Monitoring, Targeting and Reporting: a Pathway to Continuous Improvement in Energy Management

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Abstract

Leading industrial organizations strive for continuous improvement in the efficiency, productivity and performance of their systems. It is important for companies to establish effective processes that monitor and review results against performance targets.

BC Hydro's Monitoring, Targeting and Reporting (MT&R) program provides a platform for continuous improvement in energy management for industrial organizations. MT&R is a proven method for measuring and maintaining energy performance, and for identifying opportunities to improve energy efficiency. After a long history of success in Europe, MT&R is now being effectively applied to industrial settings in North America as an innovative approach to energy management.

MT&R: How it Works

MT&R is based on principles of statistical process control and energy accounting. It involves four key information management techniques:

- Collection of data and information on energy, production and other variables
- Development of an energy performance model that relates energy consumption to production parameters
- Cumulative Sum of Differences (CUSUM) Analysis: a statistical analysis technique that demonstrates the ongoing changes between actual and predicted values.
- Energy performance control charts: to provide information allowing operations to manage downward consumption by target setting.

MT&R puts energy use information in the hands of people who manage it, giving them the tools to plan and implement continuous improvement strategies.

MT&R as a DSM Program

BC Hydro, in partnership with industry energy experts, undertook a pilot project at three industrial facilities to understand the opportunity for an MT&R program. As a result, BC Hydro has designed a program that provides expertise and funding to help industrial customers implement a tailored MT&R program. The resulting program design supports an incremental approach by helping industrial customers understand the value of MT&R, build internal support, and then implement MT&R., through the following five stages:

- Custom Illustration
- Custom Workshop
- Operational Energy Analysis
- Implementation
- Continual Improvements

MT&R: How it Works

Background on MT&R and BC Hydro Pilot

Monitoring, Targeting and Reporting (MT&R) is an approach to actively monitor and control energy use. Industry in the UK has used MT&R for over 15 years [1] and, over the last 3 to 5 years, these techniques have been used successfully by North American industry [2].

By setting targets on energy consumption, energy is treated as a variable cost of production and not accepted as a fixed, uncontrolled cost. Companies first analyze the drivers that impact energy use and define a relationship between energy and production. Through an investigation of best performance periods, the target relationship can be established. From an operational perspective, actual consumption is compared against this target and variances are investigated. If actual consumption is within the expected target range, energy can be considered "IN CONTROL"; however, when this range is exceeded, then reasons for this variance can be investigated and actions taken to reduce energy use.

It is important to understand that MT&R will not save energy directly, just as meters do not save energy. MT&R is a tool for operators and managers that can provide an opportunity for them to better understand how energy is used and to adjust operating parameters to reduce energy use. Hence MT&R is treated as a "Pathway for Continuous Improvement" in managing energy use.

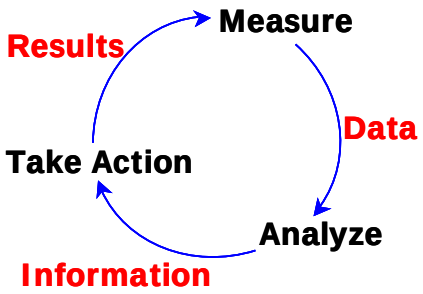
BC Hydro contracted Prism Engineering to carry out a high level pilot investigation to allow them better understand how MT&R may be applied to their industrial customers. This pilot was intended to identify the primary areas of opportunity and outline how the MT&R program would be implemented.

The approach taken for this pilot was to apply MT&R from a high level – analyzing overall electrical use compared to production – and then to "drill down" when opportunities become apparent. The following customers were included in this pilot: a Pulp Mill, a Cement Plant and a Brewery.

MT&R Procedures

Overview

The diagram to the right illustrates the process applied in MT&R. The process involves turning data into information that can be used and, ultimately, turned into results. Rather than merely taking measurements, the analysis carried out from MT&R drives the actions that save energy and costs.



The fundamental approach to MT&R involves determining which factors will have an influence on energy use, typically recorded by an energy meter. These factors are sometimes referred to as "drivers". In a production environment, the volume produced or the grade of product may be a driver. For a building with natural gas-fired heating, the driver will typically be the heating requirements expressed as the number of heating degree days (HDD).

Energy Performance Model

Once the driving factors are identified, the relationship between the drivers and energy consumption can be established with an energy performance model. For example, linear regression can be used to describe the relationship between energy consumption and its drivers with a mathematical equation.

When energy use information is compared against the driver in the model, a regression correlation coefficient, R^2, is statistically determined. This is a measure of the proportion of variability explained by the linear relationship in a sample of paired data. It is a number between zero and one, with a value close to zero suggesting a poor model. Generally, a value above 0.7 is considered an acceptable level to have confidence in the relationship; however, a lower value may be acceptable with a larger data set (for example, two or three years of monthly data).

More sophisticated models make use of multi-variable regression where two or more variables are considered as drivers.

Using CUSUM to Establish Desired Performance

The performance model can also be used to predict energy use in a period, for a specified set of conditions as described by the drivers. Future use can be compared against the prediction to determine whether energy use is higher or lower than predicted. The difference in energy use between actual and target is calculated for each period, and added together creating a "running total". This is referred to as the CUSUM or Cumulative Sum of the differences. The CUSUM is also referred to as the cumulative savings total, and trends in the CUSUM graph indicate consumption patterns.

The CUSUM model is used to review and determine the periods of optimal performance. If the operations or management staff can identify procedures in place during this "mode" of operation and can repeat this practice, savings can be achieved. The desired performance is referred to as a target.

