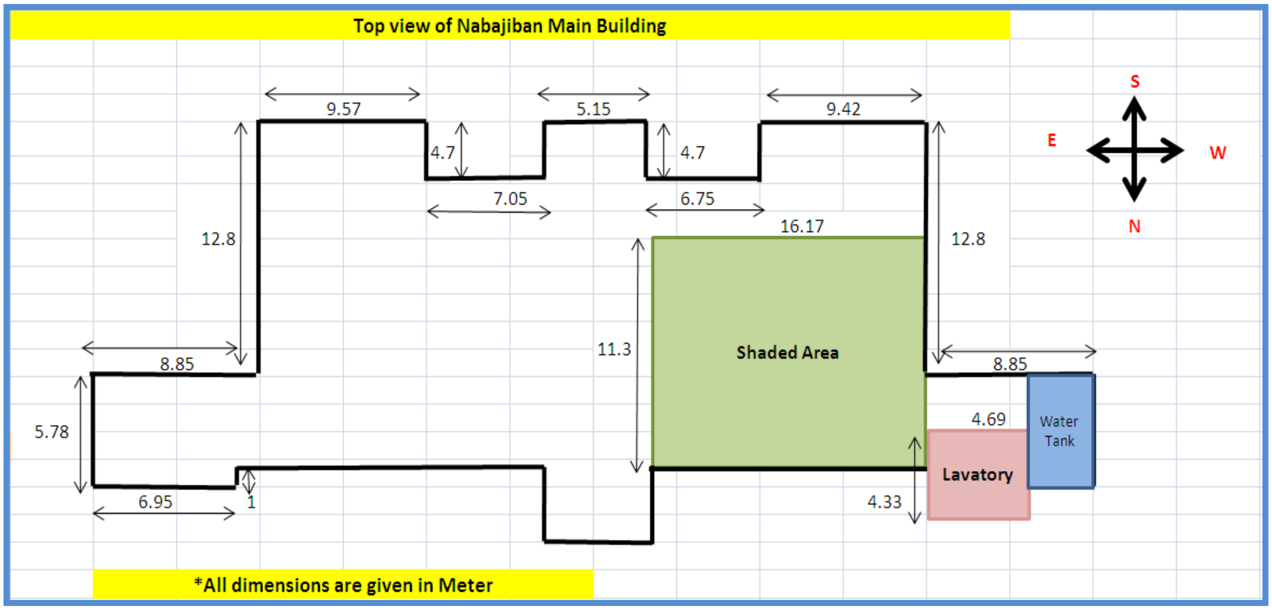
*Source - *http://en.wikipedia.org/wiki/Howrah*

Catchment area of rooftop :

- ***Satellite View :***

Approximate catchment area available = 675 m^2.
According to climate report, maximum rainfall occurs on July, Which is 347.6 mm.
So, average rainfall per day in July = 347.6/31 = 11.21 mm = 0.0112 m.

- ***Dimensions of rooftop :***



So, Water harvesting potential = **Rainfall (mm) x Area of catchment x Runoff coefficient**
Assuming that only 50% of the total rainfall is effectively harvested,
= 675 x 0.0112 x 0.5 = 3.78 m^3

We know, 1 m^3 of water =1000 litre.
So, 7.56 m^3 of water = 3780 litre.
Considering the storage capacity of rain water collection tank for storing the water of two consecutive days, the collection tank capacity will be, 3780 x 2 =7560 litre.
Assuming, collection tank capacity = 7600 litre

- ***Cost of installation :***
  Unit cost of construction activities*.

