Energy Management – Assessing the organisation's preparedness

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Objectives

- To assess the preparedness of the organization to implement energy management strategies
- To develop a strategic, phased approach
- To develop management tools that ensure success

Why doesn't it happen?

Some organizations have saved 20 to 40% of their energy costs through management—why doesn't it happen everywhere?

- *It's not my job to save energy.*
- *I'm too busy to do anything.*
- *It's always available when I need it.*
- *I don't have to pay the bills.*
- *Top Management doesn't care. Why should I?*

Assessing the organization

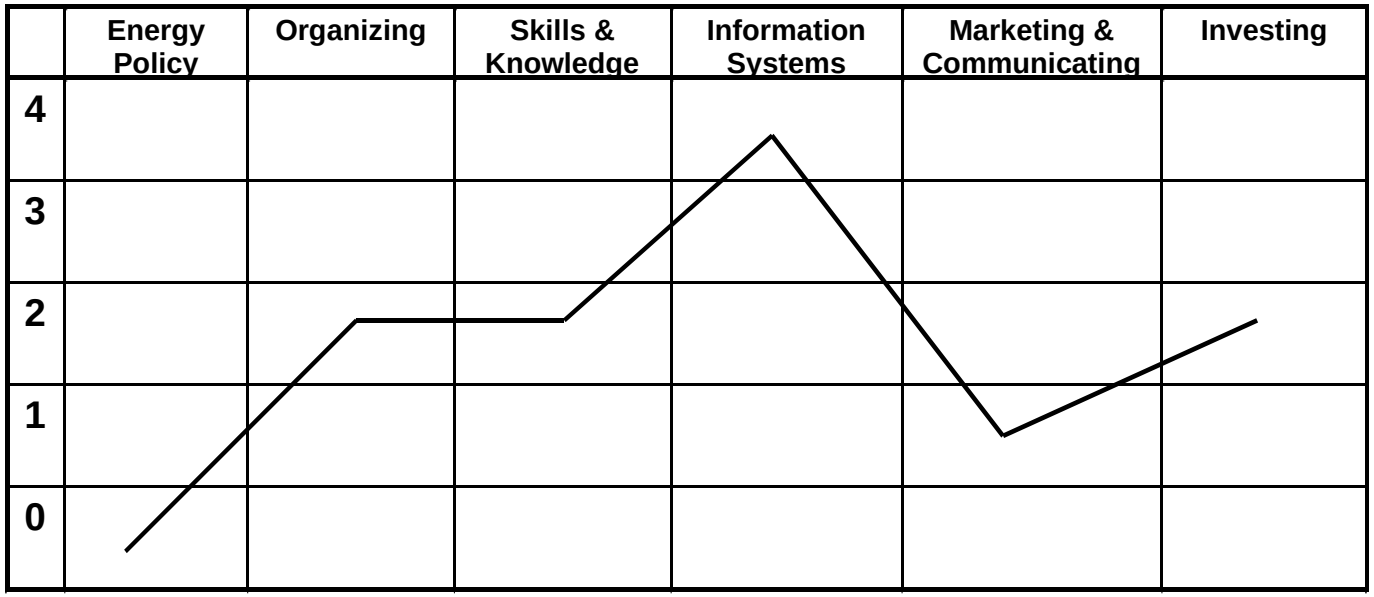
The Energy Management Matrix

	Energy Policy	Organizing	Skills & Knowledge	Information Systems	Marketing & Communicating	Investment
4	Energy policy, action plan and regular review have commitment of top management as part of a business & environmental strategy ❑	Energy management fully integrated into management structure. Clear delegation of responsibility for energy consumption. ❑	All energy users receive specific energy training integrated into other development activities. Workshops facilitate a sharing of knowledge. ❑	Comprehensive system sets targets, monitors consumption, identifies faults, quantifies savings and provides budget tracking. ❑	Communicating the value of energy efficiency and the performance of energy management within the organization and outside. ❑	Positive discrimination in favour of green schemes with detailed appraisal of all new-build & refurbishment opportunities. ❑
3	Formal energy policy but no active commitment from top management. ❑	Energy manager accountable to energy committee representing all users, ❑	Key energy users receive regular and specific training. Brief awareness training provided to all energy users. ❑	Monitoring and targeting reports for individual areas based on sub-metering, but savings not effectively reported to user. ❑	Programme of staff awareness and regular publicity campaigns. ❑	Same payback criteria employed as for all other investments. ❑
2	Unadopted energy policy set by senior manager or senior departmental manager. ❑	Energy manager in post, reporting to ad-hoc committee but line management and authority unclear. ❑	Key energy users receive awareness training, also occasional system-specific training. ❑	Monitoring and targeting reports based on supply meter data. Energy unit has ad-hoc involvement in budget setting. ❑	Some ad-hoc staff awareness training. ❑	Investment using short term pay back criteria only. ❑
1	An unwritten set of guidelines. ❑	Energy management the part-time responsibility of someone with only limited authority or influence. ❑	Key employees participate occasionally in awareness training. Some information passed informally to energy users. ❑	Cost reporting based on invoice data. Engineer compiles reports for internal use within technical department. ❑	Informal contacts used to promote energy efficiency. ❑	Only low cost measures taken. ❑
0	No explicit policy. ❑	No energy management or any formal delegation of responsibility for energy use. ❑	Energy users rely on their existing knowledge. ❑	No information systems. No accounting for energy consumption. ❑	No promotion of energy efficiency. ❑	No investment in increasing energy efficiency in the plant. ❑

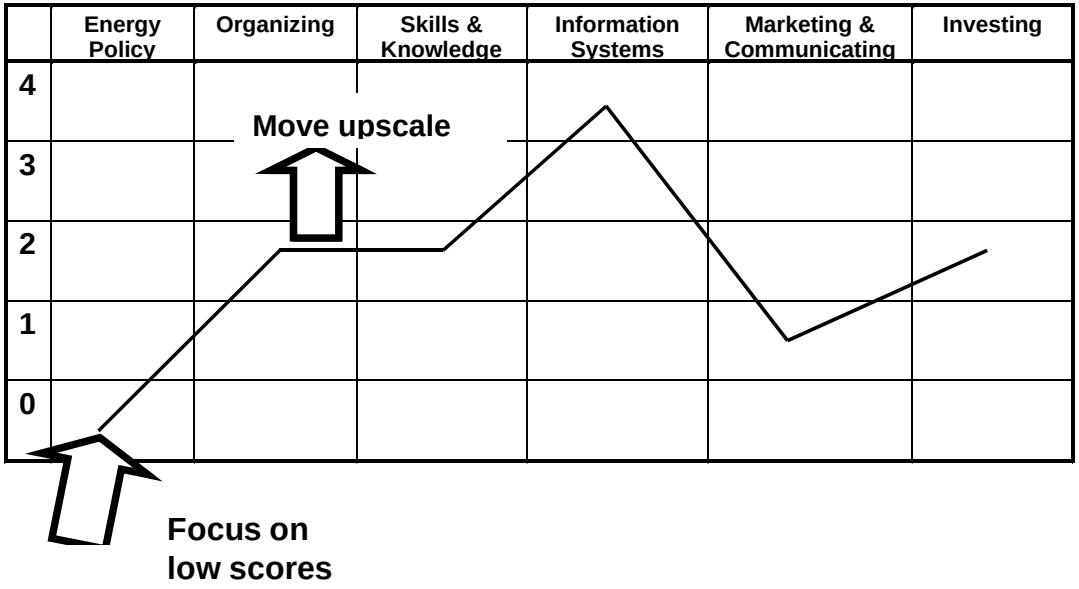
A Balanced Profile

	Energy Policy	Organizing	Skills & Knowledge	Information Systems	Marketing & Communicating	Investing
4						
3						
2						
1						
0						

