A Report

on

CSIR- Harnessing Appropriate Rural Intervention and Technologies

(CSIR-HARIT)

Project Theme

Environmental Management within CSIR-Indian Institute of Petroleum: To Improve Sustainability within the Campus

(Electricity Management)

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Introduction:

The electrical and electronic equipment (EEE) production and consumption have shown a marginal rise in waste that results in growing pollution problem worldwide.[1] These wastes are known with different names such as e-waste, waste electrical and electronic equipment (WEEE).[2] WEEE is a waste that includes all the components, subassemblies and consumables which have been the parts of the product at the time of wastage discarding as proposed by Directive 2012/19/EU.[3] E-waste encloses a wide range of electronic devices including huge household devices including air conditioners, refrigerators, cell phones, personal stereos, consumers electronics and discarded computers.[4] However, Robinson (2009) describes e-waste as electronic waste goods including cell phones, television, computers and WEEE as traditional non-electronic goods including refrigerators and ovens.[5] Step Initiative (StEP, 2014) encompasses all these definitions by describing e-waste as a term that mostly covers all types of EEE which could have the waste stream including computers, televisions, mobile phones, home entertainment, stereo systems, white goods (dryers, washing machines, fridges), kettles, toasters and any large household with electrical or circuitry items with power supply.[6]

The aim is to enhance the environmental betterment of the life cycle of EEE that has been developed by a few countries which mainly focus on setting up ambition for collection, reuse and recovery. The legislation initiation rate to deal with WEEE has been slow or inexistent worldwide.[7] The current situation of WEEE management has been analyzed wherein composition and amount of WEEE, prevention and regulation, methodologies for processing WEEE are described globally. [7] Also, the current situation of WEEE and used electrical and electronic equipment (UEEE) movement in those countries has been examined by Li et al. (2013) and analyzed to support global or regional recycling programme.[8]

To highlight the importance of energy to our national prosperity and security, every October is celebrated as a National Energy Awareness Month. We need to minimize our use of energy at work for the long term benefits because an estimated 50% of our energy use and CO_2 emissions are from the use of heating cooling and lighting buildings. We have to decrease our usage at work, especially in office buildings loaded up with electrical gear, which can easily be used more productively with minimal effort and cost.

The main objective of this report is to provide the electricity usage, pattern, and treatment of e-waste in all the buildings of CSIR-IIP campus, including recently built training centre. The pattern is also measured for the residential colony, which is currently occupied by almost 500 residents. It also discloses the detailed monthly bills of different places inside the campus. This report also focuses on the institute initiatives taken to utilize, reuse and recovery of WEEE and UEEE to improve the environment. The segregation of WEEE and UEEE inside the campus to utilize it further has also been disclosed so as to improve sustainability inside the campus and to reduce the resource utilization pattern.

Challenges for saving electricity:

A significant factor in accomplishing energy effectiveness and conservation target is the response of the people. The key point of success for saving energy is the attitudinal change in the behaviour of humans. However, the response is not helpful as there is a lake of awareness and information gap among the people. Appropriate data, information based on utilization, efficiencies of energy play an important role in energy education.

Tips for minimizing electricity wastage and energy consumption:

1. Desktop computers have become an integral component of modern life and become a large source of energy consumption. Many institutions and organizations leave the desktop computers/laptops switched on all-time for the convenience of users in

laboratory and office buildings which lead to the wastage of power and energy consumption. We should turn off our computers, especially at night and ditch the screensaver. Today's computers can be turned off and on over 40,000 times. Energy waste is defined as the energy consumed by a machine when it was not in active use, where active use meant the desktop computer was both awake and had a user logged in. From this definition, five states of desktop computers can be defined as:

(1) Awake and logged in

(2) Awake and logged out

(3) Asleep and logged in

(4) Asleep and logged out

(5) Shutdown

These states are presented in figure 1, which clearly tell us about the energy consumed in states from two to five considered as wasted because computers were not in active use in these states.

