Smart Energy Optimisation for Commercial Buildings: A Case Study

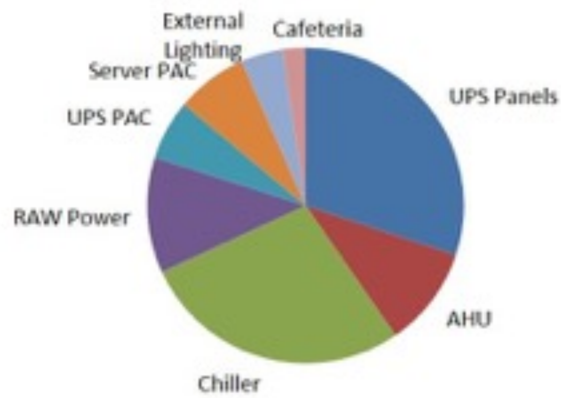
zenatix

Typical Consumption in an Office Environment

(Break-up for the month of April for an office space, located in Delhi, India, with approx. 135,000 square feet of carpet area and central air conditioning)

Heating, Ventilation and Air Conditioning (HVAC) ~ 50-60% of total consumption
UPS Backup (powering all the IT loads) ~ 30-35%
Lighting and plug loads ~ 10-15%

In countries like India, all this demand is serviced by a Diesel Generator (DG) during several hours of grid failure every day.



Our advanced analytics drive energy savings specifically by optimizing HVAC, UPS and DG consumption (primary loads contributing to > 90% of your cost)

Example Intervention – 1: Chiller-AHU Reference Start Time

Based on an earlier advice by some energy auditor (simple air by AHU in the morning results in 1-2 ºC drop in the ambient temperature resulting in lower load on the chiller when it is turned on and hence energy savings), the customer was switching on AHUs 30-45 minutes earlier than chiller start time. Collected data showed that temperature drop by such an activity was at most 0.2 ºC and hence was indeed resulting in energy wastage of more than Rs 7000/ month rather than energy reduction.

Before

After

Take data driven decisions: Use our platform to quantify savings for every energy efficiency action you take

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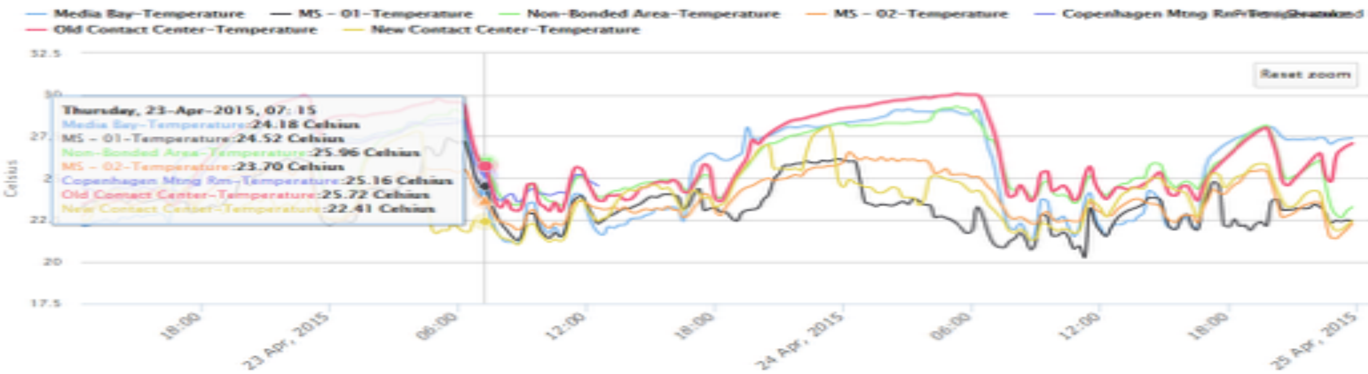
MAKING SENSE of ENERGY DATA

Example Intervention – 2: Optimising Chiller On Time



Before: Scheduled on time of chiller and AHU (based on previously followed policy) was resulting in desired temperature being achieved by 7:15 AM for an office scheduled to start at 8 AM. With approx. 200 KW of combined AHU load and 45 minutes of possible delay time (for this specific day), the savings with optimal start time would have been ~ Rs 1500/day.

Using inside temperature, outside weather and energy data, our proprietary analytics develop a (continuously learning) leakage rate model for your building. This model then indicates optimal start time for every day based on outside weather conditions using an SMS (or can automatically control your HVAC, if desired)

Example Intervention – 3: Temperature Based Chiller/Compressor Switching During Working Hours

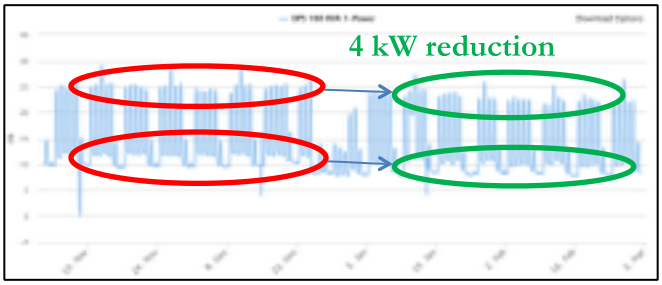
Real time monitoring of temperature data in the occupied zones and the thermal model learned by us provide feedback for windows of opportunity when a chiller can be switched off or can be run on partial load (switching off one compressor). Without our system, even with a BMS in place, such opportunities are typically missed due to lack of data and complex interplay between different HVAC system components (Chillers, Pumps, AHUs and VAVs)

Our intelligence tells you in in real time on how to operate your HVAC efficiently during working hours. Control can also be automated (both with and without BMS)

Example Intervention – 4: Identify and Control Wasteful Operations

4 AHUs were running during the night shift when the occupancy is low. Our analysis showed that desired temperature can be achieved with only 2 AHUs reducing approx. 10 KW of night time load.