An Unbalanced Profile

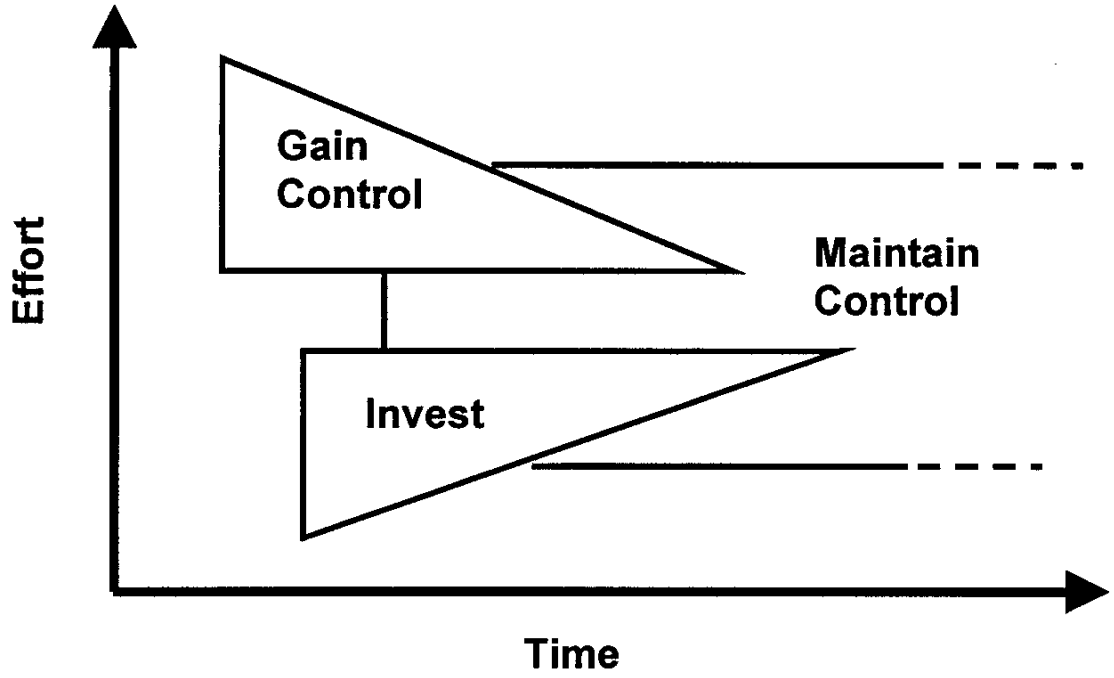


Interpreting the Profile

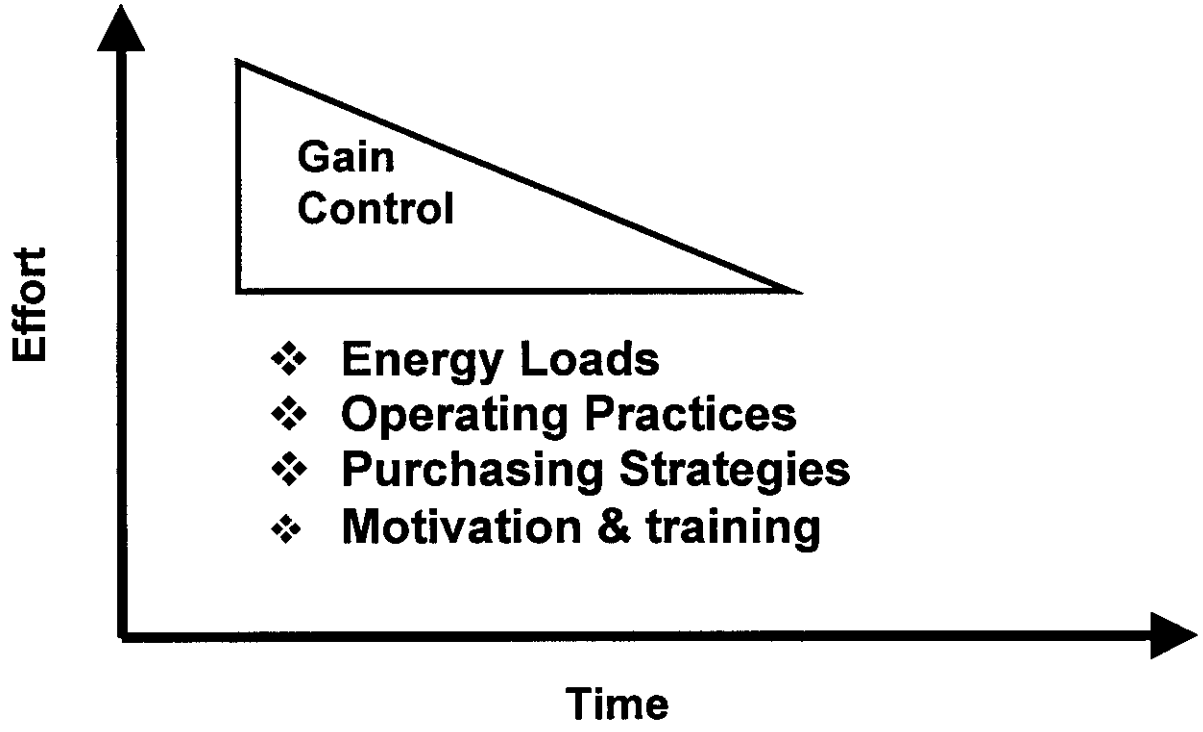


- Strive for balance
- Concentrate on raising the lowest scores
- Move all factors upwards

