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Waste Heat Recovery Market By Application (Steam and Power Generation, Pre-Heating, Space Heating), By End Use (Petroleum Refining, Chemical, Cement, Metal Production and Casting, Natural Gas Compression, Paper and Pulp, Others): Global Opportunity Analysis and Industry Forecast, 2024-2033

https://marketpublishers.com/r/W0EBD0355120EN.html
Date: September 2024
Pages: 296
Price: US$ 2,601.00 (Single User License)
ID: W0EBD0355120EN

Abstracts

The global waste heat recovery market was valued at $67.2 billion in 2023, and is estimated to reach $129.6 billion by 2033, growing at a CAGR of 6.8% from 2024 to 2033.

Waste heat recovery is the process of capturing and utilizing thermal energy which is lost in industrial processes or power generation. This excess heat, often expelled through exhaust gases, cooling systems, or hot surfaces, is redirected and converted into useful forms of energy such as electricity, steam, or hot water. By recovering and repurposing this heat, waste heat recovery systems enhance overall energy efficiency, reduce fuel consumption, and lower operational costs. In addition, this process helps decrease greenhouse gas emissions, contributing to more sustainable and environmentally friendly industrial practices.

As industries seek to improve operational efficiency and reduce expenses, waste heat recovery offers a practical solution by capturing and repurposing heat that would otherwise be wasted. This process lowers energy consumption and decreases fuel costs, contributing to substantial savings over time. Moreover, advancements in technology and increased competition among manufacturers have made waste heat recovery systems more affordable and accessible. These systems are tailored to

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various industrial processes, from large-scale manufacturing to smaller operations that makes them a viable option for a broad range of industries. All these factors are expected to drive the demand for the waste heat recovery market during the forecast period.

However, high initial investment costs pose a significant challenge to the widespread adoption of waste heat recovery (WHR) systems, potentially hampering their growth. Implementing WHR technologies requires substantial upfront capital for the purchase and installation of specialized equipment, such as heat exchangers, boilers, and turbines. In addition, the integration of these systems into existing industrial processes involves complex engineering work, which escalates costs. For many businesses, especially small and medium-sized enterprises (SMEs), these initial financial outlays are prohibitive, making it difficult to justify the investment despite the long-term energy savings and environmental benefits. The high capital expenditure (CapEx) associated with WHR systems lead to a longer payback period, which deters companies from committing to such projects, particularly in industries with tight profit margins or uncertain market conditions. All these factors hamper the waste heat recovery market growth.

The integration of smart technologies, such as IoT sensors and advanced control systems, is enhancing the performance and efficiency of WHR systems. These technologies enable real-time monitoring and optimization of heat recovery processes, ensuring that energy is captured and reused with maximum efficiency. This increases the economic viability of WHR projects and makes them more adaptable to varying industrial conditions. In addition, modular and scalable WHR solutions are becoming more prevalent, allowing businesses to tailor systems to their specific needs and gradually expand their capacity as their operations grow. These innovations reduce the complexity and cost of implementing WHR systems, making them more attractive to a broader range of industries. All these factors are anticipated to offer new growth opportunities for the global waste heat recovery market.

The waste heat recovery market is segmented into application, end use and region. On the basis of application, the market is classified into steam and power generation, pre-heating, and space heating. By end use, the market is segmented into petroleum refining, chemical, cement, metal production and casting, natural gas compression, paper and pulp, and others. Region-wise, the market is analyzed across North America, Europe, Asia-Pacific and LAMEA.

On the basis of application, the market is classified into steam and power generation,

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pre-heating, and space heating. The steam and power generation segment accounted for less than two-thirds of the waste heat recovery market share in 2023 and is expected to maintain its dominance during the forecast period. Waste heat recovery in steam and power generation is a critical strategy for improving energy efficiency and reducing fuel consumption in industrial processes. In steam generation, waste heat recovery systems capture heat from exhaust gases or other waste heat sources that would otherwise be lost to the environment. Moreover, in power generation, waste heat recovery plays a vital role in enhancing the overall efficiency of power plants. Combined Heat and Power (CHP) systems utilize waste heat from power generation processes to produce additional electricity or to provide heating and cooling for industrial or residential application.

By end use, the market is segmented into petroleum refining, chemical, cement, metal production and casting, natural gas compression, paper and pulp, and others. The chemical segment accounted for less than one-third of the waste heat recovery market share in 2023 and is expected to maintain its dominance during the forecast period. Waste heat recovery in the chemical industry plays a critical role in enhancing energy efficiency and reducing operational costs. The chemical sector is energy-intensive, with numerous processes generating substantial amounts of heat that are released into the environment. By implementing waste heat recovery systems, chemical plants capture this excess heat and repurpose it for other processes, such as preheating raw materials, generating steam, or producing electricity. This optimizes energy use and reduces the dependency on external energy sources, thereby lowering overall energy costs.

Region-wise, the market is analyzed across North America, Europe, Asia-Pacific and LAMEA. The Asia-Pacific region accounted for less than of the waste heat recovery market share in 2023 and is expected to maintain its dominance during the forecast period. Technological advancements are improving the feasibility and effectiveness of waste heat recovery in the region. Innovations in heat exchangers, organic Rankine cycle (ORC) systems, and new materials have expanded the range of temperatures and industries that benefit from WHR. This is particularly important in the Asia-Pacific, where diverse climatic conditions and industrial processes require adaptable and robust WHR solutions. Moreover, the region’s robust investment in R&D drives the growth of waste heat recovery systems, ensuring that both small- and large-scale industries are capitalized on the technology.

Key players in the waste heat recovery market include ABB Ltd., Mitsubishi Heavy Industries Ltd, TLV CO., LTD, Thermax Ltd, Siemens AG, Robert Bosch GmbH,

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General Electric Company, Echogen Power System, Schneider Electric SE, and Kawasaki Heavy Industries, Ltd.

Key Findings of the Study

On the basis of application, the pre-heating segment is anticipated to grow at the fastest CAGR of 7.3% during the forecast period.

On the basis of end use, the natural gas compression segment is anticipated to grow at the fastest CAGR of 8.2% during the forecast period.

Region-wise, Asia-Pacific has the highest share in 2023 in terms of revenue.

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Key Market Segments

By Application

- Steam and Power Generation
- Pre-Heating
- Space Heating

By End Use

- Petroleum Refining
- Chemical
- Cement
- Metal Production and Casting
- Natural Gas Compression
- Paper and Pulp

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Others

By Region

North America

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Canada

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Rest of Europe

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