

# ***ConDex***

**Condensing Economizer Systems**



**Less Exhaust Gas • Less Pollution • More Dollar Savings**

# HEAT RECOVERY PERFECTED

Introducing The **ConDex** Energy Recovery System, the breakthrough technology from Combustion and Energy Systems that perfects the recovery of heat from exhaust gases. Flue gas from boilers, turbines, ovens, dryers, etc. - single or multiple sources of waste heat, the **ConDex** System recovers tremendous amounts of waste energy and returns it directly to your operation. In fact, the **ConDex** Condensing Heat Recovery System is so effective that the payback period can be as short as six months - and the savings are guaranteed.

What is the difference? The **ConDex** System utilizes specialized metallurgy, and proprietary design engineering to significantly enhance the heat transfer process in a wide variety of applications. The **ConDex** System is also dramatically smaller and far more efficient than competing designs. As a result, the **ConDex** System costs far less to operate and maintain. Yet it has no impact on the exhaust source and operates in conjunction with your existing operation. Better still, in addition to the significant financial benefit, the **ConDex** System also reduces associated harmful emissions such as NOx, SOx, and CO2 greenhouse gases from your operation.

Boilers (150 HP - 500,000 PPH +), turbines, ovens, dryers, engines, etc., for most any waste heat exhaust requiring recovery, there is a **ConDex Energy Recovery Solution!**

**Better performance. Better savings. Better environment. That's a ConDex System.**



## TURNING LATENT HEAT INTO DOLLAR SAVINGS

When natural gas is burned, 10% of the energy is lost because the hydrogen in the fuel combines with the oxygen in the combustion air to form water vapor. When this water vapor is condensed, the latent heat, recovered at 980 Btu per pound (544.88Kcal/kg), will save one cubic foot (.28 cubic metres) of natural gas.

Given that 12% by weight of exhaust gas (at 15% excess air) is water, significant energy savings can be achieved through the recovery and use of latent heat. Moreover, every cubic foot of gas saved eliminates one cubic foot of carbon dioxide (CO2) emitted to the atmosphere.



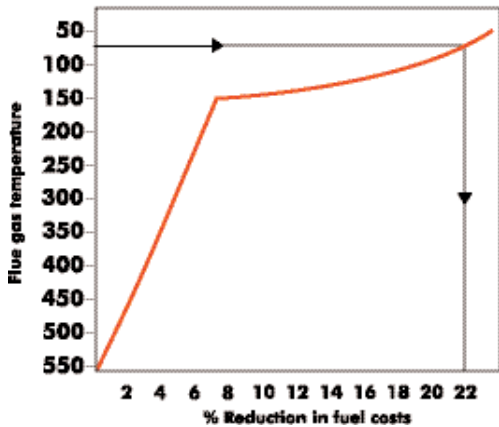
## HOW THE CONDEX SYSTEM WORKS

By heating cold process liquids with hot exhaust gases, the ConDex system recovers both sensible and latent heat energy.

When incoming cold fluid enters the ConDex exchanger and the hot exhaust gases pass through the proprietary ConDex exchanger unit, so much energy is exchanged that the gases are cooled beyond the point where the water vapor condenses out of the exhaust gas, releasing and recovering the heat it took to vaporize the water initially.

This phase change from vapor to liquid recovers 980 Btu's of energy for every pound of water condensed.

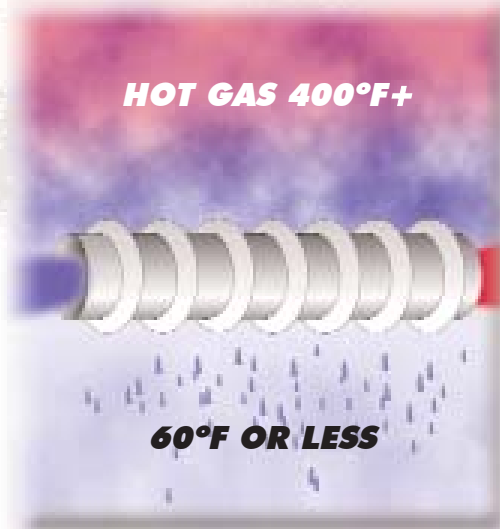
**ConDex** is not only more effective than competing systems, but also costs less to operate and maintain.



By recovering such significant amounts of heat from an exhaust gas that it is cooled below its dew point, a dramatic increase in fuel savings is achieved.

