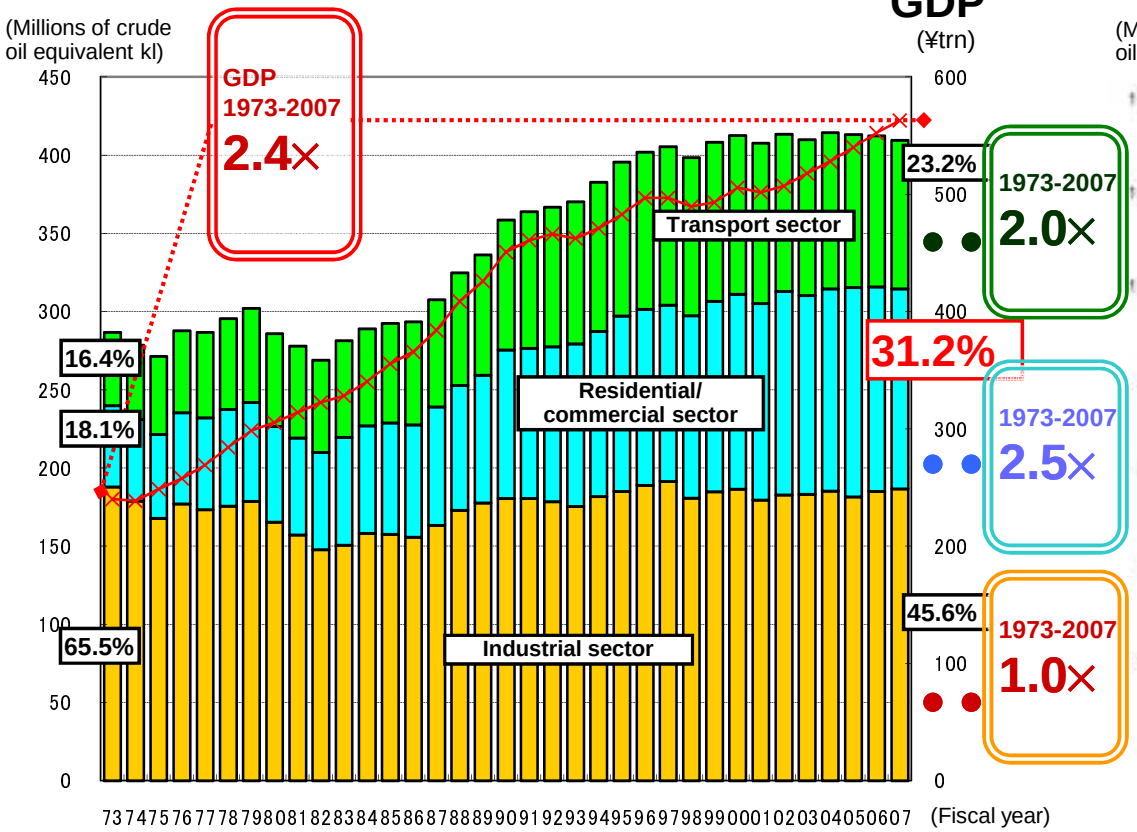
Japan's Policies, Goals and Designs for Zero Emission Buildings

October 5, 2009

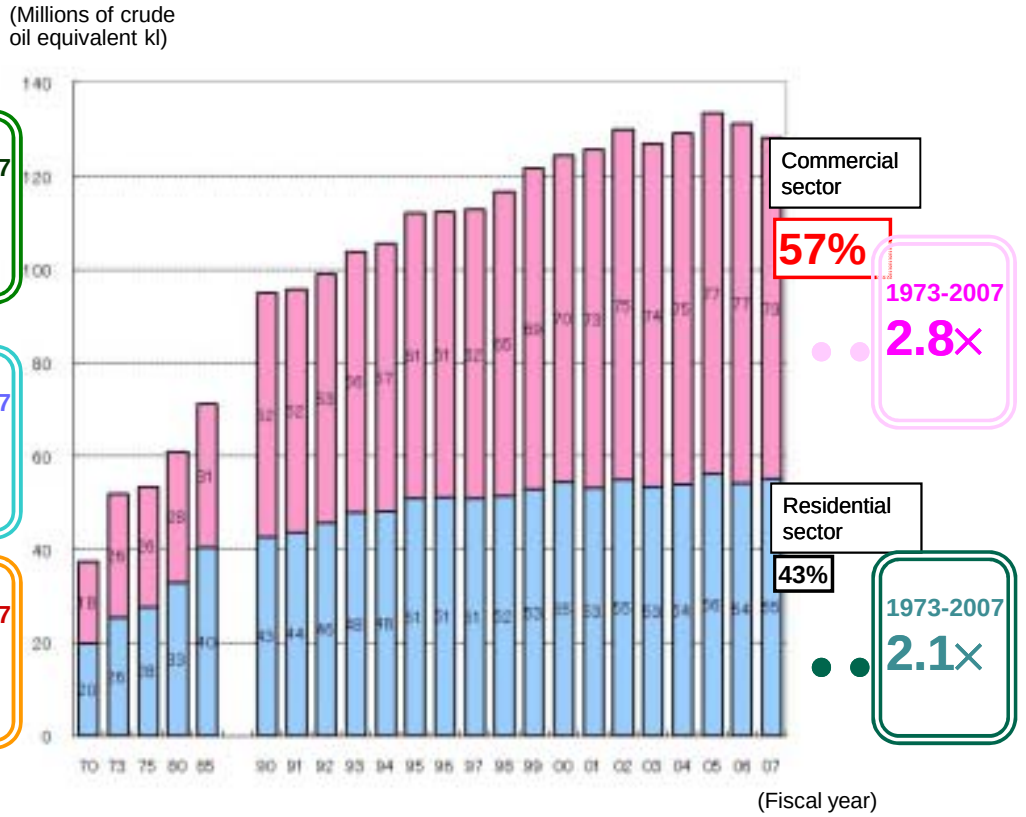
New Energy and Industrial Technology Development Organization

