IMPORTANCE OF FINDING AND DEFINING ENERGY CONSERVATION MEASURES

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ABSTRACT

It seems part of human nature to want quick fixes. “What pill can I take to get slim? “ With energy, this is often “What can I add (magic black box) or change (retrofit) that will make my energy bill slim?” Very often these additions or changes deal with efficiency issues. As a result, we too often neglect asking what should be the first question – “What can be done with simple conservation steps to save energy?”

We may think we have asked and answered this question, but this should be challenged! For example, ever noticed just how many outside lights outside are one during the day – every day – including at factories that publicly tout their energy reductions? After years of energy auditing, I am convinced that not enough attention is given to conservation, and that when attention is given, it is more often considered a distant second. This is at least partially because conservation is not in any way “sexy”, especially as compared to installing renewable energy systems like geothermal or solar.

This paper will quickly define the difference between conservation and efficiency changes, and then show within an industrial setting the many conservation steps that should first be considered. While a great many of us know and practice the concepts discussed in this paper, at least a certain number may not to the degree necessary to maximize conservation.

INTRODUCTION

My main goal behind this paper is to remind all of us why we should more fully consider energy conservation during energy reduction assessments. In making my points, conservation measures will be broken down by some general energy use systems, including: motors/dust collectors, lighting, and air compressors. With some energy use systems, we will discuss detailed specific examples from a variety of industrial and office applications. I will then present an example site where total conservation energy reduction contributions were as high as 40%, for very little capital or expense.

There a difference between conservation and efficiency

I often hear and see the two terms used interchangeably, which I believe is one reason why conservation often takes a back seat to efficiency. To me, and to various dictionaries, these two terms are indeed different. Consider these definitions found for these terms:

Conservation
- improvement by virtue of preventing loss or injury or other change
- **reduced consumption with reduced results**

Efficiency
- the ratio of output to the input of any system
- **reduced consumption with same results**

As you can see, one important way to view the difference is what happens with the results of the system. Conservation achieves reduction in energy use by reducing the results of the system, while efficiency reduces consumption while having the same system results.

To put this into a bit more perspective, consider a lighting example:

> Conservation – turning off lights when not needed, reduces the consumption of energy but the result (light level) is reduced when they are turned off.

Efficiency – switching from incandescent lights to provide 50 foot-candles of light to CFL for 50 foot-candles also reduces consumption, while keeping the same light results.

The focus of this paper will be conservation – or reducing consumption with reduced system results. Very often, reducing system results is not a problem. Frequently, there are good periods of time when we do not need the same overall system results.

Potential Magnitude of Conservation Opportunities

So why do we need the outside or inside lights on during a brightly lit summer day, when strong natural light is already available? This is probably my favorite, and most readily visible, example of conservation potential. Here we do not need the same overall system results, as in these cases, if you shut off the lights, you would not notice any reduction.

I often stay at chain hotels in the US when traveling to manufacturing sites, and I very often see outside lights, or unnecessary lights, on during the day. As an example, see the photo from one recent hotel visit, of an indoor pool area with a large amount of skylights on a bright sunny day. In this one example, there was over 2 KW of lights on, all of which could be turned off, just in this pool area alone. There are over 50,000 hotels and motels throughout the US, and I must wonder how many similar cases we might have here in the US.

To see the similar magnitude in my community, the other day I took a quick drive in my own town to see how many other outside lights I could find on during a bright summer day. In less than one hour, I found 15 outside lights on at factories (most small, former mill sites) as well as another 15 on at various homes.

Scale this snapshot up anyway you want, and you can quickly see that perhaps hundreds of MW of generation are required in the US for just lights left on mistakenly, for whatever reason. There is significant unnecessary cost, CO2 and other emissions as a result. Assuming bituminous coal for electrical generation (say 7000 kWh/ton), and assuming 35% overall generation to use efficiency, one 100W light bulb left on all year causes the burning of over 700 pounds of coal. Multiply this by perhaps 250,000 outside bulbs left on during the day across the US unnecessarily (I think too low based on my snapshot estimates), that could mean 90 million pounds of coal needed each year – just for lights that provide no real value. Now let's add to this non-lighting, conservation opportunities within homes or businesses, and the potential environmental and cost consequences from not doing enough with conservation are indeed very huge.