Targets

The concept of the target can be expanded further by using a control chart, similar to controls charts used in quality assurance programs. The control chart is used to set upper and lower limits of acceptable operations. The upper limit is a flag that the operations are not performing to meet the target. The lower limit is an indication of even better performance – perhaps this performance could be investigated to determine if the operation could continue in this manner. If that was the case, then a new "target" could be set.

User Feedback

Operations staff, managers and Energy Champions have used MT&R to gain insights into their energy use. Through many discussions with MT&R users, it has become clear that this technique helps turn data into valuable, useable information.

Software

MT&R software is commercially available for data analysis [3]. However, sophisticated software packages are not needed to understand the MT&R potential and get started. A basic Microsoft Excel spreadsheet was used for all analyses in the pilot project.

MT&R Analysis

Methodology

The primary project tasks carried out are summarized as follows:

- Reviewed available electrical energy information and had discussions with site personnel in advance of site visit to get an overview of their process, metering and energy use
- Carried out site visit(s) and met with representatives to get an overview of the plant and processes and to discuss how energy data is used
- Reviewed existing manual and automatic metering
- Reviewed accounting and reporting procedures around energy and to collect accounting reports
- Met with Information Technology (IT) support person and carried out data collection on site from various DCS (distributed control systems) for energy and production
- Consolidated energy data and carried out preliminary analysis on site
- Carried out MT&R analysis

Site 1

How Energy Use is Currently Monitored

Site 1, a market pulp mill, has real-time meter data for the total plant load and the largest 11 loads that make up 75% of the energy use. Users can access this information through a spreadsheet interface at any interval. Only these 12 meters are currently logged electronically. We did not observe any analysis carried out on this data.

In addition to the electronic metering, electricians take 21 energy readings manually on a daily basis. This data is collected on log sheets as shown in Figure 1. It is assumed that electricians use the data to review potential irregularities, but not to actively manage energy. Based on the format, it is difficult to analyze it and certainly not easy to manage from the information.

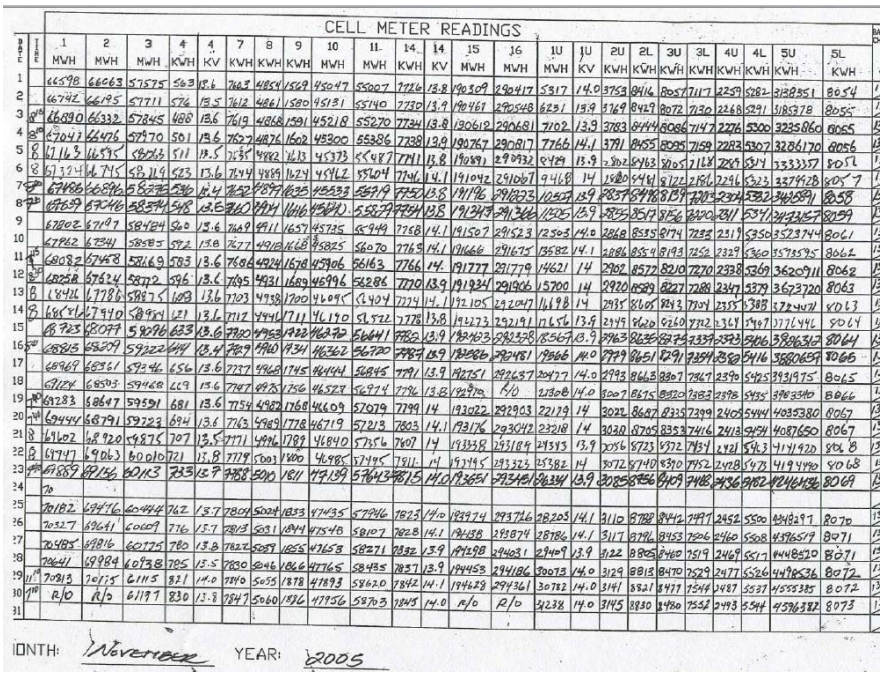


Figure 1 – Site 1 Sample Log Sheet

On a "batch" level, the accounting department carried out evaluations on overall consumption vs. production for various grades. This analysis includes a regression model of kilowatt hours per Air Dried Metric Tonne or kWh/admt for various grades of pulp production.

Analysis and Results

Accounting data was useful in establishing a model relationship. For Production Line 1 (PL1), when energy and production we compared, the R^2 value was 0.97. This improved to 0.98 when a second variable was added to the model. Using this multivariable regression, a CUSUM graph was created comparing each run with the performance model. Figure 2 shows the CUSUM for the year with the percentage relative to the annual energy use for this line. Using the entire period as a baseline shows changes in relative performance over the year.

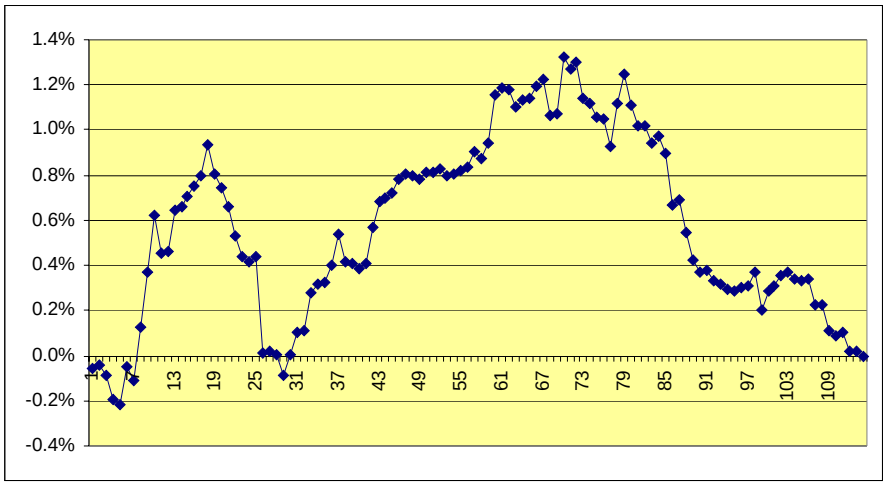


Figure 2 – PL1 CUSUM for Electrical Energy

Periods 30 through 70 show runs that have higher energy use than the model and cumulative 1.3% higher energy. Periods 80 through 94 show a sustained period of "improved" performance. If this period is chosen as the model, the CUSUM graph in Figure 3 shows that energy use for Line 1 could be approx 6.5% lower.

