

Energy Efficient Buildings: Example of a House Renovation in Tokyo

Seminar at ICU
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October 22nd, 2014

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Introduction: Energy Efficient Buildings
R&D Trends
Practical Example: Renovation
Conclusions

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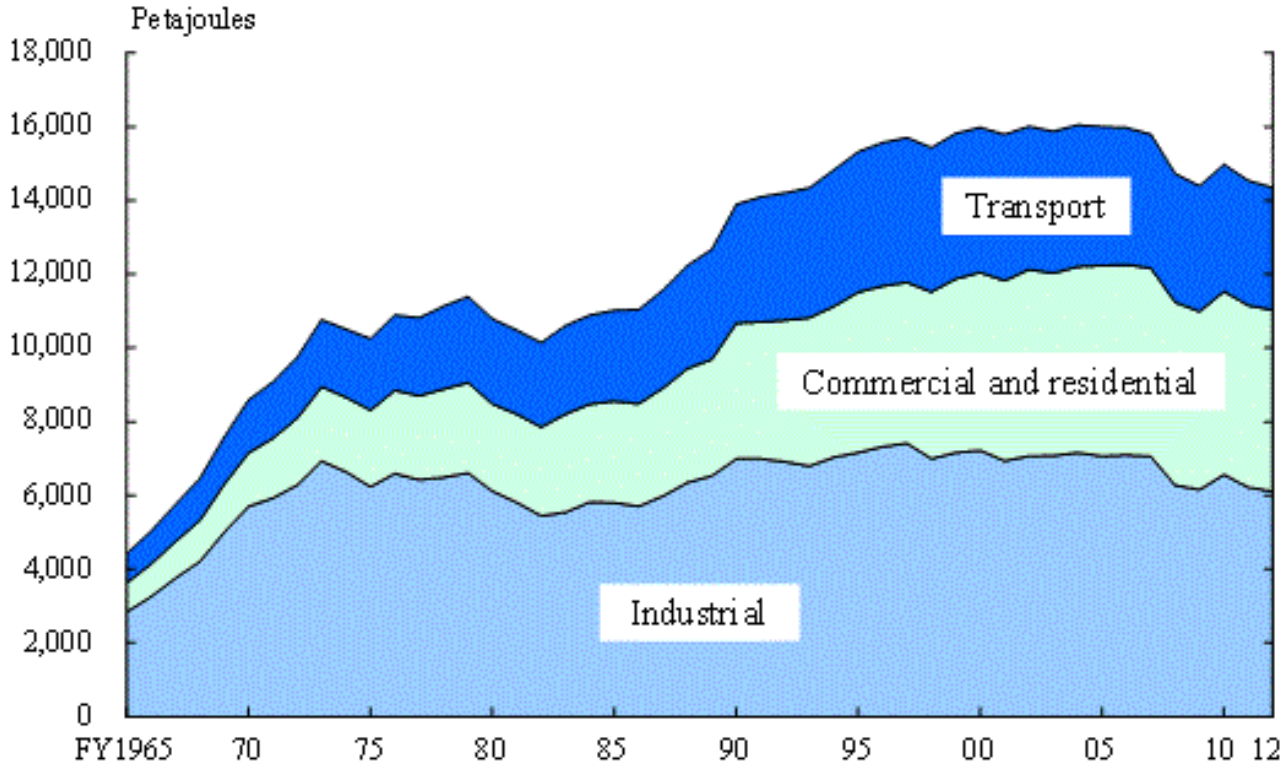
Why low energy houses?

Trends in Final Energy Consumption by Sector [1)]



1) A different statistical method was used for figures of fiscal 1989 and prior.
Source: Ministry of Economy, Trade and Industry.