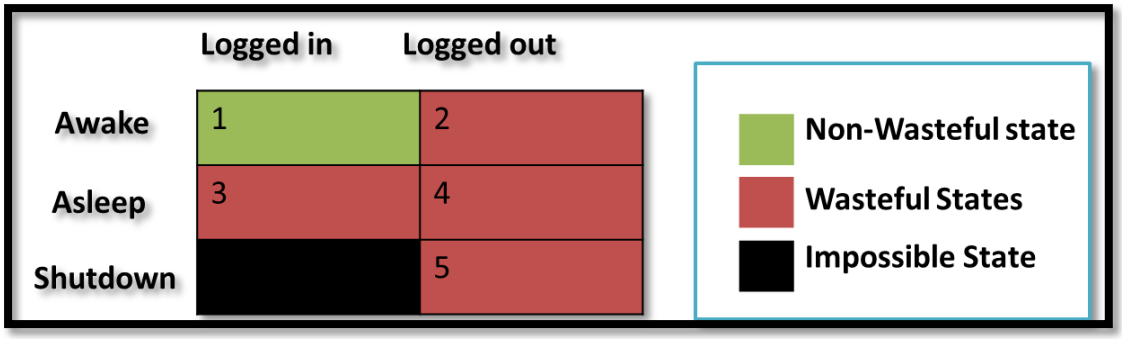

Figure 1: Five desktop computer energy states and their classification either wasteful or non-wasteful.

2. LED lights are approximately 70% more efficient than traditional lights such as incandescent and fluorescent lights. LEDs lights convert 95% of the energy into

lights, and only 5% wasted as heat, on the other hand, fluorescent lights convert 95% energy into heat and only 5% into light. The power consumption of LEDs lights is less than the fluorescent lights; a common 84-watt fluorescent can be replaced by a 36 watt LED to give the same level of light. LED lights don't have toxic elements. Most workplaces as of now utilize fluorescent strip lights which contain noxious chemicals, for example, mercury. LEDs have a superior nature of light circulation and focus light in one direction as opposed to other types of lighting which waste energy by emitting light in all directions. LED lights last up to six times longer than different kind of lights. This outcome in utilizing less light and thus, fewer assets are required for manufacturing processes, transportation and packaging materials. Therefore, less energy use cut down the demand from the power plants and reduces greenhouse gas emissions.

3. A large amount of energy is needed for cooling and heating the rooms of buildings. We should use and find alternative, cheaper, energy-efficient methods of keeping the building cool and warm. We can save 10% of the total electricity bill annually by just keeping the thermostat down by 1 °C. We can use a proper energy management system so that we can set timers for air conditioning program before getting in/leave the building.

Conservation initiatives:

There are many ways to conserve energy, and some of the following are as follows:

- Replacing light bulbs
- Use of smart power strips
- Purchasing of energy-efficient appliances
- Installation of smart thermostat

- Adjustment in day to day behaviour

Table 1: Equivalent watt and lumen output for old-style incandescent and three types of energy-saving bulbs (halogens, CFLs and LEDs)

Brightness	220+	400+	700+	900+	1300+
Standard	25W	40W	60W	75W	100W
Halogen	18W	28W	42W	53W	70W
CFL	6W	9W	12W	15W	20W
LED	4W	6W	10W	13W	18W

Table 2: Electricity Units and consumption details of CSIR-IIP campus and colony:

Month	Total Unit	Amount (Rs.)
May 2019	3,13,100	17,22,050
June 2019	3,35,200	18,43,600
July 2019	3,47,326	19,10,293
August 2019	3,27,000	17,98,500
September 2019	3,43,900	18,91,450
October 2019	2,41,800	13,29,900
November 2019	2,84,400	15,64,200
December 2019	3,54,600	19,50,300

These data have been collected from the Engineering Service Department of the institute. The above table shows the total electricity consumption over a period of 8 months in the campus including residential colony. The maximum electricity consumption was observed in the month of December 2019.

Table 3: Electricity units and consumption details of CSIR-IIP training centre:

Month	Total Unit	Amount (Rs.)
August 2019	2,360	12,862
September 2019	2,400	13080
October 2019	2,200	11,990
November 2019	3,040	16,568
December 2019	3,640	19,838

The data table shows the total electricity consumption over a period of 5 months in the training centre of the institute. The maximum electricity consumption was observed in the month of December 2019.

Recycling, Reuse and Treatment of e-waste from campus:

Institute has kept separate dustbins in each corner of the whole campus for the collection/segregation of e-waste. This segregated e-waste is transferred to Swachhta Kendra, Dehradun from the institute after collecting it for 3-4 months. Swachhta Kendra further sends this e-waste collectively to Ghaziabad for recycling purpose.

