

Enterprise Energy Management

DEBASHISH CHAKRABORTY

General Manager – Strategic Alliances & Energy Efficiency



Humanity's Top 10 Problems for next 50 yrs

1. ENERGY

2. WATER

3. FOOD

4. ENVIRONMENT

5. POVERTY

6. TERRORISM & WAR

7. DISEASE

8. EDUCATION

9. DEMOCRACY

10. POPULATION



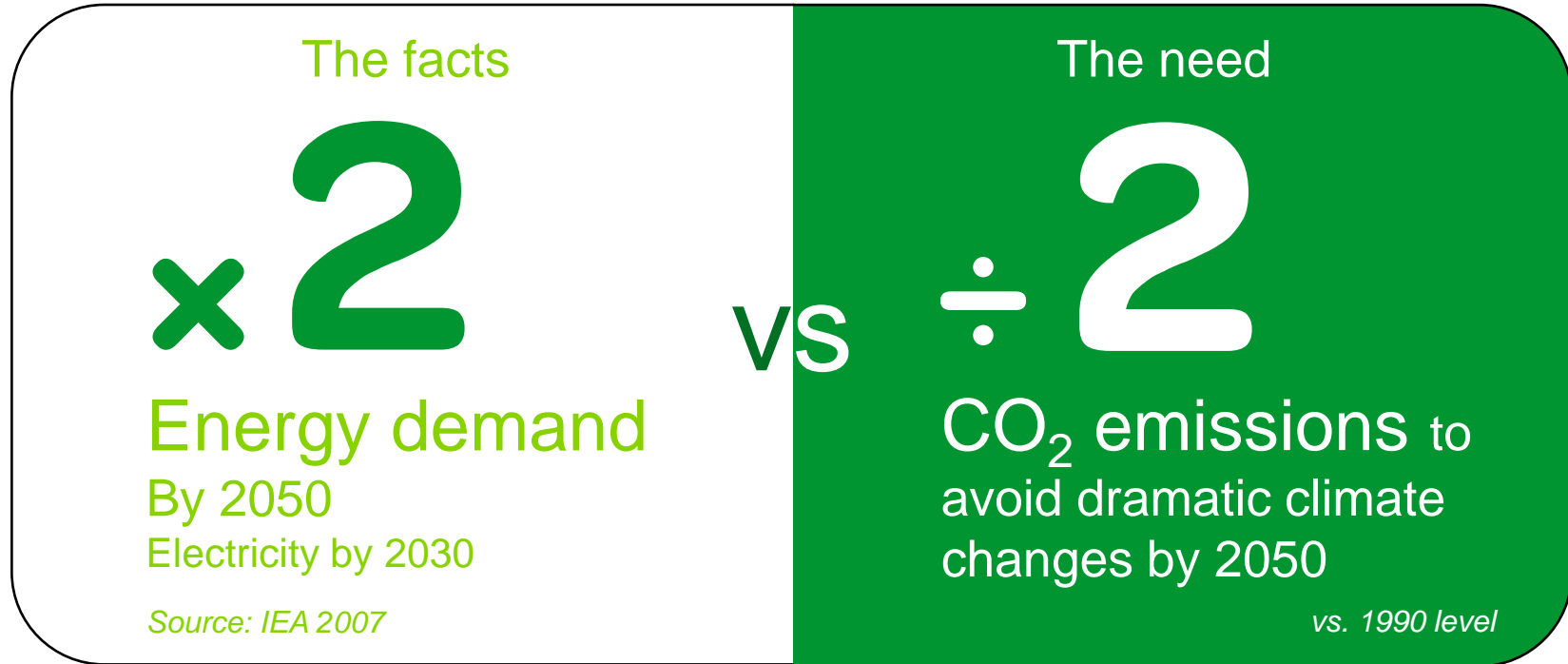
2011 - 7.3 Bn people

2050 - 9.5 Bn people

2100 - 15 Bn people

Source : United Nations

The Energy challenge is the cornerstone of our business strategy



we want to help address this challenge

What's it worth? Why bother?

Average office building

> 250 kWh/m².year

> 14 Rs/ft².month

> 1400 Rs/employee/month

Best-in-class office building

> 60 kWh/m².year

> 3.25 Rs/ft².month

> 325 Rs/employee/month

> Even just 25% of the Energy Efficiency opportunity is worth:

> 2.5 Rs/ft².month

> 250 Rs/employee/month

What's it worth? Why bother?

Average hospital

- > 300 kWh/m².year or 15,000 kWh/bed.year
- > 16 Rs/ft².month or 8,500 Rs/bed.month
- > 300 Rs/bed daily

Best-in-class hospital

- > 150 kWh/m².year or 7,600 kWh/bed.year
- > 8 Rs/ft².month or 4,300 Rs/bed.month
- > 150 Rs/bed daily

> Even just 25% of the Energy Efficiency opportunity is worth:

- > 1,000 Rs/bed monthly
- > 40 Rs/bed daily

What's it worth? Why bother?

Average hotel

> 416 kWh/m².year

> 23 Rs/ft².month

> 15,750 Rs/room.month

Best-in-class hotels

> Less than 200 kWh/m².year

> 11 Rs/ft².month

> 9,600 Rs/room.month

> Even just 25% of the Energy Efficiency opportunity is worth:

> 3 Rs/ft².month

> 1,500 Rs/room.month

Where do we start?

How do we go about it?



A Framework for Enterprise Energy Management

EEM maturity model

Basic

Organization

- Managed on a site-by-site basis
- Part time activity for staff
- Most activities at the tactical level

Process

- Often working to improve energy use at equipment level
- Manual monitoring & data collection
- Energy costs allocated to overhead

Intermediate

Organization

- Usually central control or attention
- Dedicated staff member or energy group at each site

Process

- Improved visibility into energy use
- Energy information shared across most sites
- Energy costs allocated to departments

Advanced

Organization

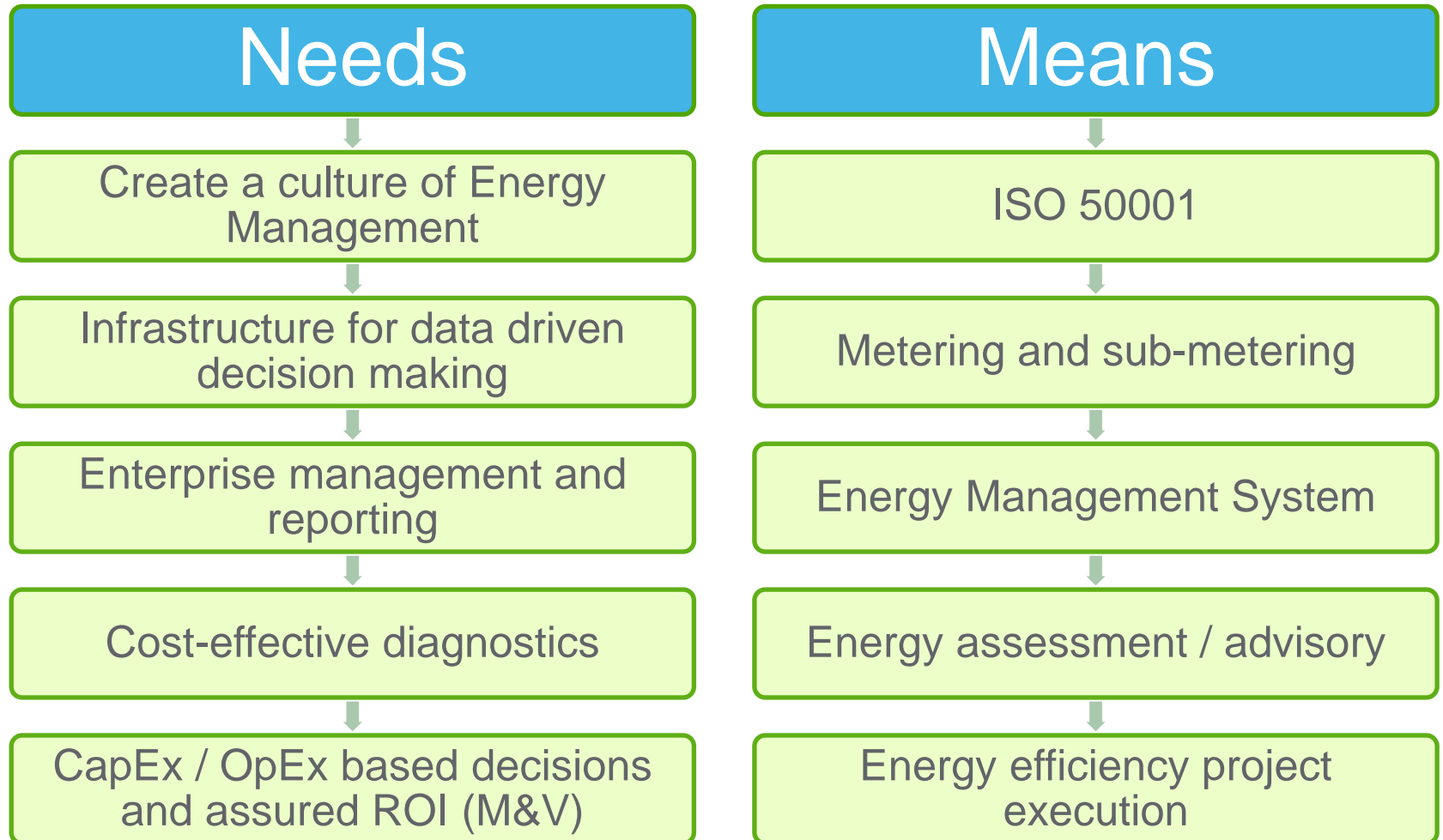
- Corporate “czar” directs, monitors activities
- Energy Management considered a core competence
- Shift to a strategic focus

Process

- Real time monitoring and optimization
- Energy integrated with production planning
- Energy information shared across all sites
- Energy costs allocated to products

KPI-driven Energy Management

From ISO 50001 to CapEx investments



“Invisible Energy”



Energy is invisible. Energy efficiency is the absence of that which is invisible.

