



Heat Recovery Systems and Saving Energy in Heat & Steam systems

Energy Efficiency Network Meeting

Holiday Inn

Thursday, September 28, 2023



AGI
ENERGY
SERVICE CENTRE



AGI
Association of
Ghana Industries



Implemented by:
giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

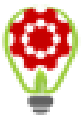
Ing. Ismaila Wiafe (CEA™, CIEP™)
AGI Energy Service Centre

Heat Recovery Systems

Heat recovery systems are innovative solutions that help **maximize energy efficiency by reusing waste heat.**

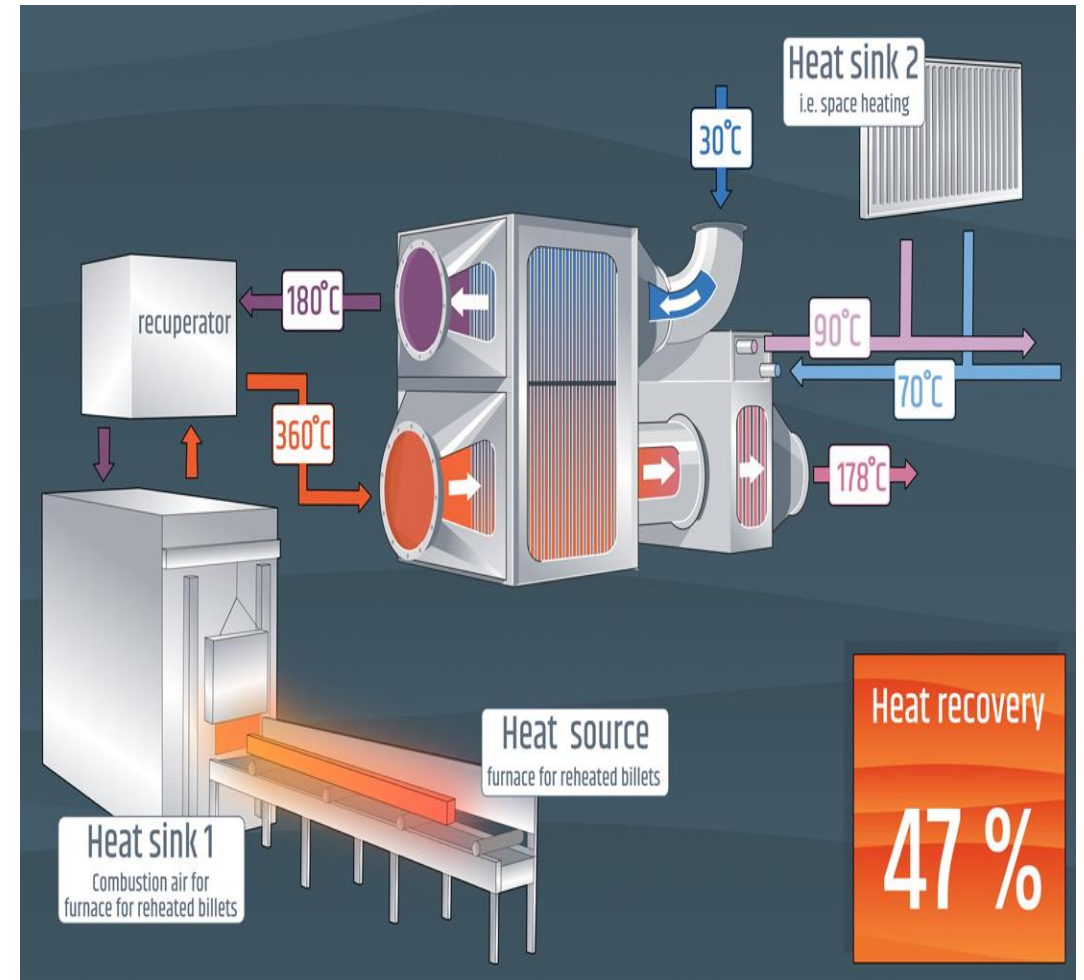
In this presentation, we will explore the following:

- Principles of Heat Recovery Systems
- Benefits of Heat Recovery Systems
- Sources of Waste Heat
- Applications of Heat Recovery Systems
- Best Practices for implementing Heat Recovery Systems
- Case studies of Heat Recovery Systems and sampled installations

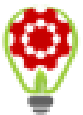


Principles of Heat Recovery Systems

- They are technologies that **capture** and **recycle waste heat** generated from industrial processes, HVAC systems, and other sources.
- They extract heat from exhaust gases, machinery, products, or liquids, and use it to preheat incoming fluids or air.
- It requires a **heat source** and **heat sink**.



