MITSUBISHI ELECTRIC
Changes for the Better

Automating the World

Proven solutions
for the recycling industry

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Changes for the Better

Recycling as part of sustainability

Innovative technology is not only cutting-edge, but also a path to sustainability for a greener future. The Mitsubishi Group was already ranked as one of the top-rated companies for water and climate management by the Carbon Disclosure Project (CDP) in 2017. How does recycling fit into Mitsubishi Electric's sustainability policy?

Mitsubishi Electric is among the technology leaders that develop advanced solutions for greater sustainability, greater safety and reliability of the products offered. By implementing its Environmental Vision 2021 plan, the company is helping to create a society based on a low-carbon economy and recycling. The solutions it promotes also work within the framework of efforts to protect biodiversity and natural resources.

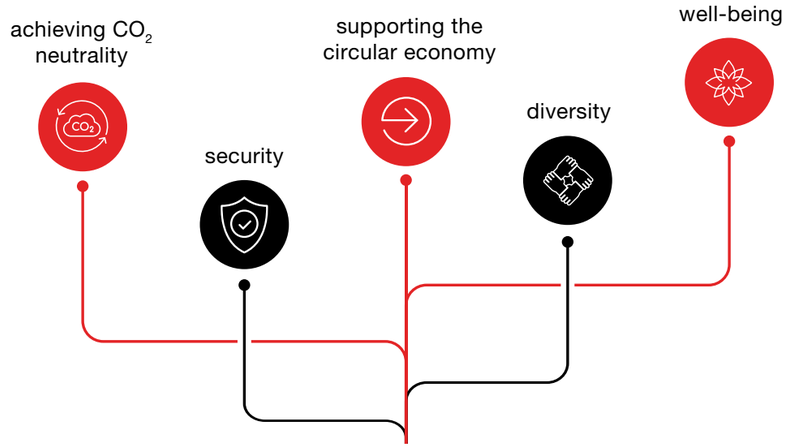
Long-term sustainability

The horizon of Mitsubishi Electric's sustainability vision extends to 2050, and the project calls for initiatives in five areas: Achieving carbon neutrality, supporting a circular economy, safety, diversity and well-being.

To combat climate change, the Mitsubishi Electric Group promotes and sells energy-efficient products, systems and services in the field of renewable energy. It develops smart solutions to support recycling companies by offering energy-saving frequency converters and software solutions such as EcoAdviser. By working with its stakeholders, the company aims to help reduce greenhouse gas emissions worldwide.

The Group's goal is also to achieve carbon neutrality by 2050 by reducing emissions at every stage of Mitsubishi Electric's product life cycle – from design to raw material

Mitsubishi Electric Sustainability Vision – the most important assumptions



sourcing and production to sales, distribution, use and disposal. Extensive recycling measures are required to reduce greenhouse gas emissions.

Recycling programmes

Mitsubishi Electric also strives to recycle its own products. According to the Group, Mitsubishi Electric companies in Japan emitted a total of 1,439 tons of waste in 2022, of which 520 tons were recycled. As part of its sustainability policy, the company has set up a recycling program for its air conditioning and photovoltaic modules to recover and reuse as many raw materials as possible. There are also other interesting local initiatives. In the UK, for example, Mitsubishi Electric, in collaboration with Overton Recycling Ltd in Stourbridge, offers its customers the opportunity to return used air conditioners free of charge. A special process ensures that 99.1% of all materials are recovered and recycled.

More information about recycling of Mitsubishi Electric Group products: Sustainability Report 2022,

The sustainability policy

The sustainability policy is one of the cornerstones of the Mitsubishi Electric Group's corporate governance. The company acts actively and on several levels in its recycling efforts. It offers innovative solutions to support companies in the recycling industry and implements programs to recover and reuse materials used in the manufacture of components and equipment.

How can energy costs in recycling processes be reduced?

Mitsubishi Electric places particular emphasis on supporting the sustainable development of all industries. The company offers solutions that help at various stages – from raw material extraction, production and transport to the disposal and processing of secondary raw materials for reuse in order to conserve natural resources.

