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Texas Industrial Energy Efficiency Program
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Greetings, from the Texas Industrial Energy Efficiency Program!

In this issue:

The Spring That Was

Spring 2021 was a productive season for TIEEP. We had three major events, all of them virtual. The Spring Energy Forum and our annual Water Forum are both longstanding features of our program. The topics this year were *Decarbonizing the Process Industries* and *Reducing Water Use in Manufacturing Plants*, respectively.

Decarbonization has become a major theme in industry, driven by the growing focus of stakeholders on ESG (environmental, social and governance). Energy efficiency plays a major role in this, but our Spring Energy Forum focused on two other important technologies – electrification and biofuels. Our next event also focuses on decarbonization – see below.

Electrification – One Key to Decarbonization

The Water Forum addressed reducing water use in three different ways. Two of these were new technologies – one that provides increased flexibility in water treatment for process use and recycling, and the other that streamlines wastewater treatment. The third presentation introduced the US DOE's *Plant Water Profiler Tool (PWP)*, software that aids understanding, managing, and improving water balances. Not only can these resources save water; they can also lead to energy savings, space savings, quality improvements, and reductions in capital and operating costs for new plants and revamps.

Our other spring event was our first ever TIEEN Webinar (*Turn Energy Efficiency into Cash Savings*), which provided an opportunity to showcase the work of our partners in the Texas Industrial Energy Efficiency Network. TIEEN is a network of publicly supported industrial energy-efficiency organizations (TMAC, SPEER, Texas A&M University Industrial Assessment Center, the Texas PACE Authority, and the US DOE Southcentral CHP Technical Assistance Program). These organizations provide valuable services for Texas manufacturers, identifying plant improvement opportunities, defining better operating strategies, and providing effective financing options, amongst other things.

You can find out more about TIEEN from the write-up on our website, and also by viewing the webinar in our archive. The Spring Energy Forum and the Water Forum are also available in our archive.

Upcoming TIEEP Energy Forum

Thursday, September 30, 2021, 9:00 am to 12:00 noon: TIEEP Fall Energy Forum, ***Decarbonizing the Process Industries II***, at the AIChE Southwest Process Technology Conference, Houston Marriott Sugar Land, https://www.aiche.org/conferences/southwest-process-technology-conference/2021 . Updates will also be posted on the TIEEP website.

From the Casebook: The Four Pillars of Energy Efficiency

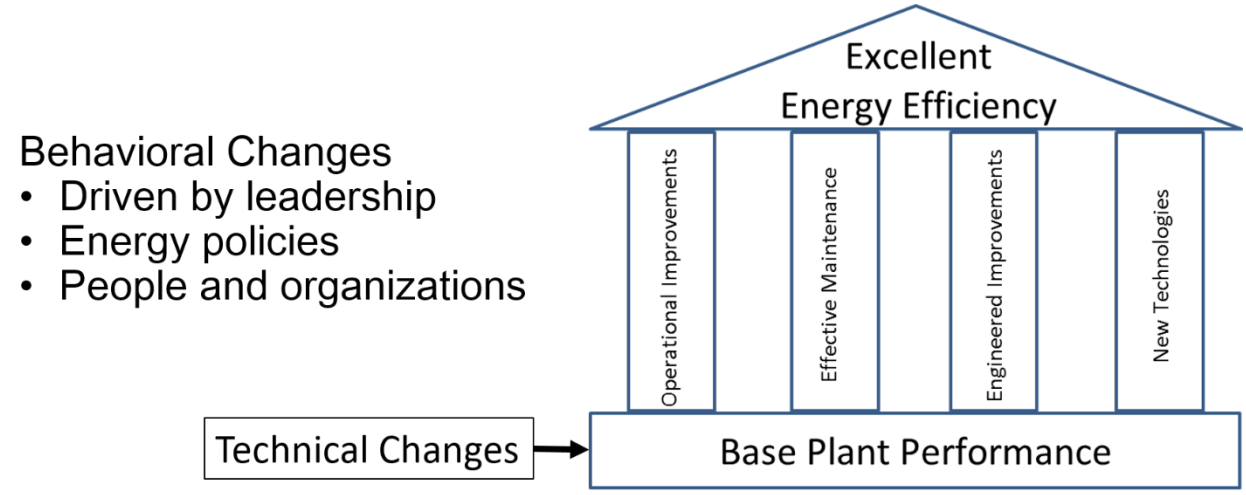
As we noted earlier, energy efficiency plays a key role in decarbonization, and it is also important in its own right as a tool for reducing the variable cost of production. So, where should we look to find opportunities to save energy in our industry?

