GREEN AUDIT 2022-2023

INTRODUCTION

The energy audit is the process of systematic approach for decision making in the field of energy conservation and energy management. It endeavors to equalize the total energy inputs with their utilization, and serves to identify all the energy streams in the campus. Energy audit is an effective tool in defining and pursuing a comprehensive energy management program within a business. Energy audit is the first step which can be conducted within an organization for the development of electrical energy efficient measures and also highlighted the other mode of energy conservation of the campus.

Electric Energy Consumption Survey

This energy audit is aimed at obtaining a detailed idea about the various end use energy consumption activities and identification, enumerating and evaluating the possible energy solving in the campus. The main aim is target is to achieve savings in electrical consumption every year as per the recommendations of the audit. Hence the present level of energy consumption of the institution has been analysed as follows.

The solar energy generation facility is distributed in four different geo locations inside the campus. A 30kV solar station is housed in Jesuit residence which provides housing to several administrators and treasurer office.

This unit generated 120 units per day and totally consumed. Two 12kV solar facilities are available in Digby Hall terrace and Joseph Institute of Management administrative building terrace each. Each generate 48 units and in total 96 units of energy is used by the respective departments. On top of Arrupe building, we have 10kV of solar system provides 40 units every day. This is being consumed by the street lights fixed on the sides. In total 180 LED solar street lights are powered by this unit and additional power is used to power lights in Library. All of these units unit use off grid inverter and provide power supply to specific location loads.

Solid Waste Management

As part of eco-friendly solid waste management initiative, the management has undertaken initiatives from 2017 on words in establishing of a vermi-compost yard within the campus. The bio-fertilizers (vermicompost) produced from the vermi-compost yard are used for the gardening purpose and the excess produce is sold to Josephit's, outsiders and formers for subsidiary price.

The college has kept more than 100 recycling bins across campus for the collection of solid waste- bio-degradable and non-biodegradable separately, in tune with Swachh Bharat initiatives by Government of India. The campus is covered with a variety of plant species numbering 1153 in all and some of which are more than hundred years old. The litters from these trees are used for vermi-compost process. Solid waste from hostels and canteen are used as feeds for fish and piglets.

The total amount of litters from the campus trees were used for vermi-compost process. Average weight of the litters from the campus trees per month was 650 to 750 Kg .Within 5 to 6 months, with the help of earth worms the litters were converted into vermicompost.

Approximately 730 kg of biodegradable waste converted into 550 kg of vermicompost. Approximately 75% conversion efficiency was recorded in our campus vermicompost yard.

Report on Rain Water Harvesting and Recharge to Ground water Table

Rainwater harvesting is the deliberate collection of storage of rainwater that runs off on natural or manmade catchment areas. Catchment includes roof tops, paved areas, vegetative areas, rocky surface or hill slopes or artificially prepared impervious / semi-pervious land surface. The amount of water harvested depends on the frequency and intensity of rainfall, catchment characteristics, water demands and how much runoff occurs and how quickly the water infiltrate through the subsoil and percolate down to recharge the aquifers. Moreover, in urban areas, adequate space for surface storage is not available, water levels are deep enough to accommodate additional rainwater to recharge the aquifers, rooftop and runoff rainwater harvesting is ideal solution to solve the water supply problems.

Advantages of Rainwater Harvesting

- To meet the ever-increasing demand for water. Water harvesting to recharge the ground water enhances the availability of ground water at specific place and time.
- To reduce the runoff which chokes storm drains and to avoid flooding of roads and streams
- To improve the ground water level
- To reduce ground water pollution and improve the quality of ground water through dilution.
- Reduce the rage of power consumption for pumping of ground water.
- Reduce soil erosion in rural and urban areas
- Rooftop harvesting is less expensive, easy to construct, operate and maintain.

Design Considerations

There are three most important components, which need to be evaluated for designing the rainwater harvesting structures are;

- Hydrogeology of the area including nature and extent of aquifer, soil cover, topography, depth to water levels
- Area contributing for rainfall which includes land use pattern such as, roof area, paved and asphalt area, green belt area and open / vacant area.