Source: www.heat-exchanger-world.com



Benefits of Implementing Heat Recovery Systems

There are a variety of benefits associated with utilizing heat recovery systems in industrial applications. Some of these advantages include:

Cost Savings 💰

By reusing waste energy, heat recovery systems can significantly reduce energy costs, leading to decreased operational expenses.

Reduced Carbon Footprint 🌿

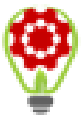
By recapturing and repurposing usable energy, heat recovery systems can reduce a facility's overall carbon emissions, supporting more sustainable business practices.

Increase in Efficiency 🚀

Excess recovered energy can be used to supplement the primary energy source, reducing dependency and increasing overall efficiency.

Improved Process Heats 🔥

By utilizing available waste heat energy, industrial processes can be optimized for optimal and more consistent thermal processing conditions



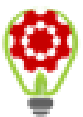
Sources of Waste Heat

Waste heat sources and their uses can be categorized by the **temperature at which the heat is exhausted.**

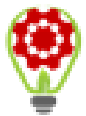
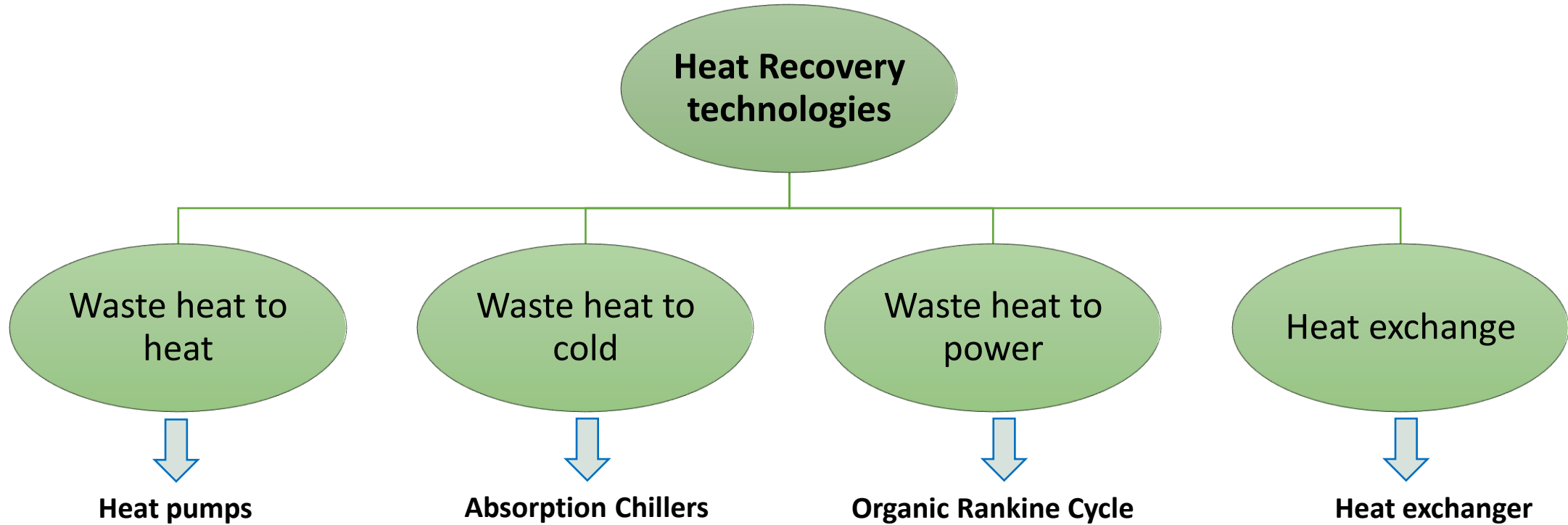


