

Energy Management & Audit

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Definition of Energy Management

“The judicious and effective use of energy to maximize profits (minimize costs) and enhance competitive positions”

“The strategy of adjusting and optimizing energy, using systems and procedures so as to reduce energy requirements per unit of output while holding constant or reducing total costs of producing the output from these systems”

Objective of Energy Management

To achieve and maintain optimum energy procurement and utilisation, throughout the organization

To minimise energy costs / waste without affecting production & quality

To minimise environmental effects.

Definition of Energy Audit

- **Energy Audit is defined as**
- **“the verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption
“**

Types of Energy Audit

- **Preliminary energy audit**
- **Detailed energy audit**

- **Type of energy audit chosen depends on**
 - Function and type of industry
 - Depth to which final audit is needed
 - Potential and magnitude of cost reduction desired

Preliminary Energy Audit Methodology

- **Preliminary energy audit uses existing, or easily obtained data**
- **Establish energy consumption in the organization**
- **Estimate the scope for saving**
- **Identify the most likely areas for attention**
- **Identify immediate (no-/low-cost) improvements**
- **Set a 'reference point'**
- **Identify areas for more detailed study/measurement**

Detailed Energy Audit

- **Evaluates all energy using system, equipment and include detailed energy savings and costs**
- **Carried out in 3 phases**
 - Pre-audit Phase
 - Audit Phase
 - Post-Audit

Benchmarking for energy performance

- **Internal Benchmarking**

- **Historical and trend analysis**

- **External Benchmarking**

- **Across similar industries**

- Scale of operation, vintage of technology,
raw material specification and quality
and product specification and quality**

Bench Marking Energy Performance

- Quantification of fixed and variable energy consumption trends vis-à-vis production levels
- Comparison of the industry energy performance w.r.t. various production levels (capacity utilization)
- Identification of best practices (based on the external benchmarking data)
- Scope and margin available for energy consumption and cost reduction
- Basis for monitoring and target setting exercises

Benchmarking parameters

•Gross production related

- e.g. kWh/MT clinker or cement produced (cement plant)
- e.g. kWh/MT, kCal/kg, paper produced (Paper plant)
- e.g. kCal/kWh Power produced (Heat rate of a power plant)
- e.g. Million kilocal/MT Urea or Ammonia (Fertilizer plant)

•Equipment / utility related

- e.g. kWh/ton of refrigeration (on Air conditioning plant)
- e.g. % thermal efficiency of a boiler plant
- e.g. kWh/NM³ of compressed air generated
- e.g. kWh /litre in a diesel power generation plant.

Maximizing system efficiency

- Eliminate steam leakages by trap improvements
- Maximise condensate recovery
- Adopt combustion controls for maximizing combustion efficiency
- Replace pumps, fans, air compressors, refrigeration compressors, boilers, furnaces, heaters and other energy conservation equipment, wherever significant energy efficiency margins exist

Matching Energy Usage to Requirement

- **Mismatch between equipment capacity and user requirement often leads to inefficiencies due to part load operations, wastages etc**
- **Examples :**
 - Eliminate throttling
 - Eliminate damper operations
 - Fan resizing for better efficiency.
 - Moderation of chilled water temperature for process chilling needs

Optimising Input Energy Requirement

- **Shuffling of compressors to match needs.**
- **Periodic review of insulation thickness**
- **Identify potential for heat exchanger networking and process integration.**
- **Optimisation of transformer operation with respect to load**

Fuel and Energy Substitution

Fuel substitution

- Natural gas is increasingly the fuel of choice as fuel and feedstock in the fertilizer, petrochemicals, power and sponge iron industries.
- Replacement of coal by coconut shells, rice husk, etc
- Replacement of LDO by LSHS

