Energy Conservation Management at BITS Pilani, K. K. Birla Goa-Campus

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Welcome to BITS

About BITS, Pilani

- Premier University since 1964,
- Main Campus at Pilani, Distt. Jhunjhunu, Rajasthan
- The Goa-Campus (KKB GC) started in August, 2004
- Institute Campus spread over 180 acres
- The project was executed by Zuari Industries Ltd. (2002-2004)
- Fully residential campus, ideal educational set-up with modern amenities matching international standards

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE PILANI, GOA CAMPUS

- Functioning since August 2004
- 74,30,390 Sq ft overlooking the Zuari river
- On NH17 B By Pass Road
- 5 km from the Airport

GOOGLE EARTH VIEW OF CAMPUS

Welcome to BITS, Pilani - Goa Campus

The Goa-Campus: AC Areas

- The Institute Building: (28,000 Sq.m.)
  - Faculty Chambers - 150
  - Class Rooms - 27
  - Lecture Theatres - 4,
  - Seminar Hall - 2,
  - Conference Hall-1,
  - Offices- 5,
- Central library & Computer Centre (8,000 Sq. m.)

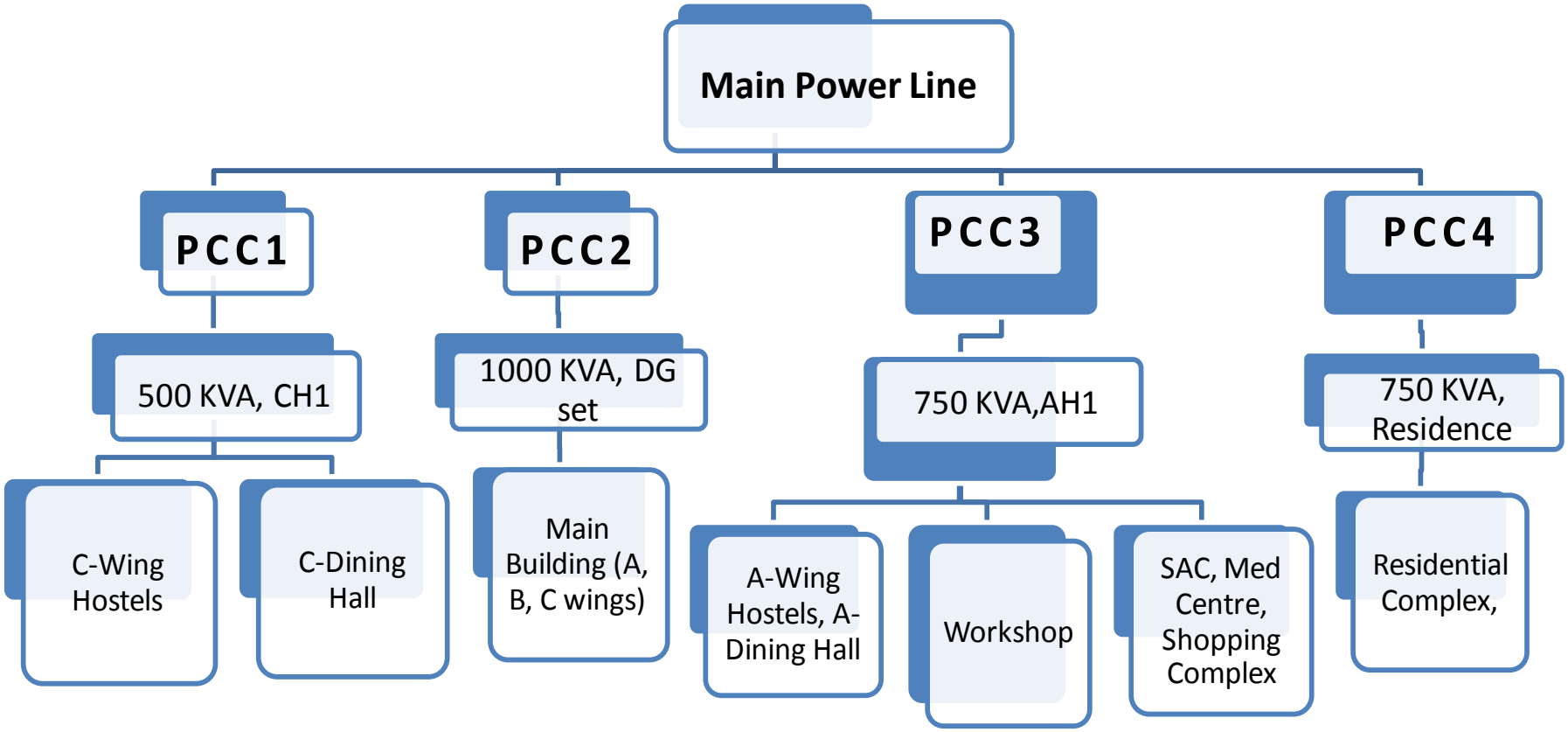
Buildings on Campus

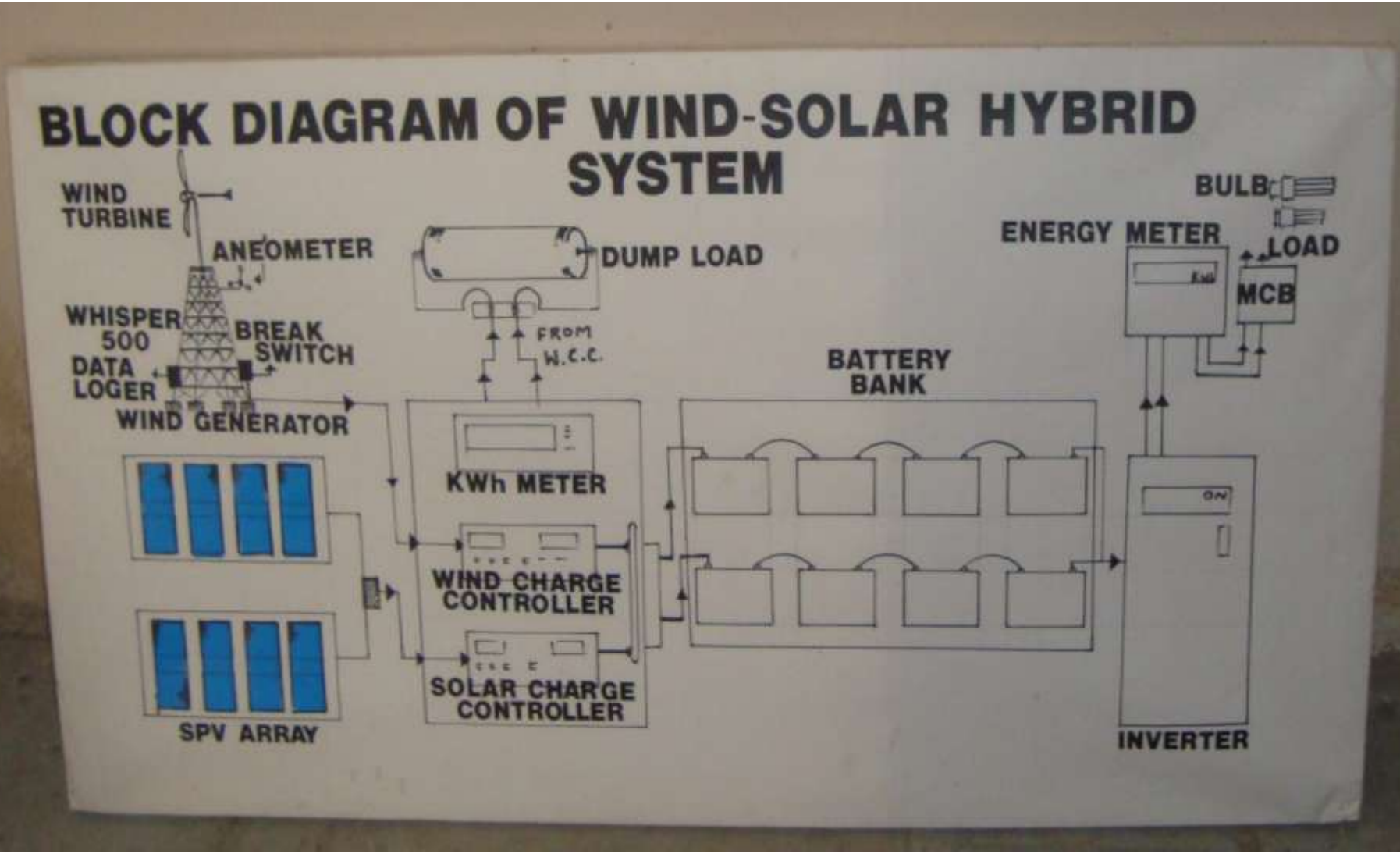
- Auditorium (6200 Sq. m) (AC)
- Central Workshop- Window AC (864 Sq. m.)
- Medical Centre- Window AC (824 Sq. m.)
- Student Hostels- 14 (60,000 Sq.m.) (Non AC)
- Visitor's Guest House (1300 Sq.m.) (AC)
- Shopping Complex (1230 Sq.m.) (Non AC)
- Student Activity Centre (3820 Sq.m.) (Non AC)
- Residential Quarters – 250 Nos. (26,000 Sq.m.) (AC/Non AC)

