

The Energy Resources Institute [TERI]

First Field Trip: TERI Campus in Gawal Pahari



SUMMARY EXECUTIVE

Five green technologies are well explained and demonstrated including main building systems, earth air tunnel, solar systems, waste water recycling and biomass gasifier.

During the visit to the TERI Campus in Gawal Pahari on 3rd February 2016, the trip took 40 minutes to reach from the hotel in Delhi. The four hours trip in TERI Campus, full with the informative lecture from Mr. Amit Kumar at the beginning and walk around the campus with demonstrations by TERI's representative. During campus visit, five green technologies are well explained and demonstrated including the main building systems, earth air tunnel, solar systems, waste water recycling and biomass gasifier. Three initiatives were introduced by TERI: solar lantern, cook stove and oil zapper. This report describes in details the overall trip at TERI Campus in Gawal Pahari and the information of each system.



SOLAR LANTERN

Lighting rural area with a lantern charged by solar panel



COOK STOVE

Improving the traditional cook way in Indian villages



BIO-REMEDIATION

A bacterial consortium that degrades crude oil and oily sludge



Building

Landscape, passive solar architecture and solar chimney



Earth Air Tunnel

A passive space conditioning system



Solar Systems

Solar power and solar hot water panels



Waste Water Recycling

Grey water treated by root zone system



Biomass gasifier

Wood waste, branches, twigs, firewood and crop stubble burn system

Introduction

The participants of 2016 ProSPER.Net Young Researchers' School have visited the TERI campus as the first field trip for this program on 3rd February 2016. TERI University as an organizer hosted for this trip. The trip's itinerary stated as below.

Trip's Itinerary

- 9.00 am : Departed from the hotel
- 10.20 am : Arrived TERI Campus in Gawal Pahari
- 10.30 am : TERI RETREAT Building Video
- 11.00 am : Lectured by Mr. Amit Kumar (Dean - Distance & Short-term Education Program, TERI University)
- 12.00 pm : Coffee break
- 12.15 pm : Walked around TERI Campus , lunch & live demonstrated of TERI's initiatives
- 2.00 pm : Travel from TERI campus to National Institute of Solar Energy (NISE)



After arrived the venue, all of us entered the campus by using green vehicle which run by a battery. The scenery of this campus is so green with a nice landscape and many flower plantations. Once reached the main building of TERI campus, Mr. Amit Kumar started his lecture by played the movie video as the introduction of TERI campus all about. After his intensive lecture about the TERI Retreat, a few minutes for a coffee break before start walking around campus. Several green technologies were introducing to the participants. The details of each special technology applied by TERI campus is explain in further section.



Background

TERI stands for The Energy and Resources Institute, which is an independent, non-profit research institute established in 1974. The vision of TERI is to work toward global sustainable development, creating innovative solution for a better tomorrow. Its mission is to provide technological solutions for both the efficient utilization of resources, and the harness of renewable energy. Moreover, the philosophy of TERI is to provide clean energy and cost-effective solutions to diverse user-groups (e.g. industrial, commercial, rural sectors), as well as to maintain sustainable buildings. Thus, the basic thrust is to seek solutions that are sustainable and environmentally benign with a focus on energy, environmental, biotechnology, and sustainable development issues. The key strengths are a multi-disciplinary team, and a balanced combination of academic background and field as well as industrial experience.



TERI RETREAT

As the name suggested, TERI RETREAT – the Resource Efficient TERI Retreat for Environmental Awareness and Training – is a model of sustainable habitat. The 36.5 hectares' infertile land was transformed into greenery landscape prior the building facilities and infrastructure were completed in 2000. In the afternoon on 3rd February 2016, the participants were guided by TERI representatives to walk around the campus. The green building design concept and renewable energy technology are demonstrated through many facilities. The technical concepts of each technology are describe further.

1. Building

The landscape is a genuine design to maximize the land use. The east and west side high trees helps block solar radiation, while deciduous trees on the south side allows winter sunlight. Furthermore, **passive solar**

architecture is applied in this building. In order to minimize sunlight exposure in summer and maximize exposure in winter, the buildings are facing south. Additionally, the innovative skylights allow only diffused sunlight to enter the building with no heat. Moreover, the attached to the South facade, **solar chimney** provides a self-induced passage cooling.



2. Earth Air Tunnel

The system is a **passive space conditioning**. Heating air in winter and cooling air in summer by conditioning air through network of underground tunnels. The ambient is suctioned into the tunnel and passed through the de-humidify unit before entering the vertical air shaft inside the building. Hence, throughout the year, the rooms are maintained at the comfortable temperature around 20-26°C without the need of air conditioner.