Final Energy Consumption for Residential/Commercial Sector

Trends in final energy consumption and real GDP



Breakdown of commercial and residential sectors



Source: Energy Balances in Japan (Processed Statistics), Annual Report on National Accounts of Japan

Note: Owing to the revision of the method for compiling Energy Balances in Japan (Processed Statistics), it should be noted that figures for fiscal 1990 onward are based on a different compilation method from that used for previous figures.

Energy-saving Measures for Commercial Sector

Regulations (relevant to commercial sector)

Energy Efficiency Law

◆**Design stage**: With regard to non-residential buildings, the thermal insulation performance of the building envelope and the energy efficiency performance of the building equipment are evaluated.
The obligation to notify the administrative agency of such evaluation has been expanded to buildings with floor space of 300 m^2 or more from the current 2,000 m^2 or more. (To be enforced on April 1, 2010)

◆**Operation stage**: Business operators whose total annual energy use in their factories and offices (including franchise chains) is 1,500 kl or more (crude oil equivalent) are required to make efforts to improve energy intensity by 1% or more every year.
Obligations:

- Submit annual regular reports on status of energy use.
- Submit medium to long-term plans regarding energy saving investment.
- Appoint Energy Management Officers at the board level, and factories and offices.

◆**"Top Runner Program:"** Improvement of energy efficiency of air-conditioning, lighting, hot water and office automation equipment.

Assistance

◆Fiscal support: Annual budget of JPY 30 billion for housing and building energy efficiency and JPY 50 billion for energy efficiency in general (excluding economic stimulus package)
◆Taxation: Accelerated depreciation, income tax deductions, etc.
◆Low interest rate financing

Source: Ministry of Economy, Trade and Industry

Acceleration of Development of Zero Emission Buildings

○ **GOJ ZEB target put forward in April 2009: "Acceleration of development of zero emission buildings (development aimed at making new public buildings zero emission by 2030)."**

ZEB definition

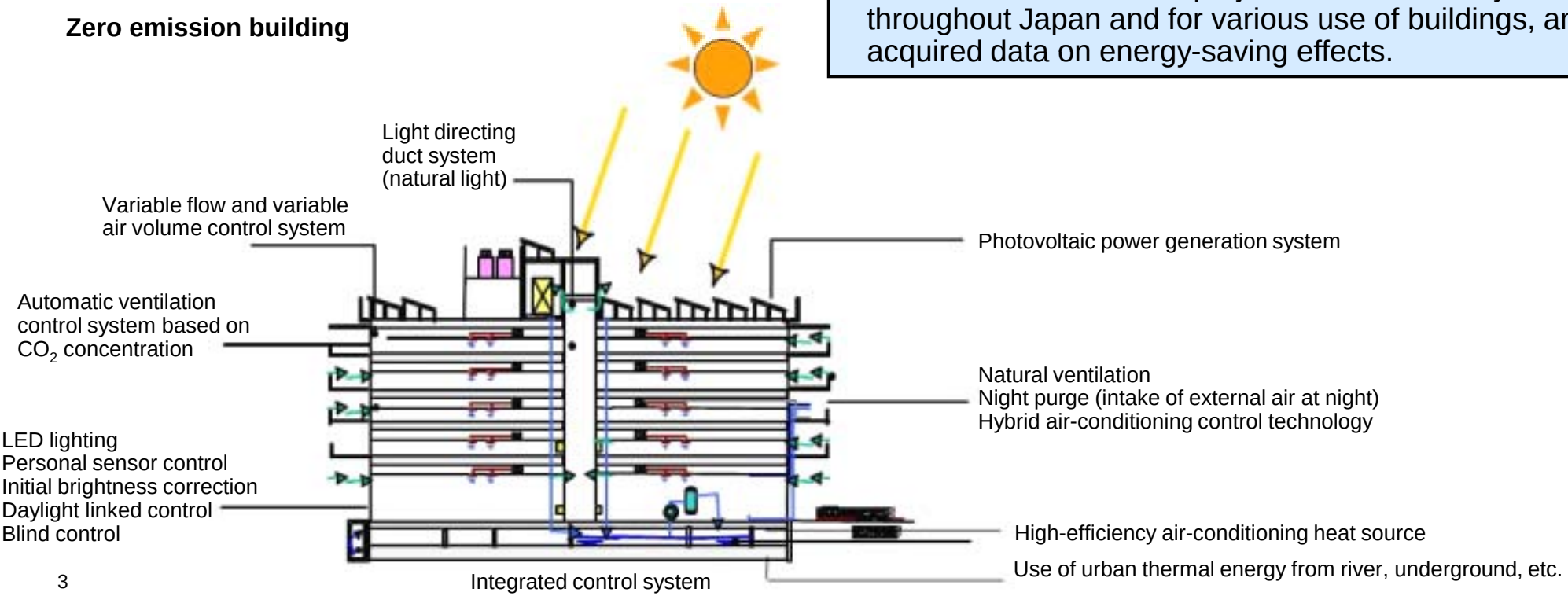
A building that emits zero CO_2 on annual net basis by reducing energy consumption through enhancement of energy efficiency of building envelop and equipment, local energy networks and the use of renewable energy on site.

