Workshop

Renewable Energy and Recovering of Energy

in Architecture and Construction

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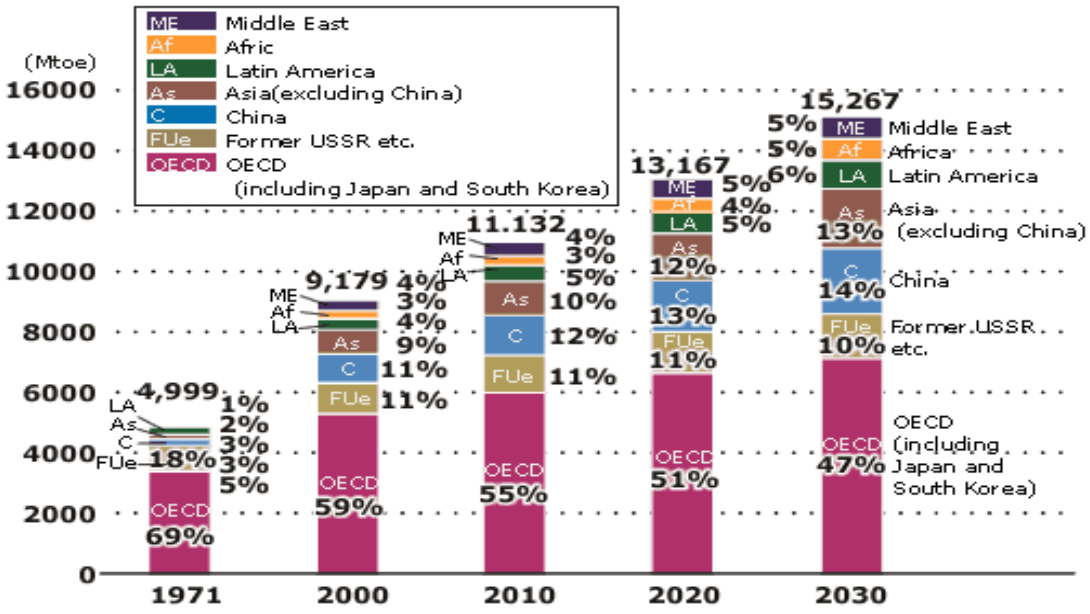
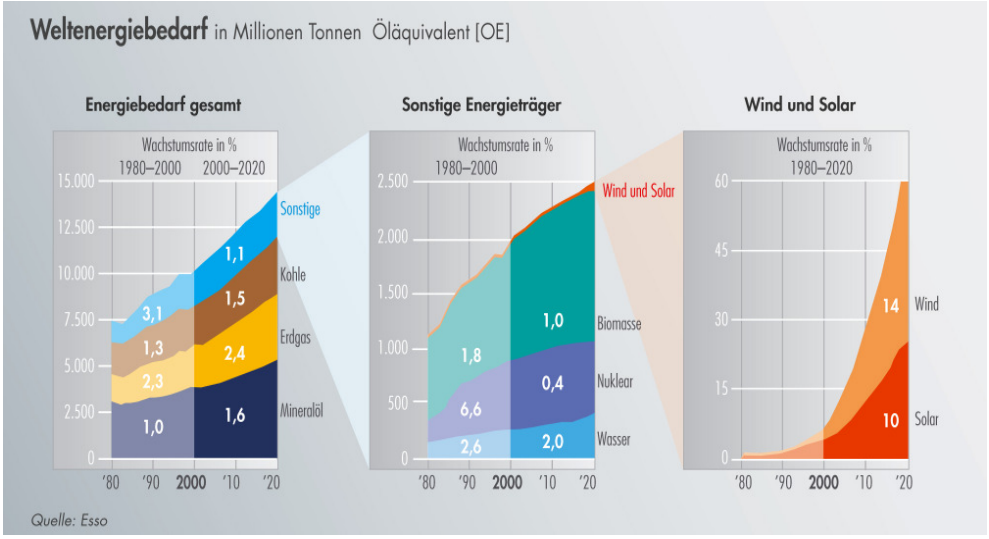
The demand for energy in the world has experienced a sudden increase in the developing regions, particularly in Asia, and predictions are that in 2030, it will increase by 66% compared to demand in 2000. The Asian region (excluding Japan) will account for almost 40% of that growth.

While the ratio of demand for energy in the world will decrease among the OECD nations from 59% in 2000 to 47% in 2030, the level of demand among countries in the Asian region will rise during the same period from 20% to 27%.



