

ENERGY MANAGEMENT & AUDIT

By-

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Unit 2-Energy Management

Defined as method of achieving quality product at least energy cost without affecting environment.

- 1970-started thinking
- 1980- seriously thinking
- 1992—Energy Policy Act-1992 -Federal USA
- India EC ACT 2001

Definition

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

Or

"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"

Objectives

The objective of Energy Management is to achieve and maintain optimum energy procurement and utilization, throughout the organization and:

- To minimize energy costs / waste without affecting production & quality.
- To minimize environmental effects.
- Increase efficiency
- Reduce carbon emission & climate protection
- Find superior energy alternatives

Necessity of energy management

- Energy cost which affects the company profitability & competitiveness in the world market
- Energy supply- demand balance the nation
- Financial balance of a nation
- Environmental issues
- Occupational safety and health
 1. Loss prevention and waste disposal
 2. Productivity
 3. quality

Principles of Energy management

- i) Control the cost of energy service provided and not the BTU
- ii) Manage energy function as a product cost and not as a general expenses
- iii) Manage only major energy functions
- iv) Concentrate energy management program on installing contracts and achieving results

Key elements of Energy management

The steps:

- STEP 1: Make Commitment
- STEP 2: Assess Performance
- STEP 3: Set Goals
- STEP 4: Create Action Plan
- STEP 5: Implement Action Plan
- STEP 6: Evaluate Progress
- STEP 7: Recognize Achievements

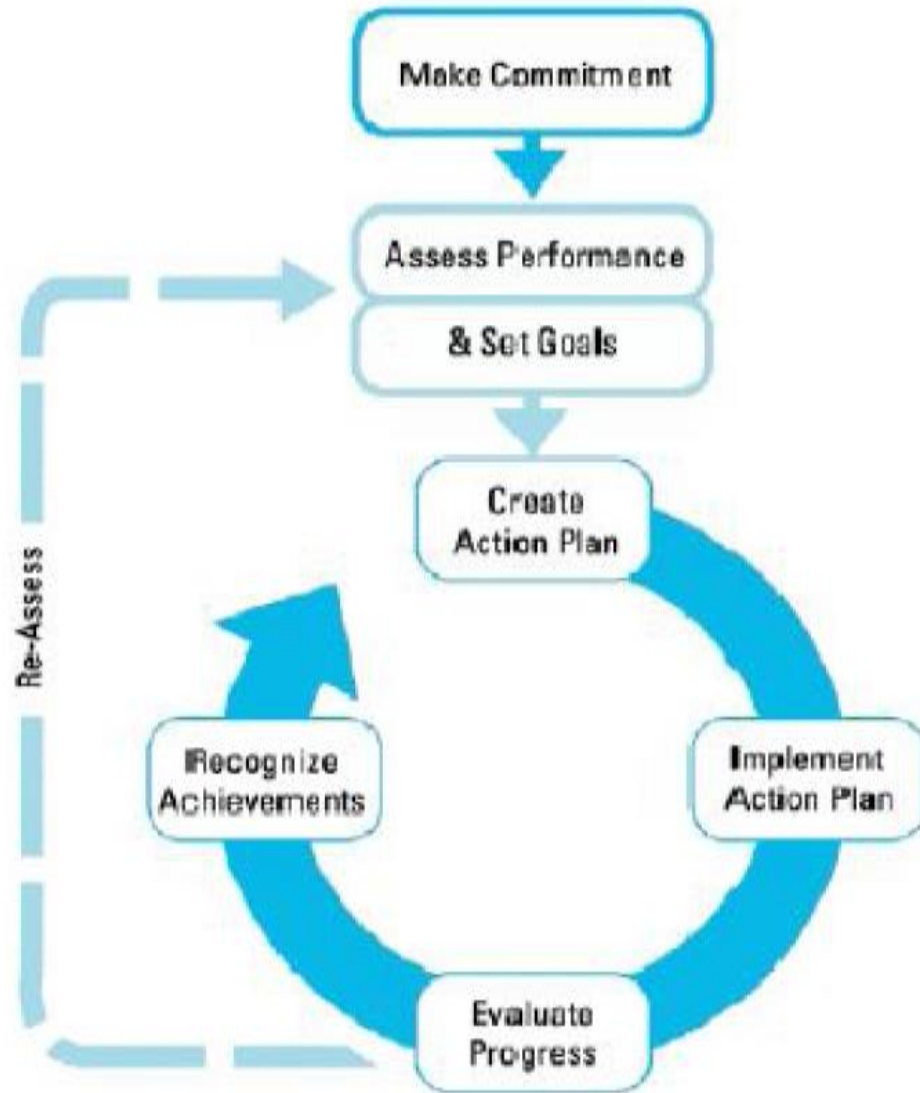


Figure 5.2 Steps in Energy Action Planning

STEP 1: Commit to Continuous Improvement

- Organizations seeing the financial returns from superior energy management continuously strive to improve their energy performance. Their success is based on regularly assessing energy performance and implementing steps to increase energy efficiency.
- **Form a Dedicated Team**

- **1.1 Appoint an Energy Director:** Sets goals, tracks progress, and promotes the energy management program.
- **1.2 Establish an Energy Team:** Executes energy management activities across different parts of the organization and ensures integration of best practices.
- **Institute an Energy Policy**
- **1.3 Institute an Energy Policy:** Provides the foundation for setting performance goals and integrating energy management

STEP 2: Assess Performance

- Understanding current and past energy use is how many organizations identify opportunities to improve energy performance and gain financial benefits. Assessing performance is the periodic process of evaluating energy use for all major facilities and functions in the organization and establishing a baseline for measuring future results of efficiency efforts.