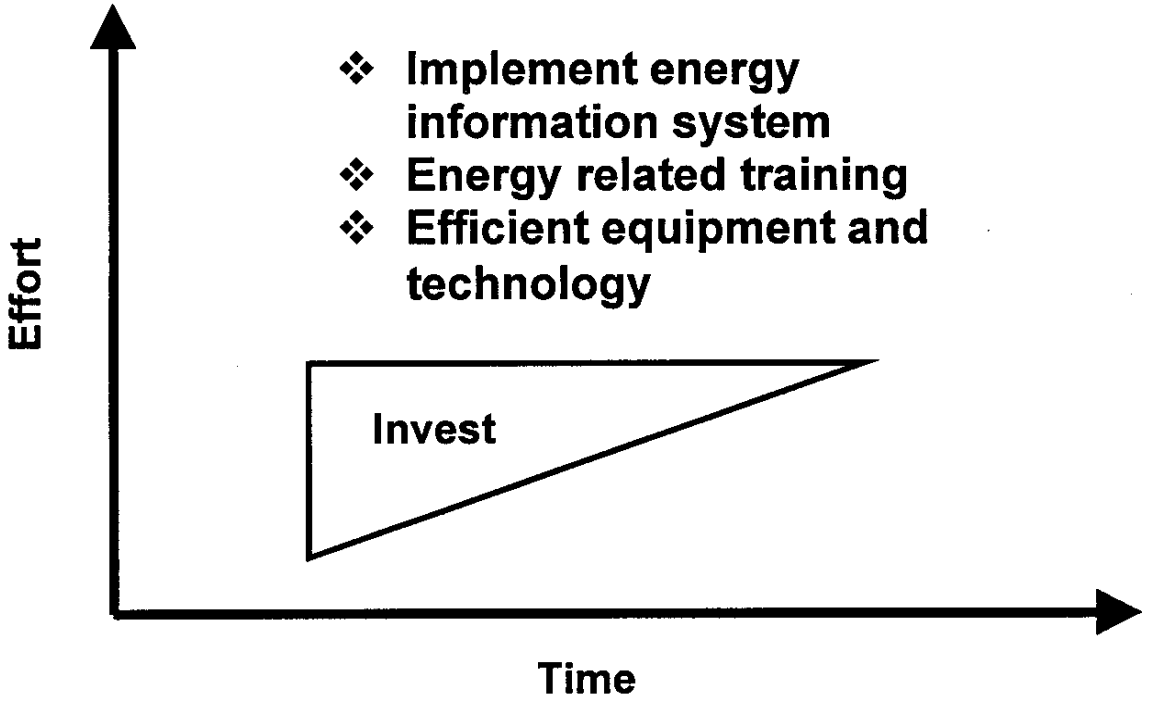
A Strategic Approach



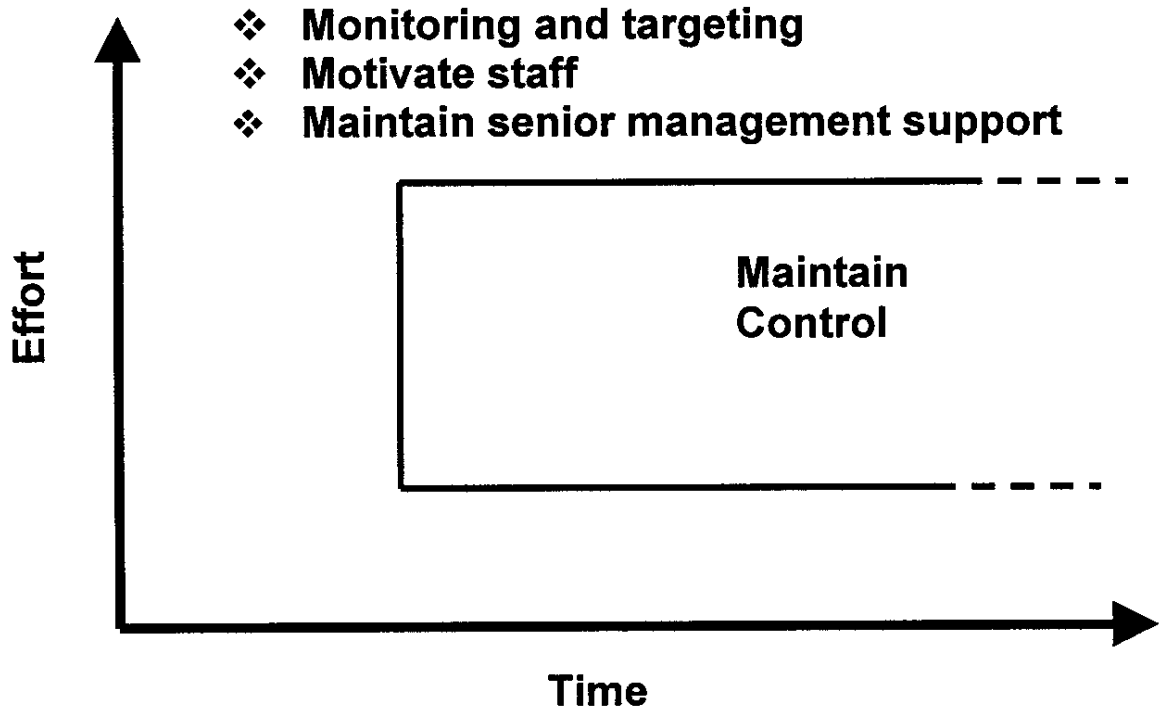
Gaining Control



Investing


Effort
Time
Invest
❖ Implement energy information system
❖ Energy related training
❖ Efficient equipment and technology

Maintaining Control



Organizational Change

- Senior Managers may care about
  - the organization's survival
  - its efficiency or profitability
  - their own professional development.
- More than energy conservation itself

Organizational Change

- Who's Responsible?
  - energy managers or co-ordinators
  - line managers responsible for the overall efficiency of their departments
- What are their concerns?
  - monitoring consumption
  - setting targets
  - identifying and correcting faults
  - motivating staff
  - identifying and implementing energy saving measures

Energy Policy

- Purpose
  - a public expression of your organization's commitment to energy management
  - a working document to guide your energy management practices and to provide continuity

Energy Policy

Why Bother?

- To protect against:
  - changes in personnel
  - alterations in perceived priorities.

Other Benefits:

- clear statement of what you are being asked to accomplish
- measure performance against an agreed programme and set of targets
- adequate staffing and funding
- formal backing from top management.

Sample Energy Policy Contents

Part 1

- Declaration of commitment to energy management
- Statement of policy
- Statement of objectives, separated into short and longer term goals

Part 2

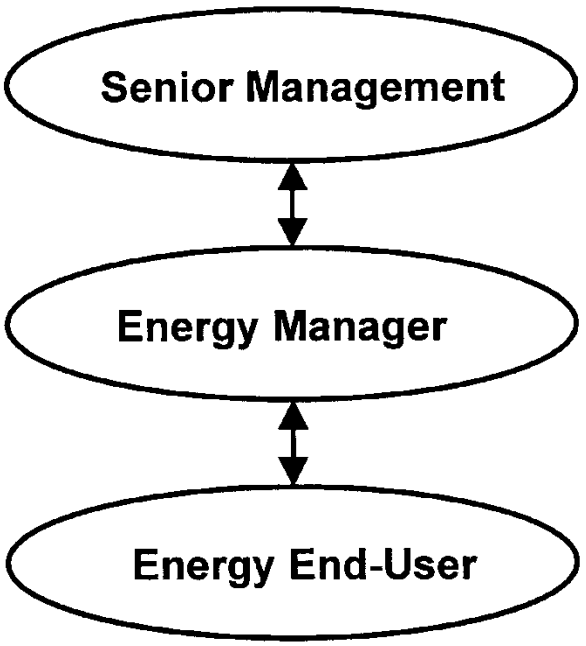
- Action plan
- Resource requirements,
- Responsibility and accountability
- Energy management committee
- Review procedure

Developing a Policy

- Consult
  - plant operations, finance, purchasing, human resources, marketing and sales, corporate communications and information services, etc.
- Draft
- Ratify

Organizing

- responsibility concentrated or distributed?
- energy management is a management function
- all managers are responsible
- accountability should be distributed to those who control it.



Energy Manager Functions

- energy policy
- management information
- reporting
- policies and practices for the purchase and combustion of fuels
- energy awareness
- 'good housekeeping' and plant operating practices
- training needs
- energy efficiency opportunities identification
- investment programme
- review procedures for return on investment

Motivating

- answer the question “what’s in it for me?”
- build commitment to achieving the corporate goal
- demonstrate the importance of energy efficiency
- involve people in the process
- provide a means for feedback
- communicate effectively
- accomplish “attitude adjustment”

How to Motivate

Factors

- financial rewards
- job security
- job enrichment
- peer pressure
- public recognition
- increased responsibility and greater autonomy.

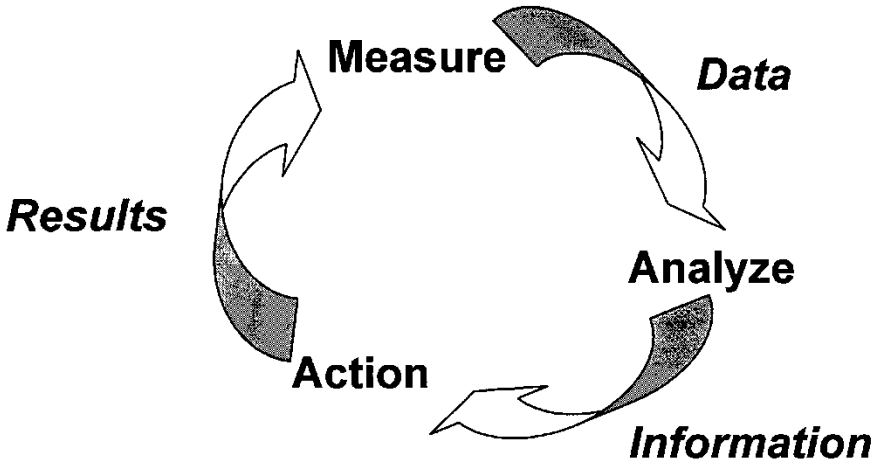
Strategies

- ensure that people get something out of what you propose
- give rewards and/or recognition
- link energy savings to the individual's own best interests

Information Systems

What is Information?

- data that has been processed so that it is meaningful to users and helps them make decisions



Designing the Information System - Some Questions

- who has an interest in the information it produces?
- what are they interested in knowing?
- are they getting the right information in the form that is most useful?

Barriers to Overcome

Managerial

- energy management marginalized as a technical specialty
- line management is inadequate
- insufficient interest and driving force from above
- little incentive to save energy

Technical

- getting accurate data on time is a key problem
- monitoring and targeting is not integrated with financial accounting
- output is not reported to either users or senior managers in a form they can readily understand and use.

Strategies for Success

- decide who will use the information and involve them in assessing their needs
- keep data input and analysis as simple as possible
- ensure that the output motivates people to use energy efficiently
- justify the expense of running the system to senior management.

Who Uses Energy Information?

- Top Level and Senior Managers
  - financial impact of energy management
  - future investment to meet payback expectations in the short term
  - what major energy efficiency projects with longer payback should be financed and why?

Who Uses Energy Information?

- Middle Managers
  - is the department meeting its target and/or staying within budget?

Who Uses Energy Information?

- Key Personnel
  - how much has energy consumption changed compared with last year?
  - what has been the effect of any energy management action taken?
  - what is the trend in energy use?

Who Uses Energy Information?

- General Staff
  - is department consumption of energy improving or getting worse?
  - what impacts are their actions having on energy use?

Who Uses Energy Information?

- Energy and Department Managers
  - by how much is their department improving?
  - how much effect has their good housekeeping had?
  - what measures would bring about increased energy efficiency?
  - what is the anticipated payback on these measures?
  - what technical advances in energy management are on the horizon?

Marketing and Communicating

- Communicate to:
  - raise awareness of the importance of energy efficiency to cost control and environmental conservation
  - promote energy efficiency measures
  - publicize your achievements in energy management inside and outside the organization.

Making the financial Case

- the size of the energy problem
- the technical and good housekeeping measures to reduce waste
- the predicted return on any investment
- the real returns achieved on particular measures over time.

Benefits of Measures

Financial:

- energy savings
- water savings
- maintenance savings
- increased productivity
- improved product quality

Non-financial:

- improved workplace environment
- mitigation of external environmental impact.

Setting Priorities

Consider:

- energy consumption per unit of production of a plant or process
- current state of repair and energy efficiency of the building fabric, plant and services, including controls
- quality of the indoor environment
- residual life or tenancy of the building
- effect on staff attitudes and behaviour.

