

# **EFFICIENCY GAINS or FUEL USAGE REDUCTION**

**OR BOTH???**

**HOW ARE THEY RELATED?**

## **COMMONLY USED EFFICIENCY TERMS AS THEY RELATE TO THE BOILER/BURNER**

### **THERMAL EFFICIENCY:**

- **THERMAL EFFICIENCY IS SIMPLY THE MEASURED VALUE OF THE BOILERS ABILITY TO TRANSFER HEAT FROM THE COMBUSTION PROCESS TO THE MEDIUM BEING HEATED**
- **THERMAL EFFICIENCY DOES NOT ACCOUNT FOR RADIATION OR CONVECTION LOSSES DUE TO BOILER COMPONENTS ie, vessel insulation, piping etc.**

**SINCE SOME LOSSES ARE NOT ACCOUNTED FOR, THERMAL EFFICIENCY SHOULD NOT BE UTILIZED IN AN ECONOMIC EVALUATION AND IS NOT A REAL INDICATION OF A BOILERS FUEL CONSUMPTION**

## **BOILER EFFICIENCY:**

- **BOILER EFFICIENCY AND THERMAL EFFICIENCY ARE TERMS WHICH ARE OFTEN INTERCHANGED INCORRECTLY**
- **BOILER EFFICIENCY MEASUREMENTS ACCOUNT FOR ALL LOSSES (Radiant, convection, etc)**
- **TRUE MEASURE OF BOILER EFFICIENCY IS TRADITIONALLY DEFINED BY FUEL-STEAM MEASUREMENTS**

## **TYPICAL METHODS FOR MEASURING "BOILER EFFICIENCY"**

- 1. INPUT – OUTPUT METHOD\***
- 2. HEAT LOSS METHOD\***
- 3. STACK LOSSES METHOD**

\*ASME Power Code PTC 4.1 recognizes Input – Output and Heat Loss methods

## **COMBUSTION EFFICIENCY:**

- **COMBUSTION EFFICIENCY IS SIMPLY THE MEASURE OF A BURNERS ABILITY TO BURN FUEL**
- **THE AMOUNT OF EXCESS AIR PRESENT IN THE STACK GASSES IS THE PREDOMINANT METHOD USED TO MEASURE THAT ABILITY**

***ANY AMOUNT OF AIR NOT USED IN THE COMBUSTION PROCESS IS UNAVOIDABLY HEATED BY THE FLAME AND CARRIED OUT THE FLUE AS A LOSS TO THE HEAT TRANSFER PROCESS / OVERALL BOILER EFFICIENCY***

# FUEL USAGE REDUCTION

## The "BIG" picture

MANY FACTORS GO INTO ACTUAL FUEL REDUCTION BEYOND JUST THE IMPROVEMENTS IN THE BOILER EFFICIENCY, THE PERCENT OF BOILER EFFICIENCY IMPROVEMENT DOES NOT NECESSARILY PRODUCE A ONE TO ONE RELATIONSHIP WITH THE PERCENT OF FUEL USAGE REDUCTION

IMPROVEMENT IN ANY OF THE PREVIOUSLY MENTIONED BOILER RELATED EFFICIENCIES HAVE A CASCADING AND COMPOUNDING EFFECT THROUGHOUT THE ENTIRE SYSTEM WHICH CONTRIBUTE TO FUEL USAGE REDUCTION.

## **FUEL USAGE REDUCTION: HOW TYPICALLY SAVINGS ARE ACHIEVED**

**MAXIMIZE THE BOILERS FUEL TO STEAM EFFICIENCY (Limited to some degree by Boiler design)**

- 1. MINIMIZE EXCESS AIR IN THE COMBUSTION PROCESS THROUGHOUT THE BURNERS OPERATING RANGE**
- 2. PRECISE LOAD CONTROL IN RESPONSE TO SYSTEM DEMAND VARIATIONS (Eliminate Overshooting and Undershooting of Required Medium Temperature)**
- 3. PRECISE CONTROL OF FUEL/AIR RATIO + MINUTE ADJUSTMENT OF RATIO BASED ON CONSTANT MULTI PARAMETER MONITORING OF FLUE GAS CONSTITUENTS**
- 4. KEEP HEAT TRANSFER SURFACES CLEAN**