- Key aspects include in assessment:
- Data Collection and Management
 - 2.1 Gather and track data — Collect energy use information and document data over time.
- Base lining and Benchmarking
 - 2.2 Establish baselines — Determine the starting point from which to measure progress.
 - 2.3 Benchmark — Compare the energy performance of your facilities to each other, peers and competitors, and over time to prioritize which facilities to focus on for improvements.
- Analysis and Evaluation
 - 2.4 Analyze — Understand your energy use patterns and trends.
 - 2.5 Technical assessments and audits — Evaluate the operating performance of facility systems and equipment to determine improvement potential.

- Assessing your energy performance helps you to:
Categorize current energy use by fuel type, operating division, facility, product line, etc.
- Priority to do poor performing facilities for immediate improvement.
- Understand the contribution of energy expenditures to operating costs.
- Develop a historical perspective and context for future actions and decisions.
- Establish reference points for measuring and rewarding good performance.

STEP 3: Set Goals

- Performance goals drive energy management activities and promote continuous improvement.
- Well-stated goals guide daily decision-making and are the basis for tracking and measuring progress. Communicating and posting goals can motivate staff to support energy management efforts throughout the organization.
- The Energy Director in conjunction with the Energy Team typically develops goals.

- **To develop effective performance goals:**
- **3.1 Determine scope** - Identify organizational and time parameters for goals.
- **3.2 Estimate potential for improvement** - Review baselines, benchmark to determine the potential and order of upgrades, and conduct technical assessments and audits.
- **3.3 Establish goals** - Create and express clear, measurable goals, with target dates, for the entire organization, facilities, and other units.

STEP 4: Create Action Plan

- Successful organizations use a detailed action plan to ensure a systematic process to implement energy performance measures. Unlike the energy policy, the action plan is regularly updated, most often on an annual basis, to reflect recent achievements, changes in performance, and shifting priorities.

STEP 5: Implement Action Plan

- **To implement your action plan, consider taking the following steps:**
- **5.1 Create a communication plan** - Develop targeted information for key audiences about your energy management program.
- **5.2 Raise awareness** - Build support at all levels of your organization for energy management initiatives and goals.
- **5.3 Build capacity** - You can expand the capacity of your staff through providing training, access to information, sharing of successful practices, procedures and technologies, and sharing of lessons learned.
- **5.4 Motivate** - Create incentives that encourage staff to improve energy performance to achieve goals.
- **5.5 Track and monitor** - Use the tracking system developed as part of the action plan to track and monitor progress regularly.

STEP 6: Evaluate Progress

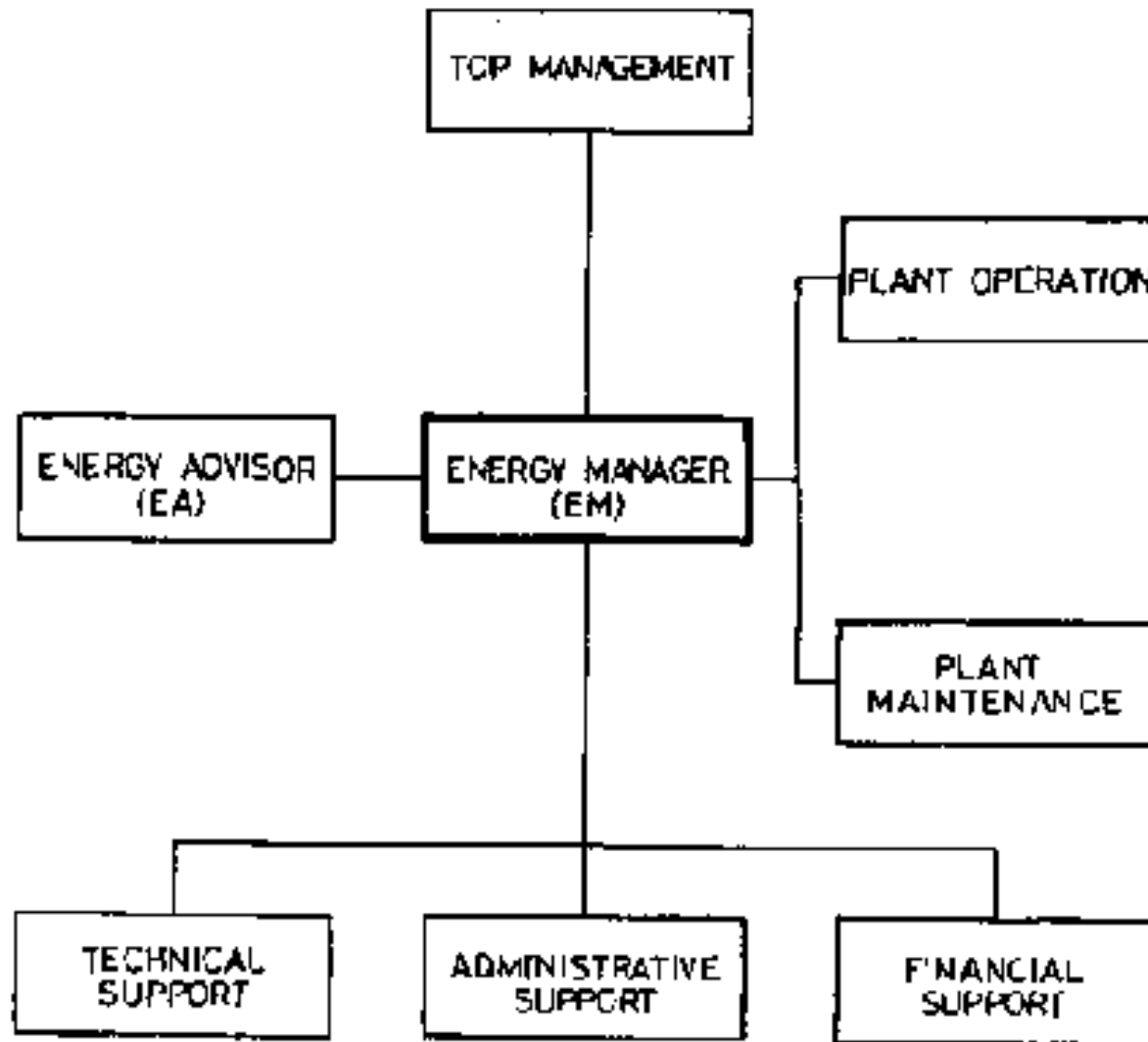
- Evaluating progress includes formal review of both energy use data and the activities carried out as part of the action plan as compared to your performance goals.
- **6.1 Measure results** - Compare current performance to established goals.
- **6.2 Review action plan** - Understand what worked well and what didn't in order to identify best practices.

