ASOPE™ Newsletter

July 1, 2009 | American Society of Power Engineers, Inc. | Volume 7, Number 1

In This Issue

Newsletter Article Links

http://asope.org/Crossword4.html

www.PlantServices.com

Contact Us

http://asope.org

asopeinc@aol.com or

admin@asope.org

Independence Day July 4th

On July 4, 1776, we claimed our independence from Britain and Democracy was born. Every day thousands leave their homeland to come to the "land of the free and the home of the brave" so they can begin their American Dream.

The United States is truly a diverse nation made up of dynamic people. Each year on July 4, Americans celebrate that freedom and independence with barbecues, picnics, and family gatherings. Through the Internet we are learning about and communicating with people of different nations, with different languages and different races throughout the world. Bringing the world closer with understanding and knowledge can only benefit all nations. We invite all nations to celebrate with Americans online this Fourth of July.

Don't forget the Americans that are in the Military serving all over the world so that we can celebrate that freedom and independence with barbecues, picnics, and family gatherings.

God Bless You and Happy Birthday, America

ASOPE-BOD

The Heat Value Chain is Broken

Energy Expert Peter Garforth delves into how cogeneration can double our energy efficiency.

By Peter Garforth

It's almost impossible to go anywhere and not see "green." From the White House organic food garden to the solar panels on the local high school, everyone is tapping into a groundswell of awareness and rethinking of our energy value chain. The cynical me asks two questions. The first wonders how much of this greenness has to with stimulus dollars. The second is about scale.

The latter brings us to heat. Most factories need heat for processes and for workspaces. Every factory releases substantial amounts of waste heat. Every furnace, chiller, melter, compressor, oven, dryer, light, pump and motor generates unused heat. All factories use electricity, virtually all of which eventually becomes heat.

Electricity, this immediately available resource, is the source of massive pollution and wasted costs measured in the trillions. For some reason, it never seems to make it to the green dialogue in a meaningful way. Where are the environmentalists hanging banners on factory cooling towers as symbols of profligate waste?

As so often is the case, the devil is in the details. When a factory starts looking at its existing processes for heat-recovery potential, a common conclusion is that there is more waste heat available than potential uses for it. It makes sense to heat the warehouse and the workspaces and to run the domestic hot water systems from waste heat recovery. Doing this saves a few thousand dollars in oil or gas purchases, and gives experience in analyzing and using heat as a utility. We might even consider taking some lessons from the past and look at applications such as melting snow in common areas using heat arrays.

But these actions can be seen as Band-Aids, as they only stem the waste of heat from processes a hundred miles away from the factory, at the power plant where the electricity is generated. To put a quick scale on this, the heat wasted in the U.S. electric system is 7% of all energy used … in the world.

So, how can factories be green about fossil-fired waste heat? With existing plants, every possible measure to reduce local and remote heat waste must be considered, prioritized and executed. This requires a deep understanding of the uses and sources of heat around the site as a part of the overall energy balance mapping. There's a need for openness and creativity in developing possible ways to bridge from a waste heat source to a heat use. Language can help. Calling a compressor an "electric boiler that also makes compressed air" might strictly be inaccurate, but it gets people thinking differently.

With new plants, focus on planning heat uses and their relationship to possible heat sources. Heat is a utility like any other. When it can be sourced from internal byproducts, operating costs and greenhouse gas risk exposure drop. At the same time, usually other process efficiencies are captured. Ask BASF. Through their "Verbund" approach to integrated chemical sites, they have some of the lowest operating costs in their industry. This approach to plant design started back in the early 1980s. It has evolved to where plant designers almost see a cooling tower as symbol of failure, not an inevitable necessity.

Heat produced at the power station must be considered. In a sane world, a lot of our green passion would be focused on enabling cogeneration (combined heat and power, or CHP) wherever it makes sense. To a first approximation, CHP doubles the fuel efficiency and radically reduces greenhouse gas emissions. Too often the barriers are sheer regulatory complexity and prohibitive statutory gateway costs with the local utility. These must be swept away now, starting with every state immediately recognizing clean electricity with at least 70% to 80% fuel efficiency as part of its Clean and Renewable Electricity Portfolio Standards, irrespective of size of the generating unit. Congratulations to the European Union for taking steps in this direction, and to Ohio and Ontario for considering this.