Benefits of conservation first

Here are some reasons to first look at conservation:

1. **Can save the whole dollar** – Consider changing a 100 W incandescent bulb to 30 W CFL. You save 70 watts when the bulb needs to be on. However, you can save the full 100 W if the bulb is shut off when not needed, not just 70 watts.

2. **Can be very easy to do** – Conservation can often be done quickly and simply, and with low costs. While typically not as large a savings as with larger, complex, efficiency projects, conservation changes are often easier, and thus quicker, to implement.

3. **Can perhaps save more than efficiency change** – as will be shown under Motors/Dust Collectors, shutting down a motor system for one hour per day will often save more than increasing its efficiency 3 or 4 percentage points, even if the motor has very long run hours.

4. **Can form the foundation of your best efficiency project** – The best way to address efficiency (energy reduction with same system results) is to first reduce demand however you can, such as with thorough conservation. In this way, sites often have a much smaller efficiency project, which means less capital expense, and less operating expense.

Simple but effective slogan for conservation

When I perform site energy assessments, I repeat the following conservation mantra many times with clients for each energy use system – ***Don't Use it, Don't Lose it, Don't Waste it:***

1. **Don't use it** – first and foremost I ask the every important Why? Why is this here? Why is it needed? Why is it running now? Why is it running later? Once you ask why many times, and challenge the answers appropriately, you can often simply remove some equipment entirely from use, or at least for some periods of time.

   For example, I found a site with 25 people in the office, but almost 50 printers, most of which were on (totally, or in sleep mode). We simply removed printers until people could truly justify their need. We grouped users to printers. We made people get out of their chairs to go to a common printer, until we got down to a total of five. Result - printer energy use cost reduced 97%. As people no longer simply printed for convenience, there was also great reduction in other office costs as well (paper, toner, repair, etc.). In fact, this non-energy savings was five times more than the energy savings, helping to make this fairly simple conservation project a true overall winner!
   - As an aside, let's see if we can all carry this further. I have not printed any documents in over 5 years. Yes – that is true. It can be done, if you combine electronic organization and tools, with a great amount of perseverance.

2. **Don't lose it** – an example might be with compressed air, ensuring you have only a minimal amount of leaks (there will always be some!). Same can exist with dirty light fixtures, where you lose light simply because of a relatively simple housekeeping issue.

3. **Don't waste it** – simple management experience, or auditing tools, can often quickly tell us when we are wasting energy. For example, do you have 100 foot candles of light in a seldom used hallway? If so, this is a serious waste of light and energy.

Interplay between conservation and efficiency

To best minimize energy consumption on any system, one needs to evaluate both conservation and efficiency, and there is often a close interaction between the two. For example, consider the three steps to lighting savings – which is often summarized as:

Right amount of light, at the right efficiency, at the right times.

If one tries to meet all of these "right" statements, you will reduce lighting costs much more than just performing a 1:1 light efficiency retrofit. Consider:

- The Right amount of light – defining and meeting your target light amounts. I often find opportunities here with conservation
  - Remove fixtures – when not needed. See example picture of light fixture over a manufacturing office. Just how much light does the top ceiling of this office need?

- Remove lamps and ballasts per meter and standards when not needed. For example, just how much light does an office now need? We have all seen offices with 100+foot candles, where people complain of eye fatigue and headaches, some of which could be removed by removing some of the excess lighting. In the example picture below, the office was well over 200 foot candles, before delamping to about 100 foot candles.

– **At the right efficiency** – this is where one might change to more efficient fixtures, now that conservation measures have been taken that provide you with a truer baseline.