STEP 7: Recognize Achievements

- **7.1 Providing internal recognition** - to individuals, teams, and facilities within your organization.
- **7.2 Receiving external recognition** - from government agencies, the media, and other third party organizations that reward achievement.

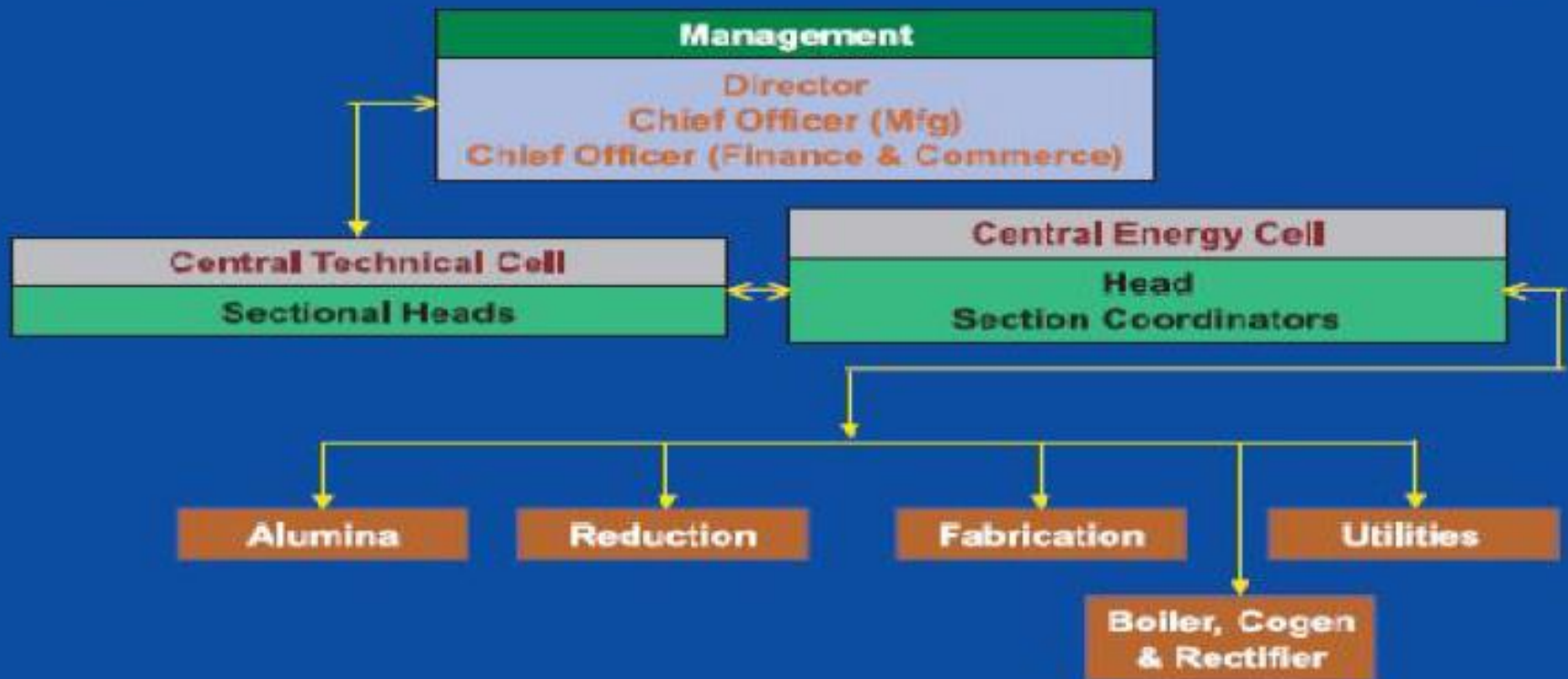
ORGANIZATION STRUCTURE- ENERGY MANAGEMENT

ENERGY MANAGEMENT CELL



General organization structure of Hindalco

Organisation structure of Energy Management in Hindalco



Energy Manager

- **The tasks of energy manger are setting goals, tracking progress, and promoting the energy management program.**
- **An Energy Manager helps an organization achieve its goals by establishing energy performance as a core value.**
- Energy Manager understands how energy management helps the organization achieve its financial and environmental goals and objectives.
- Depending on the size of the organization, the Energy Manager role can be a full-time position or an addition to other responsibilities.

- **Location of Energy Manager**
- The energy management function, whether vested in one "energy manager or coordinator" or distributed among a number of middle managers, usually resides somewhere in the organization between senior management and those who control the end-use of energy. Exactly how and where that function is placed is a decision that needs to be made in view of the existing organizational structure.