Making Energy Use Visible, Meaningful and Actionable

What is Enterprise Energy Management (EEM)?

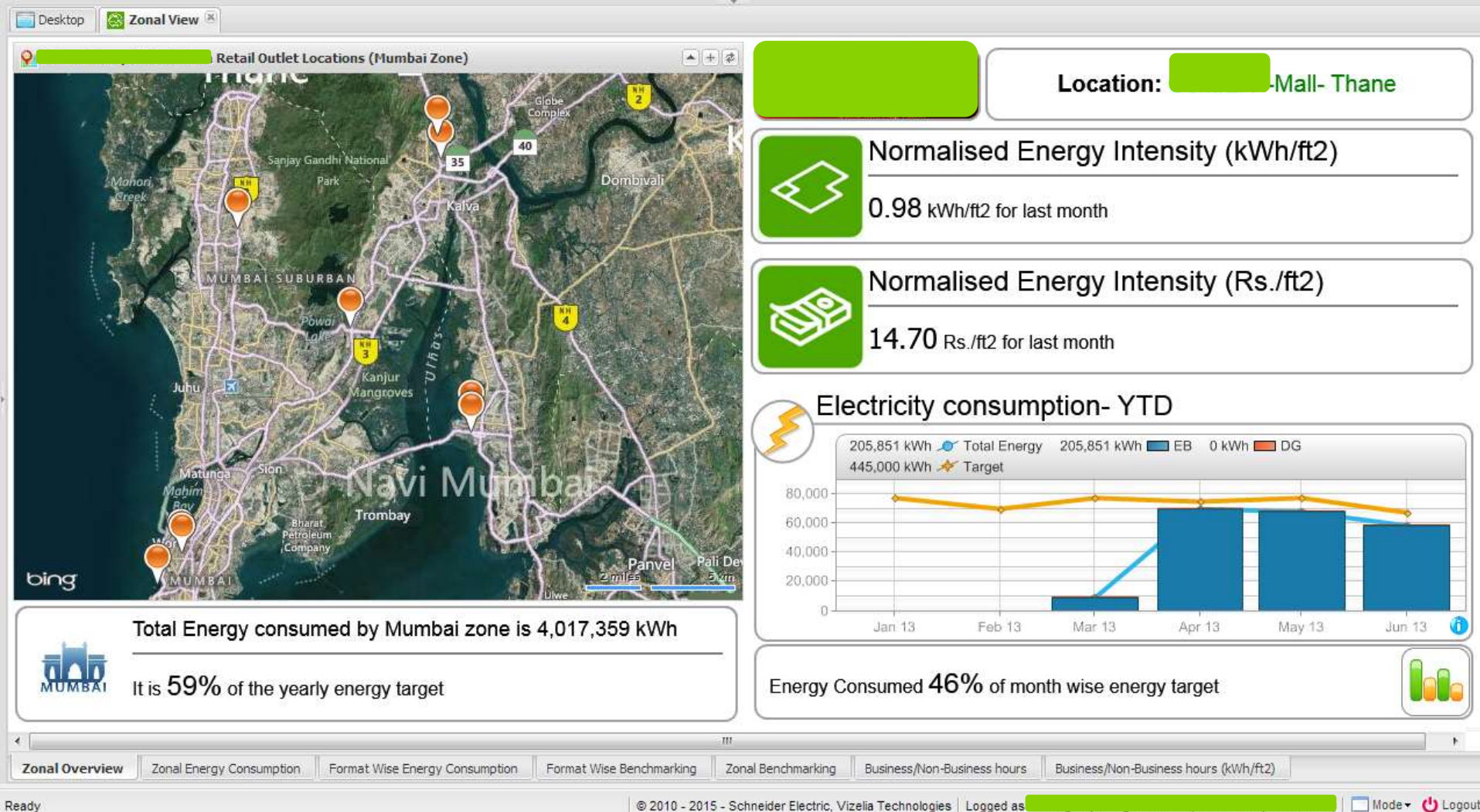
« *It is an organisation's ability to set aggressive energy efficiency targets and goals based on internal or external benchmarks, optimise energy use at all levels through energy data collection, appropriate process and procedures based on best practices and data driven decision making, and proactively deal with any climate change and sustainability policies and regulations »*



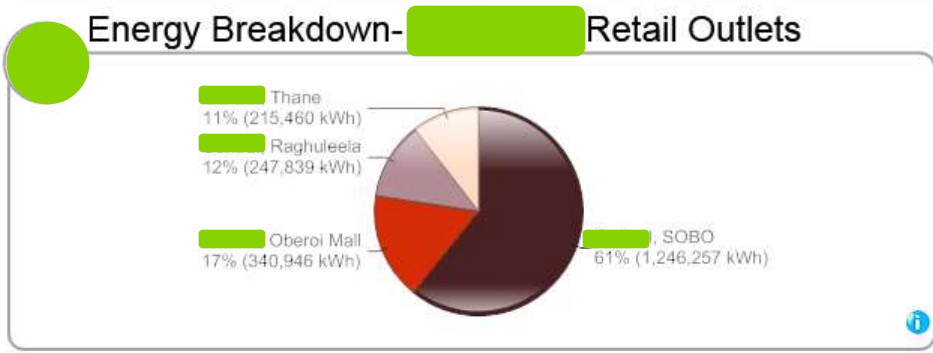
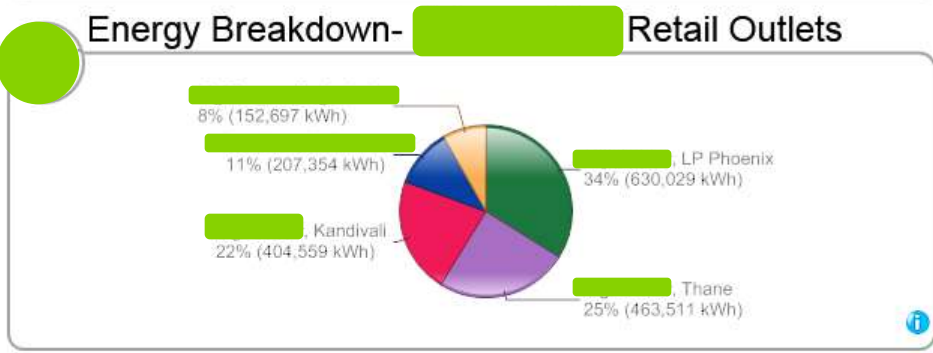
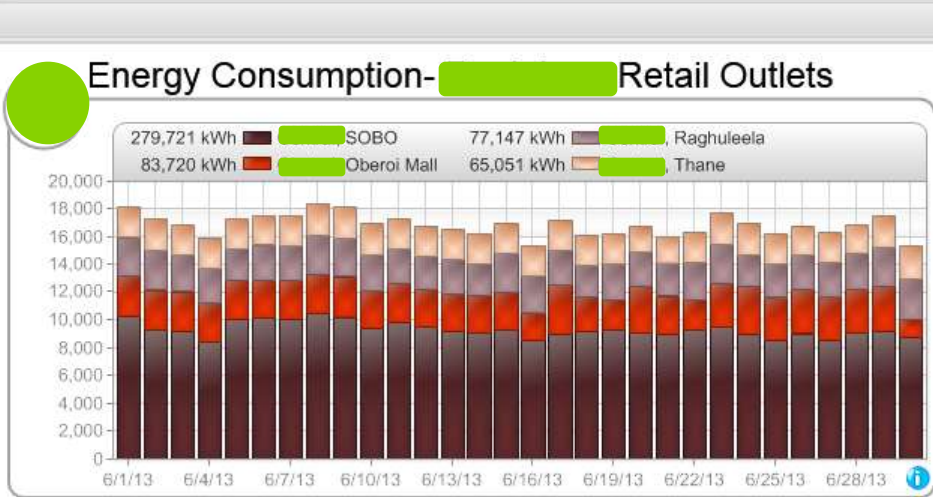
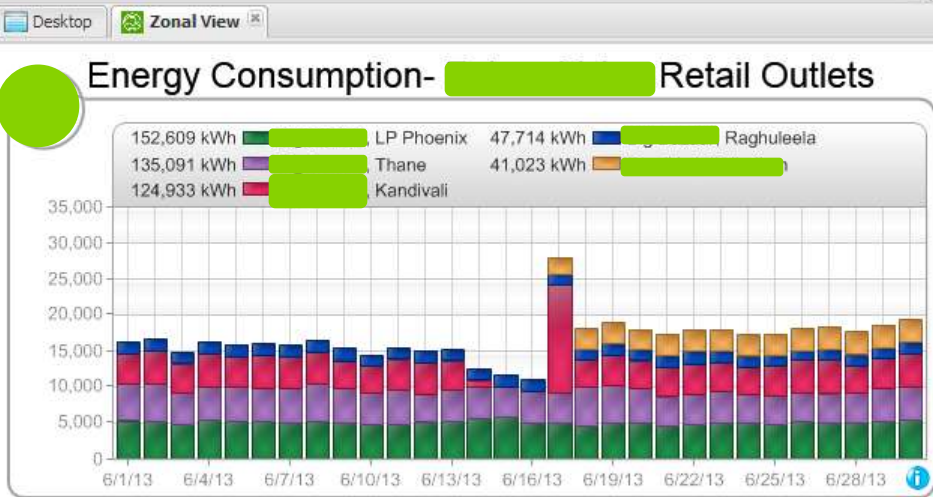
Principles of EEM