– **At the right times** – to me this is still conservation. This can be done without add-on controls through behavior change. However, more often this is accomplished with add-on controls such as motion sensors, photo sensors, timers, or combinations.

Evaluation example – all three steps together
Here is a lighting example, taking the above three steps into account. In this example, you have 100 fixtures, each with 4 T-12 40 W bulbs, on the whole year as there are no controls. During an energy assessment, we find that at least 10 complete fixtures can be removed, as these are not providing any real light value given present layouts.

Case #	Cons., Eff., or comb.	Base case, and possible changes, $0.10/kWh 100, 4 lamp, 4 ft fixtures	Number of Light Fixtures	Annual Cost	Save over base/yr	Percent Red. from base	Est. cost for savings	Simple PB - Years
1	NA	Base cost - T-12, 8760 hours/yr	100	$ 13,876	NA	NA	NA	NA
2	Cons.	Remove 10 T-12 fixtures, 8760 hrs/yr, only 90 fixtures	90	$ 12,488	$1,388	10%	$ 250	0.18
3	Eff.	Change to T-8, 8760 hrs/yr	100	$ 10,021	$3,854	28%	$6,500	1.69
4	Comb.	Change to T-8, 8760 hrs/yr, 90 fixutres	90	$ 9,019	$4,857	35%	$6,100	1.26
5	Cons.	T-12, install controls, 5000 hrs/yr	100	$ 7,920	$5,956	43%	$2,000	0.34
6	Cons.	T-12, install controls, 5000 hrs/yr, only 90 fixtures	90	$ 7,128	$6,748	49%	$2,050	0.30
7	Comb.	Change to T-8 and install controls, 5000 hrs/yr	100	$ 5,720	$8,156	59%	$8,500	1.04
8	Comb.	Change to T-8, install controls, 5000 hrs/yr, only 90 fixtures	90	$ 5,148	$8,728	63%	$7,900	0.91

If the site has limited money available (like many, especially lately), and can only spend at most $3000 (as - heaven forbid - anything above $3000 requires capital project approvals!), then the site has really only three workable options (cases 2, 5, and 6) at this time, all of which are conservation options. In fact, case #6 will potentially get 49% energy savings, which shows that conservation measures by themselves can be quite valuable.

However, the greatest annual savings, case #6, occurs when you combine conservation (delamping plus controls) with efficiency changes. In fact, case #3, the simple efficiency step of changing the original 100 fixtures (without delamping) to super T-8, has the worst simple payback. Case #3 might be proposed by a lighting supply vendor, as it is the easiest from their point of view, a very simple 1:1 changeover that would take little effort on their part. Case #3 still has an attractive payback, one which at many sites might be sufficient for project initiation. However, all the other options have better simple paybacks.

While I would strongly suggest Case #8, as it combines conservation and efficiency to maximize energy reduction while still having a very strong simple payback (<1 yr), sites should get all potential options, especially in these more difficult times.

<u>Ten Reasons Why Conservation Isn't Pursued More Often</u>

In no particular order, here are ten reasons that conservations often is not the primary thought:

1. **Manufacturing Inertia - or "We've always done it this way!"**
   When I ask sites why something is on, I very often get the Manufacturing Inertia Answer – "we've always done it that way!" Very, very often, manufacturing inertia is hard to break, especially with people who have been at the site their whole lives. People resist change in

general, but especially when “it ain’t broke, so don’t fix it”.

Whenever you hear this, your job is to politely ask why multiple times (5 why analysis) to ensure there are still valid reasons, as site conditions have likely changed over the years. For example, one site was keeping all laboratory hood exhausts on at night and weekends, as they wanted to ensure that hazardous vapors were always sufficiently removed. However, when we asked why multiple times, we found out that the compounds that primarily caused this concern had been removed during a product reformulation, for at least one laboratory section. Hence, without any employee or industrial hygiene issues, we could now turn off many (but not all) of the hoods at night, either manually or with timer controls, with great motor **and** HVAC savings.