Costs

- direct project costs
- new maintenance costs
- cost of operational adjustments (additional staffing, different production rates, etc.)
- training of personnel on new technology or operations

Selling Investment

- reducing operating/production costs
- increasing employee comfort and well-being
- improving cost-effectiveness and/or profits
- protecting under-funded core activities
- enhancing the quality of service or customer care delivered
- protecting the environment.

Investment Appraisal

- to determine which investments make the best use of available money
- to ensure optimum benefits from any investment made
- to minimise the risk from making investments
- to provide a basis for subsequent analysis of the performance of the investment.

A “Level Playing Field”

- Energy management investments should be assessed by the same criteria as investments in other priorities

Financial Analysis Methods

- Simple Payback Period

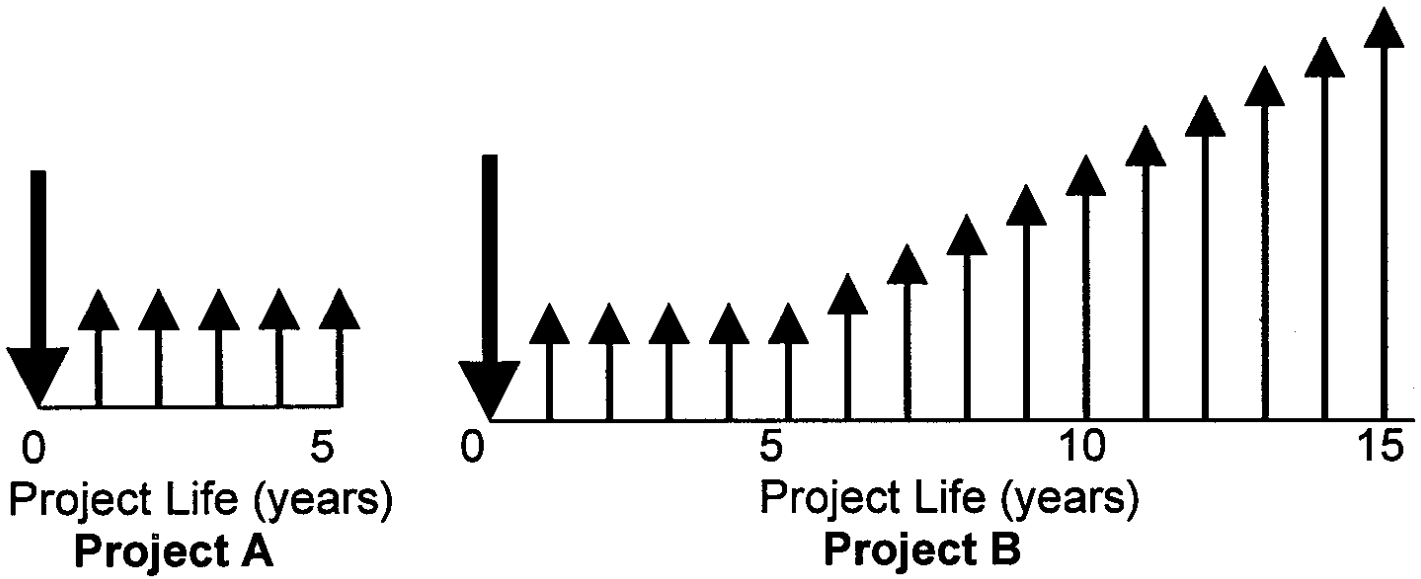
$$SPP(years) = \frac{Capital\,Cost}{Annual\,Savings}$$

- Return on Investment

$$ROI = \frac{Annual\,Net\,Cash\,Flow}{Capital\,Cost} \times 100\%$$

- Net Present Value
- Internal Rate of Return.

Cash Flow Analysis



Cash Flow Table

Table C4.1: Cash Flow Table for Purchase of new Boiler						
Capital Expenditure Rs.3,000,000 Expected Savings Rs. 1,440,000/year			90% on delivery/commissioning, and 10% performance guarantee due at one year Half in first year, full amount in all remaining years			
(Values in Rs'000)						
Year	**0**	**1**	**2**	**3**	**4**	**5**
Costs	(2700.0)	(300.0)	0	0	0	0
Savings	0	720.0	1,440.0	1,440.0	1,440.0	1,440.0
Net cash flow	(2700.0)	420.0	1,440.0	1,440.0	1,440.0	1,440.0
Net Project Value	(2700.0)	(2280.0)	(840.0)	600.0	2040.0	3480.0

Net Present Value Calculation

Table C4.3: NPV Calculation						
Year	0	1	2	3	4	5
Net cash flow (Rs000s)	(2700.0)	420.0	1440.0	1440.0	1440.0	1440.0
The discounted cash flow at 10% can be found as follows:						
Year 0	1 x (2700.0) = (2700.0)					
Year 1	0.909 x 420.0 = 381.78					
Year 2	0.826 x 1440.0 = 1189.44					
Year 3	0.751 x 1440.0 = 1081.44					
Year 4	0.683 x 1440.0 = 983.52					
Year 5	0.620 x 1440.0 = 892.80					
NPV = the sum of all these values = 1828.98 (compare to net project value = 3480.0)						

Internal Rate of Return

- The Discount Factor for which NPV = 0
- Often the basic criterion for corporate investment decisions

year	net cash flow	discount rate	NPV	IRR
0	-2700000	10	$1,664,963.84	30%
1	420000	20	$630,401.23	
2	1440000	25	$285,250.56	
3	1440000	30	$17,388.51	
4	1440000	35	-$74,644.18	
5	1440000			

Risk and Sensitivity Analysis

- Consider three scenarios:
  - Optimistic
  - Realistic
  - Pessimistic
- in energy costs
- interest rates
- tax rates

Funding Alternatives

- In-House
  - from a central budget
  - from a specific departmental or section budget
  - payment for energy services by individual budget holders
  - retaining the savings achieved.
- External
  - capital loans
  - energy performance contracts
  - leasing

Energy Performance Contracts and ESCOs

A comprehensive package of services:

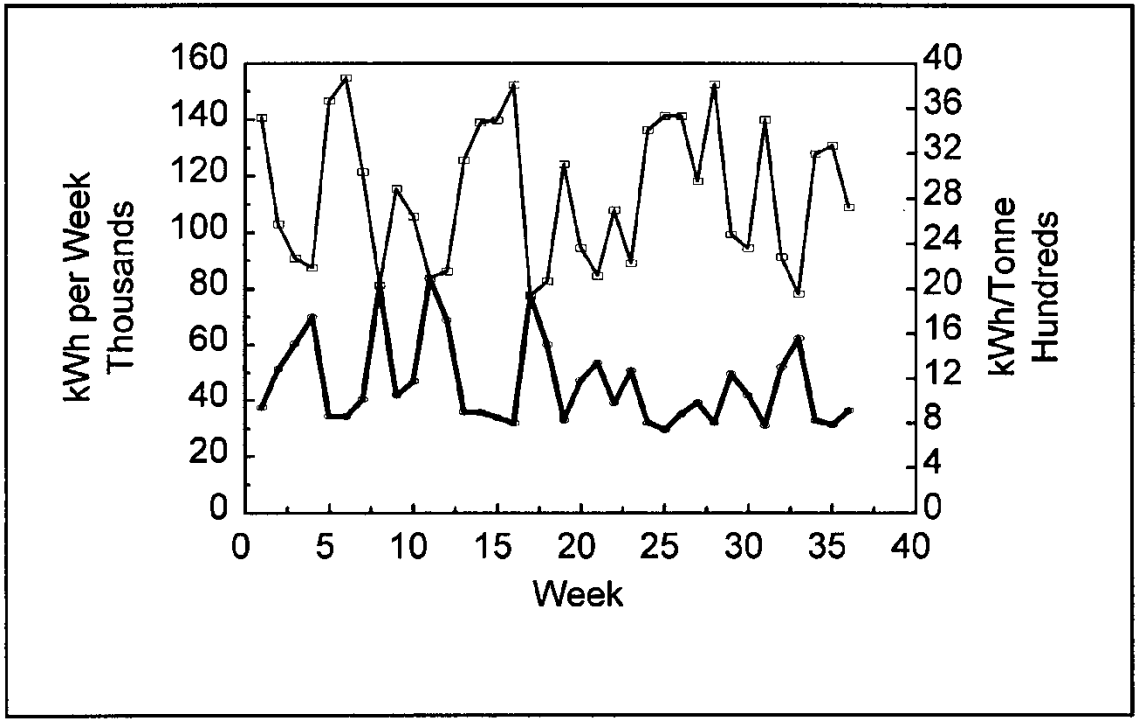
- An energy efficiency opportunity analysis.
- Project development.
- Engineering.
- Financing.
- Construction/implementation.
- Training.
- Monitoring and verification.