- > All energy related data is consolidated into a centralized data warehouse
- > The collected data is normalized and structured
- > Access to data is interactive to facilitate distillation of actionable information
- > The system makes it easy to measure and verify results
- > The system provides a platform that helps in early identification of poor performance
- > Support for decision making by creating actionable reports personalized to the needs of every decision maker
- > Historical energy efficiency auditing

Single click access to high level metrics



Portfolio energy consumption at a glance



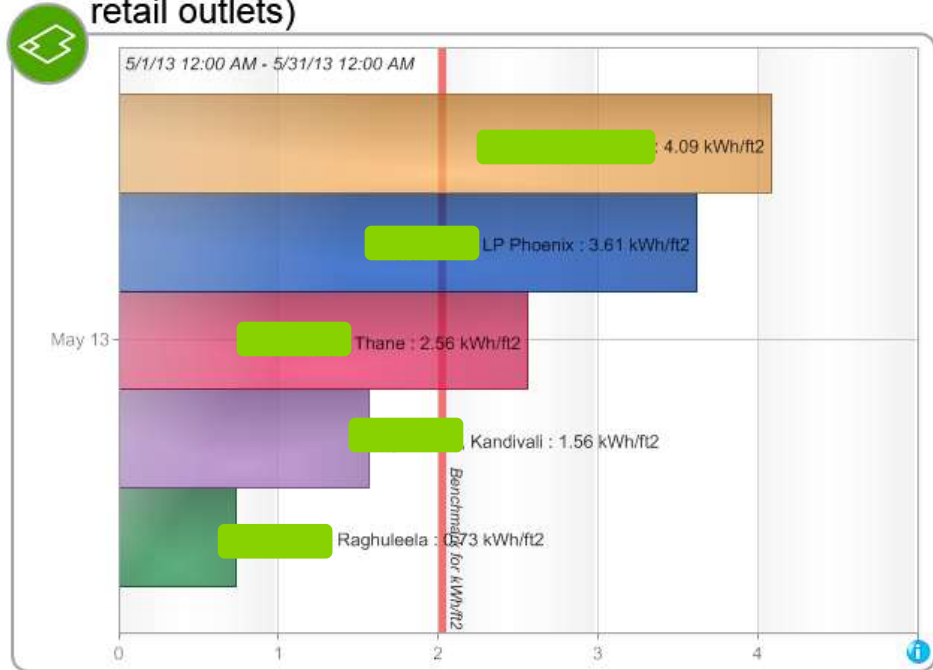
[Redacted] LP Phoenix is the highest among all

[Redacted] SOBO is the highest among all [Redacted] Malls

Identifying the energy hogs

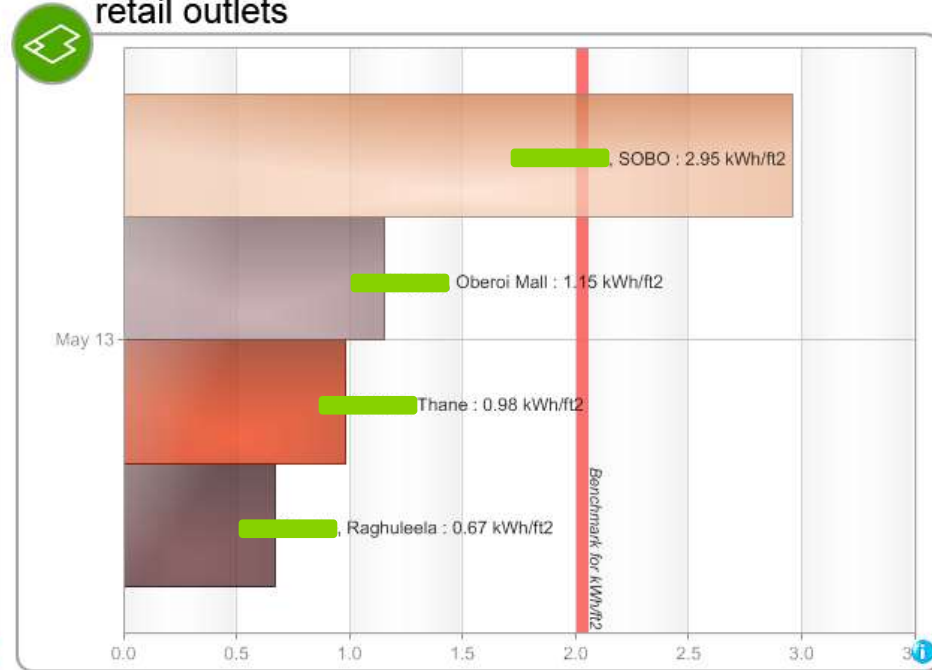
Desktop Zonal View

Energy Intensity Comparison (kWh/ft²)- [redacted] retail outlets



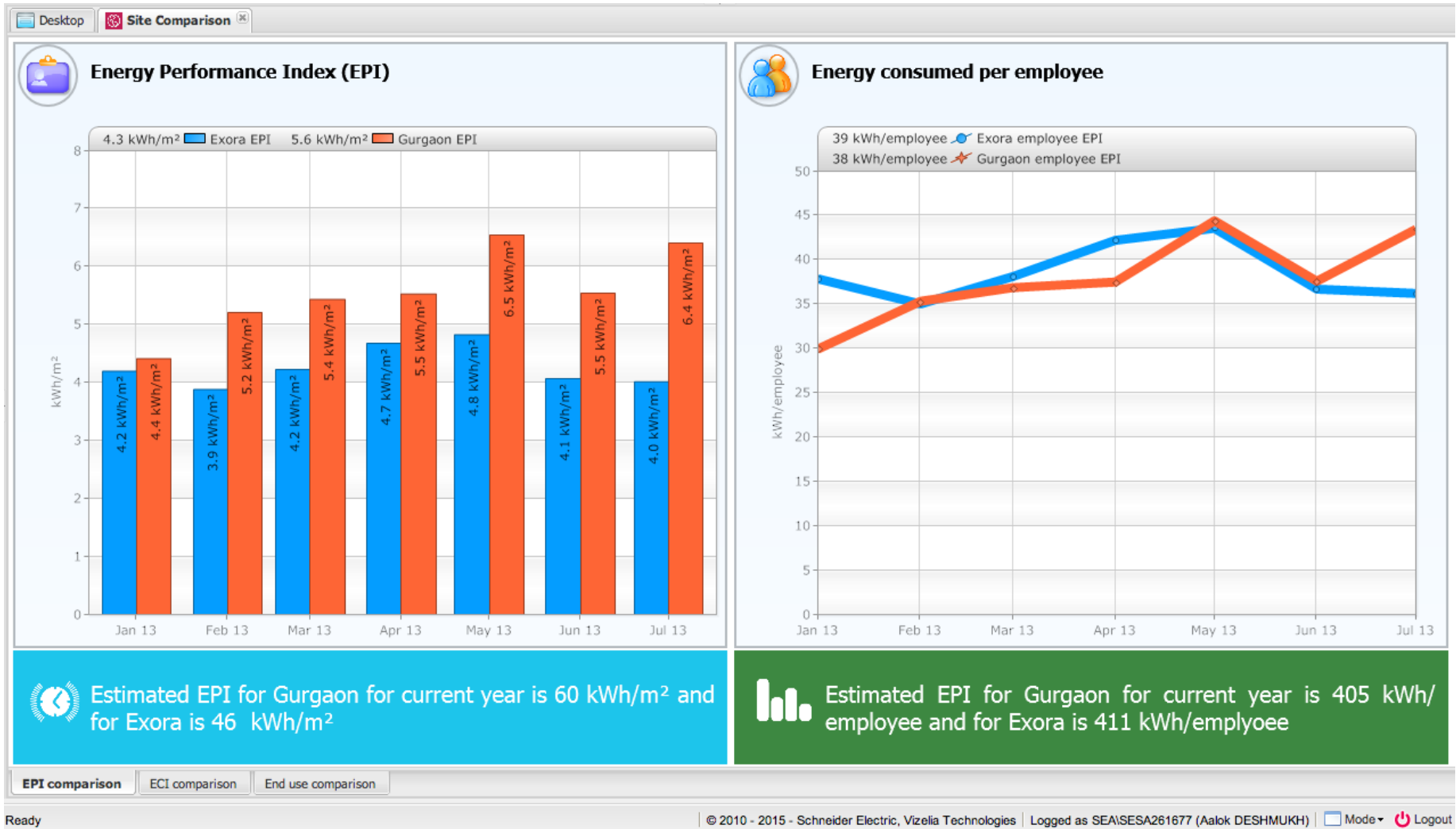
Best performer is [redacted], Raghuleela with 0.73 kWh/ft²
 Worst performer is [redacted], with 4.09 kWh/ft²
 Average Energy Intensity of all [redacted]s are 2.51 kWh/ft²