2. **Site personnel are often too busy and miss conservation opportunities**
The site energy person is often also the safety manger, environmental manager, maintenance manager, or sometimes all the above, and more. As a result, they must first consider what must be done for compliance and to keep equipment running. Saving money might be next on the list, but often it is never addressed because of all the other priorities.

3. **It is not our own personal money at work**
I am amazed how people will tell their family (especially their children) to turn off lights at home, but then they completely forget about this simple step when they come to work – primarily because they do not pay the bill at work. The same thought process could apply to any energy use system at work, and we need to change this thinking at its core.

4. **Site personnel do not think conservation will make much of a difference**
“How much can two outside lights save a year – a hundred bucks? This is not worth my time!” I often hear these statements, and once I show them the true costs, they are often amazed. For example, I often find at least one misplaced HID light in a factory costing over $400/yr. What is the cost for removing this light – about one hour of time? Is saving $400 worth one hour of overtime ($40ish)? While this is not much in a million dollar energy budget (0.04%), questions should be asked for each potential conservation item:
- What will this potentially save?
- How much cost to fix
- How much effort to fix?
- What is its individual payback?
- What other similar places will we find this general condition? (my rules of 3 – you typically will find at least two other similar problems at a site if you look hard enough, for a total of three of the same sort issue)
- How can we address these sorts of opportunities within our regular site programs (preventative maintenance, Six Sigma, 5 S, etc.)
- Would you do this in your own house, if you were paying the bill (reason #3)? Answers to this start to get interesting.
- **Would a world-class site leave this energy wasting condition alone?** Answers to this question can get very interesting, even uncomfortable.

5. **You will never see conservation savings in your utility bills**
It is true that it is often hard to see conservation savings in a large site’s utility bill, especially if the conservation savings is relatively small compared to the overall bill. However, even if you cannot see the savings, “electricity laws” still apply. If something is off, it is saving energy! What we need to do is document, and account for the savings with various systems and meters, so we can take the credit for our efforts, and then show what costs were avoided as a result. And you will see the savings, as will be shown later, if you do enough conservation steps using the appropriate methods.

6. **Conservation is often hard to evaluate, or put “hard” numbers to**
I often find that sites do not know the direct unit per hour cost for running equipment, which means they cannot calculate savings if they do somehow shut some equipment off. Because the unit equipment costs are invisible, sites seldom consider costs for running any one light or motor, or any groups of lights or motors.

I counter this, I provide good Rules of Thumbs (ROTH) for lighting and equipment PER HOUR of operation. Once sites have the numbers, they start to realize how easy it is to document savings, and thereby address items #3 and #4 above.

Lighting Example:
Consider a site that has these general lighting systems, with many conservation and efficiency opportunities. A simple lighting ROTH table like the one below can provide a large amount of simple and valuable information.

Approx. Bulb System	Approx Watts	Cost per hour at $0.10/kWh	Cost for each 12 hour day	Cost per 24 hour day	Cost - 8760 hrs (all year)
Incandescent	100	$ 0.010	$ 0.120	$ 0.24	$ 87.60
compact Fluoresent	30	$ 0.003	$ 0.036	$ 0.07	$ 26.28
T-12, 4 bulb, 4 ft magnetic bal, 40 W	168	$ 0.017	$ 0.202	$ 0.40	$147.17
T-12, 4 bulb, 4 ft magnetic bal, 34 W	144	$ 0.014	$ 0.173	$ 0.35	$126.14
T-8, 4 bulb, 4 ft, Elec ballast, 32 W	112	$ 0.011	$ 0.134	$ 0.27	$ 98.11
400 W MH, with ballast	450	$ 0.045	$ 0.540	$ 1.08	$394.20
250 W MH, with Ballast	290	$ 0.029	$ 0.348	$ 0.70	$254.04
Ouside Light, HID	175	$ 0.018	$ 0.210	$ 0.42	$153.30

Using information from a chart like this, one can quickly determine:

- Conservation savings per hour for shutting off any of their lights. For example, if a site can shut off one 100W incandescent light for 12 hours each day, it would save $0.12 each day, or $43.80/yr savings if it was previously on 12 hrs/ day every day ($0.12 for 12hours/day x 365 days/yr). So a simple $5 timer would pay for itself in 1.4 months!

