

Proven solutions

for the recycling industry, **part 2**



TABLE OF CONTENTS

1. Modern industrial automation solutions in recycling companies
2. Solutions for the metal recycling industry
3. Plastic recycling – an environmental and economic challenge
4. How do modern solutions improve recycling in the automotive industry
5. Solutions for the textile recycling industry
6. Maintenance Portal – your maintenance centre
7. ICONIC Suite – real-time insight for operational excellence
8. EcoAdviser software – an essential step towards energy saving

Modern industrial automation solutions in recycling companies

High raw material prices and increasing pressure to reduce the extraction of natural resources are resulting in a growing demand for cheaper but equally valuable recycled raw materials.

Waste treatment companies can expect growing interest in their services. In order to respond to this, they must be prepared to increase their production capacity. The financial aspect is important here. For minimise energy consumption and expand their equipment resources, they should focus on process optimisation.

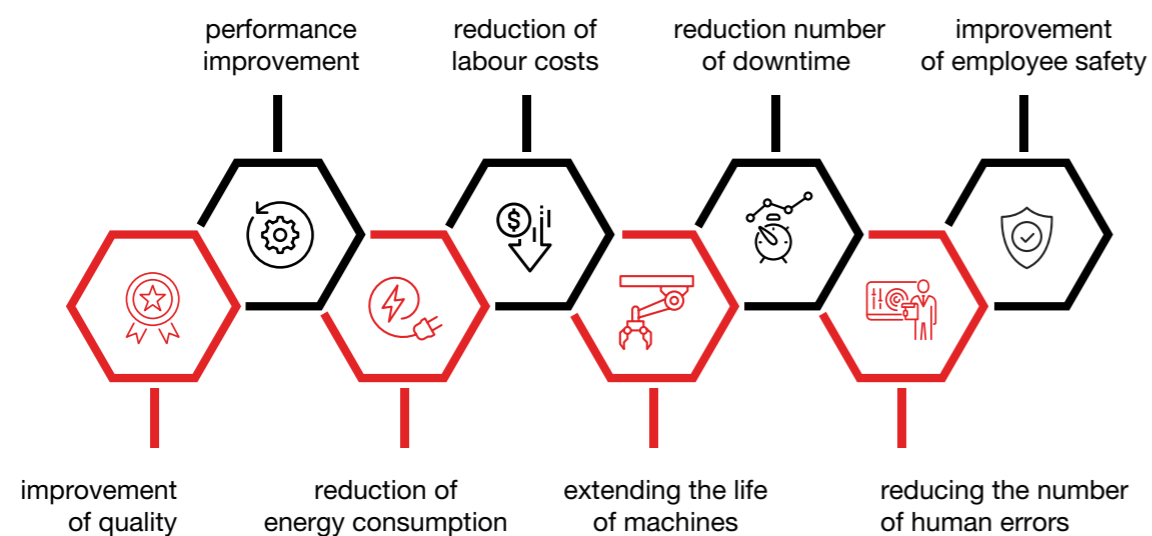
The solution for these issues is industrial automation. Automating every stage of production reduces errors and accidents at work, extends machine life, reduces downtime and energy consumption.

Mitsubishi Electric offers thoughtful, proven solutions for production

automation. Using the components, systems and software offered by the company, almost any technological process can be automated and robotised to a degree that guarantees a reasonable return on investment.

Automation can either be comprehensive or involve selected processes, such as conveyor belt transport, weighing or mixing. If the need arises, each automated line or machine can be connected to others, building a complex, centrally monitored and controlled system. This can cover a given workstation or many separate systems within the company.

Advantages of production automation



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The core components of Mitsubishi Electric's process automation on offer are PLCs, industrial PCs, network devices and utility software for their configuration. In addition, Mitsubishi Electric offers software for remote management of equipment and monitoring of machine condition. In plants where some of the processes have been automated using products from other suppliers, they can easily be linked to Mitsubishi Electric's systems through the use of universal communication protocols such as CANopen.

