



HEAT RECOVERY

Let excess energy help your bottom line.

HEAT RECOVERY INTEGRATED INTO YOUR SYSTEM

Cleaver-Brooks is the leading provider of complete boiler room solutions, including heat recovery. Our heat recovery products reduce energy costs and environmental impact by recovering waste heat or steam and using it for other system applications. This in turn helps your boiler system components work together to increase the life and overall efficiency of the entire boiler system. A fully integrated system incorporates the Cleaver-Brooks Hawk Control to monitor and control every aspect of your boiler system, including heat recovery.

From the initial fuel inlet to the stack outlet, Cleaver-Brooks can fully design, engineer, manufacture, and integrate every detail of a boiler feed system. When you're looking for a quality boiler system with the lowest emissions and highest efficiencies, you're looking for Cleaver-Brooks.

BOOST

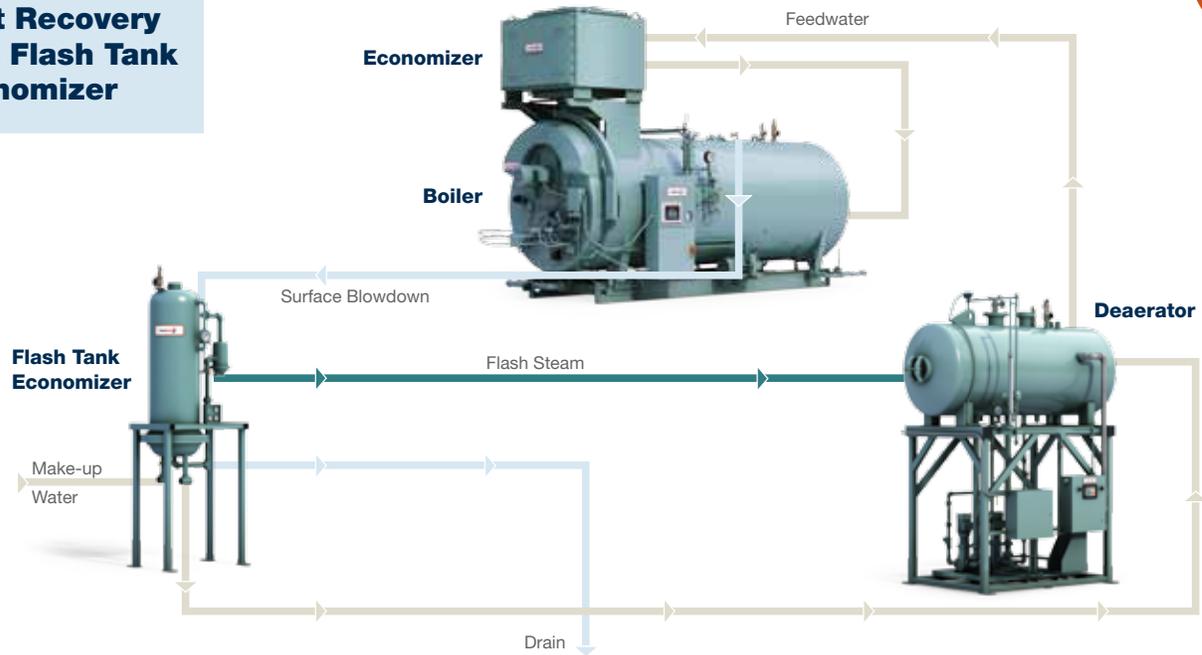
If there's a question in your mind whether adding components like heat recovery are worth your investment, our proprietary boiler room analysis tool can help. BOOSTSM (Boiler Operation Optimization Savings Test) utilizes key operating metrics from your current boiler system to determine how efficient your boiler room is in its current state. The tool compares costs of upgrades like heat recovery systems with potential energy savings and develops a detailed financial report to justify boiler room improvements. To learn more, visit us online or email BOOST@cleaverbrooks.com.