The recycling industry has a particularly large key role to play in the sustainability process, as the energy-intensive processes offer a great deal of potential for optimisation with new technologies. Conserving natural resources is a priority today, so an increasing proportion of raw materials must be obtained from secondary raw materials. This method consumes less energy and is therefore cheaper and less harmful to the environment. It can therefore be assumed that the recycling industry will remain stable even in times of declining consumption and stagnation in other sectors.

Recycling, like any other business, must be profitable. One of the most effective ways to improve profitability is to reduce costs. Preferably where they are incurred the most. What does that look like in the recycling industry, where large amounts of energy are consumed? Much of the cost in the industrial recycling process is associated with the use of machines driven by powerful electric motors: Shredders, compressors, induction furnaces, conveyors, crushers and many others.

This area is closely associated with Mitsubishi Electric. The company has been successfully looking for ways to reduce power consumption for decades. Mitsubishi Electric's expertise, experience in supporting companies in various fields and extensive product portfolio can also be used in the secondary raw materials industry.

Especially useful are proven solutions for:

- Drive technology (frequency converters and motors);
- Power supply (medium voltage switchgear, low voltage switchgear);
- Monitoring of power consumption and power quality;
- Programmable Logic Controllers (MELSEC);
- Control, monitoring and maintenance of production equipment (large area monitors, visualisation software and SCADA (Supervisory Control And Data Acquisition);
- Edge computing (MELPIC industrial computers and related software);

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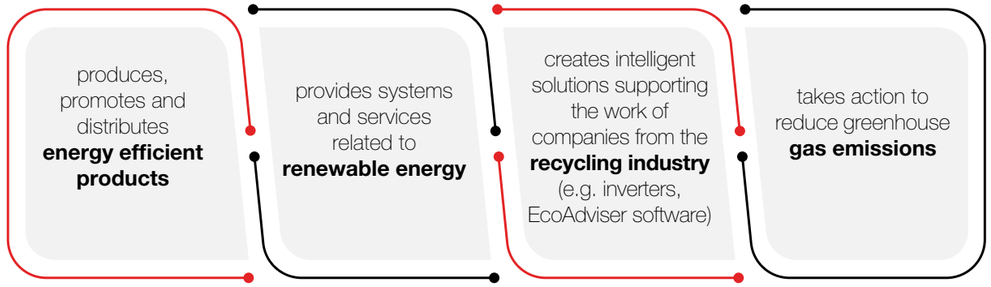
Mitsubishi Electric



At Mitsubishi Electric, even the most elaborate systems are built mainly on the basis of components from our own production. Therefore, customers can be sure that they will receive stable, optimised and energy-efficient products. Mitsubishi Electric's solutions are comprehensive but modular – their implementation can be gradual as needs arise and funds are raised.

Costs are reduced by replacing inefficient, high-maintenance and partially worn-out drives with solutions equipped with advanced AI functions and robust frequency converters that bring the drive network and the plant to a future-proof technological level. Networking plant components offers the opportunity to evaluate the energy efficiency of the entire system, look for the causes of unwanted energy losses and optimise energy consumption. One easy-to-implement solution, for example, is to limit the torque of motors to optimal values in a specific load range.

Mitsubishi Electric has been successfully seeking ways to reduce electricity consumption for decades. Mitsubishi Electric's expertise, experience in supporting companies in various fields and extensive product portfolio can also be used in the secondary raw materials industry.

For Mitsubishi Electric, every customer is a new opportunity to create innovative and new solutions, and to create and grow value together with the ever-growing needs of customer requirements.

