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Introduction of the latest Technology of Energy Conservation

--- To blue chip companies due to effective energy utilization ---

September 15, 2015

Fuji Electric Co., Ltd.

Trends and prospects of the world's energy consumption

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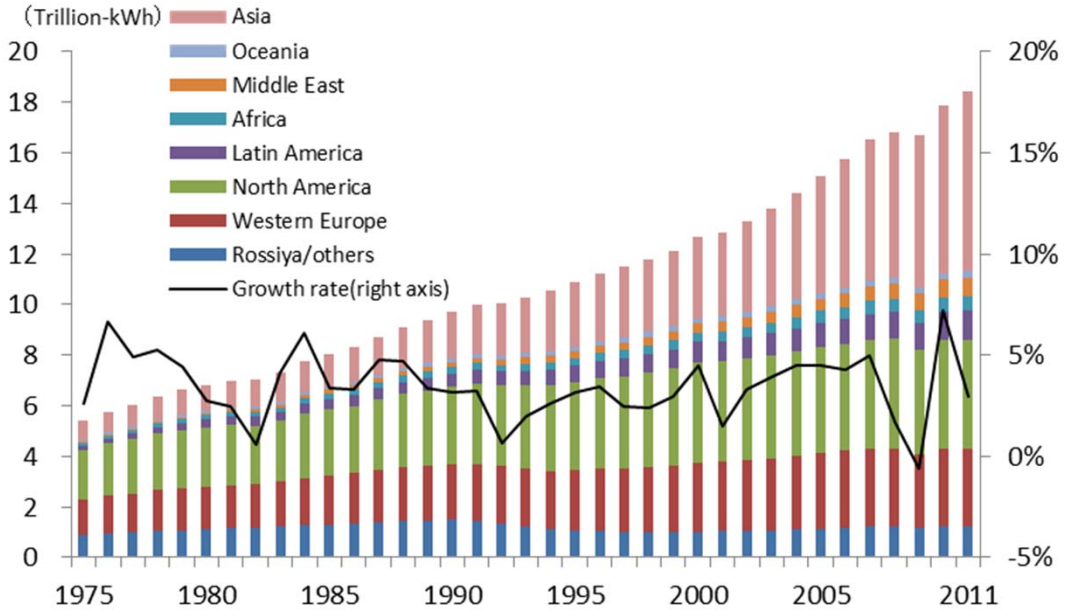
Changes of energy consumption in the world (by region)



adapted from “IEA Energy Balances 2013”.

■Energy consumption trend of expansion■

Energy consumption in the world continue to increase in the future, and especially the Asian region began to exceed the Western Europe in the power consumption since 1994.

Growth rate of the entire world has remained at an average of approx. 3.5% since 2000, however it has remained at an average of 7.5% and a very high growth rate in Asia region.

Long-term power consumption is increased, the anxiety for the power supply to be higher.

Trends in energy prices

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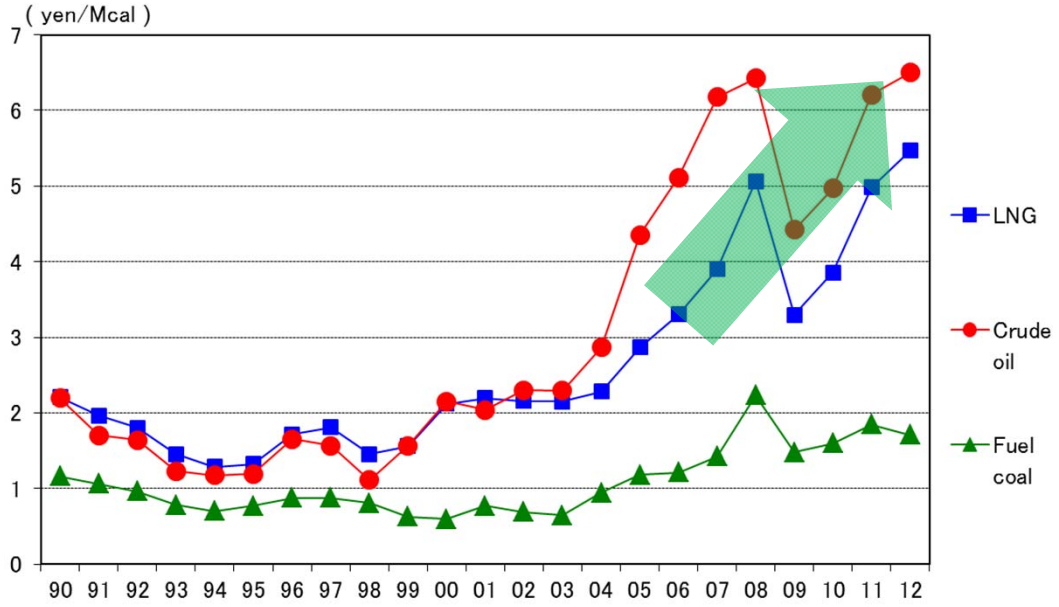
Rising the energy price



adapted from “The Institute of Energy Economics, Japan”.

■Energy high price trends■

In the medium to long term, energy costs are trend rising with expansion of the energy demand.

In the result, the proportion of energy as a percentage of the product cost to be increased.

Reducing the energy consumption, it becomes an important factor to compete with other companies.

Enhanced importance of Energy Conservation for companies. Energy prices rise and is also forced to cope with the problem of global warming.

Energy policy of Indonesia (1)

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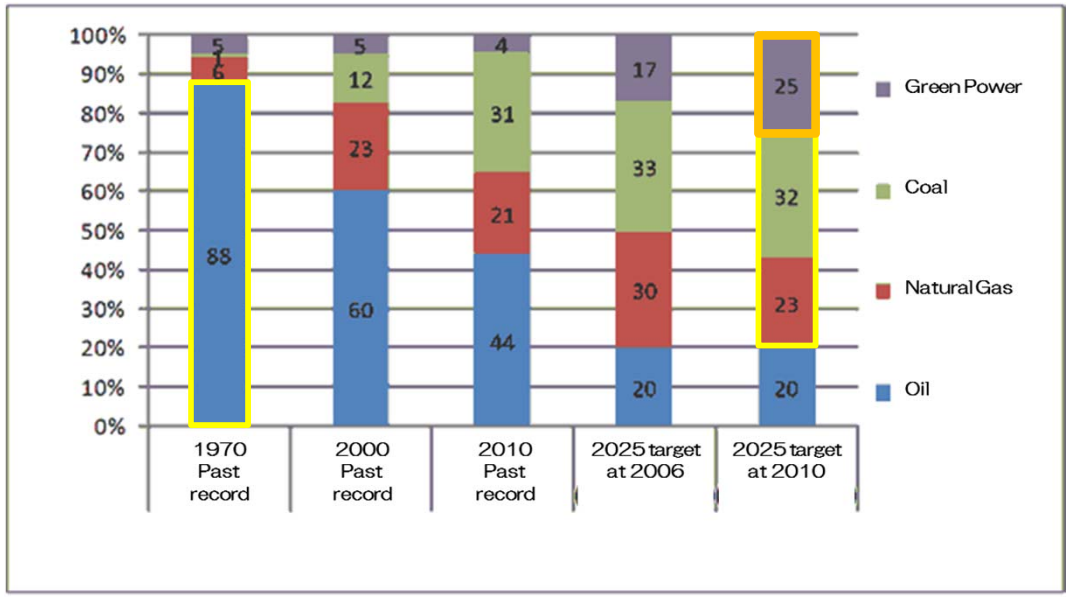
Shift to environment-friendly energy



2006 : National Energy Blueprint
2010 : Vision 25/25

■Energy shift■

Energy configuration of Indonesia shifts from Oil accounted initially 90% to Natural gas and Coal.

Hence, the policy shift to environment-friendly energy.

Energy policy of Indonesia (2)

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Energy Conservation - related policies and regulations (1)

Name		Contents
Law	No. 30/2007 on Energy	•Article 25: Energy Conservation
Government Regulation	No. 70/2009 on Energy Conservation	•Mandatory on EC (Energy Management) •EE Standard and Label •Incentive/Disincentive
Presidential Regulation/Decree	No. 5/2006 on National Energy Policy	•National RE and EE Target •Energy Elasticity < 1 in 2025
Presidential Instruction	No. 13/2011 on Energy and Water Saving	•Energy and Water Saving for Government, State-Owned Enterprises •Target: - Electricity 20% - Fuel 10% - Water 10% •Periodic reporting
Ministerial Regulation	No. 6/2011 on EE Label for Compact Fluorescent Light (CFL)	•Implementation of Label for CFL •Mandatory for CFL manufacturer •Self Declaration of Conformity (SDOC) •More star - more efficient

Energy policy of Indonesia (3)

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Energy Conservation - related policies and regulations (2)

Name		Contents
Ministerial Regulation	No. 321 & 323/EN/XII/ 2011 on Standard of Energy Manager Competence	•Competency of Energy Manager in Industrial and commercial Building
	No. 12/2012 on Fuel Saving	•The use n… …rprises Vechicle …ng companies …ion
		…sity saving 20% (Improvement of air system, lighting, & supporting equipment) •Government/Reg. Gov Office •State-owned enterprises •Street lighting, etc. •Monitoring
	No. 14/2012 on Energy Management	•Mandatory of Energy Management for large energy users (> 6,000 TOE) •The distribution of Autority (Gov, Reg.Gov.) •Monitoring of Energy Management Implementation •Incentive/Disincentive

Indonesian Energy Conservation Policy and Regulations to be reinforced.

