Report of the Green Campus Initiative (GCI) committee
Date: June 30, 2010

The committee convened three times since its inception on February 24, 2010. A variety of issues related energy use and campus environment were discussed. In the following, the recommendations of the committee are summarized area-wise, with a key person identified for each topic.

1. **Area:** Energy

   Sub-area: solar (photovoltaic) energy for the campus

   Committee Suggestion: The option of solar energy needs to be thoroughly explored for the IIT campus. In particular, grid-connected solar PV will be suitable for IIT, mounted on top of department buildings and the main building.

   Key person: Mr. B. K. Sahoo, Executive Engineer (Electrical)

   Report: Both small (200 kW) and large (1 MW) options could be explored for the campus. A consultant may be appointed to prepare the detailed project report (DPR) for implementation. The following technical committee is suggested to oversee this process and give further recommendations on the DPR.

   - Mr. B. K. Sahoo, Executive Engineer (Electrical)
   - Prof. Chetan Solanki (Energy Science and Engg)
   - Prof. B. G. Fernandes (Electrical Engg)
   - Prof. Kishore Chatterjee (Electrical Engg)

   An approval to constitute the above committee has already been obtained from the Director.

2. **Area:** Energy

   Sub-area: Using heat pumps for an energy-efficient campus

   Committee suggestion: Based on the specific usage pattern of hot water, cooled water for drinking and air conditioning of computer rooms, different optimal solutions are possible and should be explored for efficient use of energy on the campus.

   Key person: Prof. Milind Rane

   Report: Prof. Milind Rane was requested by the committee to suggest solutions which can be taken up in a short time on a pilot basis. The following things can be tried out:

   (a) Water to Water Multi-Utility Heat Pump: WtW MUHP Hot water is the primary utility with cooled water as a free utility. This WtW MUHP will have a built-in hot and cooled water storage facility. Note: Water stored will not be the water that is supplied, so the

hot and cold water tanks will not require cleaning. Hot or cooled water supplied will get heated or cooled instantly as they pass through a patented Tube-Tube Heat Exchanger. TT-HE. (One such system is working in McDonald's outlet at Palm Beach Mall, Vashi.)

(b) Air to Water Multi-Utility Heat Pump: AtW MUHP Hot water is the primary utility with air conditioning as a free utility. This AtW MUHP will have a built-in hot water storage facility. Note: Water stored will not be the water that is supplied, so the hot water tank will not require cleaning as described in Option (a). Cooling can be delivered using a high wall split unit, our conventional indoor unit of the split air conditioner, in the Warden's office, computer room or dining hall.

Both the MUHPs can be modular, with 1, 1.5 or 3 TR capacity. Multiple units may be deployed act various locations to minimise hot and or chilled water piping. Size of the insulated hot and cooled water tanks can be decided based on the hot and cold water requirement.

Up to three services per year may be required each year which should be similar to that required for conventional split air conditioners.

If selected for installation in IITB Hostels, the first couple of units can be built as a part of the consultancy project to demonstrate the MUHP technology for such applications through IRCC.

One year comprehensive maintenance and performance monitoring can be built into the project if desired. Maintenance in subsequent years can either be taken care of by AC Maintenance section at IITB or by giving the maintenance contract to the rate contract vendor operating in IITB.

Expected payback period is likely to be less than one year, but certainly less than 1.5 years.

3. **Area: Energy**

Sub-area: AC's in the academic area

Committee Suggestion: Implementation of centralized AC system in all buildings to save energy.

Key person: Mr. B. K. Sahoo, Executive Engineer (Electrical)

Report: A report consisting of feasibility of conversion will be prepared. The report will include existing number of AC's and proposed AC's (next 20 to 25 years), advantages and disadvantages of having central AC facility, number of such units required, technical details, including cost estimation, energy to be saved due to conversion from window/split AC system to central AC system, other infrastructures required for installation of central AC system, target time of changing from window AC to central AC system.

4. **Area:** Energy

   Sub-area: Solar water heating

   Committee Suggestion: Solar heating (for bath water and kitchen) is currently in operation in Hostel 2. There are five units of 2500 lt each. The pay-back period is expected to be two years. The committee recommends that other hostels should also be equipped with solar heaters.