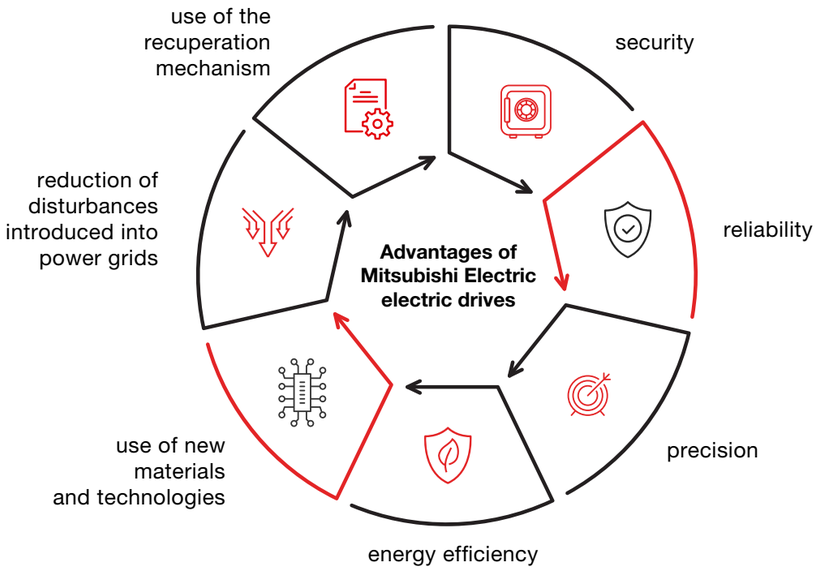
Energy-efficient solutions for recycling companies

Industrial processes in the recycling industry rely on the operation of many machines driven by electric motors. These include pumps, fans, compressors, mixers, shredders, shears, mills, presses, conveyors and much more. The machines vary in size and performance and therefore have different power requirements.

In the recycling industry, drives with very different operating characteristics are required. Sometimes it is necessary to make special individual adaptations to specific conditions that allow the drive to be used, for example, in possible potentially explosive atmospheres or in the presence of dirt, grime and aggressive vapors.

Reliability, precision, energy efficiency, the use of new materials and technologies, as well as the reduction of disturbances in the power grids and safety are a high priority for the designers.

Mitsubishi Electric engineers also pay close attention to the recovery



of electrical energy, for example during braking or coasting.

Predictive maintenance is one of Mitsubishi Electric's important solution building blocks. Early detection of signs of wear on machine parts, such as drives, provides the ability to schedule maintenance activities at a convenient time. Worn parts can be replaced during a routine shutdown without waiting until they cause a more serious failure,

Mitsubishi Electric has been manufacturing electric drives since the first half of the 20th century – the century of electric drives. These include the traditional designs – single-phase and three-phase AC induction motors and DC motors – as well as the much younger and very advanced servo drives, linear motors or reluctance motors. The offer also includes motors with built-in gears and shafts running in parallel or at a 90-degree angle.

shutting down the machine and disrupting overall operations. When more accurate diagnosis of a machine malfunction is required, data from the drives can be supplemented with information from additional sensors. Mitsubishi Electric's industrial automation systems are also very flexible in this respect.

For special applications, Mitsubishi Electric manufactures electromagnetic brakes that make it easier to keep the tension of the unwinding or winding tape on the reel constant.

This solution can be particularly useful when the recycling industry is combined with raw material reuse, such as in paper mills. Drives are also available that are optimised for applications requiring low speed combined with high torque. This diversity facilitates the implementation of a favourable procurement model: one supplier, many applications.

Solutions for energy saving

Electricity savings improve a company's financial bottom line, but that's not the only benefit. Reducing electricity consumption reduces the environmental footprint and improves a company's image in the eyes of its customers. This is especially important for companies operating in the recycling industry, for whom concern for the environment is part of their professional DNA.

The processing of secondary raw materials consumes a great deal of energy. This is particularly evident in the recovery of metals from scrap metal, such as automotive scrap. It is worth noting that almost every element of the process – transport, separation, disassembly of car parts, removal of plastics and non-ferrous metals – involves the use of machines driven by powerful electric motors or servomotors.

The use of energy-saving inverter solutions from Mitsubishi Electric on the main motor of a shredder, for example, reduces energy costs by up to 7–10%. High penalties to the utility company due to peak loads can be reduced and the power distribution network can be stabilised. The IEEE-519 standard for network harmonics is complied with.

In modern machines, it is common to connect the drives not directly to the power grid, but to electrical drive technology that regulates the transfer of energy from the grid, such as the PWM frequency converter. It depends on the quality of these inverters and their technical performance whether the actual power consumption matches the theoretical minimum required to ensure the operation of all driven motors. Mitsubishi Electric manufactures advanced and very high quality products for demanding environments. In addition, the company also provides energy recovery solutions with electric drives.

