

A photograph of an industrial smokestack emitting a large plume of white steam against a clear blue sky. The smokestack is a tall, cylindrical metal structure with a platform near the top. The steam rises from the top and spreads out, filling a significant portion of the upper right of the image. The sky is a deep, clear blue. The image is framed by a diagonal orange band that runs from the top left to the bottom right, and a white diagonal band that runs from the top right to the bottom left.

# WASTE HEAT RECOVERY SOLUTIONS

## Who Are We

Ecoscience Technologies Sdn Bhd (EST) has been incorporated to provide renewable energy solutions for various applications and industries. Our company also provides solutions such as energy audit management and implementation, dust collecting system and also biogas capture plants.

Being the technology partner of Econotherm UK Ltd, a leading UK based technology provider of waste heat recovery (WHR) systems, we provide WHR solutions using heat pipe technology to our clients that operate in a wide array of applications ranging from clean to highly corrosive and contaminated exhaust waste.

In the aspect of Waste Heat Recovery (WHR), we offer turnkey solutions to our clients by:

- Identifying waste heat recovery potential
- Offering complete technical project assessment
- Production of Heat Pipe Heat Exchanger (HPHE)
- Installation and commissioning
- Technical assistance during the period of implementation
- Post-warranty services

## Breakthrough Area & Proven Track Records

Our heat pipes heat exchangers have been successfully implemented in a range of applications previously considered not suitable for conventional equipment. These applications have attributes of high temperatures, acid content and particulate that render them unsuitable for traditional shell and tube or plate heat exchangers. The heat pipe units with their reduced risk of failure and inherent multiple redundancy offer a vastly reduced risk profile to operators wishing to reduce fuel consumption and carbon emissions.

- Palm oil biomass (e.g. empty fruit bunches)
- Heavy fuel oil fired systems
- High temperature gas or water
- Ceramic kiln
- Aluminium melting furnace
- Gypsum production

# Our Main Technology

## Heat Pipes

At the core of our WHR system lies our superconductor heat pipe. The use of patented heat pipe technology in various industries have been on the rise for more than a decade now. We provide waste heat recovery solutions ranging from clean exhaust to corrosive and highly contaminated exhaust, such as those released from the combustion of fuel oil and several types of biomass fuel.

Conventional heat recovery technology generally utilizes a complex multi-tubular thin metal structure, which is often vulnerable to single tube failure, erosion and corrosion. They are also difficult to maintain and prone to thermal stress cracking. However, heat pipes are able to overcome these weaknesses posed by conventional heat exchangers.

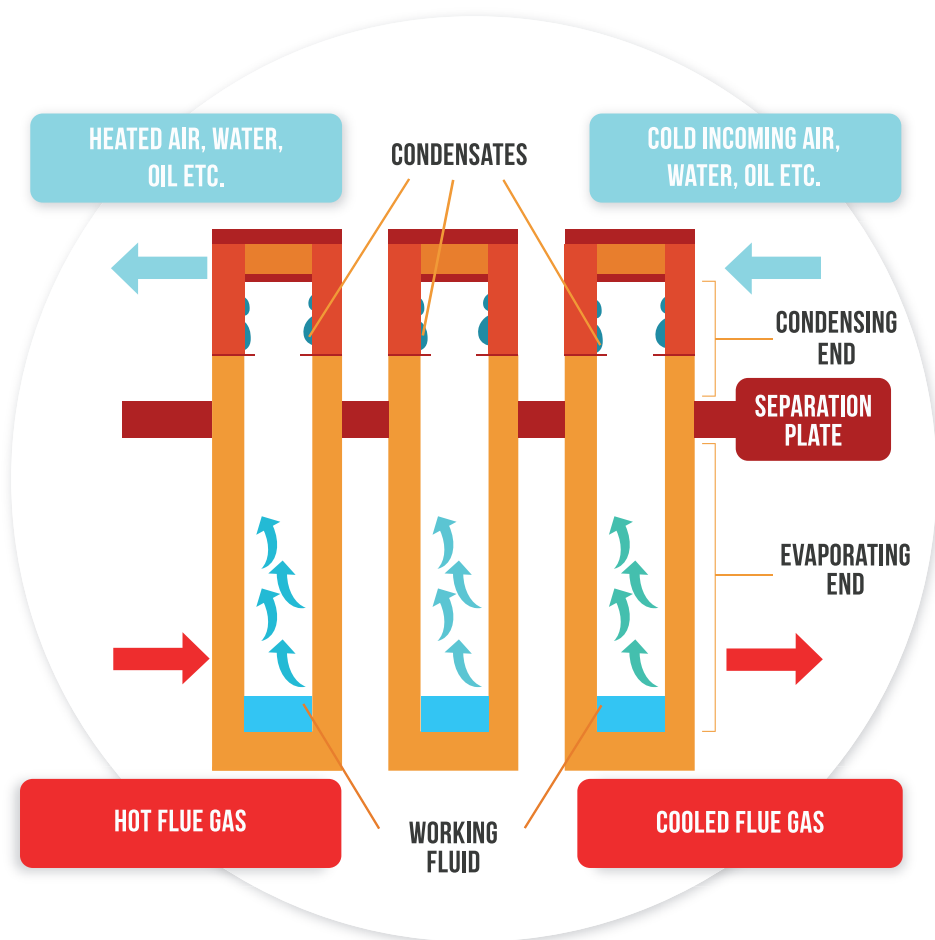
The heat pipes have been a preferred technology in the aspect of waste heat recovery as it can operate at exhaust temperatures ranging up to 1000°C, which opens up a wide range of heat recovery possibilities. The outstanding performance of heat pipes in heat transfer offers efficient and cost effective means of heat recovery for a wide range of heat sources from various applications.



