

EcoAdviser

File Conversion Tool



Mitsubishi Electric Corporation

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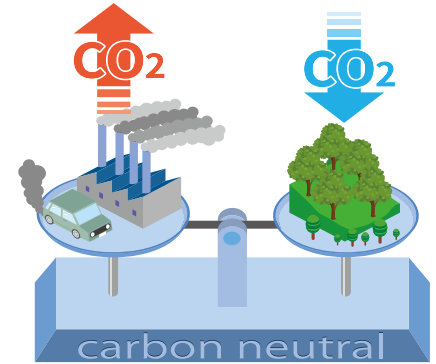
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What Does Carbon Neutrality Mean?

Carbon neutrality is the concept of curbing emissions of carbon dioxide and other greenhouse gases that cause global warming and preventing global warming by reducing the total amount of emissions minus the amount absorbed and removed to a net zero.



Company-Wide Efforts Are Necessary

Each company has set a high target based on the schedule for achieving carbon neutrality in each country. It will be difficult to achieve these goals if only a few people take measures. The entire company must work together to achieve the target.

In particular, **it is necessary to take measures to reduce CO₂ emissions at manufacturing sites**, which consume a high percentage of energy.



Mitsubishi Electric proposal:

Through our energy-saving support software

EcoAdviser

by visualizing CO₂ emissions at manufacturing sites and automatically analyzing energy loss using AI.

We support activities to reduce CO₂ emissions.

1.1 Common Concerns

Do you have this kind of problem?



We want to understand the CO₂ emissions and energy consumption of buildings, production lines, and equipment... Is there a tool that can easily visualize this?

EcoAdviser is the answer!

You can easily visualize CO₂ emissions and energy usage!

 See page 6



Do you have this kind of problem?



We are struggling to improve productivity while also reducing CO₂ emissions and energy consumption...

EcoAdviser is the answer!

You can correlate production volumes with energy to perform productivity analysis!

 See page 7



Do you have this kind of problem?



We measure the energy of our production equipment, but we don't utilize the data. Too busy to analyze the data...

EcoAdviser is the answer!

AI analysis and diagnosis functions reduce the time needed for data analysis!

 See page 8



Introduction of

EcoAdviser

Energy-Saving Support Software

2.1 Overview of EcoAdviser (2)

To improve productivity and reduce CO₂ emissions/energy consumption at the same time!

EcoAdviser is the answer!

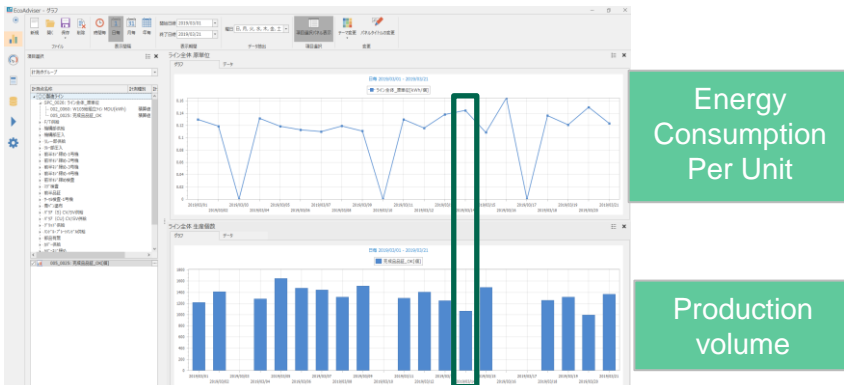
You can correlate production volumes with energy to perform productivity analysis!



Energy Consumption Per Unit management function

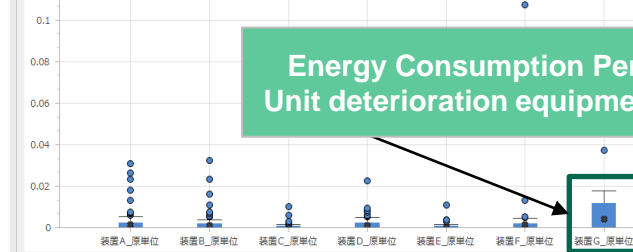
* Energy Consumption Per Unit = Electric energy/Production volumes

Identifying waste is easy by correlating production volumes with energy!



Energy Consumption Per Unit deterioration date and time

Energy Consumption Per Unit deterioration equipment



- By registering **Energy Consumption Per Unit measurement points***, you can visualize time-series trends and variations in Energy Consumption Per Unit for each piece of equipment.
* A maximum of 256 points can be registered.
- **Energy Consumption Per Unit calculation function for each product type and time period** can also be used for detailed CO₂ emissions management of production equipment.

Key point

CO₂ emissions and energy waste can be detected and, depending on the improvements made*, can lead to increased productivity.



* For example, improved set-up and reduction of standby power, etc.

2.1 Overview of EcoAdviser (3)

To reduce time spent analyzing energy loss data!

EcoAdviser is the answer!

AI analysis and diagnosis functions reduce the time needed for data analysis!