Total Annual Savings: \$88,447

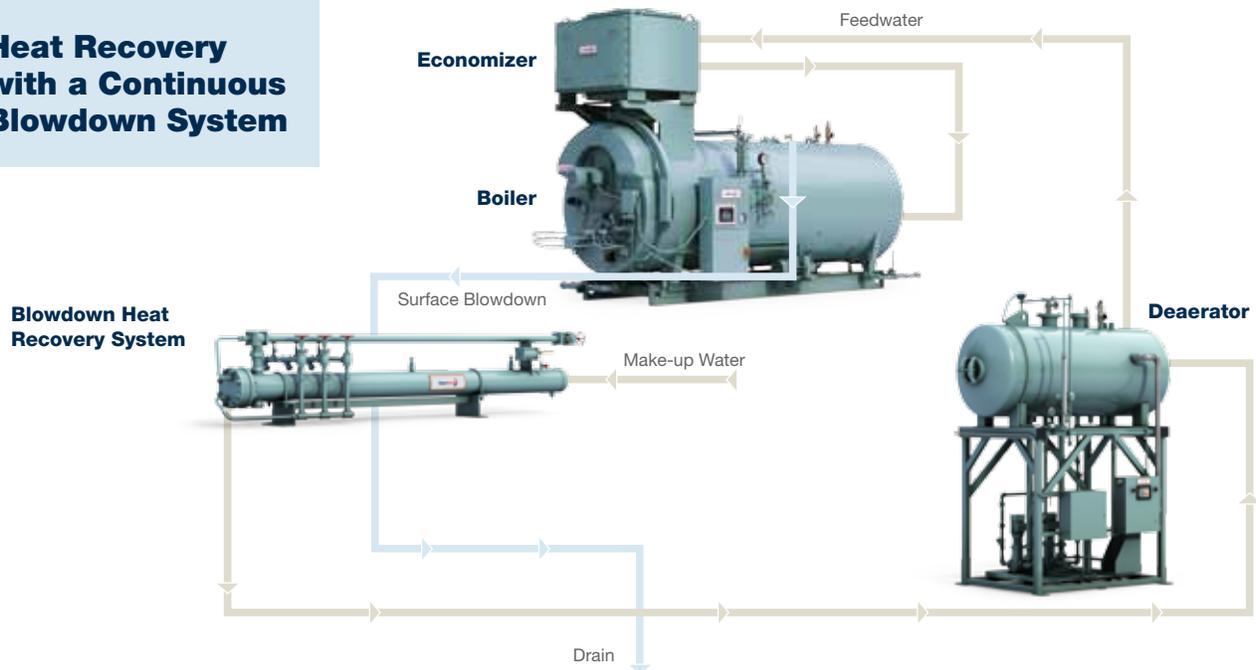
Payback: 28.0 Months
NPV: \$216,838
IRR: 40.7%

PROJECT SUMMARY CASH FLOW												
Year	0	1	2	3	4	5	6	7	8	9	10	11
Total Implementation Cost	(\$143,780)											
Annual Incremental Pre-Tax Savings		\$88,447	\$88,447	\$88,447	\$88,447	\$88,447	\$88,447	\$88,447	\$88,447	\$88,447	\$88,447	\$88,447
Less Depreciation from Boiler 1		(\$14,378)	(\$25,880)	(\$20,704)	(\$16,563)	(\$13,257)	(\$10,597)	(\$9,418)	(\$9,418)	(\$9,432)	(\$9,418)	(\$4,716)
Before Tax Savings		\$74,069	\$62,567	\$67,743	\$71,884	\$75,191	\$77,851	\$79,030	\$79,030	\$79,015	\$79,030	\$83,731
Less Tax		(\$29,628)	(\$25,027)	(\$27,097)	(\$28,753)	(\$30,076)	(\$31,140)	(\$31,612)	(\$31,612)	(\$31,606)	(\$31,612)	(\$33,492)
After Tax Savings		\$44,441	\$37,540	\$40,646	\$43,130	\$45,114	\$46,710	\$47,418	\$47,418	\$47,409	\$47,418	\$50,239
Add Back Depreciations		\$14,378	\$25,880	\$20,704	\$16,563	\$13,257	\$10,597	\$9,418	\$9,418	\$9,432	\$9,418	\$4,716
Net After Tax Cash Flow	(\$143,780)	\$58,819	\$63,420	\$61,350	\$59,694	\$58,371	\$57,307	\$56,835	\$56,835	\$56,841	\$56,835	\$54,955
Cumulative Net After Tax Cash Flow		\$58,819	\$122,240	\$183,590	\$243,284	\$301,654	\$358,961	\$415,797	\$472,632	\$529,473	\$586,308	\$641,263

