for a greener tomorrow

MITSUBISHI ELECTRIC
Changes for the Better

FACTORY AUTOMATION

# Energy Saving Support Software

## EcoAdviser

**Support tool for energy saving activities equipped with AI technology.**

iQ Edgecross


Maisart

EDGECROSS

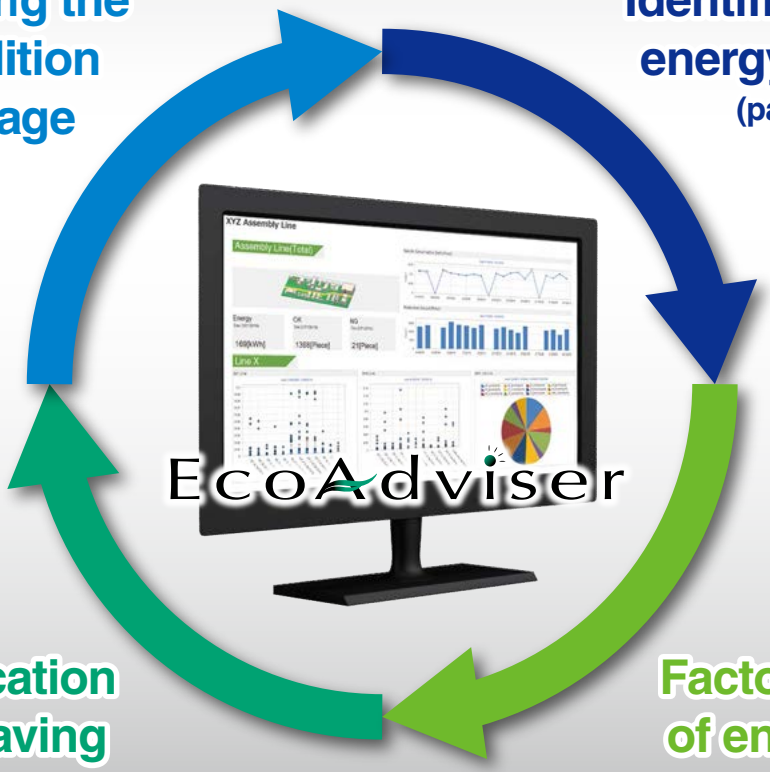
## Energy Saving Support Software

# EcoAdviser

**Equipped with the AI technology of Mitsubishi Electric "Maisart", the system provides total support for energy saving activities from understanding the current condition, identification/factor diagnosis of energy-losses to effect verification of energy saving measures.**

**Understanding the current condition of energy usage**
(page 7)

**Identification of energy-losses**
(page 4)

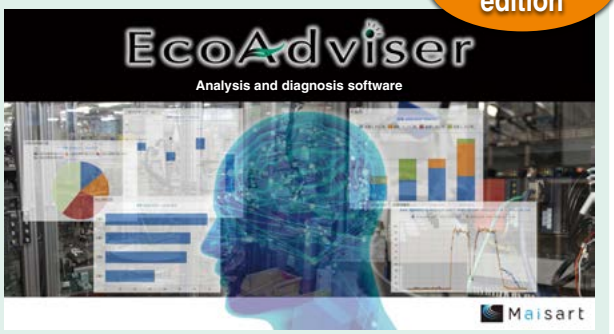



**Effect verification of energy saving measures** (page 6)

**Factor diagnosis of energy-losses**
(page 5)

In addition to simple visualization of accumulated collection data, it contributes to the realization of effective energy saving activities by AI function such as energy-losses identification and factor diagnosis.

AI diagnosis edition




## Energy saving data analysis and diagnosis software

**Model:**

# MES3-EAP1-AI

### Key features

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

It is possible to grasp the current condition by creating graphs and reports for analysis based on accumulated collection data.

Function limited edition


## Energy saving data analysis software

**Model:**

# MES3-EAP1-DA

### Key features

- Analysis graph creation
- Dashboard creation
- Report creation

What is Maisart ?

"Maisart" 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 our wish to make things "Smart" with our unique AI technology.

# 1 Automatic identification of energy-losses generated in production equipment (AI diagnosis edition only) Maisart

• By using Mitsubishi Electric's original five points energy saving methodology, the EcoAdviser can quantitatively identify and indicate daily energy-losses.

**Solutions**

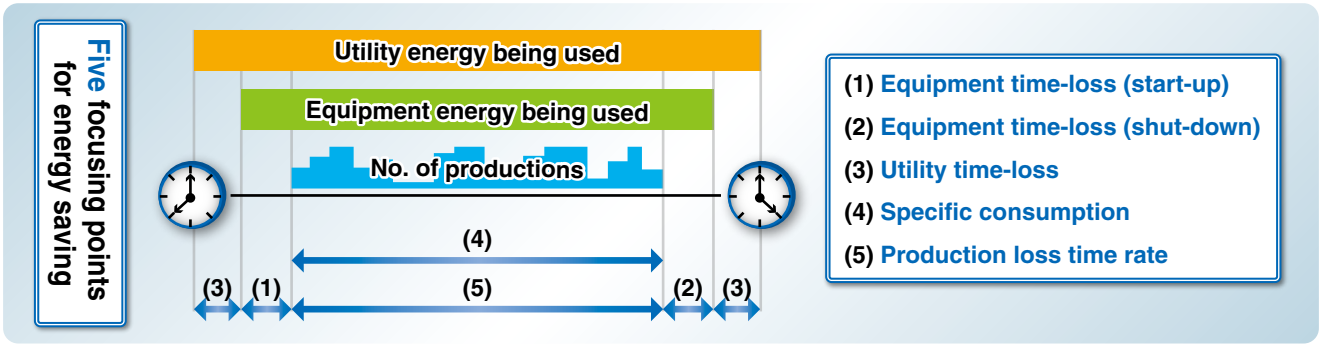
- **To quantitatively understand where energy-losses are generated.**
- **To grasp the energy-losses caused by too early starting-up of the equipment and forgetting to turn it off.**
- **To automatically calculate the energy specific consumption and production operating rate of the equipment.**