## We shape our service around your demands

We are able to provide a bespoke WHR system that is able to withstand both clean and hostile applications. Our pioneering effort in providing WHR solutions in this region and excellent track records gathered throughout the years were achieved by providing robust, reliable and cost-effective guaranteed investment return method for industrial waste heat recovery. We lead a professional team of specialist to assess your waste heat recovery opportunities, be it to increase process efficiency, promote resource conversion or even waste reduction.

## How do Heat Pipes Work?



### Improving efficiency, reliability and production capacity

Our patented heat pipe technology does not rely on thin metal surfaces for heat transfer; they are built out of highly robust material, providing enhanced resistance to acidic corrosion and possess higher corrosion allowance. Our heat exchangers provides ease of cleaning and in-situ maintenance. Furthermore, heat pipe metal surfaces do not attract particulate matter or dust that would build up contaminants leading to corrosion. This allows the heat pipes to maintain its heat recovery efficiency and prevent inevitable equipment failure.

# Heat Pipe Technology Advantages

## Technical Advantages



### Multiple Redundancy

Each heat pipe operates independently and operation will not be interrupted by single pipe failure. This reduces the risk of cross contamination as each pipe will serve as additional buffer between the two fluids.



### Reactivity

Fast reaction time, different control options and suitable for sensitive apparatus.



### Isothermal Operation

Elimination of cold corners and condensation, hence corrosion is avoided. Allows for greater heat energy recovery.



### Highly Scalable

Modular designs allows for on site assembly. Potential future expansion of unit can be designed to meet specific applications or operation needs.

## Operational Advantages



### Ease of maintenance

Can be maintained in situ without uninstalling. Manual/automated cleaning with soot blowing systems.



### Increased Life Expectancy

Manufactured with robust materials, provides enhanced resistance to corrosion and minimizes adverse effects of metal expansion: heat pipes are able to freely expand and contract independently of the casing.



### Low Pressure Drop

Less capital and operational cost needed in modifying existing boiler fans and has minimal to no impact on processes.



### Low Fouling

Use of smooth pipes allows HPHE to be used in high particulate or oily applications.



## Our Core Products

### Economizer / Steam Generator

#### Water Heating & Steam Generation

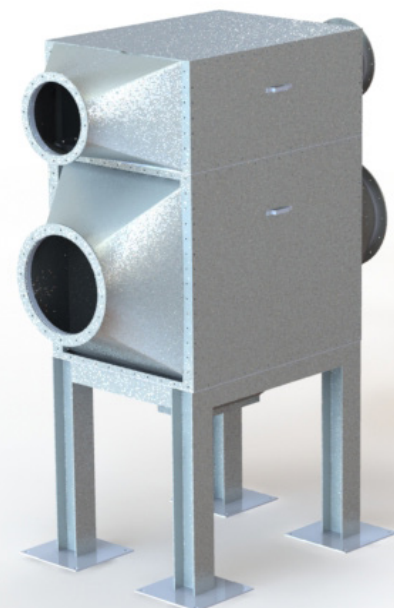
Generating hot water or steam is a profitable way of reusing high temperature waste heat. This can reduce the load on process steam boilers and lessen fuel demands. Our Economizer/ Steam Generator efficiently extracts heat from hot flue gases to generate steam or hot water. Our customers will also be able to recover waste heat from hot waste streams released by energy intensive industrial processes which could potentially be used for electricity generation.



### Air Preheater / Hot Air Generator

#### Air Preheating or Drying

Our Air preheater/Hot Air Generator is placed on the flue stack of the boilers or furnaces to preheat incoming air with exhaust gas thus increasing the temperature and overall efficiency of the plant while greatly reducing mechanical fan power requirements and emissions. It can also be designed as a hot air generator for industrial drying purposes.



