

A black and white photograph of an industrial facility, likely a refinery or chemical plant. The image shows a complex network of large, dark pipes and metal walkways. The perspective is from a walkway, looking down a long, narrow corridor. The lighting is dramatic, with strong highlights and deep shadows, creating a sense of depth and scale. A blue diagonal line runs across the image, separating the text on the left from the photograph on the right.

eBook:

USING ULTRASOUND TO ENHANCE ENERGY EFFICIENCY

ue
SYSTEMS INC
The *ultrasound* approach



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Electricity consumption and industrial activity accounted for over half of the greenhouse gas emissions produced by U.S. economic activity in 2012.

FOCUS ON CARBON EMISSIONS

The federal government has stepped up its effort to control carbon emissions by limiting the consumption of high-carbon emitting fossil fuels. According to the EPA, electricity consumption and industrial activity accounted for over half of the greenhouse gas emissions produced by U.S. economic activity in 2012, which was the equivalent of around 6,526 metric tons of carbon dioxide.

WHAT'S BEING DONE?

Energy efficiency is one of the most important strategies in addressing this issue. One major government initiative is the Department of Energy's Better Plants Program, through which partnering companies aim to reduce their energy intensity by 25 percent or more over the course of a decade. Already, the program has seen some impressive results.

As of Fall 2013 the Better Plants Program has:

- Partnered with 123 companies, making up 1,750 plants
- Accounted for 7.9 percent of the U.S. manufacturing energy footprint

As a result of the steps taken, these companies have been able to:

- Save 190 trillion British Thermal Units of energy
- Cut energy spending by \$1 billion
- Improve energy intensity by 2.7 percent

While these numbers indicate that significant progress is being made in the industrial sector, there is still much more left to be done.



40%

Power plants are the single largest carbon polluters in the country, **producing about 40 percent** of all domestic greenhouse gas emissions.

EPA STEPS IN

The Environmental Protection Agency has intervened to boost these emissions reduction efforts. Power plants are the single largest carbon polluters in the country, producing about 40 percent of all domestic greenhouse gas emissions. As a result, the EPA instituted rules aimed at reducing this pollution.

Named the Clean Power Plan, these new rules will strive to:

- Cut carbon emissions by 30 percent compared to 2005 levels
- Cut particulate matter, nitrogen oxide and sulfur dioxide emissions by more than 25 percent
- Reduce electricity bills by around 8 percent by improving energy efficiency and limiting electric grid demand

This will provide numerous societal benefits, including:

- Preventing up to 6,600 premature deaths
- Avoiding up to 150,000 asthma attacks in children
- Providing up to \$93 billion in climate and public health benefits

These new rules will make efficiency supremely important for power plants. While some use less carbon-emitting fuels than others, such as natural gas compared to coal, they still need to be operating at peak efficiency in order to keep pollution down. By having machines running at their highest performance levels, huge amounts of energy can be saved.



Industrial plants are among the most energy-intensive elements of the economy.

AN INDUSTRY-WIDE EFFORT

While the EPA Clean Power Plan applies exclusively to power plants, their implications can expand to the entire industrial sector. Industrial plants are among the most energy-intensive elements of the economy, which is creating air pollution and higher operating costs.

By focusing on energy efficiency, plants can make significant progress in addressing what is known as the triple bottom line. This concept is broken down into three components:

1. **Economics:** How does an action affect the company financially?
2. **Environmental:** What is the action's impact on the surrounding environment?
3. **Social:** How does it impact the community at large?

Taking steps to make a plant more energy efficient is a great way to address all three of these issues. Here's how an efficiently running plant can do so:

1. **Economics:** Less energy consumption means lower operating costs—something any manager can get behind
2. **Environment:** Limiting greenhouse gas emissions is vital to slowing the pace of global climate change
3. **Social:** Less harmful air pollution can improve the health of employees and the general public



HOW A RELIABILITY IMPROVEMENT PROGRAM CAN HELP

There is still some time before the EPA rules take effect, but companies should still be looking for ways to improve energy efficiency. There are a number of steps that plant managers can take right now to improve the performance of their facilities.