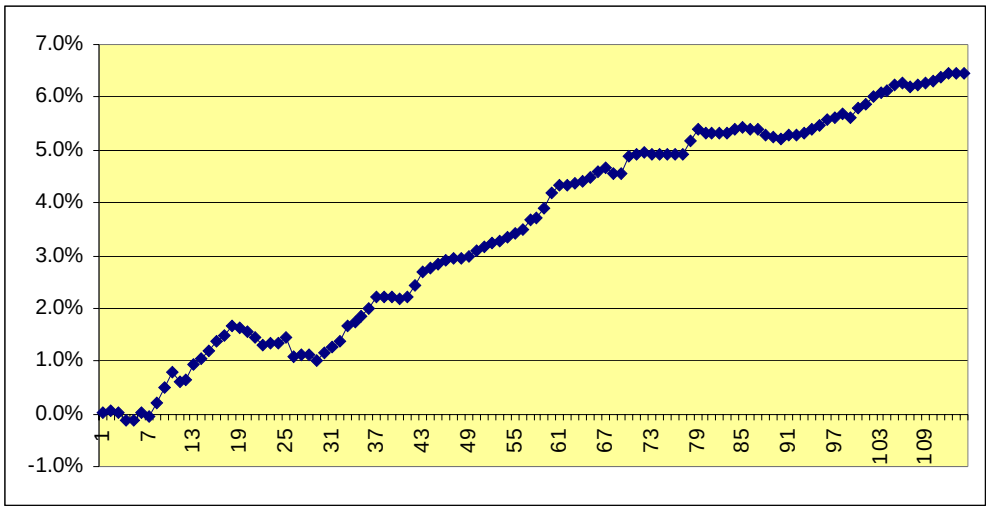


Figure 3 – **PL1 CUSUM for Electrical Based on Target Performance**

This graph was derived by using a multi- variable regression for the best period of performance, periods 80 –94. The total data set of the actual performance was then compared against the target, or best period performance.

The flat portion of the graph represents periods that are similar to the model. In Figure 3, period 80-94 is flat by definition but other periods, such as period 1-5 exhibit similar behaviour. Periods of decreasing slope, such as 19-26 have better performance than the target. However, it was not sustained for as long. Periods of increasing slope have higher energy use relative to the model.

The reason for changes in performance was not identified in this pilot. The recommended next steps are to investigate the actions behind the change in performance and the required metering to achieve and maintain the potential energy savings of 6%. The cost savings of $600,000 CDN would easily justify the implementation of an MT&R program.

Site 2

How Energy Use is Currently Monitored

Site 2 is a new cement plant and one of the most "metered" of all North American plants. Extensive data is available including real time metering of most individual electrical loads. Power monitoring screens are used extensively. However, we observed little "insight" gleaned from data analysis in terms of changes from one period to the next.

Analysis and Results

Once the power and energy "tags" were identified, daily consumption was collected for the 11 primary areas of the plant for a three-month period. Note that 96% of the total power draw was identified by these loads.

For the 3-month analysis period, production values at the various stages of production were also collected on an hourly basis. Regressions were carried out for the six largest loads and all areas had extremely strong correlations of power and energy, with the lowest being 0.89. For example, the overall regression for "Raw Grind" is shown in Figure 4.

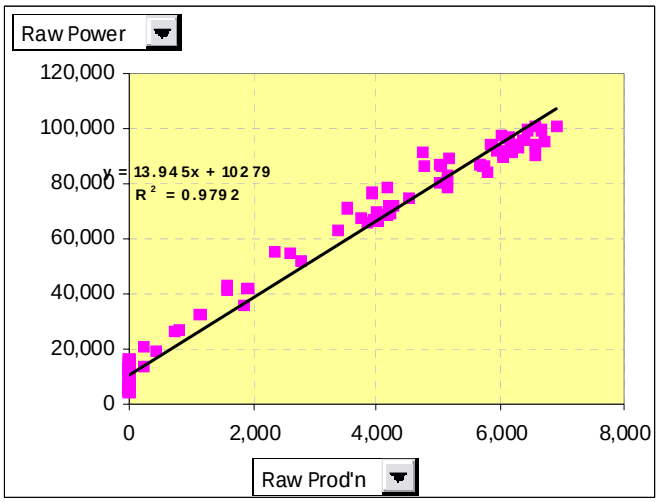


Figure 4 – Site 2 Raw Grind Regression (y axis: kWh and x axis: tonnes)

The baseline period was chosen as the first 12 days in January, and this period was used as the performance model. When the CUSUM for the three-month period was carried out, there was a substantial improvement in energy use from Jan 22 onwards. The energy use was approximately 700,000 kWh lower than what it would have been if the trend from the baseline period had continued, as shown in Figure 5:

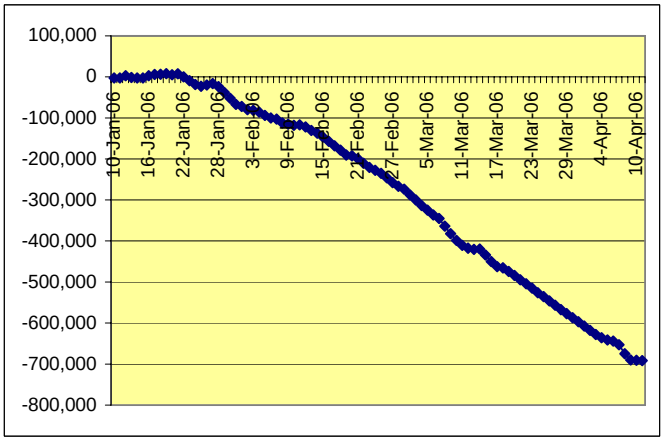


Figure 5 – Site 2 CUSUM for Raw Grind (y axis is cumulative savings in kWh)

On overall "Energy Map" is provided in Figure 6 that shows the CUSUM trends and flow of electricity (blue) and material (red). This is a useful way to visualize what is causing the overall change in energy use, both good trends and bad.

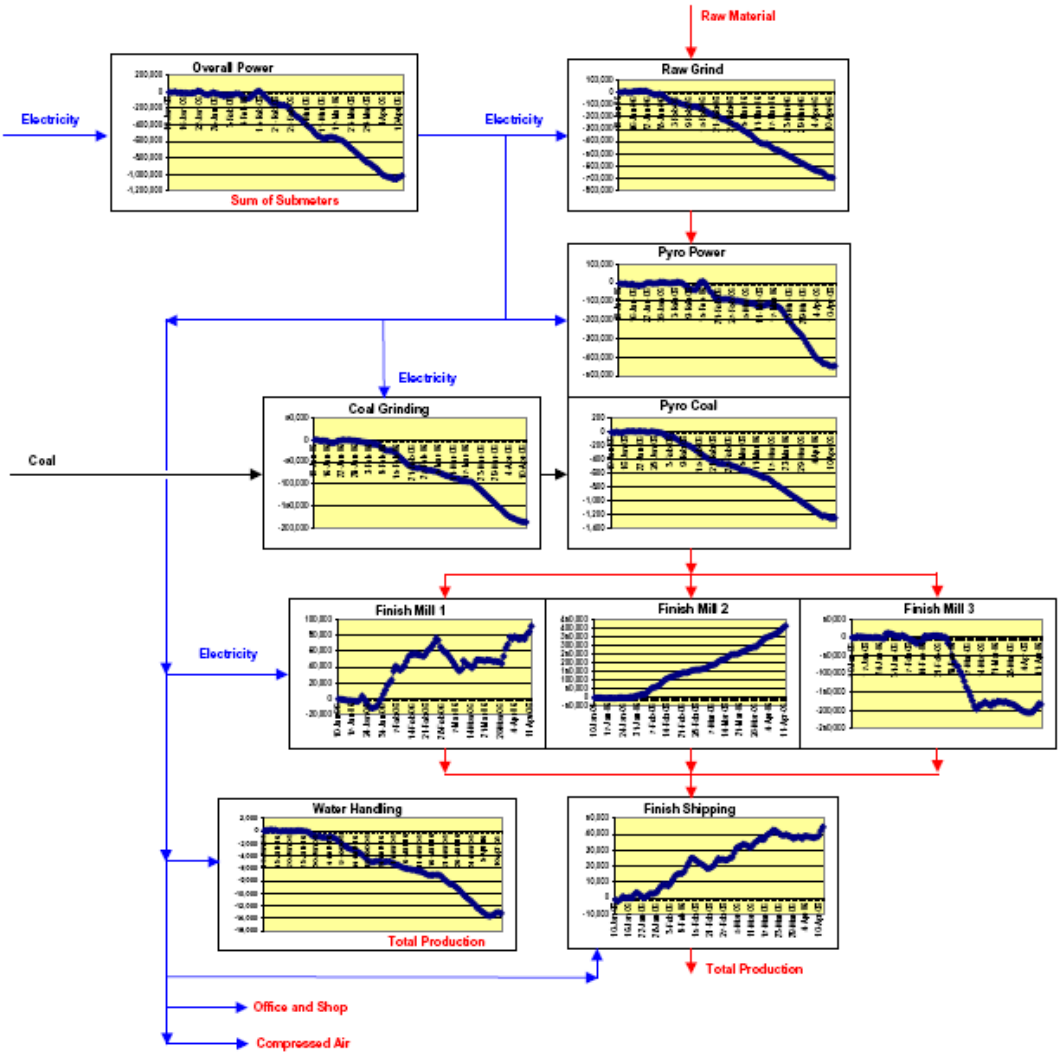


Figure 6 – Site 2 Energy Map of CUSUM Graphs

The energy map shows at a glace the areas that contribute to the overall trend. The downward slope for Site 2 electrical overall shown in the main meter is primarily driven by Raw Grind, Pyroline, and Finish Mill 3. The energy map could be enhanced by providing the relative contribution of the submeters.

This analysis technique can be used to identify that Finish Mill 1 and 2 are demonstrating increases in energy use that should be investigated.

The combined analysis for submeter in this fashion (with the energy map) is an innovative application of MT&R principles that has not been observed in other publications.

Site 3

How Energy Use is Currently Monitored

Site 3, a large brewing company, carried out an extensive metering project at five Canadian plants. The use of data from the metering system is in the early phases of implementation, and users are just beginning to understand the use and benefits. However, even with a sophisticated user interface that provides trends over time, users have difficulty linking their actions to results.