   Key person: Mr. B. K. Sahoo, Executive Engineer (Electrical)

   Report: The option of solar water heating should be explored for students' hostels. Some of the residential buildings, especially where energy saving is likely to be significant, should also be equipped with solar heaters. For new hostels and residential buildings, special care should be taken to ensure that the roofs are suitable for solar water heating (i.e., they should provide sufficiently large flat surfaces for mounting of the solar water heaters)

5. **Area:** Energy

   Sub-area: green buildings

   Committee Suggestion: All new buildings to come up in the campus should be designed as green buildings, with solar power, natural light and ventilation, rain water harvesting, and other features for saving energy.

   Key person: Prof. K. V. K. Rao, Dean (IPS)

   Report: As of now, the campus does not have a green building. The upcoming energy sciences building will be a step in the direction of an energy-efficient campus. Based on this experience, new buildings should also be designed to incorporate energy-saving features.

6. **Area:** Energy

   Sub-area: diffused light for office space

   Committee Suggestion: The option of diffused light for offices should be explored to reduce energy consumption for lighting.

   Key person: Prof. Chetan Solanki

   Report: Diffused light (with appropriate use of reflecting surfaces) can significantly reduce electricity consumption for lighting. This option may be explored in IIT offices.

7. **Area:** Energy

   Sub-area: use of reflecting paint on rooftops

   Committee Suggestion: Reflecting paint can be used to reduce temperatures on top floors and in bungalows.

   Key persons: Prof. K. V. K. Rao and Prof. Milind Rane

Report: Top floors of residential and academic buildings and single-storey bungalows get very hot because of direct contact with the roof. In the past, residents have used white wash (choona) to successfully lower the temperatures. There are more permanent paints available in the market, which should be explored.

8. **Area:** rain water harvesting

   Committee Suggestion: Rain water harvesting should be undertaken in the campus at various locations.

   Key person: Prof. V. Jothiprakash

   Report: Prof. Jothiprakash has submitted a rain water harvesting plan for the campus to Dean (IPS). Further work is required for cost estimation and implementation.

9. **Area:** water network for campus

   Committee Suggestion: Drinking and sewage water networks need to be re-designed for the campus.

   Key person: Prof. V. Jothiprakash

   Report: Prof. Jothiprakash has submitted drawings for the above to Dean (IPS). Some modifications need to be made.

10. **Area:** water recycling

    Committee Suggestion: Water recycling is successfully done currently in C-type buildings near K.V. This model should be replicated in other buildings, particularly those with a large number of residents, such as Ananta, old multi, white houses, Tulsi, Hillside type C, and hostels (stage-wise). An important aspect of this is spreading awareness among residents and assuring them that the recycled water will only go to the flush tanks and gardening.

    Key person: Prof. Anand Rao and Vishu Mahajan

    Report: Some steps in this direction are already being taken. IIT Students have submitted a proposal to replicate the above scheme in the students' hostels. Residential areas should also be taken up for the same.

11. **Area:** water-saving devices

    Committee Suggestion: Water-saving devices such as taps and shower heads with low flow rates have been proposed by students for hostels. This is an excellent initiative and should be encouraged. On a pilot basis, the concept should be demonstrated initially in one hostel.

    Key person: Prof. M. B. Patil and Vishu Mahajan

Report: Students' group working on green measures for the campus has recommended the use of taps and shower heads with a low flow rate. They have estimated a daily saving of 68.000 lt of water if the above devices are adopted in all hostels. The cost is estimated to be about Rs. 2 lacs. They have submitted a report to Dean (IPS) separately.

12. **Area:** garbage disposal
Sub-area: wet garbage

Committee suggestion: It is required to dispose off wet garbage inside the campus as per BMC guidelines.

Key person: Prof. Suparna Mukherjee

Report: Currently. composting of wet garbage from some of the hostels is being carried out near H4 (on the other side of the pipeline) Vermiculture should be taken up actively in residential and hostel areas to ensure, in the long run. that all wet garbage is treated in the campus, generating manure or bio-gas as side products. Decentralised treatment may work out well in some areas, saving the effort involved in transporting garbage to a central facility. (Currently, Mr. Patil. PHO. has been in touch with a company for constructing a bio-gas plant. This should be implemented soon).

13. **Area:** garbage disposal
Sub-area: dry leaves

Committee suggestion: Dry leaves should be composted and not burnt.