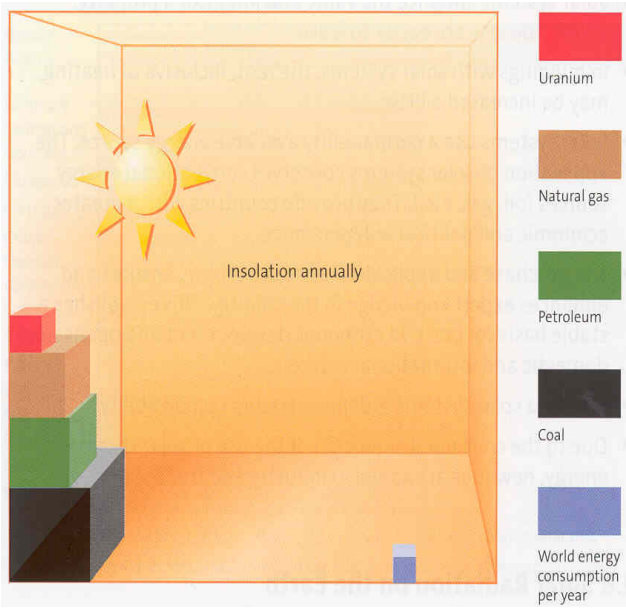
Source: IEA/World Energy Outlook



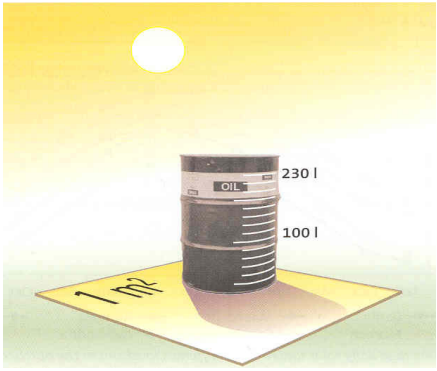
Total energy demand **other sources of energy** **wind and solar energy**

The sun is the primary source for most forms of energy found on Earth. Solar energy is clean, abundant, widespread, and renewable. Various technologies capture this solar energy, concentrate it, store it, and convert it into other useful forms of energy:

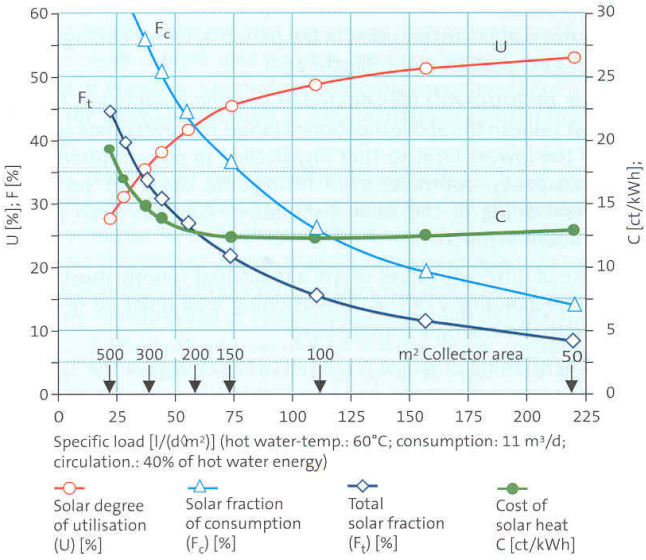
- Low-grade thermal energy for heating our homes and businesses
- Medium-grade thermal energy for running some industrial processes
- High-grade thermal energy for driving turbines to generate electricity
- Electrical energy, converted directly from sunlight, to provide electricity for all of its myriad applications and even
- Chemical energy in hydrogen (via water splitting using photovoltaic or thermo chemical processes to split water), for use in fuel cells and a broad range of electrical, heating, and transportation applications.



Solar energy technologies have great potential to benefit national economy. They can diversify our energy supply, reduce our dependence on imported fuels, improve the quality of the air we breathe, offset greenhouse gas emissions, and stimulate our economy by creating jobs in the manufacturing and installation of solar energy systems.