## What are the "Five focusing points for energy saving" of Mitsubishi Electric's knowhow?

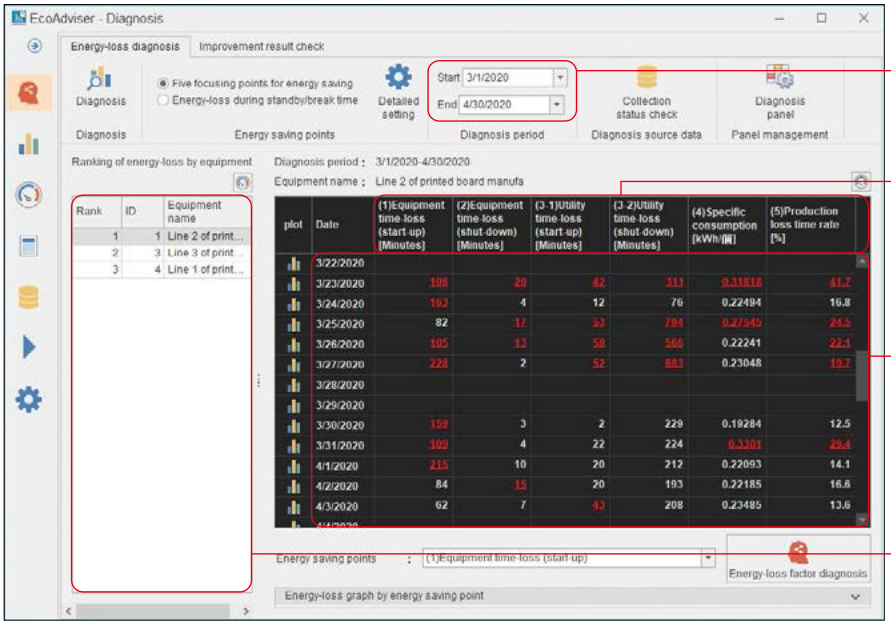
**(1) Equipment time-loss (start-up)** ..... Time-loss between production equipment start-up and production start
**(2) Equipment time-loss (shut-down)** ..... Time-loss between production end and production equipment shut-down
**(3) Utility* time-loss**
- **Utility time-loss (start-up)** ..... Time-loss between utility start-up and production equipment start-up
- **Utility time-loss (shut-down)** ..... Time-loss between production equipment shut-down and utility shut-down

**(4) Specific consumption** ..... Specific consumption between production start and production end
**(5) Production loss time rate** ..... Non-productive time ratio from production start to production end

*Ancillary equipment operated in conjunction with main production equipment (Example: Exhaust fan, Mist collector, Air compressor, etc.)




## [Energy-loss diagnosis screen]




**■ Diagnosis period**
Select a diagnosis period to identify energy-losses.

**■ Five focusing points for energy saving**
Daily energy-losses are displayed for each of significant five focusing points for energy saving.

**■ Energy-losses identification screen**
Daily energy-loss time (Unit: minutes), specific consumption, and production loss time rate are displayed together, and days when energy-losses are larger than usual are highlighted.

**■ Ranking display**
Automatically display in order of energy-loss amount with ranking style.

# 2 Energy-losses factor diagnosis
## (AI diagnosis edition only)

Maisart

• Items that have a correlation as the generation factor of energy-losses are shown as a ranking, and they are presented along with the expected improvement effects.

**Solutions**

- **To find a trend that energy-losses are generated and come up with measures.**
- **To specify time, day of the week, and production items related to energy-losses.**
- **To determine the priority of energy saving measures.**

## What is "Energy-losses factor diagnosis"?

It indicates the significant items related to date when energy-losses are higher than usual.

**Diagnosis results**

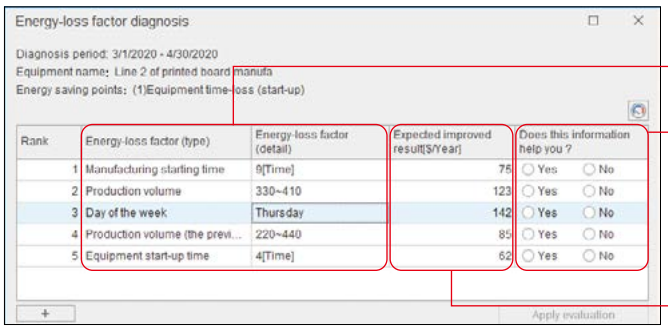
- ▶ **Example "Thursday"**
- ▶ **Start-up was 4 AM**
- ▶ **The day's number of productions is 250**

**Based on the diagnosis results, fact verification is performed, and specific measures can be taken.**

**Measures based on diagnosis results**

**"Thursday"** ⇒ **Review the start-up/shut-down time of the equipment.**
**"4 AM"** ⇒ **Call attention to reduce unnecessary early morning start-up.**
**"250 pieces"** ⇒ **Since energy-losses are large on the date with a few number of productions, review the production plan.**

### [Energy-loss factor diagnosis result screen]




**■ Energy-losses factor diagnosis**
AI is used to automatically judge the factors that have a significant correlation with energy-losses, and they are displayed in the ranking style. (Day of the week, starting-up time, production volume, etc.)

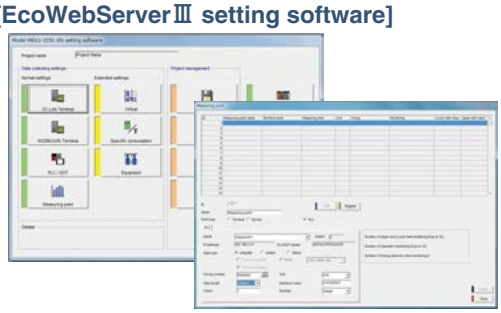
**■ Evaluation of diagnosis results**
Reflect the user evaluation on the diagnosis results afterwards. The items that Yes is selected are likely to be displayed on the top range.

**■ Expected improvement result**
Automatically calculate the expected improvement result and show the result by amount.

**<For customers who do not conduct production information collection>**

The production information in the Mitsubishi PLC can be transferred to EcoWebServer Ⅲ easily by using the setting software of EcoWebServer Ⅲ.


**[EcoWebServer Ⅲ setting software]**



For details, please refer to the EcoWebServer Ⅲ operation manual (Settings Edition).