Temperature	Source	Use
High (1200+)	Exhausts from direct-fired industrial processes: Cement kiln (dry), 11 50-1350°C Steel heating furnaces, 1700-1900°C Glass melting furnaces, 1800-2800°C Solid waste incinerators, 1200-1800°C	Cogeneration
Medium (450-1200)	Exhausts: Steam boiler, 450-900°C Gas turbine, 700-1000°C Reciprocating engine, 450-1100°C Heat-treating furnaces, 800-1200°C Drying and baking ovens, 450-1100°C Annealing and Furnace cooling systems, 800 - 1200°C	Steam Generation
Low (90-450)	Process steam condensate, 130-190°C Cooling water from: Furnace doors, 90-130°C Bearings, 90-190T Welding machines, 90-190°C Air compressors, 80-120°C Internal combustion engines, 150-250°C Hot-processed liquids, 90-450°C Hot-processed liquids, 200-450°C	Supplemental Heating

Source: Guide to Energy Management Handbook



Applications of Heat Recovery Systems



Best Practices for Implementing Heat Recovery Systems

Conducting an Energy Audit

To effectively reduce energy costs, it is crucial to understand the current energy usage and where energy waste is occurring. This can be achieved through an Energy Audit.

System Design and Sizing

Proper system design and sizing are crucial for efficient heat recovery. Factors such as flow rates, temperatures, and heat exchanger selection need careful consideration.

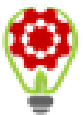
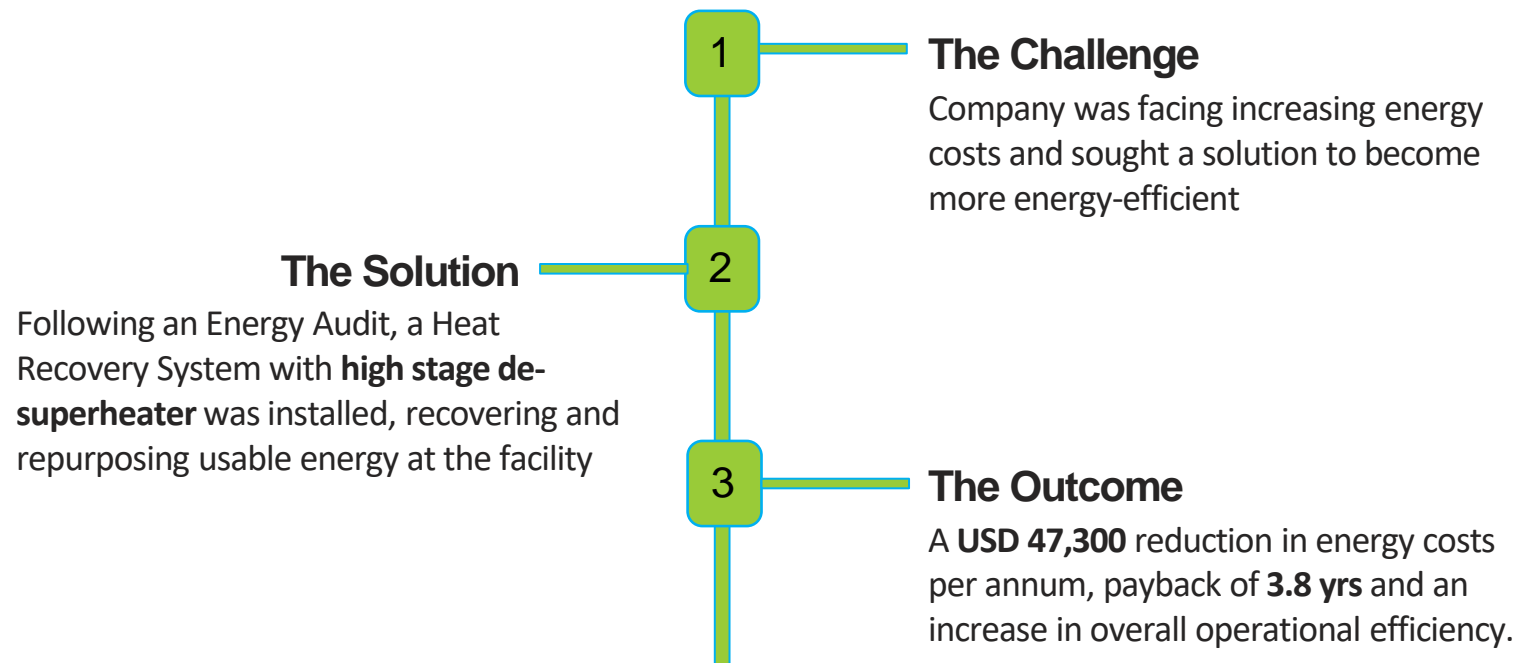
Operational Considerations