Energy Manager Skills

- Have sufficient technical knowledge either to understand the implemented technology or to be able to get trained in the technology
- Able to establish the organization structure
- Plan energy survey
- Identify educational needs
- Development strategy of energy management
- Able to understand economic evaluations like payback, life cycle cost.
- Have ability to communicate effectively and motivated the team.

force field analysis

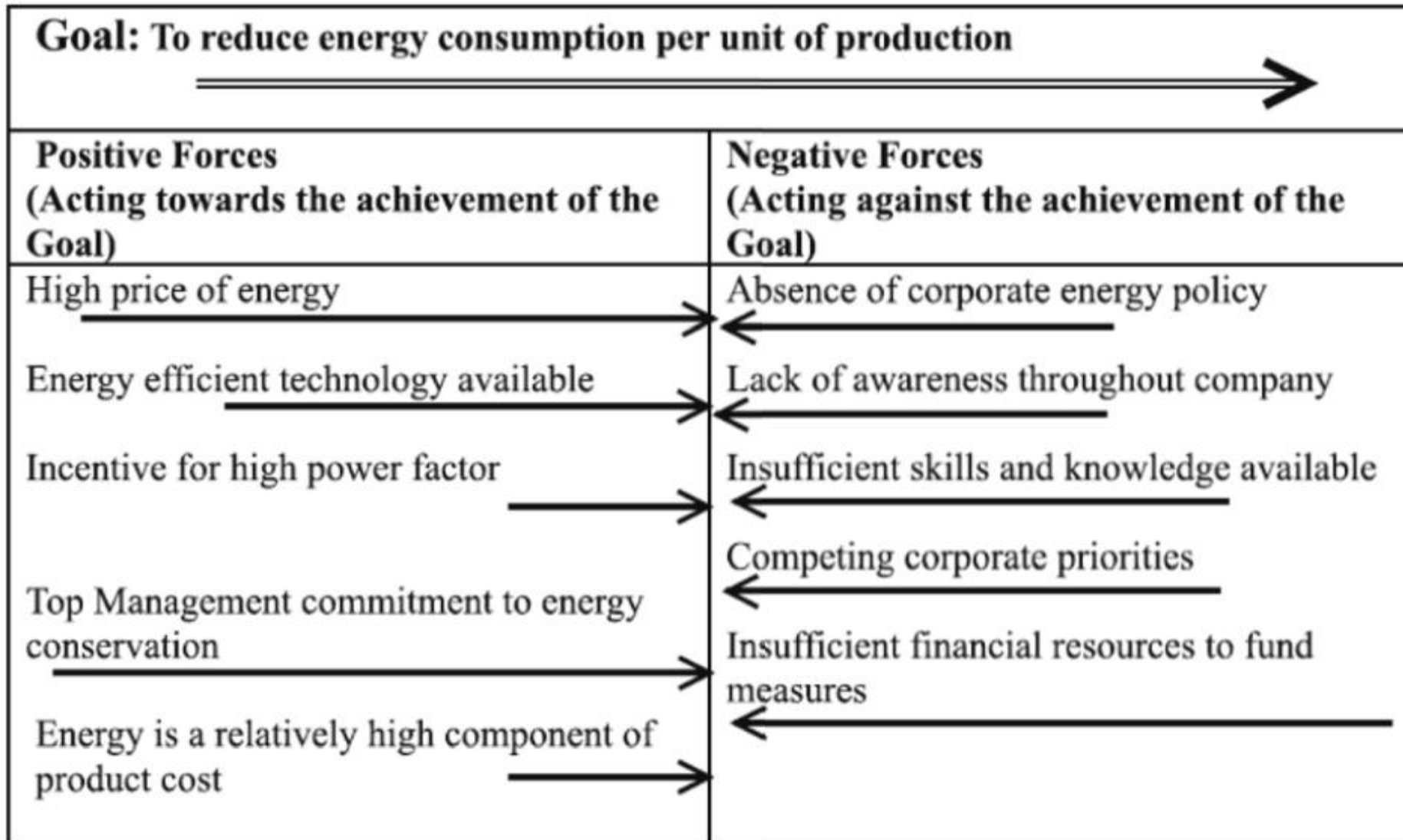


Figure 6.4 Force Field Analysis

Energy Management strategy

Strategy	Programs	Actions
Reliability	Maintenance program	Develop maintenance plan
		Develop preventive maintenance plan
	Modernization	Computerize data and analyze trends
		Evaluate emcs
		Start a stream trap survey program
		Review insulation opportunities
	Operations	Develop an operating procedures manual for mat for more energy using of equipment
		Examine operational schedules for potential energy savings
	Training	Develop training plans for: Operating procedures Maintenance Other technical topics
	Contingency planning	Develop a contingency plan for electric and gas utility cutback
		Determine alternative energy source
		Establish a shutdown procedure