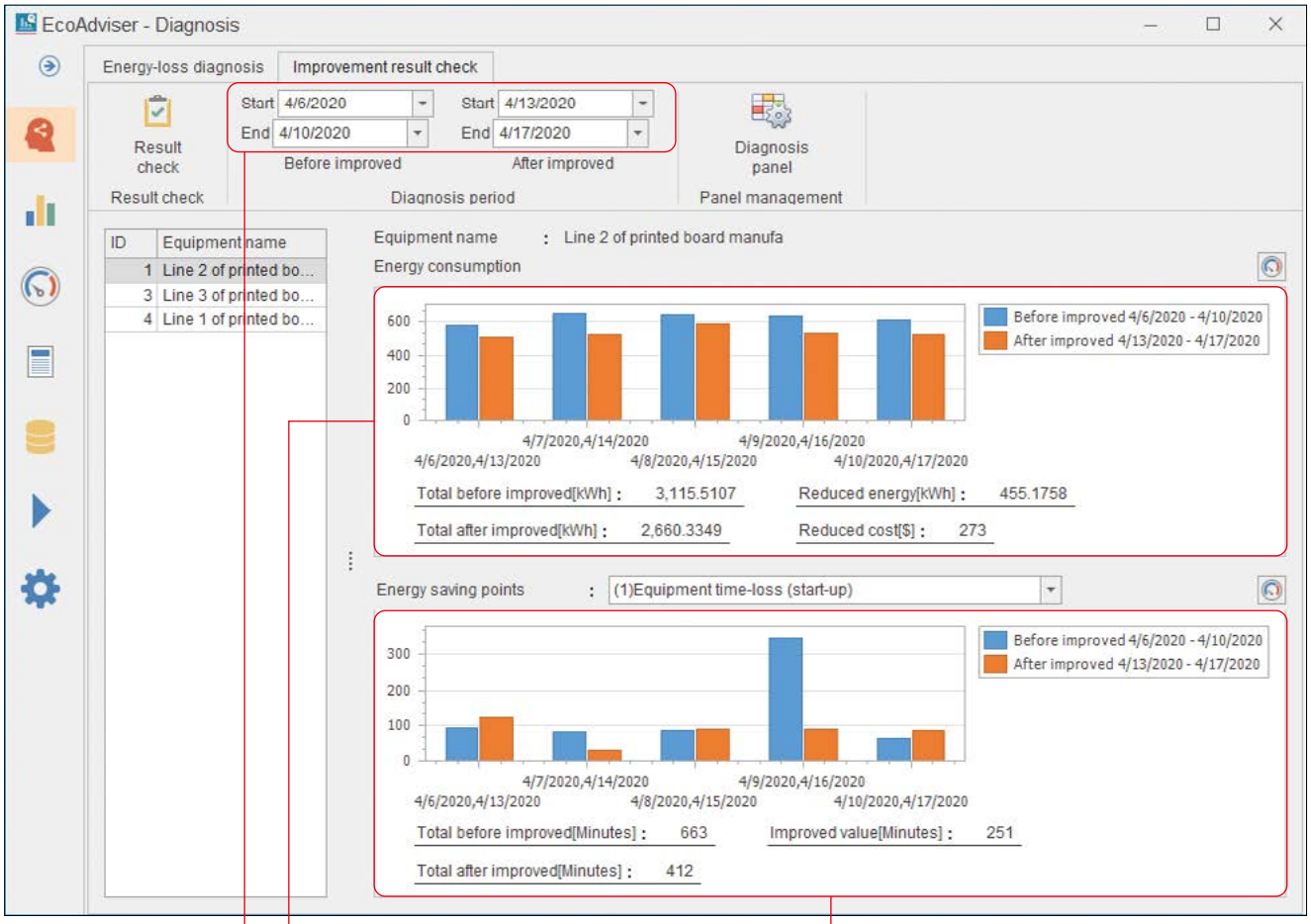
# 3 Effect verification of energy saving measures (AI diagnosis edition only)

- Just by selecting a period before and after improvement, the power usage amount, electricity rate, and energy-losses before and after improvement can be easily verified.

**Solutions**

- **To reduce the time to summary the data in order to understand the effects of the energy saving measures implemented.**
- **To conduct verification and review of energy saving measures, and achieve continuous activities.**
- **To report the results of energy saving activity with quantitative data.**

**[Effect verification screen before and after taking energy saving measures]**




**■ Improvement effect of energy consumption and reduction price amount**
Comparison based on energy consumption and price is possible.

**■ Diagnosis period**
Effect verification is possible just by selecting the period before and after improvement.

**■ Improvement effects in the energy saving perspectives**
Able to compare energy-losses of the selected energy saving points.

# 4 Energy saving data analysis by utilizing various graphs

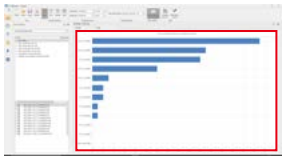
• Selectable from 7 types of graphs depending on analysis purpose

Energy analysis phase

### Understanding the present situation: Visualizing the energy comsumption of each production process

As ordering display and percentage display are possible in addition to time series, the data can be utilized for priority ordering of energy saving.

(1) Pie chart

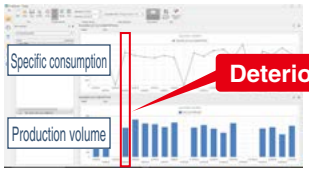


(2) Rank chart

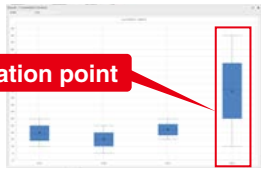
**Ranking chart helps users to identify the bottleneck process.**

### Specific consumption management: Monitoring energy consumption in relation to production volume

By managing with energy specific consumption which a number of productions is taken into account, identify the equipment and hours that are hurting the productivity.




(3) Time series chart

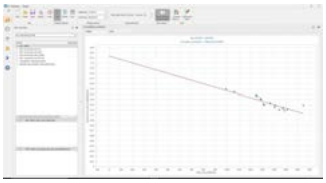


(4) Box plot

**EcoAdviser helps users to identify the deterioration point of production efficiency. It assists users to find equipments or operation where KAIZEN is required.**

### Find out correlation

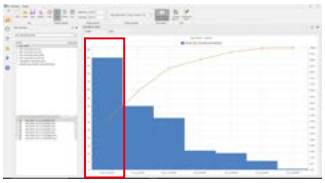
Understanding the present production efficiency by checking the correlation between production volume and energy consumption.



(5) Scatter plot

### Check error records

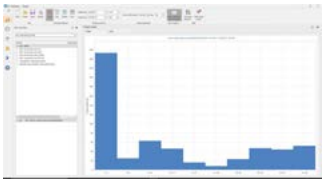
Understanding the error content to be dealt with.