Mitsubishi Electric's devices are designed so that the operating parameters (speed and torque) of these drives can be adjusted over a wide range. In addition, emphasis is placed on minimising the energy consumption of the frequency converters themselves, and attention is paid to electromagnetic compatibility and conducted terference.

Proven solutions for the recycling industry

Mitsubishi Electric energy saving solutions

inverters

EcoAdviser – software supporting energy saving

multifunctional regenerative rectifiers

The latter characteristic – harmonics and thus also grid stability – is of great importance in an industrial environment. The accumulation of inductive loads and switching operations cause fluctuations in the power grid. The nature of these disturbances is diverse. They range from load peaks to harmonics. The sum of these influencing factors means that sensitive equipment can fail and disturbances in the network symmetries can lead to supply failures. The use of drive technology and solutions from Mitsubishi Electric reduces the risk of such problems.

A modern plant should be controlled based on up-to-date and reliable data. Mitsubishi Electric equipment can provide this data in real time, and EcoAdviser software and other tools make it easy to interpret the data and look for equipment and processes that are consuming unnecessary energy.

Such analysis can take place on the production line, on the shop floor, or at the control level. Operational data can be presented directly to the machine operator, the manager, or (at the enterprise level) to analysts and independent consultants. Either real-time data or data stored in databases over any period of time can be analysed. Combining all these capabilities with modern frequency converters brings tangible benefits to companies.

With a drive controller with data logger matched to the inverter, the overall plant efficiency can be further increased. Here, flexible control of the frequency converter enables increased motor utilisation depending on the material feed and can thus increase the productivity of the recycling plant by up to 30% while reducing power consumption by up to approx. 20%, measured in kilowatt hours per ton.

Automation

Support for recycling and environmental protection

The European Environment Agency (EEA) published a report on the state of the European market for secondary raw materials in January 2023. According to the experts' findings, they are crucial to achieving a circular economy, as the secondary use of high-quality recycled materials minimises the need to extract natural resources.

Efficient recycling is therefore not only beneficial from an ecological point of view, but also from a financial one. And how can this development be supported by automation solutions?

Modern automation solutions are used at every stage of waste management – from collection to final processing. With innovative products and systems, the process can be much more efficient and cost-effective, with much less impact on the environment.

Modern solutions for recycling

Intelligent drive solutions can convert existing plants into modern and efficient recycling plants without much technical effort. For example, existing shredder plants equipped with outdated motors and fluid starters or hydraulic couplings can be easily converted to low-maintenance frequency converters with three-phase asynchronous motors.
This not only reduces energy, wear and maintenance costs, but also increases overall plant efficiency.

Recycling and sustainability with Mitsubishi Electric

Developing technologies that facilitate the recovery of raw materials is part of Mitsubishi Electric's sustainability vision and its commitment to climate neutrality. As part of this effort, the Hyper Cycle Systems Laboratory was established, where engineers from various Mitsubishi Electric companies develop technologies to improve recycling efficiency. The experts develop solutions to recover as much material as possible from end-of-life products while keeping the resulting secondary raw materials as pure as possible. The Mitsubishi Electric Group is also committed to increasing the use of recycled materials. The company is committed to ensuring that the components of the equipment it manufactures are reused – among other things, it has developed a special recycling programme for this purpose. In its Sustainability Vision 2050, Mitsubishi Electric has also stated that it aims to maximise the efficiency of the use of resources such as plastics and metals that are generated as waste in production.

Proven solutions for the recycling industry

Mitsubishi Electric – selected solutions for the recycling industry

inverters

EcoAdviser – software supporting energy saving

multifunctional regenerative rectifiers

Read the full contents of the report *Investigating Europe's secondary raw material markets*, prepared by the EEA.

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Predictive Maintenance

Effective production management

Innovative approaches to maintenance in production are smart services and predictive maintenance. They used modern tools and technologies to detect plant problems at an early stage.

The main objective is to avoid major breakdowns and to plan maintenance activities in such a way that they affect the production process as little as possible.