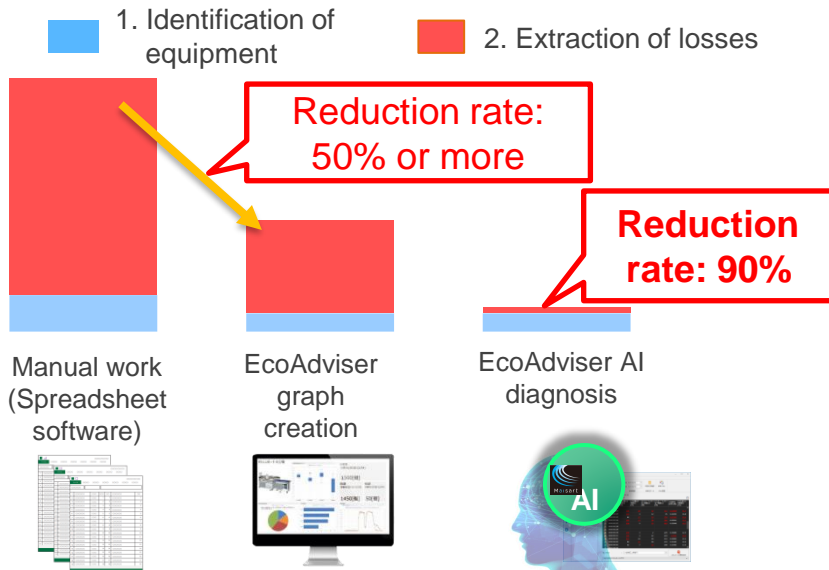
AI Analysis and Diagnosis Functions



Using AI to reduce time spent on energy-saving analysis work

Example of Mitsubishi Electric Fukuyama Works

Comparing the time needed to analyze one month's worth of data manually (spreadsheet software) versus EcoAdviser...



- Mitsubishi's AI technology Maisart can perform analysis and diagnosis focusing on the five key viewpoints of energy saving.* * Details on page 21
Energy loss is **automatically extracted using data on the amount of electric energy consumed and production volumes.**
- Based on information such as time of day, day of the week, and production volumes, **the factors causing losses are ranked** by factor diagnosis and presented together with the expected improvement effects.

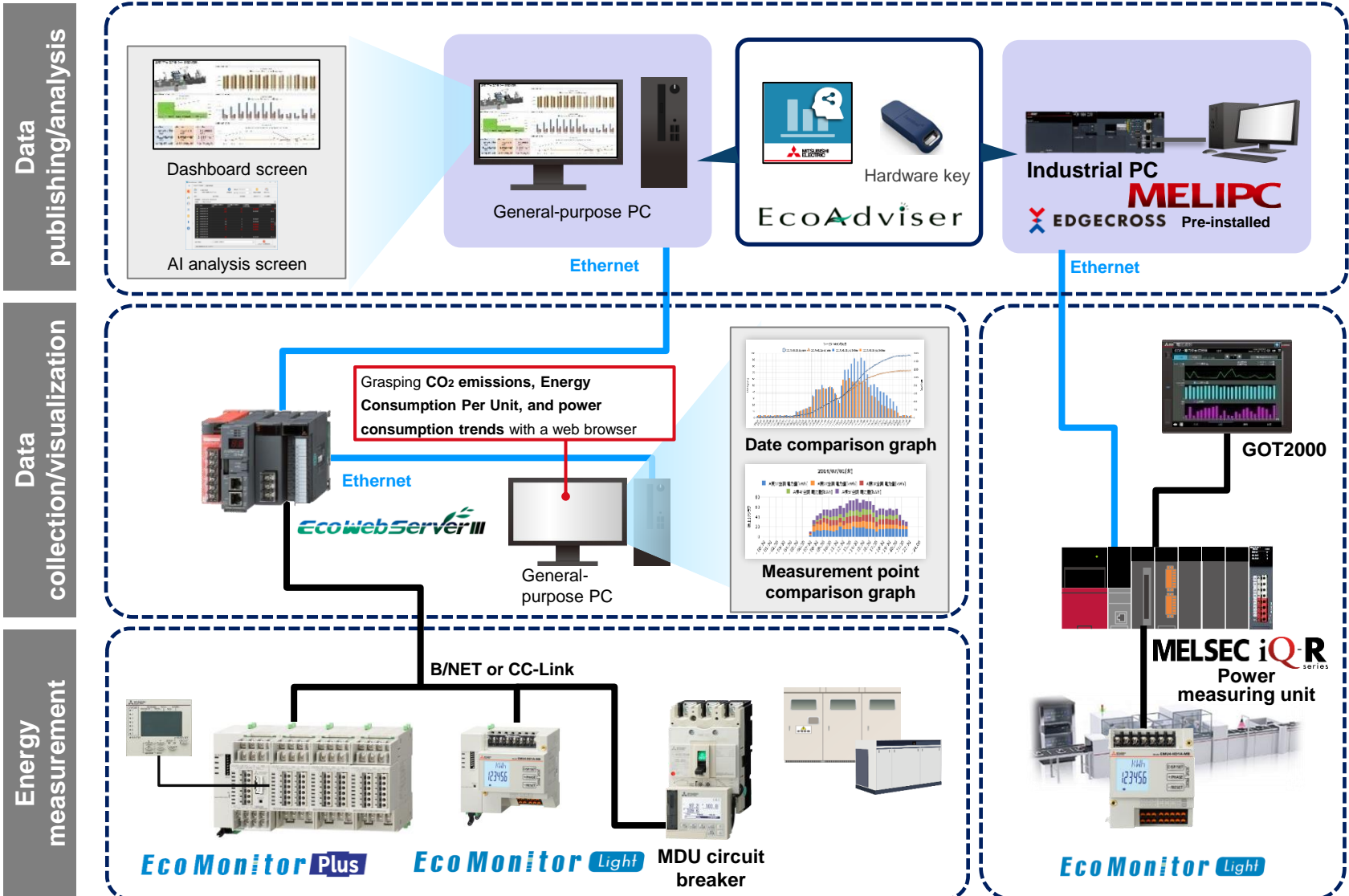
Key point

Since the AI analyzes the data, it can even diagnose hidden losses that people missed due to incorrect assumptions and other causes!