Electrical Utility Services

- Electrical Utilities-
  - 33 kV Yard , Distribution Transformers
  - Four PCCs,
  - DG sets,
  - Central AC Plant,
  - PWD Water Pumping and Supply,
  - Street Lighting, Indoor and outdoor lighting
  - STP
- SPV+Wind Hybrid Power Generation (5 kW + 10 kW) funded by GEDA and MRE, GoI (August, 2009)

Electrical Distribution of Campus

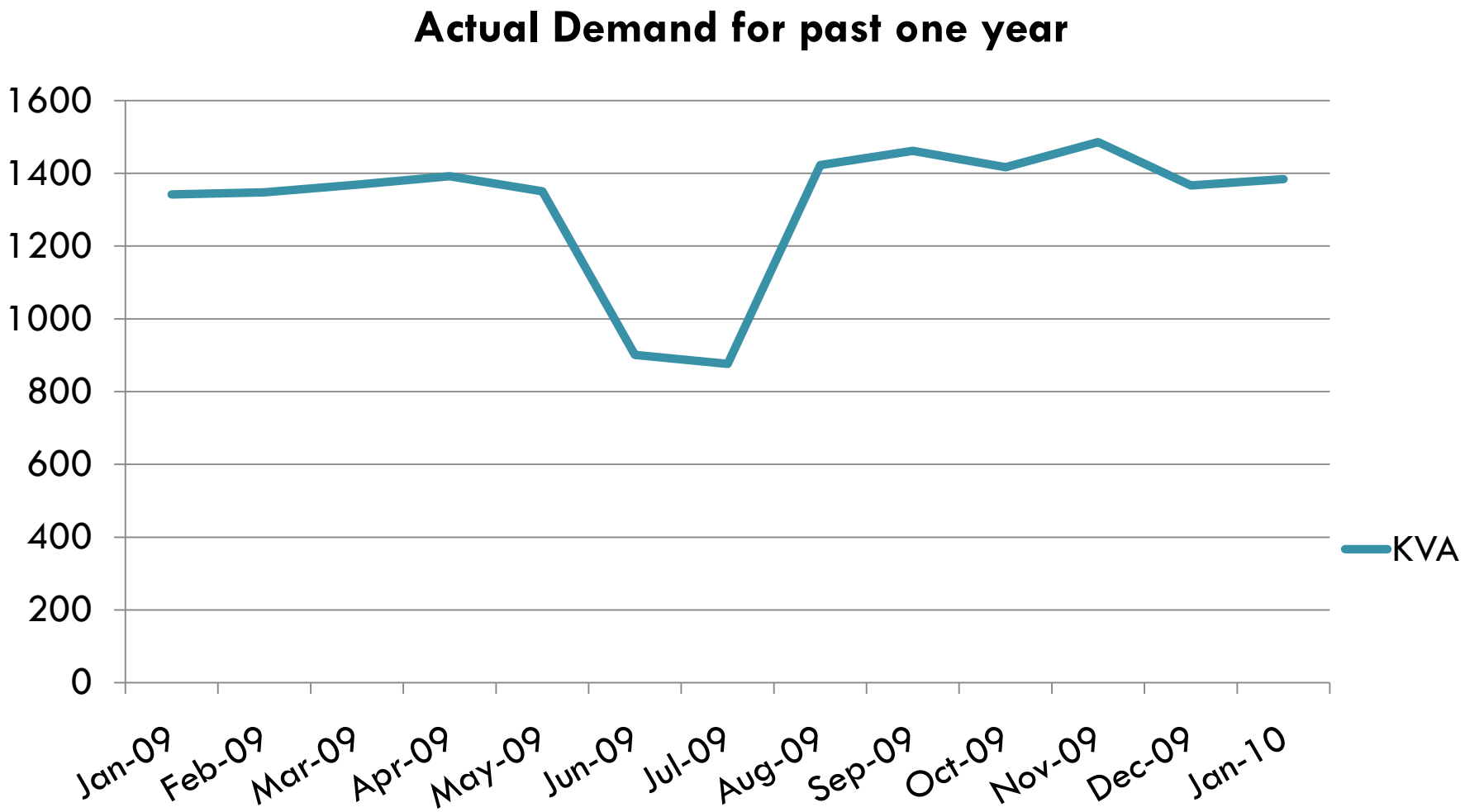



BLOCK DIAGRAM OF WIND-SOLAR HYBRID SYSTEM
WIND TURBINE
ANEOMETER
WHISPER 500
BREAK SWITCH
DATA LOGER
WIND GENERATOR
SPV ARRAY
DUMP LOAD
FROM W.C.C.
KWh METER
WIND CHARGE CONTROLLER
SOLAR CHARGE CONTROLLER
BATTERY BANK
BULB
ENERGY METER
LOAD
MCB
ON
INVERTER