(6) Pareto chart

### Setting threshold and target

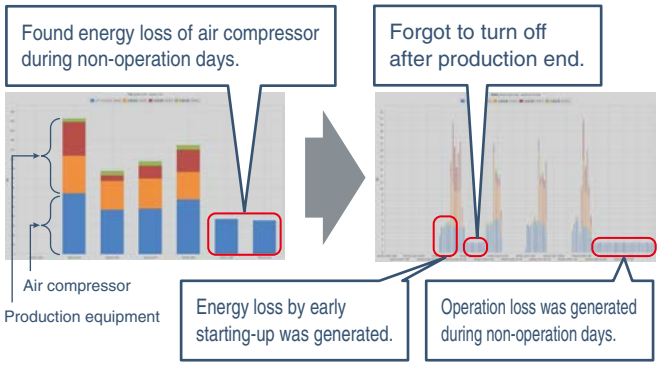
Determine the threshold or target value by understanding the distribution of collected data.



(7) Histogram

## [Case study (1)] Energy-losses finding of air compressor

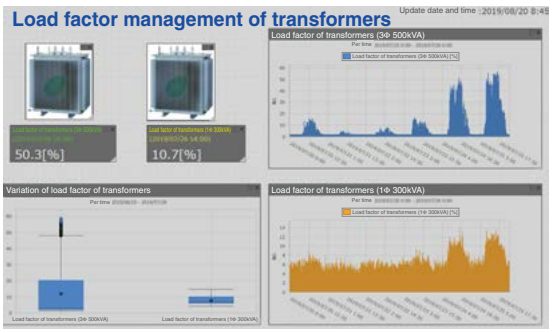
1. Verify the energy consumption of production equipment and air compressor per day.
2. Perform detail verification with the data by one hour graph.




**⇒Conduct operation improvement of air compressor to reduce loss, and actualize energy saving!**

## [Case study (2)] Management of transformer load factor

Perform the load management of transformer to grasp the residual force of the transformer. Utilize for daily safety management.



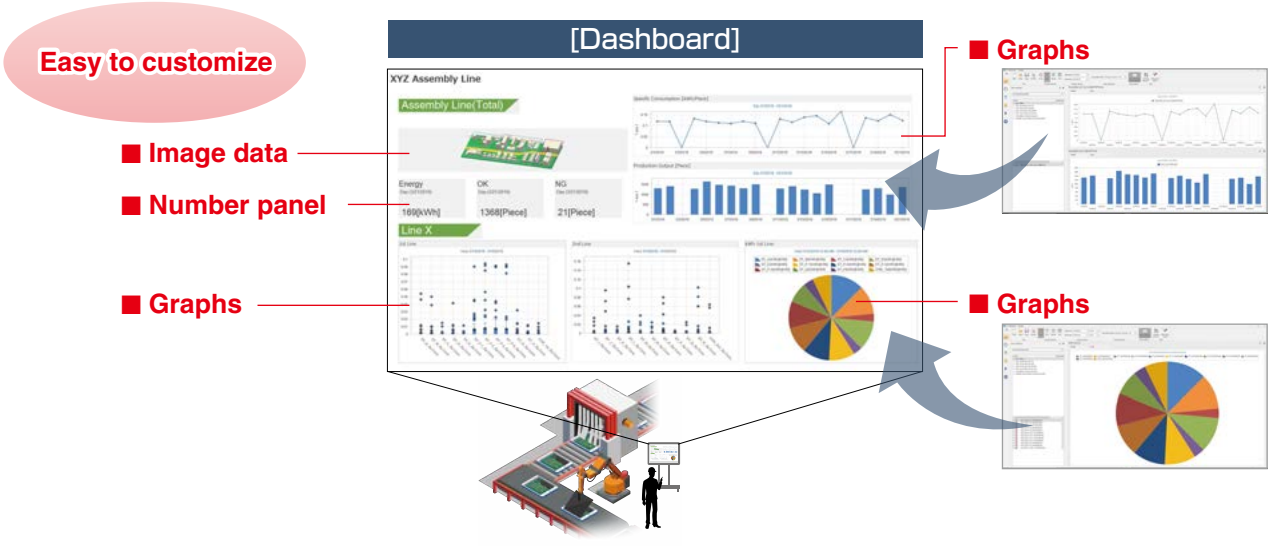

**⇒Utilize for equipment installation plan in the future and amount selection when updating the transformer.**

# 5 Remote monitoring by customizable dashboard.

• It is possible to paste the created graphs and results of energy-loss factor diagnosis (page 5) on the dashboard and save the data. Also, by setting a Web server on PC, it can be utilized as the visualization tool of the field.

**Solutions**

- **To show the dashboard at the production site and office to improve the energy saving awareness of the employees.**
- **To monitor energy information and transformer load remotely to reduce the time to go to the site.**




## [Dashboard creation example]

### For building and office

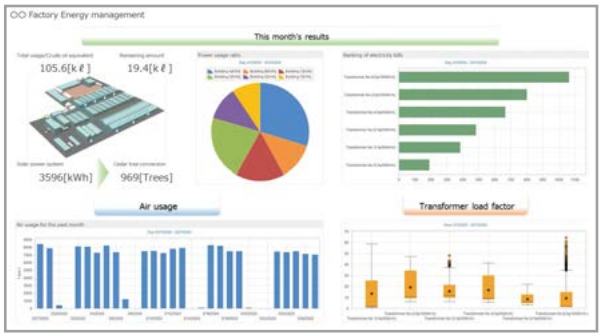
**Suitable for increasing energy saving awareness of employees!**

**List of dashboard contents**

1. Image of the building
2. Target energy consumption (Rate conversion)
3. Current electricity rate
4. Power usage ratio for each floor
5. Electricity rate ranking per 1 m²
6. Power usage ratio for each load
7. Power usage trend graph for each load

### For factory

**Remote monitoring of usage condition of utility equipment. Remote monitoring is possible with teleworking.**



**List of dashboard contents**

1. Image of the factory
2. Total energy usage (kℓ conversion)
3. Power usage ratio for each building
4. Electricity fee ranking per transformer
5. Air usage condition
6. Transformer load factor

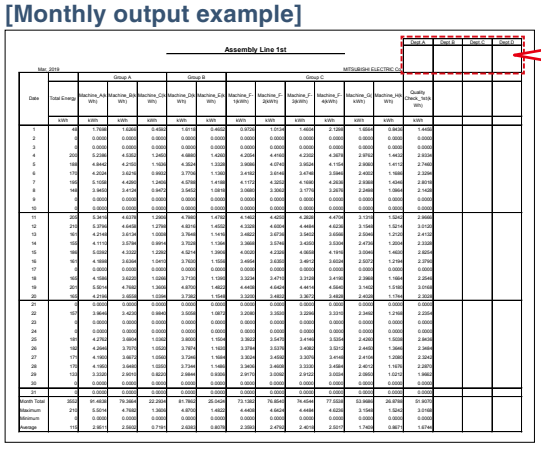
***Above dashboard is not included the software, and it is necessary to be created by customers.**