Key person: Mr. B. S. Patil. PHO

Report: Currently, pits have been dug in several places in the campus for composting dry leaves. However, dry leaves are still being burnt by residents. Apart from being environmentally harmful. the smoke is harmful for residents, particularly those suffering from breathing problems such as asthma. It is recommended that the practice of burning leaves must be completely stopped. This will require an awareness campaign for residents in which the harmful effects of burning leaves are described emphatically. A suitable fine needs to be imposed for violators for realistic implementation.

A bio-reactor is recommended which will convert garden waste and dry leaves into sludge by bio-digestion. This will serve as manure for campus gardens. and thus addressing two issues (garbage disposal and manure) at the same time.

14. **Area:** paper/plastic use
Sub-area: printers

Committee suggestion:

(a) Printers which can only print on one side should not be ordered in the future.

(b) Refilling toner cartridges for laser printers (at least 2-3 times) should be encouraged.

(c) Printing through centralized printing facility should be implemented wherever possible, in order to reduce duplication of printers. Refilling of toner cartridges and centralized printer facility will also be beneficial in terms of saving resources.

Key person: Prof. M. B. Patil

Report: It is found that many Estate Office documents have to be printed currently on a single side. They require larger storage space. Double-sided printing will address this issue. Apart from making storage more efficient, paper saving can be substantial.

15. **Area:** paper/plastic use
    Sub-area: thin plastic bags

    Committee suggestion: Thin plastic bags (less than $50\,\mu$m thick) should not be allowed in campus shops.

    Key person: Mr. B. S. Patil, PHO

    Report: It has been observed (as recently as June 28, 2010) that shops in the IIT shopping centre (near Y point) are giving thin plastic bags although they are illegal. The PHO is requested to send all shops strict notices regarding this matter, with a warning about heavy fines.

16. **Area:** paper/plastic use
    Sub-area: academic reports

    Committee suggestion: double-sided reports should be encouraged. Also, whenever applicable, e-reports should be submitted instead of hard copies.

    Key person: Prof. M. B. Patil

    Report: A large amount of high-quality printing paper can be saved if students are instructed to submit reports with double-sided printing. Also, it is often not required (esp. for short reports) to use plastic binding. Dean, Acad, to be requested to look into this possibility.

17. **Area:** recycling
    Sub-area: electronic waste

    Committee suggestion: There are agencies which recycle electronic waste (computers, printers, etc). These should be contacted to recycle the campus e-waste.

    Key person: Mr. B. S. Patil (PHO)

Report: A large number of electronic items get discarded every year due to upgrading of labs. failure of instrument. etc. These contain significant amount of toxic substances and need to be separately addressed.

18. **Area:** recycling

Sub-area: re-use of abandoned bicycles

Committee suggestion: IIT students have suggested in a separate report that bicycles which are abandoned by graduating students or others should be repaired and re-used in the campus. The committee pointed out implementation difficulties in the above. and suggested that the bicycles could be made available to new students at discounted prices, which will achieve the same purpose.

Key person: Prof. M. B. Patil

Report: A large number of abandoned bicycles accumulate each year. The current practice is to keep them in the campus chained together. As a result, the bicycles are not useful to anyone, they suffer in the monsoon, and eventually have to be thrown away. The students'. suggestion of repairing and re-using them is a good one: however. it is difficult to implement (especially. issuing and maintaining the bicycles). It is therefore suggested that the bicycles should be made available to new students at low prices so that the bicycles get re-used.

19. **Area:** recycling

Sub-area: re-use of furniture, tiles, etc.

Committee suggestion: Discarded furniture, tiles, and other useful materials should be re-used inside the campus, or suitable organisations should be identified which will do it effectively.

Key person: Prof. K. Ramasubramanian

Report: A huge amount of old furniture is discarded every year in IIT. A significant amount is teak wood which is old, seasoned, and high-quality. Often. the discarded furniture is stored in the open and is subjected to rain. As a result, it goes waste. There are other useful materials (such as tiles) which are discarded but are potentially useful for making garden paths, etc. A comprehensive policy is required to address these and related issues. It is going to be more and more relevant in the coming years because many buildings will be demolished for new constructions.

20. **Area:** recycling

Sub-area: dry garbage in hostels

Committee Suggestion: Students' group working on green initiatives has proposed that recycling bins should be placed in hostels so that segregation is made possible. This is another

excellent initiative from the students and should be encouraged. To begin with, one hostel can be taken up to demonstrate the benefits.