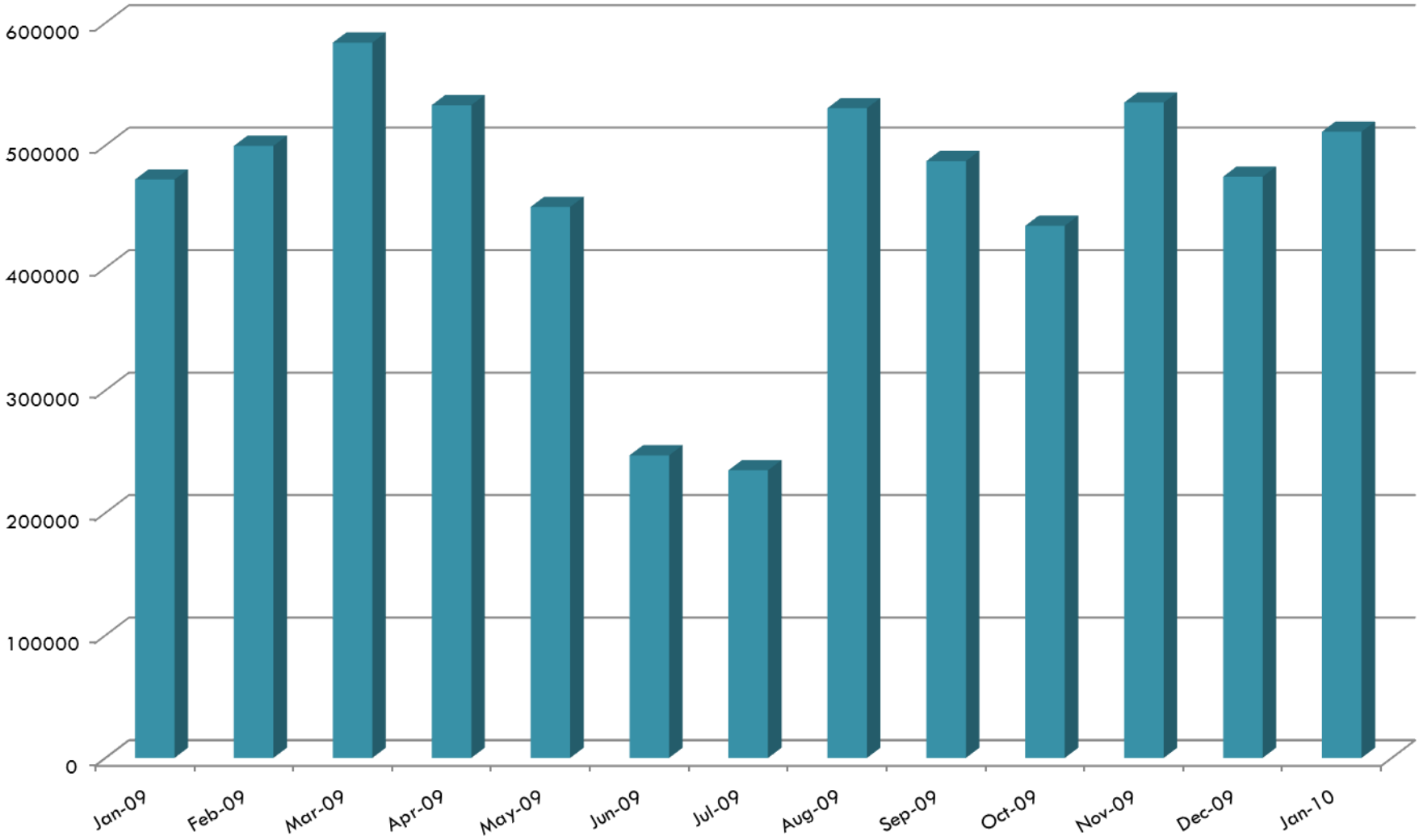
ELECTRICAL ENERGY SCENARIO

- Type of supply: 33 kV/11kV, 2000 kVA
- Tariff applicable: Two Part- Demand & Energy
- Major loads: AC, Water Pumping, Heating
- Monitoring system: Log books,
- O&M system: Qualified engineering staff
- Electricity Consumption: Season wise
  - **August to December, (Semester-I)**
  - **January to May, (Semester-II)**
  - **June to July, (Summer Recess)**