Regular monitoring, controls, and automation ensure optimal performance of heat recovery systems, including managing variables like fouling, pressure drops, and adjusting for seasonal changes.



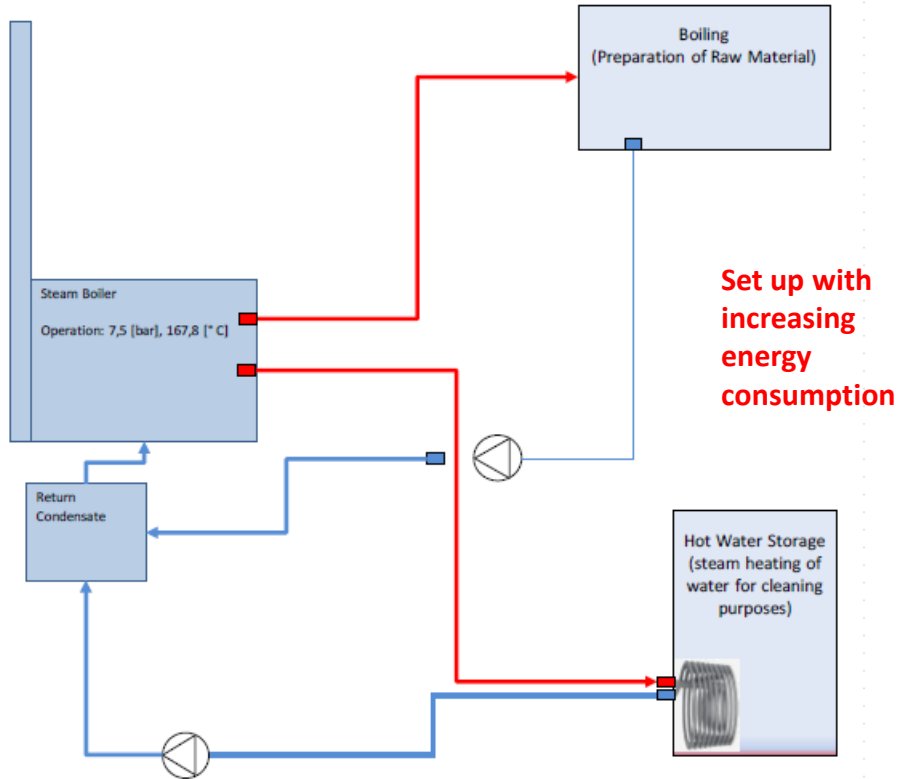
Case studies

A food processing company had struggled with rising energy expenses associated with operating their industrial facility. By implementing a Heat Recovery System, they were able to recover **10-20% of condensing heat** and repurpose waste energy produced from their **Refrigeration system** to produce hot water at 50-60 °C . This implementation resulted in significant energy savings, increased efficiency, and a reduction in carbon emissions.