Heat Recovery with Flash Tank Economizer



Heat Recovery with a Continuous Blowdown System



Reduce fuel usage and increase system efficiency

Economizer

Captures latent and/or sensible waste heat from the boiler flue gas to increase the feedwater temperature.

Flash Tank Economizer

Captures waste water from the boiler surface blowdown to increase make-up water temperature (sensible heat) and provide low pressure flash steam (latent heat) to the feedwater tank.

Blowdown Heat Recovery System

Captures waste heat from the boiler surface blowdown to increase make-up water temperature (sensible heat) to the feedwater tank.

Stack Economizer

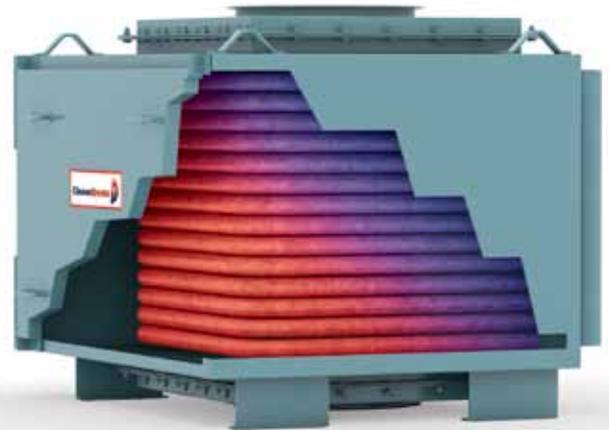
Designed to reduce fuel use and costs by recovering heat from flue gases, that would otherwise be wasted, to preheat boiler feedwater. Cleaver-Brooks economizers are easily integrated to fit your boiler system, and each is built to our high standards. Three model configurations offer design flexibility to meet any application.

CRE Economizer

The CRE rectangular non-condensing economizer can be utilized on boilers up to 2,200 HP for boiler feedwater, make-up water, hot water or process applications. Multiple size options are available to optimize space constraints while maximizing heat recovery.

CRE Features

- Individually removable finned tubes for easy maintenance and tube replacement
- Mounting during installation requires no pressure vessel welds within the shell
- Hinged stainless steel access doors
- Stainless steel internal exhaust gas bypass
- Accommodates all boiler design pressures
- Built-in bypass damper for flue gas temperature control
- ASME “UM” stamp standard, “U” stamp or “CRN” stamp are optional



CRE Economizer

CCE Economizer

The CCE cylindrical non-condensing economizer can be utilized on boilers up to 250 HP for boiler feedwater, makeup water, hot water, or process water applications. Compact/lightweight design fits space constraints while maximizing heat recovery.

CCE Features

- Compact and lightweight
- High-performance BTU recovery
- Hinged stainless steel access doors
- Stainless steel internal exhaust gas bypass
- ASME construction ensures high-quality design and manufacturing standards



CCE Economizer



Condensing Economizer

Raise your fuel-to-steam efficiency up to 90%. Our 2-stage condensing economizers save both energy and dollars while reducing environmental impact.

C2X Economizer

The C2X 2-stage condensing economizer captures heat through both a traditional stack economizer section and a condensing section. It can be utilized on boilers up to 2,200 HP. The lower section recovers energy by preheating boiler feedwater. The upper section preheats cool liquid streams, such as make-up water, process water or hot water preheating.



C2X Economizer

Features

- For steam applications
- Separate upper and lower coils allow heating of two completely separate liquid streams without cross-contamination
- Tube core assemblies are individually removable tubes with aluminum fins (Al-Fuse), and are located behind hinged stainless steel doors for easy maintenance and tube replacement
- Exhaust gas bypass, interior shell, condensate drain, transition connections and all gas-side surfaces are 316 stainless steel to eliminate corrosion
- Condenses on natural gas only

C1X Economizer

The C1X single-stage condensing economizer saves fuel by preheating virtually any cool liquid stream (make-up water, process water, hot water preheating) by capturing waste heat from a boiler stack. It increases the amount of heat recovered by capturing both sensible and latent heat. The internal gas bypass can be used to maintain water temperature when too much heat is available.