Enterprises where the smart factory model is ultimately to be implemented have a wide choice of Edge Computing solutions and transport of data collected from machines to the establishment's IT system or to the cloud of a third-party IT service provider. Mitsubishi Electric is developing scalable CC-Link IE TSN network technology. It guarantees safe and reliable real-time data exchange, which is also useful for applications such as emergency machine stops or alarm triggering.

Mitsubishi Electric is devoting much attention to areas such as the Industrial Internet of Things (IIoT) and artificial intelligence. These will determine the direction of the development of industrial automation in the near future. Software and tools for managing electricity and heat consumption will play a similar role. The tools designed by Mitsubishi Electric make it easy to add more and more innovative solutions to functional systems on any scale.

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Solutions for the metal recycling industry

Modern industry faces a new challenge – reducing carbon emissions. As part of the Paris Agreement, crowning the 21st UN Climate Change Conference of 2015, European Union countries pledged to fight climate change to limit global warming. By 2050, the countries associated with the European Union are expected to become the world’s first climate-neutral economies.

The pursuit of carbon neutrality for today’s businesses requires, among other things, the efficient recovery of raw materials. The use of recycled materials in production dramatically reduces carbon emissions throughout the product’s life cycle. Using them in a closed loop can also reduce the cost of obtaining the components needed for production.

This is especially beneficial for metals that can be recycled an unlimited number of times – as much as 70% of the steel produced to date is still in use, and using scrap steel instead of virgin ore can reduce carbon emissions

by up to 58%, air pollution by 86%, water consumption by 40% and water pollution by as much as 76%.

Challenges of the metal recycling industry

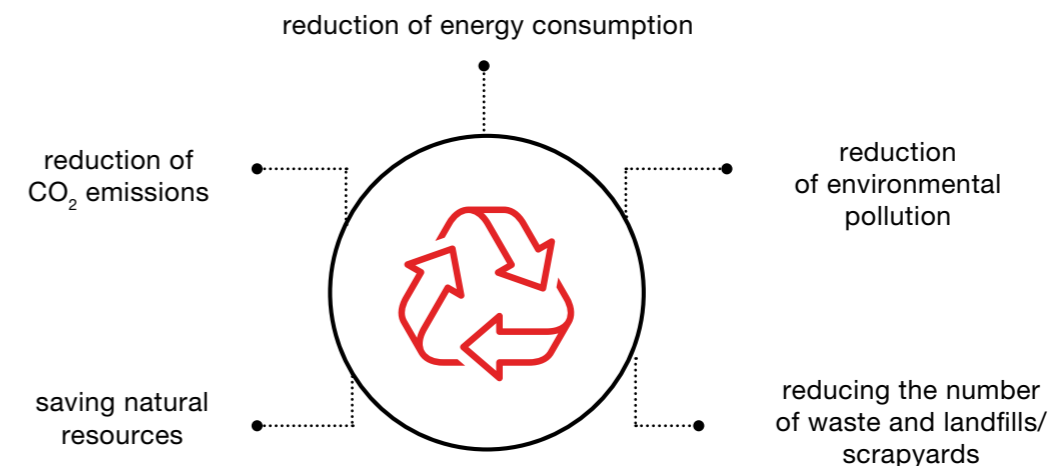
Undeniably, recycling has a positive impact on the environment. It allows us to minimise carbon emissions and save natural resources and energy. It’s also an opportunity to reduce air pollution and limit the need for landfills or junkyards.

Recycling companies are aware of these benefits, but in order to achieve them efficiently, they need partners in other technologies to help them achieve these goals. To achieve them, among

Mitsubishi Electric provides Intelligent Drive engineering software for smart recycling processes, as well as quick support through its Smart Service, which remotely monitors the condition of equipment.



The advantages of recycling



other things, innovative technologies are needed to facilitate energy recovery and optimal energy management. All equipment used in the recycling process must also operate efficiently in harsh environments.

Such requirements are met by products from Mitsubishi Electric, a leader in providing solutions that support sustainability. The company provides Intelligent Drive engineering software for smart recycling processes, as well as quick support through its Smart Service, which remotely monitors the condition of equipment.

Continuous adaptation of metal recycling technologies

A proven partner in smart solutions for companies in the metal recycling industry should continually develop its technologies. In 2021, Mitsubishi Electric launched a joint study with Emulsion Flow Technologies Ltd. to increase the efficiency of metal recycling.