Finally, we must address sharing heat. With the best will in the world, even with outstanding design and distributed generation, a facility might still make more heat than it uses. We must find ways to look to the neighbor's factory and find uses for our excess. For most companies, running their own business is enough and they balk at this step. Enter the industrial park with shared services, including electricity, natural gas, process steam, heating, cooling and compressed air managed as site utilities by an independent micro-utility. This isn't a fantasy; it's the operating reality in places like the Gersthofen Industriepark in Bavaria, taking the idea of waste heat recovery to a whole new level.

The world uses 450 exajoules annually, or 425 quadrillion Btu of primary energy. Even in slow times, we're adding 1% to 2% per year to this number, the primary fuel equivalent of adding 300 power stations every year. Conservatively, 50% of this is wasted as unused heat. That should be a big enough opportunity to keep the "greens" up at night.

Peter Garforth is principal of Garforth International LLC, Toledo, Ohio. He can be reached at garforthp@cs.com.

Thanks again for the republishing rights for this article *to* Paul Studebaker, CMRP, Editor in Chief Plant Services Magazine, www.PlantServices.com PlantServices E-News, PlantEnergy Insider, EAM Insider

Please visit this site it is an excellent site for good information and sound advice.

The Facts

By Larry Tarvin

And Googling

Global energy consumption in 1996 was around 390 exajoules; my rough attempt at extrapolating the historical numbers found at that link, without actually doing the regression, says it would be around 450 exajoules in 2006. (An exajoule is 10^{18} joules.)

Almost all of this is probably eventually released as heat. Although you'd have to take into account the fact that some methods of generating energy, such as hydroelectric, only generate as much heat as would be generated anyway from natural processes if the generating plant weren't there, so there's no net heat added to the environment. But the most common methods of energy generation, including burning of fossil fuels, certainly would.

If you want to know how much 450 exajoules per year translates to in terms of global warming, that's a much harder question, because you may have the majority of that heat being dumped into the atmosphere, but then the oceans act as a heat sink, but that's by no means instantaneous.

If the heat were all dumped directly into the oceans (it's not), and the oceans were well-mixed (in reality, it's not) so that that heat were evenly distributed, it would only increase ocean temperatures by about 0.00008°C per year, by calculations.

A exajoules is 10^{18} joules 450,000,000,000,000,000,000 Let's compare that number to the energy from the sun hitting the surface of the earth. Averaged over the entire surface of the planet in a 24 hour period, the flux of solar energy impinging on the earth is 164 W/m^2. The earth has a surface area of about 5x10^14 m^2, so the total power is 8x10^16 W. Over a day, that's 7x10^21 J, or 7,000 exajoules. So the sun contributes over ten times the amount of energy each day than humans contribute in a year. I have an idea lets put blinds between the us and the sun that will cut down on global warming and we have everything green with mold. I hope Mr. Gore doesn't see this he will make a new movie.

THE AMOSKEAG STEAM PUMPER

BY: Todd LaPlant

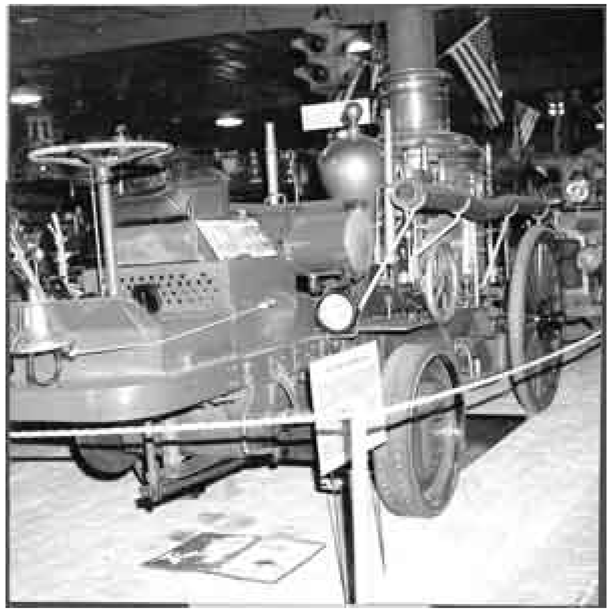
The Amoskeag Steam Pumper was a horse drawn firefighting steam pumper and was the foundation to the modern fire pumpers used everywhere from major metropolises to small volunteer based farming towns.