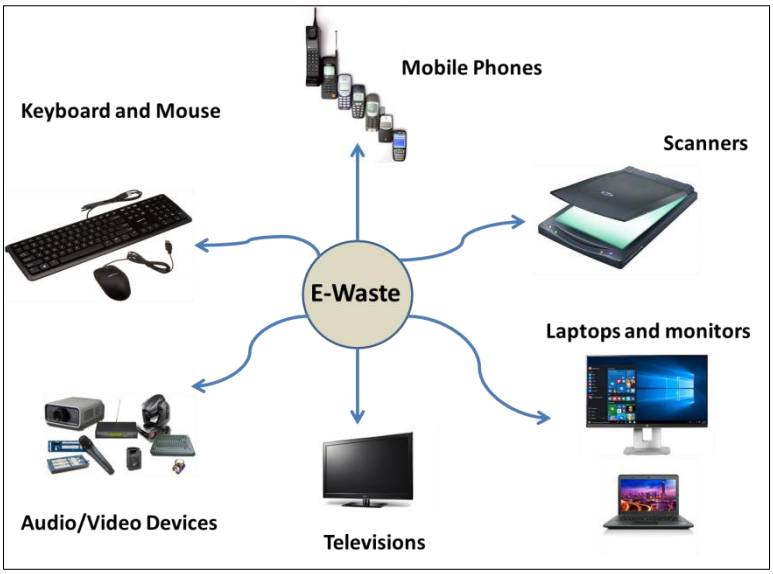

Figure 2: Types of e-waste from various household/laboratories/offices devices

The damaged electronic equipment (monitors, laptops, scanners, printers, television, audio/video equipment, electrical wires, tube lights, cell phones/telephones etc) is transferred to store yard. The images of damaged electrical equipment and e-waste dustbin are shown in **Figure 4** and **Figure 5** respectively. Few unused electrical parts are managed/recovered by instrumentation section of the institute and reused for making/binding other electrical equipment.

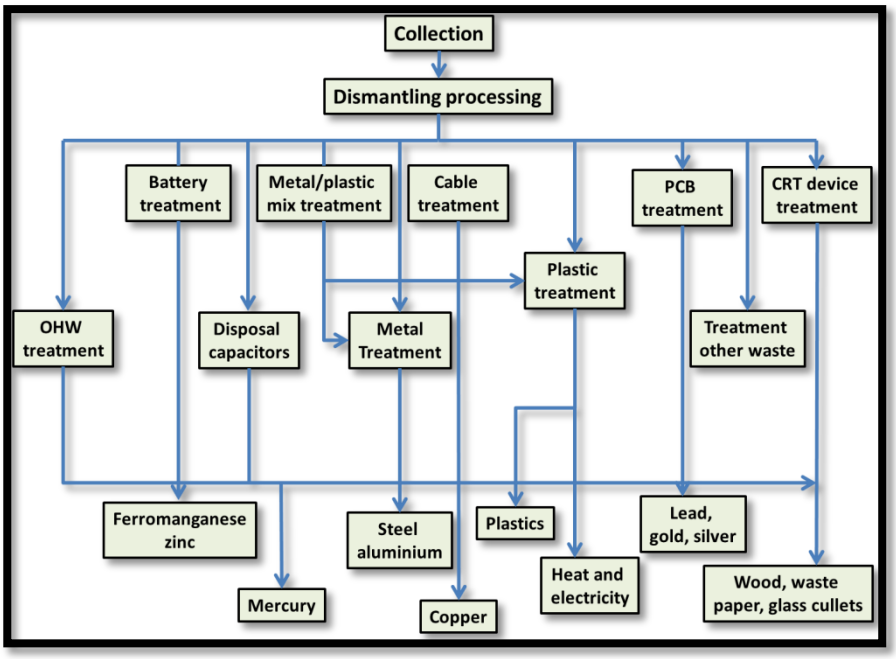

Figure 3: Proposed treatment technologies for converting e-waste to value-added products

Figure 4: Images of e-waste from store yard of the institute

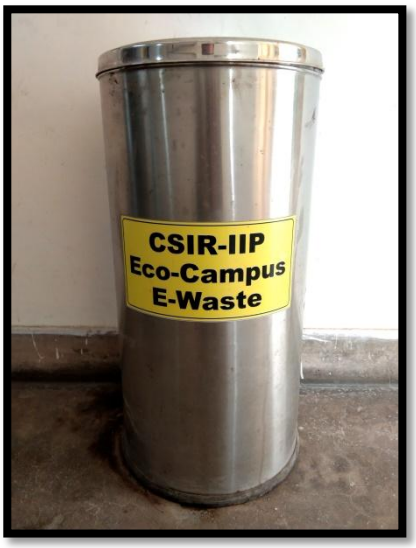

Figure 5: Separate dustbin for the segregation of e-waste in campus

Conclusion:

An initiative to e-waste management and connect the society to our nature is accelerating in many parts of the world. Towards this goal, our institute has also started an initiative to make the waste-free campus. Electricity consumption details in all the buildings of the campus have been discussed. Commendable initiatives such as keeping separate dustbins for reducing the e-waste and sending it to industry for recycling have been taken by the institute.

Acknowledgement:

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References:

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