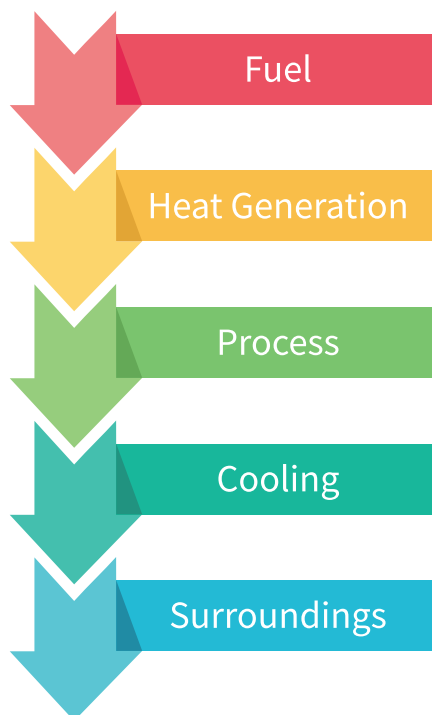
# Waste Heat Recovery

Heat recovery from industrial flue and exhaust gases contain large amounts of valuable energy savings with potential to significantly reduce carbon emissions. However, this opportunity has been largely unexploited due to technological barriers and the lack of a simple, reliable solution capable of recovering waste heat energy, which would provide a realistic and profitable return on investment.

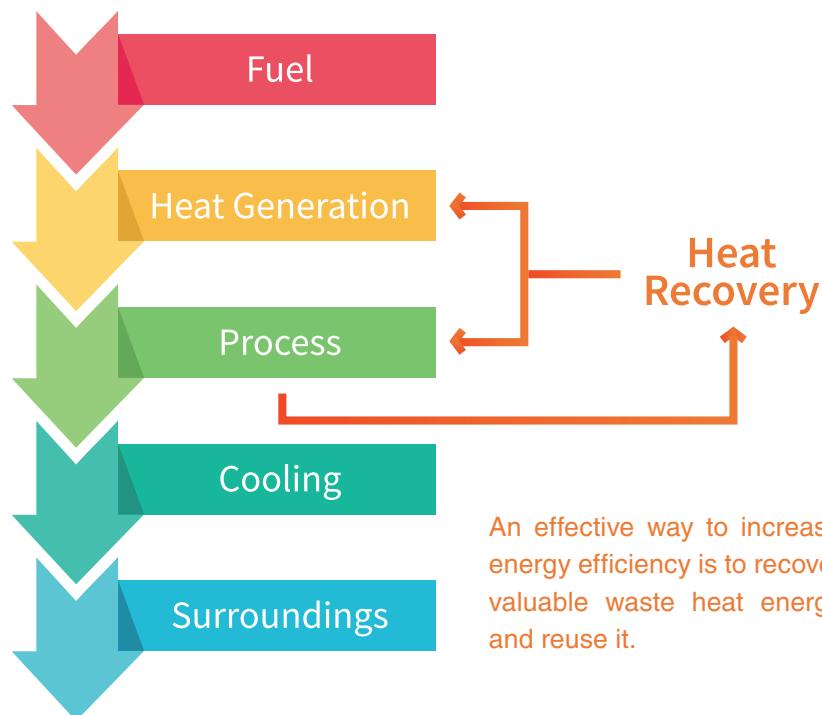
By switching towards a more energy efficient technology available in the market, companies are able to achieve huge savings and significantly reduce environmental impact. Technological advancement in the design of heat pipes and the techniques used to manufacture them allows the heat pipes to be utilize as the core component of heat exchangers for industrial applications.

Recovering waste heat energy using heat pipe heat exchangers is an easy and reliable way to increase the efficiency of a process plant. We can configure our heat exchangers to handle different fuel types and challenging heat recovery environments.

## Energy flow without Waste Heat Recovery



## Energy flow with Waste Heat Recovery



An effective way to increase energy efficiency is to recover valuable waste heat energy and reuse it.