The venture was launched by the Japan Atomic Energy Agency and focuses on metal recycling using emulsion-flow technology. It is an advanced method that allows the separation and extraction of metal components with high accuracy. Mitsubishi Electric and Emulsion Flow Technologies will work

to optimise this technique and develop equipment to create a highly efficient recycling process that at the same time has only a negligible impact on the environment.

Improving technologies and solutions for even more efficient metal recycling is part of Mitsubishi Electric’s vision of sustainability. This makes it an ideal partner in technology for companies specialising in metal recycling.

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Plastic recycling

An environmental and economic challenge

The recycling industry faces a number of challenges, one of which is the efficient management of plastic recycling. A dynamic increase in production has been observed since the 1950s, yet it is still being recycled at low levels compared to other types of wastes.

Between 6 and 15 million tons of plastic waste enter the oceans each year. Microbeads of plastic are present not only in the seas, but also in the air, rainwater, drinking water, some foods and even in human blood. Plastics take up to several hundred years to decompose – so the waste produced today will be a problem for many generations, especially since the recycling rate in many countries still leaves much to be desired.

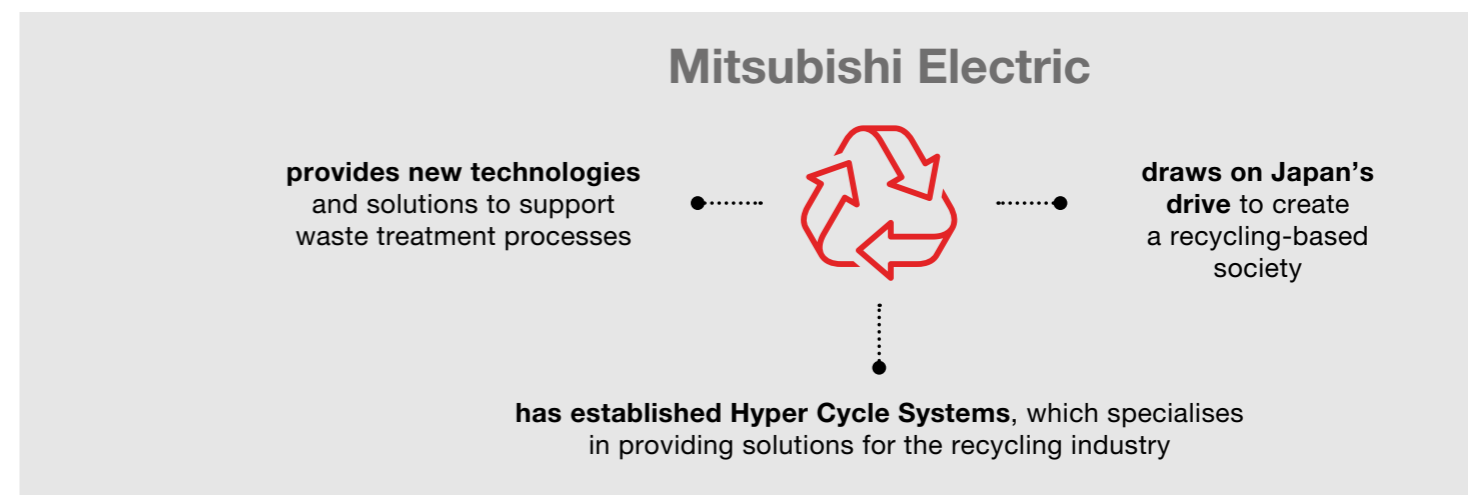
According to a report by [The Real Truth About the U.S. Plastics Recycling Rate](#), prepared using data from the U.S. Environmental Protection Agency, among others, and authored by NGOs, Last Beach Cleanup and Beyond Plastics, the percentage of plastic waste that is recycled in the United States is only 5-6%. The rest of the waste ends up in landfills, the seas and oceans, or is incinerated.

The problem of recycling has also been looked into by the European Union, recognising it as one of the key measures for achieving climate neutrality and sustainable development.