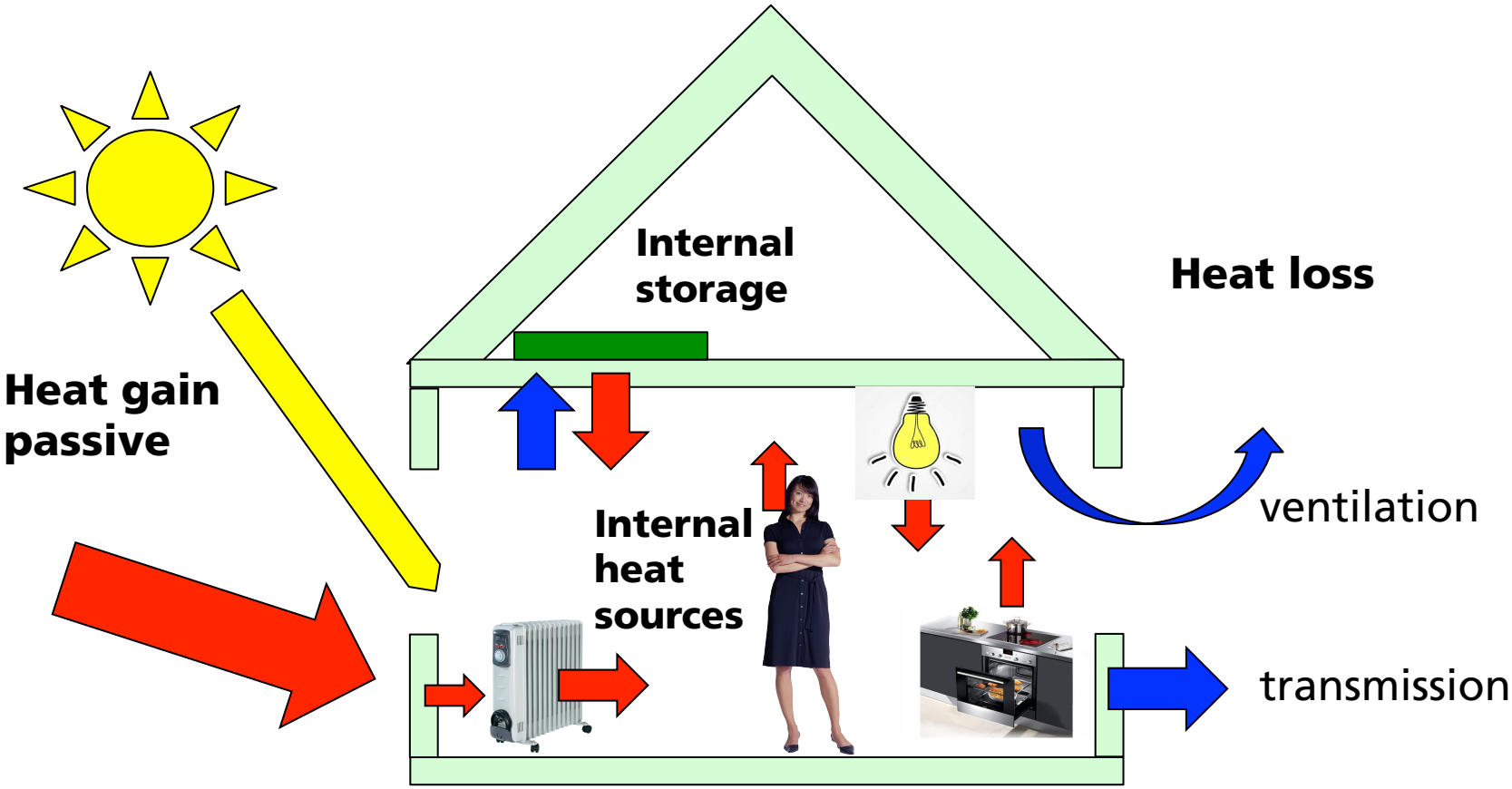
(Statistical Handbook of Japan 2014, Statistics Bureau)

Energy Consumption in the Building Sector in Japan up by 41,9% !! (1990-2012)

Reasons for Increase of Energy Consumption in Commercial / Residential Sector

- Why increase by 41.9 %:
  (i) Rise in residential floor space
  (ii) Large-scale retail stores
  (iii) Increase in air conditioning / lighting used there
  (iv) Extending opening hours
  (v) Rise in the total floor area of office buildings
  (vi) Growth of office automation
- Countermeasures:
  1) **Energy efficient buildings**
  2) **Energy efficient building equipment** (heating, cooling, lighting, smart buildings)

Energy efficient house



Heat gains and losses and internal heat sources determine indoor temperature

Energy efficient house

- Low use of energy through efficient devices:
  - efficient lighting (LEDs), use of daylight
  - efficient heating/cooling equipment
  - Home Energy Management System (HEMS), etc.
- Reduction of heat and cold loss through:
  - better / outside insulation of walls
  - better insulated windows/window frames
  - air tight building envelope
  - ventilation system with heat exchanger