Considered by classifying the energy

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■Considered by classifying the energy■

- Efficiency of energy supply
- MIERUKA (identifying problems and bringing them to the foreground)
- WAKARUKA (to know the weight of numbers, to understand the meaning of the graph)
- Energy optimization of production equipment

✓ **Energy supply (infrastructure)**
(Efficiency of energy supply)

- Power distribution equipment, etc.

✓ **Energy management (entire factory)**
(MIERUKA and WAKARUKA of energy)

- Energy management
- Equipment management

✓ **Energy consumption (Production process)**
(Energy optimization)

- Production equipment
  (Manufacturing/ transport equipment, etc.)
- Utility equipment

Individual management of energy

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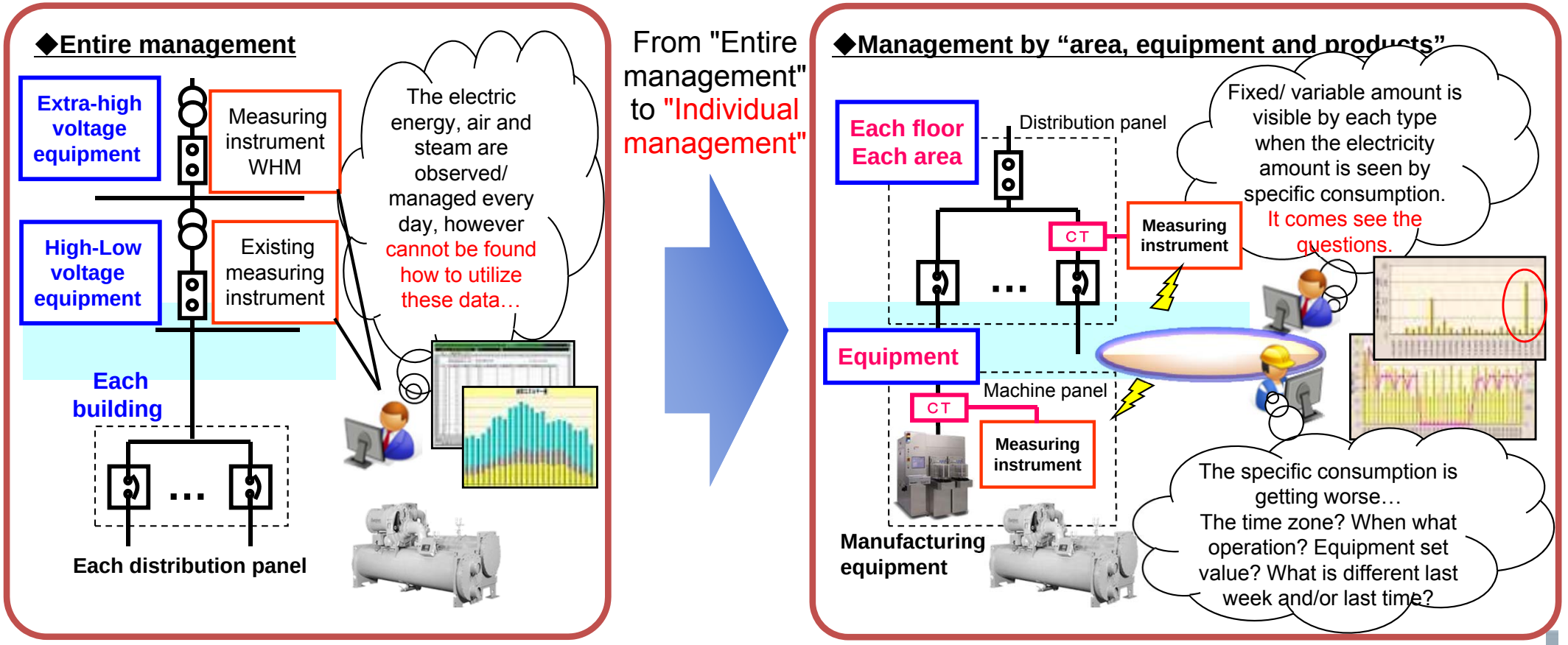
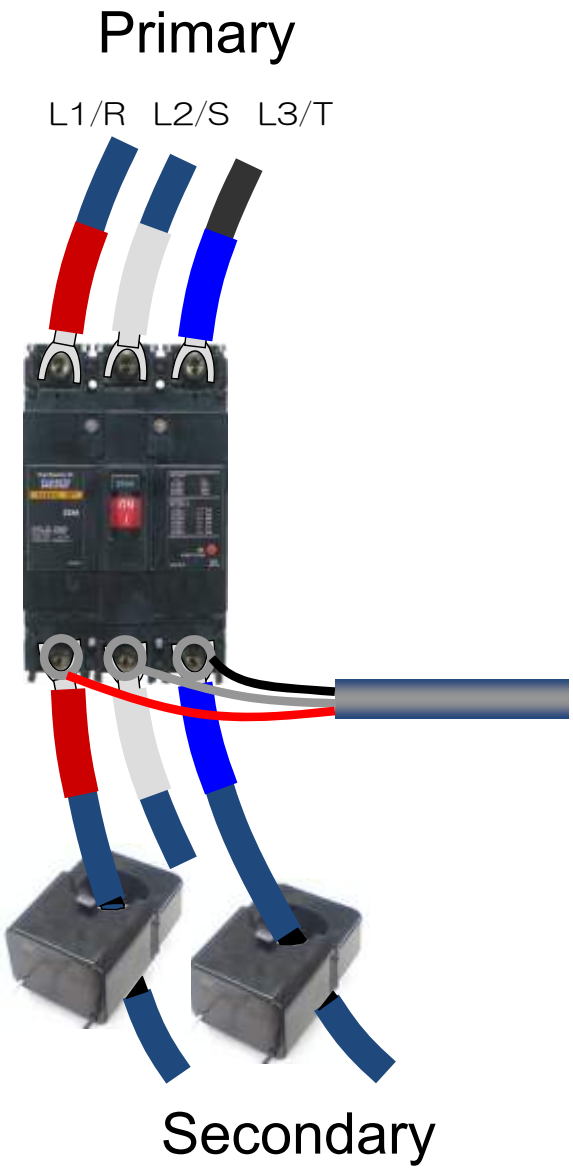
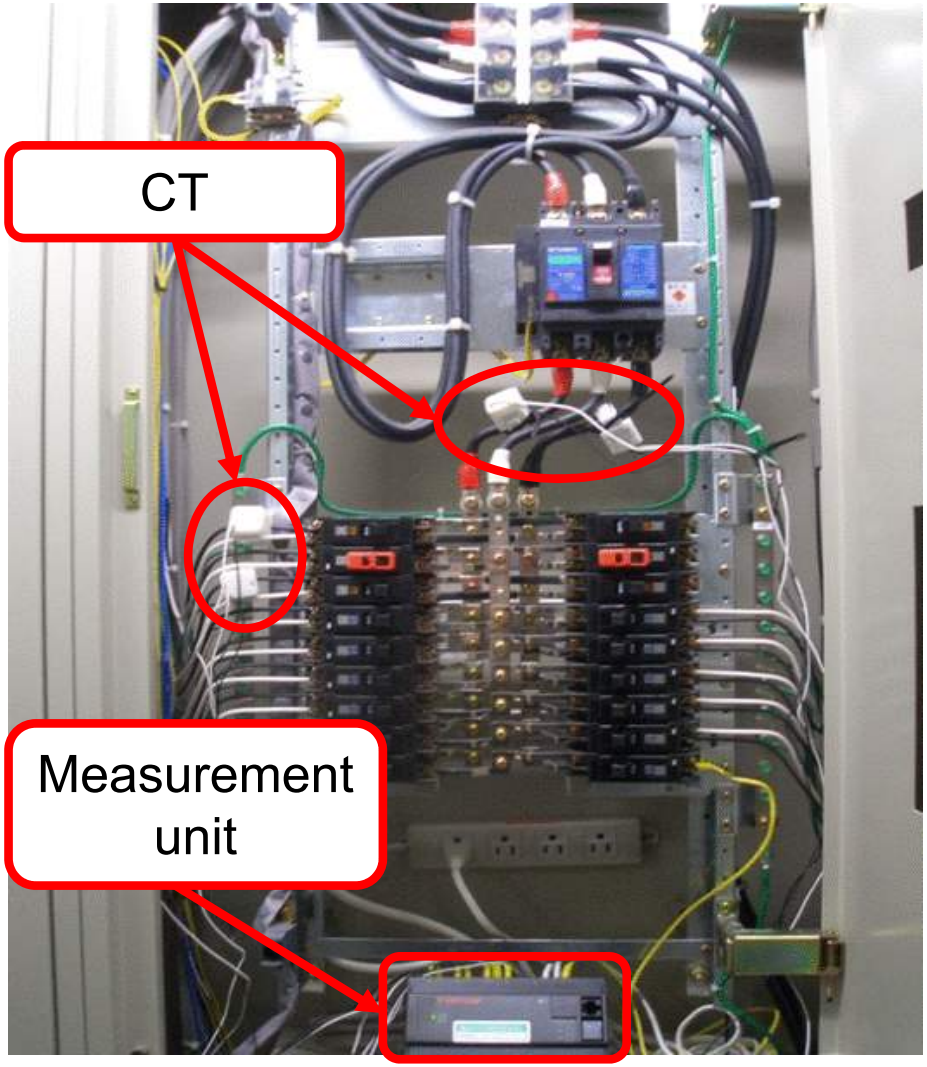
■Energy management (MIERUKA)■

Centralize energy data, such like electricity and gas, so that it can see from variety of perspectives utilizing IT technology.
With this way, "MIERUKA" is possible in individual units such as "area, equipment and products" from entire energy management. Moreover, KAIZEN items for energy conservation can be found.



