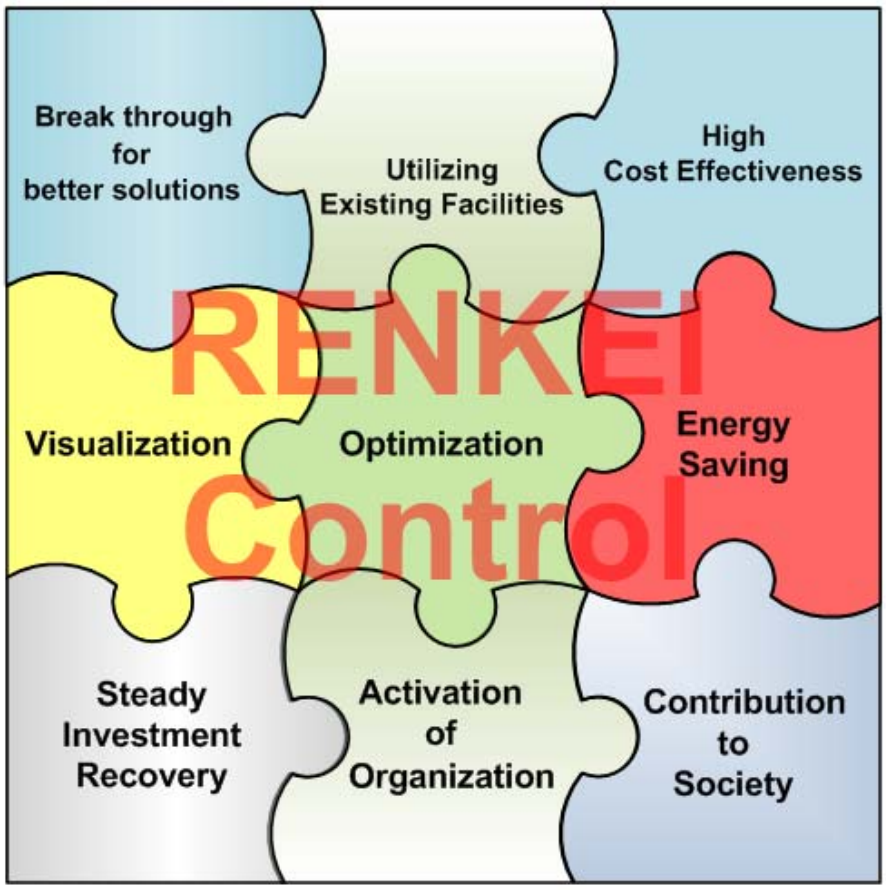
Innovative control technology for energy saving

