

Benefiting from waste heat recovery

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Waste heat recovery is the capture and utilization of rejected heat from industrial processes for beneficial use elsewhere on a site. Manufacturing environments often have concentrated sources of waste heat - such as exhaust air from gas burners, refrigeration condensers, oil coolant systems, and wastewater discharge - that go unused. Recovering this waste heat back into processes can save substantial energy costs and increase the spare heating capacity of existing systems. Government guidance emphasizes reducing unnecessary heat generation and losses before investing in recovery equipment, making heat recovery a priority efficiency strategy.

Publication context: This article reflects its publication date. Market prices, program rules, reporting duties and deadlines may have changed. Confirm current official guidance before making a decision.

Do you have waste heat and don't know what to do with it?

Energy costs are hurting business. Yet often there are concentrated sources of energy going to waste in manufacturing environments. Recovering waste heat back into processes can save substantial amounts of energy cost, and increase the spare heating capacity of existing systems.

Data matters

Doing heat recovery well requires good data and a good understanding of the existing systems, combined with a methodical approach to determining the optimum solution. Especially where there are multiple heat sources and heat sinks.

A Pinch Analysis is the gold standard for optimising heat recovery in your plant, but discrete feasibility studies are also very useful.

How can waste heat be recovered and used?

Waste heat can be available from a range of sources, including exhaust air from gas burners, de-superheating a refrigerant prior to latent heat rejection, oil coolant systems on air compressor and refrigeration compressors, wastewater discharge, furnace exhaust, refrigeration condensers, and many other sources.

Direct heat exchange using a tube or plate heat exchanger is a simple method for heat recovery, however, there are other methods. For example, a waste heat source at a relatively low temperature can be used to heat a process flow to a higher temperature using a heat pump. Indirect heat exchange can be achieved using a hot oil circuit where the heat source is too hot for direct heat exchange with the heat sink.

Waste heat can also be used in many ways:

re-heat combustion air for a furnace or oven

Use directly in a dryer

Heat water in pasteurisers

Generate electricity using an Organic Rankine Cycle or Steam turbine to drive a generator

Generate hot water up to 100 degrees C or steam at up to 160 o C by extracting heat from a lower temperature waste heat source..

Optimising waste heat recovery

Where a site has numerous heat sources and sinks, a "Pinch" analysis can be used to determine the optimum combination of heat recovery alternatives for that site. PinCH analysis attempts to identify similar heat loads nearest to available heat sources and minimise the use of artificial heating (e.g. from natural gas or electricity). The optimum combination from a heat recovery perspective is not always practical in a retrofit though, so the key is to determine how to get as close to the optimum as possible in a practical and cost-effective way.

Implementing waste heat recovery

Implementation should take into account a number of factors:

The operating characteristics of the process, to ensure the implementation doesn't impact on output, product quality, process reliability or productivity.

Staging of projects if possible, to minimise process disruption and spread capital spend.

Heat quality available (temperature and rate of supply) and proximity to heating loads

Measurement, monitoring, and verification so that energy savings can be measured over time, and energy-saving or carbon abatement certificates can be created

Future plans for expansion or plant upgrades

Make informed and smart decisions about heat recovery.

Northmore Gordon is passionate about helping large industrial and commercial customers increase energy productivity. We have done a number of pre-feasibility studies and business cases specifically investigating waste heat recovery options. We can help you identify and quantify your heat sinks and sources, determine the optimum solution for your situation, and develop an investment-grade business case.

For more specific details on heat recovery contact Andrew at a.clarke@northmoregordon.com

Using this guidance

Check the site's operating conditions, data quality, project stage and current program settings before turning the dated discussion into a scope or investment decision.

Related guidance

Energy audits

Measurement and verification

Contact us

Read the original article for the source publication and its full context.

What is waste heat recovery and why is it significant for manufacturing facilities?