Electric energy measurement (MIERUKA)





Case study (WAKARUKA)

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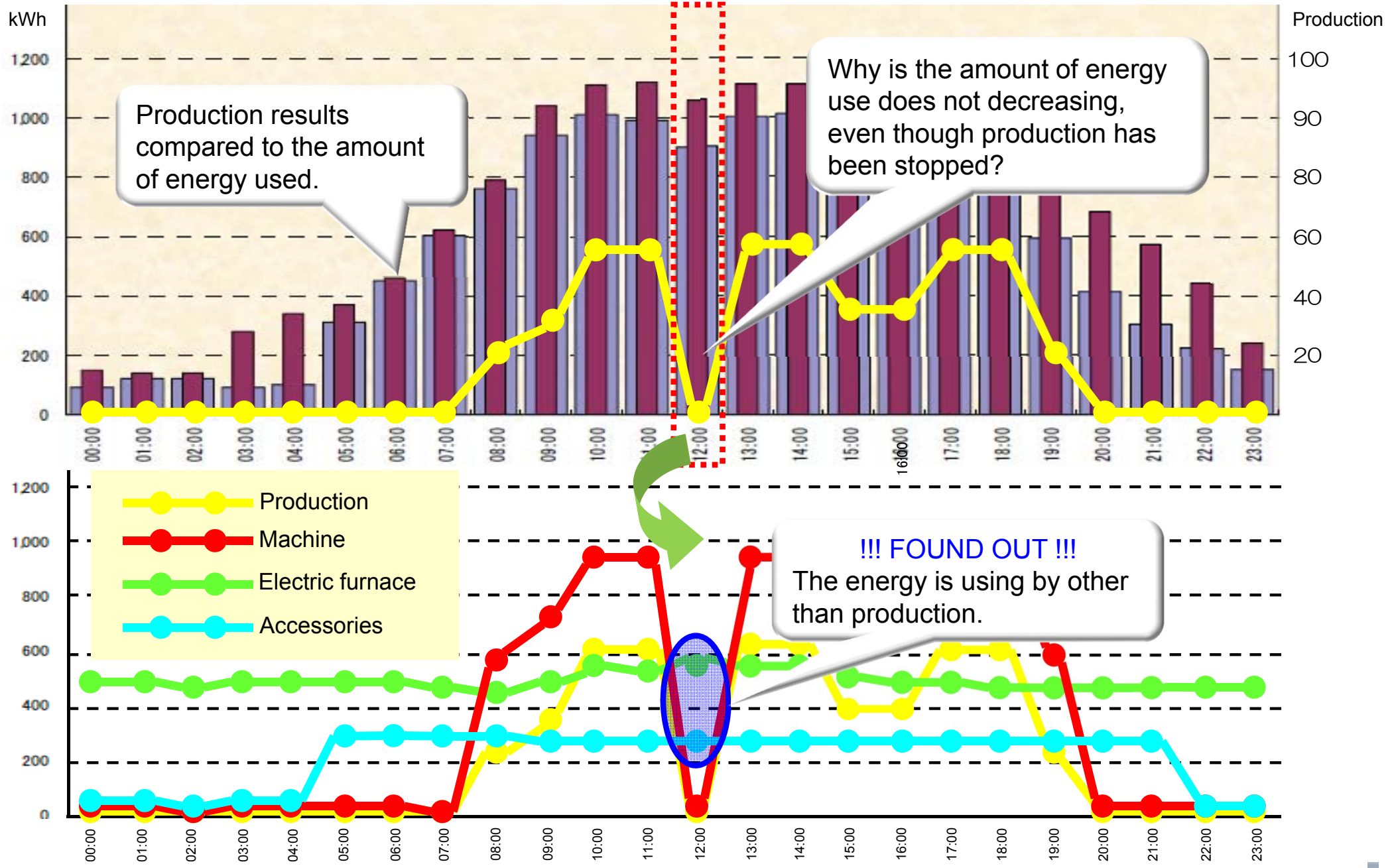

Target of Energy Conservation

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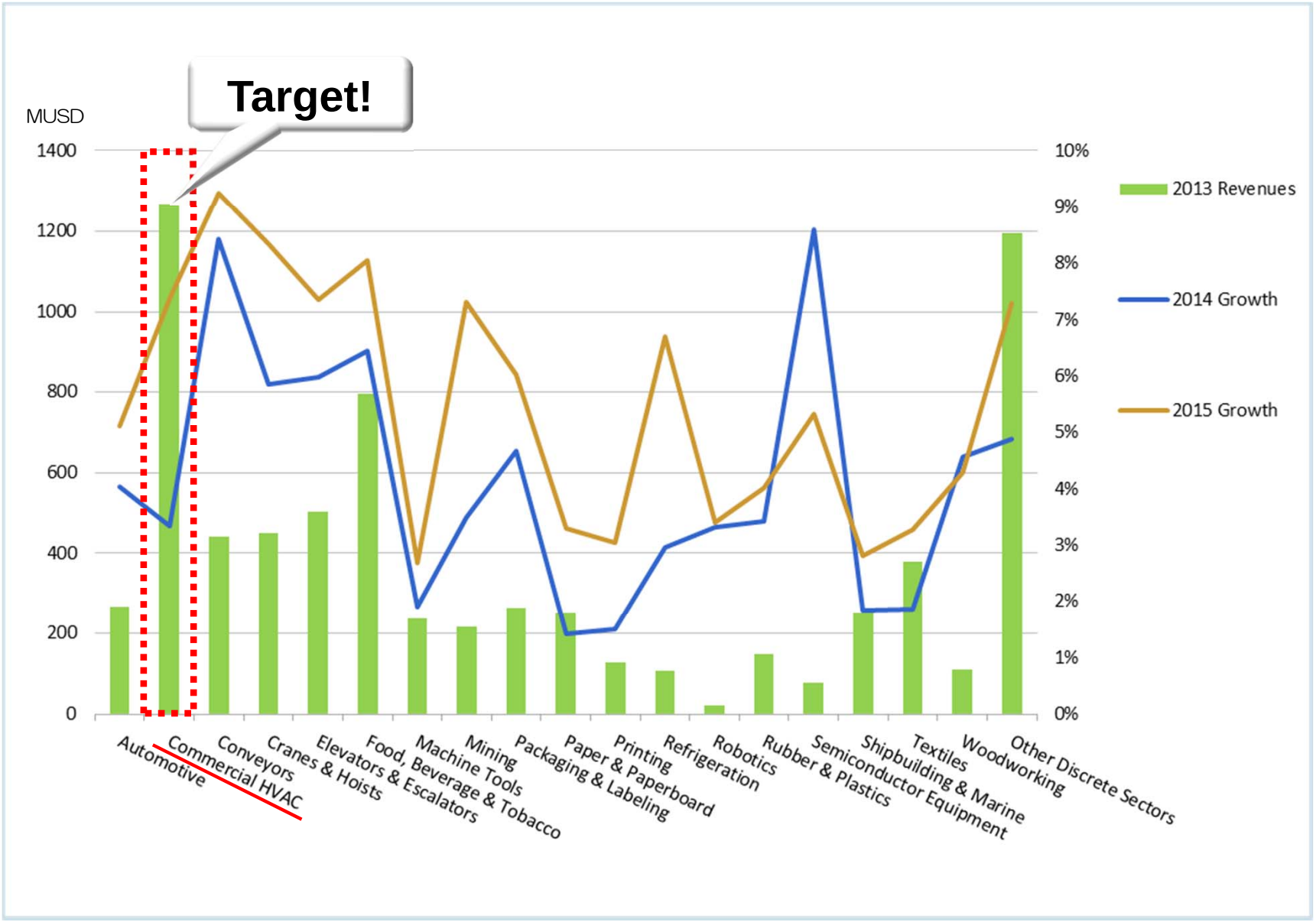
■Sectoral market size, growth rate■



adapted from IHS

Motor to be used in HVAC application (fan, pump)

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Cooling tower fan

The heat dissipation of the cooling water to the atmosphere.