Energy Intensity Comparison (kWh/ft²)- [redacted] retail outlets

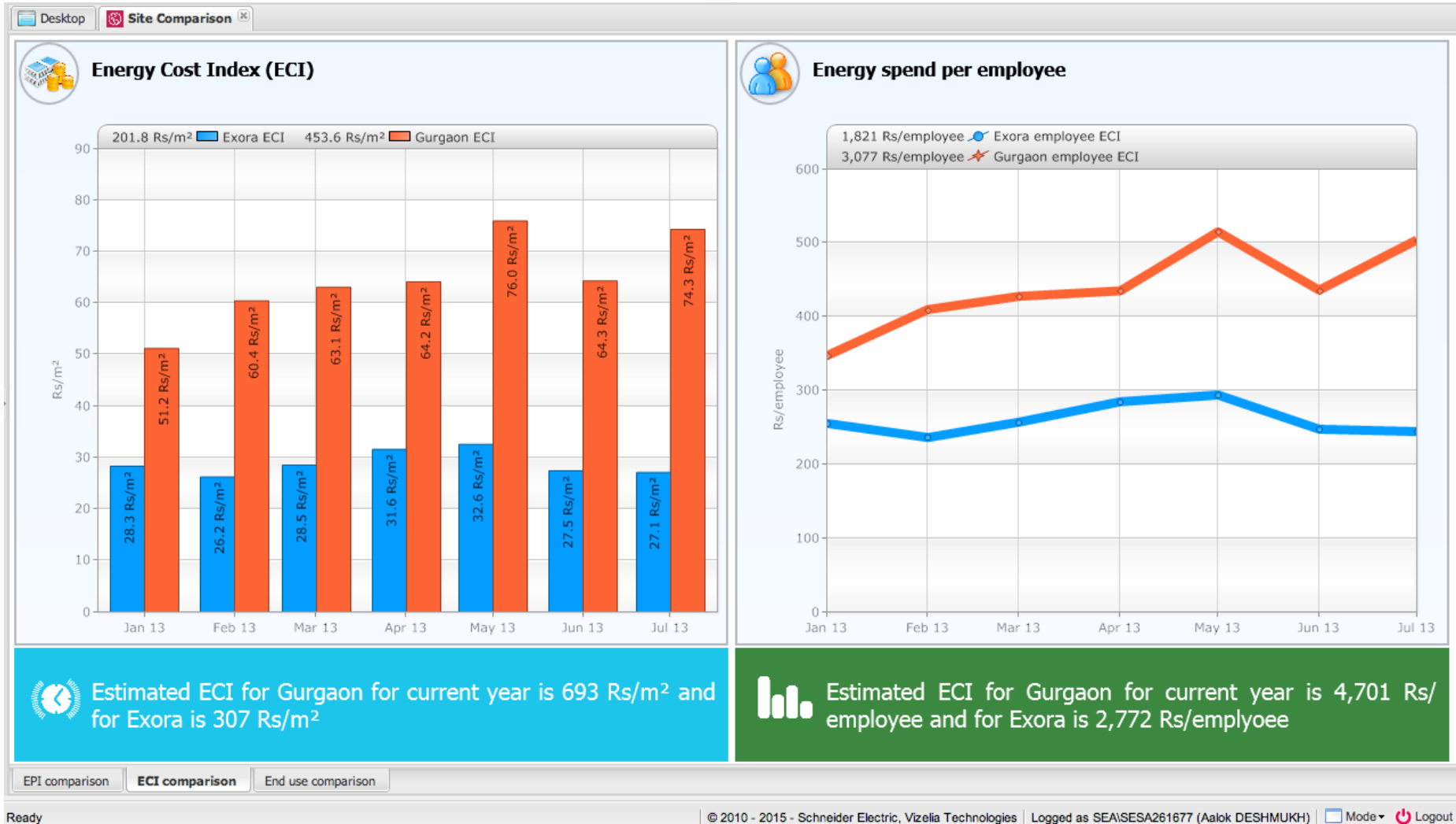


Best performer is [redacted], Raghuleela with 0.67 kWh/ft²
 Worst performer is [redacted], SOBO with 2.95 kWh/ft²
 Average Energy Intensity of all [redacted] Malls are 1.44 kWh/ft²

Comparing the right metrics...



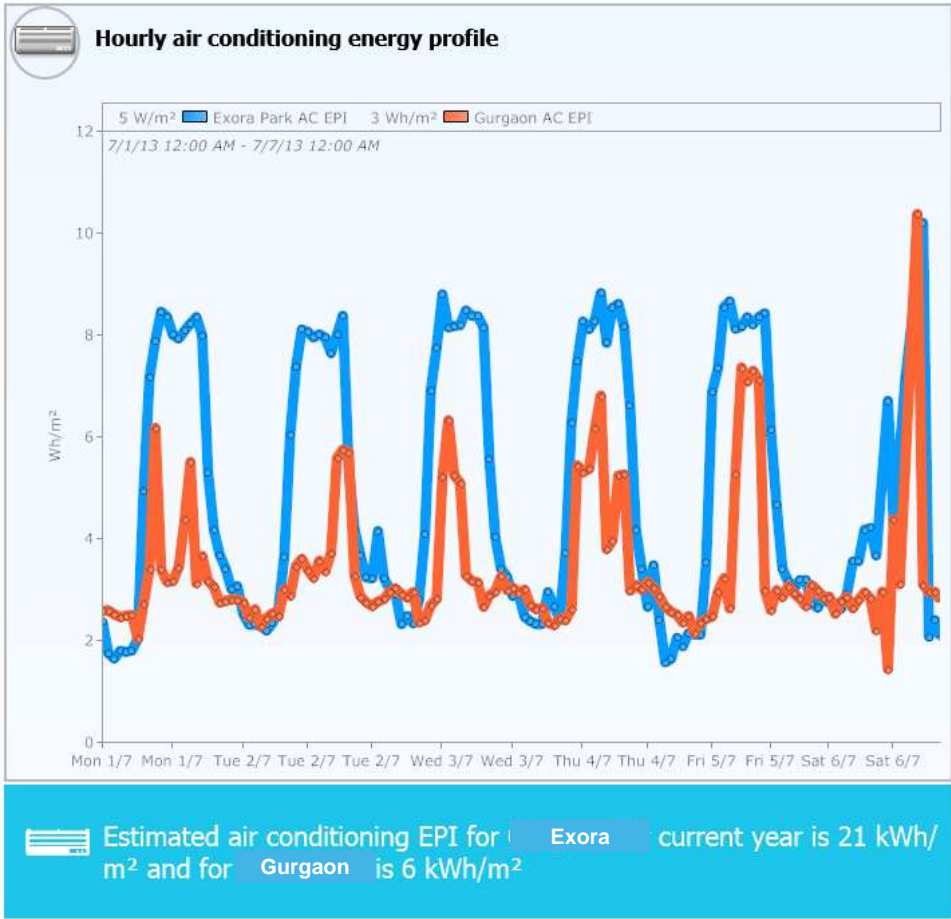
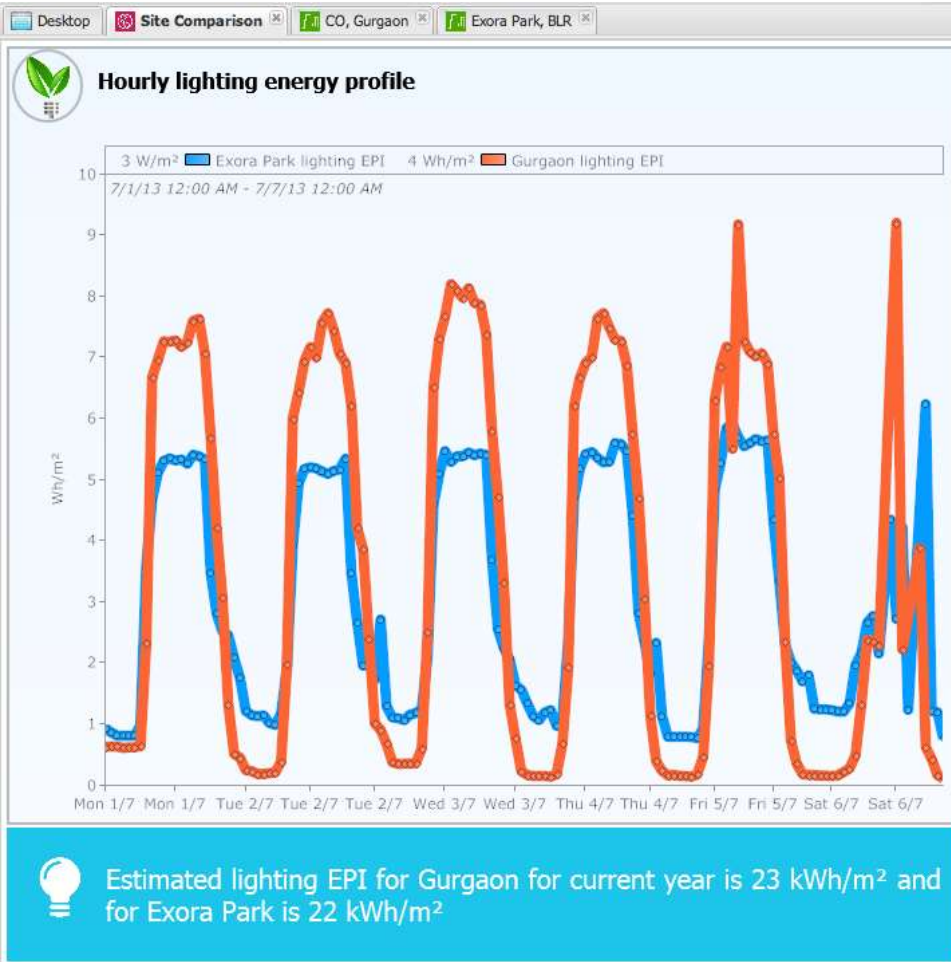
Comparing the metrics that matter...