Strategy	Programs	Actions
Efficiency	Plant property evaluation	Develop an audit program
		Develop a plan for updating inefficient equipment
		Establish proper size for equipment, such as motors
	Measurement	Establish permanent instrumentation for energy measurements
		Produce necessary portable instruments
		Develop an energy reporting and evaluation program
	Control	Assure proper functioning of existing controls
		Develop a low cost/ no cost program for controls
	Energy organizational efficiency	Evaluate and install EMCs where economically feasible
		Enhance stability of energy council
		Amend the energy management organizational structure as necessary for increased efficiency
		Establish a corporate level energy management team to assist lower organization

Strategy	Programs	Actions
Funding utilization	Stabilize funding	Identify and prioritize future projects
		Develop long range budgets
	Return savings to customer	Develop a formula for sharing savings
		Advertise and implement
	Short term funding	Establish funds for a test program for verification of energy savings
		Establish a fix-it-fund
	Economic analysis training	Establish a training program to teach:
		Accounting procedures
Life cycle cost		
Energy cost		
Determination and analysis		

energy policy

- **Energy policy** is the manner in which a given entity (often governmental) has decided to address issues of energy development including energy production, distribution and consumption.
- The attributes of energy policy may include legislation, incentives to investment, guidelines for energy conservation, taxation and other public policy techniques.

• **Typical Format of an Energy Policy**

- Declaration of top management's commitment to senior and middle management's involvement in, energy management.
- Statement of policy.
- Statement of objectives, separated into short and long-term goals.

Actions

- Have the CEO or head of the organization officially issue the policy
- Involve key people in policy development to ensure cooperation
- Tailor the policy to the organization's culture
- Make it understandable to employees and public alike
- Consider the skills and abilities of management and employees
- Include detail that covers day-to-day operations
- Communicate the policy to all employees, and encourage them to get involved

ENERGY POLICY

ENERGY POLICY OF THE CO-----

SUBJECT: Energy management program Policy & procedure manual

OBJECTIVE
ACCOUNTABILITY
REPORTING
TRAINING

- 1--- POLICY-Energy management shall be implemented in all the areas of Company Operations
- 2--- OBJECTIVES- to use energy efficiently & provide energy security for the organization for immediate & long term range by:
 1. by incorporating energy efficiency in to existing equipment's.
 - 2 by complying government regulations---
 - 3 by putting energy management program----
- 3--- IMPLEMENTATIONS—
 - ENERGY MANAGE
 - Committee
 - CO-ORDINATOR
- 4.REPORTING:
Employee—energy coordinator—energy manager—top management
5. TRAINING:
The energy manager will provide training to all levels of the company
- 6 POLICY UPDATING:
The energy manager & energy committee will meet ----- & review the policy --- annually ? & make recommendations for updating or changes
7. POLICY STATEMENT.
XYZ co is committed to effective & cost effective & environmentally responsible use of energy though out world wide operations . ----- will also promote energy efficiency by implementing cost effective programs that will maintain or improve the quality of the work environment ,optimize service reliability, increase productivity & enhance the safety of work place & operations.



Enriching Lives

KIRLOSKAR OIL ENGINES LIMITED

ENERGY POLICY

We, the KOEL, leading manufacturer of Diesel Engines, Gensets, and Pumpsets in the country are committed towards Nation's Mission for Enhanced Energy Efficiency by making continuous efforts to optimize use of energy and to bring about improvement in the energy efficiency in all our manufacturing processes and products.

We shall strive to achieve the above by:

- Benchmarking all our products for energy consumption by comparison with the regional and national best.
- Procuring and Using highly energy efficient products and technologies in our operations to reduce carbon footprint.
- Eliminating wastage of energy and promoting reuse and recycling of resources, and be environmental friendly in our operations.
- Promoting and increasing use of renewable energy resources, within and outside KOEL.
- Adopting national energy conservation norms and codes in new Building constructions as well as in existing buildings.
- Conducting periodic energy efficiency improvement studies and implementing all improvement measures and continuously monitoring gains obtained through Energy Management System.
- Involving all stake holders including employees in the energy conservation efforts through training & awareness programs. Recognizing employee's efforts through competitions and schemes.
- Sharing and enriching our experiences on energy conservation with our group of companies and other organizations
- Complying with National Energy legislations and other related legislations.

KOEL, as a part of our energy efficiency improvement strategy, will make every effort to reduce our specific energy consumption by 2-5% per year by promoting culture of innovation, creativity and aligning commitments at all levels.