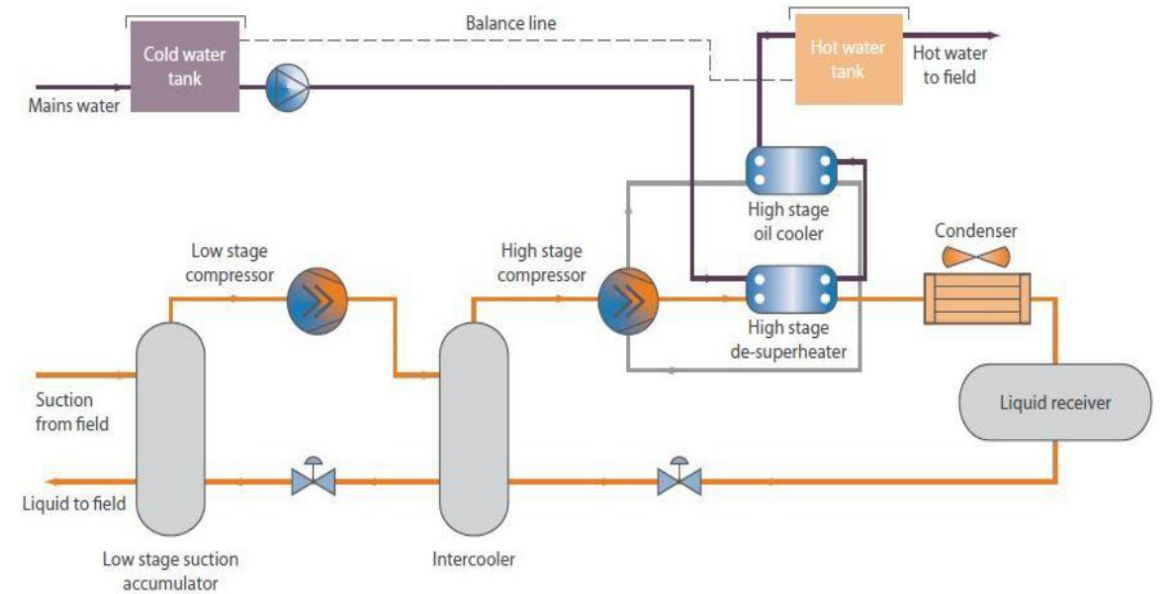


Cont'd

Food Processing Company



Heat Recovery from Refrigeration System

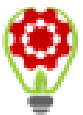


Heat Recovery system

Energy Savings: 846,000 kWh

Cost savings: USD 47,300

Payback: 3.8 yrs



Heat Recovery System sample installations

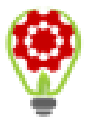
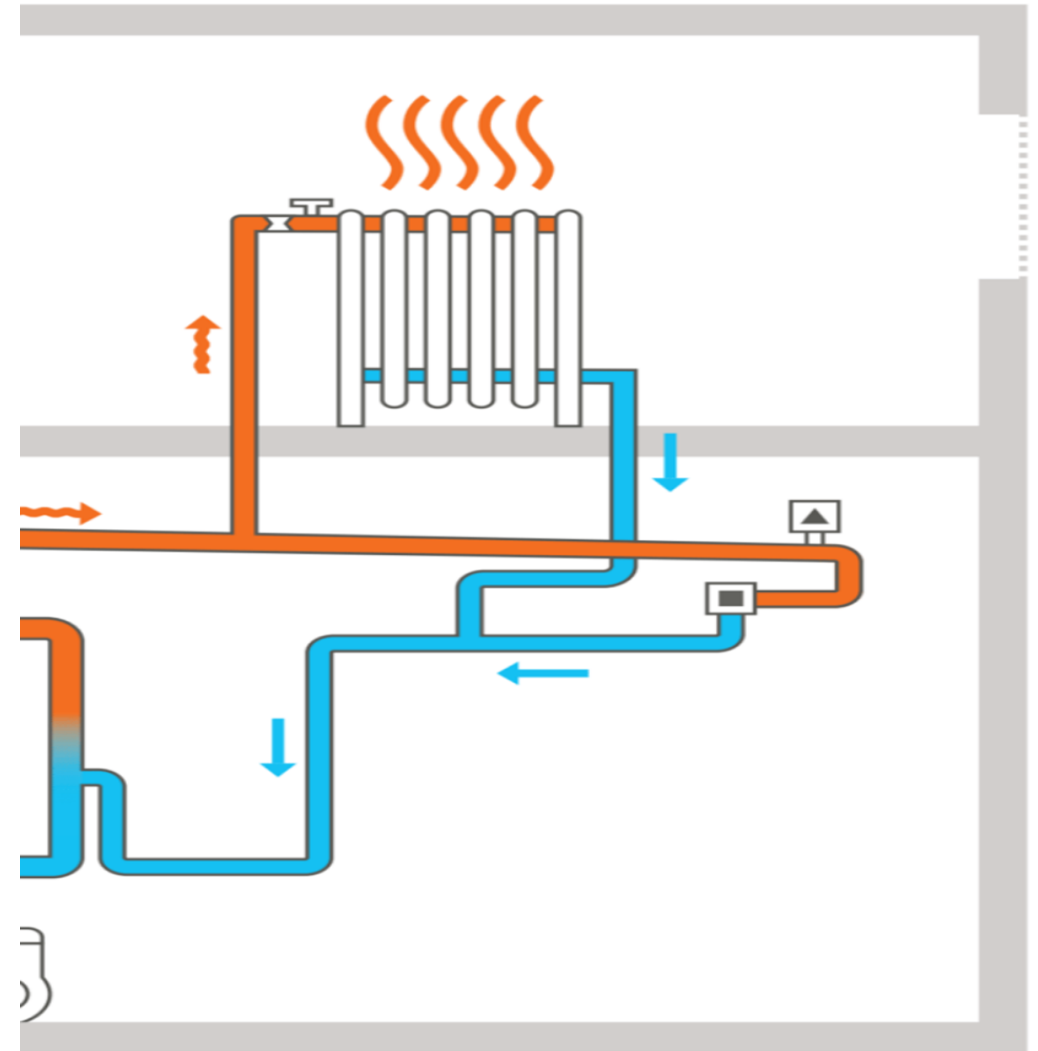


