



Energy cost reduction via process change and behavior

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On a recent flight, the in-flight magazine carried a story about reducing carbon emissions, a theme that seems to be obligatory in airline magazines today. In this particular article, 21 tons of CO² will be reduced annually by replacing 45kg of crew documents with a 2kg laptop. What this article nor most of the others I've read – and that's a lot of in-flight magazines – didn't highlight, was the reduction in the cost of fuel that this change will bring. Airlines are amongst the hardest hit by the rising cost of fuel and being slightly cynical, the public focus on carbon emissions is a little transparent.

None-the-less, the article underscored two important hints for those looking for ways to reduce energy costs. In addition to more efficient airplanes, engines, boilers, and machinery, process change can also be a powerful aide in reducing energy costs, without the need for (quite often) heavy capital expenditure.

Let's take the airline example. A newer, more fuel efficient aircraft may cost \$200 million. I'm not sure how long the ROI would be but it's safe to say, it's not months. The switch, however, from 45kg of paper to a laptop carries with it a very small cost and the payback will be very short term. Importantly, for the context of this article, the fuel reduction from this process change is small in comparison with the very substantial cost reductions that process change will bring about.

Consider the printing, distribution, time updating manuals and the people and logistics costs to print enough copies and get them to hundreds or thousands of flight crews. Might even save some CO² emissions driving the pages around. Finally, it's a cleaner, faster process. Wins all around.

Back in 2000, when oil was much cheaper, Renoir did a project at a food manufacturing plant in the USA, that processed onions for seven months following the harvest. We initiated a number of process changes and reduced the processing time to six months. Our client was very pleased because of the very substantial cost savings, (\$1.2 million) but the irony is, we never even considered the reduced cost of energy, because oil wasn't \$130 a barrel.

The point however is that although we all know that process change can reduce costs, process change centered around energy costs can pay huge dividends in today's high



priced energy environment. And yes, Renoir is paying very close attention to reducing energy costs for our clients through process change, not capital expenditures.

Industry type is clearly the determiner of how much energy cost reduction is available but it's a matter of degree. Everyone's energy costs are on the rise. Transportation and process manufacturing head the list but other manufacturing and even high tech service organizations and hospitals are feeling the pinch. Energy costs—typically 10% of the corporate tech budget—could rise to as much as 50% in just a few years, according to consulting firm Gartner.

Process manufacturing can spend \$20 million to \$400 million annually on energy. It is generally their number one or two largest operating costs. Not surprisingly, these companies invest heavily in managing their energy costs and typically their efforts are focused on three main areas. (Airlines usually focus on the first two as the aircraft and engine manufacturers dictate strict procedures, backed by federal agencies, that prohibit retrofitting, I'm happy to say.)

(1) Capital Equipment [new or rebuilt boilers, generators, state of the art energy equipment to replace old inefficient machinery, etc.]

(2) Supply Side [negotiating energy contracts with local utilities – taking advantage of peak vs. non-peak rates, generating or co-generating power and selling any excess to the grid to off-set costs

(3) Retro-fitting [this is an engineering driven activity that utilizes the knowledge of the manufacturing process to make adjustments that will not adversely affect the finished product but none-the-less reduces the energy bill. It can be as simple as the addition or elimination of a pipe or re-positioning generators]. These three areas will be supported by engineers, a control room, meters and sub-meters throughout the operation. Large process manufacturers generally do these activities very well.

Consumption is a **4th** area of opportunity that can provide significant opportunities to reduce energy costs because of inconsistencies in behavior, data, focus, and roles & responsibilities. Compared with Capital Equipment, Retro-fitting, and Supply, the benefits in consumption are small when viewed individually, however, in the aggregate these opportunities range between 5% (in an extremely well run operation) to 14% of the total energy bill. Remember we are talking about energy costs between \$20 million to \$400 million annually.



Discreet manufacturers also have opportunities to reduce their energy spend in the range of 15% - 30%, but of course the size of their energy bills will be much less. Having said that, how many manufacturers would turn up their nose at \$3-4 million.

Don't forget that the process changes that will deliver energy savings, may also deliver even bigger, non energy cost reductions, as with the airline manual example described earlier.

As is often the case with OEE improvements, Maintenance is also the key area to focus on when going after consumption related energy costs. Deferred maintenance can represent a significant opportunity and we consistently find poor or poorly executed maintenance systems. Boilers are often maintained by outside contractors and it's not uncommon for us to find that short cuts are being taken when tuning, eg tuning a center flame and not the others.

As we analyze energy opportunities, we begin by understanding the current energy management system as well as the biggest potential areas of opportunity. Systems, processes, metrics, protocols, behavior, training requirements, and documentation are all critical components and require alignment and consistent compliance. Energy flow maps are developed or critiqued in parallel with process flow maps. Variations between operators are analyzed and detailed observations carried out to paint a complete picture of causal factors affecting performance and creating the variations.