Issue No: 3

Issue Date: 01.08.2003.

Review Date: 14.12.2011.

Atul Kirloskar
Chairman & Managing Director

Energy Managers Responsibilities

- Prepare an annual activity plan and present to management concerning financially attractive investments to reduce energy costs
- Establish an energy conservation cell within the firm with management's consent about the mandate and task of the cell
- Initiate activities to improve monitoring and process control to reduce energy costs
- Analyze equipment performance with respect to energy efficiency
- Ensure proper functioning and calibration of instrumentation required to assess level of energy consumption directly or indirectly
- Prepare information material and conduct internal workshops about the topic for other staff
- Improve disaggregating of energy consumption data down to shop level or profit center of a firm
- Establish a methodology how to accurately calculate the specific energy consumption of various products/services or activity of the firm

- Develop and manage training program for energy efficiency at operating levels
- Co-ordinate nomination of management personnel to external programs
- Create knowledge bank on sectorial, national and international
- development on energy efficiency technology and management system and information denomination
- Develop integrated system of energy efficiency and environmental up gradation
- Wide internal & external networking
- Co-ordinate implementation of energy audit/efficiency improvement projects through external agencies
- Establish and/or participate in information exchange with other energy managers of the same sector through association.

Duties of energy manager

- Report to BEE (Bureau of Energy Efficiency) and State level Designated Agency once a year. The information with regard to the energy consumed and action taken in the recommendation of the accredited energy auditor, as per BEE format
- Establish an improved data recording, collection and analysis system to keep track of energy consumption
- Provide support to Accredited Energy Audit Firm retained by the company for the conduct of energy audit.
- Provide information to BEE as demanded in the Act, and with respect to the tasks given by a mandate, and the job description
- Prepare a scheme for efficient use of energy and its conservation and implement such scheme keeping in view of the economic stability of the investment in such firm and manner as may be provided in the regulations of the Energy Conservation Act