***The data update cycle of a dashboard is one hour.**

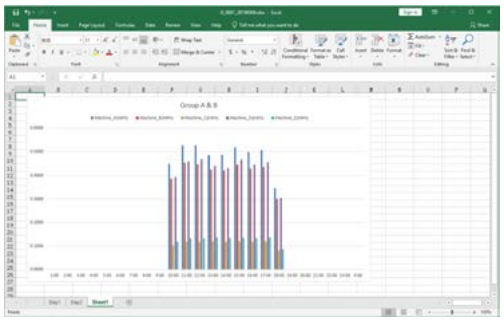
# 6 Creation of reports (daily, monthly and annual)

• Able to create daily, monthly, and annual reports based on the data collected from EcoWebServer Ⅲ.

**[Monthly output example]**

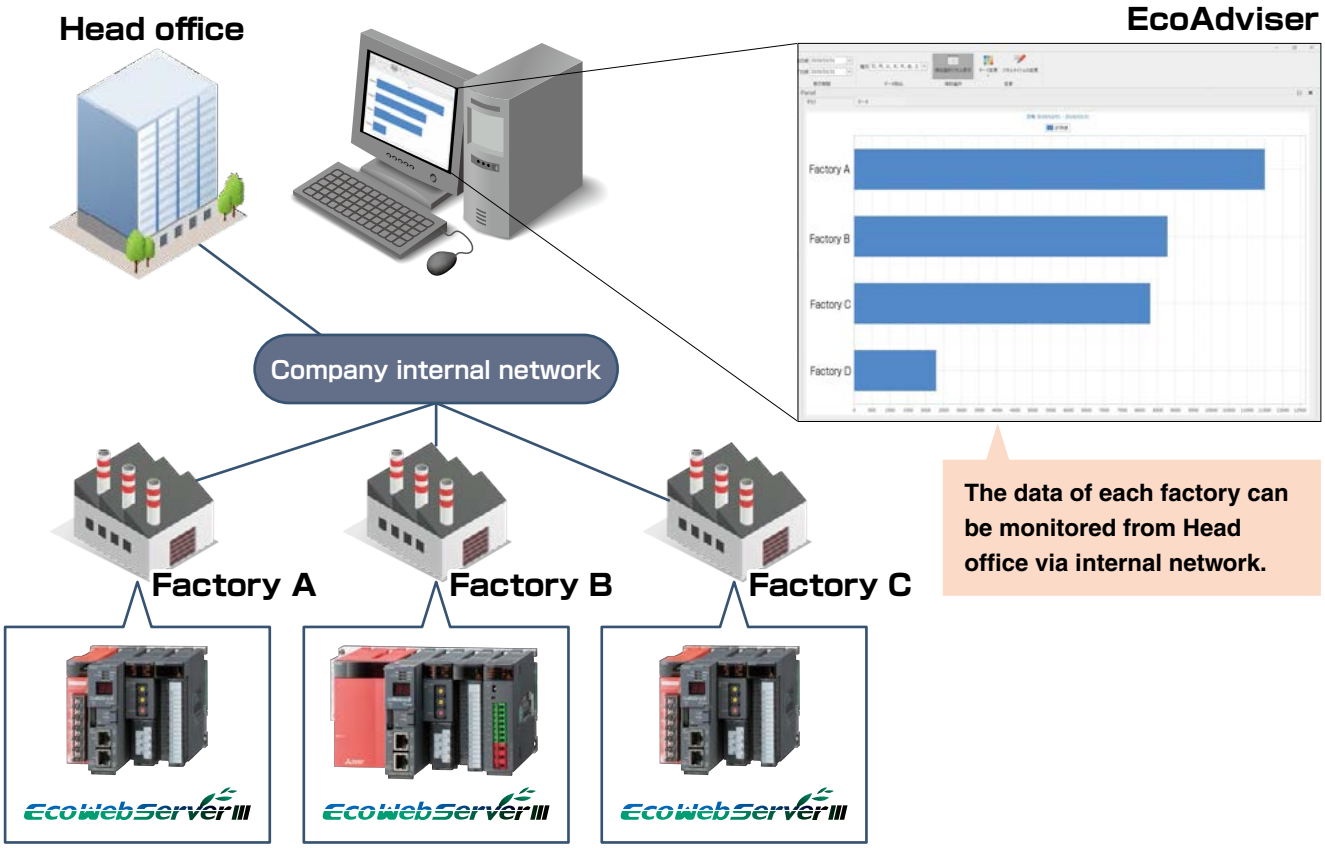


By setting, a **sign field** can be added, and a report can be customized by creating a format.
(For detail, refer to the manual)



# 7 Integrated energy monitoring and management of multiple locations

• Able to monitor energy usage conditions of multiple locations by utilizing VPN communication, etc.

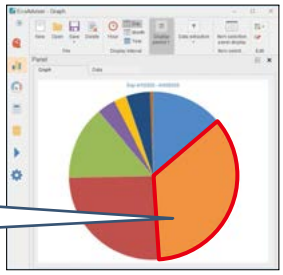



The data of each factory can be monitored from Head office via internal network.

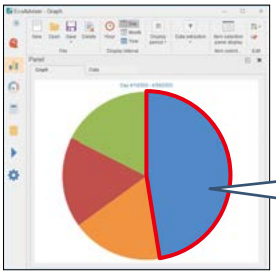
## Energy saving example of PCB manufacturing line using EcoAdviser

### Understanding the current condition

(1) Specification of the Equipment that requires energy saving measures by utilizing the energy saving data analysis function.



Specify “PCB mounting line” from various lines in the floor.



It was found that “Reflow furnace” in the PCB mounting line is using the most energy.