Accelerated development of zero emission buildings

◆Aim to drastically raise energy efficiency performance through technological development and integration of advanced design technologies, equipment and operational control as total systems.

◆Conduct demonstration projects of such total systems throughout Japan and for various use of buildings, and acquired data on energy-saving effects.

Zero emission building



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Potential to Realize ZEB (1)

ZEB should be possible around 2030 for medium and low-rise office buildings with certain technological progress as outlined below. Achieving ZEB will be easier if area networks are created with neighboring buildings.

Assumptions:

- **Office building with about 5,000 m^2 per floor**
- **Primary energy consumption: 2,000 MJ per square meter per year (average for office buildings)**
- **Technological progress by around 2030 (based on "Cool Earth Energy Innovative Technology Plan" etc.)**
  - Passive architecture: high thermal insulation, solar shading
  - Use of natural energy: outdoor air cooling, night purge, and outdoor air intake control based on indoor CO_2 concentration
  - High-efficiency heat sources: development of heat sources with about 20% higher efficiency than at present (raising the current COP 6.4 turbo chillers to around 8.0)
  - Low energy consumption conveyance: thorough use of inverters, high-efficiency motors, pumps and fans, low friction loss piping and duct size
  - High-efficiency lighting: development of high-efficiency lighting equipment and brightness setting with one-third of the current level of power consumption, and thorough use of variable light and blinking control
  - Low energy consumption OA equipment: development of low-consumption OA equipment, security and disaster prevention equipment, and standby power equipment with one-third of the current level of power consumption
  - Electric power emission coefficient: 2030 energy supply and demand estimates
  - Photovoltaic power generation: installation of panels with conversion efficiency that is double the current level on two-thirds of rooftop area