Waste heat recovery is the capture and utilization of rejected heat from industrial processes for beneficial use elsewhere on a site. Manufacturing environments often have concentrated sources of waste heat—such as exhaust air from gas burners, refrigeration condensers, oil coolant systems, and

wastewater discharge—that go unused. Recovering this waste heat back into processes can save substantial energy costs and increase the spare heating capacity of existing systems. Government guidance emphasizes reducing unnecessary heat generation and losses before investing in recovery equipment, making heat recovery a priority efficiency strategy.

How does Pinch Analysis help optimize waste heat recovery projects?

Pinch Analysis is considered the gold standard for optimizing heat recovery in plants with multiple heat sources and sinks. It identifies the most thermally efficient combination of heat recovery alternatives by matching similar heat loads nearest to available heat sources and minimizing reliance on artificial heating from gas or electricity. Because the theoretical optimum is often impractical in a retrofit setting, Pinch Analysis helps determine the optimum combination achievable in a practical, cost-effective way. Discrete feasibility studies are also valuable, particularly when multiple sources and destinations exist.

What are the main methods for recovering waste heat from industrial sources?

Three primary waste heat recovery methods exist. Direct heat exchange using tube or plate heat exchangers is the simplest approach for compatible temperatures. Heat pumps can raise low-temperature waste heat sources to higher temperatures needed for process heating. Indirect heat exchange using a hot oil circuit is used when the heat source temperature is too high for direct contact with the sink. The choice depends on temperature requirements, flow rates, contamination concerns, and the physical arrangement of heat sources and destinations within the facility.

What practical applications exist for recovered waste heat?

Recovered waste heat has diverse applications across manufacturing. It can re-heat combustion air for furnaces or ovens, directly heat dryers, warm water in pasteurizers, or generate electricity via Organic Rankine Cycles or steam turbines. Heat recovery systems can generate hot water up to 100°C or steam at up to 160°C by extracting heat from lower-temperature waste sources. The specific application depends on the temperature and flow rate of available waste heat and the thermal requirements of receiving processes. Selection should match heat quality to intended use.

What factors must be considered when implementing a waste heat recovery project?

Successful implementation requires balancing multiple considerations. Operating characteristics must be preserved to avoid impacting output, product quality, reliability or productivity. Projects should be staged to minimize disruption and spread capital expenditure. Heat source proximity to heating loads matters significantly for practical feasibility. Measurement, monitoring and verification systems must be established to track energy savings and enable creation of energy-saving or carbon abatement certificates. Future expansion or plant upgrade plans should inform system design to avoid premature obsolescence or inefficiency.

How should heat sources and destinations be identified and assessed?

Identification begins by mapping where heat is generated and where it can be utilized within a process system. For each heat source, document temperature, flow rate, and any contamination concerns. For each potential destination, establish required temperature, pressure, rate, timing and reliability specifications. Government guidance emphasizes this mapping step before investing in recovery equipment. Assessment should establish whether rejected heat is useful elsewhere on site and whether source and destination are compatible in temperature, timing and physical arrangement. This foundational analysis prevents investing in recovery systems with no viable applications.

What role does feasibility assessment play in waste heat recovery projects?

Feasibility assessment is the systematic evaluation methodology applied to determine the viability of waste heat recovery solutions. It evaluates whether proposed systems can deliver required conditions reliably, examines installation scope and supporting infrastructure needs, and develops cost-benefit

analysis. We have conducted numerous pre-feasibility studies and business cases investigating waste heat recovery options, helping clients identify and quantify heat sinks and sources, determine optimum solutions, and develop investment-grade business cases. Feasibility work should address both technical performance and commercial viability before capital commitment.

How does waste heat recovery connect to broader energy optimization and decarbonization?

Waste heat recovery is a key component of energy optimization strategies, particularly in reducing reliance on fossil fuel heating. By capturing available waste heat, facilities can reduce gas consumption and lower heating costs while supporting decarbonization objectives. Heat recovery systems may contribute to carbon credit potential through applicable schemes, though carbon-credit assessment requires separate evaluation. Recovery opportunities should be considered alongside other measures such as demand reduction, efficiency improvements, and renewable heat options when developing comprehensive energy-improvement programmes for industrial sites.