2.2 System Configuration Example

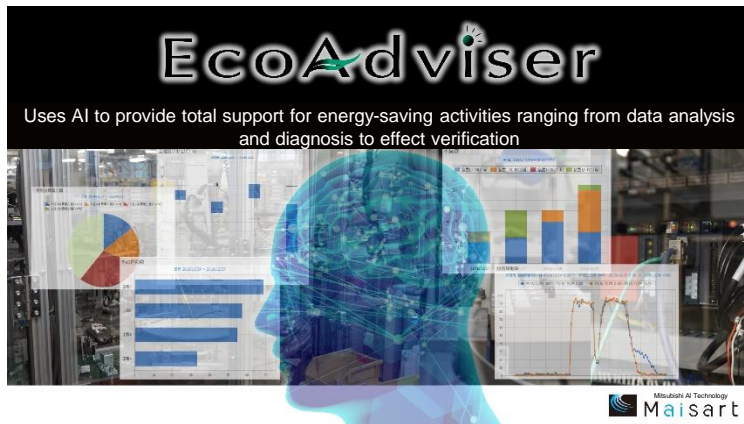
Example system configuration when EcoAdviser automatically updates measurement data



Lineup of software to meet your needs

Energy-saving data analysis and diagnosis software

MES3-EAP1-**AI**

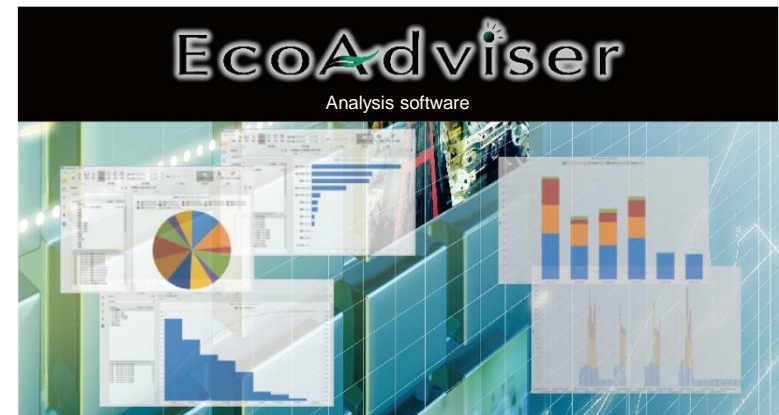


Key features

- Analysis graph creation
- Dashboard creation
- Report creation
- **Energy-loss identification**
- **Energy-loss factor diagnosis**
- **Effect verification of energy-saving measures**

Energy-saving data analysis software

MES3-EAP1-**DA**



Key features

- Analysis graph creation
- Dashboard creation
- Report creation

Introduction of

EcoAdviser

File Conversion Tool

3. Introduction of EcoAdviser File Conversion Tool

Do you have any of these problems?



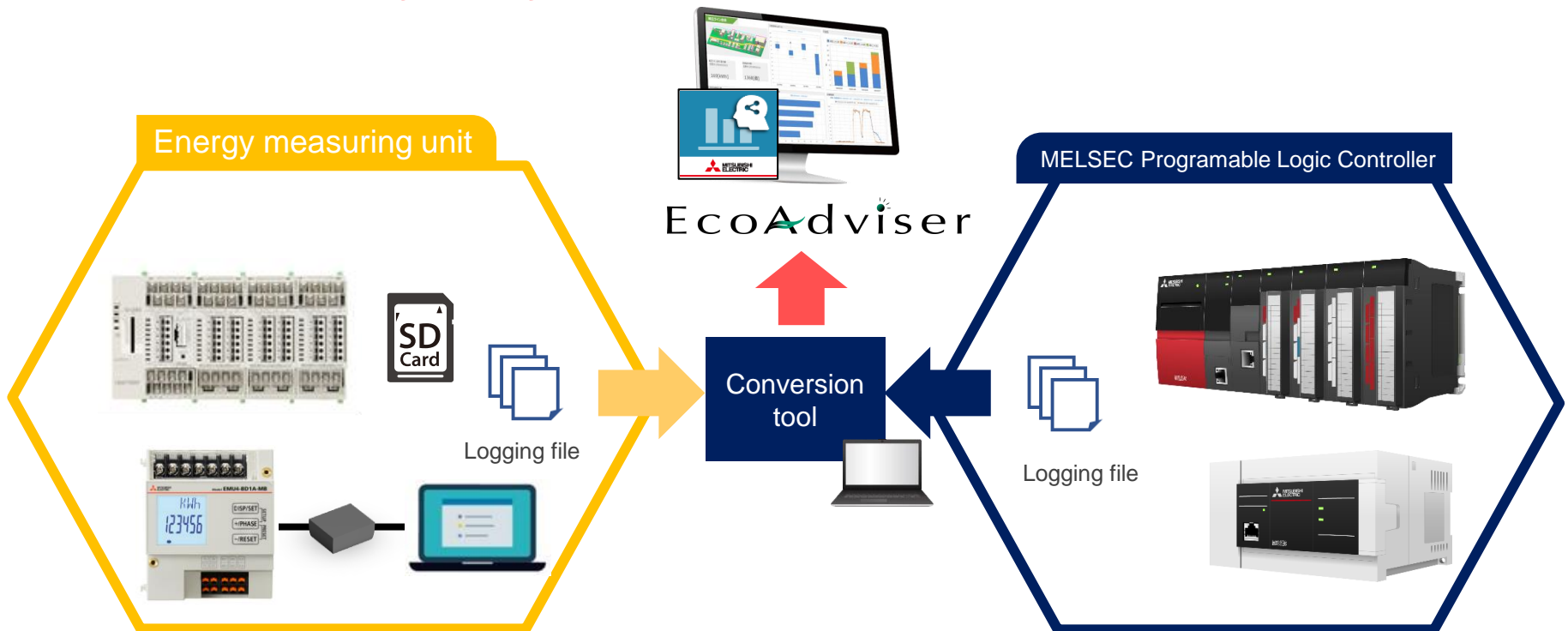
I need to build a system to use EcoAdviser...
I want to get started easily...