Cooling water pump

To transport the heat of the refrigerator to the cooling tower.

Hot and cold water pump

To transport the hot and cold water to the air conditioner, fan coil.

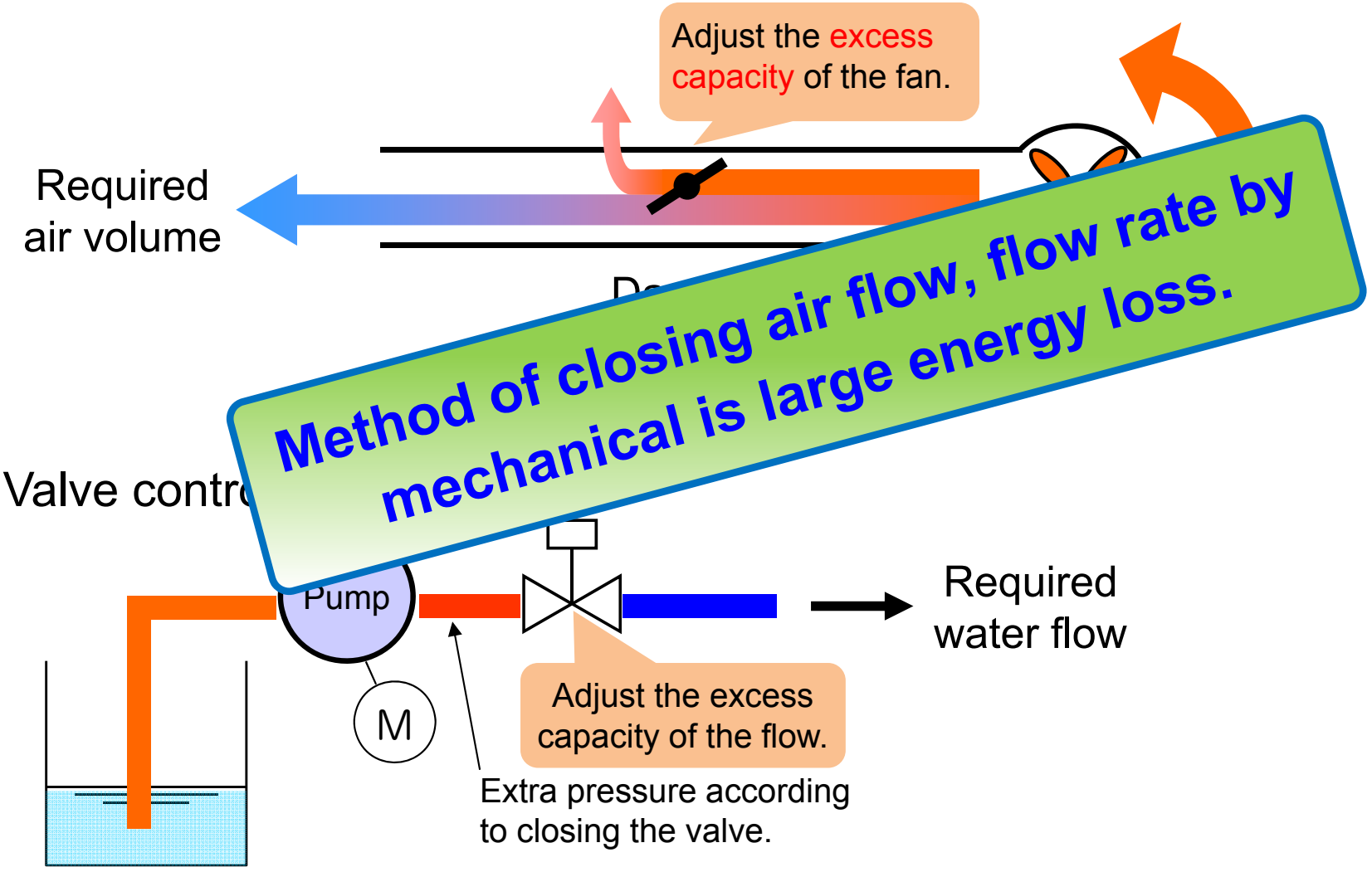
Supply, ventilation and exhaust fan

To transport hot and cold air and exhaust air

General method of adjusting air flow, flow rate

■Damper control■

Adjust the air volume in the loss of the damper.



What is inverter?

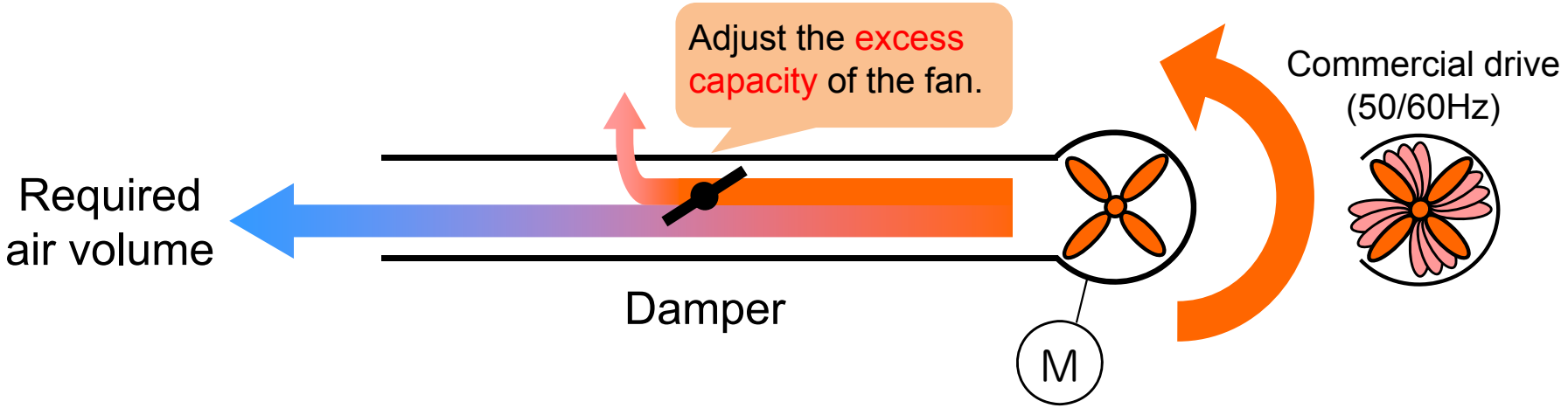
■Inverter■

The equipment which can control the motor rotating speed by changing the frequency.

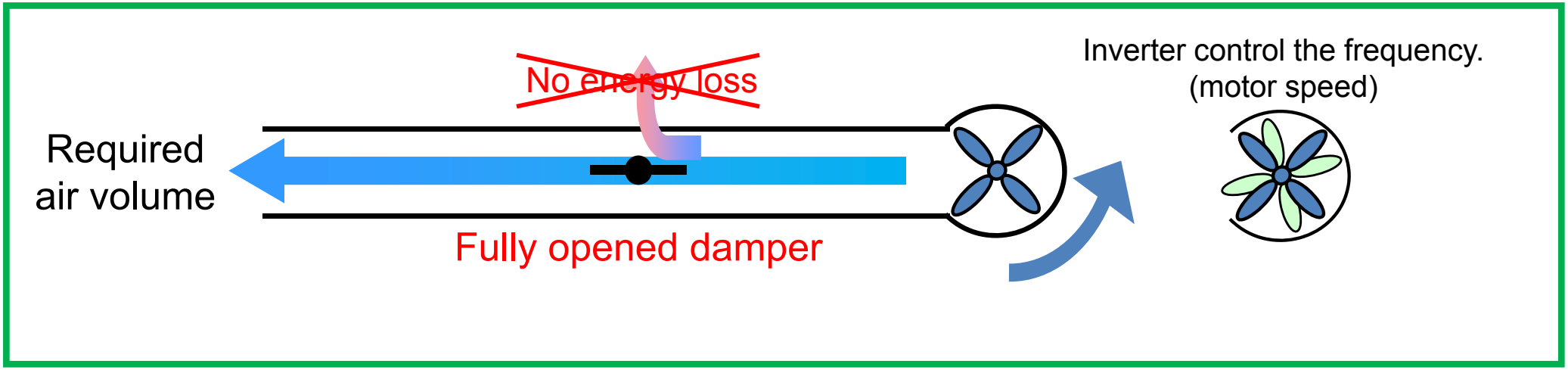
Controlled by inverter

■Damper control■

The air flow is adjusted by the loss of damper.