Features

- For steam or hot water applications
- 316 stainless steel exhaust gas bypass, interior shell, condensate drain, and transition connections
- Condenses on natural gas only

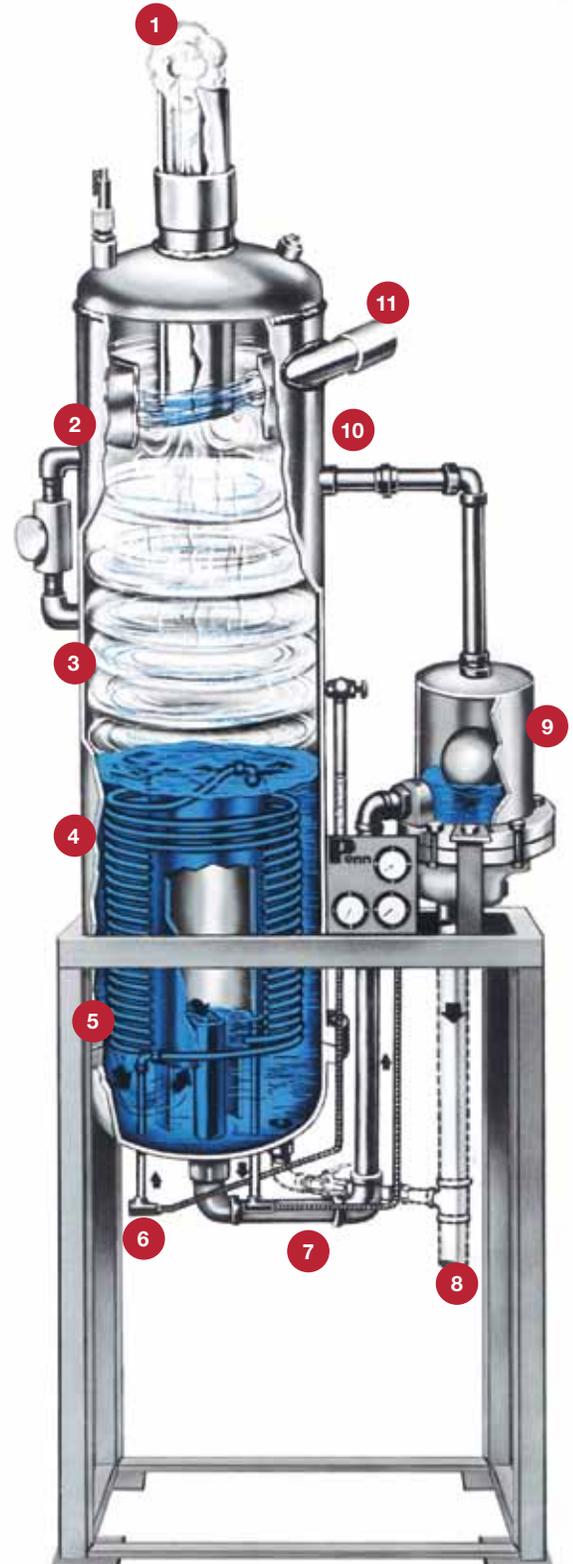
Flash Tank Heat Recovery

The Cleaver-Brooks AHR flash tank economizer recovers heat and steam, which can then be recycled to be used as-is or used to heat new feedwater, thus saving fuel and money. This system quickly pays for itself with fuel savings resulting from recycled heat that would otherwise be wasted through exhaust. Our flash tank is a coil-type, flash tank heat exchanger. It is a compact, low-cost alternative to the shell-and-tube design.