The annual solar radiation per m² is equivalent

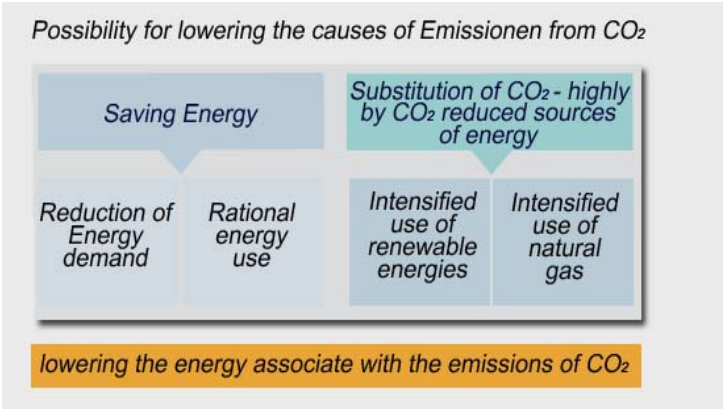


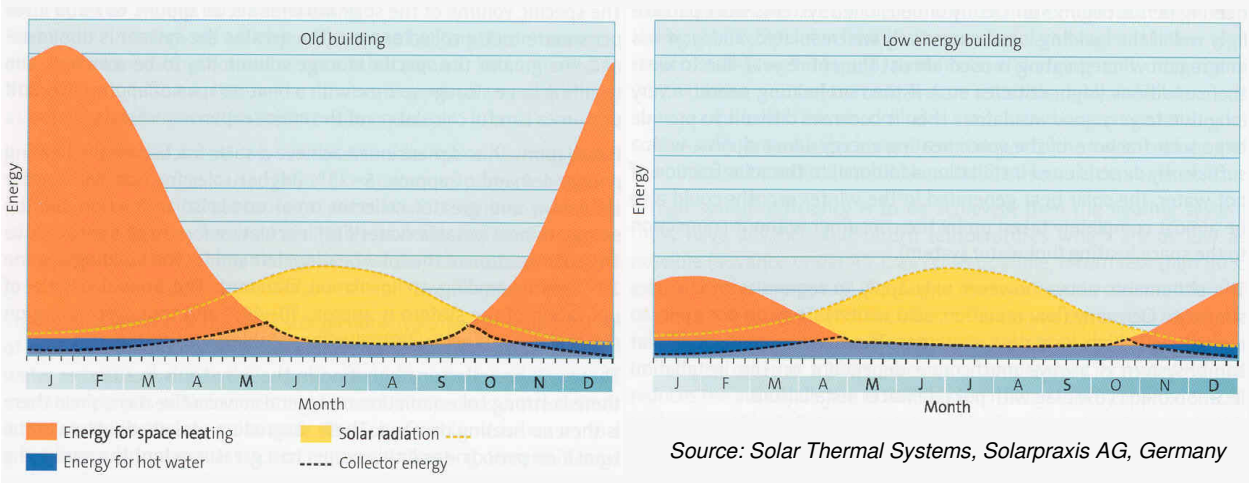
Source: Solar Thermal Systems, Solarpraxis AG, Germany

Degree of utilization, solar fraction and costs of available solar heat, in solar installations of different sizes and constant consumption (average component quality).

<u>Energy efficient buildings happen by design.</u>

Through solar building methods a huge amount of energy can be saved. Passive Solar Design (windows facing south, heat insulation, etc.) alone has the potential to save up to 90 % in the cost of Heating, while the remaining heat can be produced using solar collectors. Coordination between architects and solar technology experts is an excellent basis for the highest Efficiency and living comfort. Low- or Zero-Energy Buildings face south and combine Heat Insulation, demand-oriented ventilation, and 'intelligent' solar energy systems. When the energy needed for heating and CO2 emissions both decline, then the standard of living will improve.





Source: Solar Thermal Systems, Solarpraxis AG, Germany

Energy demand of the building in comparison to the solar radiation and the delayed supply of useful energy, caused by the storage tank of a solar installation having a low fraction for hot water and space heating (German or similar climate).
Germany and especially the Freiburg solar region, holds a high position in the area of renewable energy and energy efficiency. Compared to other countries there is a very concentration and high level of development of science, research, practical application and a large market for testing products. This does not refer to solar technology alone but to the entire area of energy efficient technologies and future-oriented construction. The efficient cooperation between different researching, designing, educational institutions and consulting agencies constitutes an important part of this solar cluster. They regularly provide important impulses for training and further training in renewable energy and energy efficiency for the region itself, and for the whole of Germany and Europe. There are also currently projects with South and East European, with African and with Latin American partners.