3. Renewable energy

Solar power is generated from photovoltaics. Not only a transparent building integrated photovoltaic (BIPV)

solar panel is installed at the roof, but other modules are installed throughout the campus. Batteries are used for storage and provide power at night. **Solar hot water panels** attached to building structure provide hot water for the living quarters.



4. Waste water Recycling

At the waste water recycling plant in TERI, the person in-charged show us the recycling process is by **root zone system**. This method to recycle waste water for irrigation and for watering and maintaining the garden or landscape for the whole TERI area. As mentioned, the grey water from the TERI building is collected in a settling tank and the sludge settles at the bottom. Next, the water passes through to the bed soil with reeds. The roots of these plants act as a filter, removing and absorbing unwanted substances and contamination from the grey water. The reeds plantation use for filter is long lasting for one year. In addition, this is one of the good technology to purified the waste water because it is done by a natural process.



5. Biomass gasifier for energy generation



During visited to Biomass gasifier plant, the technical person explained the process of the system. The process started with **burnt twice as efficiently the wood waste, branches, twigs, firewood and crop stubble** inside the reactor. Energy that generated is used to power the TERI's building by connecting with the smart mini grid as a centralize energy distribution.

Any surplus energy that is generated is used to recharge the battery bank. This battery bank is thus served by two sources of power, namely the photovoltaic panels and the gasifier.

TERI Initiatives

There are three main initiatives done by TERI. During the visit, the participants able to have a look the real cook stove demonstrated by one of the TERI's worker. Unfortunately, due to time constraint, the visit at bio fragmentation laboratory was unable to manage.

1. Solar lantern



Photo sources: <http://labl.teriin.org>

Another evening sets in, an oil lamp fights darkness. Many people have never known the joy of electricity. When people cook food on mud stove, the smoke chokes them. Over 1.4 billion people across the world lives in darkness, of which 80% are in Africa and South Asia and in which India counts 400 million people. Is there any hope for this people? Yes, some dreams going to be true across hundred of Indian villages. Solar lanterns are lighting up the nights. Rural women have become entrepreneur. These women manage solar charging station and also rent this lantern.

Now life of such people is changing very fast. Studying which were boring earlier now became joyful. Cooking became easy, and new ways of livelihood are being tapped. This will be the light of the next generation. A few advantages are extend the working day in rural areas, improves health issues, improves fire reduction, improves literacy rate, saves an energy, reduces maintenance, reduces local air pollution and offsets greenhouse gases.

2. Clean combustion cook stove for residential purpose



Photo sources: <http://www.teriin.org/technology/stove-writeup.php>

Out of five, four houses in the rural areas in India depends on direct burning of solid biomass fuel like fuel wood, crop residue, and dung cake in the traditional mud stove. These type of cooking practice deploys an incomplete combustion of biomass fuel leading to an emission of toxic smoke. Women which are exposed to these types mud stoves, especially in poorly ventilated kitchens, have high risk of pneumonia, respiratory disease etc. The toxic smoke also relates to climate change. The thermal efficiency

of these stoves is approximately 17% and has high fuel consumption.

With this background, TERI came up with a cleaner combustion cook stove called UNNAT CHULAH. With two years of intensive research, field visits, testings, TERI had developed an innovative cook stove using one-third of fuel wood, agriculture residue etc. The additional part of the cook stove is the fan powered by 11.1 V, 2.2 AH lithium cobalt oxide batteries. Fabricated with stainless steel, the cook stove has the air chamber which is a good insulator and it is safe to touch the outer part. Advantages are not only less fuel consumption and cooking time reduction, but also around 70% reduction in smoke particulate matter and a better cooking environment. Subsequently, the efficiency has been increased up to 38%.

3. Bio-remediation



Photo sources: <http://www.teriin.org/technology/oilzapper>

This initiative concerns a bacterial consortium that degrades crude oil and oily sludge. After seven years of research, TERI and a support from Department of biotechnology, Ministry of science and technology, Government of India, a product called oil zapper (the powder-like material) is developed.

The oil zapper breaks down hydrocarbon compounds in the crude oil and oily sludge (hazardous product which is generated by the oil refineries) and converts to harmless carbon dioxide and water. The life of the product is three months at ambient temperature.

As the oil zapper can be used in situ, there by eliminating the need to transfer large quantities of contaminated waste. Nonetheless, bio-remediation is considered as one cost effective technology. Oil zapper work out 30% cheaper than the conventional physicochemical treatment.

Conclusion

The first field trip was really informative and set a good demonstration of sustainable habitat. The participants were enjoyed the landscape and environment in this campus, together with learning numerous action-research oriented technologies and renewable energy systems.



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