The following screenshot in Figure 7 shows how electricity use is viewed. Exporting to a spreadsheet was required for further analysis.

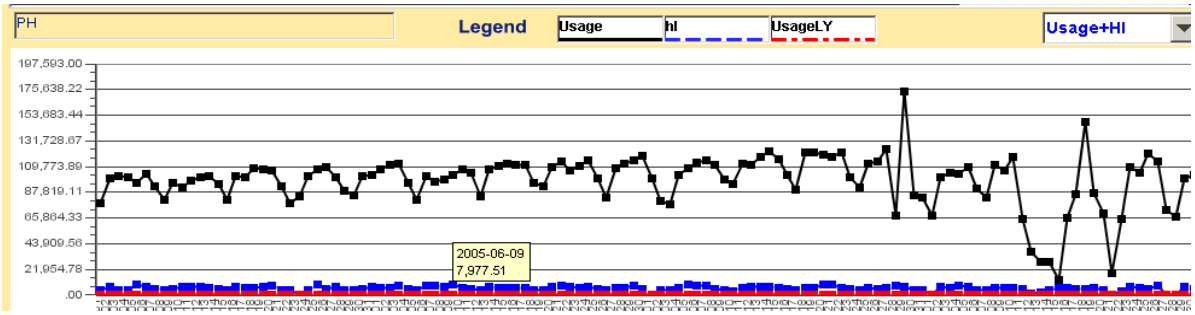


Figure 7 – Site 3 Electricity Consumption View

Analysis and Results

Daily electricity data was collected by Account Centre. The account centres were Brewing (BR), Packaging (PK) and Powerhouse (PH). All energy units are tracked in megajoules, MJ.

The monthly electrical values over five years were compared to the volume of beer packaged each month in hectalitres, Hl. Overall, the R^2 was 0.73 and showed a strong correlation as shown in Figure 8.

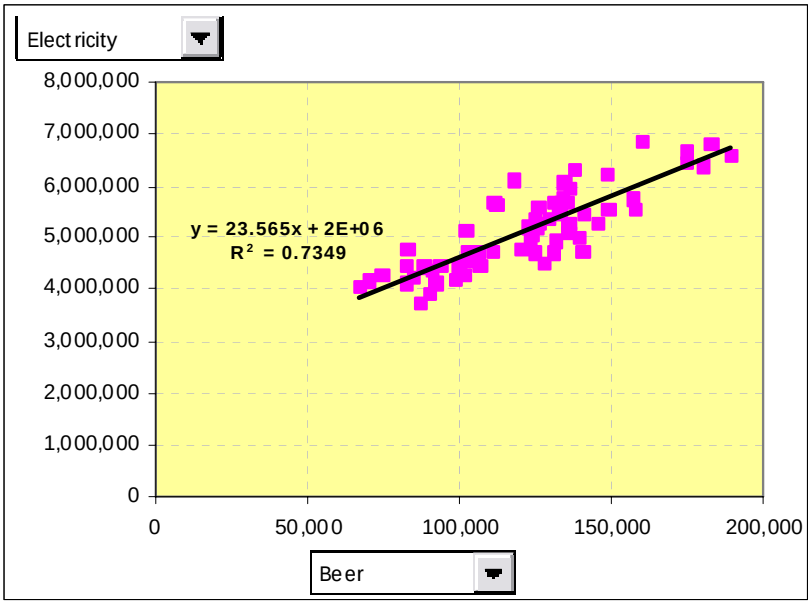


Figure 8 – Site 3 Electricity (MJ) v Production (Hl)

Using 2002 as the baseline period, the regression improved to 0.886. However, when outdoor air temperature is added as a second variable, the regression improves slightly to 0.893. A five year CUSUM with the 2002 baseline was prepared in both MJ in Figure 9.

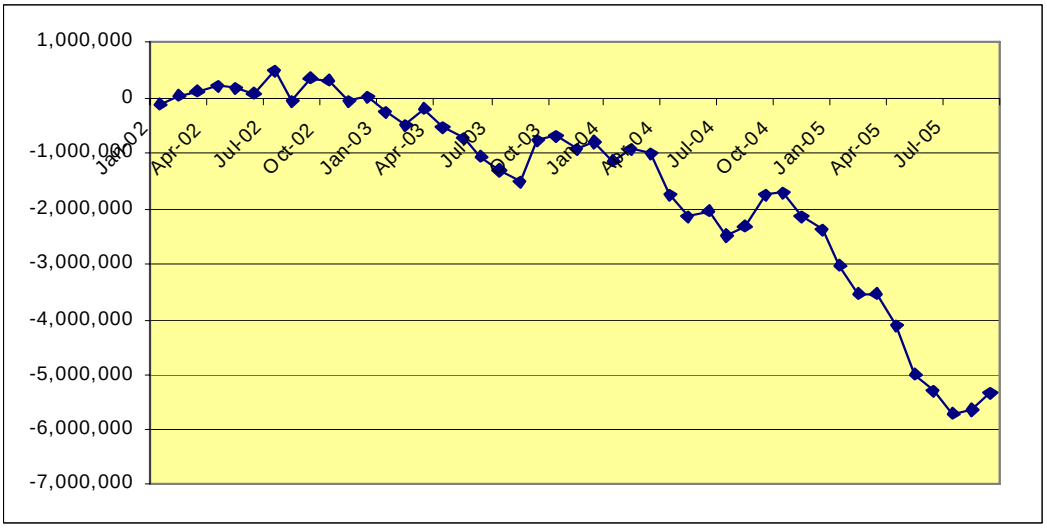


Figure 9 – Site 3 CUSUM Based on 2 Variable Model, Base 2002 (Electrical MJ)

The CUSUM graph shows an improved performance trend by just under 2% in 2003 and again in 2004. Between October 2004 and September 2005 there was a 4% reduction in energy use equivalent to 2.7 million MJ or 750,000 kWh.