M&T Finding Answers

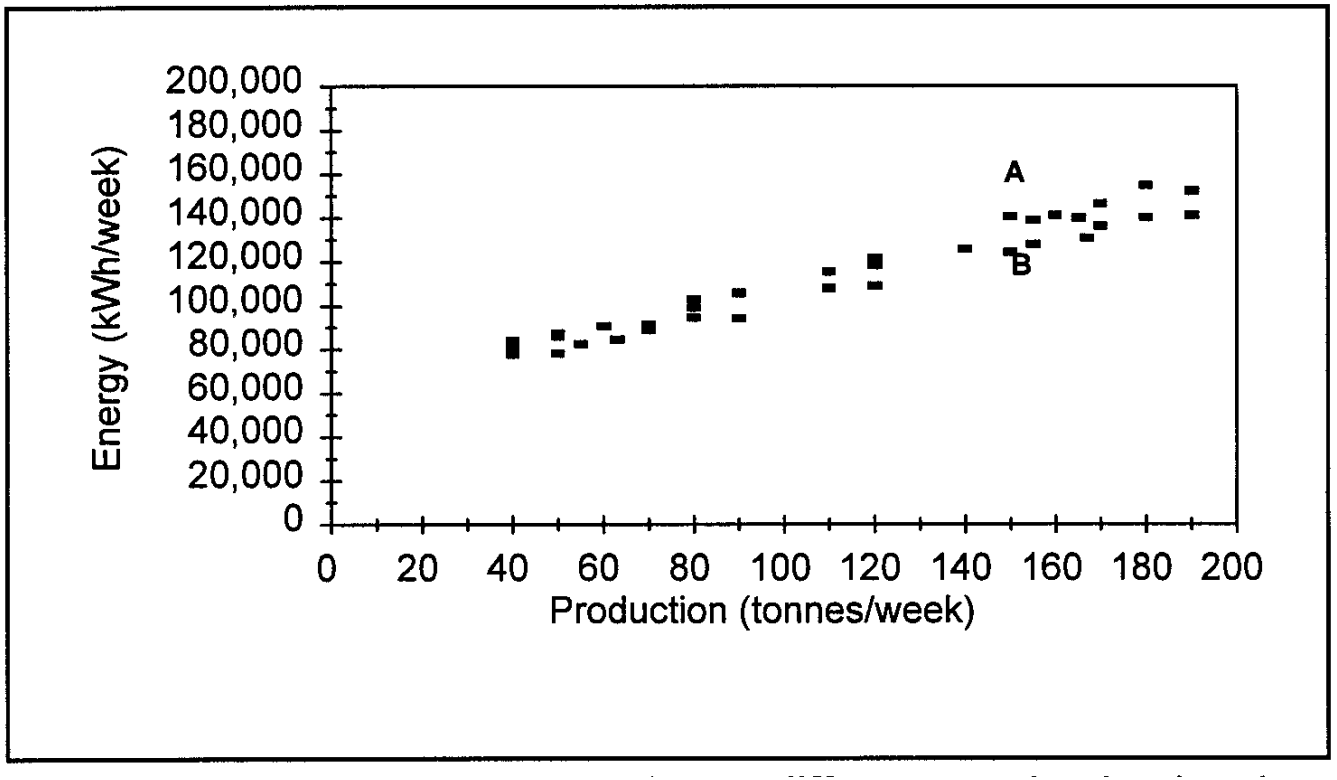
- How many energy saving measures have been introduced
- When did each take effect?
- How much energy has each measure saved?
- Are all the energy saving measures still working?
- Have any breakdowns been restored?
- How much energy will be required for a budgeted production of 120 tonnes a week in the next quarter?
- What further savings can be achieved?

Week	Production (tonnes)	Energy kWh	Specific Energy (kWh/Tonne)
1	150	140726	938
2	80	103223	1290
3	60	90764	1513
4	50	87567	1751
5	170	146600	862
6	180	154773	860
7	120	121575	1013
8	40	81436	2036
9	110	115586	1051
10	90	105909	1177
11	40	83916	2098
12	50	86272	1725
13	140	125892	899
14	155	138966	897
15	165	139922	848
16	190	152274	801
17	40	77788	1945
18	55	82711	1504
n		124317	829