Item	Unit	Rate (Rs.)	Installation cost (Rs.)
Excavation in soils	cu. m.	90.00	680.40 (for 3.78 m^3)
Plain cement concrete (1:3:6)	cu. m.	1500.00	11,340 (for 3.78 m^3)
Reinforced cement concrete (1:2:4) cu. m. 4700.00Including steel bars, shuttering etc.	cu. m.	4700.00	35,532 (for 3.78 m^3)
PVC piping for rainwater pipes - 200 mm diameter	meter	275.00	13,750 (For apporx. 50 mt.)
Making borehole in metre 165.00Soft soil (with 150 mm diameter PVC casing)	meter	180.00	9,000 (For apporx. 50 mt.)
Total			**Rs. 48,756.40/-**

Construction cost for ferrocement tanks with skeletal cage is aproximately **Rs. 14,000/-**
**Source http://www.rainwaterharvesting.org*

So, total cost for installation = **Rs. (48,756.40 + 14,000) = Rs. 62,756.40/-**

- ***Savings per Year :***

Average yearly rainfall is 1,683.10 mm = 1.683 m.
Average available rain water per year = 675 x 1.683 = 1136.02 m^3 [catchment area = 675 m^2]
So, average available rain water per day = 1136.02/365 = 3.11 m^3 = 3110 litre.
Daily water requirement = 12000 litre.
So, electricity charge will pe paid for pumping for 12000 – 3110 = 8890 litre water per day

The 2 hp water pump requires total 1.5 hours for pumping 12000 litre of water per day.
So, for 8890 litre, time will be required, 1.1 hours.
So, energy charge will be saved for 1.5 – 1.1 = 0.4 hours = 24 mins.
In 0.4 hours, the pump saves , 1491 x 0.4 = 596.40 Wh = 0.596 kWh energy.
So, energy savings in a year = 0.596 x 365 = 217.54 kWh

Energy charge as per electricity bill = Rs. 5.41 per unit.

For 0.596 unit, it will be, 0.596 x 5.41 = Rs. 3.22/-
So, savings in a year = **Rs. 1175.30/-**

- ***Pay back period :***

We know, $$\textbf{Payback Period} = \frac{\textbf{Initial Investment}}{\textbf{Savings per year}}$$

Payback period without subsidy will be, $$= \frac{62,756.40}{1175.30}$$

= 53 years (approximately)

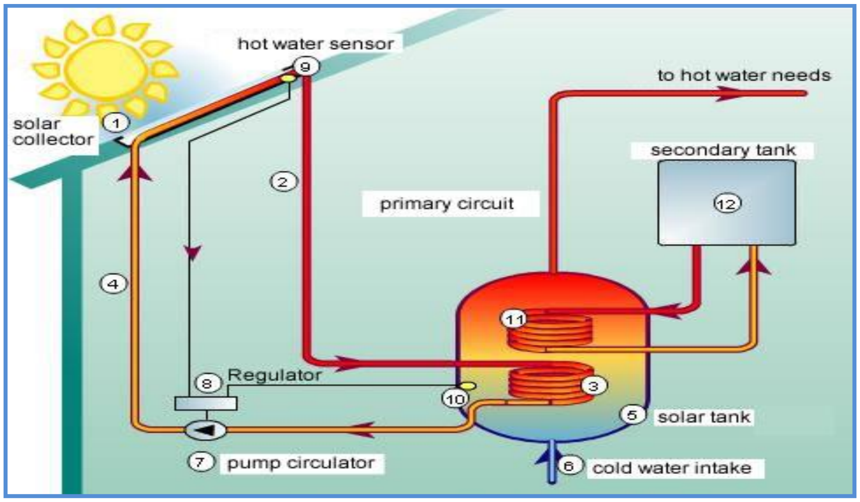
Description	Beneficiary contribution	Simple Payback period (approx)
Rooftop Rain Water Harvesting System	Rs. 62,756.40	53 years

1.8.3.2 Hot Water

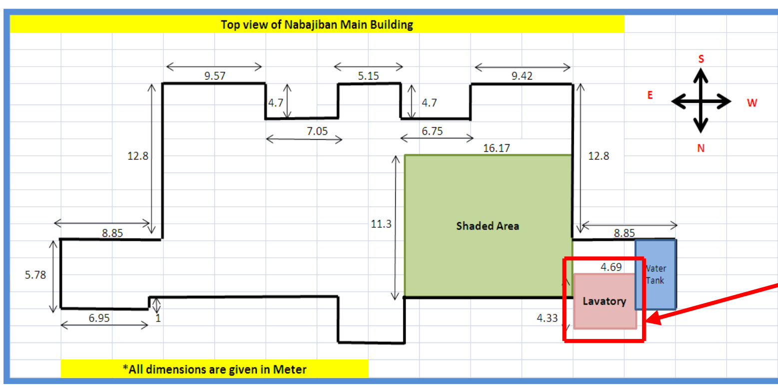
1.8.3.2.1 **<u>Solar water heating system :</u>**

A solar water heater is the most competitive alitreernative to conventional water heating methods such as electric geysers and fuel-fed boilers.