Important in this context is the [Report on Management of Plastic Waste in Europe](#), on which representatives of twelve European Supreme Audit Institutions worked for more than two and a half years. As their findings indicate, in the countries that participated in the survey, a circular economy is not used in

practice but preparations for it are at an early level. There are a lack of systemic solutions, as well as reliable data on the current state of waste management or selective waste collection. As many as ten participants in the survey were critical of the national waste management systems, and considered the measures taken to reduce the generation of plastic waste and treat it properly, to be inadequate. Attention was also drawn to bad practices, such as the shipment of some waste to other European and Asian countries.

The need for modern technology and optimisation of waste processing can be met by Mitsubishi Electric's innovative solutions. They are rooted in Japan's drive to create a recycling-based society. The country passed a law on recycling household appliances as early as 1998.



Recycling for the European Green Deal

The European Union is striving to achieve a circular economy, for which it is necessary to develop norms and standards in recycling processes. For this purpose, a detailed analysis of the plastic cycle was prepared – from its production, processing, consumption, waste management and recycling through reuse.

The results of a study conducted by the European Plastics Manufacturers Association were published in a report [The Circular Economy for Plastics – A European Overview](#). According to experts, it is necessary to double the current recycling capacity of European countries in order to achieve their climate neutrality goals.

To give a coherent direction to achieve climate neutrality, the European Parliament has published a special action plan, known as the [European Green Deal](#). According to recommendations contained therein, 55% of plastic packaging waste should be recycled by 2030. Developing the market for recycled plastics can be achieved by the introduction of reduced VAT on recycled products or with new rules for minimum recycled content in products. The development of the recycling industry, its automation and robotisation remains a key value.

Modern recycling

The need for modern technology and optimisation of waste processing can be met by Mitsubishi Electric's innovative solutions. They are rooted in Japan's drive to create a recycling-based society. The country passed a law on recycling household appliances as early as 1998.

The Mitsubishi Electric Group responded to these guidelines just a year later and opened its first recycling company, Hyper Cycle Systems, which now offers advanced technology, machinery and automated processes for the recovery of metals, glass and reusable plastics on a massive scale.

Its proposed solutions are all the more important as the quest for climate neutrality and sustainable development becomes a key challenge of the whole world. Now [scientists estimate](#) that by 2050 the production and incineration of plastic will emit 2.8 billion tons of greenhouse gases into the atmosphere. If we want to strive to minimise the negative environmental impact of these processes, we need to optimise the recycling process. This in turn will be made possible by its automation and the support of modern technologies.

How do modern solutions improve recycling

in the automotive industry?

The automotive industry is one of the sectors that handles the issue of recycling best. This approach is forced on manufacturers by regulations and directives – as of 2015, they are required to reuse 95% of end-of-life vehicles. What are the challenges of recycling in the automotive industry and how can this process be supported by modern technologies?

As recently as 2015, plastic derivatives accounted for only 17% of the weight of cars, according to a study published by [Field Actions Science Reports](#). By 2030, that percentage is projected to rise to nearly 20%. The average weight of cars is to be reduced by more than 100 kg, to 1125 kg, of which about 25 kg is to be plastic.

Circular economy in the automotive industry

Increasing the use of recycled materials is a real challenge facing automotive manufacturers. How do they deal with it? For example, Ford, as a pioneer in the industry, makes use of plastic collected from

the ocean, commonly referred to as ghost gear (the company makes wire harness clamps from it). Volvo, on the other hand, has ensured that at least 25% of the plastics used in its cars will be recycled in 2025. The potential of polypropylene has also been recognised by Renault brand, which in 2019 published a study titled [Closed-loop Polypropylene, an Opportunity for the Automotive Sector](#).

It highlights the possibilities of using polymer as a source of supply for the automotive industry.

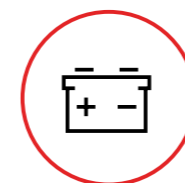
Circular economies are also promoted by national governments. They believe that access to recycled raw materials could be the answer to the problems experienced of intermittent supply chains for extracted materials.