Energy substitution

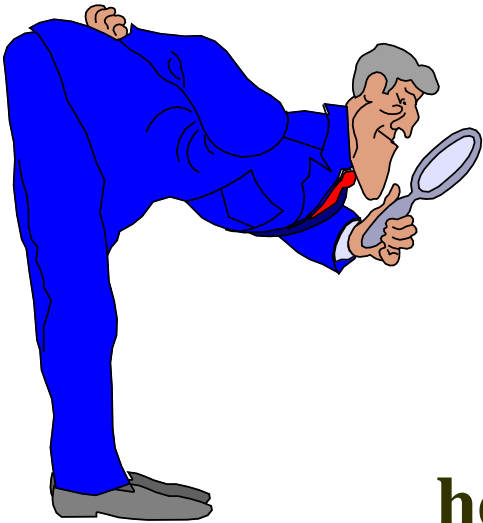
- Replacement of electric heaters by steam heaters
- Replacement of steam based hot water by solar systems

Seven Steps to Energy and Cost Reduction

1. **Understand the Cost of Energy**
2. **Compare Yourself**
3. **Understand When Energy is Used**
4. **Understand Where Energy is Used**
5. **Eliminate Waste**
6. **Maximize Efficiency**
7. **Optimize Energy Supply**



Understand Demand Charges

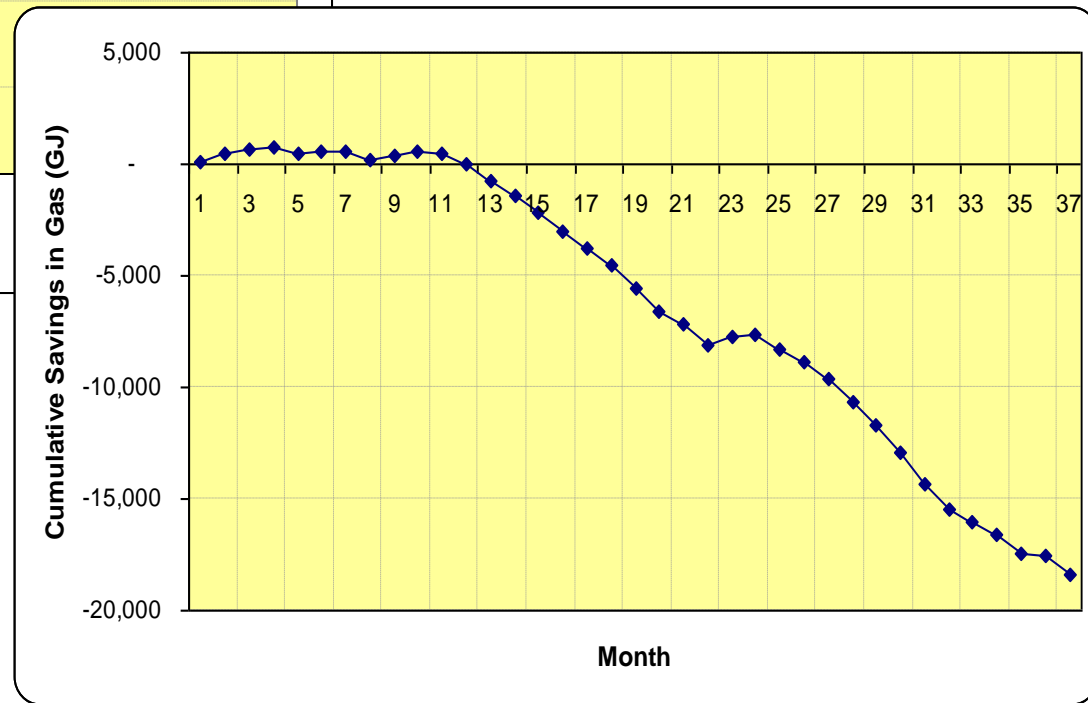
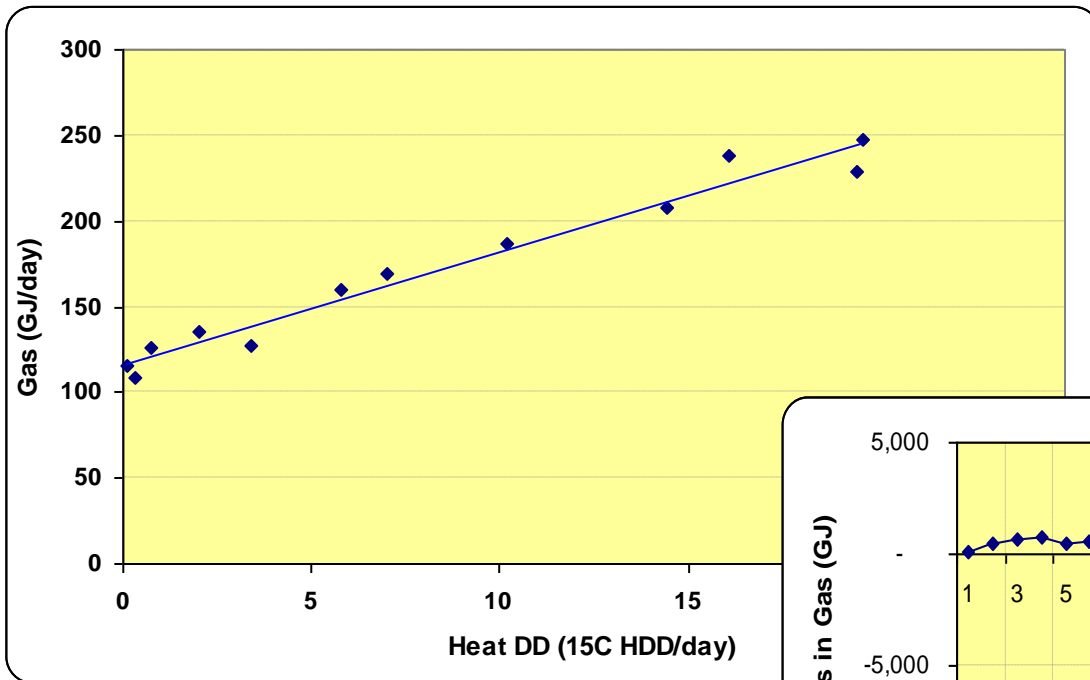