Features

- Heat recovered as flashed steam
- Efficient baffling separates the dirty blowdown water from the clean steam
- Transfers the remaining heat normally lost during blowdown to the cold makeup water as it flows to the feedwater heater
- ASME-approved and stamped flash tank and a blowdown heat exchanger

- 1 Steam Outlet**
Clean dry steam 97% quality to deaerator.
- 2 Low-Pressure Vortex Area**
Expedites instant flashing of all steam to outlet.
- 3 High-Velocity Centrifugal Action**
Drives liquid and solids to outside-only clean dry steam releases into central vortex area and up into the steam outlet.
- 4 Spiral Coil Heat Exchanger**
Designed to provide maximum heat transfer.
- 5 Sludge Area**
No pockets or baffles in heat exchanger area for sludge to deposit and reduce heat recovery efficiency or to clog the flow area.
- 6 Cold Water**
Boiler make-up enters system.
- 7 Boiler Make-up**
Exits heated by continuous blowdown at no extra cost.
- 8 Cooled Blowdown**
To drain (100–110°F).
- 9 Float Trap**
For continuous discharge of cooled water to drain.
- 10 Stainless Steel Wear Plate**
A point of impingement prevents erosion of separator wall.
- 11 Tangential Inlet**
Imparts high-velocity spinning action to liquid.





Blowdown Heat Recovery Systems

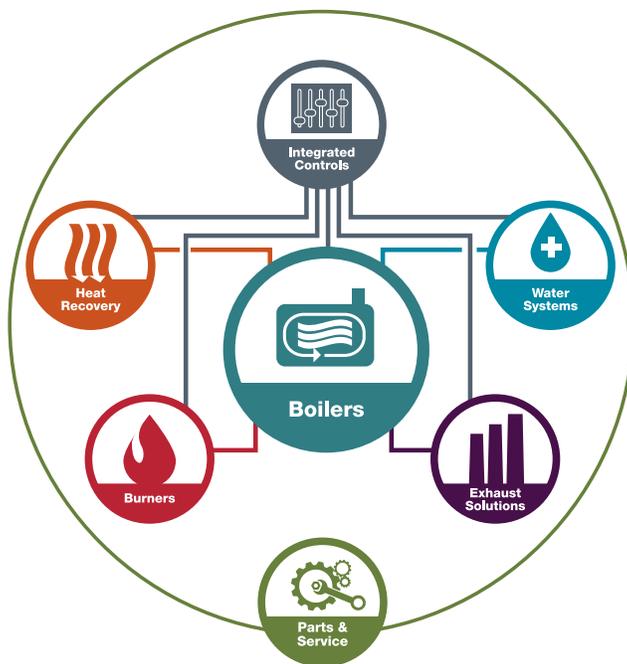
Blowdown is necessary for proper boiler maintenance, but you lose energy every time you blowdown. You can recover up to 90% of the heat normally lost to blowdown with the Cleaver-Brooks blowdown heat recovery system. Our system automatically controls surface blowdown flow to maintain the desired concentration of dissolved solids inside the boiler. Continuous boiler surface blowdown heat recovery (BDHR) is the most effective method of purging destructive solids from any steam boiler system. It also recovers the heat from the high-temperature blowdown and transfers it to the incoming cold makeup water, maximizing boiler efficiency. The blowdown heat recovery systems will usually result in a payback in a few short months from fuel savings alone.

Blowdown heat recovery units are available for boilers of all sizes, including multiple boilers. Each unit is pre-piped for simple installation.

Features

- Compact size for convenient placement
- Transfers the blowdown heat to the makeup, thereby decreasing fuel costs
- Saves chemical costs by reducing blowdown
- Operates from 35 psi – 250 psi on up to six boiler systems
- Up to 22 gpm of blowdown and up to 180 gpm of make-up





The Power of Total Integration goes beyond heat recovery.

For more than 80 years, Cleaver-Brooks has built a reputation for innovation in the boiler solutions industry. We remain committed to introducing technology and products that enable a more energy-efficient and environmentally friendly generation of steam and hot water.

When you come to us for a fully integrated heat recovery solution, you can know that each element is created to the highest standards and all will work seamlessly together to give you a highly efficient and reliable solution for protecting your boiler system. To learn more, please call us at 1-800-250-5883 or visit us online at cleaverbrooks.com.



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