**HOW ARE THE RELATIONSHIPS BETWEEN THE TWO INTERTWINED?**

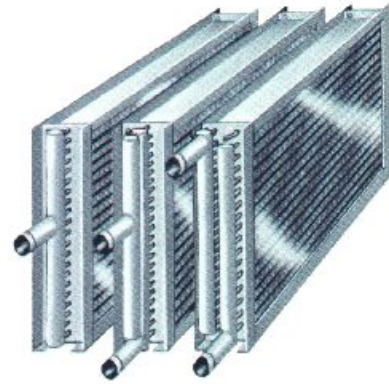
**TO UNDERSTAND THE RELATIONSHIP COMPLETELY WE MUST FIRST LOOK AT ALL OF THE SYSTEM COMPONENTS AND HOW THEY WORK TOGETHER TO MAXIMIZE TOTAL SYSTEM EFFICIENCY**

**MEDIUMS HEATED BY BOILER ARE USED IN VARIOUS PROCESSES, GENERALLY STEAM OR HOT WATER.**

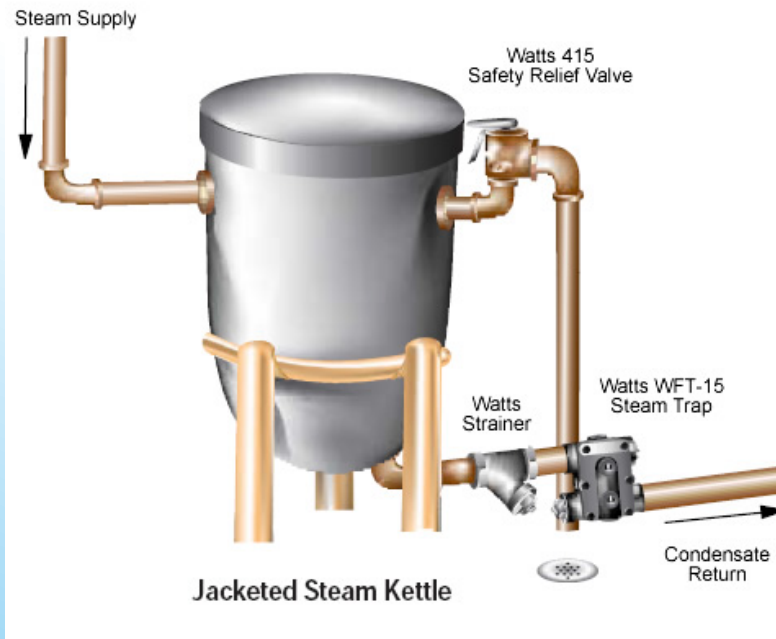
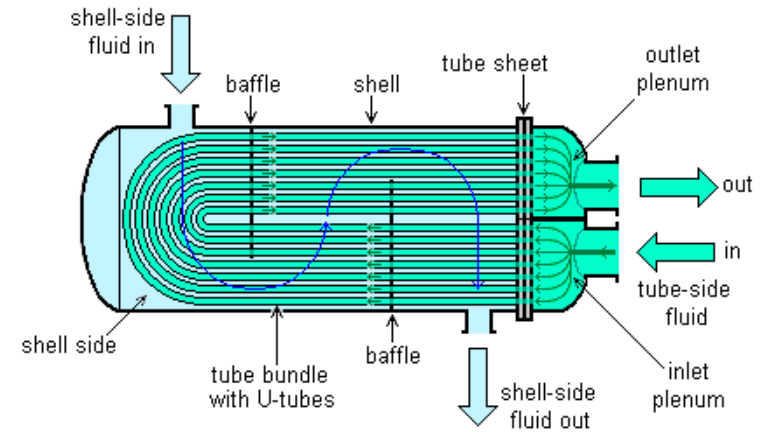
**DIFFERENT METHODS ARE USED TO TRANSFER HEAT FROM THE MEDIUM TO THE PROCESS.**