Apart from energy efficiency and renewable energies (solar energy, wind energy, biomass, geothermal energy, etc.) a great number of projects have been carried out in recent years in the areas of energy-saving and adapted construction materials production – particularly in Latin America and Africa.

Realized examples:

Dresdner Bank, Freiburg

In the 70ies, the planners in Germany didn't care about saving energy. They designed the buildings for heating all year long. Even in summer they cooled and heated the buildings at the same time.

Technical innovations:
Intelligent regulation systems, including an automatic control system for Venetian blinds
Use of an adiabat cooling system, which works by spraying water into the ventilation system to get a cooling effect
Free cooling ventilation during the night in some parts of the building, which means to cool the building during the summer by raising the ventilation with fresh, cool air from the outside. To use this method you need heavy walls, ceilings and other materials inside to have temperature stores like cooling batteries in iceboxes.

Total energy saving: about 60 %!!

Brauhaus Riegel (Restaurant):

Reduction of the space heat requirement Installation of a thermal protection insulating glazing in the restaurant, as well as an internal insulation in the bar and guest area.

Improvement of the room air Source ventilation: the fresh preheated supply air expands within the base range into the guest area, continues to warm up by internal heat loads and presses up used air into the air exhaust duct.

> best air conditions with optimized change of air Reduction of the ventilation losses by ventilation heat recovery in the bar with a recuperation grade of 95 %.
Reduction of the ventilation losses in the kitchen by use of ventilation equipment with direct admission of fresh air into the exhaust air caps and optimal kitchen ventilation with smallest losses of energy over the exhaust air.

Chamber of commerce and industry (IHK), Freiburg

Air condition (10.200 m^3/h) with heat supply through 100 m^2 solar air collector

Task: climatisation of a seminar room and a cafeteria on the upper floor from the `IHK Südlicher Oberrhein building

Characteristics: no back up, no storage solar thermal self-sufficient system
Economical solar power system;
Simple system concept

Solar cooling system in Greece

actual largest installation worldwide

2700 m^2 flat solar thermal collectors

2 absorption cooling machines with 350 kW refrigerating capacity each

3 compression-cooling machines, 350 kW each climatisation of cosmetic factory production halls.

Location: Inofita Viotias (ca. 50 km northeastern from Athens)

Reasonable system concept; current saving through feed-in of the cooling energy into cold power system with high base load

The Energy concept of Solar Info Center

For the credibility of the tenants and users the uncompromising energy concept within the building itself is decisive. In planning the Solar Info Center therefore great store was set by an innovative and forwarding looking power supply.

Efficient energy use

Through the compact nature of the building structure, increased heat-insulation measures and through passive solar energy gains the energy requirements were reduced to a minimum. With heat requirements of 30 kWh/m² and power requirements of 10 W/m², realized through numerous energy savings measures, the building is well equipped for the future.

Natural cooling

The entire building is cooled naturally. Daylight optimization through intelligent arrangement of window fronts reduces cooling requirements from the start. In summer cool night air streams through air intakes in the outer walls into rooms. The seminar room is additionally air-conditioned by coolness that comes from a depth of 100m in the earth. In the same way the cold air is warmed up in winter.

Pure solar power

How solar energy can be used for active heat and power generation is demonstrated on the test spaces and on the outer walls. In this way architectural possibilities, technical know-how and practical and ecological use can be shown clearly. The generated energy, solar heat as well as solar power, is used in the building. Additional power requirements are covered by electricity that comes from100% renewable energy.

Energy savings in the generating plant

The minor additional heat requirements are covered by heat recovery in the nearby university electricity generating plant. With further investments into energy savings at the university heating plant itself, as much energy can be saved there as is required to run the solar info centre.

With its innovative energy concept the Solar Info Center contributes actively to prevent further pollution arising through the operation of the building.

The energy concept

- *High efficient insulation through 20 cm outer wall and roof lagging*
- *'draft free' windows with double heat protection glazing (U=1,2 W/m²K)*
- *Modest light power requirements through daylight lit offices (33% proportion of window spaces on outer walls)*
- *Natural cooling: the use of earth and night coolness reduces energy requirements.*
- *Through massive stone floor and by doing without hanging ceilings, building mass is coupled with room air hereby optimizing the room climate.*
- *Pleasant room temperatures and reduced cooling requirements through automatically regulated sun protection.*
- *Thermal solar collectors for warm water production*
- *Photovoltaic power generation*
- *Heat requirements covered by local heat coupled with plant generated thermal energy*