Example: 80°F exit flue gas temperature results in 22% fuel savings.

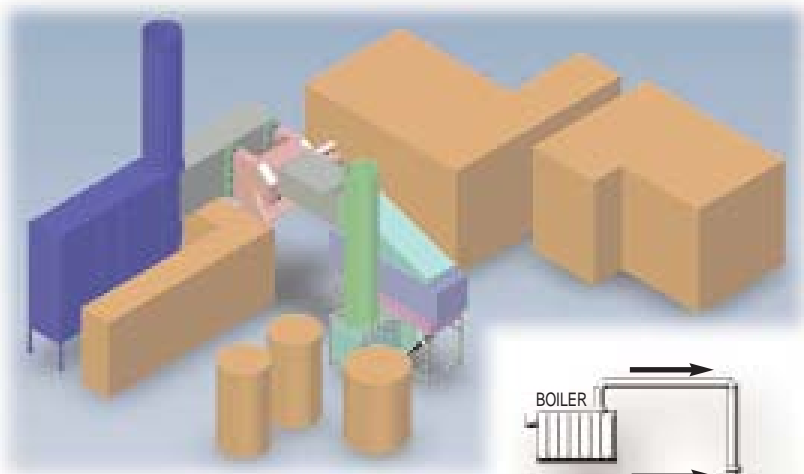
**COLD WATER 40°F**



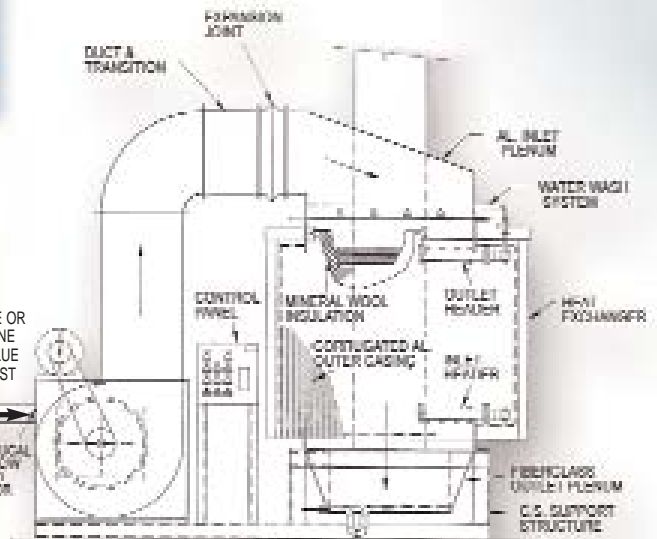
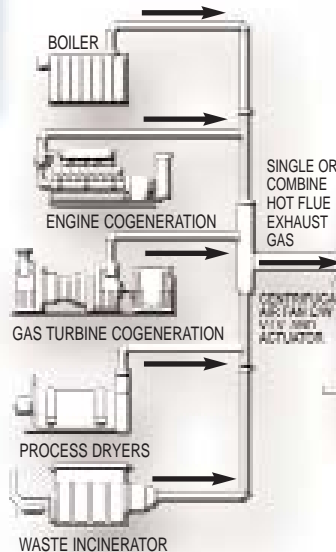
**HOT WATER 200°F+**

**60°F OR LESS**

**ConDex** maximizes water condensation and the resulting recovery of latent heat. This key advantage is achieved in two ways: special metallurgy with high heat transfer capabilities and the addition of fins to dramatically increase the heat transfer surface area.



## APPLICATIONS AND SOLUTIONS



**AS A CONDEX SYSTEM CLIENT,  
YOU ARE IN WITH SOME VERY GOOD COMPANY;  
FOLLOWING IS A PARTIAL LIST OF CUSTOMERS CURRENTLY  
RECOVERING ENERGY, SAVING MONEY, AND REDUCING EMISSIONS:**

## **COMPETITIVE ADVANTAGES**

The ConDex System offers many competitive advantages over direct contact "spray tower / scrubber" types of condensing heat recovery systems, such as:

The ConDex Systems can produce much higher recovered temperature returns on heated fluids, thus recovering much more energy. Because the temperature rise of the liquid being heated in the ConDex System is not limited by the dew point of the exhaust gas, the ConDex System is much more effective than competing designs. Typically, a gas-fired boiler will have an exhaust gas dew point of 135°F, thus limiting the recovery temperature for heated water from a direct contact style system to 130 - 145°F. Compare this to the ConDex System's ability to heat the same volume of water to 200°F +, and it is easily seen how the ConDex System can recover much more energy.