Saving Energy in Heat and Steam systems

Heat and Steam systems play a critical role in manufacturing, agro processing, and other industries. By improving energy efficiency, it is possible to save money and reduce environmental impact.

In this presentation, we will explore the following:

- Basics of Heat and Steam systems
- Energy Saving strategies
- Case Studies



Basics of Heat and Steam systems

Heat Transfer

Heat transfer is the movement of thermal energy from one physical system to another

Steam Generation

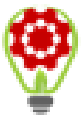
Steam generation is the process of converting water to steam. This process requires a lot of energy.

Key Components

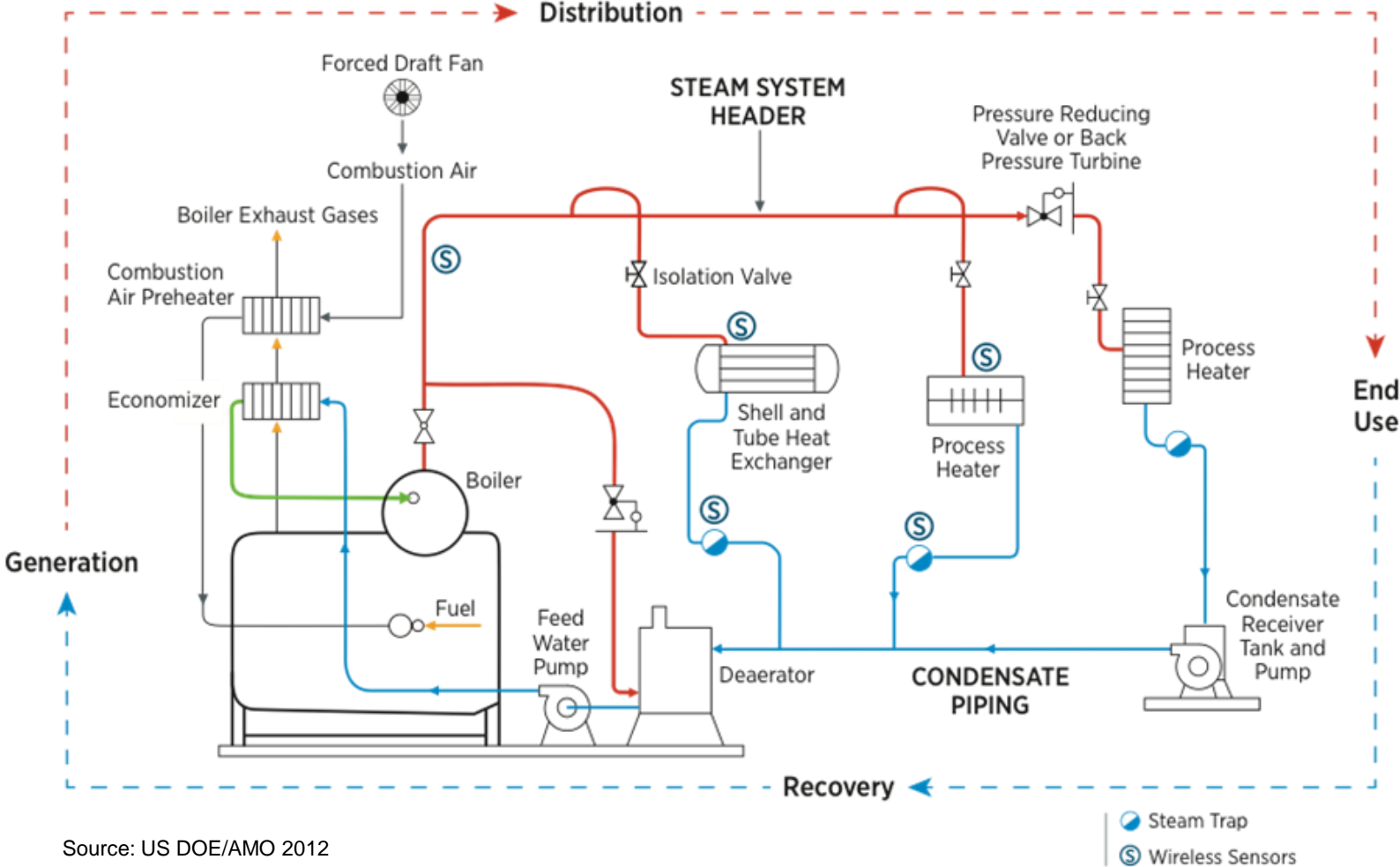
Heat exchangers, boilers, condensers, pumps, and valves are some of the key components of a heat and steam system.

Energy Consumption

Heat and steam systems are among the largest consumers of energy in many industries, often accounting for 30-50% of total energy use.



Heat and Steam systems schematic



Energy Saving Strategies in Heat and Steam systems

Steam Trap Maintenance and Optimization

Testing and repairing steam traps, replacing faulty ones, adjusting steam pressure, etc.

Process Optimization

Redesigning processes, optimizing equipment usage, improving system controls, etc.

1

Insulation and Heat Transfer Improvements

Adding insulation, repairing leaks, using heat transfer fluids, etc.

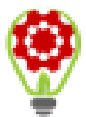
2

3

Heat Recovery Systems