With insights on high night time lighting load, tighter control can be put in place.



Desktops are often left on during non-working hours. Better messaging to employees and use of IT tools to put these machines in sleep can save significant energy

Buildings are living ecosystems. One time monitoring by energy auditors has limited use. Our system helps you identify wasteful operations when they happen, develop policies to mitigate them and automatically ensure that policies are adhered.

Example Intervention – 5: DG Optimisations

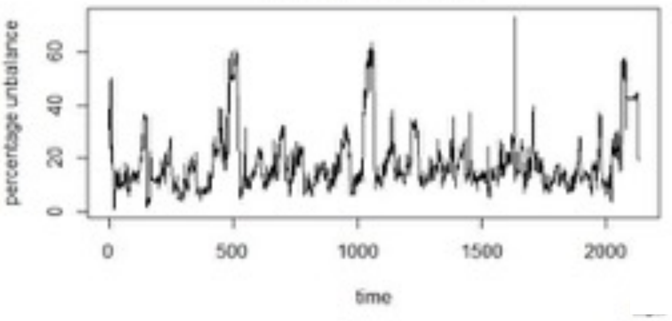
Per KwH cost of running on DG is often 3-4 times the cost of running on grid. Several ways in which the DG running cost can be optimised are:

1. Use our load estimation to know which DG to run at what time (when you have 2 DGs of different capacity e.g. 400 KVA and 750 KVA)
2. Optimise your testing schedule to avoid no-load operations
3. Get alerts when the facility is still running on DG even after the grid supply is restored
4. Our correlations of DG tank level sensors and energy consumption help you identify diesel theft in real time

Diesel Saving Calculations	
No. of tests in 1 month (Before)	30
No. of tests in 1 month (After)	17
Minutes (each testing)	4
Reduced DG on minutes (in 1 month)	52
Total per hour DG consumption for 4 DG's on No load	140
Total Diesel saving in DGs	121
Saving (Rs.) with diesel price as 52 rupees per liter	**6,292**

Optimise DG operations to save money and contribute to cleaner air for our children

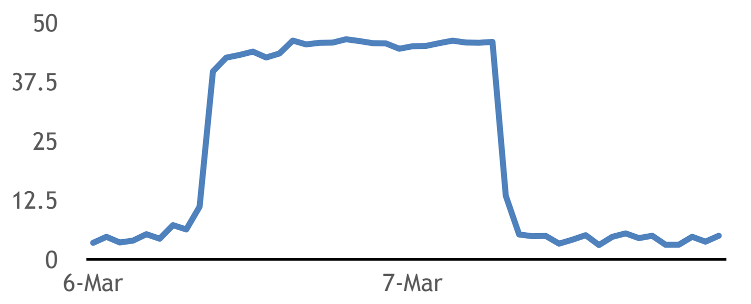
Intermittently Unbalanced System

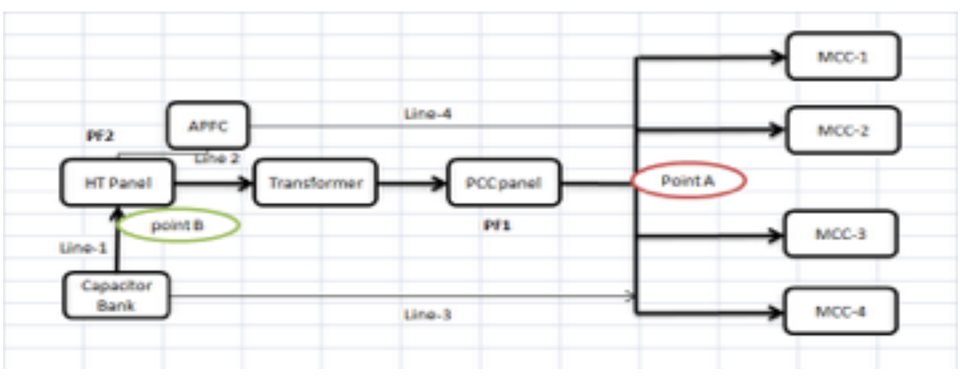


Real time data from the main meter is analyzed to keep track of voltage and current imbalances that can eventually lead to large line losses, extra heating of motors in the equipment, reduced equipment lifetime and higher harmonics, among others. In this case, Phase Y was observed to be problematic which was rectified by distributing some single phase loads cross other two phases.

K factor transformers have additional heat dissipation capability for handling effects of non-linear loads. As transformer's efficiency and heating of both winding and oil depends upon the current, sudden changes in the K factor can result in poor performance as well as lower transformer life. Zenatix system monitors and alerts for sudden changes in the K-factor of transformer.

Sudden Increase in Transformer K-Factor





We often observe that the location of capacitor panels and the sizing of capacitors in the panels is inappropriate leading to intermittently poor power factor and hence higher electricity bills. Zenatix recommends the right sizing and location of capacitor panels based on analysis of collected data

Connection Arrangement	PF at Point A	PF at Point B	Pros	Cons
Both capacitor and APFC at Point A	*0.99*	*0.95*	*Reduced Distribution Copper losses*	*Poor control on PF at HT, extra KVA charges from*
Both capacitor and APFC at Point B	*0.8*	*0.99*	*PF at HT will be near to unity, minimum KVA charges*	*Poor distribution PF, High copper losses in transformer and cables*
Capacitor at Point A and APFC at Point B	*1.01*	*0.99*	*Low copper losses and better control over HT PF*	*PF can go above unity, which will can be harmful if fed from a DG*

Data and its automated analysis from Zenatix helps in both longer life for the equipment and reduced losses in the electrical infrastructure.