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Reliability improvement programs are a great way to improve overall plant performance. One component of this is better machine and system efficiency. If industrial assets are performing as best as possible, you should see the following advantages:

- Longer lasting, higher performing machines
- Lower energy demands
- Plant savings from less downtime and power expenditure

The challenge in achieving this performance level is using the right tools to identify potential problems. Because the early warning signs of machine issues are difficult, if not impossible, to detect using just your human senses, one component of a reliability improvement program relies on these high-tech tools to detect issues sooner:

- Ultrasound Instruments
- Lubrication application monitoring instruments such as UE Systems' Grease Caddies
- Infrared Thermography
- Vibration Instruments

When it comes to industrial energy efficiency, two of the best places to start are compressed air leaks and steam leaks. To address these issues, you will need an ultrasound instrument such as the Ultraprobe 15,000.



WHAT IS ULTRASOUND?

Ultrasound technology is an extremely useful tool when it comes to implementing a reliability improvement program. This is because it can detect issues with machines before they become larger problems. By detecting noise that would otherwise be undetectable to the human ear, ultrasound works to identify issues before they become costly and time consuming to repair.

Because of these qualities, ultrasound can be applied to a variety of different elements in a reliability improvement program including:

- Compressed Air
- Steam
- Lubrication levels
- Mechanical efficiencies

There are a number of areas that have already been tested through which ultrasound can help improve energy efficiency.

The beauty of ultrasound is that there are many ways to apply the technology. By experimenting with it, you can find other applications to identify potential machine breakdowns and other issues.

There are a number of areas that have already been tested through which ultrasound can help improve energy efficiency, particularly when it comes to compressed air and steam leaks.



In 1995, **30 percent of all industrial compressed air** was lost to leaks, resulting in around approximately \$3.2 billion in losses.

COMPRESSED AIR

Contrary to what some might think, compressed air is not free. In fact, the Department of Energy notes that more than 50 percent of all compressed air systems have energy efficiency problems that should be corrected.

These losses can be quite costly. In 1995, 30 percent of all industrial compressed air was lost to leaks, resulting in around approximately \$3.2 billion in losses. A leak that is just $\frac{3}{8}$ of an inch (0.95cm) can cost a plant upwards of \$25,000 per year if it goes undetected.

In order to understand and evaluate what compressed air leakage is costing you, be sure to follow this 7-step process:

1. **Evaluation:** Look for leaks and identify misuse or poor applications for compressed air
2. **Detection:** Use ultrasound technology to pinpoint where you're leaking compressed air
3. **Identification:** Make sure you tag all areas where leaks are located
4. **Tracking:** Keep records of repairs and cost savings
5. **Repair:** Fix leaks as soon as they are found
6. **Verification:** Make sure that these leaks are fixed and the system's performance has improved
7. **Re-evaluation:** Continue to re-inspect your compressed air system

Simply by implementing these steps into their reliability programs, every plant could reduce its energy waste by 10 to 20 percent.



TIPS TO REDUCE COMPRESSED AIR LEAKS

One of the best things you can do for your compressed air system is to implement an air leak detection survey. Compressed air leaks are bound to crop up at some point. By having a system in place that is designed to identify them before they become a large problem, you can save time, money and energy.

The following are the four major components of implementing a compressed air leak detection survey:

1. Create a route for inspection based around the design of your air piping system.
 - » Make sure to find and tag all leaks. Keep an eye out for misuse, such as valves that are left wide open.
2. Design the best possible route for inspection
 - » Start from the compressor/ supply side and work toward the use side each time to maintain consistency.
 - » Take a sketch or diagram of your system to help you identify all the components of the system.
 - » Break your path into a series of zones that can make your inspection route more organized and easier to track.
3. Follow the same route each time so that you don't miss any components during your inspection
 - » Use ultrasound to catch small leaks before they become larger issues.
4. Tag your identified leaks and report your results to management, highlighting your cost and energy savings.

Compressed air leaks are bound to crop up at some point.



Leaking steam traps can increase operating expenses **by as much as 33 percent**. For this reason, energy conservation programs should start with a steam trap survey.

STEAM

Steam leaks are also among the most wasteful, and therefore, expensive issues found in a plant. In fact, leaking steam traps can increase operating expenses by as much as 33 percent. For this reason, energy conservation programs should start with a steam trap survey.

According to the Department of Energy's Office of Energy Efficiency and Renewable Energy, even the smallest steam trap leak can cost up to \$8,000 per year. A dry steam leak costs \$15 per every thousand pounds.