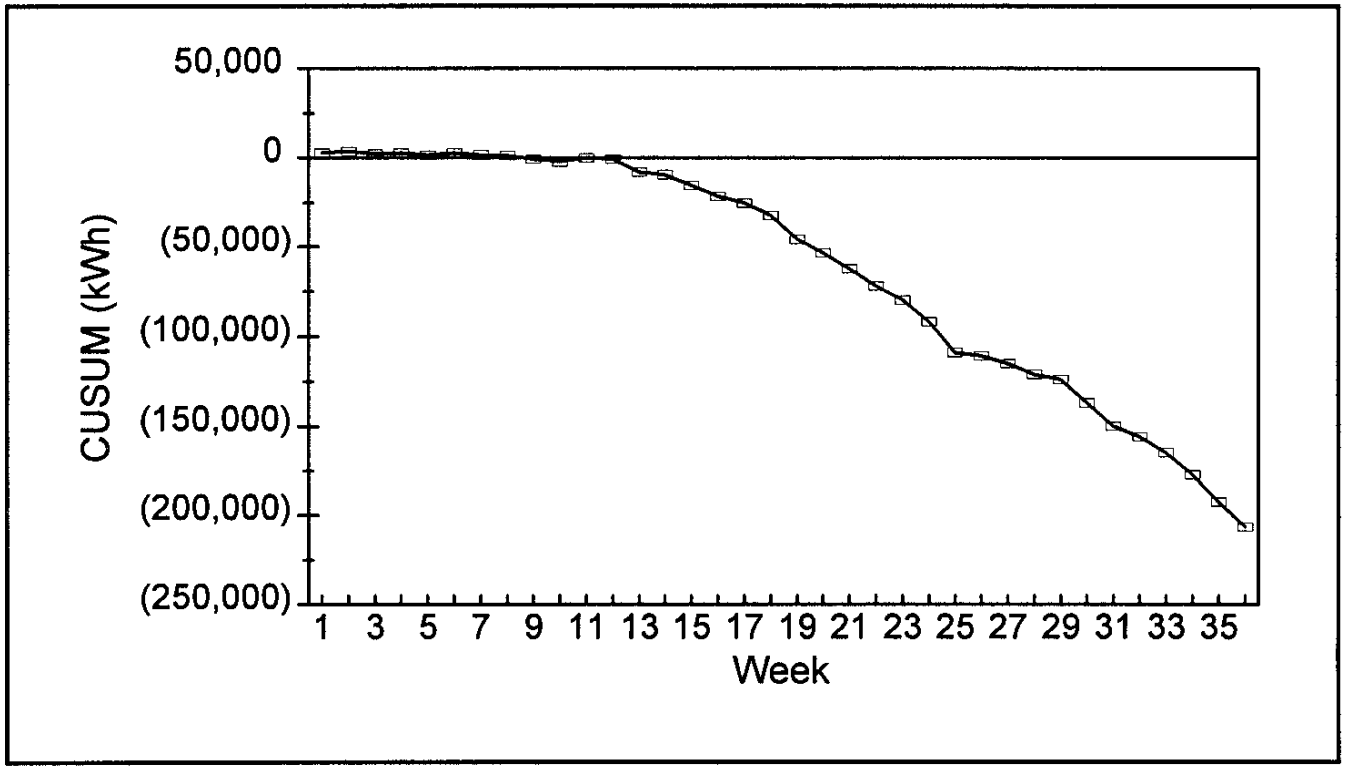
Data is still Data



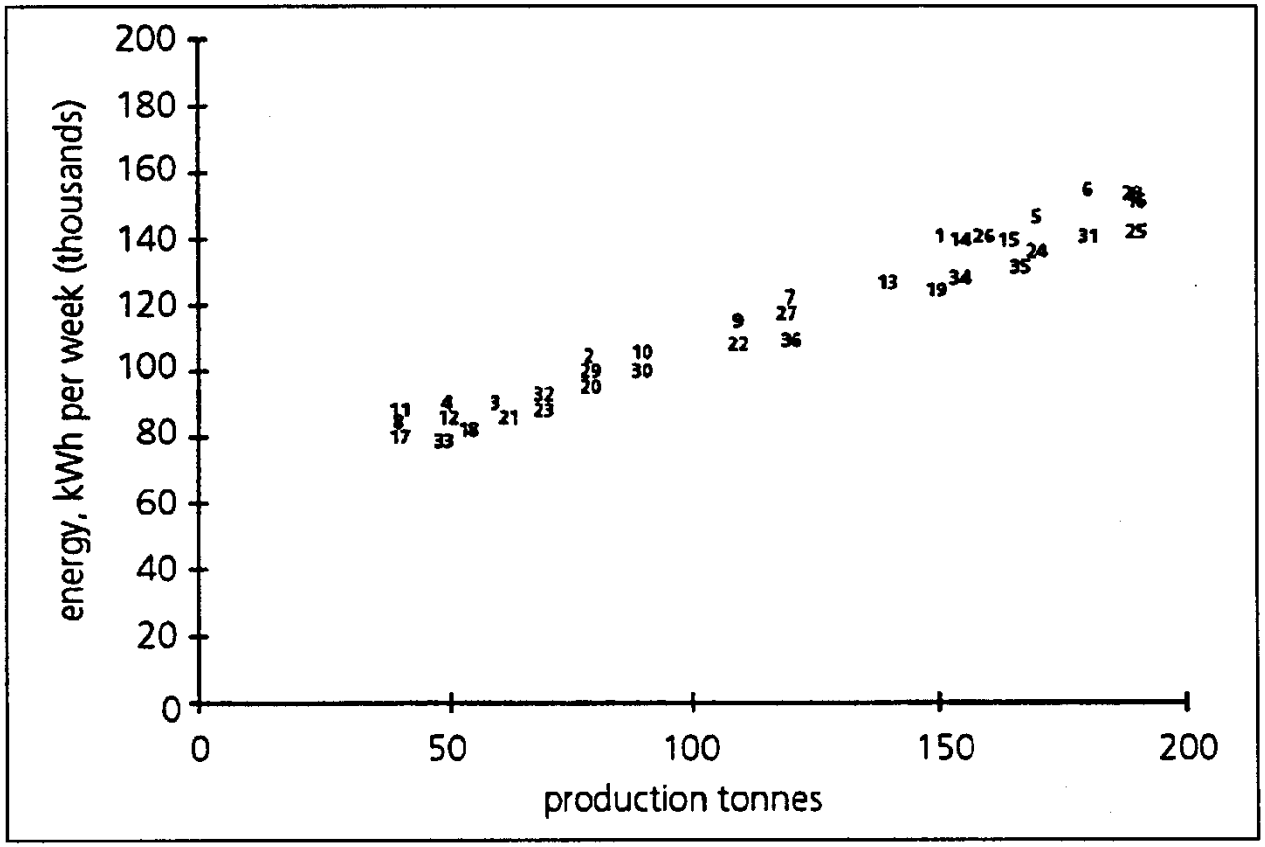
Energy Consumption and Production



CUSUM


50,000
0
(50,000)
(100,000)
(150,000)
(200,000)
(250,000)
CUSUM (kWh)
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35
Week

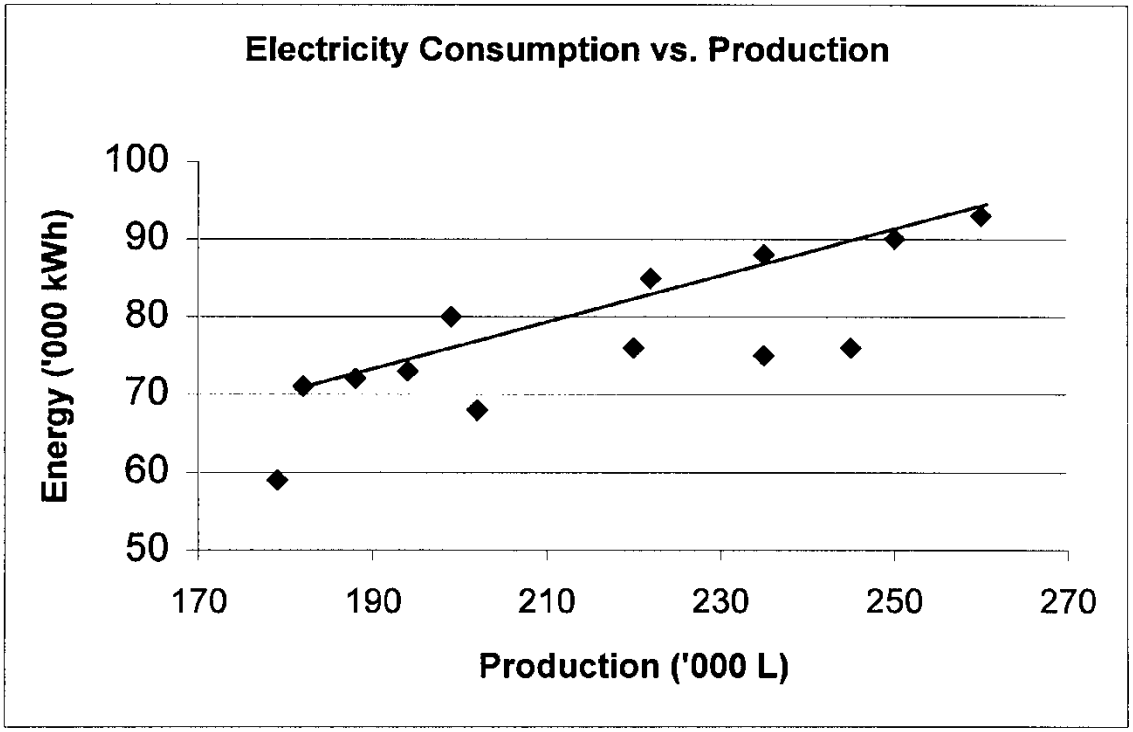
Regression Analysis



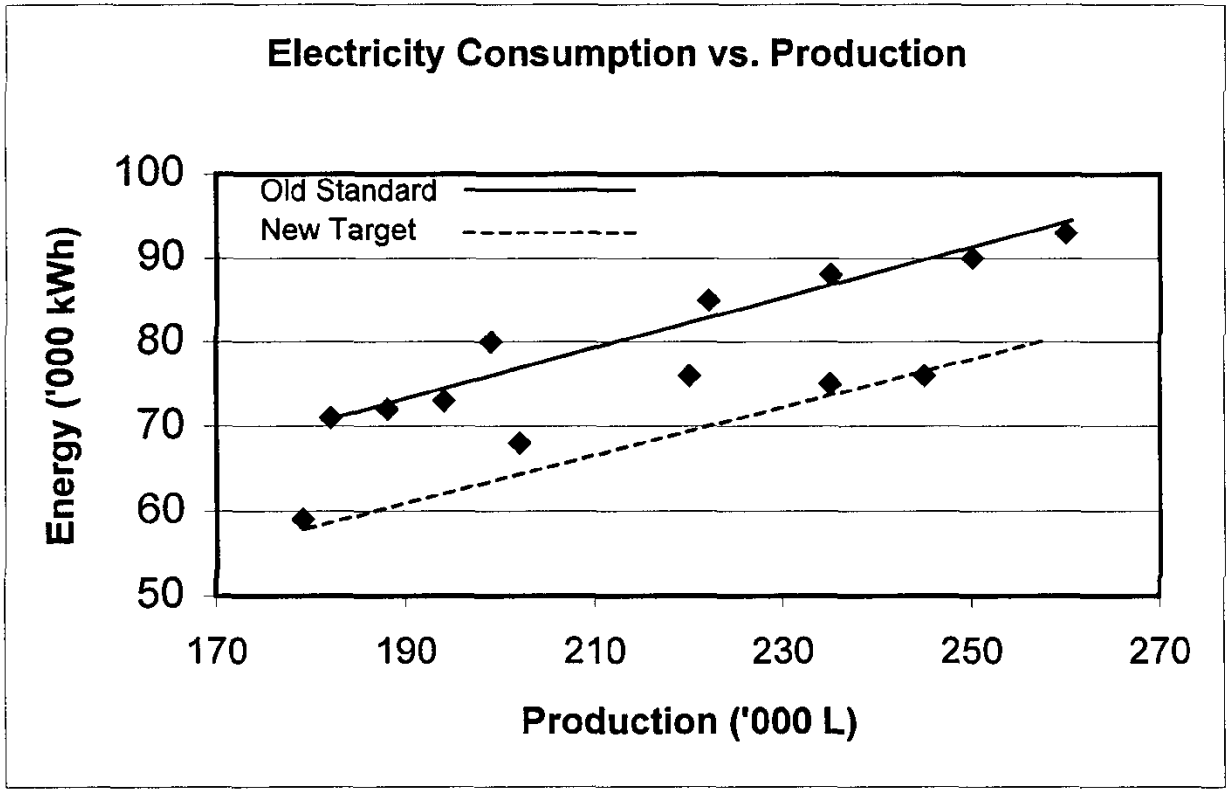
Calculating CUSUM

Measured Data				Baseline			Control Chart	
Week	Production (T)	Specific Energy (kWh/T)	Total Energy (kWh)	Predicted Energy (kWh)	Difference (kWh)	CUSUM (kWh)	Actual (kWh)	Difference (kWh)
1	150	938	140726	138020	2706	2706	125029	15697
2	80	1290	103223	102250	973	3679	92829	10394
3	60	1513	90764	92030	-1266	2413	83629	7135
4	50	1751	87567	86920	647	3060	79029	8538
5	170	862	146600	148240	-1640	1420	134229	12371
6	180	860	154773	153350	1423	2843	138829	15944
7	120	1013	121575	122690	-1115	1728	111229	10346
8	40	2036	81436	81810	-374	1354	74429	7007
9	110	1051	115586	117580	-1994	-640	106629	8957
10	90	1177	105909	107360	-1451	-2091	97429	8480
11	40	2098	83916	81810	2106	15	74429	9487
12	50	1725	86272	86920	-648	-633	79029	7243
13	140	899	125892	132910	-7018	-7651	120429	5463
14	155	897	138966	140575	-1609	-9260	127329	11637
[illegible]	[illegible]	[illegible]	139922	[illegible]	763	-15023	131929	799
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]1209	[illegible]	[illegible]