Here's what makes you happy

The conversion tool let you use EcoAdviser with smaller equipment configurations!



Logging files from the logging unit and data acquisition software for EcoMonitor energy measuring units and from MELSEC Programmable Logic Controllers can be **converted, collected, and analyzed by EcoAdviser!**



3.1 Data Conversion Flow

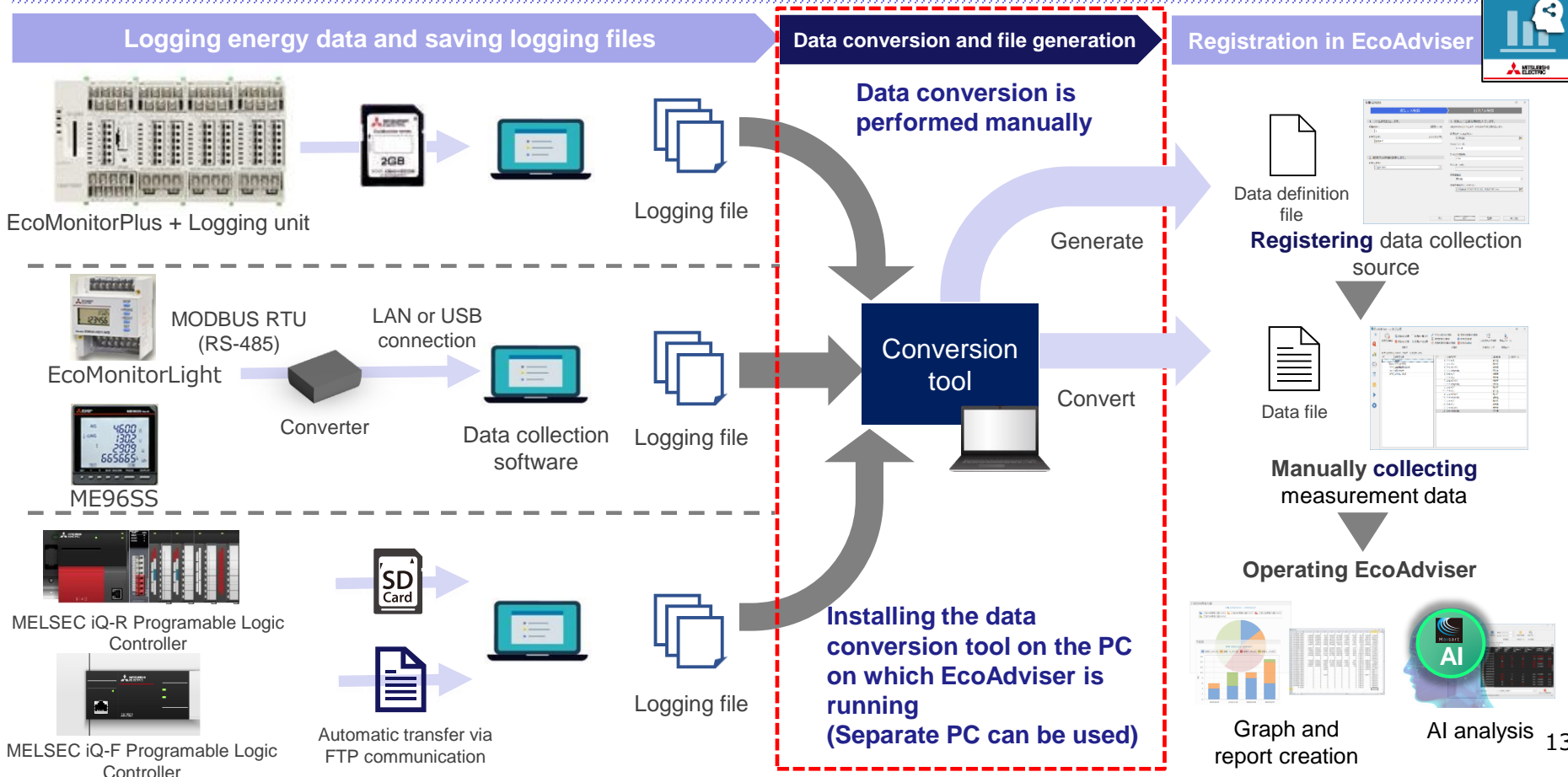
What is the EcoAdviser file conversion tool?

This **free software** converts logging files generated by EcoMonitor units and MELSEC Programmable Logic Controllers into a **data format that can be imported by EcoAdviser**, and also generates the definition files needed for configuration.