Due to the inability of a spray tower or direct contact condensing economizer to recover as much heat or save as much money as a ConDex System, it is not recommended that a spray tower be used to heat streams such as boiler make up water, it simply cannot maximize energy recovery.

Unlike the direct contact spray tower systems, the ConDex unit does not contaminate the process water with the products of combustion. In the ConDex System only the condensed water on the outside of the tubes (typically 2 - 20 GPM of water) absorbs contaminants through contact with the flue gas. This allows the water (or a variety of fluids) being heated in the tubes to be sent directly to the deaerator or potable water process, etc. This eliminates the requirement for the use of secondary plate & frame heat exchangers, thereby eliminating the loss in heat and efficiency associated with the direct contact style systems. The costly chemical treatment systems associated with direct contact spray towers are also not required with the ConDex System either - another big savings!

Because of the ConDex System's unique ability to provide everything from low grade to high-grade heat, it can also provide tremendous savings by using recovered energy from flue gases for absorption chillers in refrigeration or air conditioning applications!

Please refer to our Case Histories to see real-life examples of the exceptional capabilities of the ConDex Energy Recovery System.

*Dow Corning Corporation,  
Condensing Heat Recovery - Boilers*

*Toyota Motor Manufacturing Inc.  
Condensing Heat Recovery - Boilers*

*Unilever  
Condensing Heat Recovery - Boiler*

*Pacific Gas & Electric Inc.  
Condensing Heat Recovery - Boilers*

*Frito-Lay  
Condensing Fryer Exhaust Heat Recovery*

*Cincinnati Children's Hospital  
Condensing Heat Recovery - Boilers*

*LiDestri Foods Inc.  
Condensing Heat Recovery - Process Water*

*Nestle - Purina  
Condensing Heat Recovery - Dryer*

*Fundy Linen Inc.  
Condensing Econ - Process Water Recovery*

*Greenfield Ethanol Inc.  
Condensing Economizer - Boiler Heat Recovery*

*DuPont  
Condensing Heat Recovery - Boilers*

*Nestle  
Coffee Dryer Heat Recovery - Dryer*

*Bunge North America  
Condensing Heat Recovery - Boilers*

*Core Energy  
Boiler/Co-Gen Heat Recovery - Condensing Economizer*

*University of Guelph  
Condensing Heat Recovery - Boilers*

*PB Leiner Inc.  
Boiler Heat Recovery - Process & Boiler Water*

*Patrick Cudahy  
Boiler Heat Recovery - Process & Boiler Water*

*Schneider Foods  
Condensing Economizer - Boiler Heat Recovery*

*BioKyowa Ltd.  
Condensing Economizer - Boiler Heat Recovery*

*Del Monte Foods,  
Condensing Economizer - Boilers*

*Goodyear Tire and Rubber Company  
Condensing Economizers - 250,000 lb/hr boilers*

*Parmalat Ltd.  
Condensing Economizer - Preheats oven air and boiler makeup water*

*Altiivity Packaging  
Condensing Economizer on GE LM2500 gas turbine & HRSG - Heating plant white water*

*Rock-Tenn Company  
Condensing Economizer heats pulper water and boiler make up*

*Menu Foods Ltd.,  
Condensing Economizer heating boiler makeup water.*

# CASE STUDIES

## Dow Corning - RTV Silicone Plant

ConDex System utilized to heat boiler make up water from 50° F up to 180° F with recovered energy from boiler exhaust. System recovers 6,800,000 Btu/hr on average with peak recoveries of over 8,000,000 Btu/hr.

Annual average fuel savings: \$606,000.00  
Annual CO2 emission reduction: 4,010 Tons  
Annual NOx emission reduction: 2.63 tons  
3,120,000 gallons / year of water recovered  
Payback: 8 months

## Toyota Motor Manufacturing Corporation Automotive Assembly Plant

ConDex System recovers waste heat from three boilers and reapplies the energy to heat incoming boiler water from 107° F up to 177° F. System recovers 2,744,000 Btu/hr on average with peak recoveries of over 3,900,000 Btu/hr.

Annual average fuel savings: \$205,000.00  
Annual CO2 emission reduction: 1,127 Tons  
Annual NOx emission reduction: 0.74 Tons  
Payback: Less than 1.5 years - Installed

## Menu Foods Inc.

ConDex condensing economizer systems installed at two plants, designed to heat plant process water using recovered heat from boiler exhaust gas. The exchanger recovers heat from two 450 HP firetube boilers, heating the water from 50° F up to 180° F, recovering energy at an annual average rate of 1,734,000 Btu/hr.