MT&R analysis can be extended down to the equipment level as shown in Figure 10 for compressed air. The CUSUM quickly shows an event in early February 2005 that resulted in 100,000 MJ of increased use (28,000 kWh).

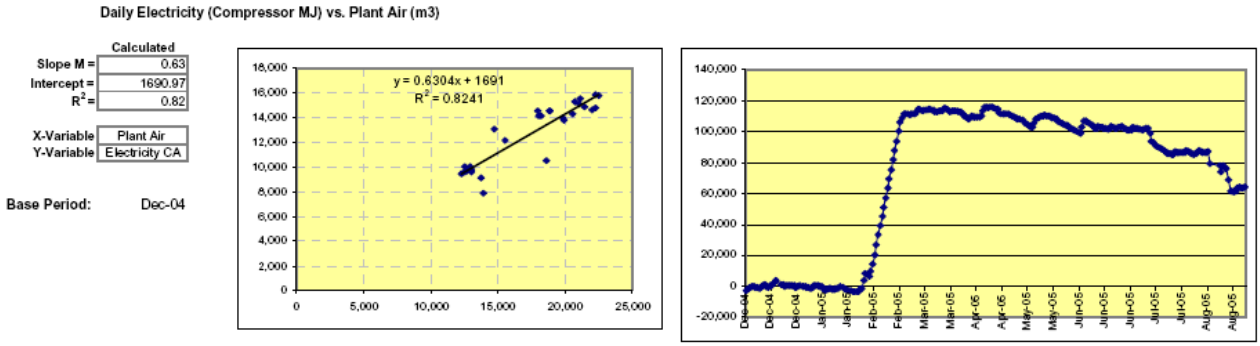


Figure 10 – Site 3 Compressed Air Load

Savings Opportunity

Savings levels of 4% were identified in the pilot study for each of the 3 plants. In all cases, operators would need to identify the practices that were in place in this best performance period and then would need to modify operations to realize the savings. MT&R tools would be used to track performance against targets and to follow through with the best practices as part of a continuous improvement process.

MTR Learning from Pilot

Challenges

The challenges faced in carrying out this MT&R analysis included:

- Too much data can be a problem as the user is not sure how to get clear information
- Most views of metered data are only by time series
- In some cases, to have equivalent units throughout, there were no views in fundamental quantities (such as kWh)
- Metering was put together without view of what outputs were required
- Developing an interface to the daily data for use by operators
- Making this initiative a higher priority
- Not enough adequate measurement of raw material quality brought in to plant
- Storage of product creates a lag between when energy is used and when product weight is measured.
- Not a straightforward integration of metering and production systems to provide real time analysis

Analysis Technique

Key points on the process of MT&R and the analysis technique include:

- Understanding what data is required is often a challenge for industrial energy users. In some cases, there are not enough metering points and data is not available. In other cases, there is too much data and the user does not know what data is appropriate.

- Time series graphs and regression often do not reveal the periods of best performance. Time series analysis shows the changes over time while regression models the predicted behaviour. The CUSUM combines the regression with a time series to show the actual vs. predicted energy use over time. It demonstrates the periods of changing performance in one informative view as well as the periods of best performance.

- The performance model is not restricted to regression techniques. Other models that predict energy use behaviour can be used in MT&R and, specifically, with CUSUM. Other models include simulation models of operating parameters or hour by hour simulations of operations.

- An energy use index (energy/unit produced) is often misleading and does not necessarily provide information on best performance because it assumes a zero intercept of energy use versus production [4]. Benchmarking energy intensity may be misleading when managing operationally. Targets can be set for annual use but daily or monthly use could provide inaccurate feedback on the results of actions taken.

- Look at each major area with MT&R and CUSUM separately. Visualizing meters and submeters by using numerous CUSUM graphs in a “map” helps to identify quickly the causes of changes in performance

- How well can you “turn down” is a key opportunity – try to incorporate into the model. An idle load index to track energy use when production off (motors under human control) is one example. There is an opportunity to have a direct impact on energy use by taking action when the idle load value is higher than a preset level. This straightforward tool is easily implemented and visible to the operator. The index will be easy to track with a time series graph and could be alarmed at certain levels.

Benefits for Industry by Applying MT&R

MT&R can provide the following benefits to organizations:

- MT&R is a useful tool to not only track energy use but to control it. Industry may gain improved insight into their operation through MT&R.

- MT&R is a useful way of turning data on energy use into useful information that can lead to significant energy and cost savings. The case studies showed that if the best performance periods could be replicated, savings of 4% would be achievable.

What is Needed to Apply MT&R Successfully

Lessons from the case studies show that the following items should be considered when applying MT&R in industry:

- Too much metering can be detrimental – less data may be better if it is the right data. One should establish what data needs must be collected first. There is a need to balance between metering every possible point and just have one summary meter that does not "drive" energy.

- There is no "one size fits all" report. Reports need to be designed for operators (daily – control chart), technical supervisors, energy leaders/managers (CUSUM, coach operators, weekly to monthly) and senior managers (monthly or quarterly).

- To establish "savings" need to know what the baseline is – maybe there is a REASON for the higher use in some periods.

- Data often exists in disparate systems and/or in different time intervals. Production data and energy data need to be combined.