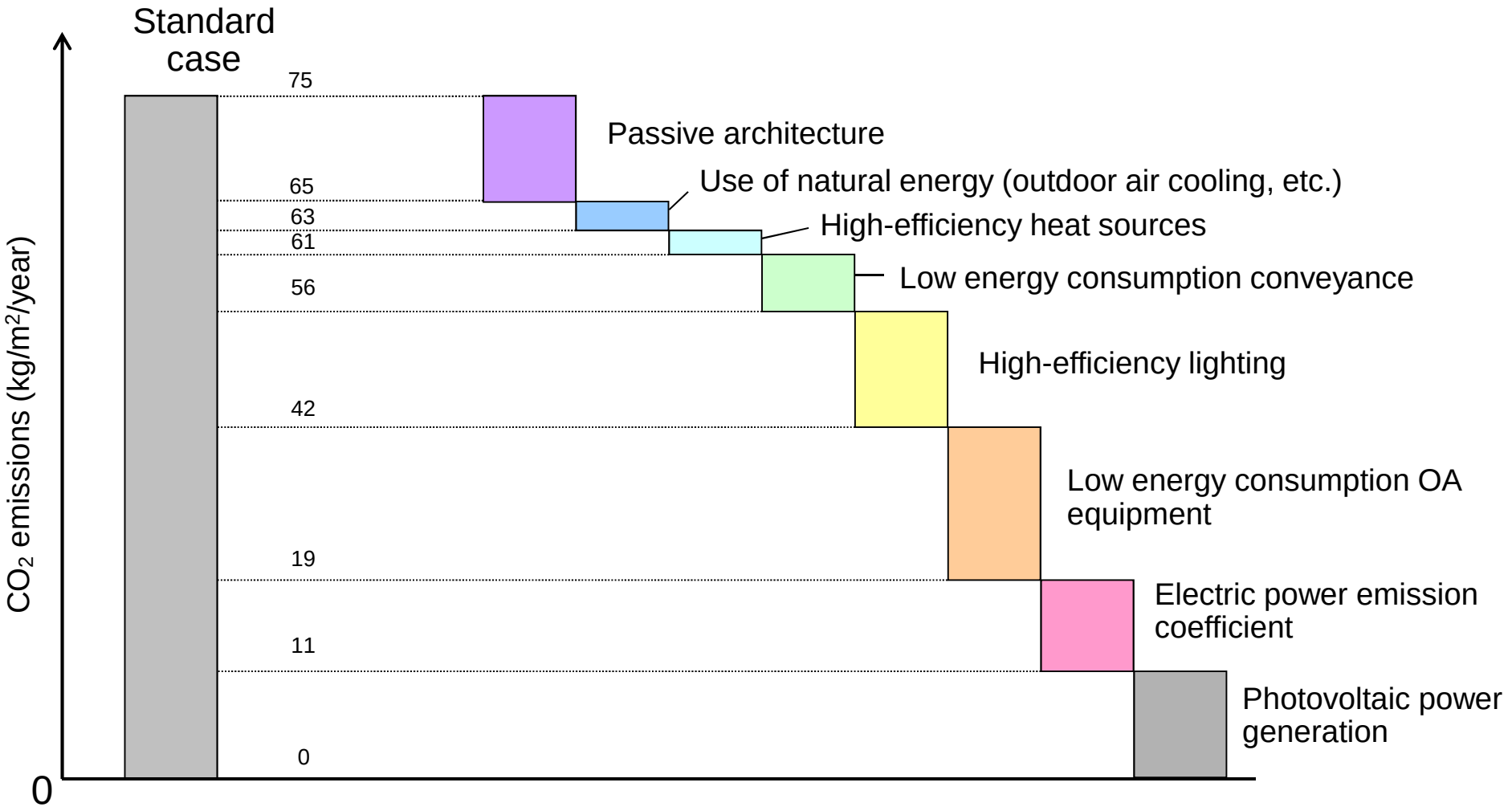
Expected Results:

- **Low-rise buildings (up to 3 floors) will achieve ZEB, and buildings with up to 10 floors will be able to reduce emissions by about 90% (almost zero).**

Source: Ministry of Economy, Trade and Industry

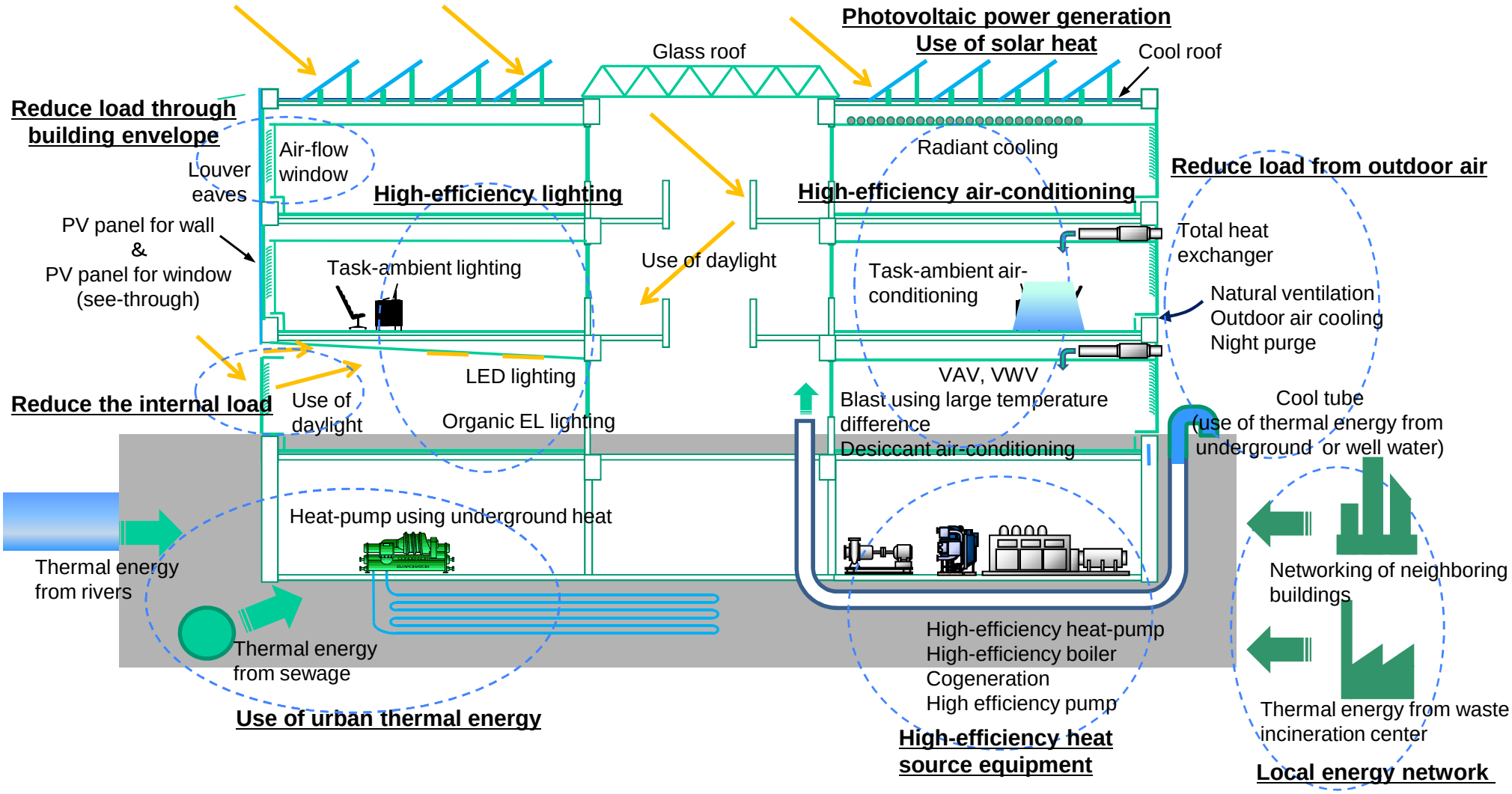
Potential to Realize ZEB (2)

