

Solar Thermal System in Buildings

- Solar thermal technology -

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Solar Thermal Technology in Buildings

Systems

- Hot Water Heating
- Space Heating
- Cooling

Components

- Solar Collector
- Solar Hot Water Heater



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Development of Solar cooling (1974)



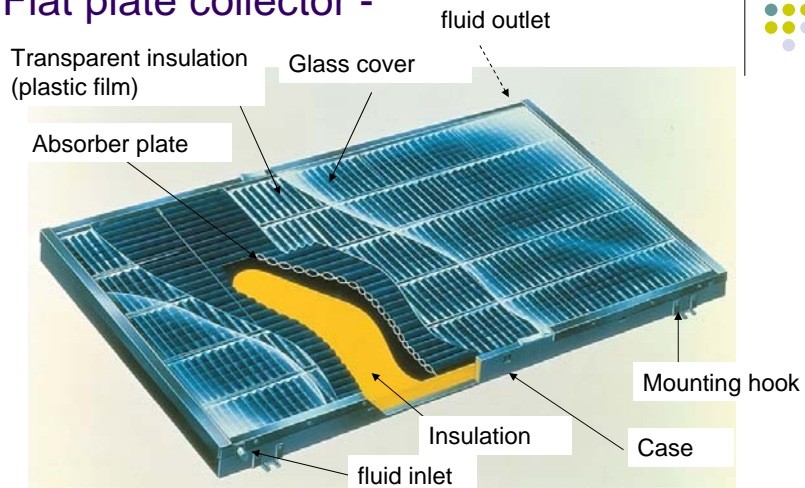
Total Floor Area 127m²

Collector area: 102m² Heat storage tank: 5m³

Absorption chiller: 7kW, 75 – 90 degrees C

(Yazaki, Solar House One) ³

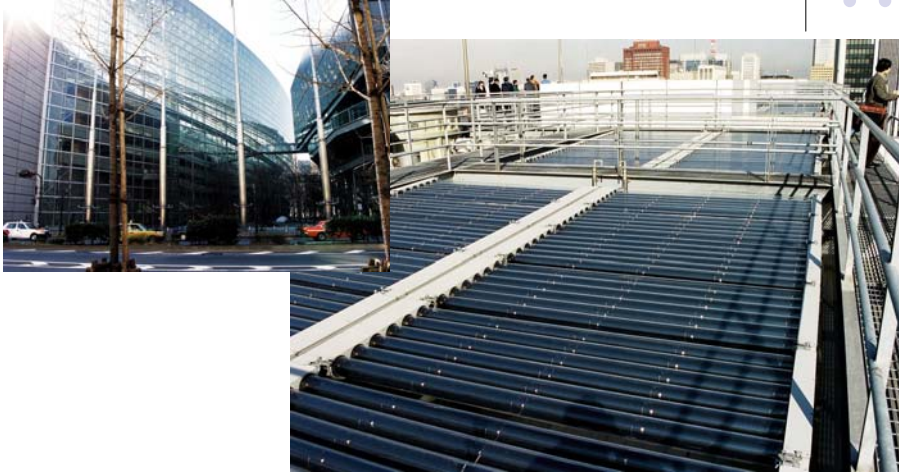
Solar Collector - Flat plate collector -



Super Blue Panel (Yazaki Corp.)

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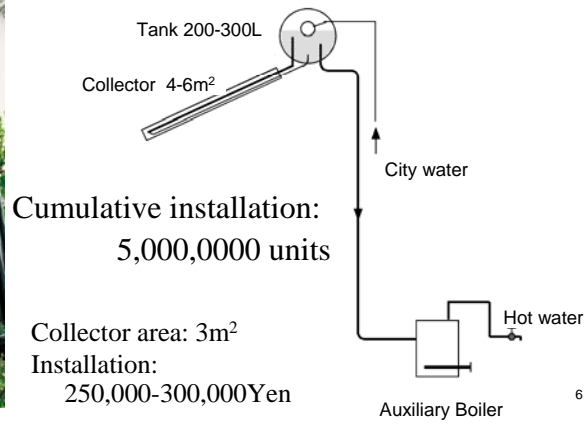
Solar Collector - Evacuated Tubular Collector -



