

GREEN AND ENERGY EFFICIENT BUILDINGS INTERNATIONAL BENCHMARK : THE THREE MODELS

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1/ The international benchmark project

The framework: the French Research Programme dedicated to Energy Efficient Buildings (PREBAT),

The funders: the French Environment and Energy Management Agency (ADEME) and the French Urban Construction Architecture Plan (PUCA).

The budget: one million €

Report available at www.prebat.net (in French).

The pilot: the Scientific and Technical Building Centre (CSTB)

a French public research establishment

800 persons

Turn over: 80 million €

Strategic items:

- Sustainable Cities and Buildings
- Health and Environmental Risks
- Quality and Innovation.

1/ The international benchmark project

Mobilization of 55 engineers, economists and sociologists from 12 different countries



Danmarks Tekniske Universitet



JC Hadorn

Mansi Jasuja



Massachusetts Institute of Technology

MECHLAB @ UNSW



A socio-eco-technical methodology in 6 steps:

Step 1 - Background: national and local background, origin of the initiative or the innovation;

Step 2 – Content of the initiative or innovation, type of building concerned, new construction, refurbishment, techniques used;

Step 3 – Implementation: dynamics of the actors involved, funding, incentives, investment and operation costs;

Step 4 - Evaluation: real performances, real costs, users' view, impact of the initiative or innovation;

Step 5 – Critical reflection: strengths, weaknesses, opportunities and threats;

Step 6 – Transposition conditions.

A governmental objective of decreasing of 75 % (The “factor 4” policy) the emissions of Green House Gaz between 1990 and 2050.

A State Ministry of Ecology, Energy Sustainable Development and Planning having monitored in 2007 an original negotiation among **government, local authorities, firms, unions and environmental associations** (see www.legrenelle-environnement.fr).

An ambitious action plan for the building sector:

- New buildings: minus 50 % energy consumption in 2012 in comparison with 2005
“positive energy” buildings in 2020
- Existing stock: minus 38 % energy consumption in 2020 in comparison with 2007
- Energy climate plan for all the regional, counties and local authorities of more of 50 000 inhabitants in 2012

4/ Green and energy efficient buildings: the three models

1/ The Low Consumption Model (LC Model).

The emphasis is placed on lower consumption in over-insulated buildings. The **German** concept (*Passivhaus*) is more demanding than the **Swiss** one (*Minergie®*) and the **French** one (*Effinergie®*)

2/ The Energy Saving and Production Model (ESP Model).

Buildings, especially individual houses, are insulated to a certain extent; photovoltaics is responsible for electricity production. The **American** concept houses are more insulated and less industrialized than the **Japanese** concept houses. **Spanish** experience is a particular way to use solar energy.

3/ The Energy and Environment Model (EE Model).

The **British** *BREEAM* label, the **French** *HQE®* label, the **American** *LEED™* label are examples of this strategy. Energy is articulated to other environmental objectives (integration into the site, comfort, materials, waste, etc.).

The Germans know how to **construct new buildings with practically no heating** in the German climate, with an investment of 5 to 12% more than usual.

A house bearing the *Passivhaus* label must have:



- heat consumption of **15 KWh/m²/year** of primary energy,
- total primary energy consumption of less than **120 KWh/m²/year**,
- maximum **airtightness** of 0.6 volume/hour.

The five most common characteristics of these houses are: **over-insulation from the outside with triple-glazed windows, double-flow ventilation with heat recovery, passive solar gains, low-consumption household appliances, the use of renewable energies.**

See <http://www.passiv.de/>

The Swiss concept



6780 bâtiments ont été certifiés selon MINERGIE® et 128 selon MINERGIE-P®, 4 selon MINERGIE-ECO®, et 3 selon MINERGIE-P-ECO®. Surface utile chauffée: 6.31 Mio m² dans les reconstructions et rénovations.