Results of initial calculations: Scenario for three-story building



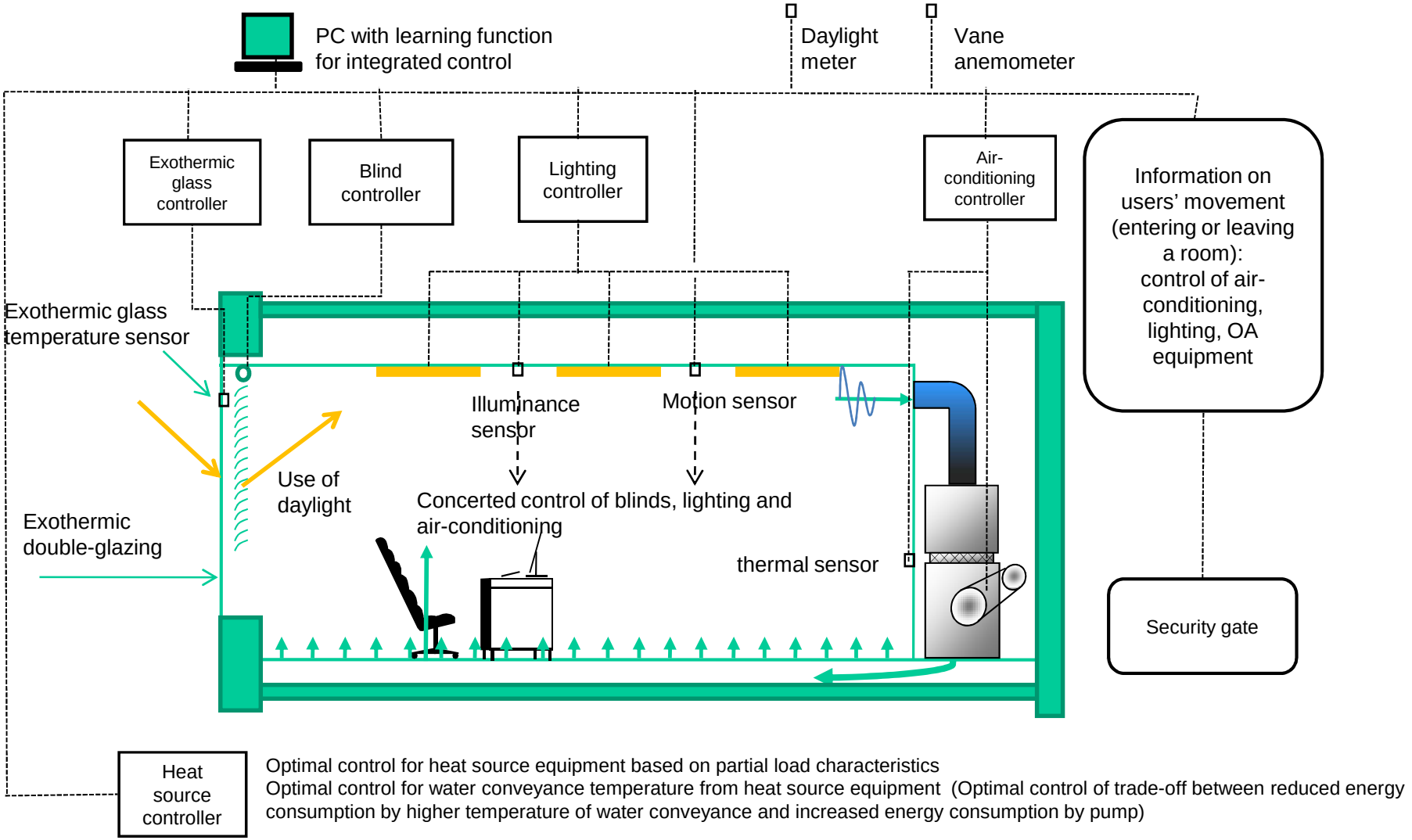
Source: Ministry of Economy, Trade and Industry

