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TERRE magazine for youth

APRIL 2015

ASSESSING THE POTENTIAL OF RENEWABLE ENERGY AS A PRIMARY SOURCE FOR RESIDENTIAL COLLEGE CAMPUSES – EVIDENCES FROM SIC1

TERRE Policy Centre
Technology, Education, Research and Rehabilitation for the Environment
Leading platform for development through Alternate Path

INKING INNOVATIONS

ISBN : 978-93-85311-04-8

Abstract:

This exercise is being conducted at the Symbiosis Infotech campus (SIC) located in Hinjewadi, Pune, India. The primary objective of this study is to understand the consumption patterns and identify potential areas for improvement in energy consumption within a residential campus. The study involves making a cost-benefit analysis of present energy sources with respect to renewable energy sources. This is to assess the potential of running a greener campus .The study proposes and tests a hypothesis that a greener college campus using renewable sources of energy is financially viable over a long period of time. A detailed analysis of current energy consumption and costs will be made. Along with this, discussions will be there with energy experts and renewable energy equipment providers. The comparative study would conclude with an objective assessment of the potential of renewable energy in a residential campus.

Keywords:

Renewable energy, residential campus, solar energy, campus greening, Bio gas, cost-benefit analysis

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Introduction:

For years we have seen our uncouth and reckless use of fossil fuel devoid of any kind of foresight has rapidly diminished these reserves gradually bringing them to the point of extinction. However it is never too late look back and stymie this rapid exhaust of our resources. The key here is to tap those resources which nature has provided us in abundance of our greed.

Renewable energy is indeed the future. Their clean pollution free manner of producing energy along with their abundant availability makes them a perfect foil to pollution inducing rapidly depleting nonrenewable sources of energy.

Sustainability is a philosophy of life and a way of life that strives to enable everyone access to environmental, social and economic resources yet defends the rights of future generations as well. Every society has its special concept of sustainability linked to its traditions and environment. Therefore every group may enrich the ideas and activities of others. Campus Greening is a concept which stands for the efforts to establish environmentally sustainable practices in educational institutions the world over. Its goal is to diminish the impact of ecological footprints by implementing the principles of sustainability at every level of institutional functioning.

College campuses are at the forefront of progressive ideas and programs and that's certainly the case when it comes to protecting the environment.

About Symbiosis InfoTech Campus:

Surrounded by hills on either sides and pervaded by a sense of endless space and tranquillity, this picturesque campus is spread over five acres, boasts of an auditorium, an indoor swimming pool, an equipped health and medical care centre, an academic block which is of international standards and separate hostels for boys and girls along with the accommodation for the faculty. Located in Pune InfoTech Park, Hinjewadi, the campus is surrounded by some of India's largest multinational companies in the mould of Wipro, Infosys, Cognizant, TATA Technologies and many others.

Initiatives in place already :

Shuttle-Link service.

A shuttle service which runs every day providing bus services to different parts of Pune throughout the day open to faculty, staff and students is one of the major initiatives in the process of creating a green sustainable campus. This initiative apart from saving fuel at a granular level also inculcates a responsible approach towards the environment and its depleting resources in the students.

Zero wastage Day: Zero wastage day started by the CSR cell of SCMHRD is a once in a month

initiative to have zero wastage in terms of mess cooked food. Apart from putting less strain on mess resources for the day and with its approach which directly puts a responsibility in hands of the students making them a contribution to finding a solution to the problems of our environment.

Sustainability Courses: SCMHRD was one of the first colleges to have a dedicated course on sustainability and sustainable practices in the industry.

Materials and Methods

Data was collected regarding energy and water consumption at the campus and D hostel. For evaluating consumption, office of Administration was contacted and information about monthly/Yearly consumption of electricity and Water was obtained.

Results and Discussion:

***Biogas Plant:** Biogas, a clean and renewable form of energy. Biogas is a renewable energy source by which biogas produced by the anaerobic digestion of organic matter including manure, sewage sludge, municipal solid waste, biodegradable waste or any other biodegradable feedstock, under anaerobic conditions.*

Biogas contains 50 - 70% methane and 30 - 50% carbon dioxide along with small amounts of other gases and typically has a calorific value4 of 21 - 24 MJ/m3. Solid wastes can be collected, and treated in a non-polluting, environmentally feasible cost effective process to produce biogas. Kitchen waste is organic material having high calorific value and nutritive value to microbes. It means higher efficiency and size of reactor and cost of biogas production is reduced. It can also be utilized in modern waste management facilities.

SIC catering to over 1200+ students and mess, generates approximately about 3337.867kg. The amount of waste generated in the form of left-over food and remains of vegetables and fruits are huge. This amounts to 110 kg of food that is being dumped daily. Further, municipal solid waste of the residential campus- 800+ students generates about 120kg of slurry that can be used as input source of the plant.

*Therefore, a biogas plant capable of processing 250kg is suggested. The plant can be installed in 30*20 sq. feet area behind the canteen and would cost about 6.5 lakhs which includes the installation cost, digesters and pipelines cost, and O&M costs. The total combined manure of 225 kg is expected to produce 25-40 cubic meter of biogas daily. 1 m3 of biogas is equivalent to 0.45Kg (450g) of LPG.*

Month	July	August	September	October	November	December
Food Wastage(kg)	*3968*	*2852*	*2944*	*3168*	*2910*	*4185*
Generation of biogas(max)	*40 cu. M*					
LPG equivalent of biogas per day	*16.1 kg*					
Savings through LPG per day @83.68/kg	*Rs.1347.25*					
Generation of biogas yearly	*14600 cubic m*					
LPG equivalent	*5876.5*					
No. of cylinders equivalent	*416.77*					
Savings per year	*Rs.491745.52*					

Table 1: Food and energy consumption pattern of SIC mess

Solar Energy:

Solar energy is an important means of expanding renewable energy resources. As the energy resources are exhausting so it becomes important to use solar energy in place of other non-renewable energy sources. With an average of 300 sunny days a year and high solar insolation, India has the capability of producing 5,000 trillion kilowatts of clean energy annually.