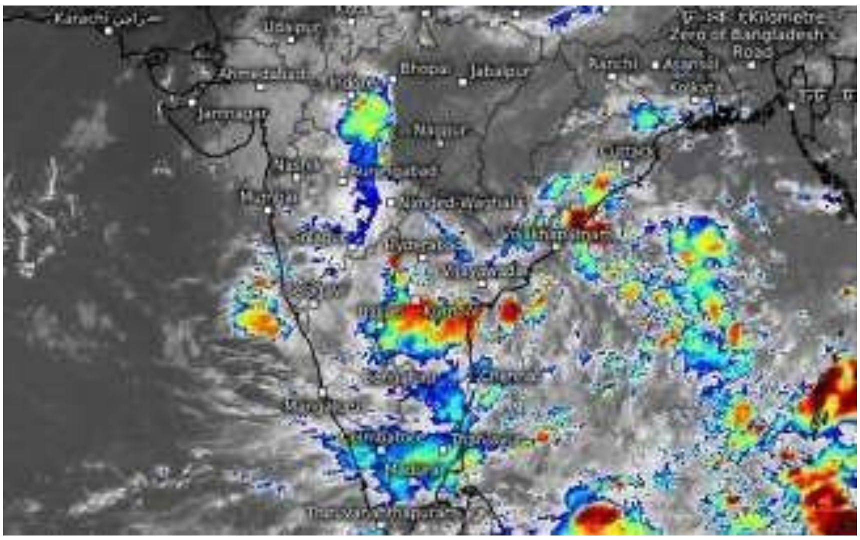
- Hydro-meteorological characters like rainfall duration, general pattern and intensity of rainfall.

Climate and Rainfall

The climate of the study area is semi-arid and characterized by general dryness during the summer season. As per Indian Meteorological Department, the maximum temperature ranges from 34°C to 40°C and the minimum temperature from 20°C to 26°C. Rainfall data collected from Indian Metrological Department (Table 1) are used for rain water harvest calculations.

Table 1. Rain fall data in Tiruchirappalli from June 2021 to May 2022

Month	Year	Rainfall, mm
June	2021	46
July	2021	42
August	2021	67
September	2021	95
October	2021	172
November	2021	182
December	2021	74
January	2022	18
February	2022	6.2
March	2022	8.9
April	2022	31.4
May	2022	61.4
From June 2021 to May 2022		**803.9**



Rainwater harvesting

Surface and subsurface recharging measures are possible depending upon the site conditions. The specific recharge measures are to be selected depending on the soil characteristics, lithology and nature of the aquifer material, pre and post monsoon rainfall, ground water level and so on. The ground water level in and around the project site is 35 m below ground level, which clearly indicates that the ground water level in the study area is deep. As the ground water level is deep, **roof top collection, Storage cum percolation pond** has been contemplated. In addition, the above recharge trench with bore well inside the storage cum percolation pond has also been done.

According to the slope of the roof, sump locations have been identified. The roof area and the normal monthly rainfall have been considered for designing the capacity of the sump. The estimation of run-off from the campus has been assessed. Based on vacant, roof top area and the monthly rainfall and run-off, the storage structures and percolation pond have been contemplated.

Estimation of Monthly run-off from the Campus

For the estimations, monthly normal rainfall has been considered. The run-off data without and with water conservation in the campus site has been estimated based on Rational method. The co-efficient used to estimate the run-off from the different surfaces is as follows. The co-efficient are considered are as per the MoEF and CGWA Guidelines.

Roof Area	-	0.95
Asphalted and Paved Area	-	0.85
Green Belt Area	-	0.20
Open and Vacant Area	-	0.30

- Volume of rainwater that can be collected from the project site has been estimated from the monthly normal rainfall.
- Vacant & Green belt area, Roof top area and paved area of the project site have been considered for the run off estimation and conservation measures. The details of various areas are given in Table 2.

Table 2. Details of area for rain water harvesting

Description	Area (m^2)
Roof	13314.37
~~Road/Pavement~~	~~21735.66~~
Green Belt	65207.00
Open/Ground	130413.99
Total	230671.02

Amount of harvestable rain water has been calculated using the following relation:

collected rainwater in litres = mean rainfall in mm × area in m^2 × runoff factor

The predicted run-off without conservation strategy

Table 3. **Predicted run-off without conservation strategy**

run-off without water conservation					
Month	**Year**	**Rain fall (mm)**	**Area (m^2)**	**Run-off coefficient**	**Monthly run-off (m^3)**
June	2021	46	230671	0.3	318
July	2021	42	230671	0.3	291
August	2021	67	230671	0.3	464
September	2021	95	230671	0.3	657
October	2021	172	230671	0.3	1190
November	2021	182	230671	0.3	1259
December	2021	74	230671	0.3	512
January	2022	18	230671	0.3	125
February	2022	6.2	230671	0.3	43
March	2022	8.9	230671	0.3	62
April	2022	31.4	230671	0.3	217
May	2022	61.4	230671	0.3	425
Total annual pre-project run-off (cu m)					**5563**

Post-conservation run-off

The same rainfall and the land area have been taken up for the estimation of run-off for the prediction after construction. As the vacant exposed land would be converted in to build up land, the natural recharge that had taken place during the preconstruction period would not occur and hence there would be meager infiltration. The losses such as, percolation, evaporation and other unforeseen loses have been considered. Predicted run-off from different sites of the campus after taking up the conservation strategy (Table 4).