Key person: Prof. M. B. Patil

Report: A proposal has been submitted by students working on green initiatives to place recycling bins in hostels so that paper, plastic, tin cans, glass bottles, cartons, etc. can be segregated into different bins. They have estimated the cost for 500 bins to be Rs. 2.5 lacs. The recycled material can be sold to vendors, and it is expected to fetch about Rs. 8 lacs a year. This amounts to a pay-back period of 3 to 4 months.

21. **Area:** campus ecology

    Sub-area: planting of new saplings

    Committee suggestion: Saplings should be planted with a reasonable chance of survival. Saplings which are 2-3 years old are better in this respect; also, they need watering for only one year generally, as compared to two years for smaller saplings. It is recommended that ALL PLANTING MUST BE DONE IN CONSULTATION WITH AND MONITORING BY THE GCI COMMITTEE. If cost is a concern, the saplings can be grown in the institute nursery and then planted at the site.

    Key person: Prof. M. B. Patil

    Report: A very large number (thousands) of saplings get planted by IIT every year. There are several areas in which this exercise can be improved:

    (a) watering in dry months: In the past, saplings have been planted on Vanamahotsav day and were not watered in dry months. As a result, they have perished.

    (b) Fire hazard: Unless dry grass around saplings is removed in October, saplings face the risk of burning in wild or purposely lit fires. Thousands of saplings have succumbed in the past because of the dry grass catching fire.

    (c) Appropriate varieties: In the past, exotic (non-local) varieties (which are also more expensive) have been planted, which is harmful from the bio-diversity angle. To maintain a healthy ecology, local species must be planted. In particular, local species which are not present in the campus (or are very few in number) should be given preference.

    Hundreds (thousands?) of trees have been cut in the past few years for new buildings/hostels. Compensatory compensation still remains to be done. With active involvement of the GCI committee, much can be achieved. Dean (IPS) is requested to convey the above concerns to the institute horticulture section so that appropriate steps can be taken. In particular, a meeting of the GCI committee with the horticulturist will help to streamline related activities.

22. **Area:** campus ecology

 Sub-area: planting near buildings

 Committee suggestion: Specific areas should be left unpaved around new buildings (either a continuous area or 3 ft × 3 ft squares, every 6 ft or so) so that planting of saplings can be done.

 Key person: Prof. K. V. K. Rao

 Report: When new buildings come up, the area around the building is generally paved for parking. If no free soil is available for planting saplings, the entire area remains devoid of trees, and this has a significant effect on the temperature. There are concerns that the branches may fall and injure residents or cause property damage. However, the varieties can be carefully chosen so that this issue is addressed. It is important that PLANTING MUST BE DONE IN CONSULTATION WITH THE GCI COMMITTEE so that appropriate varieties get planted.

23. **Area:** campus ecology

 Sub-area: cutting of vegetation

 Committee suggestion: Vegetation (creepers and shrubs) should not be cut during or after monsoon especially in the thickly vegetated, non-residential areas.

 Key persons: Prof. M. B. Patil and Prof. K. V. K. Rao

 Report: Cutting of vegetation after monsoon, especially in the non-urbanised areas of the campus should be stopped as it destroys the eco-system (including wild flowers, habitat for some of the species). This problem has been specifically mentioned in the WWF survey of the campus. Dean (IPS) is requested to convey the same to the institute horticulture section.

24. **Area:** campus ecology

 Sub-area: construction camps

 Committee suggestion: Construction camps should not be allowed in pristine areas such as Soneri Baug and Koldongari. Existing campus should be dismantled as soon as it becomes practically feasible.

 Key person: Prof. K. V. K. Rao

 Report: Construction workers' camps are extremely damaging for the campus environment. Large areas are cleared of vegetation for setting up of these camps. Further, the workers cut wood for burning. This activity has already caused a great deal of damage. Apart from impact on the campus ecology, it has been found that the construction workers make the surrounding areas filthy (by using it as an open toilet). All these factors considered, it is recommended that camps should not be allowed in the future particularly in thickly vegetated areas, and strict observation of certain rules should be enforced on the contractors.

25. **Area:** campus ecology

   Sub-area: dumping of debris

   Committee suggestion: Dumping of debris inside the campus should be strictly prohibited. and contractors should be fined heavily if they do not co-operate.