Evacuated Tubular Collectors on the top of the **Tokyo International Forum**

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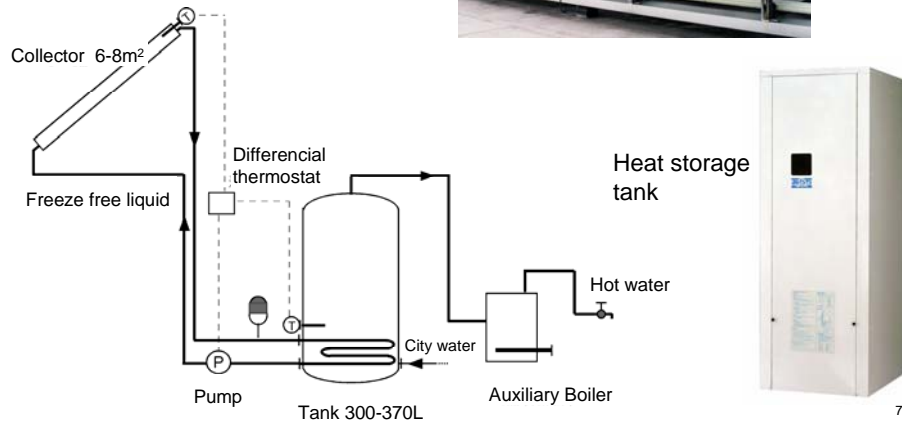
Solar Water Heater



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Solar Hot Water Heating system

- Solar collector and Heat Storage tank
- Pump with heat collection control system



Solar space heating system 1985



USH
(Udagawa1985)

Collector 12m²



Solar floor heating



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USH

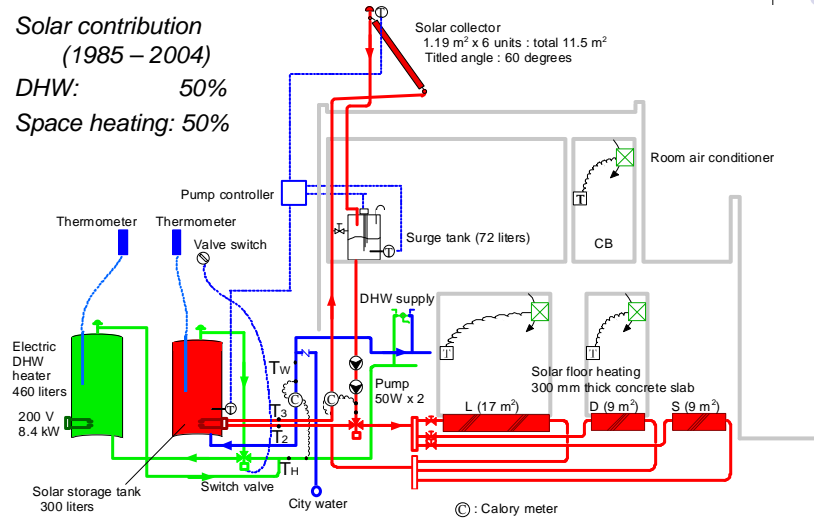
Solar floor and DHW heating for single family house



Solar contribution
(1985 – 2004)

DHW: 50%

Space heating: 50%



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Solar House (Chiryu, Aichi Pref.)

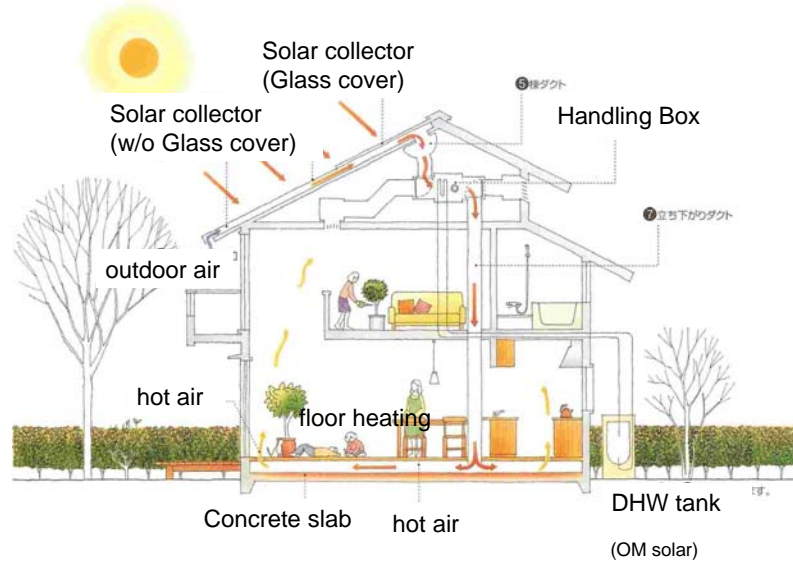


- Active + Passive Heating
- Solar collector+floor heating and Tromb wall

(Photo and drawing by Okamoto, Chiryu Heater) ¹⁰

OM Solar System

Integrated solar house with air collector



Solar PV and Thermal Systems

Solar PV House appeared (1990s)



PV system with well insulated house and Solar DHW heating
(Housing area near Akita City, Misawa Home Co.)