**50 kW
heater for
5 hours**

Cost to Operate:

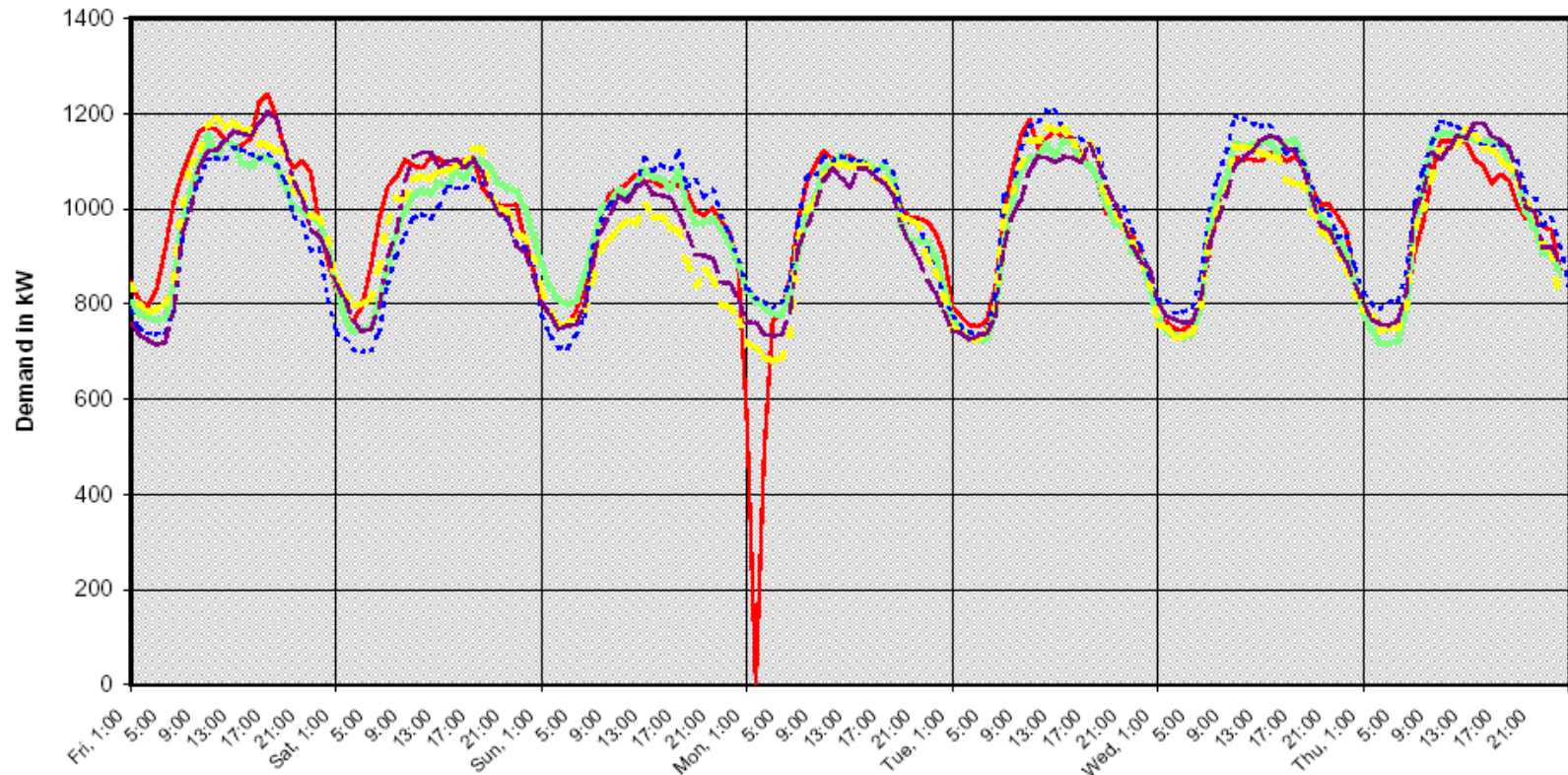
- **“Off Peak”
Time
approx \$8**
- **“On Peak” Time
approx \$330**