With a high population density, large tracts of land required for large-scale solar projects will be hard to come by in India in the near future. And this is where small-scale rooftop solar projects can fill in the gap and address the ever-increasing domestic energy requirements

Rooftop Solar Grid Installation (Figure 1)

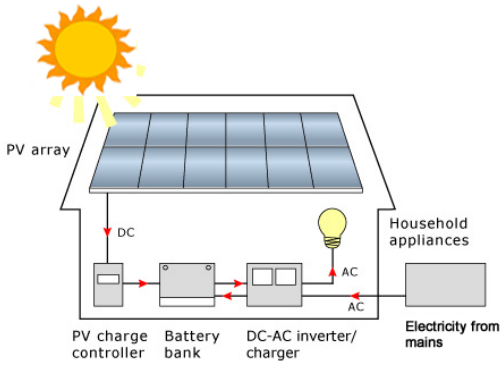

Figure 1: Rooftop Solar Grid system

Rooftop photovoltaic power station, or rooftop PV system, is a photovoltaic system that has its electricity-generating solar panels mounted on the rooftop of a residential or commercial building or structure. The various components of such a system include photovoltaic modules, mounting systems, cables, solar inverters and other electrical accessories. Rooftop solar PV systems are of 3 types:

Grid-tied – These rooftop systems are primarily designed to supply the generated power to the grid and also power the load. These systems will NOT generate power during a power failure as the inverter shuts down the system to stop sending power into the grid and avoids the risk of electrocuting utility personnel who are working to repair the grid

Grid-interactive – This system works in conjunction with either a battery backup or diesel generator to support the load even during a power failure.

Off-grid – This system does not work with the grid and is designed to work only with a battery backup or diesel generator in off-grid applications.

	SIC Campus	D-Hostel	Total	Consumption in watts
June	*93600*	*29794*	*123394*	*123394000*
Julu	*108820*	*38010*	*146830*	*146830000*
August	*91690*	*37872*	*129562*	*129562000*
September	*96510*	*36824*	*133334*	*133334000*
November	*83610*	*28802*	*112412*	*112412000*
December	*91670*	*30462*	*122132*	*122132000*
			Average	*107588666.7*
			Average in a day	*3586288.889*
			Avg / day in KW	*3568KW*
			Cost of 1KW Plant	*1,70,000*
			Govt Provides 30% sub	*48,000*
			Final Cost	*1,22,000*
			Cost to make total o.p	*435296000*

Subsidies

The high capital cost of setting up systems to tap energy through renewable sources is deterrent in taking up large-scale deployments of the same. To promote electricity generation using solar energy Government of India launched Jawaharlal Nehru National Solar Mission in January 2010. The objective is to achieve large-scale deployment of Solar Energy Systems and also to assist domestic production of critical raw materials, components and products to achieve grid parity by 2022.

Calculations

A rooftop solar PV system costs approximately Rs. 1,00,000 per kW peak (kilowatt peak) including installation charges but without batteries and without considering incentives. After considering battery backup and benchmarking, the cost rises to about 1,70,000.

Further government provides an incentive of 30% on such installations taking which Into consideration we get a final total of 1,22,000 to get around 100kw of power. Doing further calculations we see from the table the average monthly requirement of power is around 100000 kW which come s exactly equal to 3568kw per day.

Thus we see the final cost comes around 435296000 rupees for installation with battery backup. A look at the SIC campus in terms of area would shed more light on the feasibility.

Building	Security office	Acad. and Admin	Boys hostel	Mess and Gym	Library	Faculty guest House	Girl's Hostel	Staff Quarter	Meter room	Audi	TOTAL
Area	*12.5*	*1838.04*	*688*	*806.87*	414.85	278.35	687.94	116.81	155.54	1014.3	6013.23

Table 3: Total area Details of SIC buildings (in sqm.)

However we cannot apply it to the whole campus since an open rooftop area of only 651 m2 is available however we would look to apply it to only 20% of the total capacity which would put costs to 8 crore however the benefits it would provide far out see these costs and in a long run would provide further long term benefits as in.

***Reduction in electricity bills** – The per unit cost of electricity from the grid shall rise with the impending rise in cost of non-renewable fuel in the future. The only alternative for educational institutes to reduce their high cost of electricity consumption is to generate their own electricity through solar.*

***Govt. Subsidy -** Government gives 30% subsidy on solar installation so the cost of the solar solution goes down marginally.*

***No extra space required** – The solar panels to be installed in the Solar PV system only require open spaces which are readily available on school rooftops. Off Grid systems eliminate the use of batteries thereby requiring minimal space for the PCUs/inverters in the system.*

Becoming a differentiator *– Many Private Schools/Institutes/universities have very high fee structures which make it a compulsion for them to showcase themselves as a differentiator . An ideal way to do the same would be to adopt solar energy which shall be noiseless, eco-friendly and pollution free. Going solar and not using DG sets shall bring down the Noise/environment pollution and pose lower health risks to children; this can be a major deciding factor in the parents' choice of school for their children.*

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