■Inverter control (Air flow is adjusted by motor rotating speed)■



Energy Conservation theory

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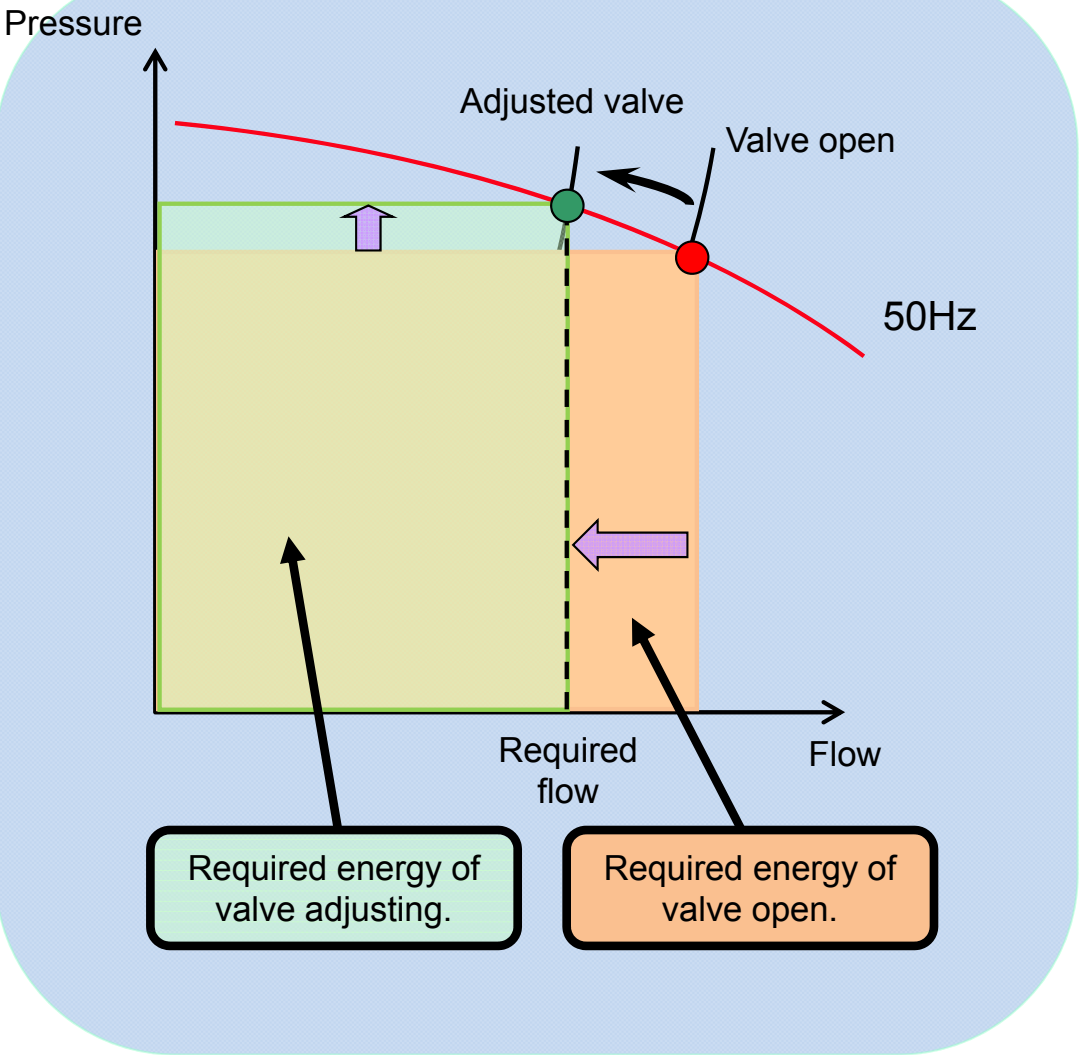
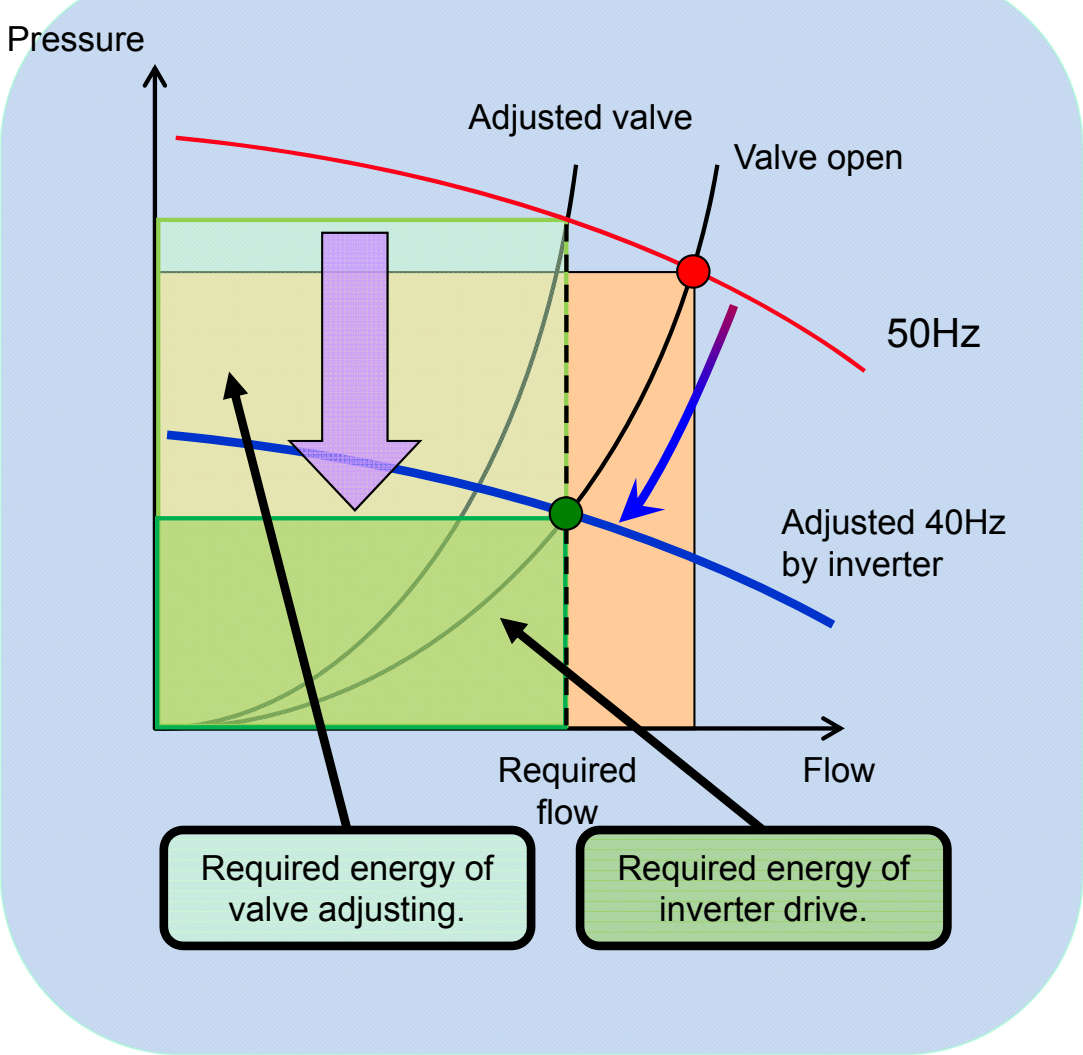
Amount of work adjusted by valve (electricity power)



Amount of work adjusted by inverter (electricity power)



Energy Conservation by inverter (Operational change)