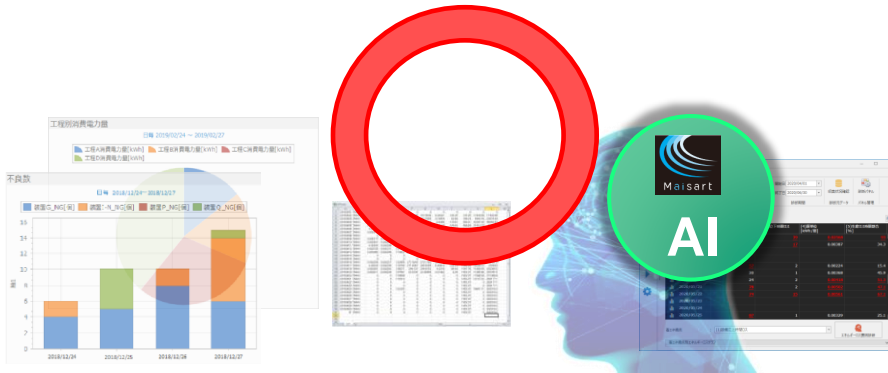
This software can be downloaded and used free of charge from the Mitsubishi Electric FA website.
<https://www.mitsubishielectric.com/fa/download/software/search.page?mode=software&kisyu=/ems>

Data conversion examples



3.2 Operation Method

With the file conversion tool, file conversion and data collection in EcoAdviser are manual operations, which is suitable for **periodic analysis of CO₂ emissions and energy loss, and for creating reports.**



Graph and report creation

AI analysis

With this data conversion tool, after manual collection of data, you can **understand the current situation by visualizing CO₂ emissions and energy, and analyze energy losses of production equipment using AI.**

Key point

Too busy to analyze energy data every day, but want to start analyzing it at a reasonable frequency (about once a month)? This is the recommended solution for you.



Dashboard (automatic update)

Since using this data conversion tool is a **manual operation**, it is not recommended for use in dashboard displays that require automatic updates.

If you want to update data automatically, please consider building a system using an energy-saving data collection server or Edgecross.

System configuration examples are shown on page 9.

3.3 Usage Considerations

CSV files created with the supported models listed below can be converted to a file format that can be imported by EcoAdviser.



EcoAdviser's AI diagnosis function analyzes energy usage and production volumes in one-minute cycles, so logging data in one-minute cycles is required.

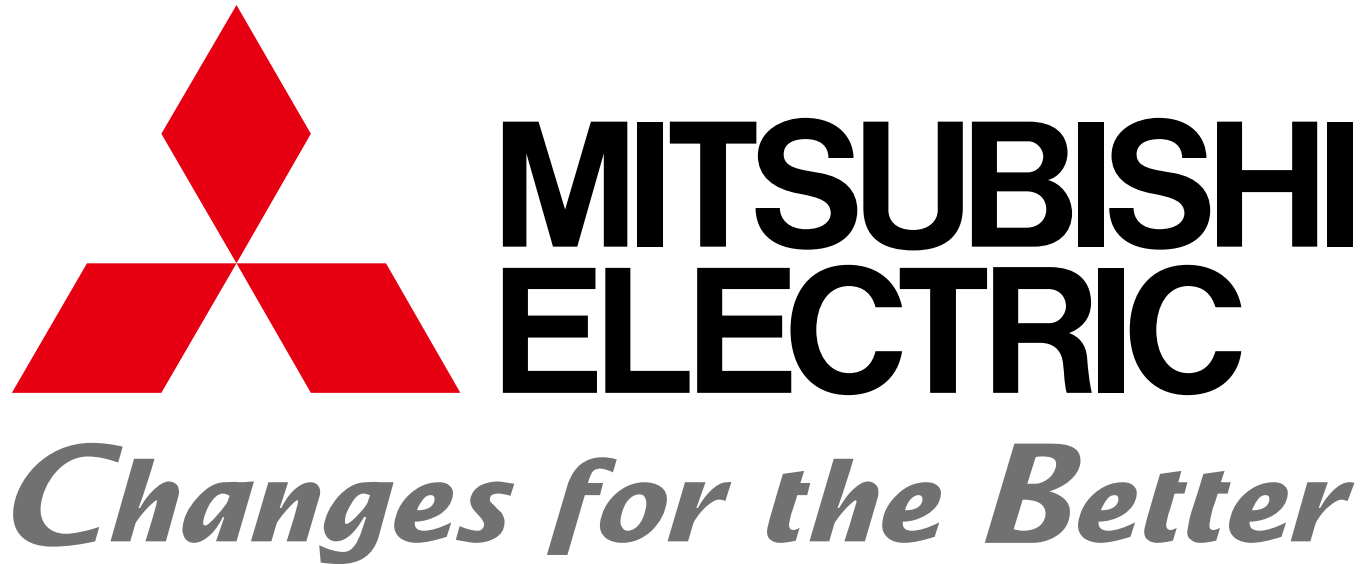
Supported models/logging files

	Model	Logging cycle	Compatibility with EcoAdviser (●: Compatible, —: Not compatible)	
			Graph and report creation	AI diagnosis
EcoMonitor related	Logging unit	1 minute	—	●
		15 minutes/30 minutes/1 hour	●*1	—
	Data collection software	1 minute	●*2	●
		1 hour	●	—
Programmable Logic Controller related	MELSEC iQ-R Series MELSEC iQ-F Series MELSEC-L Series MELSEC-Q Series	1 minute or less	●*2	●*3
		More than 1 minute	●*2	—

*1 The EcoAdviser data cycle setting and logging cycle must correspond.

*2 EcoAdviser will extract and collect data according to the EcoAdviser data cycle setting.

*3 EcoAdviser extracts and collects data in 1 minute cycles.



