

Efficiency, Useful Power & ROI

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Recently, as fuel prices have shot skyward and demonstrated considerable volatility, and as electricity grids have shown signs of strain, energy efficiency— or sometimes fuel efficiency— has received increasingly serious consideration in boardrooms and boiler rooms alike. Several major corporations have launched high-profile initiatives with impressive multi-year goals, but measures such as these are out of reach of the authority of most operations and maintenance managers.

The View From The Plant Floor

But there are still options available to plant managers, as well as a lot of other variables to deal with, such as:

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- How can cost impacts from variable and rising fuel costs be contained?
- How can facility owners sustain, improve, or expand their operations while containing energy consumption?
- How can existing facilities be made to consume less energy while continuing to produce the same or greater output?
- What efficiency enhancements can be utilized by managers with operational but not corporate decision-making authority?
- Are there any which have sufficiently rapid payback periods to satisfy upper management's demand for near-term results?

While not all of these are applicable to every operation, at least some are applicable to the majority of operations.

Utilizing Government Resources

Believe it or not, the Department of Energy has done a great deal of groundwork in providing guidelines and resources for line-level managers. Aimed at government employees, they are nonetheless available to the private sector as well.

As a case in point, EERE, the Department of Energy's Energy Efficiency and Renewable Energy office, has a user-friendly site which provides links to products and vendors, along with downloadable planning and purchasing guidelines. On the EERE site, there are several pages dedicated specifically to operations and maintenance topics, starting here:

www1.eere.energy.gov/femp/operations_maintenance/index.html [1]. Topic areas include energy cost calculators for energy-efficient products, and advanced metering, among others.

Regional, state, and local agencies are also increasingly active in offering practical information and assistance, so it's worth checking with your local government. A good place to start is your state government website.

Non-Profits Assisting For-Profits

Non-profit organizations such as the Alliance to Save Energy (ASE) also provide information, services, and even training to industrial operations. See the Industrial Clearinghouse section of the ASE site, at www.ase.org/section/topic/industry/clearinghouse/ [2].

Another prominent example is the Consortium for Energy Efficiency (CEE), which offers a variety of initiatives for commercial and industrial members. See the CEE site at www.cee1.org/ [3]. There are many others, so don't stop your search there.



Everything Old Is New Again

An obvious method to increase energy or fuel efficiency might be to replace aging boilers and other equipment, but in many cases that simply is not an option due to the potential capital costs, operational disruption, and/or the engineering complexities of replacing primary systems. One alternative is to undertake power recovery—recapturing waste steam, heat, or both, from existing systems to power mechanical systems or to generate electricity.

Modern boilers typically generate steam at higher pressure than is required for downstream operations, primarily to increase boiler efficiency and minimize distribution costs. Pressure is reduced to the downstream requirement through a pressure-reducing valve (PRV), but the thermal energy dissipated through the PRV is actually a significant amount of wasted energy.

Replacing the PRV with a back-pressure steam expander permits either reduction of

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existing electrical consumption (by connecting the steam turbine to drive a piece of rotating process equipment, such as a fan or pump), or generation of electrical power which may be used to offset local load or sold back into the grid.

Boiler Power Recovery Systems (BPRS), comprising an expander, generator, and controls, are designed to produce power from waste steam originally generated to serve a heat load, as above. For example, a BPRS recovering approximately 20 kW per MMBtu would represent power generation opportunities in the 200 kW to 5 MWe range on boilers rated between 10 MMBtu and 250 MMBtu.

A BPRS typically would be supplied as a self-contained, skid-mounted unit that attaches to a medium/high pressure boiler. The integrated package would comprise a steam turbine, a generator (either induction or synchronous), interconnecting piping, valves, and a control system. In boiler replacement situations, the pressure rating of the new boiler could be specified to optimize the output from a BPRS while meeting the thermal load required by the plant.

These systems can be expected to carry a market price in the range of \$500,000/MWe, so they are not small purchases, and it is crucial to select a package with easy installation and minimal disruption to your operation. However, properly selected units can achieve payback within two to three years based on fuel cost avoidance alone (not counting locally-offered efficiency, carbon, or renewable credits for which the system may be eligible), and have a service life of 10 to 20 years.

Be sure to consult your local government to determine which credits may be available to you, how you demonstrate eligibility, and how to go about getting paid.

The Old Switcheroo...

The last option covered here is fuel substitution. This requires considerably more homework to put into practice, but for some plants — particularly smaller operations located in rural or semi-rural areas — it can be well worthwhile, since fuel prices would effectively be frozen over the life of the project.

Agricultural biogas and municipal biogas projects are already under significant development in Germany and the UK, where projects range from family farms to centralized installations.

By substituting biogas for conventional natural gas, or by generating electricity from biogas instead of purchasing it from the grid, plant managers can steeply cut fuel or electricity expenses— and in some areas, qualify for state-level tax credits or other incentives worth even more than the fuel and/or electricity cost savings.

Clearly the practicalities and economics of agricultural or municipal biogas are dependent on the particulars of a given project, and the US is considerably behind Germany and the UK in encouraging these projects. However, several states, notably Pennsylvania [see www.depweb.state.pa.us/ [4]], have recently instituted incentive and/or assistance programs to accelerate adoption of alternative fuels programs. So again, it's worth investigating your state's programs.

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About That Boiler

If none of these options work for you, you may consider replacing that vintage boiler. But before making that decision, be sure to thoroughly research equipment upgrade and replacement assistance programs— your state may be one of several that offer credits or other ways to offset replacement expenses, or even financing or grants for more significant plant upgrades.

Now And Later

Energy efficiency isn't just a fad, and even though your operating budget faces increasingly intense pressure from rising fuel costs, you don't want to get stuck making decisions for short-term savings alone. Investigate your energy efficiency options and choose the solution— or set of solutions— that delivers you the operational power you need for this year and for years to come.

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Links:

- [1] http://www1.eere.energy.gov/femp/operations_maintenance/index.html
- [2] <http://www.ase.org/section/topic/industry/clearinghouse/>
- [3] <http://www.cee1.org/>
- [4] <http://www.depweb.state.pa.us/>