Circular economy in the automotive industry

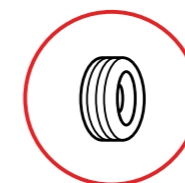
Selected initiatives of automakers



Car recycling includes, among other things



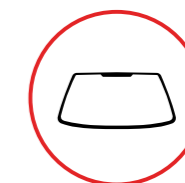
batteries



tires



engine oil



windshields

In 2023, the U.S. Department of Energy provided a huge loan to one company to finance the construction of a battery recycling plant in Upstate New York. It is expected to eventually be one of the largest sources of lithium production, which is needed to make electric cars.

Recycling – challenges and technologies

While cars are the consumer products that are recycled the most (nearly 30 million vehicles were

reprocessed in 2018, according to Recycle Nation), that does not mean there are no new challenges ahead for recycling in this industry.

In the case of cars, this process already begins during operation and involves components that are consumed while driving, such as batteries, tyres and engine oil. Glass recycling is also troublesome. Often glass is additionally laminated or contains metal components – in this case, the separation of individual components is more difficult to do. Another challenge is the proper processing of batteries.

In all these cases, intelligent industrial robots or cobots from Mitsubishi Electric can help. A modern, automated sorting line will be a big improvement in the recycling process.

Long-term benefits

It is estimated that applying a circular economy to the automotive industry could reduce carbon dioxide emissions per passenger-kilometer by up to 75% by 2030. This is an obvious benefit from an environmental point of view, but such a production system is also expected to reduce costs, primarily in terms of material and energy losses. The introduction of a simplified supply chain, based on recycled raw materials, will bring significant savings to the automotive industry.

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Solutions for the textile recycling industry

A substantial portion of secondary raw materials are textiles. One reason for this is the specific nature of the clothing market, which forces the introduction of new clothing collections several times a year. Unsold stocks of earlier models are not put on the market, but go straight from warehouses for recycling. The processing and secondary use of such large quantities of textiles is only possible through complex, multi-stage mechanical, chemical and thermal processes.

Textile recycling is perfect for automation. It is energy-intensive and complex, and an automatic process control allows for the maintainance of optimal conditions and efficiency in processing secondary raw materials and reduction of energy consumption to a bare minimum. Mitsubishi Electric offers solutions that can make it easier to optimise recycling and enable finding areas where too much energy is being consumed and machines that show early signs of wear.

The collection and processing of data using Mitsubishi Electric's systems can

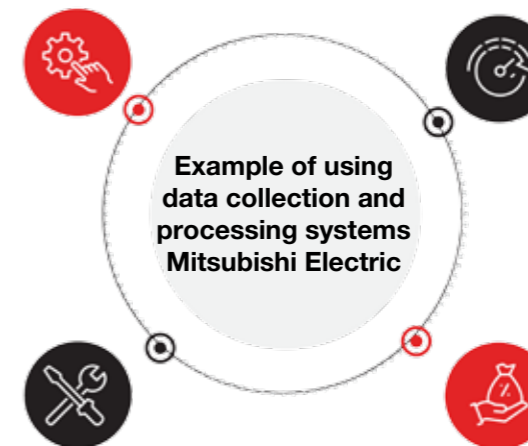
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be done at every level: from the operational level (employees operating machines using operator panels, shift managers), through maintenance services, to the people and departments responsible for optimising energy consumption and strategic investment planning in the company.

The foundation of the automated operation of the plant and the company as a whole is an industrial data network. Mitsubishi Electric is a supplier of equipment utilising a number of solutions: CC-Link, MODBUS, MELSECNET, Ethernet. The varied solutions on offer make it easy to select the network topology and components that best meet the requirements for a specific case, taking into account bandwidth, data transfer rates, real-time data exchange and alarm handling (including emergency stop of machines).

The EcoAdviser software suite uses data collected directly from components (servo drives, inverters, additional sensors mounted on machines) to visualise electricity consumption at every level: from a single machine drive to the entire company. EcoAdviser – in conjunction with ICONICS SCADA software – enables centralised, precise machine management. The advantage of such an approach is the multiple use of the same complete

Operational level
employees operating machines using operator panels, shift managers



Energy consumption optimisation
employees of departments responsible for the consumption of energy and other production utilities

Maintenance
maintenance services

Investment planning
management, executives

and consistent dataset. Depending on the context, it provides a set of information and tools necessary at the operator, engineer, manager or system integrator level. Individual applications can run on operator panels, edge devices, industrial PCs or within the IT layer - on servers and in the cloud, in a single or multiple locations.