<u>A model of Rooftop solar water heating system system:</u>



- ***<u>Area available for solar water heating system at rooftop :</u>***



Rooftop lavatory Shade is the proposed area

Total Area available solar water heating system =4.33 x 4.69=20.31 m^2 =20 m^2(Approx)
Assuming 1 m^2 area required for a 25 litre/day solar water heating system , we get, the Capacity of the Solar Water Heating System=20 x 25=500litre/day.

Now, daily available hot water = 500 litre.

Where as daily requirement of hot water=200 litre (that also for only 6 months)
Excess hot water from this system would be gainfully utilized in cooking and thus reduce the gas consumption and it is assumed to fetch the equivalent saving as shown here.

Per day Theoretical Electricity consumption to heat 500 litre water = 30 kWh (approx.)
Assuming Efficiency of Water Heating System = 90%
Actual Electricity consumption to heat water = 30/.9=34 kWh (approx.)
So, total hot water can be available through the solar water heating system.

- ***Cost of installation :***

*The benchmark price as fixed up by MNRE Government of India is as follows –

Type of SWH System	Benchmark Price/sq. m	Capital Subsidy/ sq.m (30%)	Beneficiary contribution/ sq.m
ETC Based System	Rs. 10,000/-	Rs. 3,000/-	Rs. 7,000/-
FPC Based System	Rs. 11,000/-	Rs. 3,300/-	Rs. 7700/-

**source: WEBREDA*

For Nabajiban, coat of installation will be, as follows-

Type of System	Area in m^2	Installation Cost/ m^2 (Rs.)	Total Cost (Rs.)
ETC based System without subsidy	20	10,000	2,00,000
ETC based System with subsidy	20	7,000	1,40,000
FPC based System without subsidy	20	11,000	2,20,000
FPC based System with subsidy	20	7,700	1,54,000

- ***Savings per Month :***

Energy charge as per electricity bill = Rs. 5.41 per unit.

The total hot water requirement can be supplied by solar water heating system. So, the total heating cost Which is Rs.12,984/-will be saved per year.

- ***Pay back period :***

Simple Payback Period of ETC type System without subsidy :

Installation cost = 20 x 10,000= Rs. 2,00,000/-
Simple Payback period = $^{\text{Initial investment}}/_{\text{savings per month}}$
= 2,00,000/ 12,984 years
= **15 years 5months**

Simple Payback Period of ETC type System with subsidy :
Installation cost = 20 x 7,000= Rs. 1,40,000/-
Simple Payback period = $^{\text{Initial investment}}/_{\text{savings year}}$
= 1,40,000/ 12,984
=**10years 10 months (approx)**

<u>Simple Payback Period of FPC type System without subsidy :</u>

Installation cost = 20 x 11,000= Rs. 2,20,000/-

Simple Payback period = $^{\text{Initial investment}}/_{\text{savings month}}$

= 2,20,000/ 12,984years

=**17 years (approx)**

<u>Simple Payback Period of FPC type System with subsidy :</u>

Installation cost = 20 x 7,700= Rs. 1,54,000/-

Simple Payback period = $^{\text{Initial investment}}/_{\text{savings month}}$

= 1,54,000/12,984

= 11 years 11months (approx)

Description	Beneficiary contribution	Simple Payback period (approx)
ETC type System without subsidy	Rs. 2,00,000/-	15 years 5 months
ETC type System with subsidy	Rs. 1,40,000/-	10years 10 months
FPC type System without subsidy	Rs. 2,20,000/-	17 years
FPC type System with subsidy	Rs. 1,54,000/-	11years 11months