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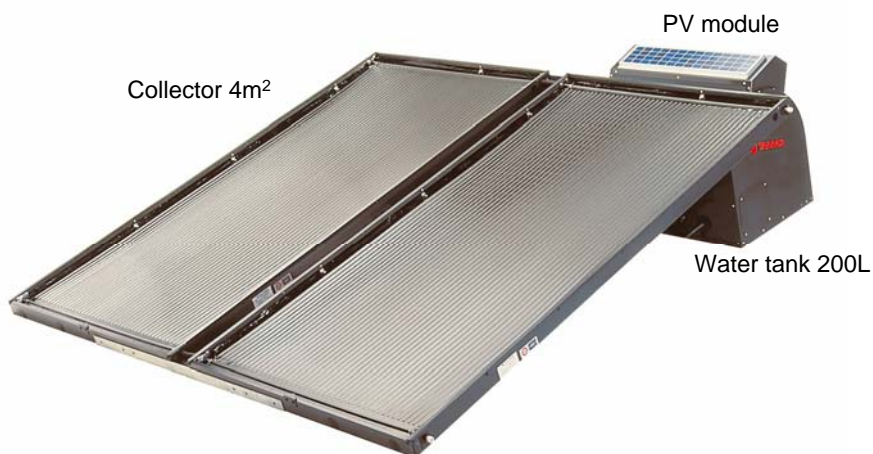
Hybrid Solar House



4 collectors + 24 PV modules (Yazaki Co.)

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Solar Hot Water Heating System with PV pump



(Yazaki Corp.)

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Solar systems for apartment houses

Noborito solar house, 1978

- Feasibility study by Japan Housing Corporation -



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Solar apartment houses



Chiryu City



Kanazawa City

- Examples of solar DHW system for multi-family house in 1980s
- Individual system using balcony mounted solar collector

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Solar space and hot water heating for a lowrise apartment house(Chiryu City)



(Chiryu heater)



Solar apartment house
(Chino City, Nagano Pref.)

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Large Solar Building - Senior Center in Shiobara -

Health care center for elderly people
Solar heating and cooling system (Yazaki, 2003)