The Amoskeag Steam Pumper was built by The Amoskeag Manufacturing Company in the mid to late 1800's in the northern City of Manchester, NH. Amoskeag Manufacturing Company was located on Canal Street in Manchester, NH and was sold to the Manchester Locomotive Works in 1876. Even though the fire pumper manufacturing was sold to Manchester Locomotive Works, they were still referred to as the Amoskeag Steam Fire Engines.

In my studies of the steam fire pumper, I've learned some interesting facts about them. Such as, the Horses, (usually 2 of them) were in open stalls in the firehouses, and when the fire bell rang, the horses were trained to take their positions in front of the pumper, to be hitched to the fire pumper.

Obviously, the wood burning firebox on the steam boiler of the steam pumper had to be stoked all day, in preparation for any unforeseen fires. The pumper usually had two riders: A driver & a "fireman"…. The guy who rode on the back of the pumper, stoking the firebox while enroute to the fire. Thus is the dual meaning of the "Fireman" – as in boiler tender and the "Fireman"- as in Firefighter. It's also kind of ironic that up until safety codes prohibited such, firemen still rode on the back of modern fire pumpers.

This 4th of July, please keep in your hearts and give a big thanks or a cup of coffee, to the men & women of your local volunteer or full-time fire company, for the tireless work they do for our communities as well as the many cold, rainy, snowy, nights they're awakened to protect & serve your community.



Portland Maine Fire Department
1907 Engine 4

Another Amoskeag Steam Fire Pumper

Manchester Locomotive Works (today)
(now a small business complex)

Support your local

Fire Department

Air Compressors

By Rick Bullard

Practically every industry, world-wide, depends on compressed air, in varying degrees, to support one or more of its processes. Machine tools, painting processes and production machinery for most manufacturing operations use compressed air as the motive force driving and operating their machinery. The newest and largest coal fired power plants use large quantities of compressed air for soot blowing of the heating surfaces of their boilers and to a lesser degree for pneumatic control systems. Many HVAC systems in large buildings, college campuses, hospitals, etc. use pneumatic controls for these systems.

There are three basic designs of air compressors, each one having inherent advantages and disadvantages. The reciprocating, or piston-type of air compressor was the first design of an air compressor and still today, remains a viable type of compressor for the right application. The rotary screw design was the next design to be widely used in industry. Both the reciprocating and rotary screw designs are considered to be positive displacement types of compressors. The next major breakthrough in air compressor technology was the centrifugal type which is not a positive displacement type.

Reciprocating Compressors

As stated previously, reciprocating compressors are positive displacement using one or more pistons within a cylinder as the compression/displacement element. They are considered to be positive displacement because the exact volume of air that enters the cylinder is the same amount that leaves the cylinder under a greater pressure. The close clearance between the cylinder wall and the outer wall of the piston is maintained by the piston ring, thereby compressing the air as it moves through the cylinder. There are 2 designs of cylinders used in reciprocating compressors, lubricated or non-lubricated.

Lubricated cylinders require oil to prevent wear to the cylinders, pistons, and piston rings that are usually of cast iron construction. Some of that oil is carried out of the cylinders and may or may not be permitted to enter the compressed air piping distribution system. If the equipment being supplied with air cannot tolerate lubrication oil entrained in the air, it is removed from the air leaving the compressor cylinders, usually using coalescing type of filtration systems.

The advantage of the lubricated design is that wear is reduced to a minimum and therefore very little maintenance is required. The disadvantages of having to remove the oil from the air are that there is a significant pressure drop across the coalescing filter system which reduces the efficiency of the compressor and the maintenance that is required of the filtration system.

Oil-free reciprocating air compressors utilize Teflon piston rings that require no lubrication and in some cases aluminum pistons that are much lighter than cast iron and do not “drag” in the cylinders which also requires lubrication to prevent wear. The disadvantages of the non-lubricated design is that high quality crankcase seals are required to prevent migration of oil from the crankcase sump into the cylinders, the Teflon piston rings require frequent replacement as they continually wear away and there is sometimes a concern with Teflon “dust” from piston ring wear migrating out of the cylinders and into the compressed air distribution piping which may cause problems with the equipment in the system that is using the air.