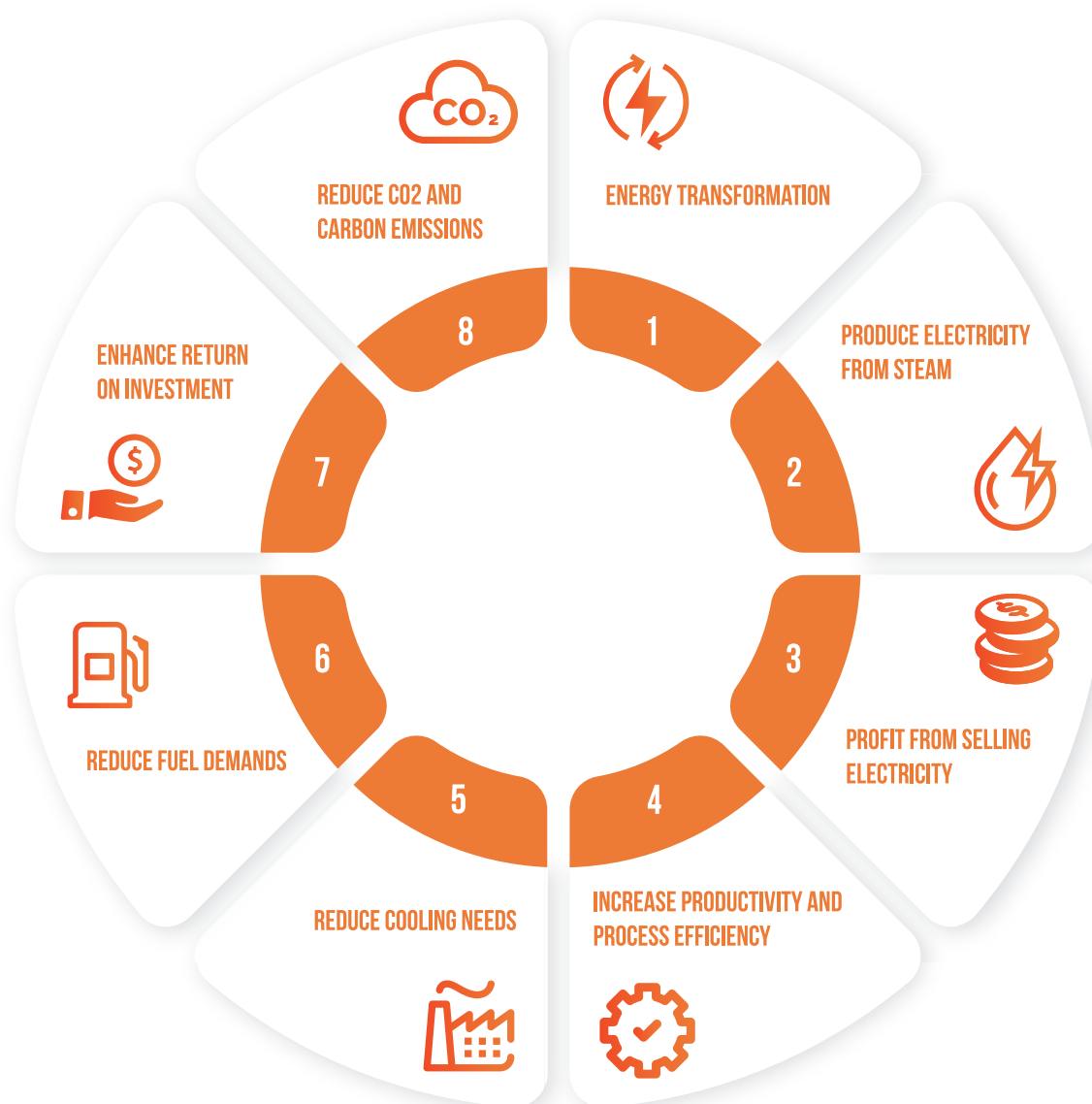
# Sectors and Applications

The diagram shows the examples of the many applications we can provide for. Our team of design experts are able to discuss your complex heat recovery application and propose an HPHE system that meets your industrial application requirements.

Sector	Source of Waste Heat	Waste Heat Recovery Application
Palm Oil Mills Palm Oil Refineries	Biomass Boiler	Hot Water (Economizer) Boiler Feed Water Process feed water ORC Power Generation
Construction Materials e.g. Bricks, cement, ceramics, glass, lime	Gas Fired Boiler	Hot Air (Air Preheater) Combustion Pre-heating Drying Building Heating
Food & Beverages	Fuel/Oil Fired Boiler	Steam (Steam Generator) Steam Generation HVAC
Rubber Glove	Incinerator	Thermal Oil Heating Thermal transmission ORC Power Generation
Oleochemicals/ Petrochemicals	Furnace	Cooling Process water cooling Process air cooling Steam Condenser
Oil & Gas Exploration, Generation & Processing	Kiln	
Pharmaceutical		



# Opportunities to profit on Waste heat recovery



## Payback period in less than 2 years

Capital investment of waste heat recovery technology are often shorter than 24 months as our heat pipe technology offer reliability, longevity and minimal maintenance requirements with inbuilt redundancies that allows for highly attractive payback returns.



**We deliver long-term efficiency, reliability and return on investment**

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