Table 4.

Predicted run-off from different sites of the campus after taking up the conservation strategy						
Month	***Rainfall mm***	**Run-off (cu m)**				***Total monthly run-off (cu m)***
		roof area	***Asphalt area and paved area***	***Green belt area***	***Open area***	
June	46	58	85	60	180	383
July	42	53	78	55	164	350
August	67	85	124	87	262	558
September	95	120	176	124	372	791
October	172	218	318	224	673	1433
November	182	230	336	237	712	1516
December	74	94	137	97	290	616
January	18	23	33	23	70	150
February	6.2	8	11	8	24	52
March	8.9	11	16	12	35	74
April	31.4	40	58	41	123	262
May	61.4	78	113	80	240	511
TOTAL	803.9	1017	1485	1048	3145	6696
Total predicted run-off from different sites						**6696**


Decimal DMS
Latitude 10.828722 10°49'43" N
Longitude 78.691135 78°41'28" E


Decimal DMS
Latitude 10.827748 10°49'39" N
Longitude 78.691867 78°41'30" E


Decimal DMS
Latitude 10.828578 10°49'42" N
Longitude 78.691999 78°41'31" E


Decimal DMS
Latitude 10.82938 10°49'45" N
Longitude 78.691874 78°41'30" E


Decimal DMS
Latitude 10.82938 10°49'45" N
Longitude 78.691874 78°41'30" E


Decimal DMS
Latitude 10.829897 10°49'47" N
Longitude 78.691789 78°41'30" E


Decimal DMS
Latitude 10.829297 10°49'45" N
Longitude 78.691765 78°41'30" E


Decimal DMS
Latitude 10.828911 10°49'44" N
Longitude 78.691678 78°41'30" E


Decimal DMS
Latitude 10.829011 10°49'44" N
Longitude 78.69164 78°41'29" E

The estimated pre- and post- conservation run-off are given in Table 5.

Table 5.

Description	Pre-conservation run-off (cu m/year)	Post-conservation run-off (cu m/year)	Difference in run-off (cu m/year)
SJC campus	5563	6696	1133

Surplus run-off of 1133 cu m/year is being generated in the campus during post conservation. The excess run-off that is being generated can be harvested within the campus site to maintain the hydrological balance.

Details of roof-top collection at different sites of the campus

In order to harvest water from roof tops of different constructions sites within the campus, a total of 30 sumps have been constructed. The details of these sumps and the amounts of harvestable water by them are furnished in the Table.

Table 6.

S. No	Building name	Type of roof	Area (m2)	Harvestable water (cu m/year)	No. of sumps installed
1	Father's residence annexe	Galvanized sheet	523.23	39.96	1
2	Father's residence	RCC	841.91	64.30	1
3	Loyola hall	Madras terrace	487.00	37.19	1
4	Museum and Herbarium	RCC	468.46	35.78	1
5	New Hostel Abdul Kalam Learning Center	RCC	48.00	3.67	1
6	New Hostel dining and kitchen	RCC	1026.00	78.36	2
7	New Hostel	RCC	1955.25	149.32	4
8	New Hostel new toilet	RCC	118.12	9.02	1
9	New Hostel Sports block	Mangalore tiles	410.00	31.31	1
	Total		5878	449	13

Rainwater that is being collected from the roof is allowed to pass through a filter media. The proposed filter media is multilayer vertical filters. The size of the filter media is:

The size of the multilayer vertical filter is 2m × 2m × 1.2m . The outlet pipes from the roof area are connected with 115 mm diameter PVC pipe allowing the water to pass through the filter media before storing in the sump.

Means of preserving surplus water by the Storage Pond and Percolation Pond in the campus

Though the major portion of water collected at roof tops have been conserved through the sumps installed, we have still huge run-off volumes from other parts of the campus, namely, from asphalt paved area, green belt area and other vacant area which amounts to a total of 5678 cu m/year (Table 4). Two ponds have been constructed in the campus whose dimensions are 15m × 20m × 3m, each with estimated annual storage capacity of 1800 cu m. Rainwater run-offs from different sites are taken to the storage pond through unlined open channel with a width of 0.5 m. Inside the storage and percolation ponds recharging trenches with bore well are incorporatedto enhance the recharge.

Storm water recharge systems

In addition to roof top collection and storage in ponds, runoff in the storm water drain provided in the campus area are also used for storm water recharge. Water generated in the campus area wherever possible can be harvested by recharge wells. Surplus flow from all sites and the storage pond is proposed to let out through open channel to the streamlet and nearby tanks for recharging the ground water.

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