Annual Fuel Cost Savings: \$164,400.00  
Annual CO2 Emission Reduction: 1,040 Tons  
Annual NOx Emission Reduction: 0.69 Tons  
Payback: Less than 2 years - Installed

**"The ConDex System has paid for itself several times over since its installation. The weekly steam requirement for the feedwater heater has been cut from 800,000 lbs. to 400,000 lbs. We love it."**

UNILEVER, Toronto, Canada

**"Based on the successes during the first year, we have just completed the start up of ConDex Systems at two other seasonal facilities, and have begun evaluating the potential for a fifth facility. The sixth and seventh facilities have already been identified"**

DEL MONTE FOODS, Rochelle, Illinois

## Altiivity Packaging Boxboard Mill

ConDex condensing economizer system recovers waste heat from an HRSG and uses the recovered energy to heat the paper plant's white water up to 180° F. The recovered energy offsets 30,000 lb/hr of steam that was previously required to heat the white water.

Annual Fuel Cost Savings: \$ 2.68 Million Dollars  
Annual CO2 Emission Reduction: 21,554 Tons  
Annual NOx Emission Reduction: 2.69 Tons  
Payback: Less than 1 year - Installed

## Goodyear Tire & Rubber Company

ConDex Condensing Economizer System recovers heat from a 250,000 lb/hr boiler and heats boiler make up water for a series of 8 boilers. The condensing economizer heats the full stream of boiler make up water from 70° F up to 195° F, recovering energy at an average rate of 20,719,000 Btu/hr.

Annual Fuel Cost Savings: \$ 1.92 Million Dollars  
Annual CO2 Emission Reduction: 11,434 Tons  
Annual NOx Emission Reduction: 7.46 Tons  
Payback: Less than 1 year - Installed

**Things continue to go well with the ConDex System - over 6 million Btu's per hour recovery and basically invisible operation... we're satisfied!**

**DOW CORNING CORPORATION,**  
Carrollton, KY



**Since the commissioning and startup of the ConDex System three months ago the unit has recovered 2.8 Billion Btu's of energy, which is the equivalent of saving our company 2,861,820 ft<sup>3</sup> of natural gas - a significant dollar savings and emissions reduction.**

**TOYOTA MOTOR MANUFACTURING CO.,**  
Cambridge, Canada

## Bunge North America

ConDex System recovers waste energy from two boilers with existing economizers and preheats 180 GPM of boiler make up water from 55° F up to 180° F. The system recovers 11,200,000 Btu/hr on average with peaks of over 15,000,000 Btu/hr.

Annual average fuel cost savings: \$1,025,000.00  
Annual CO2 emission reductions: 6,510 Tons  
Annual NOx emission reductions: 4.28 Tons  
7,791,000 gallons per year water recovered  
Payback: Less than 6 months - Installed

## Pacific Gas & Electric - Central Steam Plant

ConDex System utilized to heat boiler make up water from 55° F up to 187° F with recovered energy from multiple boilers exhaust gas, after economizers. System recovers 7,800,000 Btu/hr on average, with peaks of over 10,000,000 Btu/hr.

Annual average fuel cost savings: \$ 696,000.00  
Annual CO2 emission reductions: 4,592 Tons  
Annual NOx emission reductions: 3.0 Tons  
Payback: Less than 1 year

## University of Guelph

ConDex System recovers waste heat from boiler exhaust and provides heat for campus district heating loop and boiler make up water.

The ConDex System heats the district-heating loop up to 190° F and heats boiler make up water from 60° F to 195° F. The system recovers and reapplies over 6,000,000 Btu/hr.

Annual average fuel cost savings: \$ 535,000.00  
Annual CO2 emission reductions: 3,432 Tons  
Annual NOx emission reductions: 2.25 Tons  
Payback: Less than 1 year

## William Osler Hospital

Dual staged ConDex System separately heats both boiler make up water and domestic hot water for hospital. The make up water is heated from 45° F up to 190° F and the domestic water is heated from 45° F up to 140° F. System recovers 5,160,000 Btu/hr on average with peaks of over 7,000,000 Btu/hr.