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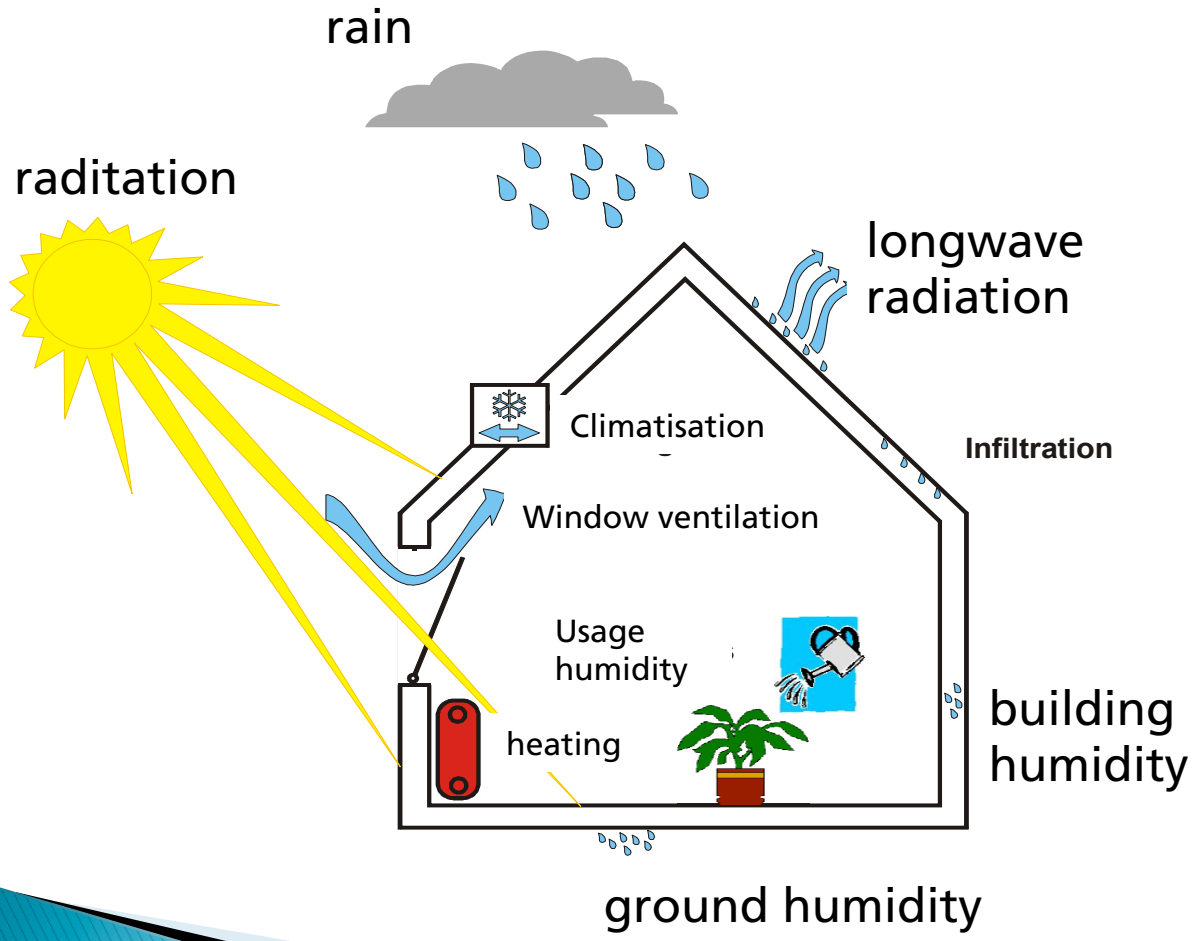
Important: hygrothermics