Ready

© 2010 - 2015 - Schneider Electric, Vizelia Technologies | Logged as SEA\SESA261677 (Aalok DESHMUKH) | Mode Logout

Comparing end uses across facilities...



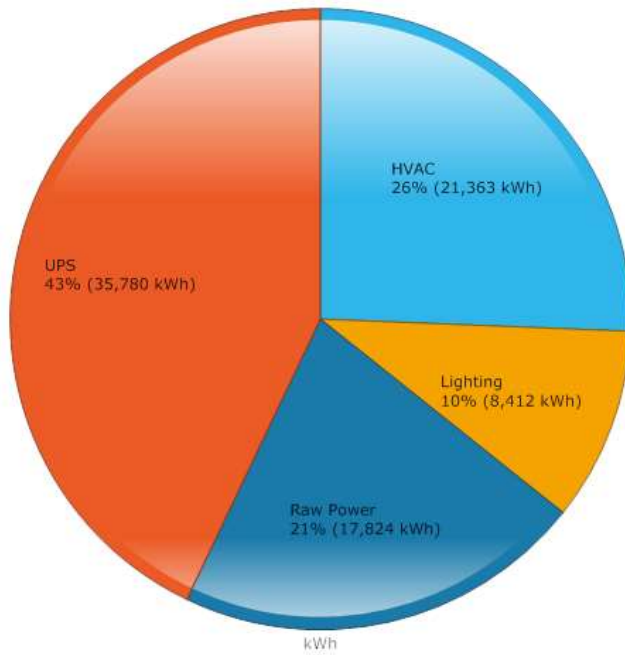
EPI comparison | ECI comparison | End use comparison

© 2010 - 2015 - Schneider Electric, Vizelia Technologies | Logged as SEAISESA261677 (Aalok DESHMUKH) | Mode | Logout

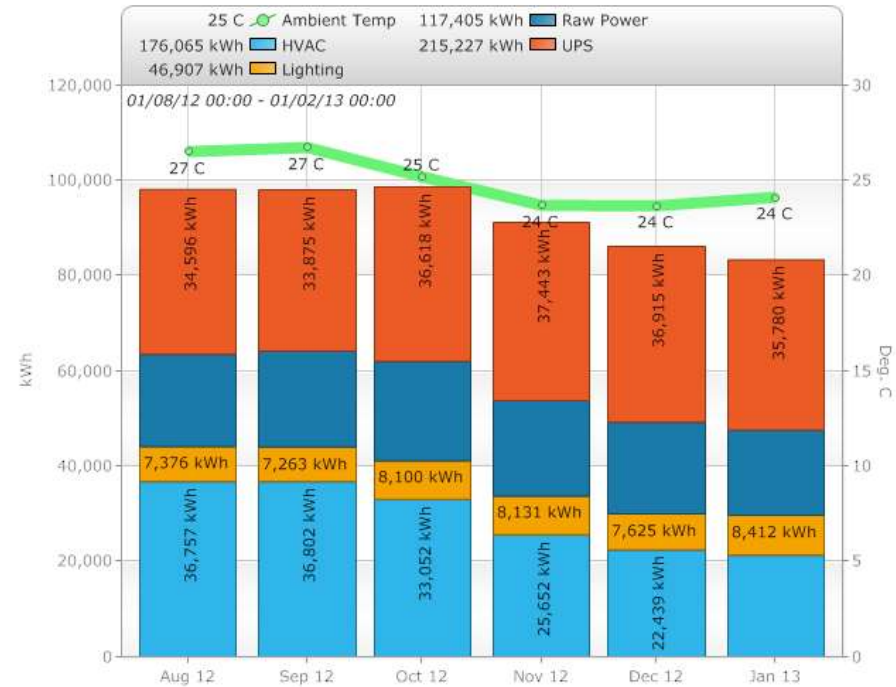
Knowing where to prioritize...



Energy end use breakup (Jan'13)

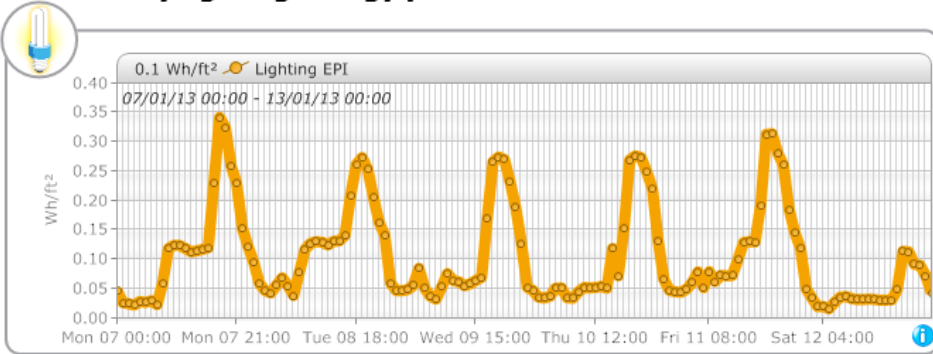


Energy end use breakup (monthly)

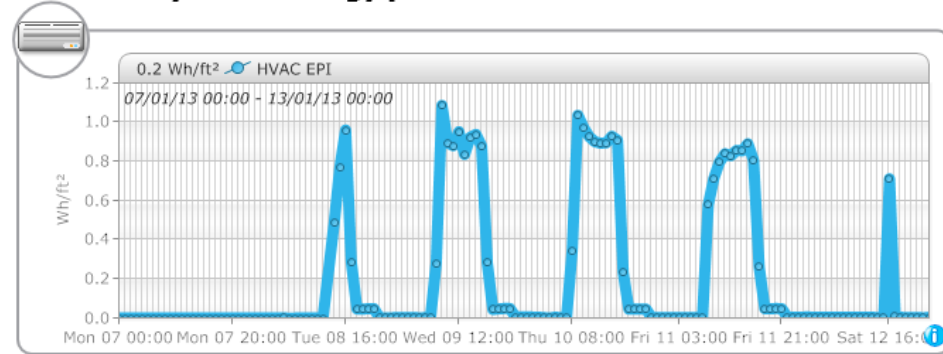


Hourly Energy Profiles (by end use)