Prevention of unplanned outages

Avoiding sudden, unplanned downtime to production losses due to maintenance and spare parts availability is very important in any industry. The recycling sector is no exception. A delay in separating and processing recyclables can have serious consequences: Failure to meet contracted delivery dates, contractual penalties for delays, accumulation of excessive quantities of untreated raw waste, and resulting problems in handling subsequent contracted deliveries and purchase quantities.

Predictive maintenance focuses on continuously monitoring machines and looking for early signs of wear on parts and components. In this way, the company ensures that it can deliver consistent quality and maintain a continuous production process.

Prioritisation

The solution to the above problems is to implement a predictive maintenance strategy that optimises maintenance team priorities and schedules missions efficiently.

In the traditional approach, maintenance specialists, automation specialists and service technicians work according to a predetermined schedule. The time between scheduled shutdowns is known, and no major failures usually occur during this time. The stoppages are related to the condition of the machine, its load, the maintenance methods used, etc. If no serious damage is found during a regular inspection, the machine is put back into operation. If a breakdown occurs, the maintenance team focuses on reducing the impact on production and tries to fix the problem as soon as possible – regardless of the time of day, weather, actual workload in the plant, etc.

Early detection of potential failures

Predictive maintenance focuses on continuously monitoring machines and looking for early signs of wear on parts and components. The programme draws conclusions, often using artificial intelligence mechanisms, based on information provided by sensors attached to the machine. In this way, maintenance actions, including the replacement of worn components, can be planned and carried out before a failure occurs and the machine is shut down.

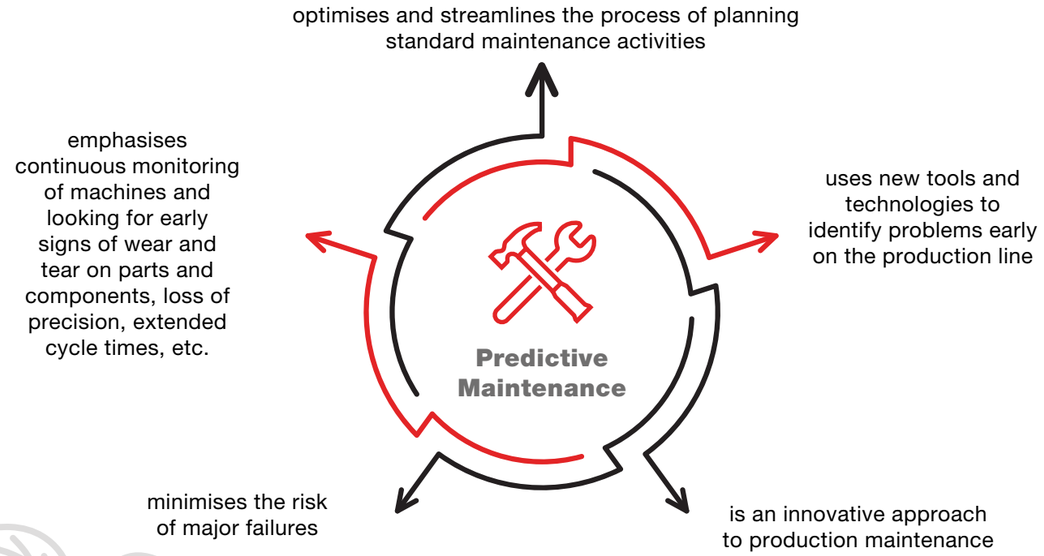
Mitsubishi Electric supports predictive maintenance at all levels

The use of frequency converters eliminates the need for high-maintenance components such as hydraulic couplings or fluid starters. The use of modern three-phase asynchronous motors (e.g. efficiency class IE4) in contrast to a traditional slip-ring motor with high maintenance requirements, reduces the maintenance effort and costs.

Mitsubishi Electric is also developing software that allows machine status to be monitored in real time by the operator or production manager. Historical data transmitted from edge-layer devices to the company's IT system can be analysed to identify matches of events that precede a failure.

The interplay of all these elements means that Mitsubishi Electric's customers can save time and money and, above all, run their business predictably and without unpleasant surprises.

Mitsubishi Electric offers a wide range of additional vibration and oscillation sensors to support the function of predictive maintenance systems and obtain the data required for smart services.



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