Mitsubishi Electric has the knowledge and experience

essential for industries that combine machining and other fibre loosening methods (e.g. thermal and chemical treatment), including control of valve drives, yarn receiving reels and palletisation of finished products. All this within a single, fully complementary ecosystem.



Maintenance Portal

Your maintenance centre

The recycling industry is highly diversified in terms of the technologies used, the size of companies and their locations. What can be done to make sure they are all under control and that individual processes are managed efficiently?

Mitsubishi Electric



- **has lot of experience** in the production of: industrial robots and cobots, technical equipment, components, machinery and software for industry (e.g. Servo/Motion, Inverter, HMI and PLC)
- **develops solutions** based on the methodology of continuous improvement
- **provides modern systems** for energy management, planning and maintenance, among others

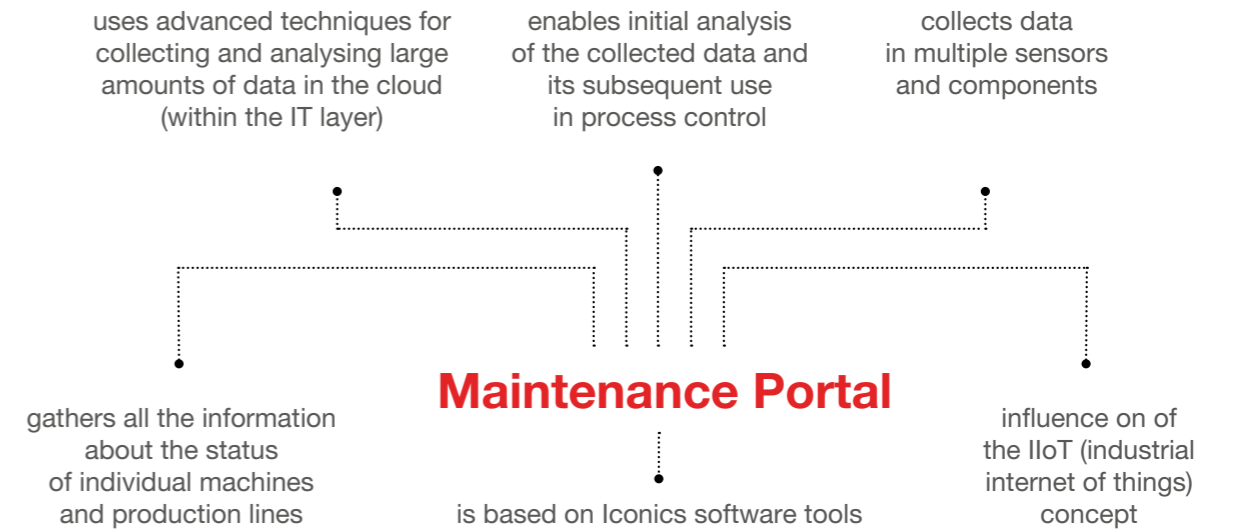
Processing of recycled material is a multi-stage process and involves a number of different operations, such as collection, sorting, preparation of secondary raw materials, and the actual recovery process. This specifically means

that multiple plants located in different locations may operate within a single company.

Dispersion simplifies the recovery of secondary raw materials, but makes it difficult to manage infrastructure and achieve some of the strategic goals, such as saving electricity or servicing equipment and machinery. Meanwhile, the best results in these areas are achieved by implementing a consistent strategy and by responding to observed anomalies, detected areas of energy loss and harbingers of equipment failure.

A reliable partner that understands the needs of businesses Mitsubishi Electric has extensive experience both in the manufacture of technical equipment, components or machines and software. Thousands of implementations during decades have allowed for the accumulation

Maintenance Portal can be built in stages, using those modules that will bring measurable benefits. Modularity and flexibility are inherent features of all Mitsubishi Electric's solutions.



of invaluable knowledge and the constantly developing methodology for product improvement has made it possible to adapt quickly to the needs of customers.