Supplement a. Conversion tool—Compatible MELSEC Programmable Logic Controller series/logging files

Series	Logging file
MELSEC iQ-R Series	CSV files or Unicode text files logged by the data logging function of the CPU module
	CSV files or Unicode text files logged by the high speed data logger module
MELSEC iQ-F Series	CSV files logged by the data logging function of the CPU module
MELSEC-L Series	CSV files logged by the data logging function of the CPU module
MELSEC-Q Series	CSV files logged by the data logging function of the CPU module (QnUDVCPU)
	CSV files logged by the high speed data logger module

Supplement a. Conversion tool—Restrictions (1)

Logging unit

Item	Restrictions	Logging file
Data date and time	Duplicates not allowed	If the same date and time of data exist in one file, conversion is possible, but data cannot be collected by EcoAdviser.

Data collection software

Item	Restrictions	Logging file
Data name	Max. 30 characters	If the maximum number of characters is exceeded, conversion is possible, but measurement points cannot be registered in EcoAdviser.
Data date and time	Duplicates not allowed	If the same date and time of data exist in one file, conversion is possible, but data cannot be collected by EcoAdviser.

MELSEC Programable Logic Controller

Item	Restrictions	Logging file
Number of records in one file	Max. 36,000 records	If the maximum number of records is exceeded, conversion is possible, but data cannot be collected by EcoAdviser.
Number of logging items in one file	Max. 256 items	If the maximum number of items is exceeded, conversion is possible, but measurement points cannot be registered in EcoAdviser.
File name	8-digit hexadecimal sequential number must precede the extension	Files that do not have an 8-digit hexadecimal sequential number portion before the extension are not eligible for conversion.

Supplement a. Conversion tool—Restrictions (2)

MELSEC Programmable Logic Controller

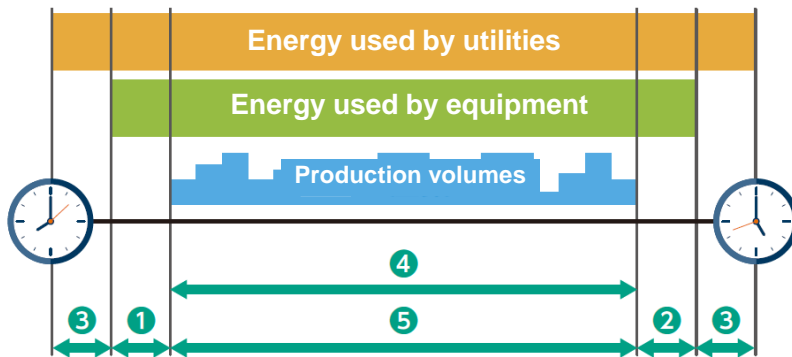
Item	Restrictions	Logging file
Data type	Only the following can be converted: BIT, USHORT, SHORT, ULONG, LONG, FLOAT, DOUBLE	Data types that cannot be converted are output without conversion. Cannot be registered as a measurement point in EcoAdviser.
Data name	Max. 30 characters	If the maximum number of characters is exceeded, conversion is possible, but measurement points cannot be registered in EcoAdviser.
	Duplicates are not allowed	If data names are duplicated, conversion is possible, but data cannot be collected by EcoAdviser.
Data date and time	Output of data date and time columns is required	If a data date and time column is missing, a conversion error will occur.
	Duplicates are not allowed	If the same date and time of data exist in one file, conversion is possible, but data cannot be collected by EcoAdviser.
Header lines	Output of file information line, data type information line, and data name line is required	If there is no file information line, data type information line, or data name line, a conversion error will occur.
Integration value type	Indicated value	In case of difference value, EcoAdviser may not be able to collect it correctly.



How does the AI diagnosis function work?

The Maisart AI technology automatically extracts energy losses from data on electric energy and production volumes by focusing on the **five key viewpoints of energy saving**, which are based on Mitsubishi Electric know-how cultivated over many years.

What are the five key viewpoints of energy saving?



- ① **Equipment start-up time loss**
Time from production equipment start-up to production start
- ② **Equipment shut-down time loss**
Time from production end to production equipment shut-down
- ③ **Utility* time loss**
 - **Utility start-up time loss**
Time from utility start-up to production equipment start-up
 - **Utility shut-down time loss**
Time from production equipment shut-down to utility shut-down
- ④ **Energy Consumption Per Unit**
Energy Consumption Per Unit from production start to production end
- ⑤ **Production loss time ratio**
Non-production time ratio from production start to production end

* Ancillary equipment that operates in conjunction with production equipment (exhaust fans, mist collectors, compressors, etc.)

* To extract ①, ②, ④, and ⑤, it is necessary to collect production volumes. (① and ② can also be extracted based on the difference from the set working hours)

* Utilities are air conditioning, lighting, compressors, etc. related to the production equipment. (It is also possible to define them as ancillary equipment related to the production equipment.)

* If the number of decimal places in the electric energy data is small and energy loss is not calculated correctly, it is necessary to collect data with a **higher resolution** by making the electric energy data **more detailed (detailed electric energy, etc.)**.



Are there any cautions to be observed when using the AI diagnosis function?

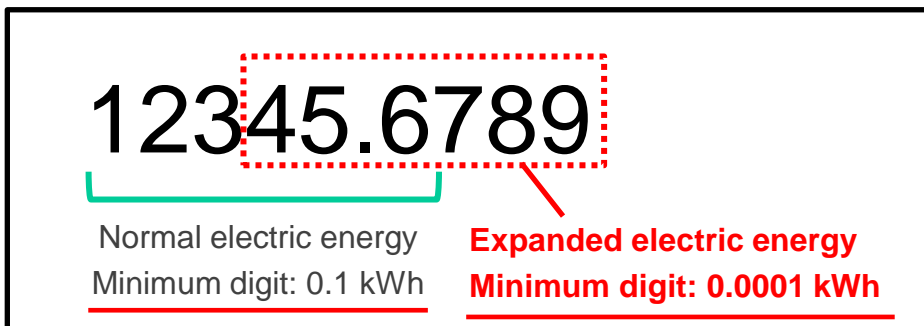
For AI analysis, expanded electric energy (detailed electric energy) data is required as a measurement item.