Example: Fuel Use in a Hospital



Understand When You Use Energy

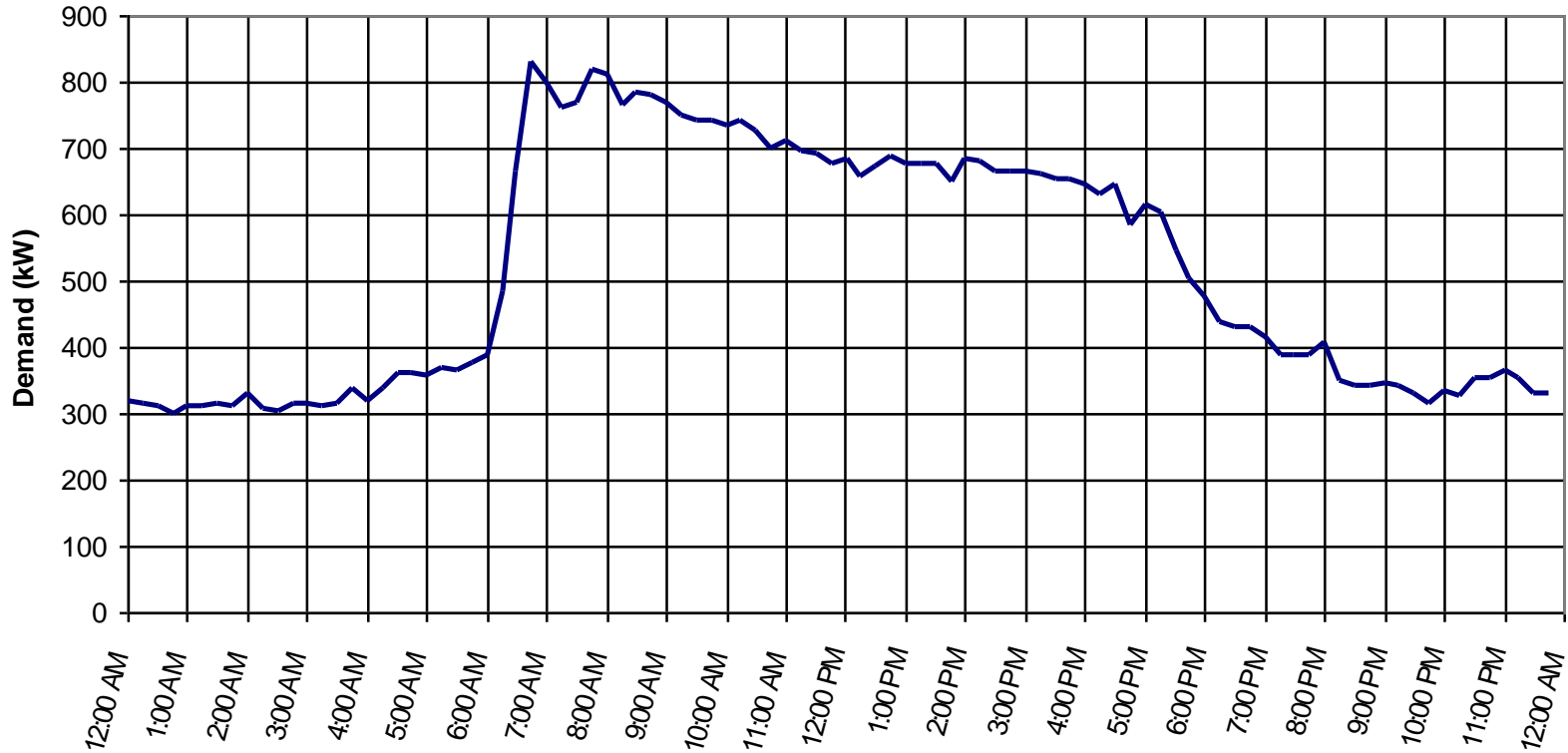
WEEKLY LOAD PROFILES FOR FIVE WEEKS



— WEEK 1 (Oct 27 thru 2) - 164,736 kWh — WEEK 2 (Nov 3 thru 9) - 163,153 kWh - - - WEEK 3 (Nov 10 thru 16) - 164,265 kWh
- - - WEEK 4 (Nov 17 thru 23) - 161,374 kWh - - - WEEK 5 (Nov 24 thru 30) - 161,422 kWh

Example: Office Building Peak at 7am

Electrical Demand - January 14, 2002