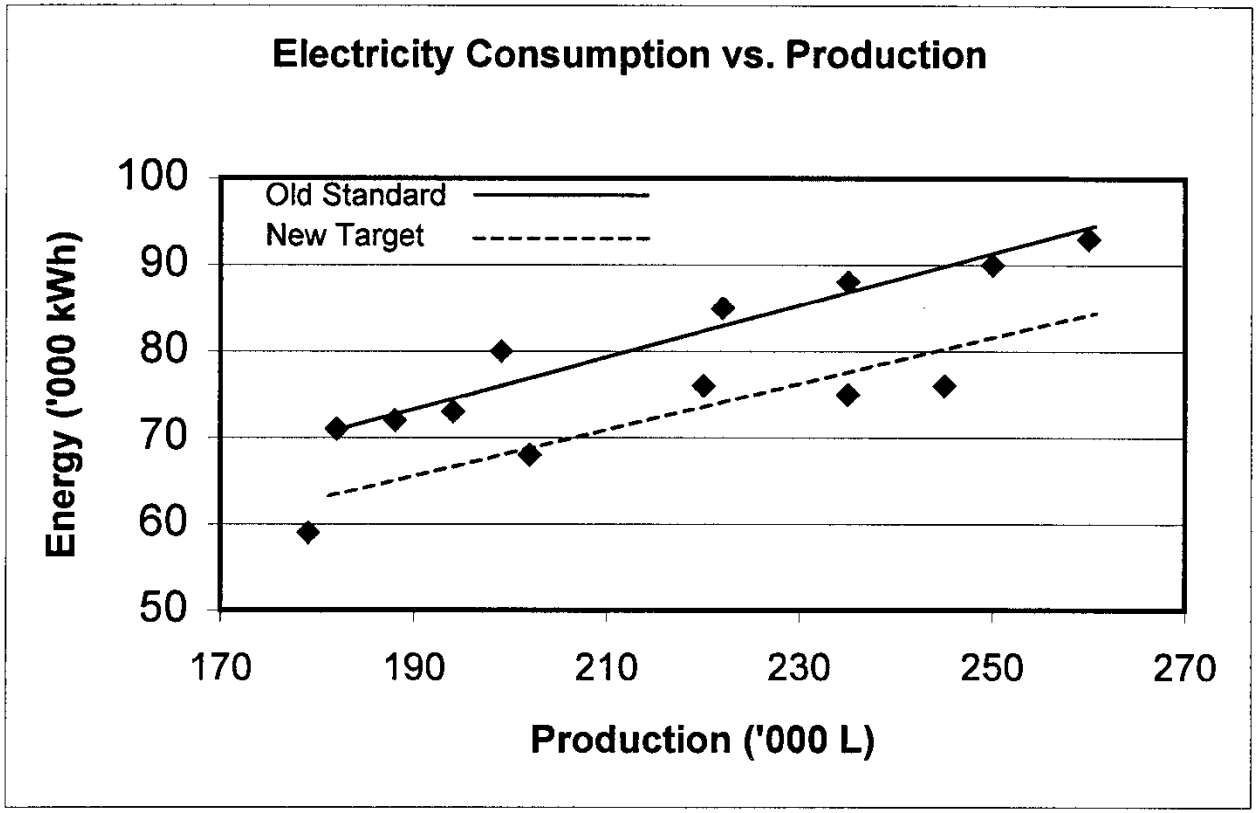
Target Setting - Preliminary Target



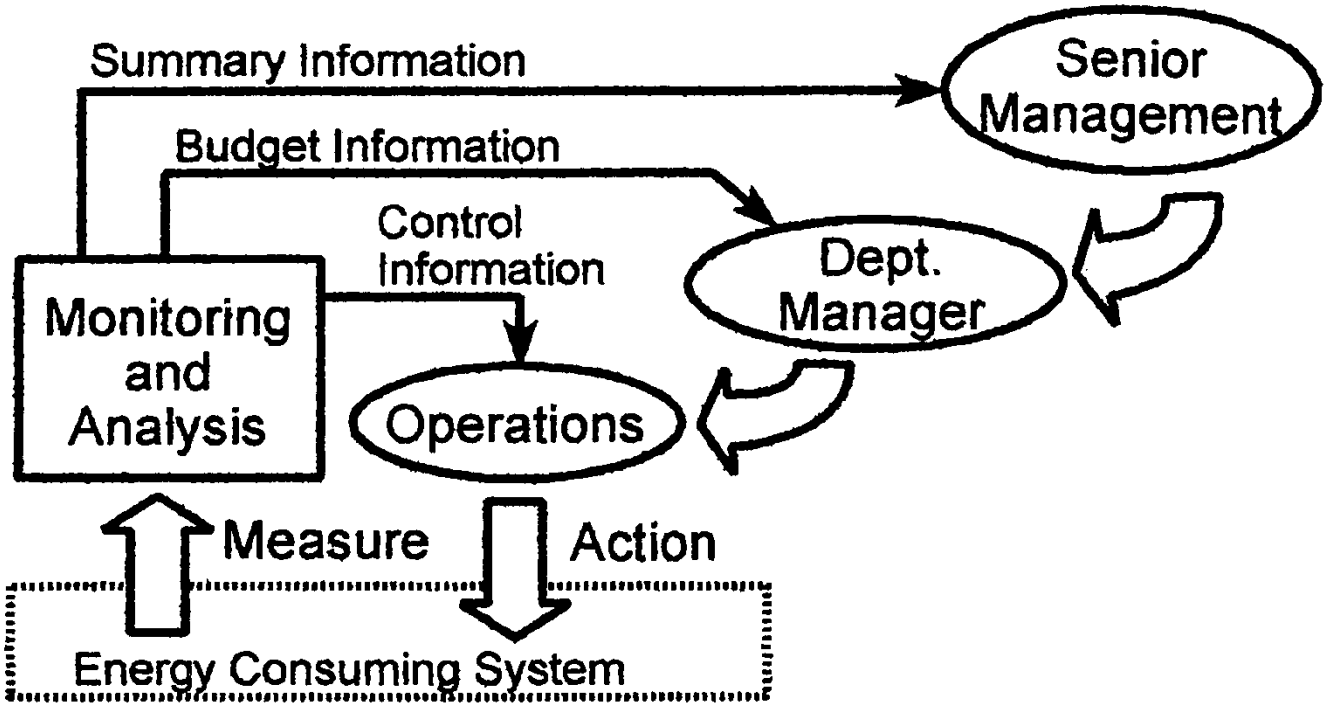
Target Setting - Best Historical Performance