Capacity control of reciprocating compressors is achieved by variable speed drivers such as steam engines and steam turbines and variable speed-controlled electric motors. Constant-speed compressors utilize a 5-step clearance control system to operate the units at partial loads in increments of 25% of capacity. Each cylinder is equipped with four clearance pockets with each pocket having a piston-operated valve that open incrementally to partially unload the cylinder and conversely, close to load the cylinder.

Most reciprocating compressor dissipate heat buildup via water-jacketed cylinders, intercoolers between the stages and aftercoolers for final heat and moisture removal from the discharge air.

Reciprocating compressor capacity is limited to about 12,000 cfm @ 125 psig for a double, 2-stage unit due to the amount of floor space and foundation necessary.

Rotary Screw Compressors
Rotary screw compressors are also a positive displacement type of compressor. A rotary screw compressor is comprised of two or more interlocking “screws”, which resemble gears, lobes or cams that mesh and turn together in the casing to pull the air into the meshing mechanism. As the air is pulled in and “squeezed” through the mechanism it leaves the casing under a higher pressure than that which it entered.

Rotary screw compressors are built in 2 basic designs: Flooded and oil-free. The flooded rotary screw compressor will carry over oil with the air being discharged from the compressor. Oil separators of the filter/baffle design are utilized on the discharge of flooded rotary screw compressors to minimize and practically prevent any oil carryover. The separators remove sufficient oil to limit the carryover to @ 5 ppm and their design permits returning most of the oil removed from the air back to the sump of the compressor for re-use. 100% oil removal can be further accomplished by installing coalescing filters downstream of the separator.

The capacity of flooded rotary screw compressors can be controlled by on/off operation, inlet throttling slide valve or turn valve operation and by speed regulation.

Flooded rotary screw compressors will operate for several years without any major maintenance required provided the oil, oil filter and oil separator are changed at regular intervals.

Oil - free rotary screw compressors utilize the same compression design as the flooded screw but employ non-contacting carbon ring seals to prevent oil from entering the compression zone of the machine, thereby producing oil-free air. While flooded rotary screw compressors can be controlled to very low capacities by inlet throttling, dry screw compressors cannot, due to excessive heat buildup at low loads. This limits their overall operating efficiency compared with the flooded design.

Single stage rotary compressors utilize an external, fan-cooled aftercooler for heat removal from the final effluent. Multi-stage design use water-cooler intercoolers between the stages to dissipate heat buildup. Rotary screw compressors are built to displacements as high as 2,500 cfm @ 125 psig.

Centrifugal Compressors
Centrifugal compressors are not positive displacement and utilize two or more rotating elements called impeller assemblies to compress the air much the same way a centrifugal pump creates hydraulic pressure with water; by imparting velocity energy to a mass (air) and converting it into pressure energy.

Each impeller rotating at very high speed imparts primarily radial flow to the air which then passed through a volute or diffuser to convert the residual velocity into pressure energy. Each impeller assembly is driven by a common gear, called a bull gear, which is directly connected to the prime mover. Centrifugal compressors are driven typically by electric motors or steam turbines.

Centrifugal compressor design employ 2, 3, 4 or 5 stages of compression. Multiple staging minimized heat generation through the individual stages thus permitting less heat loading of the intercoolers between the staging.

Capacity control of centrifugal compressors by throttling the air inlet to the unit, throttling the air outlet and by varying the speed. Centrifugal compressors are built to capacities as high as 15,000 cfm @ 125 psig.

The primary advantage of the centrifugal design is the small footprint and ease of installation as they are skid-mounted and do not require elaborate foundations. Disadvantages include high intitial cost, repair and rebuilt costs due to close bearing and impeller tolerances and high rotative speeds of the individual impeller assemblies.

ASOPE™ Cross Word Puzzle 4

Visit the link below for new ASOPE™ Cross Word Puzzle Fun.
http://asope.org/Crossword4.html

Answers will be posted in next month's newsletter.

Answers to last month's Cross Word Puzzle 2 is listed on the following page.

Answers to ASOPE™ Cross Word Puzzle 2