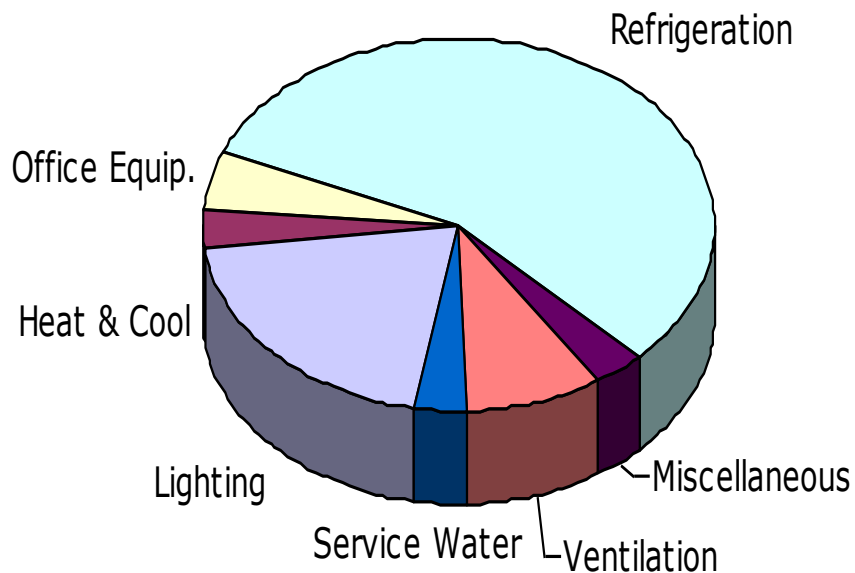


Identify Largest Areas of Consumption

Choose Your Facility Type:

Large Grocery

Typical Electricity Cost Breakdown



Annual Electricity Cost Breakdown

Refrigeration	57%	\$56,000
Lighting	20%	\$20,000
Ventilation	9%	\$9,000
Office Equip.	5%	\$5,000
Heat & Cool	3%	\$3,000
Service Water	3%	\$3,000
Miscellaneous	3%	\$3,000

THANK YOU

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