Most corporate energy management programs focus on encouraging positive corporate and personal behaviors. At the highest level, most companies have an energy policy that is intended to integrate energy efficiency into the corporate culture. The policy then flows down to various departments and disciplines in the company for implementation. This can lead to a wide range of new practices and behavioral changes, both individually and corporately; for example:

- Engagement of executive level support for corporate energy efficiency activities.
- Enhanced data collection and analysis to support the development of energy strategies and the deployment of energy management systems.
- Engineering standards and procurement rules that require premium efficiency electric motors, enhanced insulation, and other measures to minimize energy use in new plants and revamps.
- Allocation of funds specifically for energy efficiency projects, or allowing a lower rate of return for projects that reduce energy consumption than for other types of projects.

- Site energy audits, pinch studies, and other programs designed to identify and implement energy saving opportunities.
- Employee awareness programs (e.g., energy fairs and competitions) designed to raise interest in energy and environmental matters.
- Training programs to build competency.
- Making energy efficiency a criterion for executive compensation and employee bonuses.
- Sharing of useful information and best practices – for example, through TIEEP.

Human factors and behavioral changes are important, but they must translate into improvements in how your plant runs if you are to achieve energy savings. There are four main ways this happens – *The Four Pillars of Industrial Energy Efficiency*[1]. These are: operational improvements, effective maintenance, engineered improvements, and new technologies.



Pillar 1. Operational improvements

Many operational improvements can be captured at little or no cost. This makes them particularly attractive where energy prices are low and it is difficult to justify investment in energy-efficiency projects. Also, before committing to projects that require capital expenditure, it is prudent to ensure that existing equipment is being used to its full advantage.

When we identify suboptimal operating practices, the first response is generally to modify operating parameters (e.g., change control valve set points). However, this is only a short-term fix. Additional energy management steps are needed to ensure that the improvement becomes permanent. These might include, for example:

- operator training
- modified operating procedures and updated documentation
- additional control valves and/or automation
- real-time optimization systems

• performance monitoring systems with energy performance indicators (EnPIs)

Pillar 2. Effective maintenance

If we are to get the most out of existing facilities, we must ensure that the plant is properly maintained, especially the equipment and systems that have the largest impact on energy use. These include heat exchangers (especially those in preheat services, and some condensers), furnaces and boilers, steam piping, steam traps, insulation, compressors, pumps, and turbines. The most common maintenance programs and activities include:

- boiler and furnace tune-ups
- convection bank cleaning
- steam system management programs – including steam leak and steam trap surveys and repairs
- heat exchanger fouling surveys, analysis, and cleaning

Managing heat exchanger fouling is important for energy efficiency

When problems recur frequently, it is wise to explore root causes. For example, the underlying issue with recurrent steam leaks is often poor piping design or inadequate drainage. Correcting the root cause (*e.g.,* re-routing steam lines, adding drop legs or replacing failed steam traps) can eliminate — or at least minimize — the occurrence of future steam leaks, and the cost and inconvenience of further repairs.

Pillar 3. Engineered improvements

Engineered improvements — additions and upgrades to existing plant facilities, and modifications to new plant designs — can lead to significant improvements in energy efficiency. Examples include:

- resequencing equipment (*e.g.,* heat exchangers in a pre-heat train)
- replacing or upgrading electric driver systems (*e.g.,* installing variable frequency drives)
- adding or modifying heat exchangers, steam turbines, distillation columns, etc.
- new control schemes
- catalyst upgrades

Engineered improvements can be expensive, and they are often difficult to justify based on energy savings alone. However, many of these projects bring additional benefits (e.g., product quality improvements, reliability, or increased capacity), which improve the economics. Factoring in a “cost of carbon” (e.g., a carbon tax) also improves the project return.

Pillar 4. New (breakthrough) technologies

Engineered improvements apply proven solutions to identified problems. In contrast, solutions that incorporate breakthrough technologies require validation through research and/or development, so they require more time to implement, and their degree of technical and financial risk is higher.

Some of the largest energy efficiency improvements in the process industries have come through technological breakthroughs. Twenty-first century examples include the Dow/BASF hydrogen peroxide to propylene oxide (HPPO) process[2], which reduces energy usage by 35% compared to earlier propylene oxide technologies; and Shell's OMEGA EO/EG (ethylene oxide/ethylene glycol) process[3], with 20% less steam demand and 30% less wastewater than a traditional thermal conversion MEG plant. Incorporating new types of equipment in existing processes can also lead to significant energy savings – e.g., novel heat exchanger designs and distillation column packings.

References

[1] Alan P. Rossiter, "The Four Pillars of Industrial Energy Efficiency," Chemical Engineering Progress, Vol. 111, No. 5, pp. 40-44, May 2015

[2] https://www.basf.com/ru/ru/media/news-releases/2009/03/p-09-154.html

[3] https://www.shell.com/business-customers/chemicals/factsheets-speeches-and-articles/factsheets/omega.html

In Closing…

Thank you for taking the time to read along with us. We hope you found the information useful, and that you'll join us in our upcoming events.

If you would like to ensure that you receive all program updates and notices of upcoming events, please subscribe on our webpage.

If you have any questions, or difficulties with registration, or to request removal from this distribution list, please contact Li Lopez, llopez37@Central.UH.EDU or 713-743-7904.