Recovering and reusing hot exhaust gases, condensate, reducing flash steam losses, etc.

4



Case Studies

1 PepsiCo

PepsiCo used a variety of energy-saving measures in its heat and steam systems and saved over \$100 million in energy costs.

3 Emerson Electric

Emerson Electric implemented waste heat recovery techniques and accomplished a 20% reduction in energy consumption.

2 Heineken

Heineken reduced steam consumption by optimizing its boiler and steam distribution systems, saving over 10,000 tons of CO2 emissions.



Conclusion

Summary

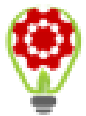
Heat Recovery Systems Heat recovery systems hold significant promise for businesses looking to reduce energy costs, improve production performance, and support sustainable practices.

Heat and Steam systems are essential for many industrial processes, but they consume a significant amount of energy. Energy loss in these systems can be costly and harmful to the environment.

Takeaway

Reducing energy loss and promoting energy efficiency in heat and steam systems is essential for cost reduction, environmental protection, and competitiveness.

Investing in energy efficiency strategies like Heat recovery, Heat and Steam systems optimization, insulation and heat transfer improvement etc, should be a priority.





AGI Energy Service Centre

AGI Secretariat, North Ridge, Accra



+233 507 977 902



info.esc@agighana.org



www.agiesc.com



AGI Energy Service Centre



@agi_energy





Thank you