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- LISTE DES BATIMENTS
- GALERIE D'IMAGES
- PLACE DE MARCHÉ
- CARNET D'ADRESSES
- MODULES
- FAQ

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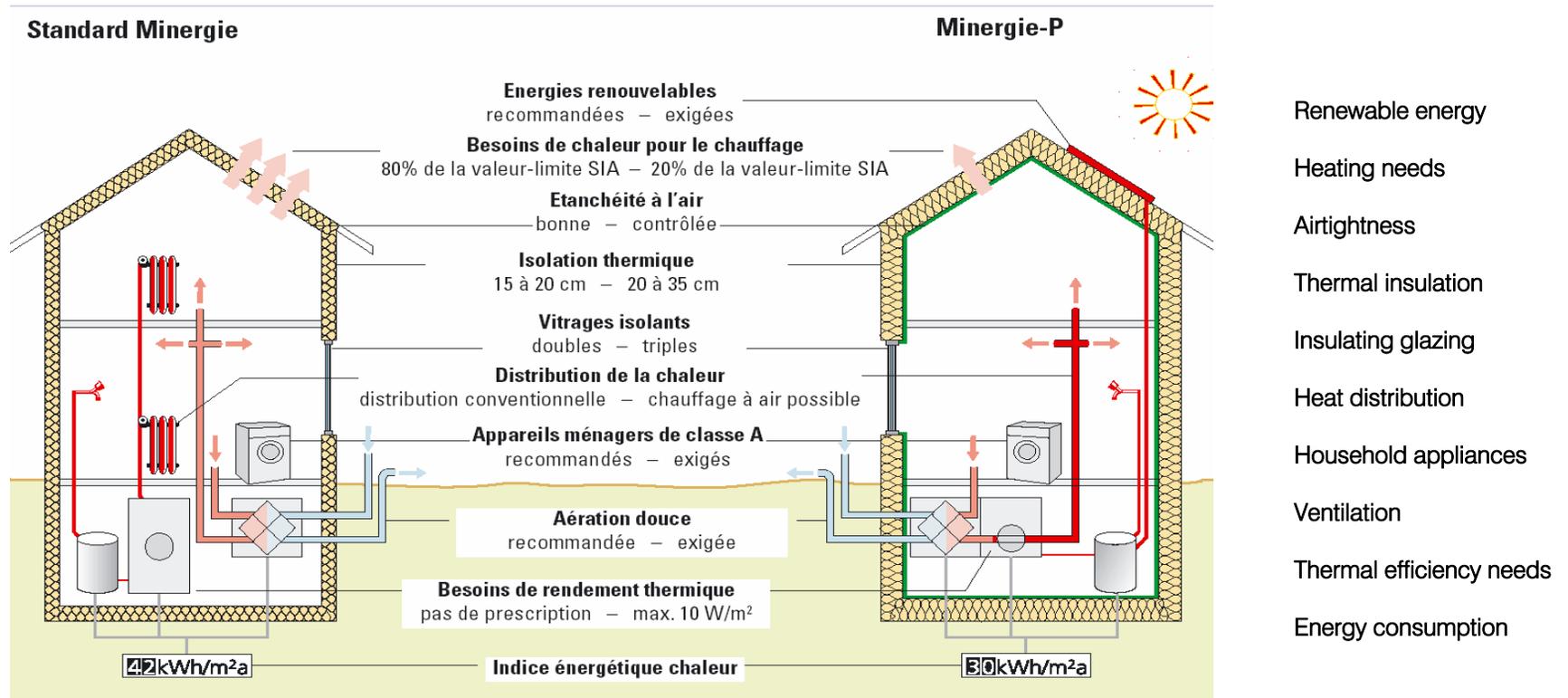
suisse énergie
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The Swiss *Minergie®* label is less demanding than the *Passivhaus* label:



See <http://www.minergie.ch>

The French concept: Effinergie© is close to the Swiss Minergie® concept:

- new building: 50 KWh primary energy per m² and year
- refurbished buildings: 80 KWh primary energy per m² and year

for Central heating, Hot water, Ventilation and heating equipment, Lighting, Conditioning