   Key person: Prof. K. V. K. Rao

   Report: Dumping of debris in a haphazard manner is taking place inside the campus. This needs to be controlled in a very strict manner. The PHO has issued strict guidelines for transport of debris. However, there are still instances of contractors dumping debris inside the campus.

26. **Area:** campus ecology

   Sub-area: security measures

   Committee suggestion: Security measures need to be strictly implemented to curtail activities that are harmful to the environment. These include

   - drinking (and throwing bottles/cans)
   - unrestricted access to motorcycles in vegetated areas
   - allowing outsiders into the campus without verifying if they have legitimate work in the institute
   - trapping of birds

   Key person: Prof. K. V. K. Rao

   Report: The above activities are taking a heavy toll on the campus ecology. It is recommended that the Security Officer be requested to look into each of these matters. Also. as a part of the Soneri Baug project (batch of 1984), the institute has agreed to close vehicular access to the Soneri Baug area. This should be implemented as soon as possible (there are existing gates near the guest house and hostel 8 which can be used for this purpose).

27. **Area:** parking

   Sub-area: stopping haphazard parking

   Committee suggestion: Parking should not be allowed in a haphazard manner within the academic area.

   Key person: Prof. K. V. K. Rao

   Report: In many places inside the academic area, parking is done in a haphazard manner. This prevents beautification efforts (e.g., flowering plants) apart from causing inconvenience and safety problems. It is recommended that all such parking should be prohibited. Parking

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only in the designated areas (next to Physics, convocation hall, Civil, Aero, Library, etc) should be allowed. If there is still a shortage of parking space, efficient options with a small footprint should be explored. For example, the parking lot near the Physics dept can be converted into a multi-storey parking lot

28 **Area:** interaction with campus residents

Sub-area: awareness campaign

Committee suggestion: A few sessions should be conducted to spread awareness about environmental matters and resource-saving practices.

Key person: Prof. Chetan Solanki

Report: The success of implementing committee recommendations will depend strongly on how these are perceived by the campus community. A few sessions need to be conducted to spread awareness. It is important to make these formal events so that institute non-academic staff members can attend the presentations (they should be given time off to attend) The personnel training and development office of the institute could be requested to help.

29. **Area:** interaction with campus residents

Sub-area: lectures/seminars for Estate Office staff

Committee suggestion: Lectures should be organised to create awareness among the Estate Office staff regarding several issues related to sustainability, better use of resources, practices that should be avoided to reduce damage to the environment.

Key person: Prof. K. Ramasubramanian and Prof. Anand Rao

Report: Significant amount of damage to the campus ecology can take place if good practices are not followed. In addition, material can be saved (which also has an environmental impact) through prudent use of resources.

30. **Area:** interaction with other entities

Committee suggestion: CESE students, under the guidance of Prof. Asolekar, have submitted a report on "Green campus initiative." There is a large overlap between the measures being suggested by the GCI committee and by CESE. CESE students should be involved in implementation of some of the measures.

Key person: Prof. M. B. Patil (and Prof. S. Asolekar)

Report: The CESE report has categorized the environmental issues area-wise, such as, air quality, water resources, solid waste, checmical waste, etc. Action plans have been suggested to address each issue. CESE students' inputs for implementation will help significantly since they will also be able to comment technically/quantitatively on several aspects. It may be possible for CESE faculty to offer some of these topics as M. Tech. projects.

31. **Area:** policy

Sub-area: scope of the GCI committee

Committee suggestion: The tenure of the GCI committee should be extended.

Key person: Prof. K. V. K. Rao

Report: In the interest of smooth/successful implementation of the committee recommendations, it is desirable that the tenure of the committee is extended to a year or so. Since the issues discussed by the committee will remain relevant for a long time, it would be a good idea to make the committee a formal one, which is nominated by the Senate. The scope of the committee can also be expanded to include interaction with the infrastructure committee, town planner, and Dean (IPS) office so that it can offer suggestions on matters related to campus ecology, energy efficiency, etc. The committee can serve as a useful link between the institute and the residents/students, which will help in implementation of new initiatives.

The institute is planning to prepare a land use plan with the help of an urban planning adviser. The GCI committee should be closely involved in this planning so that sufficient green spaces can be developed along with new constructions.