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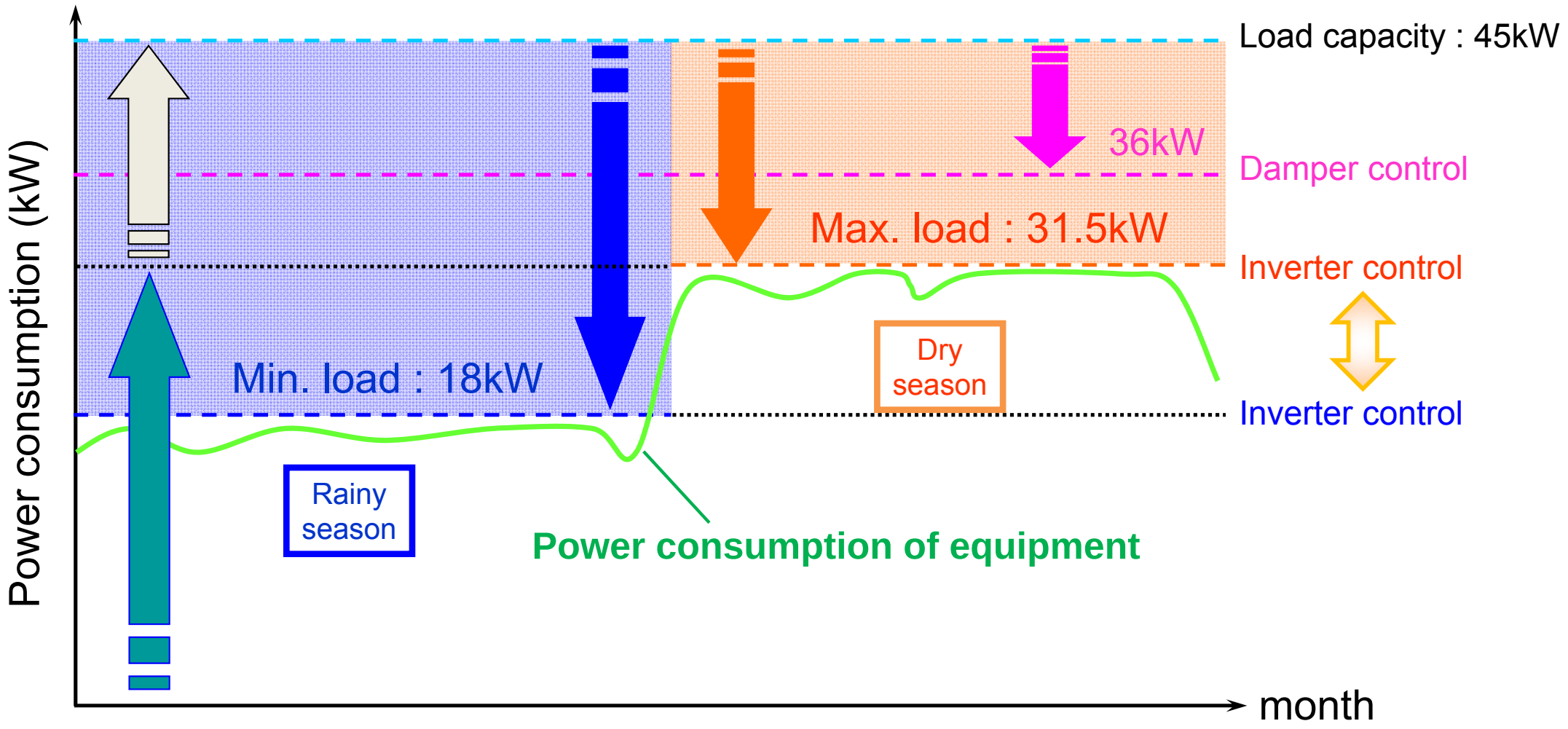

Design margin 30%

Required max. capacity

Energy Conservation by damper control

Energy Conservation by inverter control

Energy Conservation target (example) by the inverter (1)

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Business : Wood processing, metal processing, etc. Equipment : Bag filter, blower motor for dust collector Point : Check if adjusting the air volume in the damper?	Business : Factory, building, etc. Equipment : Air blower fan Point : Check if adjusting the air volume in the damper?

Dust collector of wood processing

Foundry dust collector

Air handling unit (AHU)

Energy Conservation target (example) by the inverter (2)

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Business : Chemical plant, etc. Equipment : Cooling tower circulation pump Point : Check if adjusting the flow rate in the valve.	Business : Factory, building, etc. Equipment : Cooling water circulation pump of the refrigerator (chiller) Point : Check if adjusting the flow rate in the valve.

Cooling tower

Circulation pump

Cooling tower

Circulation pump

Features of FUJI inverters (model map)

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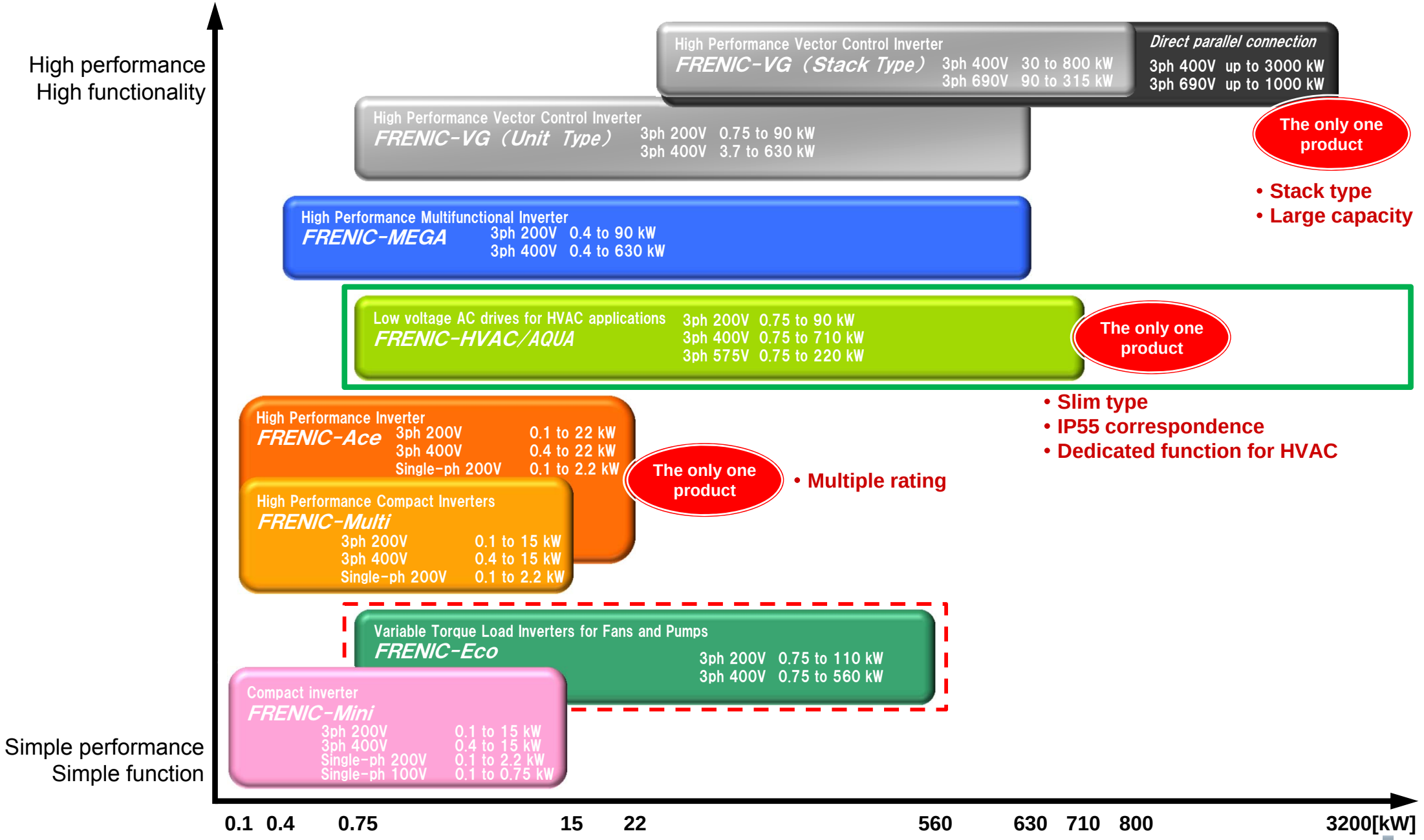


Features of FRENIC-HVAC Series

■Built-in the equipment for noise measures■
■Unnecessary the control panel and self-standing available (*1)■

Existing inverter

Control panel

For noise measure
(separated option)


EMC filter


DC reactor

Surge voltage suppression equipment

When driving a motor at 400V series inverter, if the wiring length is longer than a certain distance (less than 10m to 20m), the required "surge voltage suppression device".

Applied FRENIC-HVAC

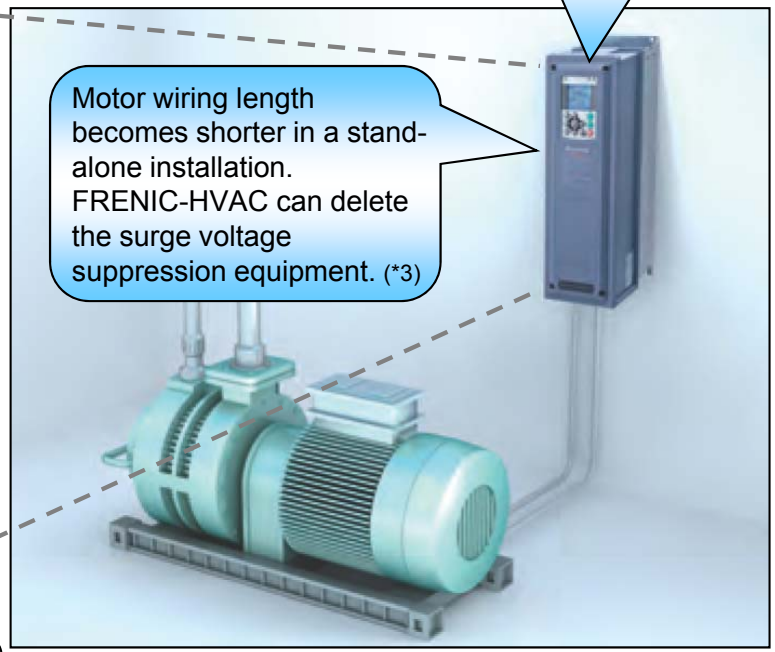
Built-in the equipment for noise measures
- DC reactor
- EMC filter

IP rating : IP55

Slim shape allows to install to the narrow pillar. (*2)

Installation image

Motor wiring length becomes shorter in a stand-alone installation. FRENIC-HVAC can delete the surge voltage suppression equipment. (*3)



*1 In the case of outdoor use, a simple panel might be required.
*2 Some capacity not covered.
*3 The motor is older, it may not be deleted.