When checking the electric energy in circuits with small electrical capacities, the value may hardly change.

To solve this problem, some measurement terminals have a value of electric energy called **expanded electric energy***

By using this **expanded electric energy**, it is possible to check **detailed fluctuations** in power usage, which allows AI analysis to be conducted more effectively.

* Some measurement terminals call this detailed electric energy.



Example of expanded electric energy

Supplement b. EcoAdviser—AI analysis when production volumes cannot be collected (1)



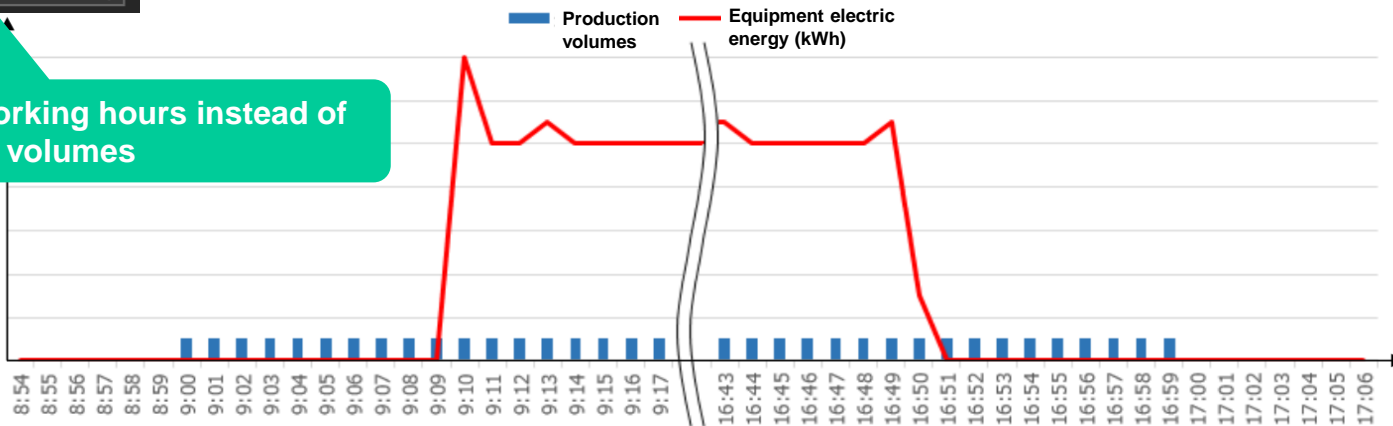
It is difficult to collect production volumes in a timely manner. Is there another way?

AI analysis is possible* with only **working hour settings** and **the electric energy of the equipment to be analyzed**.

* Analysis of the Energy Consumption Per Unit and production loss time ratio from the five key viewpoints of energy saving is not possible.

Start time : 09:00
End time : 17:00

Register working hours instead of production volumes



Start time Equipment ON

Equipment is turned on 10 minutes after the start time

Equipment start-up time loss = -10 minutes

Equipment OFF End time

Equipment is turned off 10 minutes before the end time

Equipment shut-down time loss = -10 minutes

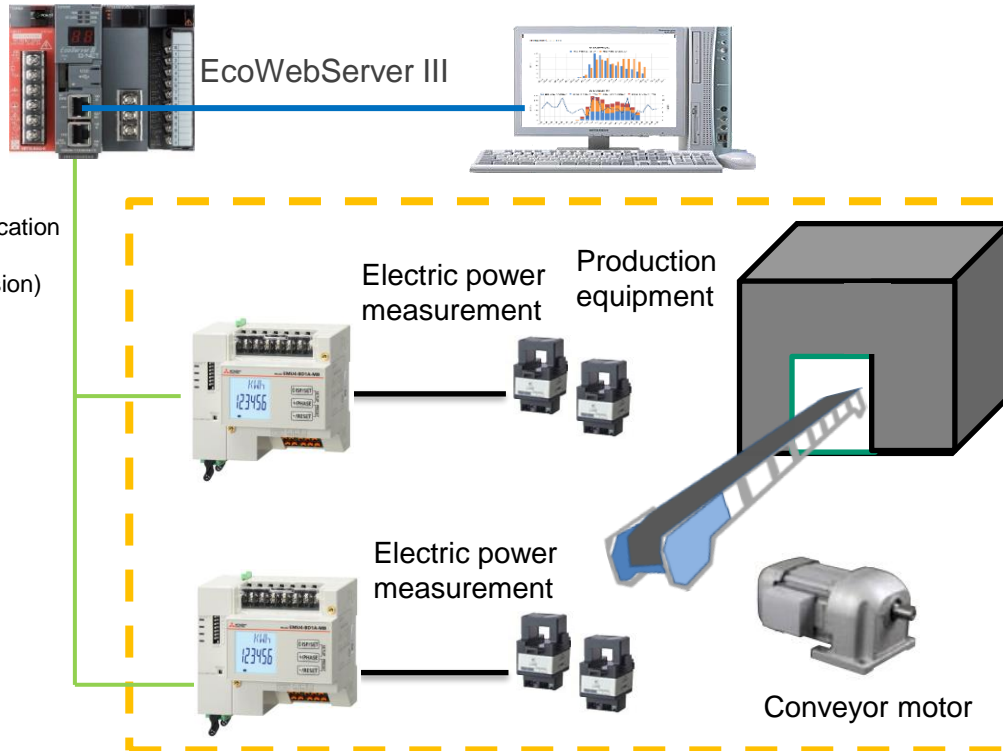


It is difficult to collect production volumes in a timely manner. Is there another way?