The company's answer to the needs of energy management are robotic, automated IT solutions which help with reducing costs and plant maintenance. They allow to interconnect multiple equipment units in dispersed locations into one coherent and efficiently managed system.

Innovative Maintenance Portal is a concept fully in line with Mitsubishi Electric's vision. It makes all information about the status of individual machines, production lines, factories and enterprises available in one place, using devices that can run a web browser and simple applications.

This solution takes advantage of the capabilities of the IIoT (Industrial Internet of Things) concept, i.e. collecting data from multiple sensors and components on each equipment unit and making it available on the network. Analysis and the use of data to control processes by edge-layer devices

are linked together with advanced techniques for analysing and collecting data in the cloud within the IT layer.

The basis of Maintenance Portal is a set of software tools belonging to the Iconics family. Among other things, they allow for detection of the causes of increased energy consumption, plan the operation of machines and equipment, and analyse information about failures and downtime.

A common feature of all the tools is an interface designed and optimised to provide comfort to its users, regardless of the device they are working on. The programmes can be operated from an operator panel, PCs, laptops, tablets and smartphones. A new feature is optimisation for smartwatches and other wearables.

The system simplifies the establishment of rules for accessing information and designing reports for employees at each level so that they have access to selected information that is necessary for working effectively and thus avoiding information noise and promoting the protection of company secrets.

ICONICS Suite

Real-time insight for operational excellence

Mitsubishi Electric is leveraging its experience in industrial automation equipment and data networking and is offering customers from the recycling industry unique solution, the ICONICS Suite.

In manufacturing plants using electrically driven equipment and automatic control, day-to-day control of machines and processes can be organised by connecting machines and systems through a data transmission network, supervised by a SCADA system.

This type of software is provided by a number of vendors and is designed to allow factory management from a single location. This is a natural and very beneficial way to supervise production in all plants where lines are either partially or fully automated. Mitsubishi Electric has expanded the versions offered by other vendors, equipping its solutions to efficiently manage production, industrial automation equipment, smart buildings, etc.

The software can be run at any level – from GOT operator panels built into machines (machine level), to PCs used to remotely manage equipment (line level), to factory or multi-site management systems.

Contents of ICONICS Suite

This cutting-edge software delivers real-time visualisation, mobility, analytics, and connectivity to deliver a contextualised view of enterprise operations for manufacturing, industrial automation, and smart buildings customers. The suite consists of four core components: SCADA software

GENESIS64, database software HYPER HISTORIAN, data analysis programmes including Energy AnalytiX®, Facility AnalytiX® and Quality AnalytiX®, and tools for IoT (Internet of Things) systems.

The basic modules of the suite include:

- **GraphWorX™** – graphic creation/visualisation
- **TrendWorX™** – real-time and historical trends
- **AlarmWorX™/AlertWorX™** – alarm visualisation/notification
- **WebHMI™/MobileHMI™** – remote monitoring on any smart device
- **EarthWorX™** – monitor widely dispersed assets
- **AssetWorX™** – asset management using hierarchical tree structure
- **GridWorX™** – database access
- **KPIWorX™** – dashboard creation
- **Workflow** – programming by flowchart
- **Workbench** – centralised project management
- **Converter-GOT** – GOT (HMI) screen conversion

ICONICS Suite – main objectives

Integration
Combining various devices, equipment and systems into a single integrating network using accessible protocols.



Contextualisation
The presentation of processed data in juxtaposition with additional information that facilitates its interpretation and use for management.

Utilisation
Utilisation of data for fault detection, performance evaluation, energy consumption studies - both at edge equipment level and information systems.

Visualisation
Covering all devices available on the market: from PCs and laptops to tablets, smartphones, smartwatches and more.

Customers who would like even more options can optionally equip the system with the following features:

- **Hyper Historian™** – high-speed/highly reliable data collection
- **BridgeWorX™** – transaction-based processing by flowchart
- **ReportWorX™** – automated reporting
- **Energy AnalytiX®** – visualisation and analysis of energy consumption
- **Quality AnalytiX®** – quality control
- **Facility AnalytiX®** – advanced fault detection and diagnostics (FDD) technology
- **CFSWorX™** – monitoring of field service workers and maintenance personnel
- **IoTWorX™** – IoT communication function for Cloud
- **Asset Builder** – process screen configuration support

The modular design of the suite makes it easy to compose a set of tools needed at a given time. A large number of modules and features cover the needs of most enterprises: from small plants to organisations with branches around the world.