- Conservation savings from removing a light from use. Like many, this site has changed over the years so that the original lighting grid no longer makes as much sense, and at least one 400 W light can be removed without anyone even noticing. From the table, if formerly on 8760 hrs/yr, annual savings would be $394. No site calculations are needed, and the savings is immediate and permanent! Most sites have at least one that can be completely removed.

- Efficiency savings from changing light efficiency – consider a site presently having T-12 40 W systems. If they change to new super T-8 technology systems, they can save $0.006 per hour for each light fixture ($0.017 - $0.011 = $0.006). So changing 100 lights, if on 6000 hours each per year, can save $3,600/yr ($0.006/light-hr savings x 100 lights x 6000 hours/yr = $3,600/yr)

- Combined efficiency and conservation savings – If you change the 100 Watt bulb to a 30 W CFL, your new operating cost per hour is $0.003. So if you change this bulb, and install the $5 timer so it operates only 12 hours each day, new operating costs per year would be $13.14 ($0.003 x 12 hrs/day x 365 days/yr). Savings per year would be $74.46 per year ($87.60/yr for incandescent for 8760 hours - $13.14 for CFL for 4380 hours). If total change cost is $10 ($5 for timer and $5 for bulb), then payback is 1.6 months!

Making costs visible and usable are the keys to sites pursuing additional and faster conservation and energy reductions. With unit cost information and its dissemination, will come easier and quicker behavioral change.

Motor Example:
Consider that a typical three phase 1 HP motor at $0.10/kWh will cost about $0.066 per hour to run (at 90% efficient, **if** 80% load, PF = 1). Once a site has this unit cost, on their own they can fairly accurately calculate savings from shutting down any size motor for any amount of time. For example, a 15 HP dust collector under the same general conditions, if shut down one hour per day (30 min lunch, and two 15 min breaks), 250 operating days per year, would save about $248/yr. ($0.066/HP-hr x 15HP x 250 hr/yr = $248/yr). At one site, they had 55 dust collectors, all of which we found could be shut down much more, with resulting annual savings of over $30,000 per year, with literally no cost!

Comparison – conservation vs. efficiency

I often show sites how conservation may be more cost effective than efficiency change especially where operations are not 24x7. Consider this comparison:

Efficiency - For the same 15 HP dust collector, rough estimated savings from changing this motor from 90% to 93% efficient, if on 8 hours per day, 250 days/yr, would be $65/yr.

Conservation – shutting down the same 15 HP dust collector, one hour per day, 250 days/yr, at $0.10/kWh, would save $248/yr.

Conservation savings in this example is $183 more per year than changing the motor. In fact, even if this motor is run

6000 hours per year, or about three full shifts, changing to 93% efficient would only save $192/yr, which is still less than the savings from shutting it down one hour per day. (Obviously, if high running hours, we should consider changing the motor and pursuing conservation savings)

7. **Site personnel do not know what to do to achieve this conservation**
Sites often think that they cannot shut down certain equipment, or if they do, there will be large problems with bringing it back on line. Or they often just don't know how to shutoff equipment - with controls or otherwise.

Our job – let sites know what opportunities exist, and then detail how easily and quickly they can achieve conservation savings based on real world examples.

8. **Old wives' tales still abound**
I still hear that you should leave a fluorescent light on instead of shutting it off when you leave a room and plan to come back within 30 minutes. Due to problems with older style fluorescent light systems, coupled with lower operating costs many years ago, at one time that may have been more true. But in most facilities conditions have changed.