If production volumes cannot be collected, the energy consumption of equipment that automatically starts and stops only during production can be used as an indicator of production.

(Example) Electric energy of a conveyor that is operated only when material is fed by a sensor

Electric energy of robots and servo motors that are controlled to operate only during production, etc.



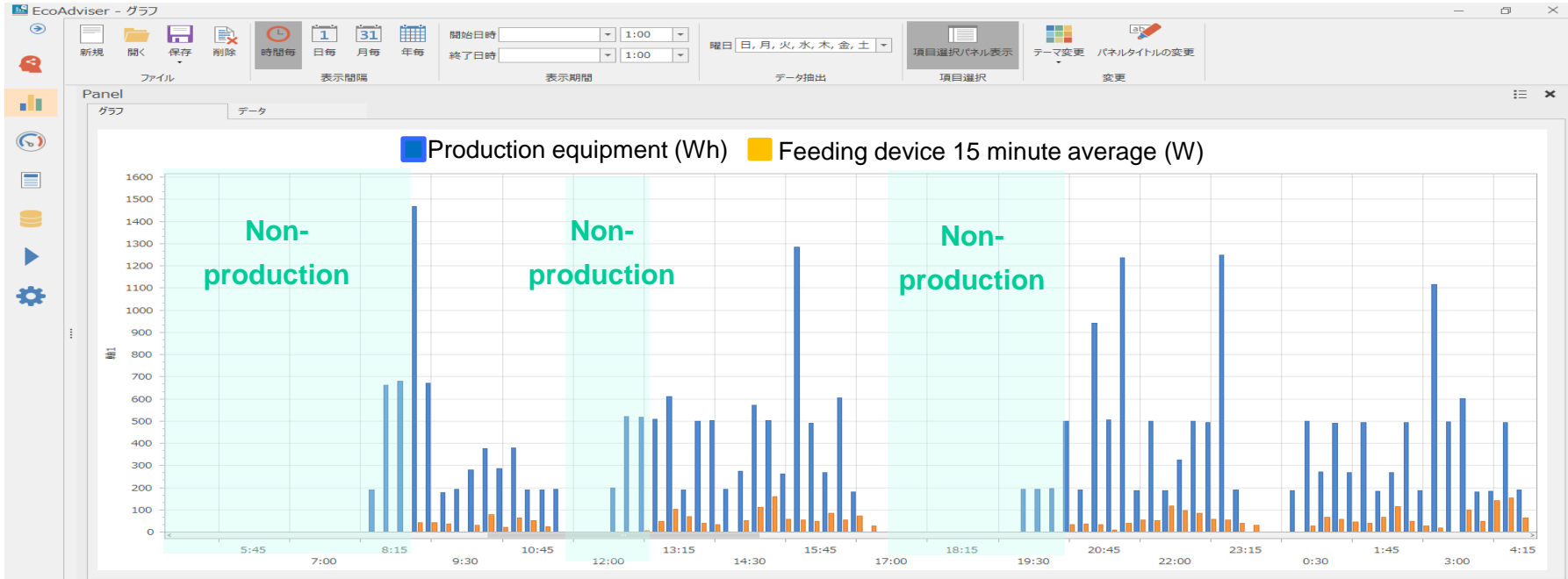
Feeding device is feeding material
→ **Electric power consumed is used for production**

Feeding device is not feeding material
→ **Electric power consumed is not used for production**

* Set the interval for calculating the average electric power to match the tact time of the feeding device.

Next page



Example of EcoAdviser screen



Key points of analysis:

Focus on the operating status of production equipment during non-production

⇒ Able to grasp the start-up and shut-down loss of equipment

グラフ	日付	(1)設備立上時間ロス [分]	(2)設備立下時間ロス [分]	(3-1)ユーティリティ立上時間ロス [分]	(3-2)ユーティリティ立下時間ロス [分]	(4)原単位 [Wh/Wh]	(5)生産ロス時間割合 [%]
	2022/0...	49	16			8.4893	14.7
	2022/0...	128	41			6.92077	3.7
	2022/0...	100	0			7.28412	4.5
	2022/0...	88	0			7.9818	12.9
	2022/0...	10	0			9.03154	0
	2022/0...	70	0			6.9081	5.5

Automate loss extraction with EcoAdviser to reduce analysis time



Does reducing electricity use lead to a reduction in CO₂ emissions?

Calculation of CO₂ emissions

In order to set specific CO₂ emission reduction targets, it is necessary to calculate CO₂ emissions and understand the current situation.

To calculate CO₂ emissions, it is necessary to use a calculation method that mirrors the actual situation as closely as possible.

CO₂ emissions from electric power = **Electric energy consumption** × **CO₂ conversion factor**

[t-CO₂]

[kWh]

[t-CO₂/kWh]

• Energy-saving

- Self-consumption type renewable energy (solar, wind, etc.)
- Green/Blue hydrogen fuel cells
- Binary power generation, etc.

- Renewable energy
- Thermal power generation with CCUS
- Hydrogen/ammonia power generation
- Methanation
- Small nuclear power generation (SMR)
- Microgrid
- VPP control, etc.