Annual average fuel cost savings: \$ 480,000.00  
Annual CO2 emission reductions: 3,209 Tons  
Annual NOx emission reductions: 2.11 Tons  
Payback: Less than 8 months

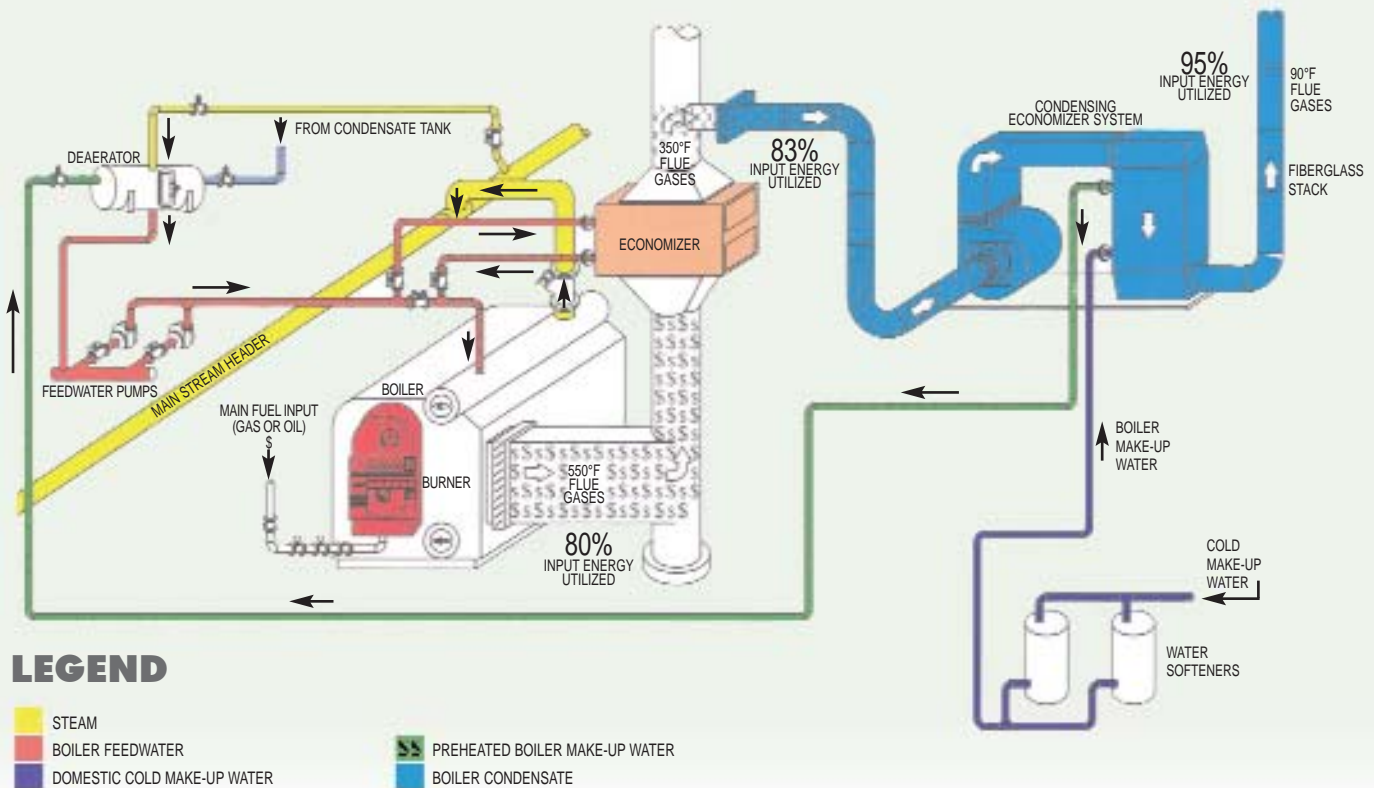
# THE *ConDex* SYSTEM



The **ConDex** condensing economizer is a self-contained energy recovery system which has been designed for a variety of applications to heat water or other process fluids by recovering both sensible and latent heat from the flue gas of boilers, ovens, turbines, paper machines, etc. The system is completely scalable and adaptable; a single unit is capable of recovering energy from one or multiple stack sources on a fully modulating basis, and can provide recovered fluid temperatures from low grade heat to 200°F and up.

The system includes a proprietary engineered heat exchanger section for energy recovery, an induced draft fan or diverter, a flue gas damper, an inlet and outlet plenum with expansion joint, a stack and also includes an integral stand-alone control system.

## 95% EFFICIENT BOILER OPERATION



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