Once the process and the energy flows, as well as behaviors are understood, re-development of the flows are considered to determine if there are opportunities to reduce energy usage without compromising production demands, quality, safety, etc. Common housekeeping items such as lead tag programs, steam traps, and proper boiler tuning will provide some reduction in waste, however, changing the process and therefore incurring less waste while producing the same amount of product (or more) provides an even bigger opportunity.

In order to build an effective *Energy Management System* that is sustainable, there is the need for clear understanding of *roles & responsibilities*. Who is responsible for energy at what part in the process? What tasks must be completed hour by hour, shift by shift, week by week, etc. in order to reduce energy waste? This is exactly what we do with non-energy process management. It's simply change management with a different focus and the added advantage of being even easier to measure the results.



We find that the top energy consumers are paying close attention to energy costs, but their focus is on supply, retro-fitting (engineering), and five year capital equipment plans. With few exceptions, they are not focused on process and behavior with regard to energy.

Although process manufacturing and transportation are the clear champions when it comes to energy consumption, everyone can save considerable money through process change and technology.

Consider big outsourcing and call centers, data centers, computer and networking centers. A PC uses an average of 600kw hours per year, even more if left on 24/7. Multiply that by hundreds or even thousands of PC's and then by the increased price per kw hour and you'll see that even a very simple process (and behavioral change) of shutting them down when not in use can make a big difference, and you can even claim you're going green, too.

And how about this? More than half of Sun Microsystems' employees work from home or in a flexible office, and a study of some of those employees found big savings in vehicle expenses and energy use.

The company's Open Work Energy Measurement Project studied more than 100 participants in the company's flexible work program to see how much energy they used at Sun offices, at their homes and when commuting to and from work.

Employees saved more than \$1,700 a year on gas and vehicle upkeep by working from home an average of 2.5 days a week. They also saved an average of 2.5 weeks of commute time.

In addition, office equipment in Sun offices used twice as much energy as home office equipment, the study found. And commuting accounted for more than 98 percent of the employees' carbon footprints.

About 19,000 Sun employees are in the flexible work program, accounting for 56 percent of the company's workforce.

It's time to think outside the box and save money. It's also time to improve your process flows, energy flows and behavior. Look at these comments from a recent analysis we did:



- “We run 14 cooling towers on 250/85 hp motors. Presently we adjust fans according to cooling water temperature. Temperature is the main concern, but how we control that temperature may be something we should look at.”
- “We are quick to turn pumps and compressors on but not so quick to turn them back off when we don’t need them any more.”
- “We have no procedure to run some of our equipment that might run during the day or at night on a night only basis, when energy cost is lower.”
- “Compressors A & B are rated 309 mcfh each and they currently run 24/7. Plant nitrogen needs for the last week have been below 300 mcfh for all but a very short period of time. Each motor is rated 400hp. We do have a nitrogen back up system that could have supplemented the short time during higher flows.”
- “We have 8 sets of double pumps running and could run single pumps at times.”

Two things jump out. One is that, as usual, the people doing the work know better and know how to reduce costs. And two, they haven’t done anything about it for a host of reasons: roles and responsibilities, too busy with their “day jobs”, lack of training, inadequate systems, didn’t realize the benefits and the biggest one, no management focus.

And how about revisiting some of your old make-buy decision analyses? It may be that outsourcing production to someone who has invested in more energy efficient production processes or who has greater economies of scale, could save you money.

Here’s an excerpt from a sugar mill analysis. The overall process change resulted in significant benefits, including some serious energy cost reduction however the non-energy cost reduction was about 80% of the total.

Costs	Min	Max	Work With	Min	Max
Energy	30%	60%	38,856,041	11,656,812	23,313,625
Maintenance Costs	10%	25%	70,000,000	7,000,000	17,500,000
Labour Costs	33%	50%	150,000,000	49,500,000	75,000,000
Total				68,156,812	115,813,625



And finally, here's another example from an analysis of how process change, in this case changeovers, paved the way for energy reduction. And again, the actual process change will result in bigger savings than just energy.

A quick investigation of the upcoming change-over procedure from C25 to BC in February proves that potential exists...

- Historical change-over performance ranges from 15 to 25 days, with an average of 20 days
- A clear procedure ('big rock planning') containing duration and appropriate timings does not exist
- In the change-over period, most of the equipment (85%) is switched off, but the remaining 15% is still consuming 85% of the normal energy costs (85% of 11,500\$ per day)
- In the first weeks of the implementation, a SMED (Single Minute Exchange of Dies)-workshop will be held in order to determine the most optimal planning for all the activities that really have to take place during the change-over period
- Base target for the 2007 change-over: 15 days (5 days gained versus 'normal')
 - Base improvement potential: 5 days @ $(0.85 * 11,500) = 49k\$$
- Stretch target for the 2007 change-over: 10 days (10 days gained versus 'normal')
 - Stretch improvement potential: 10 days @ $(0.85 * 11,500) = 98k\$$

...to reduce the change-over duration significantly, thus saving a large part of the daily energy costs as well as significant people and equipment productivity.

Companies of the Renoir Group operate around the world and have amassed 15 years of helping companies implement changes that result in significant bottom line benefits, without a requirement for capital expenditures. Visit our website at www.renoirgroup.com.