better energy performance = higher risk of moisture problems



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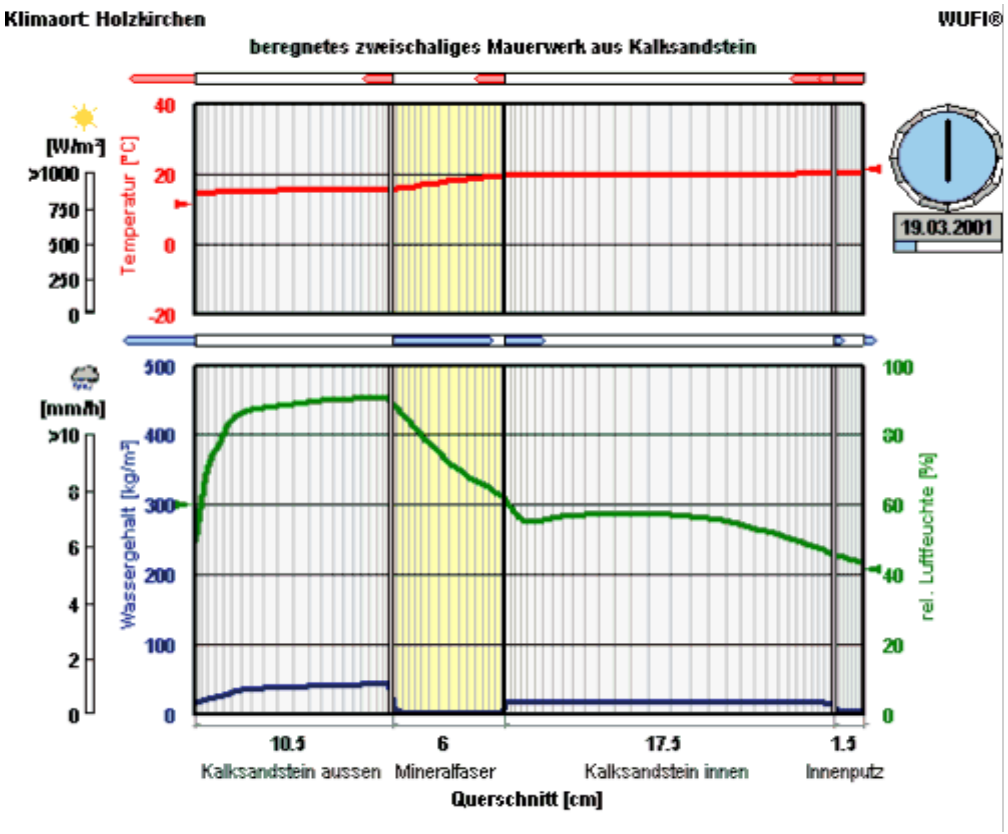
Moisture Control and Climate Specific Design

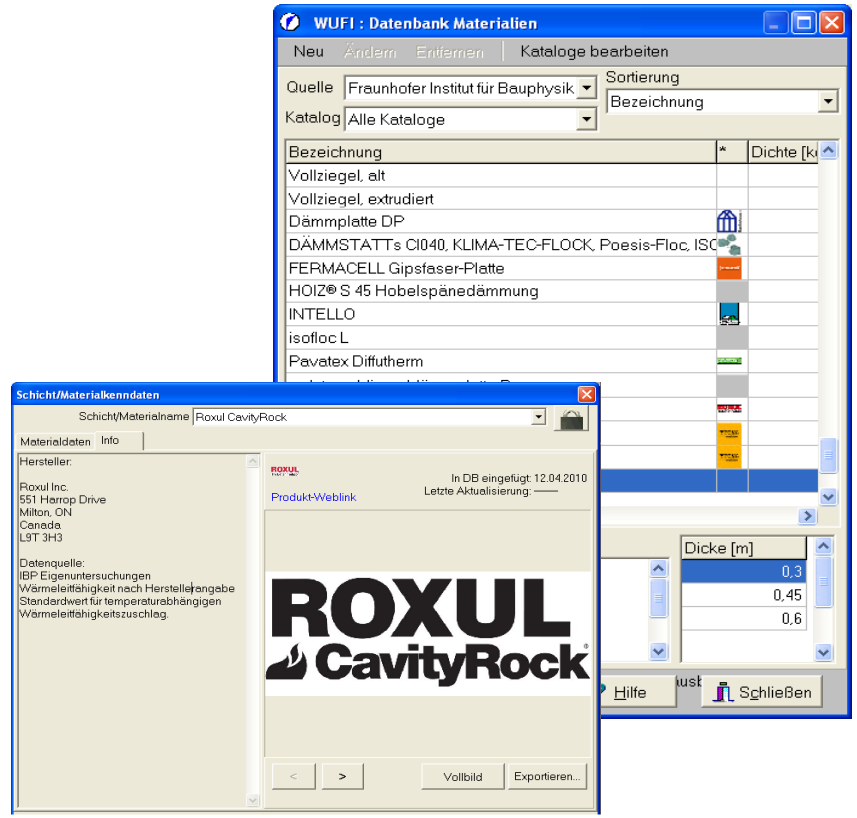
Moisture control assessment based on simple diffusion calculations (Glaser, dew-point method) not sufficient.