Reduction of peripheral equipment

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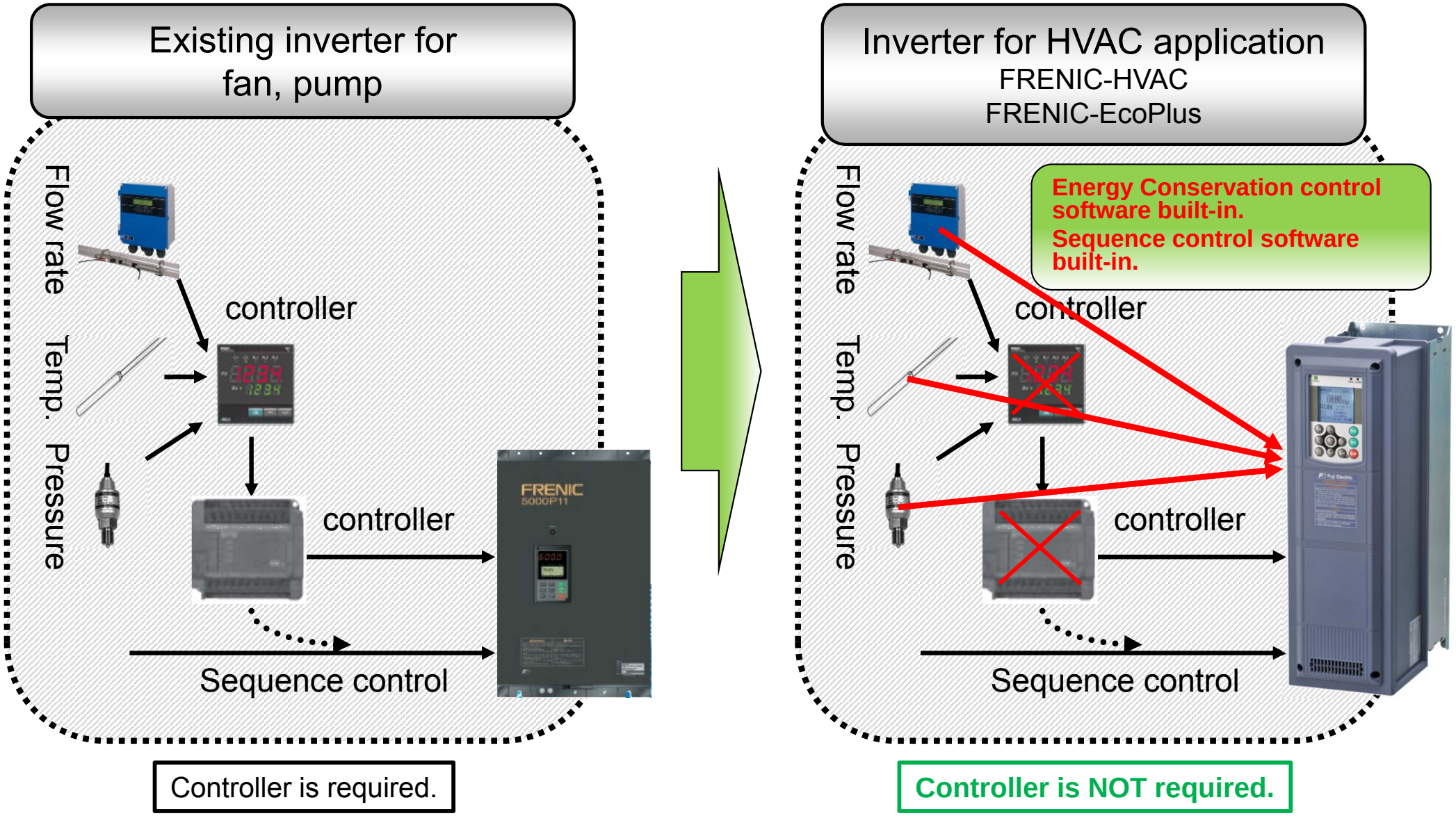

Challenge to further Energy Conservation

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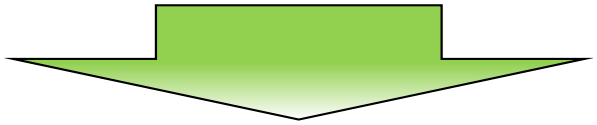
Fixed waste is controlled by the inverter. (traditional control of inverter)

- Waste of adjusting by the valve or damper
- Waste of extra flow
- Waste of backing in the bypass



Controlled by the inverter to be the optimum value. (future control of inverter)

- Temperature difference constant control
- Estimated terminal pressure control
- Flow rate (pressure) controlled by two-way valve to be controlled by inverter.
- Wet-bulb temperature presumption control

What is the optimum value control…

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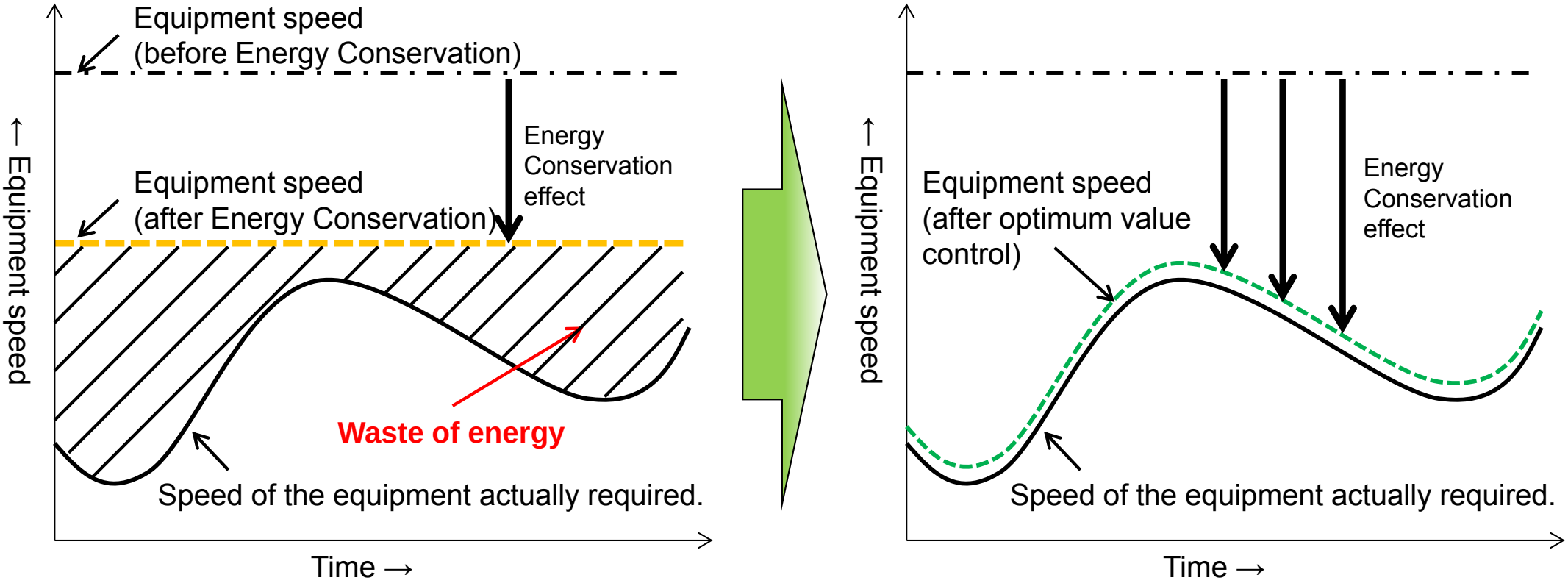
■Further Energy Conservation of existing inverter controlled facilities■