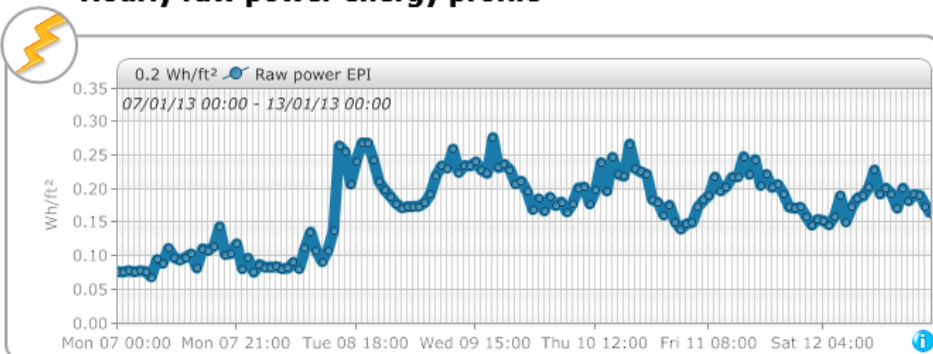
Hourly lighting energy profile



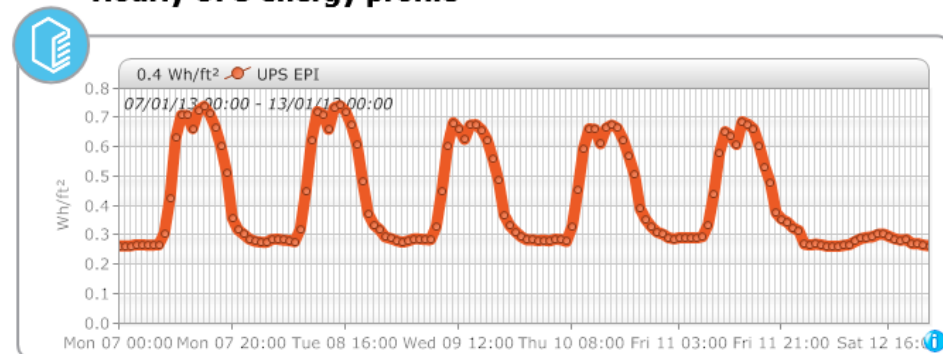
Hourly HVAC energy profile



Hourly raw power energy profile



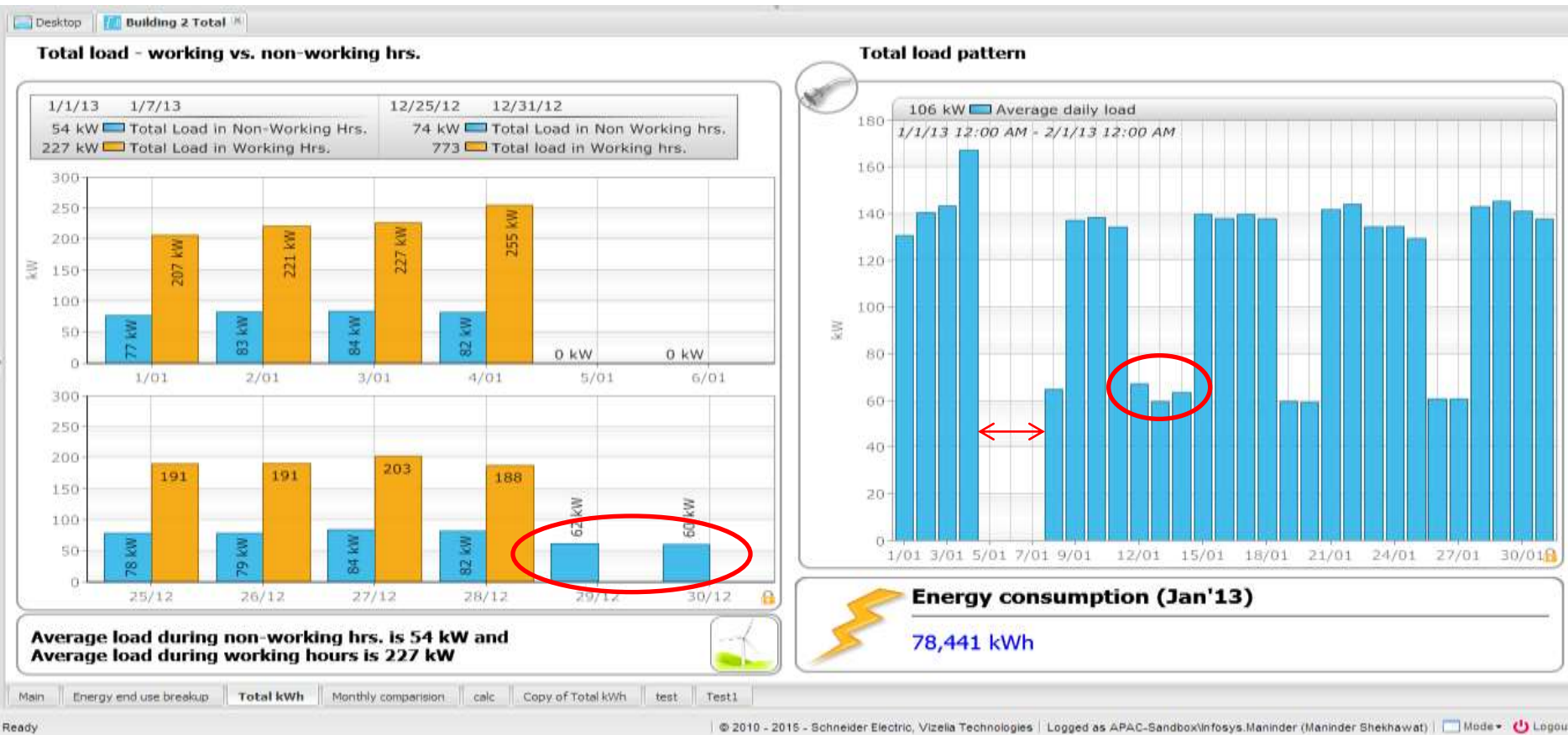
Hourly UPS energy profile



Observation:

- Current operations are highly energy efficient, less than 3 Wh/sq. ft. on an hourly basis.

Energy Use Patterns



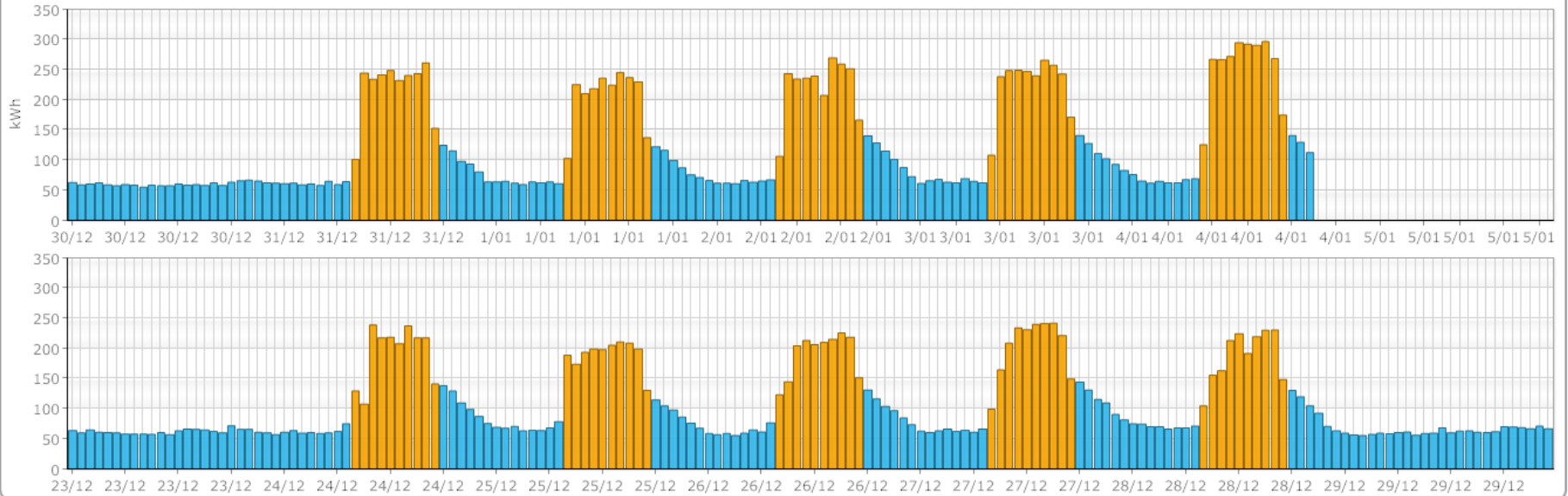
Observations:

- Usage is observed during non-working hours, needs to be investigated by looking at hourly data.
- Meter was not working from 5-Jan-2013 to 8-Jan-2013.
- Consumption on 4-Jan-2013 was higher than the average weekday consumption for the month (by ~500 kWh).

Non-working vs Working Hours: Total

Energy use comparison (working vs. non-working hrs.)

30/12/12 00:00	06/01/13 00:00	23/12/12 00:00	30/12/12 00:00
6,839 kWh	8,639 kWh	8,639 kWh	9,668 kWh
11,297 kWh			
Non-Working Hrs.	Non-Working Hrs.	Non-Working Hrs.	Non-Working Hrs.
Working Hrs.	Working Hrs.	Working Hrs.	Working Hrs.



Observations:

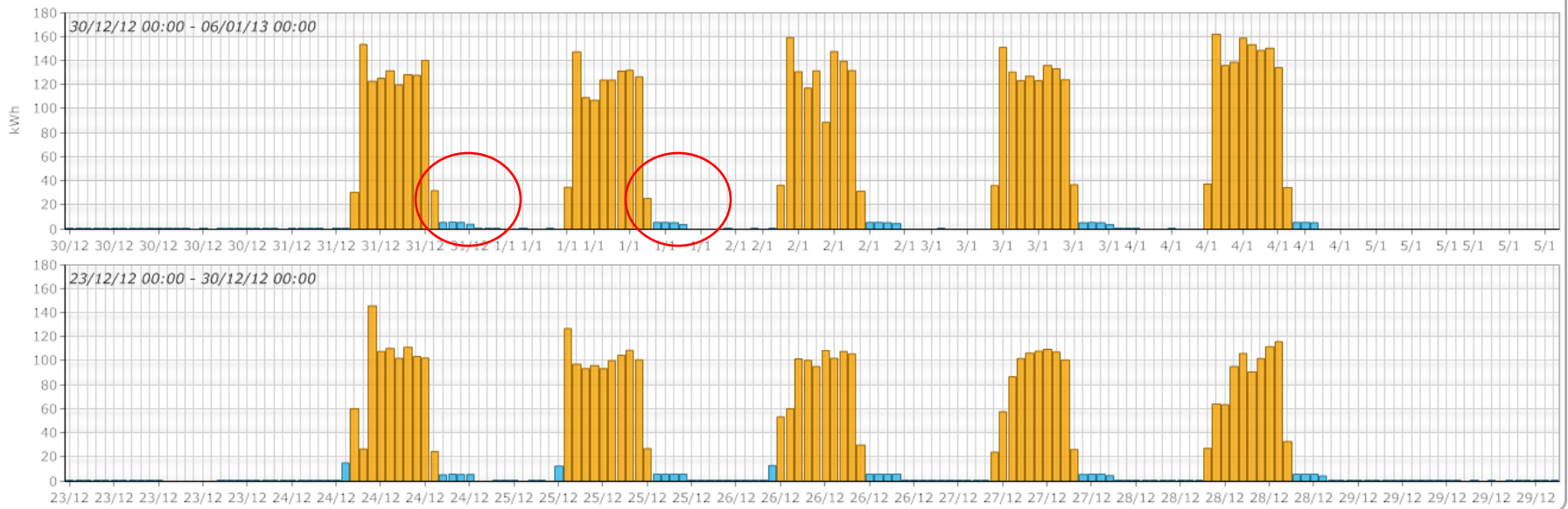
1. Need to investigate end uses contributing to energy use in non-working hours

Non-working vs Working Hours: HVAC

HVAC daily usage



30/12/12 00:00	06/01/13 00:00	23/12/12 00:00	30/12/12 00:00
134 kWh	213 kWh	213 kWh	213 kWh
5,682 kWh	Working hrs.	4,363 kWh	Working hrs.