RENKEI Control

Energy saving methodology that provides systematic measures



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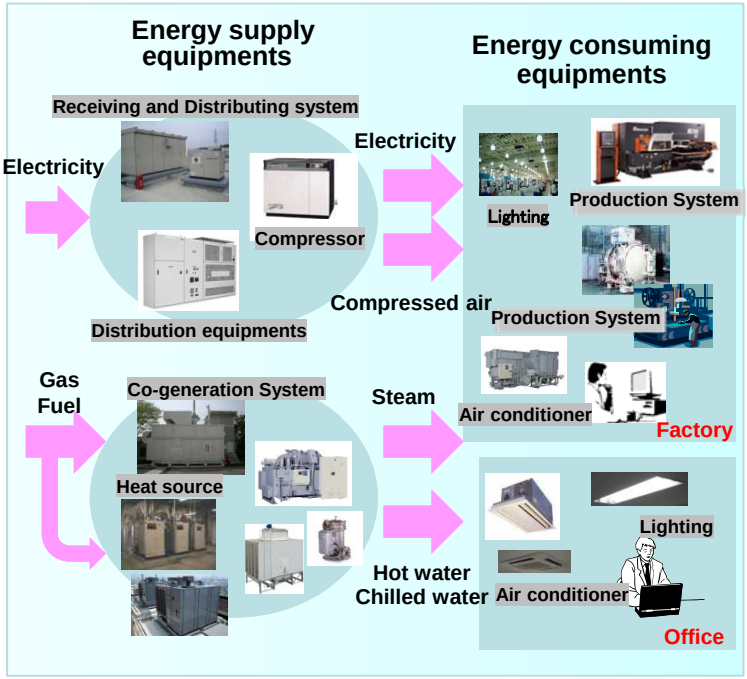
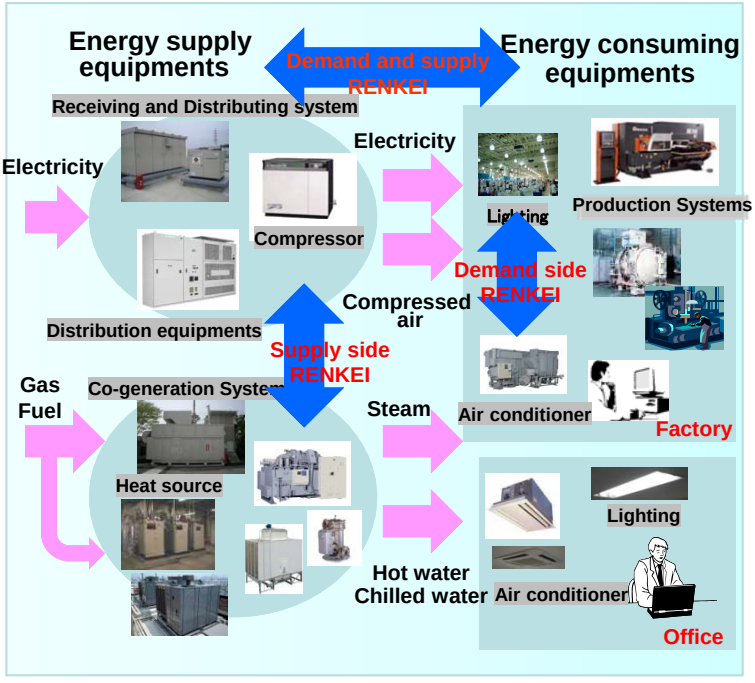


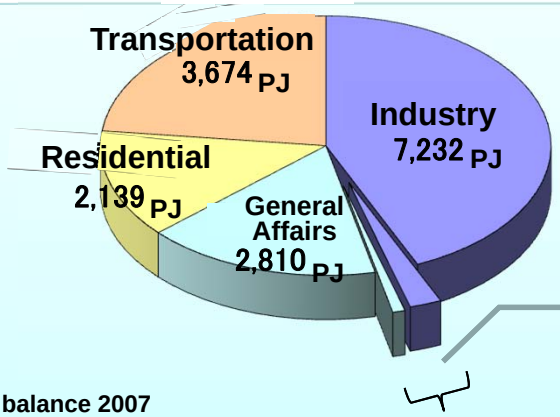
Visualization and Optimization

Buildings and factories are supplied with the primary energy such as electricity, gas and fuel and the secondary energy such as steam, chilled/hot water and compressed air. These energies are used for air conditioning and the operation of production equipment.
Energy efficient equipments have been introduced for energy savings. Companies have been promoting the activity for energy savings by visualizing the actual energy consumption.
However, the nature of energy that is difficult to be stored and transported tends to cause some mismatch between supply and demand of energy when the boundary condition such as production volume is changed. It is usual that production plants are designed to operate at the maximum energy efficiency for the maximum demand. So, it should also be noted that simply reducing energy supply can degrade the total energy efficiency of the plant, when the production volume is reduced. It is necessary to find the best mix of energy sources to optimize the demand and supply balance. In order to maximize the total energy efficiency of a factory, total optimization control is important rather than integrating partially optimized equipments.