1.9 Local Service provider's List

Sl. No.	Name	Contact No.	Email ID	Website	Service
1	Sigma Search Lights Limited	P-27 Sagar Manna Road, Kolkata-700060, 24061721, 24060058, Mobile:9433016081, 9748773291	bhandari@sigma-lights.co.in	www.sigma-lights.co.in	Energy Efficient Light Suppliers

Sl. No.	Name	Contact No.	Email ID	Website	Service
2	Prabhu Dayal Agarwal	"Bigapple Arcade", 1-8-167 to 179, S.D.Road, Secunderabad - 500003 Ph: 040 – 3912 3939 / 2789 9222 Mob: 0 9347 52 51 50 Fax: 040 – 2789 6969	bigappleledlights@gmail.com		Energy Efficient Light Suppliers
3	MyRIAD TECHNO PVT. LTD, Myriad Techno Pvt. Ltd. 56C, Mirza Ghalib Street, (Inside Armenian Boys School) Kolkata - 700 016	Phone: 033-22170606, Mobile:9748727966	indiaenergysaver@gmail.com	www.myriadindia.com	Energy Saver
4	Mr. P K Das, M/s Skyl Engineering, 16/2, Dasarath Ghosh Lane, Bamangachi, Salkia, Howrah-711106	9433040880	golden_skyl@rediffmail.com		Capacitor bank
5	Asian Electronics Ltd	033-2465 0239 / 0589	aelcal@cal2.vsnl.net.in	*www.aelgroup.com*	Energy Efficient Light Suppliers
6	Binay Opto Electronics Pvt. Ltd	033-2242 9082,2210 2039	info@binayled.com, binay@vsnl.com	infobinayLED.com	
7	SECO Control (Pvt) Ltd	044-24961434 / 24964554	mrktg@seco-india.com	*www.**seco-**india.com*	
8	Aditya Energy System	91-11-26026081, 26027796	satish@adityasolar.in	*www.**aditya**solar.in*	
9	Saur Oorja Solutions	011-65862554 / 22471398, Mobile - 09811047670		*www.**oorja**solar.com*	
10	Instapower Ltd.	011-26015000	sales@instapower.com	*www.**instapower**.com*	
11	Mr Suman Chatterjee, CGM equipment pvt Ltd, 176, Bidhan Sarani, Kolkata-6	Ph: (033) 6444551/51 Mob: 9433002919	info@cgmepl.com, cgmepl@gmail.com		Energy Efficient Equipments
12	Mr M P Sharma Decolux Ligting solution	03325709777, 9903144886	mps@decoluxlighting.com , sales@decoluxlighting.com		LED Specalist
13	Industrial Supply Syndicate 54,Ezra Street, Kolkata- 700 001, Mr. Sourabh Choudhary	Phone - 32916080, 22356676 Fax- +91 33 30222923, Mob: 9831057357	info@industrialindia.com	www.industrialindia.com	Energy Efficient Equipments

2.0 Result & Discussion

The audit was done successfully. After the audit, we found that by replacement of the existing incandescent lamp with CFL and conventional tubes with T5, we can reduce the maximum demand by approximately 812 Watt per day. We also found a huge opportunity for using the renewable energy through Solar Photovolitreaic System and Bio-Gas Production From Food Wastes. If these are implemented properly, Nabajiban can be an example of self sufficient building from energy point of view. It will help the minimization of energy cost.So, we are looking for the fast implementation of the above mentioned systems.

At last, according to Mother Teresa,

“I am not sure exactly What heaven will be like, but I know that When we die and it comes time for God to judge us, He will not ask, 'How many good things have you done in your life? Rather He will ask, 'How much love did you put into What you did?' ”

So, we want to give our best to the pooest of the poor, by our honesty andwork, and we know, it will be a small gift to their life.

Energy Department of Indian Institute of Social Welfare & Business Management always try to give community services. Energy audit in Nabajiban, Howrah is one of the best opportunity among them.