### Identification of energy-losses

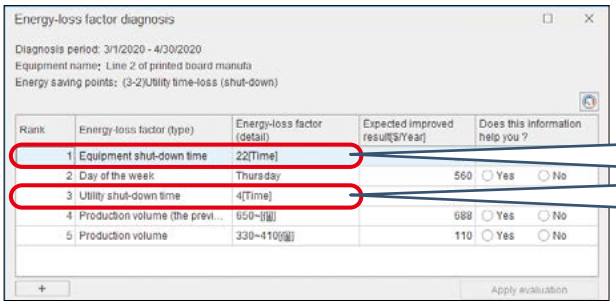
(2) Identification of energy-losses by the energy-losses identification function.

| plot | Date | (1)Equipment time-loss (start-up) [Minutes] | (2)Equipment time-loss (shut-down) [Minutes] | (3-1)Utility time-loss (start-up) [Minutes] | (3-2)Utility time-loss (shut-down) [Minutes] | (4)Specific consumption [kWh/個] | (5)Production loss time rate [%] |
|---|---|---|---|---|---|---|---|
| | 3/22/2020 | | | | | | |
| | 3/23/2020 | 106 | 20 | 42 | 311 | 0.31818 | 41.7 |
| | 3/24/2020 | 163 | 4 | 12 | 76 | 0.22494 | 16.8 |
| | 3/25/2020 | 82 | 17 | 53 | 294 | 0.27545 | 24.5 |
| | 3/26/2020 | 105 | 13 | 58 | 566 | 0.22241 | 22.1 |
| | 3/27/2020 | 228 | 2 | 52 | 683 | 0.23048 | 19.7 |
| | 3/28/2020 | | | | | | |
| | 3/29/2020 | | | | | | |
| | 3/30/2020 | 159 | 3 | 2 | 229 | 0.19284 | 12.5 |
| | 3/31/2020 | 109 | 4 | 22 | 224 | 0.3101 | 29.4 |
| | 4/1/2020 | 215 | 10 | 20 | 212 | 0.22093 | 14.1 |
| | 4/2/2020 | 84 | 15 | 20 | 193 | 0.22185 | 16.6 |

It was found that significant energy-losses are generated in **“Loss at starting-up of the reflow furnace”**, **“Loss at shutting-down of ancillary equipment”**, and **“Operation time loss of the reflow furnace”**.

### Factor diagnosis

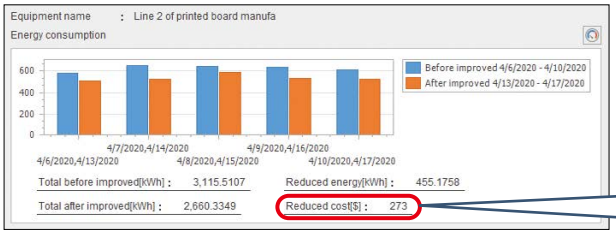
(3) Factor diagnosis of energy-losses of the reflow furnace.




Though the reflow furnace is turned OFF at 22:00, it was found that the ancillary equipment still continues to operate.
When the actual condition is verified, **it was found that ancillary equipment is always operating during weekday**.
→Automatic control with the EcoMonitorPlus control unit so that the ancillary equipment is turned OFF in conjunction with the reflow furnace.

### Effect verification

(4) Effect verification before and after taking the measure




When measures are taken for above and other energy-loss items, actualized the energy saving effect for

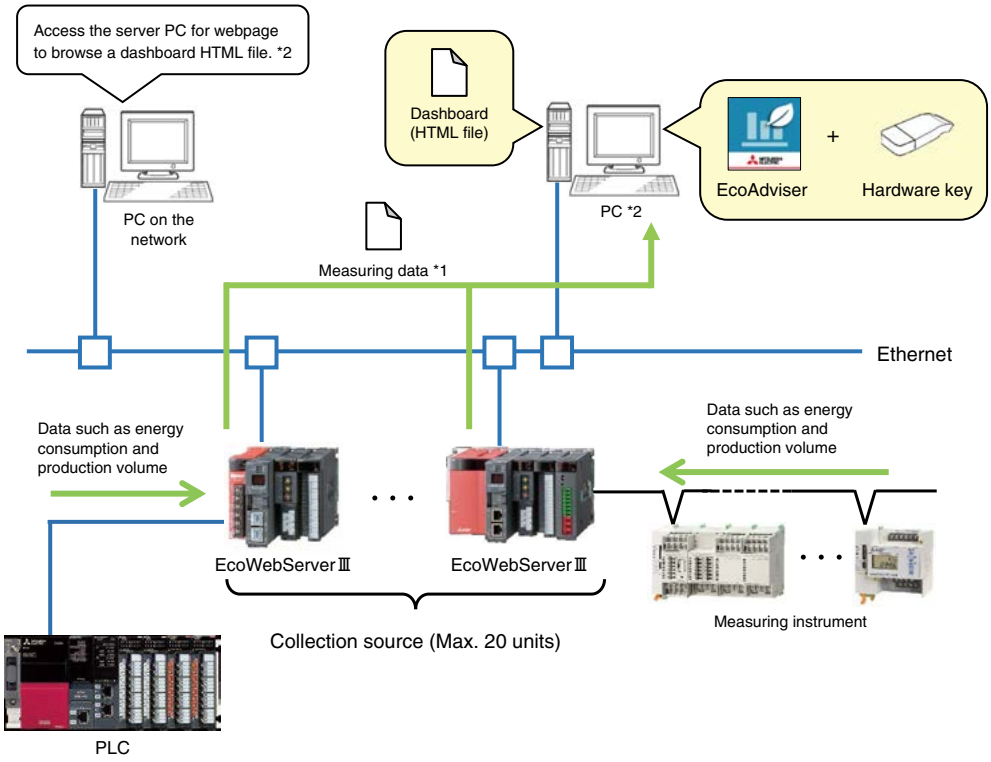
**approx. 2,000 USD**

per reflow furnace in a year.
In addition, 90%* of work hour for data analysis and cause determination were reduced.