By implementing an inspection program similar to that of compressed air, your plant can see a number of efficiency improvements, such as:

- Reducing the amount of traps blowing steam to 3 percent, compared to 50 percent without any program.
- Improving system and plant performance
- Limiting carbon emissions and energy waste

There are a number of warning signs of a faulty steam system, and the following are a few examples:

- Abnormally warm boiler room
- Condensate receiver venting excessive steam
- Condensate water pump failing prematurely
- Water hammer
- Boiler operating pressure is difficult to maintain



Carbonic acid can break down some of the most vulnerable parts of a steam system.

TIPS TO REDUCE STEAM LEAKS

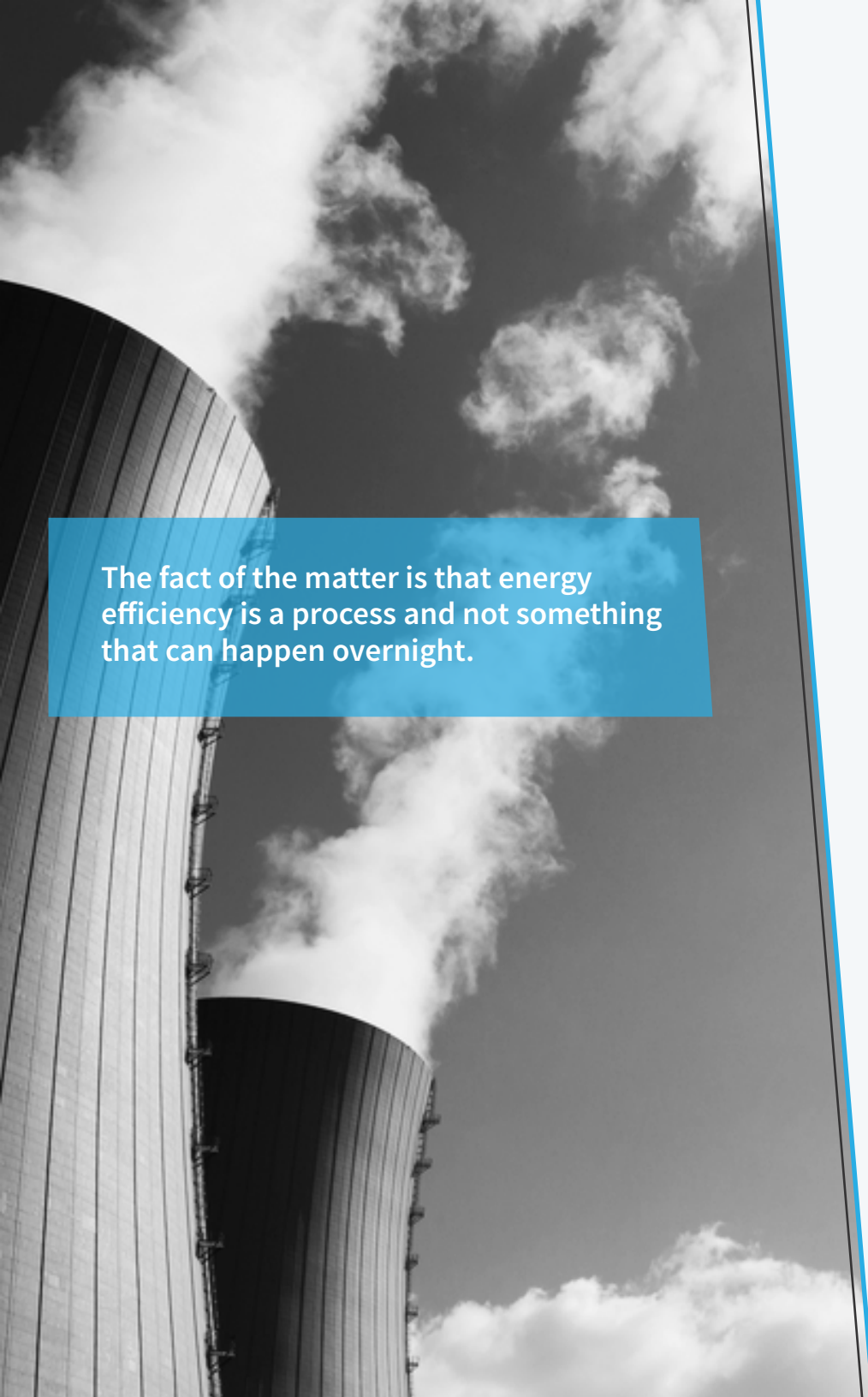
In many ways, steam leaks can be quite similar to compressed air leaks. For this reason, conducting a survey similar to compressed air is a great way to make sure your steam system is regularly maintained.