- Get support from the top to build MT&R into the culture of continuous improvement

- Frequency of feedback for control system depends on the storage mechanisms. In many cases, hourly is too frequent, daily may or may not work, and weekly or monthly typically better. Storage is handled better with CUSUM as it "never forgets".

- Ensure that IT programmers have a strong sense of energy relationships and requirements.

Monitoring, Targeting & Reporting as a DSM Program

The overall purpose aforementioned pilot investigation was to feed the development a MT&R DSM program. The goal of the program is to assist customers in implementing their own MT&R process for the purpose of improving the performance of their operations and reducing their electrical energy consumption.

Market Barriers & Risks

As a result of the pilot investigation, the following barriers were identified within the industrial market and currently inhibit MT&R from being widely accepted as an effective energy management practice. These challenges lead to some very distinct risks and the program offer is designed to "remove" the barriers.

Barrier: Awareness

- MT&R is a new approach to analyzing energy data so the knowledge and understanding of its benefits is limited.

Solution: Build awareness of the benefits of MT&R through education and training. Also promote industry leaders in other jurisdictions are finding success with MT&R as a critical element of energy management strategies used to stay competitive.

Barrier: Acceptance

- Must have buy-in from all management levels to fully implement and achieve continual improvement.

- Perception that MT&R is labour intensive and additional unnecessary work.

- The value proposition will vary for each customer (specific benefits uncertain) therefore MT&R is hard to sell.

- Not a physical product-based or off-the-shelf software solution, therefore hard to define.

Solution: The program needs to move the customer forward in increments, demonstrating benefits over time, and supporting customer adoption and change.

Barrier: Accessibility

- Customer resources are limited and a sponsor or "Champion" is needed to initiate and own MT&R.

- Companies struggle with HOW to do the analysis: even if they have the software tool, they need the requisite skill set.

Solution: Provide hands-on training to Industry, on how to apply MT&R. Following the training, provide statistical analysis support to help develop performance models.

Barrier: Availability

- Limited MT&R expertise in consultant community.

- Existing metering and energy management information system vendors are already in the marketplace and may believe they are providing MT&R services.

- Reporting requires custom programming of customer IT infrastructure or off-the-shelf software.

Solution: Train external consultants on the benefits of MT&R and support their implementation of opportunities. In addition, look for opportunity to train and partner with hardware/software vendors to increase knowledge base and expand program capacity. This could include developing template specifications that companies can use for procuring MT&R services, specifically with hardware/software companies. The specifications could include sample reports and views of the system.

- MT&R expertise alone will not get savings; any MT&R savings will come from customer idea generation and support from operations.

Solution: Promote customer adoption of MT&R as a better way to view energy information and report on targets, thereby creating value to the customer in the new approach.

Barrier: Affordability

- The perceived barrier is that MT&R is a metering solution and metering is expensive.

- New metering (or hardware) may be required to gather sufficient data.

Solution: Significant energy data is already available within customer facilities, but not being utilized. Short term, look for an opportunity to turn existing data into actionable information by applying MT&R. Longer term, the benefits of a full MT&R program can build the business case for metering infrastructure where required.

Other Risks

- It is hard to assess the point at which BC Hydro disengages from the process.

- As the majority of savings resulting from MT&R activities is of an O&M nature, persistence of savings is an issue.

- MT&R is process tool and savings will result from follow-up activities.

Solution: Operator training and buy-in is critical; provide a specific scope with well-defined implementation process that supports customer ownership. Also design a robust, post implementation offer, to assist and support customers to use MT&R as the mechanism to achieve continuous improvement. This includes support and motivation for industry to track the causes of improved performance so the savings can be attributed to the DSM program.

Market Motivators

In addition to the direct benefits that MT&R provides customers, one can look at market or industry motivators as a way to promote or position the MT&R offer with Industrial customers. Some key motivators are:

1. Ability to gain significant leverage from other process perspectives and experience.

⇒ **MT&R can speak to the customer's language around quality control, cost reduction and Key Performance Indicators**; **MT&R is statistical process control applied to energy management**.

2. Savings is primarily operational & maintenance.

⇒ **Minimal capital costs required to achieve savings of electricity, other fuels or manufacturing costs so payback is short**.

3. M&V is inherent in CUSUM approach.

⇒ **Provides a platform for verifying savings from all energy management activities and can maintain persistence of savings. MT&R can be used as a KPI assessment tool.**

4. Does not matter where you start.

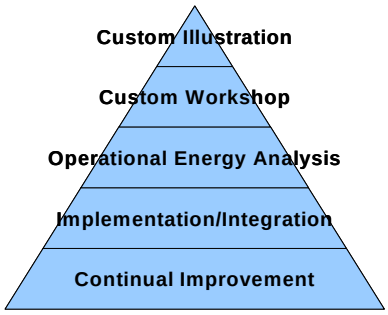
⇒ **Start anywhere - bottom up or top down. Flexible in its initial approach, one can start with a plant wide analysis and drill down or with a particular end use system or process area.**

Program Design

To address the barriers outline above, a stepwise approach was taken to gain customer commitment. Therefore, the MT&R program offer is comprised of the following elements:

Custom Illustration

The purpose of this step is to build customer awareness with respect to the potential benefits of MT&R, with the expectation that eventually the customer will engage BC Hydro to take a more definitive step. Building customer awareness about MT&R can take several forms, such as:



- Presentations (e.g. Industry association conferences)
- Case studies, sales collateral or hand-outs at industry conferences
- High-level analysis using existing customer data if available or customer supplied data – delivered through a report or website. The information should compare the old way (interval profile) and the new way (regression/CUSUM). At the most basic level, it would show the correlation between energy use with production (e.g. kWh/ton)

The purpose is to seek buy-in and support from management to proceed to a Custom Workshop.