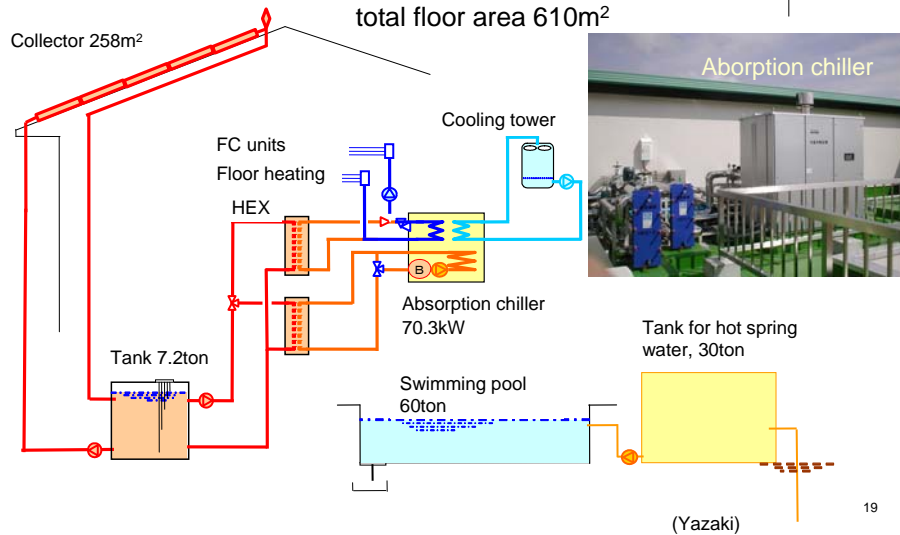


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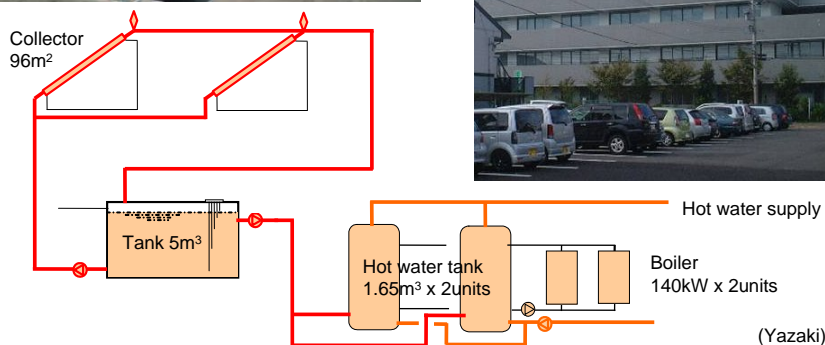
- Senior Center in Shiobara -



Solar heating and cooling system total floor area 610m²



Fujieda Sunppu Hospital Solar DHW heating system, 2000



OM Solar Systems

- integrated solar house design -



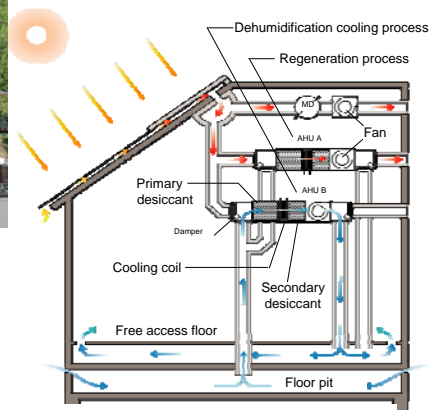
(OM Solar)

Office building of OM Solar "Egg of Earth", Hamamatsu, 2004

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Solar Desiccant Dehumidification and Cooling System

(Harunocho Regional Center, Hamamatsu)



(OM solar)

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Expected Solar Energy Use in Japan

(Primary Energy, 10⁶ kL Oil/year)



	FY2003	FY2010
Solar thermal	0.59	0.9 (4.39)
Solar PV	0.21	1.18
Wind power	0.28	1.34
New energy total (Gross energy)	10.54 (1.8%)	19.10 (3%)

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Expected Collector Area



Collector Area	x 10 ⁶ m ²	
Existing Area in 2004	7.7	stock
Expected until 2010	12.8	
Expected installation until 2010 (every year)	1.3	for 4 years, 2007-2010
Installed in 2005*	0.25	

*Solar DHW system and Solar Water heater

**Collector Area 1m² = 0.07kL Equivalent Oil

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Feature of Solar Thermal System

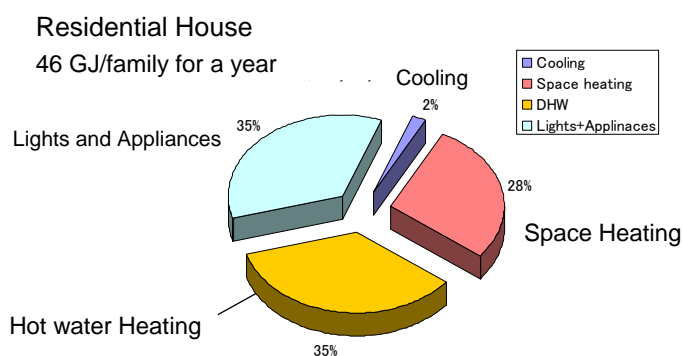


Solar thermal system vs. PV system

- Solar thermal system
 - **Heat load:** Hot water heating, space heating and cooling
 - Solar system: Tightly connected with **Heat Load**
 - **Heat load** influenced by weather condition and behavior of the occupants
- PV system
 - Electricity, for all purpose
 - Grid connected system: sell and buy the electric power

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Example of Energy Requirement in Buildings in Japan



- Hot water heating and Space heating, Major heat requirements
- Solar heating to reduce hot water heating energy
- Building thermal insulation and solar energy to reduce space heating energy

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Solar Thermal System for Today, Tomorrow



- Integration
 - Integration with Heat loads and Building service systems
 - Integration with Building thermal system and Architectural design
- Standardization
 - Standardization of Systems and Components
 - Standardization of Design and Evaluation Methods
- Cost effectiveness
 - Reduce Installation cost
 - Improvement of Pay back period
Including Finance, Subsidy

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