*According to our reasearch

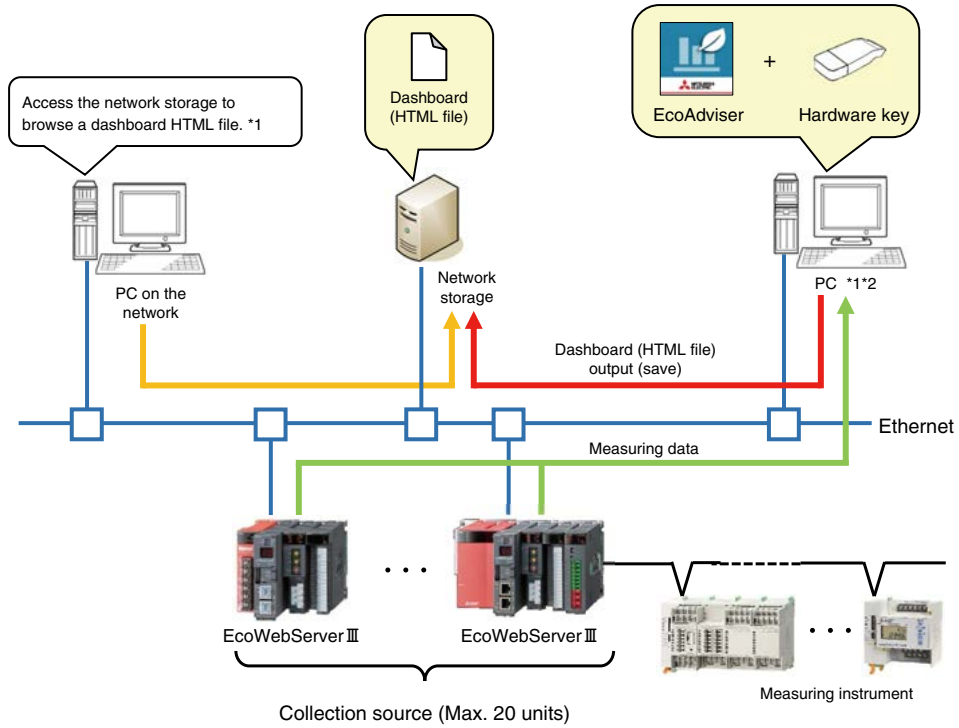
# System configuration example

## ■Collecting measurement data from EcoWebServer Ⅲ




*1: EcoAdviser collects measuring data from the zoom (1 min.) data file or demand (daily) data file of EcoWebServer Ⅲ.
*2: To browse the dashboard HTML file on the PC in the network, activate the web server function, such as IIS, on the PC.

## ■Using a network storage




*1: If you output/save the dashboards HTML file to/in the network storage, you can browse the file by accessing to the network storage from the PC on the network without setting the web server function such as IIS.
*2: You can configure the system using the network storage even when using the industrial PC (MELIPC).

# Specifications of EcoAdviser

★: The function only for Energy Saving Data Analysis and Diagnosis Software

| Item | | | Specifications |
|---|---|---|---|
| Measuring point settings | Register collection source | | Register a collection source and its measuring points. |
| | | Collection source | EcoWebServerⅢ, Edgecross |
| | | Number of collection sources | Max. 20 units *1 |
| | | Number of measuring points | Max. 5680 points |
| | | EcoWebServerⅢ | Max. 255 points per unit |
| | | EcoWebServerⅢ with the demand monitoring function | Demand period (15 minutes): Max. 284 points per unit<br>Demand period (30 minutes): Max. 282 points per unit<br>Demand period (60 minutes): Max. 280 points per unit |
| | | Edgecross | Max. 256 points per unit<br>Data type: BOOL, INT, UINT, DINT, UDINT, REAL, LREAL |
| | Register manual input measuring point | | Register a measuring point other than collection sources. |
| | | Number of registration | Max. 256 points |
| | Register product type time period measuring point | | Register a measuring points to extract data of one product from multiple types of products. |
| | | Number of registration | Max. 256 points |
| | | Measuring value point Time period measuring point | Select from collection sources' measuring points or manual input measuring points. |
| | | Time period type | 0 to 65535 |
| | Register calculation measuring point | | Register a measuring point to calculate measuring points with each other. |
| | | Number of registration | Max. 256 points |
| | | Available measuring point | Select from collection sources' measuring points, manual input measuring points, or product type time period measuring points.<br>· Max. 200 points can be registered per calculation formula.<br>· Max. 4000 letters can be used per calculation formula. |
| | Register specific consumption measuring point | | Register a measuring point to calculate specific consumption. |
| | | Number of registration | Max. 256 points |
| | | Energy measuring point Production number measuring point | Select from collection sources' measuring points, manual input measuring points, product type time period measuring points, or calculation measuring points. |
| | Measuring point group | | Folder tree: Max. 4 hierarchy levels<br>Number of groups: Max. 256 groups<br>Number of measuring points: Max. 256 points per group<br>* Max. 7000 measuring points for total groups |
| Graph function | Analysis method (Graph type) | | Select from time series chart, box plot, pie chart, scatter plot, histogram, or pareto chart. |
| | Display interval | | Select from hourly, daily, monthly, or yearly.<br>*For an analysis method of box plot, this is set to hourly. |
| | Number of saving | | Max. 300 panels |

| Item | | | | Specifications | |
|---|---|---|---|---|---|
| Dashboard function | Dashboard creation | | | Create a dashboard with graph and measuring point data panels arranged. | |
| | | Sheet setting | | Max. 10 sheets per dashboard | |
| | | Available panel | | Graph panel (created with graph function)<br>★Diagnosis panel (graph/table of diagnosis result) | Total max. 10 panels per sheet *2 |
| | | | | Numeric panel (collected measuring point data) | Max. 15 panels per sheet |
| | | | | Image panel (image file) | Max. 5 panels per sheet |
| | Number of saving | | | Max. 5 files | |
| | Display mode | | | Display the created dashboard on EcoAdviser. | |
| | Display settings | Auto-update | | Set the automatic update of graphs and measuring point data. | |
| | | Auto-update timing | | 1-hour cycle (after automatic collection) | |
| | | Tab display | | Set the display of the tab for sheet switching. | |
| | | Auto-switch | | Set the automatic switching of the sheet at regular intervals. | |
| | | Auto-switch interval | | 10/20/30/60/120/180/300 (sec.) | |
| | HTML output | | | Output the created dashboard to the HTML file. | |
| | Automatic HTML output function | | | Set the automatic output to the HTML file at the time of change of dashboard settings or update of displayed data. | |
| | | Output timing | | 1-hour cycle (after automatic collection) | |
| | Saving destination | | | Set the saving destination of HTML files to be output. | |
| Report function | Format | | | Set up the report format. | |
| | | Saving number of report settings | | Max. 24 report settings<br>(In one setting, output items of daily, monthly, and annual report are saved.) | |
| | | Number of output items | Daily report | Max. 320 items,<br>16 items per sheet × 20 sheets | |
| | | | Monthly report | Max. 320 items,<br>16 items per sheet × 20 sheets | |
| | | | Annual report | Max. 320 items,<br>16 items per sheet × 20 sheets | |
| | | Output item | | Select from collection sources' measuring points, manual input measuring points, product type time period measuring points, calculation measuring points, or specific consumption measuring points. | |
| | Report creation | Daily report | | Create the daily report of a specified day and save it in the Excel format. | |
| | | Monthly report | | Create the monthly report of a specified month and save it in the Excel format. | |
| | | Annual report | | Create the annual report of a specified year and save it in the Excel format. | |
| | Automatic report output settings | | | Set the automatic output of reports. | |
| | | Automatic output time | | Set the time of automatic output of reports. | |
| | | Saving destination | | · Set the destination path of daily report files.<br>· Set the destination path of monthly report files.<br>· Set the destination path of annual report files. | |