Custom Workshop

Once a customer is engaged enough to commit to further exploration of MT&R opportunities, a workshop will be arranged. Workshops may be directed at specific customer sites, or alternatively may be conducted for generic facility types (e.g. sawmills, pulp & paper plants) end uses (e.g. compressed air, refrigeration).

External trade allies, with specialized knowledge of MT&R, will be engaged to facilitate the workshops. The workshops will take a day (or less). The intent is for the customer to analyze their data at the workshop and allow the session to be more relevant to a particular site. The data needs to be supplied prior to the session to provide for some preparation.

There are three primary objectives to the workshop:

1. The first objective is to provide the customer with a broader overview of the "nuts and bolts" of MT&R. This will allow the customer to understand what resources will be required to undertake an MT&R initiative, as well as to get buy-in at the appropriate level of management.

2. The second objective is to actually conduct sufficient analysis to get the customer excited about the opportunity through their own assessment of value.

3. The third objective is to identify an MT&R Champion who will be the key implementer of MT&R within the organization.

Operational Energy Assessment

The implementation of MT&R at any given customer location will be unique, depending on the customer's production processes, availability of instrumentation and data, required type and frequency of reporting, or level of commitment. The scope of work for the Operational Energy Assessment (OEA) will be to define the MT&R project in such a way that the costs and resource implications can be identified, along with the potential savings, at a level that will allow the customer to proceed with implementation.

Once again, trade allies will be engaged with specialized knowledge of MT&R to conduct these assessments. The consultant will be required to work with the customer to define the opportunity, which may require analyzing multiple options before choosing the project with which to proceed.

The following will be elements of a typical Operational Energy Assessment:

- Develop an Energy Performance Model - regression analysis or other correlation
- Identify the critical drivers of energy use and variability of performance
- Determine an initial, rough estimate of potential savings (utility, production, maintenance, etc.) at the facility level
- Identify training requirements (for both the MT&R system, but also for any associated system operating issues)
- Identify reporting requirements (who receives the reports, the content, and frequency)
- Determine report generation requirements (custom software or infrastructure upgrade implications to gather potentially disparate data and produce the required reports)
- Develop the cost of additional metering equipment, if required

Implementation

From a utility perspective, in order to claim savings, it is necessary to ensure that the MT&R process is carried out until at least the generation of the first CUSUM report, at which time the implementation will be considered to be complete.

The CUSUM report is the primary deliverable of interest for a DSM program in that it quantifies the energy savings for the identified activities. An associated implication is that a customer who continues to generate the CUSUM report for a given project is one that continues to be engaged such that the project's measure life can also be quantified in this manner.

Continual Improvement

Continual improvement implies that the customer continues to use MT&R principals to set targets and provide feedback to deepen savings and ensure persistence. To support the ongoing use of MT&R as part of this initiative, a user group session will be organized. The individual MT&R Champions can get together and share success and challenges and learn from one another. This could be annually, or bi-annually. It is anticipated that customers would provide CUSUM report on an ongoing basis, at least either monthly or quarterly.

MT&R Target Market

MT&R has the potential to fundamentally change the way a customer views their utility data, turning data into information, and providing the measurements which can lead to intelligent management and operational decisions. However, in order for this to happen, the customer can not be a disinterested by-stander, but rather, must be willing to completely own the MT&R process.

Given this challenge, it is appropriate to target customers who are more advanced with regards to having a corporate culture conducive to energy management principals. This means customers who are able to engage in a strategic energy management planning or are focused more on operations & maintenance savings opportunities.

The six basic approaches or strategies used by organizations towards energy management are as follows [5,6]:

- Do nothing
- Price shopping
- Fuel switching
- Technology-based projects
- Operational / procedural and maintenance improvements
- Strategic Energy Management Planning

MT&R will actively target customers in the last two approaches:

1. **Operational / procedural and maintenance improvements** – theses customers will realize the greatest value from MT&R as most of the opportunities for savings are non-capital related.

2. **Strategic Energy Management Planning** – customers that have the ability to undertake a SEMP will need MT&R to develop baselines, uncover opportunities and measure success of all activities outlined in the SEMP.

Within this group of target customers, it will be necessary to target, uncover and develop an **MT&R Champion**. The first two stages of the initiative are designed address the MT&R Champion, as they are critical to overcome the other barriers.

Summary

The pilot investigation was a very necessary and valuable first step. It provided insights into the "real-world" application of MT&R in customer facilities. It highlighted that customers are various points of the spectrum as far as collecting energy data and managing energy information is concerned. It also proved the potential energy savings that is could be realized if industrial energy users take a more comprehensive approach to viewing energy data. Innovative applications for MT&R, such as energy mapping, were presented in this paper. Although the primary purpose of identifying MT&R benefits was met, there is still a need to define the scope of a permanent MT&R implementation at these sites which will link the best practice operations with optimized energy use.

In addition to validating the current "state" in Industry, the pilot defined some real and significant barriers for industry to support implementation of a MT&R. Understanding these barriers is critical in developing a DSM program around MT&R. One of the biggest challenges with engaging customers in an MT&R program is convincing the customer of the benefits of the individual components of installing monitoring equipment, setting and reviewing targets, or creating, distributing and reviewing reports. Another, perhaps greater, challenge is engaging a customer who is willing to take on a change in corporate culture leading to a continuous improvement model for energy management.

In order to overcome these challenges, the final program design is based on an incremental approach to the MT&R concepts and process. Through this incremental approach, customers can gradually implement MT&R principles, become more familiar with them and incorporate them into a continual improvement approach to energy management.

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