Energy Monitoring System

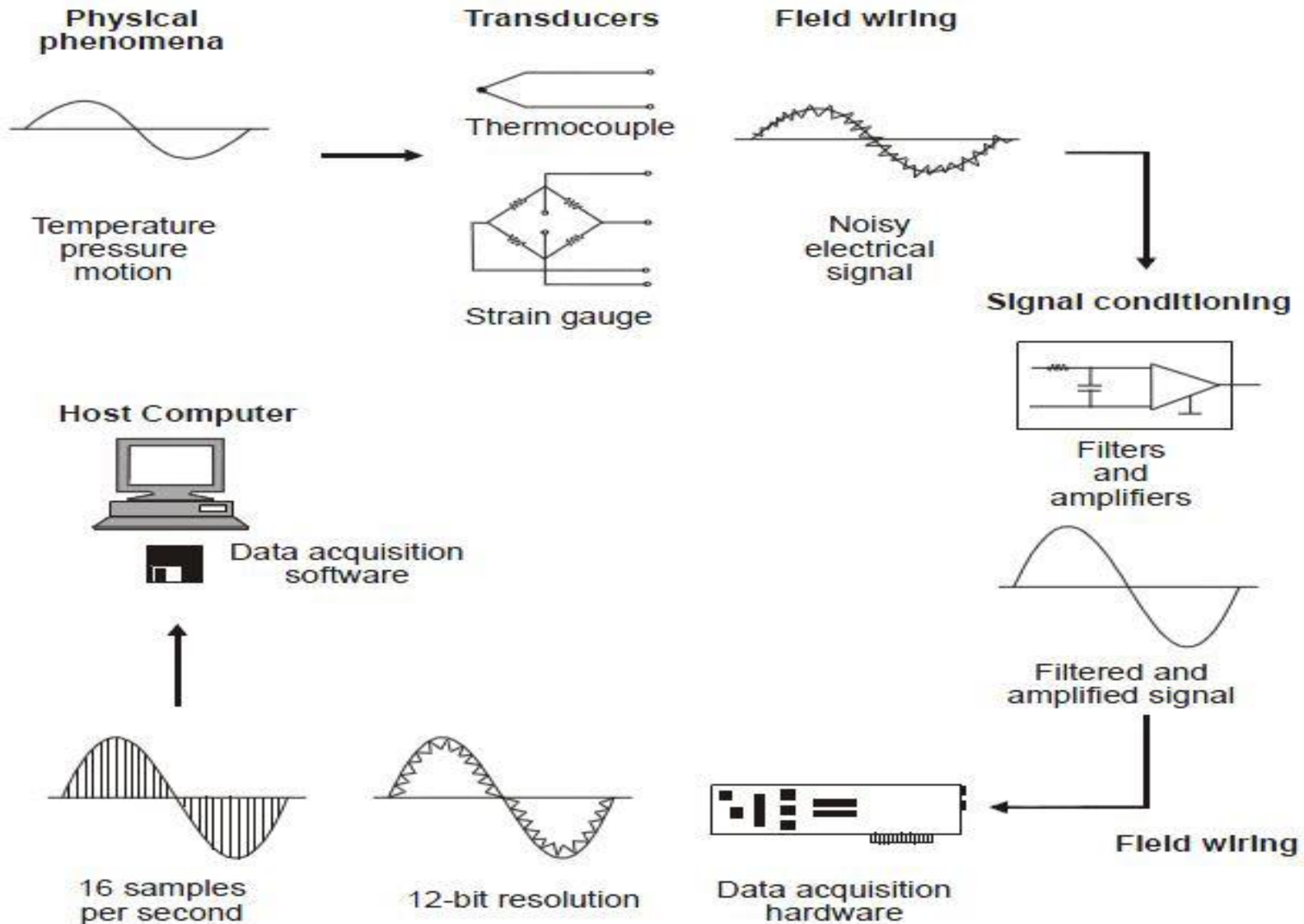
SCADA: SUPERVISORY CONTROL & DATA ACQUISITION SYSTEM

- *SCADA* performs centralized monitoring and control for field sites over long-distance. Monitoring and processing status data and Based on information received from remote stations, automated or operator driven supervisory commands.
- Field devices control local operations such as opening and closing valves and breakers, collecting data from sensor systems, and monitoring the local environment for alarm conditions.
- SCADA provides management with real-time data on production operations, implements more efficient control paradigms, improves plant and personnel safety, and reduces costs of operation
- SCADA systems more becoming efficient with improved communication protocols and increased connectivity to outside networks, including the Internet.

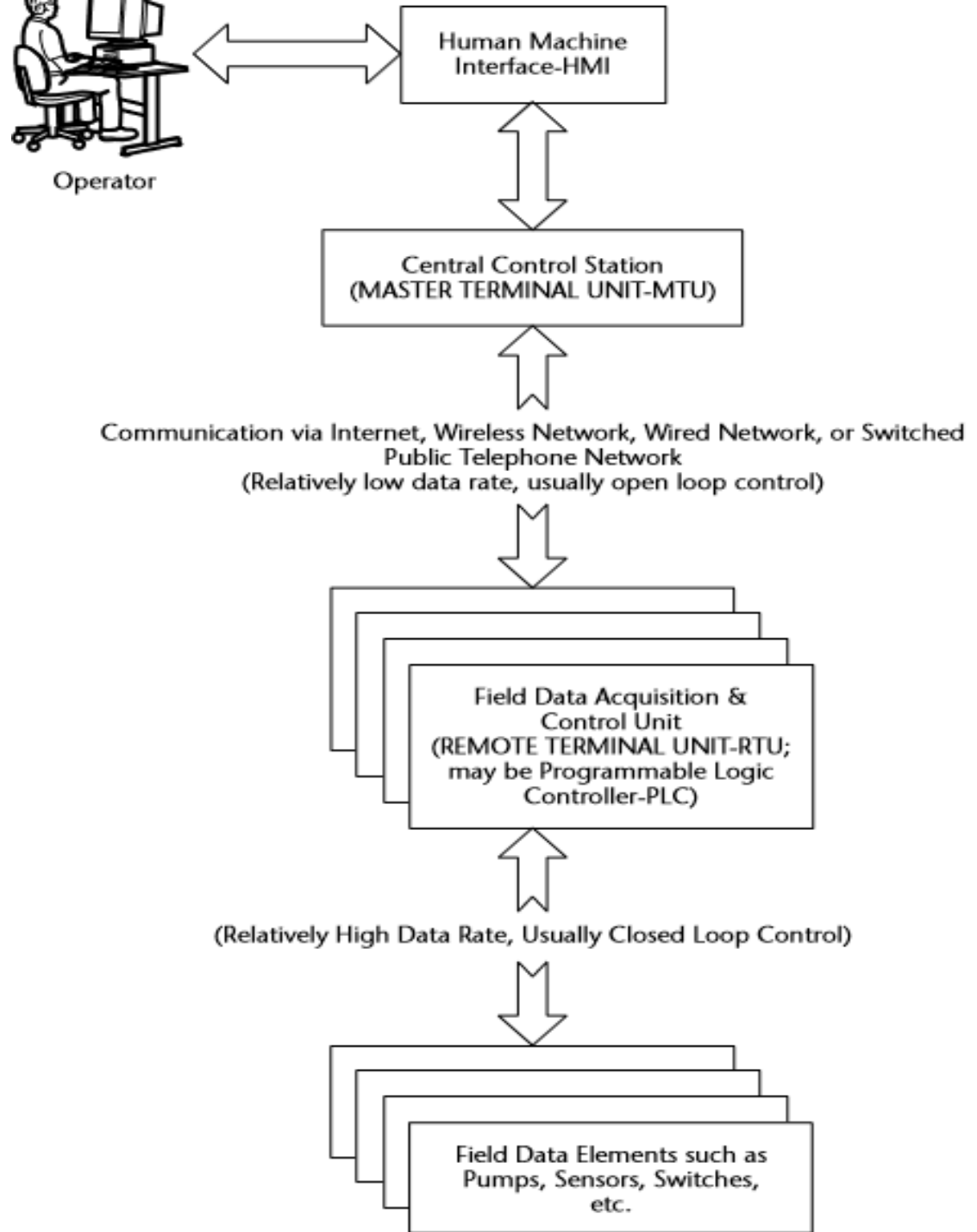
- SCADA is the technology that enables a user to collect data from one or more distant facilities and/or send limited control instructions to those facilities.
- A system operating with coded signals over communication channels so as to provide control of RTU (Remote Terminal Unit) equipment.
- Data acquisition is the process by which physical phenomena from the real world are transformed into electrical signals that are measured and converted into a digital format for processing, analysis, and storage by a computer.
- the data acquisition system is designed not only to acquire data, but to act on it as well