Comprehensive Building Design for ZEB



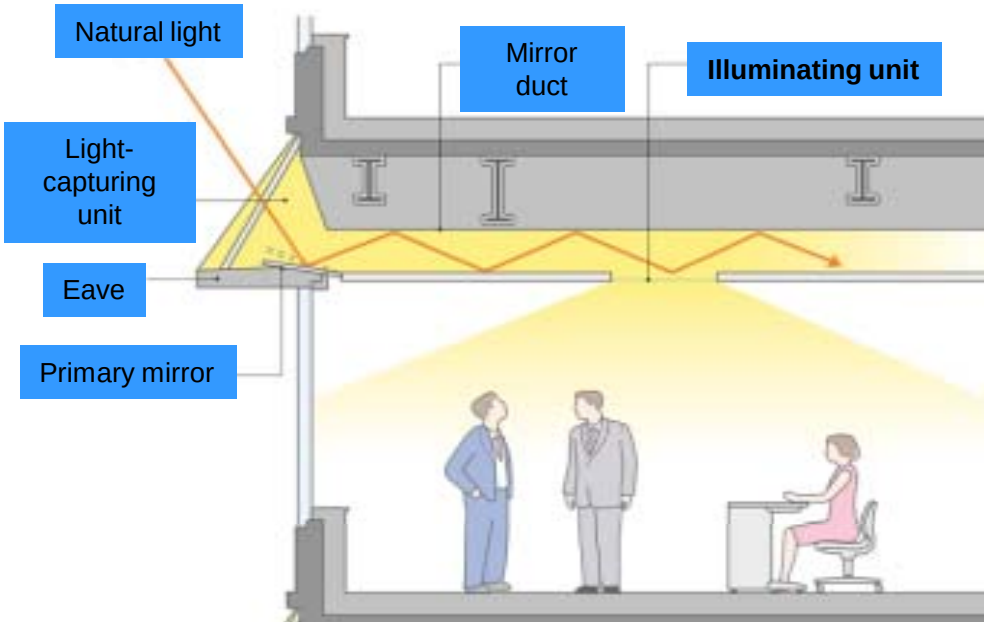
Source: Ministry of Economy, Trade and Industry