Observations:

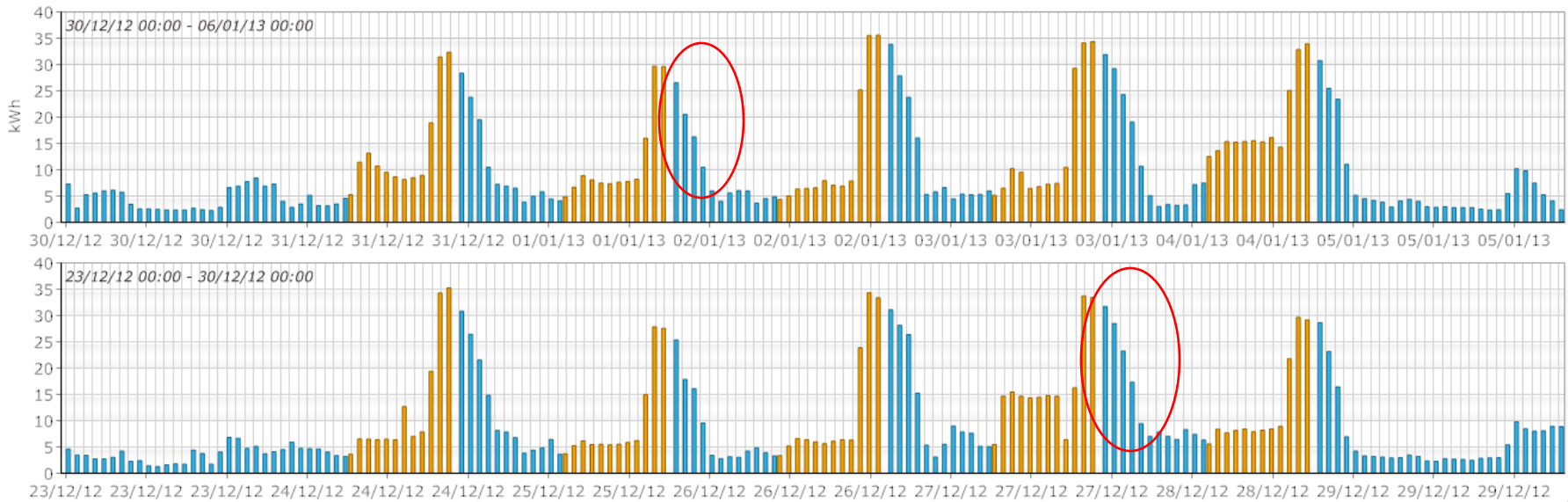
1. HVAC does not seem to be contributing significantly to non-working hour energy use.
2. Some HVAC loads observed in non-working hours – need to be investigated.

Non-working vs Working Hours: Lighting

Lighting - working vs. non-working hrs.



30/12/12 00:00	06/01/13 00:00	23/12/12 00:00	30/12/12 00:00
857 kWh	Working Hrs.	767 kWh	Working Hrs.
868 kWh	Non-Working Hrs.	849 kWh	Non-Working Hrs.



Observations:

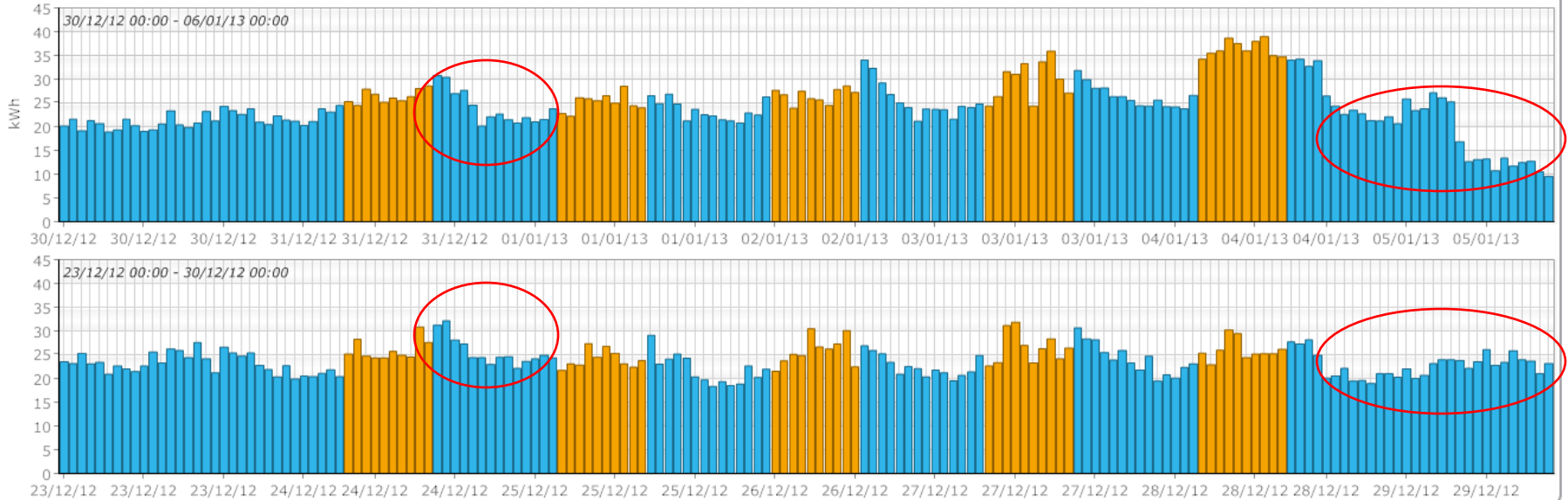
1. Lighting controls seem to be working very well during the day time.
2. Lighting energy use peaks at around 7-8 pm and does not shut down to lower (base load) levels until well after midnight.
3. Base load lighting level appears to be ~3 kWh per hour; significant variation observed above this during non-working hours.
4. Possible opportunity for reducing lighting energy use after 8 pm. (~60 kWh X 22 = ~1320 kWh/month)

Non-working vs Working Hours: Raw Power

Raw power - working hrs. vs. non-working hrs.



30/12/12 00:00	06/01/13 00:00	23/12/12 00:00	30/12/12 00:00
2,703 kWh	Non-working hrs.	2,744 kWh	Non-working hrs.
1,443 kWh	Working hrs.	1,284 kWh	Working hrs.



Observations:

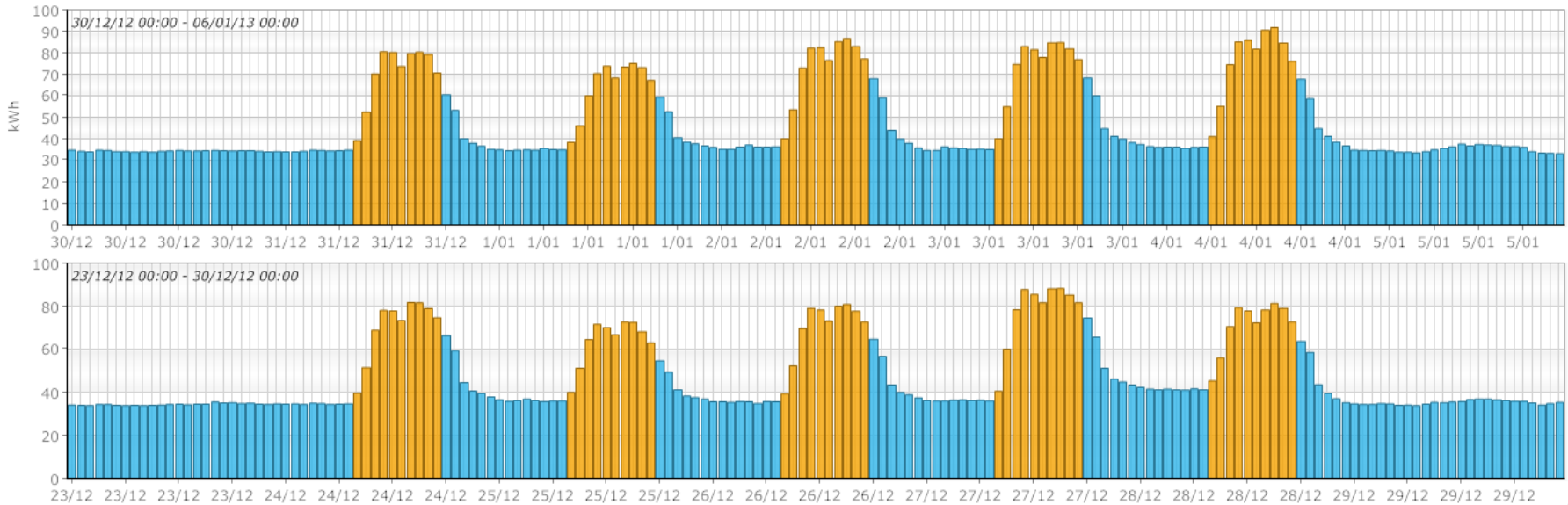
1. Raw power is being consumed at almost the **same rate during non-working hours as during working hours**. There may be an opportunity for savings.
2. **Raw power being used only by fans and vending machines**
3. Assuming ~50% optimization during non working hours, we can avail savings opportunity (~10 kWh X 12 X 22 = ~2640 kWh/month)

Non-working vs Working Hours: UPS

UPS working vs. non-working hrs.