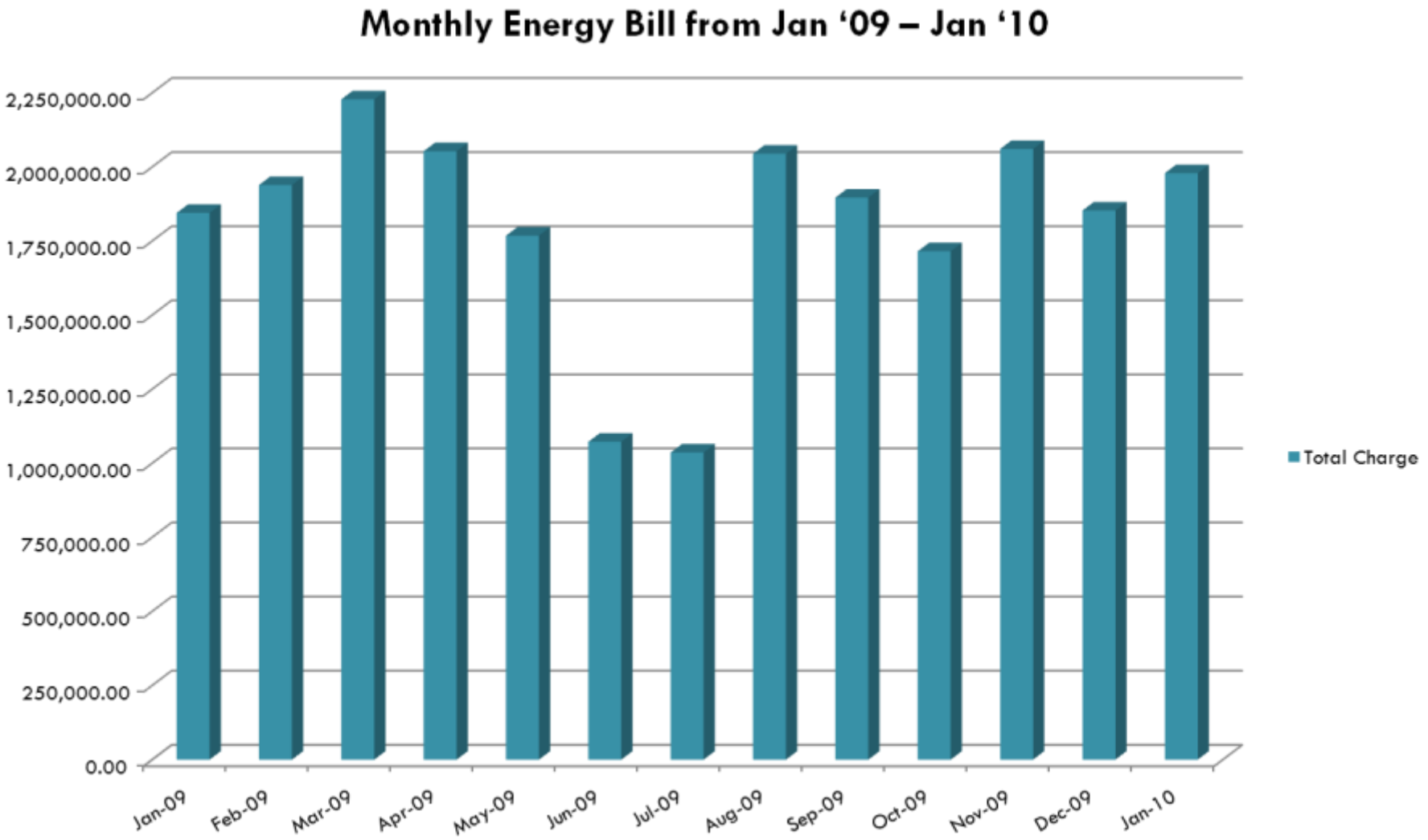
Typical Demand (kVA) Curve



Electricity Consumption, kWh



Electricity Bill (Rs./month)



Central Air-conditioning Plant

- Screw Compressor Water-Cooled Liquid Chiller Carrier Make, installed by Blue Star,
- Capacity 665 TR/Hr.
- Three Chillers with seven Compressors: Each Chiller has capacity of 235 TR
- One Cooling Tower with Three Cells, Each Cell with 15 kW fan motor (Pharapur make)
- Many AHUs installed in Class rooms, Chambers, Labs, Lecture Theatres, library and Computer centre, Server Room

Operation of Central AC Plant

- Electrical Load is 750 kVA, i.e., 40% is due central AC Plant.
- Hours of operation 14 Hrs/day
- 26 days per month operation
- Full load operation for 9 Hrs and part load for 5 Hrs per day
- Maintaining record of operating parameters

Good Practices of O & M

- CHILLER
  - High Energy Efficiency Screw Compressors
  - Very low maintenance
  - Energy saving mode
- AIR HANDLING UNIT (AHU)
  - Requires very low maintenance
  - Independent operation and control of each unit is possible
  - Better and effective cooling space
  - Better control over cooling rate and operation

MAINTENANCE OF AHU’S

- Carried out every week or fortnight
  - Cleaning of filters
  - Belt checking; if damaged to be immediately replaced
  - Condenser coil cleaning
  - Vibration monitoring ,if any, lose to be tightened
  - Avoid the breakdown