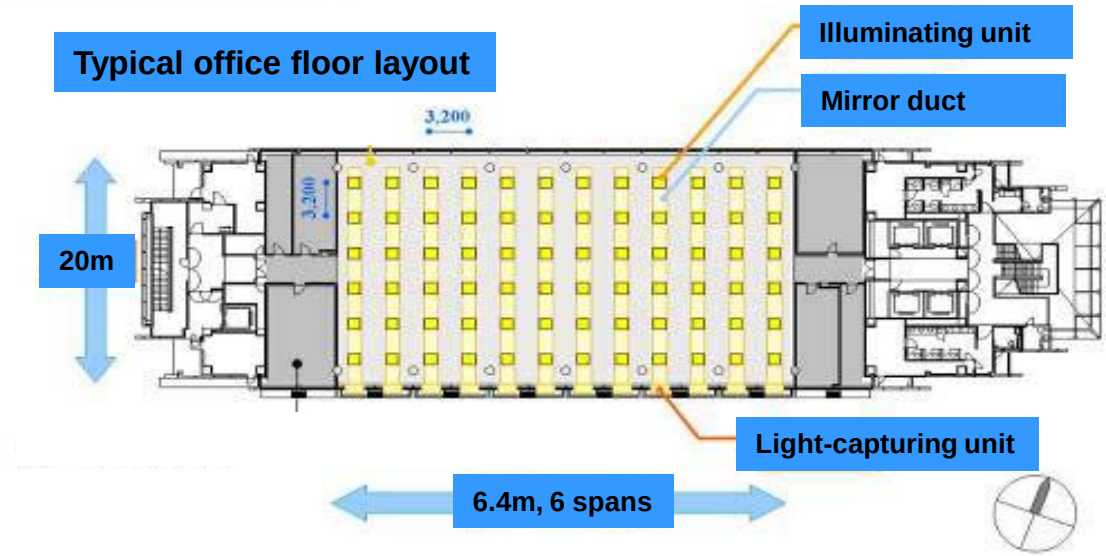
Integrated Building Control for ZEB

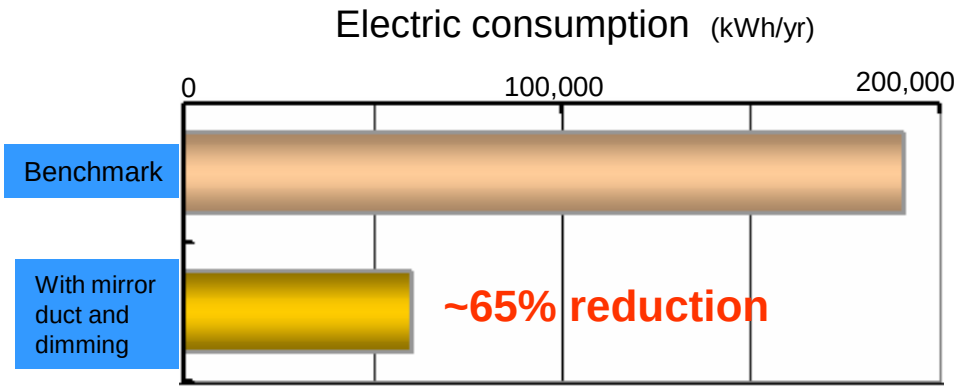


Source: Ministry of Economy, Trade and Industry

Mirror Duct: Channeling Natural Light into Workspaces







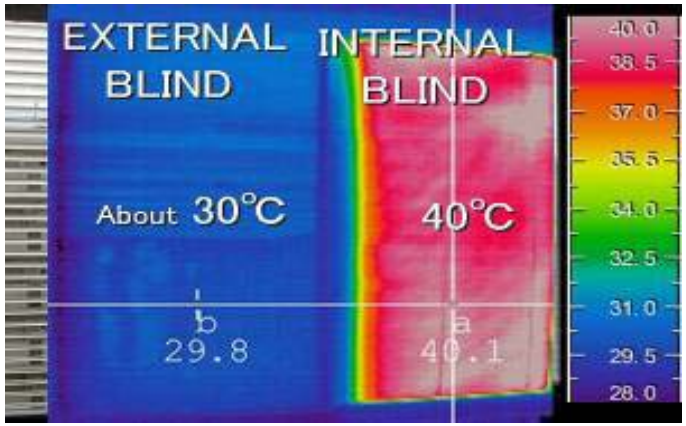
・13,700 m^2 office building completed in 2003