It's important to keep an eye out for the main causes for steam leaks and their solutions. Kelly Paffel of Swagelok Company laid out the following three as the top causes of steam leaks:

- 1. Threaded pipe connections:** Pipe threads can fail as they expand and contract with steam and condensation.
 - » Instead, use a different form of connection such as welded or tube-type connections.
- 2. Packing on standard type valves:** Standard packing on steam isolation valves are prone to failure without a thorough proactive maintenance program.
 - » Ball valves and butterfly valves can better address these sealing problems.
- 3. Carbonic Acid:** Carbonic acid can break down some of the most vulnerable parts of a steam system.
 - » By using stronger connection methods, such as welded or tube-types, systems can better resist corrosion, while using stainless steel will improve the resistance of the condensate system.

Ultrasound works best when it is applied to on-line steam systems, as it can detect issues as they occur in real time. However, there are also some clear signs of a steam system being neglected. Here are just a few:

- 1.** Oversized and misapplied steam traps
- 2.** Wiredrawn control valves
- 3.** Low steam temperatures
- 4.** Low percentage of condensate return



The fact of the matter is that energy efficiency is a process and not something that can happen overnight.

MAKING IMPROVEMENTS TODAY

There may be no single improvement that is going to solve all of a plant's energy inefficiencies. The fact of the matter is that energy efficiency is a process and not something that can happen overnight.

While there are a number of high-cost investments you can make to improve the efficiency of your plant, implementing a thorough reliability program is a much more inexpensive, efficient way of limiting power usage and finding savings today. By implementing these kinds of inspection programs, you can get a head start on limiting the carbon pollution your plant produces, as the EPA continues to refine its efficiency rules.

In order for your reliability program to be truly successful, you need to have the right tools so that you can tackle and identify issues before they become larger problems. Investing in ultrasound, infrared and vibration analysis equipment and training can be a great way to do so.

No matter the industry, be it electricity production, manufacturing or another sector, the beauty of energy efficiency improvement is the ability to address both fiscal and environmental concerns with one initiative. Saving energy means saving money and limiting carbon emissions—improvements that everyone can support!



ADDITIONAL LEARNING RESOURCES

While this guide should provide you with some important insight into how to detect steam and gas leaks to improve plant efficiency, there is still much to learn. The following are some important resources you can use to further expand your compressed air and steam leak detection efforts and make your plant more sustainable.

- [UE Systems' Energy Guide for conducting compressed air and steam surveys](#)
- [Reporting Savings From A Compressed Air Survey Webinar](#)
- [Steam Trap Testing Webinar](#)
- [Building A Successful Leak Management Program Webinar](#)
- [Ultrasonic Leak Detection Survey Experiences at Industrial Plants Video](#)
- [Go Green Or Go Home Video](#)
- [Advanced Trends In Compressed Air Best Practices](#)

By making a concerted effort to control leaks and carbon emissions from your plant, you can not only help combat global warming, but save money in the process.



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RESOURCES:

- <http://www.uesystems.com/new/wp-content/uploads/2012/08/energy-guide.pdf>
- <http://yosemite.epa.gov/opa/admpress.nsf/a92ceceac8525735900400c27/5bb6d20668b9a18485257ceb00490c98!OpenDocument>
- http://energy.gov/sites/prod/files/2014/03/f11/bp_progress_report_fall_2013.pdf
- <http://energy.gov/eere/amo/better-plants-program-partners>
- <http://epa.gov/climatechange/ghgemissions/sources/industry.html>
- <http://www.whitehouse.gov/share/climate-action-plan>
- http://www1.eere.energy.gov/manufacturing/pdfs/webinar_steamtrap_2010_0605.pdf
- <http://www.plantengineering.com/single-article/best-practices-steam-and-condensate-leaks/ff4641751fc4cadd898a29246e7603d6.html>