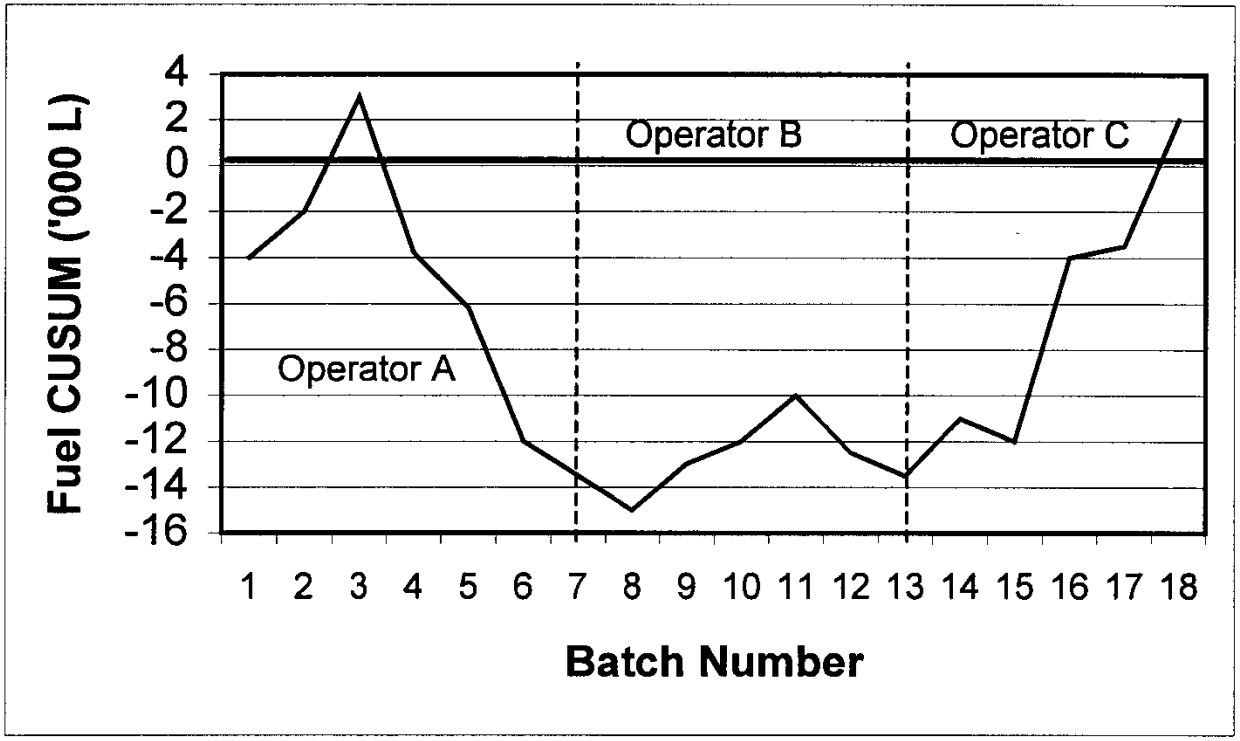
Target Setting - Arbitrary 10% Reduction



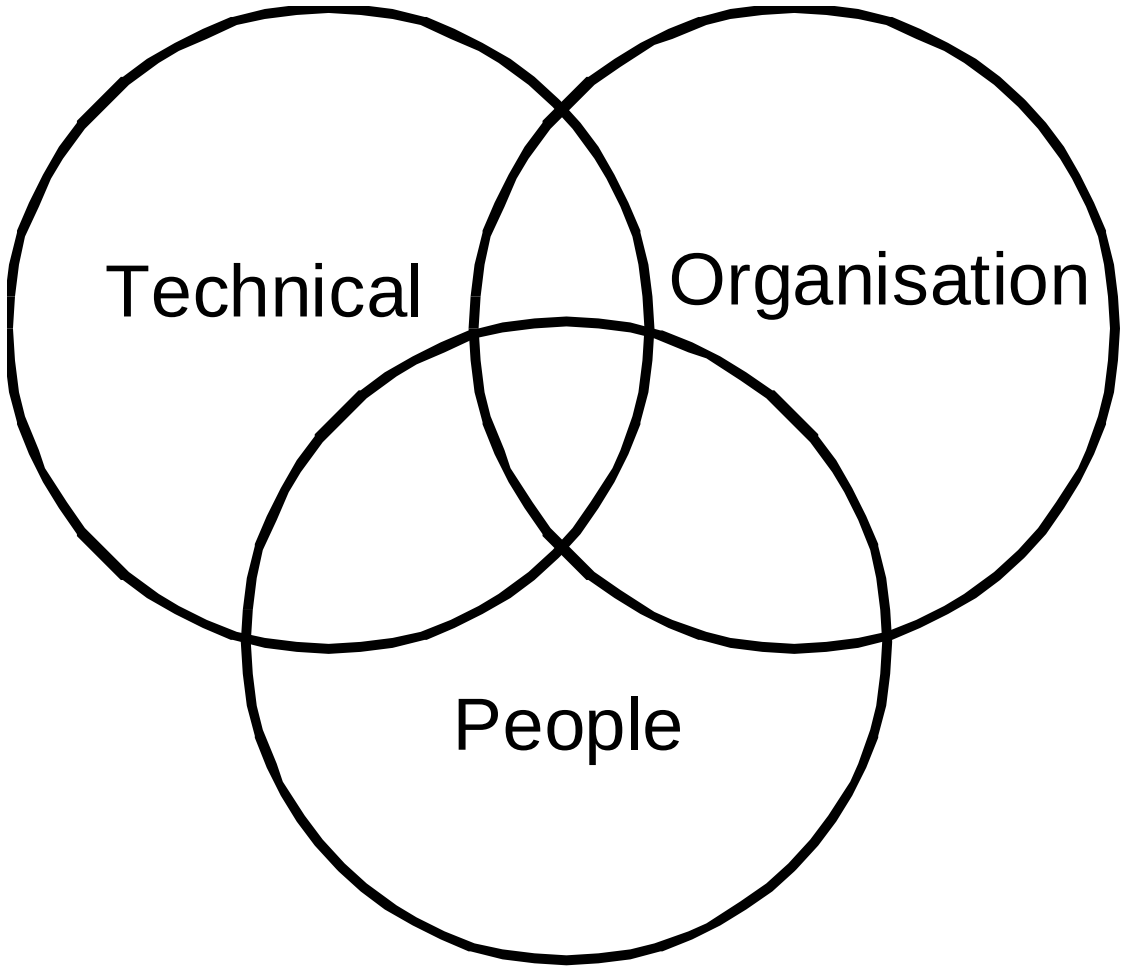
Reporting


Summary Information
Senior Management
Budget Information
Control Information
Dept. Manager
Monitoring and Analysis
Operations
Measure
Action
Energy Consuming System

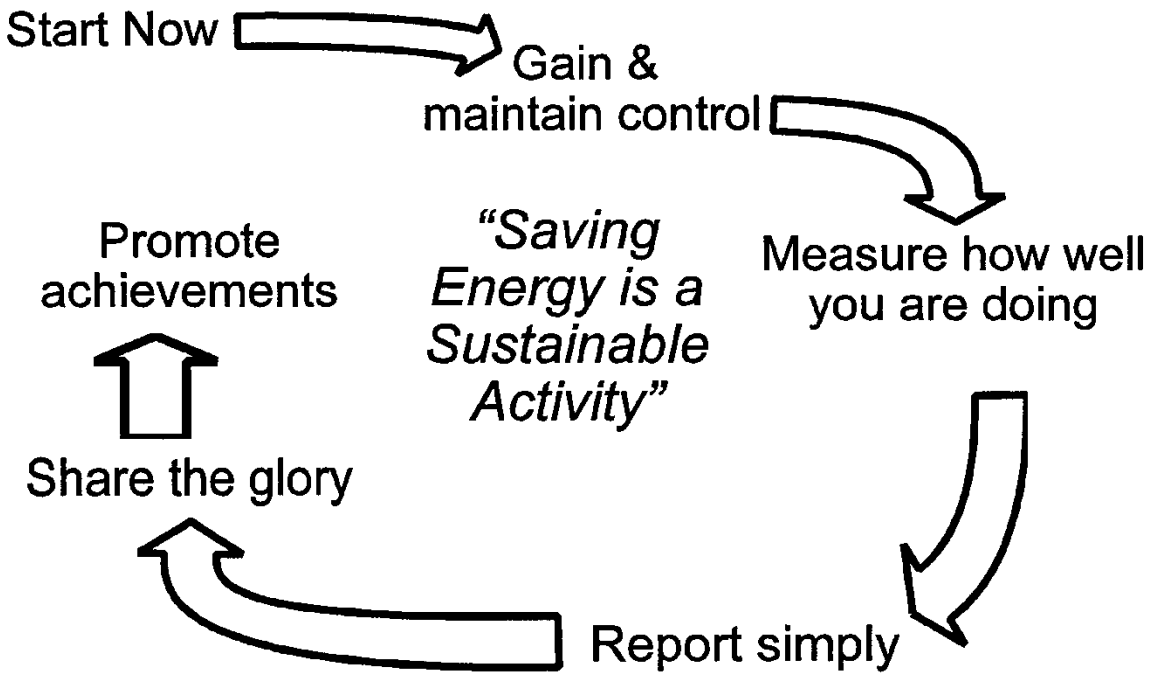
Detailed CUSUM Report



Three Themes to Energy Management



A Process of Continuous Improvement



The Good News

- Energy Management Pays Off!
  - Financial Savings
  - Improved Competitiveness
  - Environmental Protection

Thank you!

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