- **□ The basic elements of a data acquisition system are as follows:**
- □ Sensors and transducers.
- □ Field wiring.
- □ Signal conditioning.
- □ Data acquisition hardware.
- □ PC (operating system)
- □ Data acquisition software

basic elements of a data acquisition system



- SCADA System Architecture



SCADA Advantages:

A SCADA systems can be utilized achieve:

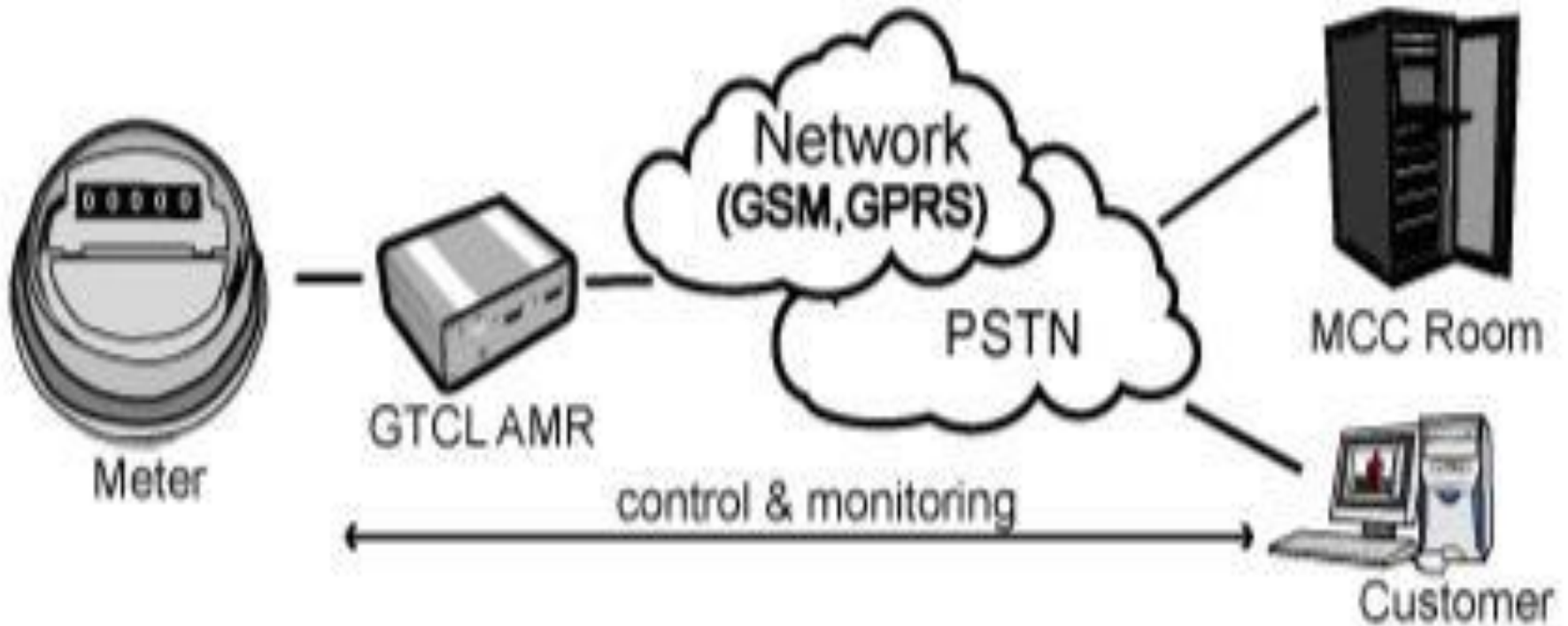
- Increase Efficiency
- Minimize Fault Response Time
- Reduce Planned Downtimes
- Isolate and Precisely Locate Faults
- Maximize Profitability
- Reduce Failures / Unplanned Downtimes
- Reduce Operations Overhead
- Reduce Manpower Requirement
- Maximize (Achieve Expected) Equipment Life
- Time
- Maximize Safety
- Public Safety
- Site Safety

Automatic Meter Reading (AMR):

AMR Utility Metering & Sub-Metering

Remote Site

Control Management



Automatic Meter System for building and utility sector

The benefits of AMR include:

- Lower cost to read the meters—
- More accurate and complete reads—
- Working as a two-way communication with each meter—
- Theft of service detection and prevention—
- Improved billing
- Accurate profile classes and measurement classes, true costs applied
- Improved security and tamper detection for equipment
- Energy management through profile data graphs
- Less financial burden correcting mistakes
- Transparency of “cost to read” metering
- Improved procurement power through more accurate data
 - “de-risking” price
- In cases of shortages, utility will be able to manage/allocate supply.

Disadvantages of advanced metering

- ☒ Utility can control amount allocated to users.
- ☒ Utility can remotely shut off users.
- ☒ Loss of privacy - details of use reveal information about user activities
- ☒ Greater potential for monitoring by other/unauthorized third parties
- ☒ Reduced reliability (more complicated meters, more potential for interference by third parties)
- ☒ Increased security risks from network or remote access