RENKEI Control

"RENKEI" control is a generic concept of optimisation control technology that maximizes the total energy efficiency by controlling individual equipments to work in concert with each other and harmonizing the demand and supply of energy.
There are several types of RENKEI Control. "Demand and supply RENKEI" controls the load balance of energy supply equipments to get the optimized energy efficiency as a whole. "Supply side RENKEI" controls equipments in the supply side into an optimum load balance for the demand. Energy supply facility is operated based on the demand forecast that is affected by factors such as production schedule and weather forecast. When the demand is expected to exceed the maximum capacity of the energy supply equipment, production operation and scheduling may be changed.
It is practical to push forward energy savings in a step-by-step manner by finding an optimum operating point of individual equipments to work in concert with each other. RENKEI Control is an advanced control technology that enables energy savings utilizing the existing equipments in both supply side and demand side.





Energy consumption by sectors and expected savings by RENKEI Control

About 500PJ*

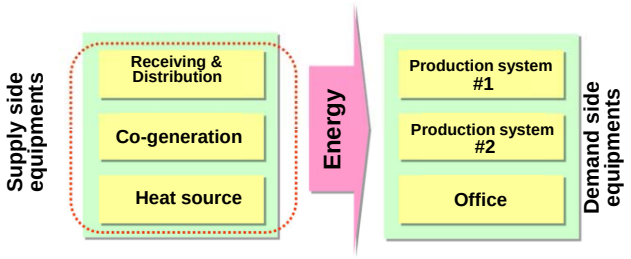
Expected Energy Savings by RENKEI Control

Source: Energy balance 2007
Agency for Natural Resources and Energy
(Data: Energy balance in Japan)

* Estimated as 5% of Industry and General affairs
* PJ: Peta(10^{15})Joule

Supply side equipment RENKEI

Method to control equipments based on their energy characteristics.
Minimize the CO2 emission and costs by optimizing the load balance of equipments.
(1) Optimum balance of heat sources by electricity, fuel and gas
(2) Optimum load balance of equipments in the supply side according to their energy characteristics

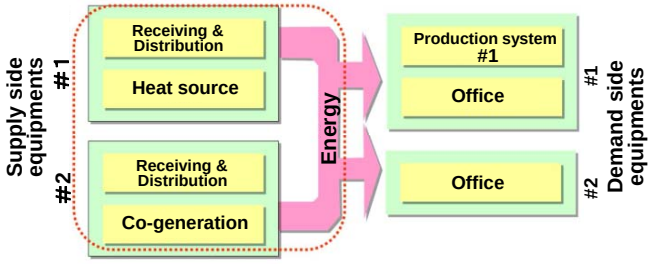


Actual implementation examples

- Optimum load balance between heat source equipments
- Optimum load balance between utility equipments
- Optimized quantity control of supply side equipments such as heat sources/compressors /pumps, that may have different capacities.

Supply side facilities RENKEI

Method to control the optimized operation of neighborhood facilities
(1) Optimum load balance between supply equipments in a factory
(2) Optimum load balance between supply facilities in neighborhood factories

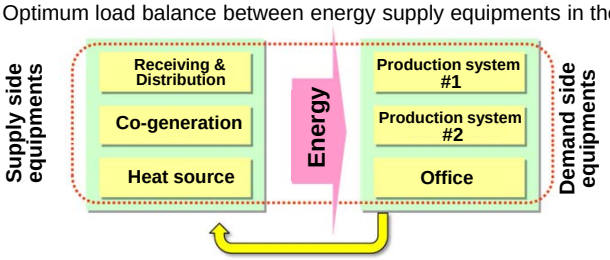


Actual implementation examples

- Optimum load balance between heat source equipments
- Optimum load balance between utility facilities
- Sequential operation control of auxiliary equipments (Compressor + Cooling water pump)
- Integrated control of multiple compressors