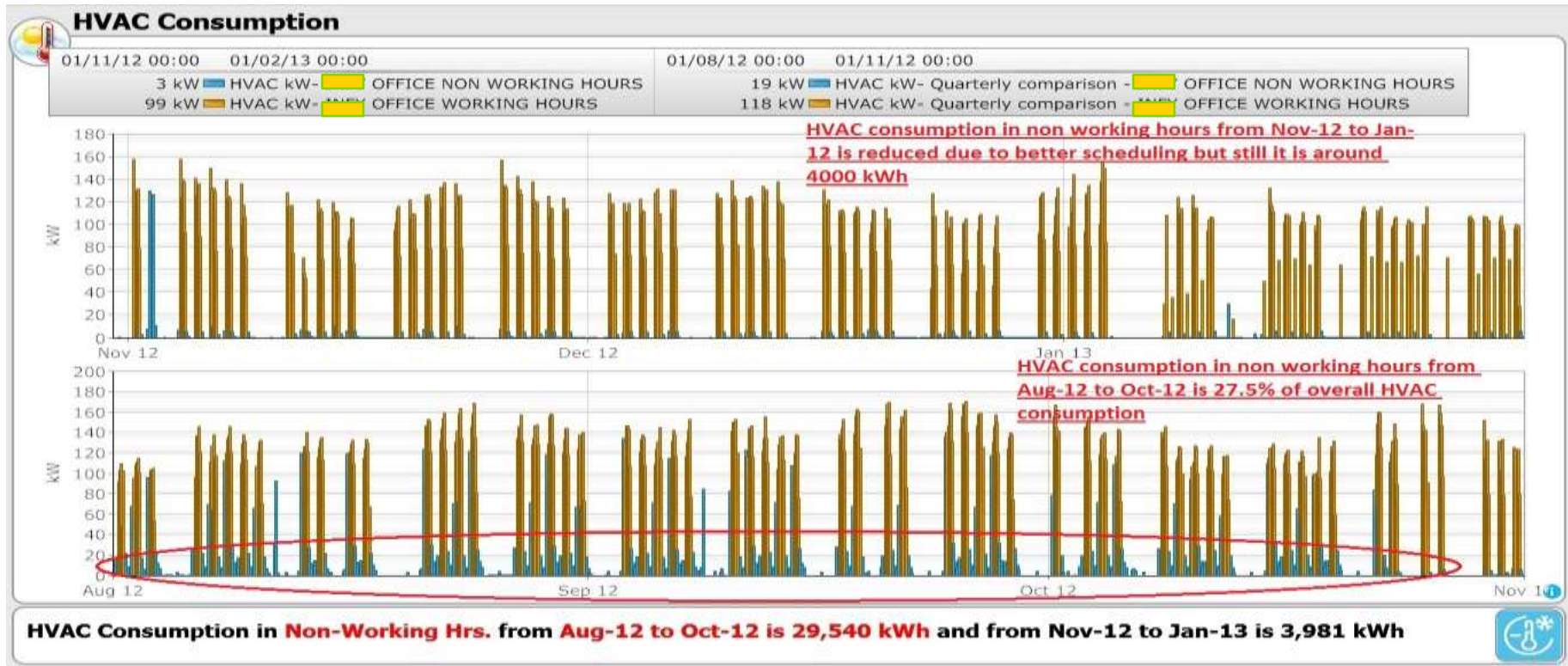
30/12/12 00:00	06/01/13 00:00	23/12/12 00:00	30/12/12 00:00
4,477 kWh	Non-working hrs.	4,572 kWh	Non-working hrs.
3,598 kWh	Working hrs.	3,540 kWh	Working hrs.



Observations:

1. On site assessment of the UPS usage may be beneficial to **determine if laptops & Desktop CPU's are being plugged into UPS points.**
2. Raw power , HVAC and UPS usage patterns to be examined together to determine what is driving consumption under both end-uses during non-working and working hours
3. Detailed energy efficiency analysis on UPS performance can be performed with information on **UPS configuration, redundancy, connected loads .**

HVAC: Consumption Analysis

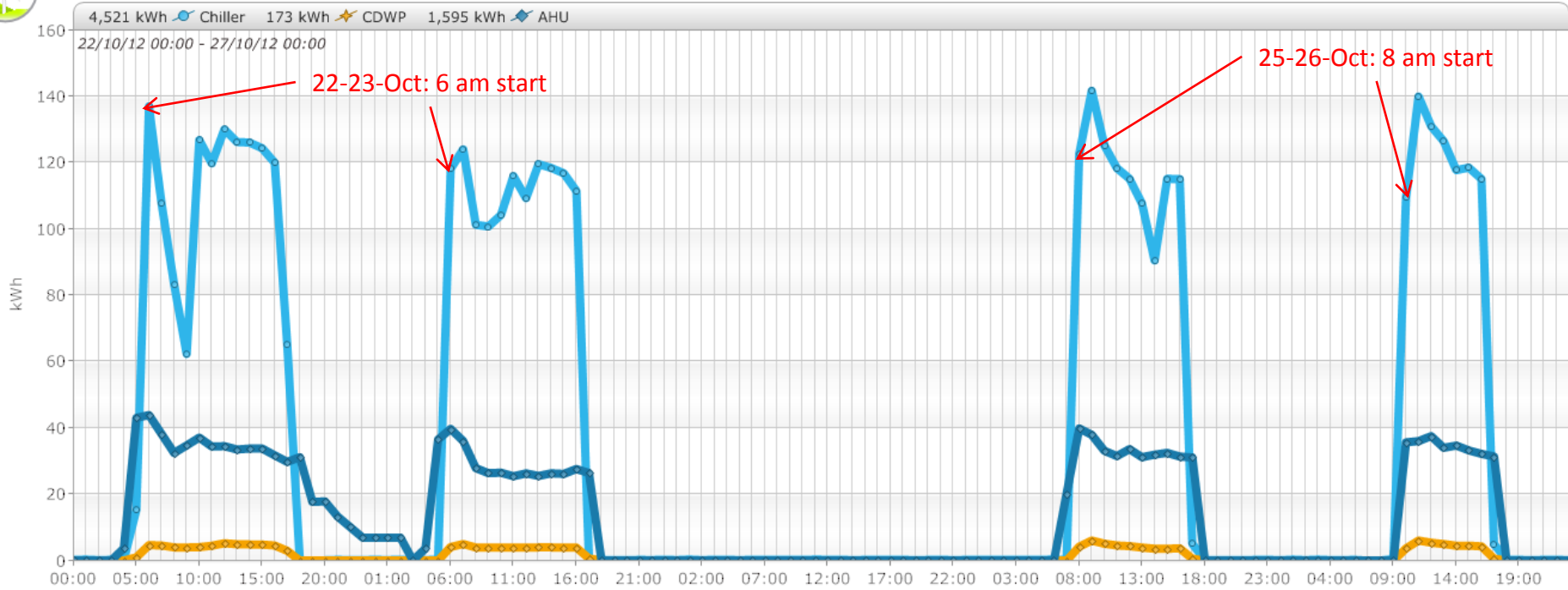


Observations:

1. It has been observed that from Aug-12 to Oct-12, HVAC consumption in non business hours was very high (29540 kWh) possibly due to poor Scheduling of HVAC unit.
2. This consumption is more than 27% of the overall HVAC consumption for the mentioned period.
3. This consumption is reduced to 1/7th (3981 kWh) from Nov-12 to Jan-13.
4. **Approximately 25,000 kWh have been already saved by ABC Tech in non-working hours in Nov-12 to Jan-13 as compared to Aug-12 to Oct-12 by optimizing operation schedule.**

HVAC: Operation Schedule

HVAC operation schedule



Observations:

1. It has been observed that until end of Oct-2012, HVAC system start times were 6 am, and this was changed to 8 am starting 25-Oct-2012.
2. **~7,000 kWh/month, or ~20,000 kWh** over a 3-month period, has already been saved by ABC Tech during Nov-2012 to Jan-2013 by implementing this scheduling change.

Success Stories

Estimated savings based on 6 months data (Aug-12 to Jan-13)

Energy Conservation Measures (No Investment)

No.	Energy Conservation Measure - Description	Possible Savings (kWh) per month	Average Monthly kWh	% Savings
1	Optimizing lighting consumption in non-working hours	~1320		
2	Optimizing raw power consumption in non-working hours	~2640		
3	Other chiller optimization possibilities to be explored:	~1290	~95000	~5.9%
	- Optimizing non-working hours use	~550		
	- Optimizing chilled water leaving temperature	~540		
	- Optimizing response to ambient temperatures and load	~200		
Total no-cost ECMs		~5250		
ECMs requiring additional investment				
4	Optimizing CDWP consumption by installing or automating VSD	~374		
Total no-cost and low-cost ECMs		~5624		

Energy Management Opportunities

Expected energy reduction per square meter

Monitor

Increased employee awareness

2%

Installation of meters

Analytics and Improved awareness

3%

Dashboards:
Cost allocation
Benchmarking
Incentivizing

Control

Improved awareness, identification of O&M improvements

10%

Facility tune-up
Elimination of waste

Optimize

15% to 30%

Operation Benchmarking, project improvements, continuous attention

Continuous improvement
Action plans

Source: Schneider Electric best practices, US Department of Energy Metering Guide, Feb 2006

Schneider Energy Action

> Challenge:

- > 60+ sites across India
- > 300 MINR energy spend in 2011

> Enterprise Energy Management Strategy

- > Focus only on sites over 5000 sq m
- > 17 sites, with energy spend of over 200 MINR
- > Remote energy monitoring, quarterly reporting, audits/assessments

> Results

- > 30+ MINR savings in 2.5 years with less than 10 MINR investment
- > 10 sites certified ISO 50001, 2-3 more pursuing certification

Thank you!