Effective moisture control design must consider all loads including construction moisture, summer condensation, effects of wind-driven rain

Software for Hygrothermics

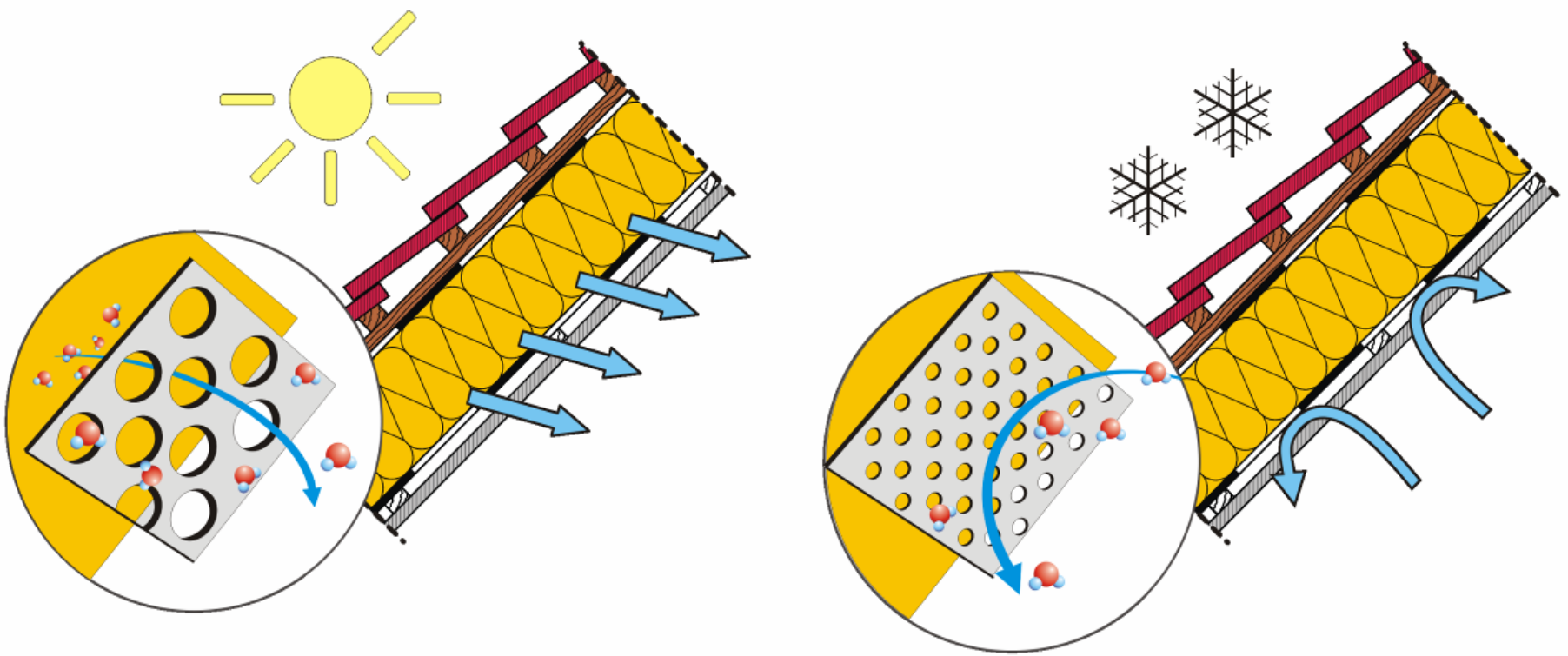


Fraunhofer *WUFI® Pro 1D film viewer*



WUFI® Material Database

Functional principal of the adaptive vapor barrier



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House before / after

Construction: frame

Construction: windows

Construction: inside insulation

Construction: outside insulation

Construction: heating / cooling

Construction: vapor barrier / plaster board

Construction: wall paper / interior

Blower test

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