Demand and supply RENKEI

Method to control the operation of equipments in the supply side according to the demand
(1) Optimum load balance between energy supply equipments in the supply side based on the actual demand
(2) Optimum load balance between energy supply equipments in the supply side based on the forecasted demand

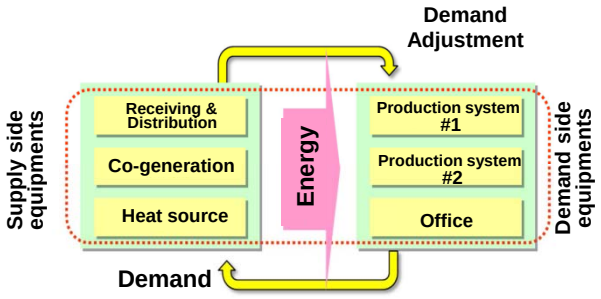


Actual implementation examples

- Regional air-conditioning
- Compressed air system,
- Cooling equipment system

Demand and supply bidirectional RENKEI

Method to control the operation of energy supply equipments according to the demand and to adjust the demand when the demand is expected to exceed the maximum supplying capacity.
(1) Change the of production operation
(2) Change the production schedule

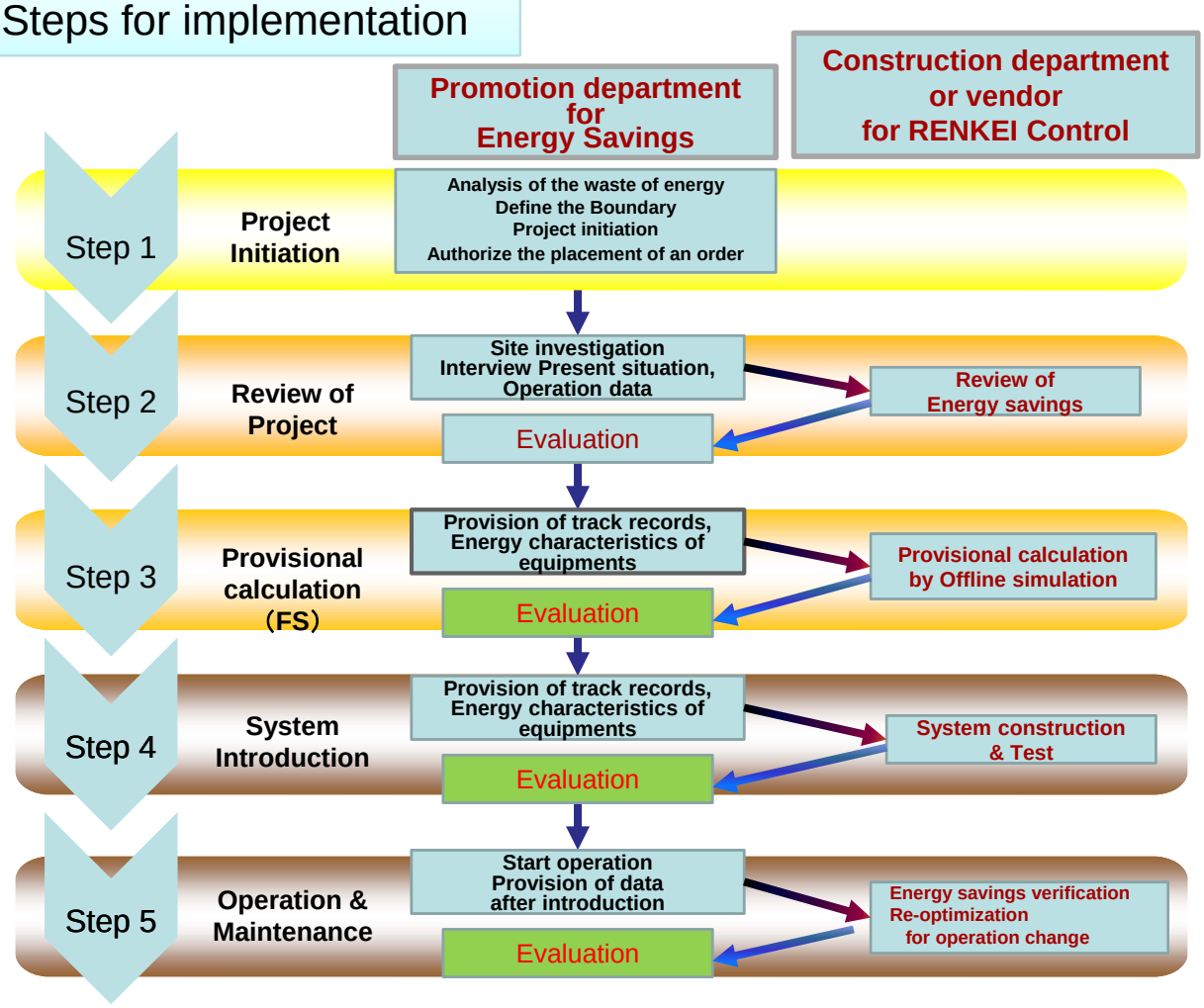


Actual implementation examples

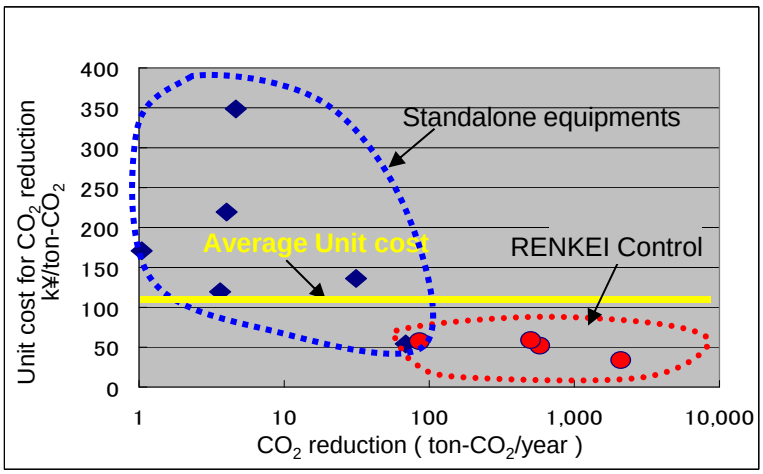
- Nighttime operation of a plant that is a heavy user of electric power
- Off-gas heat recovery of blast furnace
- Utility facilities in the supply side

※ In additoin to above categories of RENKEI Control, “Demand side facilities RENKEI” has been developed and implemented in actual factories.
※ Details explained in『RENKEI Control Guidebook (Japanese)』(issued January 2012)
Download from the HP(http://home.jeita.or.jp/)

Steps for implementation



Effect of RENKEI Control



This figure shows the effect of investment for equipments and solutions for energy savings using the unit cost for CO_2 reduction. The vertical axis represents the unit cost of CO_2 reduction. Unit cost is defined by the investment (k¥) to reduce 1 ton of CO_2. The smaller the unit cost, the better the energy savings. The horizontal axis represents the amount of CO_2 reduction. Blue markers represent the examples of energy savings by using energy efficient stand alone equipments such as transformer and heat source. Red markers represent the examples energy savings by RENKEI Control. Average unit cost is about 110k¥/1 ton of CO_2. RENKEI Control enables less expensive solutions as compared to the cases of stand alone equuipments.

Note1: Unit cost for CO_2 reduction : Investment necessary for reducing 1-ton of CO_2
Note2: Unit Cost of standalone an equipment is calculated by the difference an between energy saving type and a conventional type. (Source :Building Equipment 2005/December,2006/January)
Note3: Average renovation cost for energy savings (Source:Nikkei Sangyo Shimbun 2006/12/25)

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