PUMPS

- Daily routine checking
  - Oil checking
  - Vibration
  - Temperature
  - Pressure maintenance
  - Gland tightening: presently all the gland packing is being replaced by mechanical seal
- Advantages:- This prevents the shaft damage, water leaking (chilled). Eliminates wastage of water, effluents and improves safety. Minimizes requirement of chemical dosing and chilled water, as these are costly

COOLING TOWER

- Daily check for following, before starting machines:
  - Gear box and motor vibration & Temperature
  - Gear box oil
  - Sprinklers and Fins. If found choked, then & de-choke

Air Discharge from Cooling Tower

- The In-house staff implemented modification for improving energy efficiency of CT. Accordingly,
  - On the top of Cooling tower, a discharge duct with increased height of 1 m is added
  - This has led to improved,faster cooling of water in CT through 2 to 5 ^{o}C.

Energy Saving in Lighting

- 80% of existing tube lights, Sodium Vapour Lamps, Mercury Vapour Lamps are replaced with CFL which are energy efficient, long lasting and power saving.
- Also, lights in labs, offices and class rooms have been replaced by CFL's. This has reduced the load for air-conditioning.
- To reduce thermal load, venetian blinds have been installed on all glass windows.

Search for New ECOs

- Continuing search for current, accepted energy efficient technologies
- Minor adjustments or modifications can lead to significant savings
- Skill-level of in-house maintenance staff can savings
- Participation of young engineering and science students