New program-start super T-8 systems, coupled with today's energy pricing, instead suggest you turn off the fluorescent lights anytime you leave a room. I especially think this is true when I hear people say "I will be back in just a couple of minutes". Who really is gone just two minutes? In the real world, two is really five, which very often becomes 10 minutes or more.

I hear the same sort of comment about increased energy startup concerns with motors. Some people think that shutting down a motor and then restarting it after an hour will increase a site's demand charge due to the current in-rush to start. This is non-sense, as there will be some extra energy required to start a motor – but for only a very small period of time (maybe seconds). Demand charge times typically are of much longer duration, such as 15 minutes or more. Our job – carefully explain that these older beliefs no longer apply given present conditions.

9. **Sites are hesitant to address behavior issues**
How do you get people to shut equipment down manually when not needed? This is probably the biggest issue with energy conservation. Once you have identified what can be saved with simply shutting off equipment through understanding of unit costs per hour, the harder question is how do you get people to do this, or do you have to resort to potentially expensive, or even complex, controls?

In general, people only change their behavior because:

- They want to (but who really wants to!)
- They have to (or a negative "they want to")

For people to want to change behavior, they must know exactly why to do something, what to do and when to do it – which all boils down to some level of training. You then also should have some sort of feedback system to know if they have done what they are supposed to do (positive feedback first, negative only if truly needed). But most importantly, they must feel they are making a difference – individually or as a group.

So in summary - For behavior energy conservation to work, you must:

a) Define what should be done in great detail (what, who, when, why, how)
b) Train people as to what should be done (I do, we do, you do)
c) Have a system in place to remind, monitor, document and report
d) Provide routine feedback as to if actions are being performed. Some sites use their existing manufacturing management systems, like 5S or Six Sigma, to provide daily or end of day feedback.

10. **Conservation projects are not typically supported by vendors**
Most vendors want to sell you something, and the more that is sold, and the higher the value, the more the salesman and their company will get. What is the cost (and commission) of buying a new air compressor – 100 HP, as compared to buying only a 75 HP unit, if conservation measures are taken first. While some salespersons do evaluate demand and conservation in addition to efficiency changes, a fair number still do not do enough.

Some Typical Conservation opportunities within some energy use systems

Lighting – in the examples above, we have covered many of the typical conservation ideas, including:

- Remove fixtures
- Remove some light bulbs (and ballasts)
- Relocate fixtures
- Shut off by installing controls – photo sensor, timers, etc
- Shut off with behavioral change

Compressed air – Here I am not talking about changing compressed air motors, vibrators, etc., to their electric equivalents, as this to me is efficiency (less energy, same result). I am instead referring more to leak prevention and control (don't waste it). One overlooked method of leak prevention, is simply closing valves to sections of a site when not active. One site eliminated a compressor coming on at night by simply shutting off one section of the site each afternoon at its close of operation, then opening it back up each morning. While leaks still occurred during the 8 hour day shift in this area, this night shutoff was quicker and more cost effective overall than trying to continually fix all the inherent leaks in this one area.

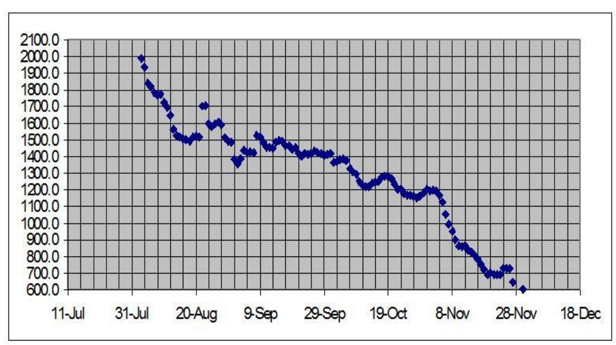
Motors such as dust collectors, exhaust fans, air handlers - It is expensive to move air, either in or out, and we should do anything we can to reduce the operating times to their required minimums. Some methods I have seen to reduce operating hours:

- Timers – from simple to complex, a whole array of types
- Pressure pad – when operator steps on the pad, the dust collector comes on. Often coupled with a timer.
- Motion sensors/photo-eyes – activates the units when operators present
- Interlock to process – so that the dust collector runs only when the machine generating the dust is running and generating dust
- Individual dust collectors – instead of having one very large unit for a whole department, consider having more individual units that can be more easily controlled
- Behavioral – once know costs, methods and systems for manual shutoff (if it can, and WILL, be done). Sites often try behavioral change, and then find that other controls or systems provide more consistent conservation results. However, some sites, such as the one described below, have found manual conservation can work when everyone is trained, motivated, and systematized.

Conservation and Six Sigma - example team results

The Six Sigma process works very well with conservation. The example below provides a great example of why conservation can be so important to reducing energy consumption. Using the six sigma methodology, I worked with one smaller site with energy reduction starting in the summer of 2008. We met for two hours initially at the site to kick off the project, and collect data where possible. We then had eight web-calls, where we followed six sigma methodology to define where and why energy was used within each use system (motors, lighting, compressed air, ventilation, extraction, etc), and then how to reduce its use. Among other things, the team used Cause and Effect (C&E) tables to prioritize efforts, and Failure Mode Effects Analysis (FMEA) to provide appropriate actions to these priorities. Along the way, the team met, and defeated, manufacturing inertia, behavioral issues, as well as other top ten reasons against conservation. This team used a great many of the ideas and concepts discussed in all the above sections.

The chart below shows daily progress from August 1, 2008 to the end of the year, plotted against a seven day running average of KWH/day. We used a seven day average as each data point would then include two weekend days, where there was no production.



From August 1 until October 30, savings at the site was largely from conservation efforts. During nights and weekends, the site shutoff equipment (motors, lights, office equipment), shutoff compressed air loops to prevent all leakage in many areas, turned off air handlers at night, shut-off unnecessary compressed air uses, and more. But they also performed conservation during the day as well, working with employees on behavioral change to turn off equipment when not in the room. As a result of all their efforts, the site went from 2,000 kWh per day at the end of July, 2008, to just about 1,200 kWh per day by the end of October 2008, or a reduction of 40%.

On October 30, we started operation of our first true expenses, for two variable speed drives, which further reduced usage to about 700 kWh/day, or a further 25% reduction. By the end of November, with conservation and efficiency, we reduced electrical consumption by 65%, having reached this new plateau of around 700 kWh/day. The site has continued to track electrical usage on a daily basis to calculate the seven day running average.

The moral – the Six Sigma process does a great job in identifying and prioritizing conservation opportunities. When coupled with dedicated, motivated personnel, these conservation measures provided over half of our total savings, with a great many of the ideas costing little or nothing to implement.

Closing and Summary Points

- There is a difference between conservation and efficiency, and we should stop using the two interchangeably. Conservation saves energy by reducing the system results, while efficiency reduces energy while keeping system results unchanged.
- There is large potential conservation savings at typical sites, if only one knows where to look, what the value is, and then how to attack and address.
- Conservation can achieve as much or more than efficiency gains in some areas, and should always be considered first.
- Remember the simple slogan for conservation – “Don’t Use it, Don’t Lose it, Don’t Waste it”. You will find cost effective energy conservation opportunities within any energy use system if you truly apply this slogan.
- There are many reasons why conservation is not addressed more. This is the bad news. The good news is that there are systematic ways to address each reason.
- Energy behavior might not be easy to change, but it can be changed, and it is usually worth the effort. It just takes hard work, and time.
- The largest energy reductions are very often achieved through a combination of conservation (first), then efficiency (second).
- Team Based approaches, such as Six Sigma, can be very effective with identifying and addressing energy conservation.

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