# TYPICAL HEAT TRANSFER DEVICES

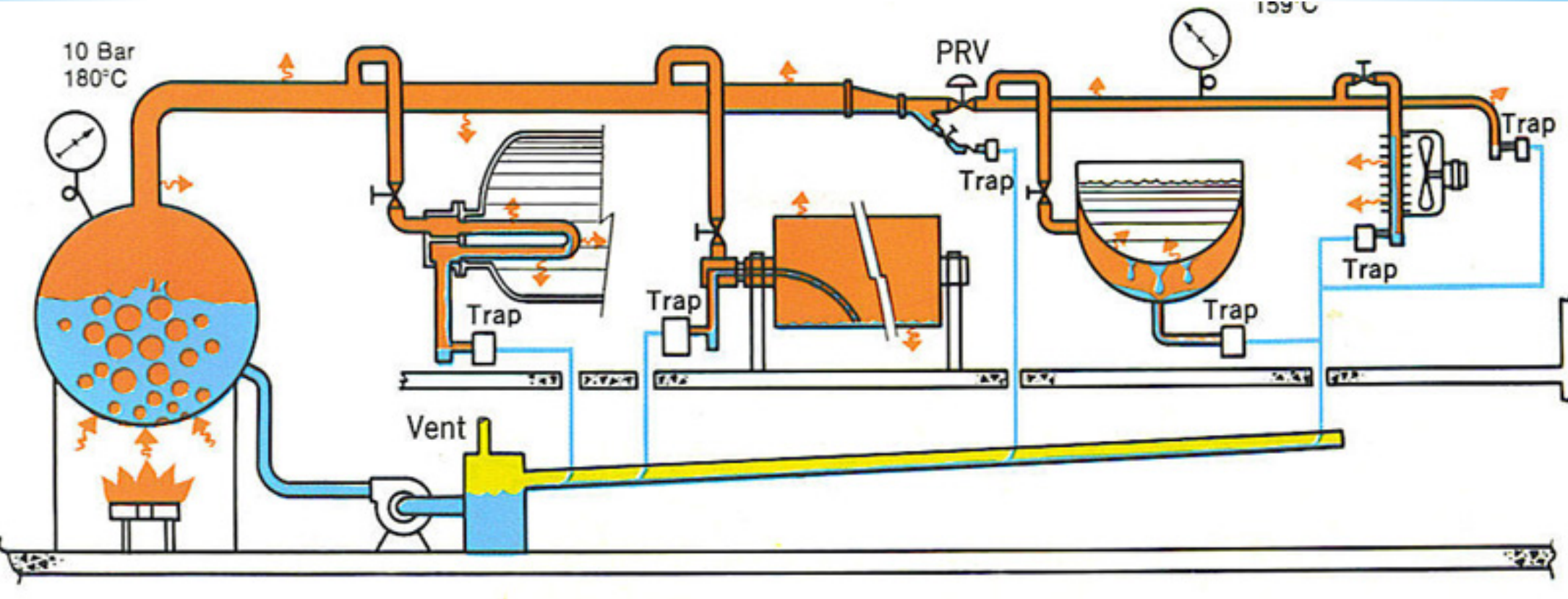


### U-tube heat exchanger





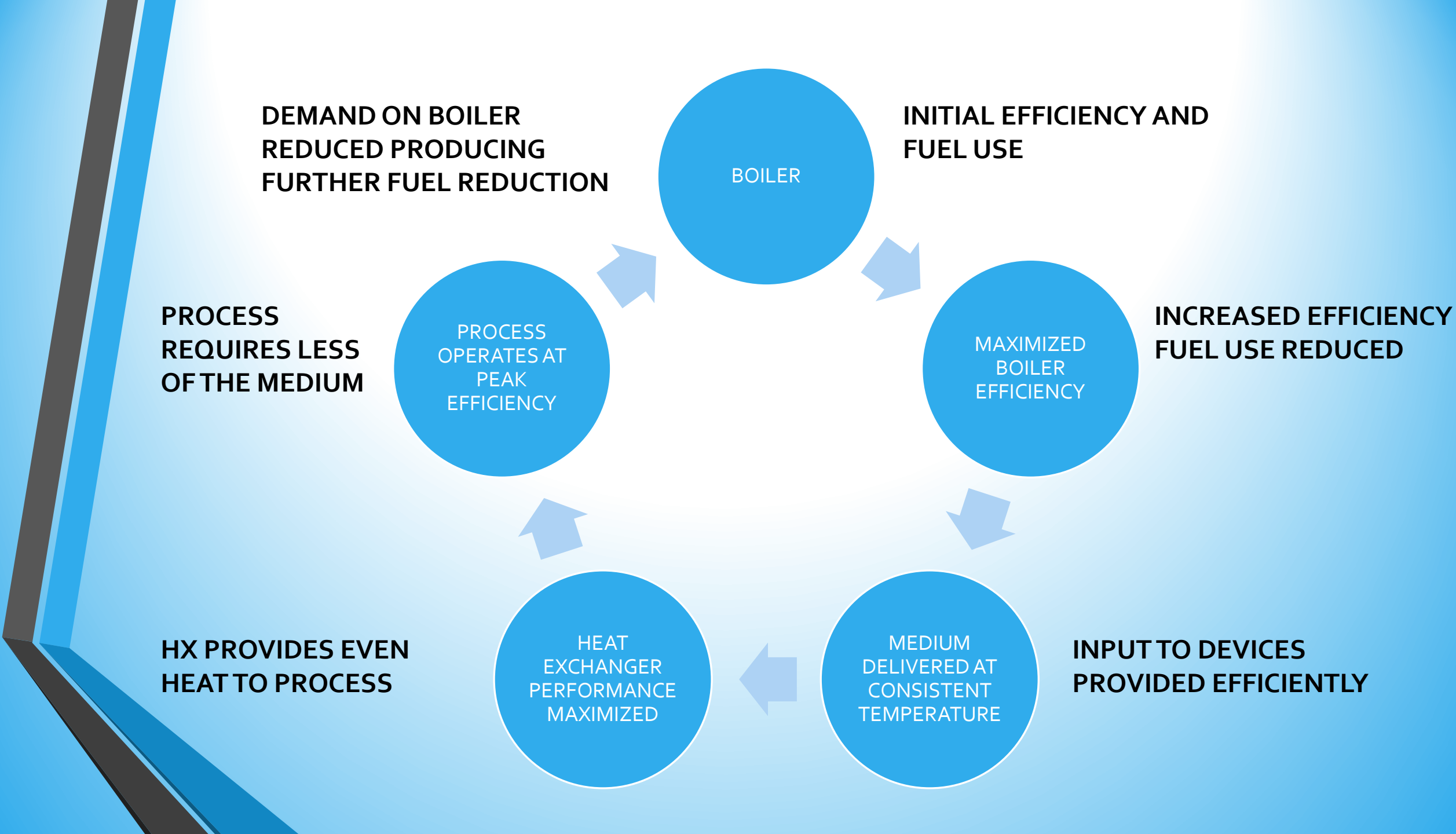
# SIMPLIFIED STEAM SYSTEM



**EACH HEAT TRANSFER DEVICE USES THE HEATED MEDIUM TO PERFORM A PROCESS**

**THE HEAT TRANSFER DEVICE IS MOST EFFICIENT WHEN THE MEDIUM IS DELIVERED AT A CONSISTENT TEMPERATURE**

**THE PROCESS IS THEN MOST EFFICIENT WHEN THE HEAT TRANSFER DEVICE IS AT ITS PEAK EFFICIENCY**



## **JUST TO SUM IT ALL UP!**

**BY MAKING YOUR BOILER AS EFFICIENT AS POSSIBLE THROUGH:**

- **LOW EXCESS AIR COMBUSTION**
- **TIGHT CONTROL OF MEDIUM PRESSURE / TEMPERATURE**

**THE INTIAL FUEL SAVED AT THE BOILER COMES AROUND FULL  
CIRCLE THROUGH THE SYSTEM IN EVEN GREATER FUEL  
REDUCTION AS THE EFFICIENCY THROUGHOUT THE SYSTEM IS  
IMPROVED!**

**THANK YOU**

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