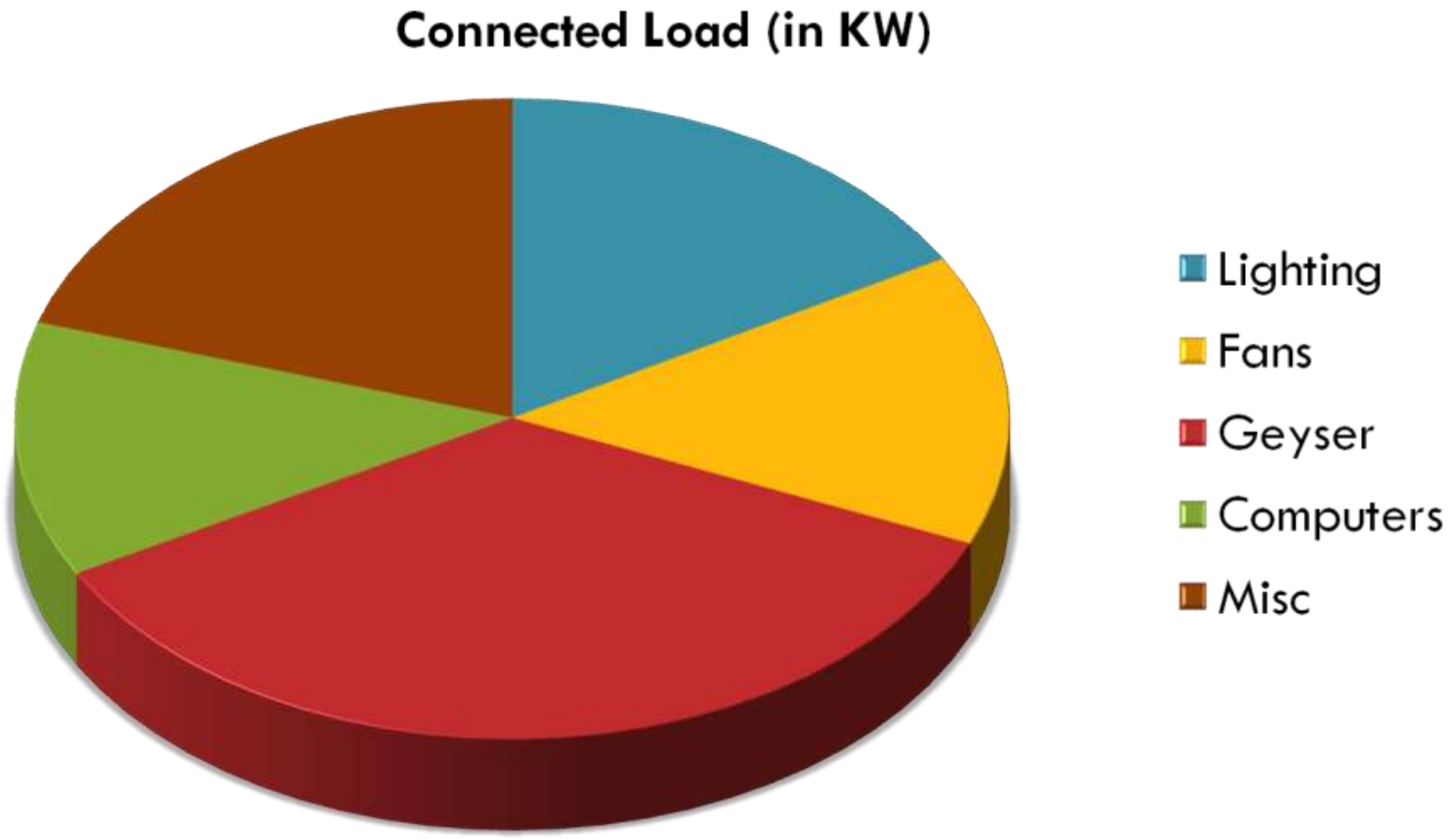
Types of Loads in Hostels

- Lighting
- Fan
- Geyser
- Computer
- Misc. Appliances
  - Kettles,
  - Irons,
  - Speakers,
  - TV(common room),

Hostel Load Distribution

HOSTEL	CONNECTED LOAD (kW)	Percentage in Total
AH1	75.48	6.29
AH2	80.16	6.68
AH3	71.28	5.94
AH4	73.2	6.10
AH5	73.44	6.12
AH6	80.04	6.67
AH7	79.32	6.61
AH8	79.32	6.61
CH1	134.2	10.81
CH2	59.64	4.97
CH3	59.64	4.97
CH4	**225.24**	**18.77**
CH5	109.04	9.46

Connected Load due to Hostels



Short Term Payback Measures

- **Checking and sealing of AC leakage.**
- Regular maintenance of equipment.
- **Regular detailed energy audits.**
- Insulation of hot water pipes and tanks.

Short Term Payback Measures

- Use energy efficient lamps
- Repair exhaust/dampers
- Weatherstrip doors
- Delamping
- Install additional light switches
- Repair pipe insulation
- Recalibrate thermostats

Long Term Payback Measures

- **Investment in smart metering and other electronic DSM systems for effective monitoring and controlling of equipment**
- **Install Timer Switch for Exhaust Fans in bathrooms, toilets in hostels**
- Energy Park – clean energy supply.
- Install Solar Water Heating Systems on Hostel Roof Top

Timer Switch for Exhaust Fans – Experimental Study by Students of BPGC, KKB, Goa-Campus

Energy Conservation in BITSG

- **Method 2 Replace the old exhaust fans with new energy efficient exhaust fans**

SPRING AIR

› Economical. Quickly removes stale air to bring in the freshness of spring. Powder coated metallic colour.

SPRING AIR			
Sweep in mm	RPM	Air Displacement in m3/Hour	Consumption in Watts
225	1300	780	45
300	1300	1290	65

To Do List As on 19/05/2010

- **The focus is on maintaining good practices of O&M**
  - **Keep air conditioner running efficiently**
  - **Reduce conditioned space**
  - **Use shading efficiently**
  - **Raise the air conditioner thermostat setting in summer**
  - **Lower the heating thermostat setting in winter**

To Do List Contd..

- **Reduce light level**
- **Plug air leaks in the building's envelope**
- **Repair any leaks in pipes and ducts**
- **Caulking and Weather stripping to check infiltration….**
- **Implement Renewable Energy Systems on Campus such as SWHS, SPV, WECS, Bio power, etc..**

Thank you!!