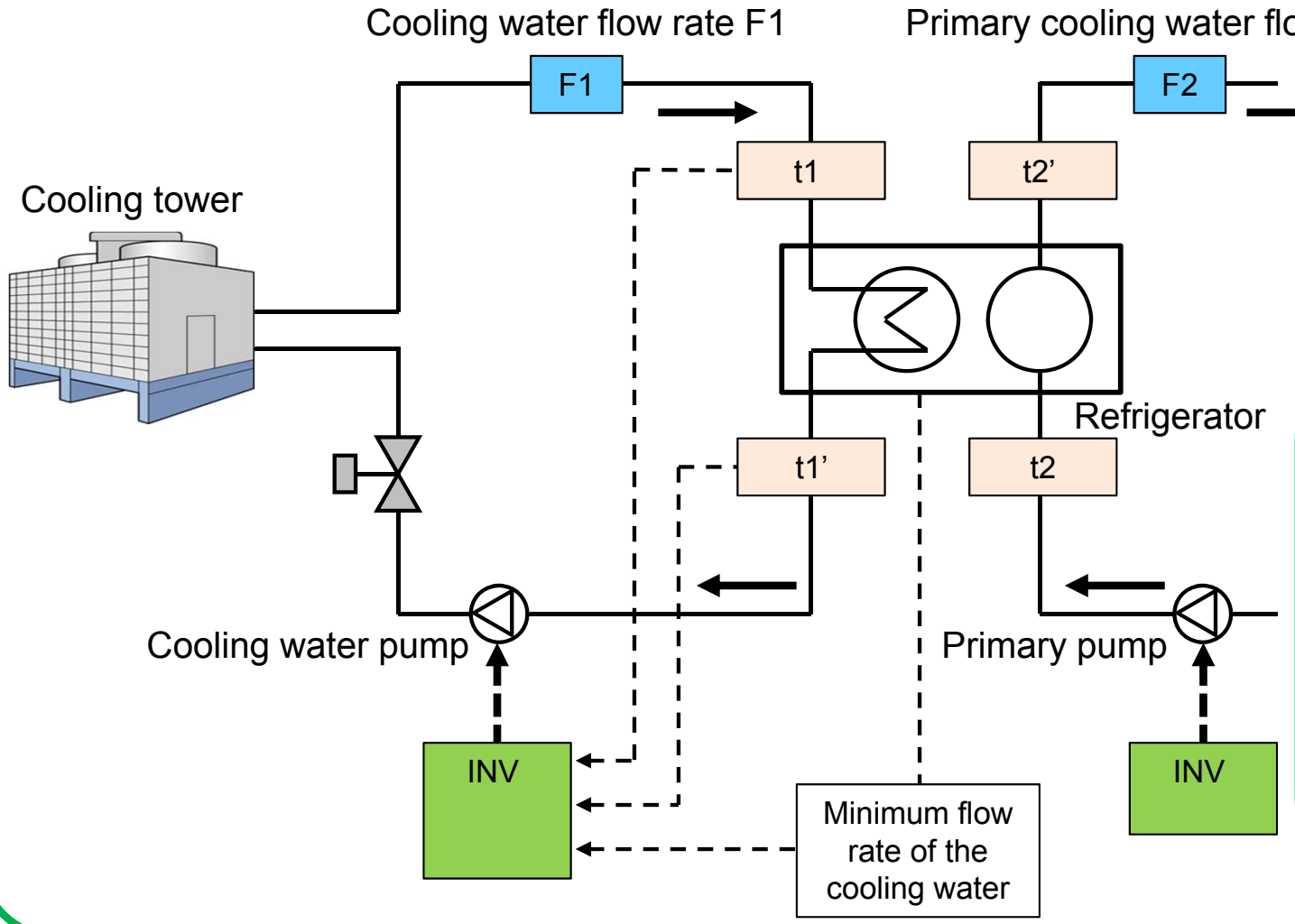
Reduce the speed of the equipment

Control the speed of the equipment

Temperature difference constant control

■Temperature difference constant control for cold water pump■

Control the cooling water pump so that the temperature difference between the cooling water outlet and inlet all times a constant.



Reduce the pump power to less than half.

In some cases, controls the temperature difference between the inlet and outlet constant in HVAC equipment.
If become a temperature difference is constant and does not circulate the coolant more than necessary, can be performed to save energy by lowering the rotational speed of the motor.

Estimated terminal pressure control

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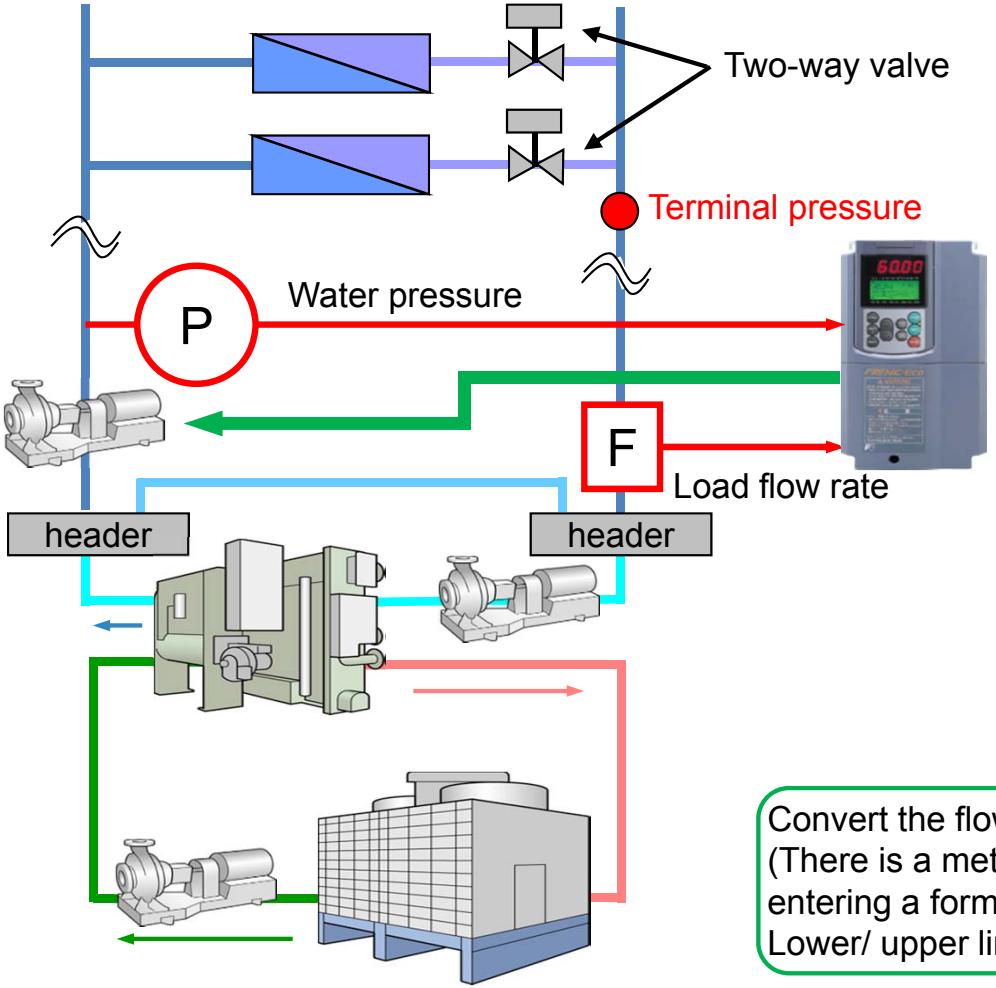
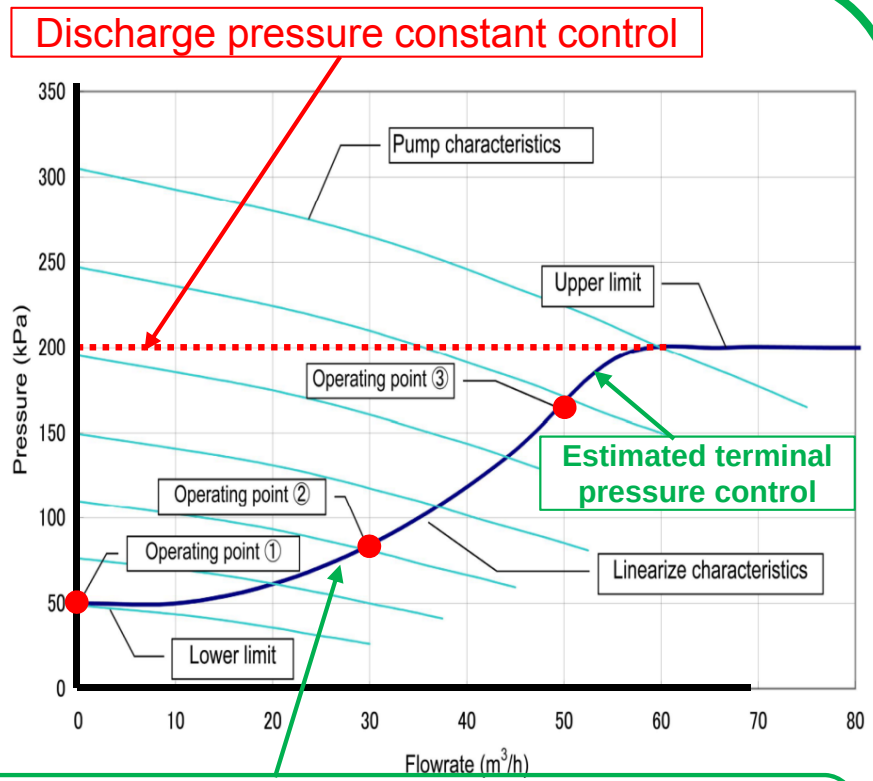
■Estimated terminal pressure control for cold (hot) water of secondary pump■

When the cooling (heating) load is light; less discharge flow rate of the pump, convey the cold (hot) water by lowering the water pressure of the secondary pump as per proper value.





Convert the flow rate signal to the target pressure in the linearization function.
(There is a method for inputting a data value of 3 points, and method of entering a formula.)
Lower/ upper limit setting on the linearize output is also possible.

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