Source: Nikken Sekkei Research Institute

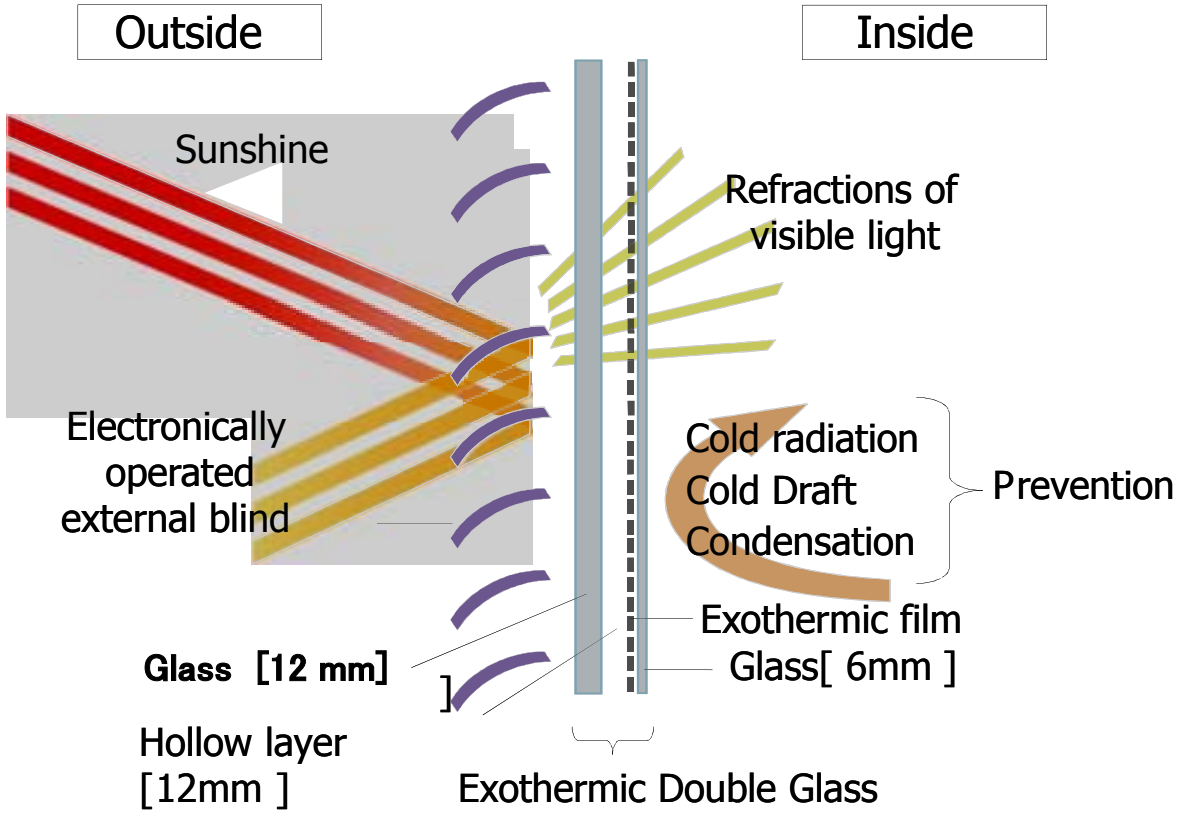
External Blinds

Effect of automatically controlled external blinds

- Multi-glazed glass, horizontal and vertical louvers for sun-shading
- Perimeterless AC system
- Retain view and comfort while conserving energy
- Variable facade



External blinds are more effective



Source: Nikken Sekkei Research Institute

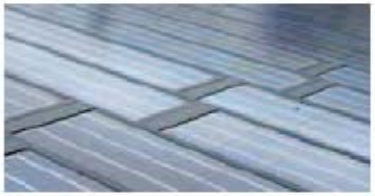
External Blinds (Automatic slat angle and up-down control)

Nikken Sekkei Tokyo Office

- Completed: 2003
- Floor area: 20,581 m^2

Source: Nikken Sekkei Research Institute

Small Wind Turbine Generator
Zephyr Co., Ltd



Photovoltaic (PV) Systems
Sekisui House, Ltd

Organic LED Lighting
Yamagata Promotional Organization for the Industrial Technology Research Institute for Organic Electronics

Portable High-capacity Lithium Ion Battery Power Supply
Kyushu Electric Power Co., Inc., Mitsubishi Heavy Industries, Ltd.

High-performance VIP Hybrid PU Insulation Board
Achilles Corporation
Matsushita Electric Industrial Co., Ltd.

Mirror Duct System
Material House Co., Ltd.

Eco cement
Taiheiyo Cement Corporation

Woody Material Reclaimed from Thinned Wood and Waste Wood
Sekisui Chemical Co., Ltd.

High-efficient Heat Pump Hot Water Supply System
Panasonic Corporation

Residential Fuel Cell System
Toyota Motor Corporation

Examples of the Results of R&D at ***Zero Emission house***

Organic LED Lighting

Reserch Institute for Organic Electronics

High-efficiency OLED lighting is long-life, thin and the design is sophisticated. It will change the future of lighting.

Organic light-emitting diode (OLED) lighting is highly efficient and it has a spectrum similar to natural sunlight. It now has a greater efficiency than incandescent bulbs and the same lifetime as fluorescent lamps. In the future, OLED lighting will be more efficient than fluorescent lamps, and it is expected to be one alternative to mercury-containing fluorescent lamps.

〈http://www.organic-electronics.jp/〉

High-perfomance VIP Hybrid PU Insulation Board

ACHILLES CORPORATION, Matsushita Electric Industrial Co., Ltd.

High Perfomance VIP hybrid PU Insulation Board for "the house without heating " and " the zero energy house "

This product has twice the thermal insulation properties in a thickness equal to PU foam board. Development of advanced high-performance vacuum insulation materials and construction experiments using hybrid insulation board were supported by the New Energy and Industrial Technology Development Organization (NEDO)

High-efficient Heat Pump Hot Water Supply System (Eco-Cute)

Matsushita Electric Industrial Co., Ltd.

Highly efficient and the industry's smallest natural refrigerant (CO_2) heat pump hot water supply system (Eco-Cute)

The heat pump unit and hot water reservoir unit have been integrated into one unit in this product (COP4.6). This product has been commercialized based on research supported by the New Energy and Industrial Technology Development Organization (NEDO).

Mirror Duct System

Material House Co.,Ltd.

A mirror duct system is a lighting system that transfers daytime solar light into buildings for use by lighting fixtures, with no electricity or thermal energy required

The mirror duct system is a lighting system that transfers daytime solar light into buildings for use by lighting fixtures, with no electricity or thermal energy required. With low running costs after installation, the system can continue to provide natural lighting on a semi-permanent basis. Demonstration of the system was supported by the New Energy and Industrial Technology Development Organization (NEDO).

〈http://www.materialhouse.co.jp/〉

Thank you for your attention!