ICONICS Suite's areas of operation

The suite was created with four primary goals in mind:

1. **Integration:** linking various devices, equipment and systems into a single integrating network using secure and accessible protocols;
2. **Contextualisation:** presentation of processed data against additional information that facilitates its interpretation and use for management;
3. **Utilitarianism:** the use of data for fault detection, performance evaluation, and energy consumption studies at both the edge device and information system levels;
4. **Visualisation:** covering all devices available on the market from PCs and laptops, to tablets, smartphones, smartwatches and more.

EcoAdviser software

An essential step towards energy saving

Reducing the amount of electricity used is possible and advisable in any manufacturing plant.

The effects of saving are noticeable especially where high-powered equipment is used, for example, electric motors, induction furnaces, etc. The recycling industry, whose multi-stage processes also require a large energy commitment, faces similar challenges. It is on the side of cost that money is saved, but must not disrupt work or reduce productivity.

The importance of analysing available data

A prerequisite for making good decisions is access to data which is up to date and the use of tools that make it easy to extract the information needed from the data. The larger the enterprise, the greater the number of electricity consumers and events involving them, the more difficult it is to find relationships between the condition of equipment, its configuration, load and energy consumption.

Developed by **Mitsubishi Electric**, EcoAdviser collects information from equipment fitted with the relevant interface, analyses it and presents it in the form of figures and graphics.

Either analysing raw data or using popular but non-automated tools such as spreadsheets, is not an optimal solution. These are labour-intensive, imprecise processes that carry the risk of overlooking important correlations between events and energy consumption. In an effort to address these main points, Mitsubishi Electric is offering its customers, including those in the recycling industry, a tool specifically designed to diagnose energy consumption.

EcoAdviser software

Developed by Mitsubishi Electric, EcoAdviser collects information from equipment fitted with the relevant interface, analyses it and presents it in the form of figures and graphics. The methodology adopted in its development assumes that the following factors have the greatest impact on energy consumption:

- 1. Equipment time-loss**
 - start-up: time-loss between production equipment start-up and production start
 - shut-down: time-loss between end of production and production equipment shut-down
- 2. Utility time-loss**
 - start-up: time-loss between utility start-up and production equipment start-up
 - shut-down: time-loss between production equipment shut-down and utility shut-down
- 3. Specific consumption between production start and end of production**

EcoAdviser software – basic functions



4. Production loss time rate – non-productive time ratio from production start to end of production

Basic features of EcoAdviser

- Automatic identification of energy-losses generated in production equipment
- Diagnosis factor of energy-losses
- Effect verification of energy saving measures
- Energy saving data analysis by utilising various graphs
- Remote monitoring by customised dashboard
- Creation of reports (daily, monthly and annual)
- Integrated energy monitoring and management of multiple locations

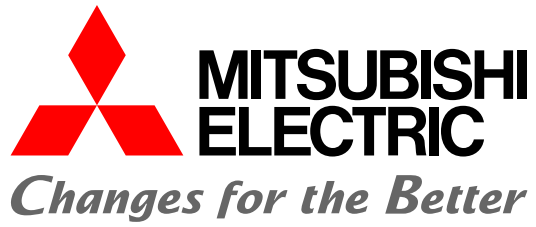
Maisart technology

A wide range of analysis utilises Maisart technology. It is a brand name of Mitsubishi Electric AI technology that stands for “Mitsubishi Electric’s AI creates the State-of-the-ART in technology” representing the company’s wish to make things “smart” with its unique AI technology.

Technological responsiveness

The customers of Mitsubishi Electric have repeatedly confirmed the usefulness of this tool in managing energy consumption. Mitsubishi Electric is constantly developing the tools to meet their expectations and needs. The ergonomics of using the software are being improved, report configuration capabilities are being expanded, the graphical interface is being customised, etc. The goal of all this work is to provide customers with low-cost, accessible and effective tools supporting the decision-making process for energy management.

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