*1: When the collection source is Edgecross, the number of registration depends on the flow number of data logging of Edgecross. The number of the data logging flow is up to 8. For more information about the data logging flow, refer to the Edgecross Basic Software for Windows User's Manual.
*2: For the diagnosis panel, the panels to display the energy-loss factor diagnosis results can be placed up to 100 panels/whole dashboard.

★: The function only for Energy Saving Data Analysis and Diagnosis Software

| Item | | | Specifications |
|---|---|---|---|
| Data collection function | File collection settings | | Collect the logging files stored in the collection sources. |
| | Collection source | EcoWebServerⅢ | Zoom (1 min.) data file,<br>Demand (daily) data file *3 |
| | | Edgecross | Historical data file |
| | Automatic collection settings | | Set the data collection for each file type. |
| | | Automatic collection timing | EcoWebServerⅢ: Collection time specified by the user<br>Edgecross: Collection period specified by the user |
| | | Collection period | Set the collection period on daily/monthly/annual basis. |
| | Retention period | | Set the retention period for each file type. |
| | | 15/30/60-minute basis data | 2 to 10 years<br>*Default: 10 years |
| | | Daily basis data | |
| | | Monthly basis data | |
| | | Annual basis data | |
| | | ★Diagnosis data | |
| | | ★Diagnosis source data | 62 days |
| | File deletion timing | | Sequentially delete the logging files of expired retention period. |
| Data input function | Data input | | Input 15/30/60-minute basis data of each measuring point for a user-specified period.<br>Max. 256 measuring points can be selected simultaneously.<br>Specified period: Max. 31 days |
| | Export | | Output 15-min/30-min/60-min/24-hour basis data of each measuring point for a user-specified period to the Excel file. |
| | Import | | Input 15-min/30-min/60-min/24-hour basis data of each measuring point based on the imported Excel file. |
| Calculation function | Available measuring point | | Select from product type time period measuring points, calculation measuring points, or specific consumption measuring points.<br>*Max. 256 measuring points can be selected at one time. |
| | Automatic calculation | | Automatically calculate measuring point data. |
| | | Available measuring point | Select from product type time period measuring points, calculation measuring poins, or specific consumption measuring points. |
| | | Calculation timing | At the execution of automatic collection |
| Data output function | Data output | | Output the collected measuring point data, which is saved in the file. |
| | Auto output settings for data file | | Set the automatic output of data files. |
| | | Output group setting | Max. 30 groups |
| | | Output destination setting | Set the destination path. |
| | | Output measuring point | Select from measuring points, manual input measuring points, product type time period measuring points, calculation measuring points, or specific consumption measuring points. |
| | | Output timing | After automatic collection |

| Item | | | Specifications |
|---|---|---|---|
| Maintenance function | Backup | | Back up the setting values and data to the folder |
| | Restore | | Restore the setting values and data backed up from the specified folder |
| ★Diagnosis settings | Equipment setting | | Register the equipment information for energy-loss diagnosis |
| | | Number of registration | Max. 50 pieces |
| | Energy-loss factor setting | | Set the energy-loss factor for equipment |
| | | Number of registration | Max. 20 points per equipment |
| | Calculation measuring point for diagnosis setting | | Set the calculation measuring point for energy-loss diagnosis. |
| | | Number of registration | Max. 150 points |
| | | Available measuring point | Select from measuring points.<br>*Demand measuring points are excluded. |
| | Electricity rate setting | | Set the currency unit and electricity rate per 1 kWh to convert energy consumption into the amount for diagnosis. |
| | Evaluation reset | | Reset the evaluation for energy-loss factor |
| ★Diagnosis function | Energy-loss diagnosis | | Diagnose the following two items for equipment. |
| | | Energy-loss extraction | Extract energy-loss on the five focusing points for energy saving or the standby power for each equipment to rank in order of energy-loss. |
| | | Energy-loss factor diagnosis | Diagnose energy-loss factors for any points for energy saving of any equipment. |
| | Improvement result check | | Compare the data of two periods to check the effect of energy saving improvement activities. |
| | Automatic diagnosis | | Execute automatic diagnosis of energy-loss and its factor. |
| | Diagnosis panel | | Save the graph ot table of energy-loss extraction or energy-loss factor diagnosis result. |
| | | Number of saving | Max. 50 panels |

*3: When the collection source is EcoWebServerⅢ with demand monitoring function, demand (daily) data files can be collected.

## PC's Operation Environment

The following table shows the operation environment of the PC where EcoAdviser is to be installed.

| Item | Specification | |
|---|---|---|
| OS | Microsoft® Windows® 10 Pro/Enterprise/IoT Enterprise (64-bit) | |
| Language version | Japanese, English, Simplified Chinese | |
| CPU | Intel Core™ i3-550 (recommended) | |
| Memory | 4 GB or more | |
| Hard disk | <Energy Saving Data Analysis Software><br>Software: 4 GB or more<br>Data: 15 GB or more *1 | <Energy Saving Data Analysis and Diagnosis Software><br>Software: 4 GB or more<br>Data: 20 GB or more *1 |
| LAN | 10/100/1000BASE-T×1 | |
| USB connector (Type A) | 1 connector (for connecting the hardware key) | |
| CD drive | 1 drive (for installing EcoAdviser) | |
| Spreadsheet *2 | Microsoft® Excel® 2016 (32-bit/64-bit)<br>Microsoft® Excel® 2019 (32-bit/64-bit) | |
| Display resolution | 1024×768 pixels or more | |
| Input device | A mouse and keyboard | |

*1: If you set the storage period of each data and the registration number of each measuring point to the maximum, this capacity will be necessary.
*2: You cannot use the Excel that has been purchased from Microsoft Store.
Use the desktop version of Excel.

### Trademarks

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# Mitsubishi Electric Energy Saving Support Software EcoAdviser

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