50 % less than the current 2005 rules

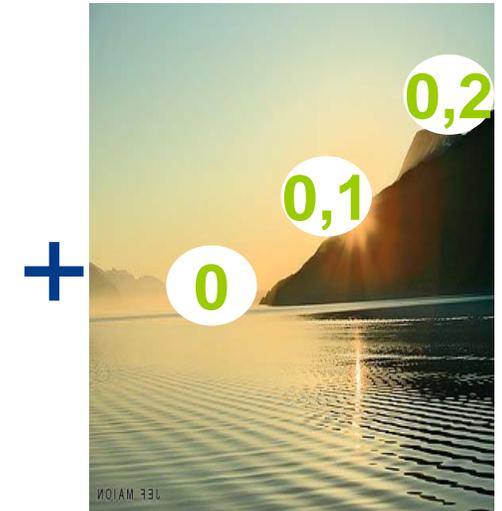
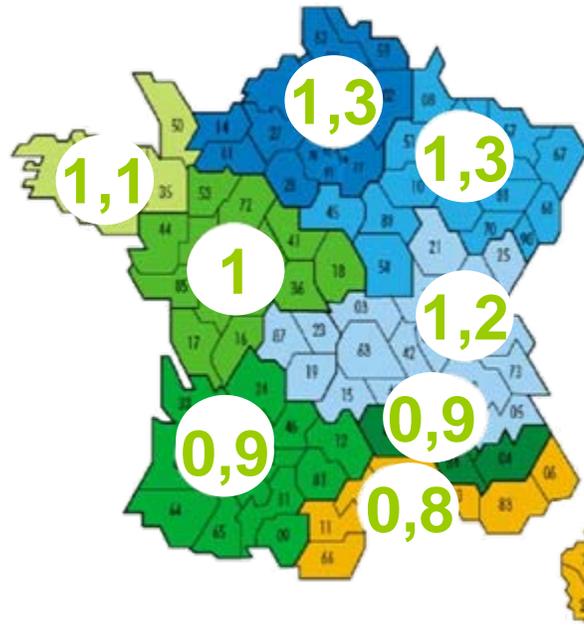
Will be compulsory in France for all new buildings in 2012

With an adaptation:
-to the climate,
-the altitude

New buildings:
- 65 Kwh in the North
- 40 Kwh in the South

Altitude for a 50 KWh type:
- Plus 400 meters: 55 Kwh
- Plus 800 meters: 60 Kwh

See www.effinergie.org



The American concept



Building America is a private/public partnership that develops energy solutions for new and existing homes. The Building America project combines the knowledge and resources of industry leaders with the U.S. Department of Energy's technical capabilities. Together, they act as a catalyst for change in the home-building industry.

+ Photovoltaïcs = « ZERO ENERGY HOME »

More than 30,000 houses have been built through the Building America programme.

A typical energy-efficient house entering the “*Building America*” programme is a wood-framed house with:

- a thicker structural frame, with a damp-proof membrane on the outside;
- well-insulated attic space;
- low-emission double-glazed windows;
- mechanical ventilation;
- a high-efficiency boiler and short networks;
- compact fluorescent lamps.

In a “*Zero Energy Home*”, the system is completed by thermal solar energy and a photovoltaic system.

See http://www.eere.energy.gov/buildings/building_america/about.html

The Japanese concept

A typical Energy Saving and Production Japanese house is:

- a prefabricated house,
- in which everything is **electric**,
- with **slightly reinforced insulation**,
- **double-glazed windows**,
- **mechanical ventilation**,
- **heat pump**,
- and local production through **photovoltaic** models integrated in the model.

160,000 Japanese houses use photovoltaic.

6/ The Energy Saving and Production Model

The Spanish experience

1999 In Barcelona all important new and renovated buildings must cover 60% of the demand for:

- domestic hot water
 - heating the water of covered temperature-controlled pools
 - hot water used in industrial processes
- with thermal solar energy

2005 The standard order was adopted by 60 municipalities.

2006 Requirement throughout Spain to install thermal solar energy and photovoltaic.



The British concept

The Building Research Establishment Environmental Assessment Model (*BREEAM*) was launched in the UK in 1990.

It uses, for residential buildings, **seven criteria**: Energy, Water, Pollution, Materials, Transport, Ecology and Land Use, and Health and Well-Being.

It is employed for seven types of buildings: dwellings (EcoHomes), industry, offices, retail, schools, courts and prisons.

It specifies **four performance levels**: “Pass” with 25 points, “Good” with 40 points, “Very Good” with 55 points, and “Excellent” with 70 points.

More than 65,000 buildings have received *BREEAM* certification.

See <http://www.breeam.org/>

The French concept

The “*Haute Qualité Environnementale*” *HQE*® method was created in France in 1997. It specifies **fourteen criteria** in four fields:

- Site: Integration, Materials, Site process;
- Management: Energy, Water, Waste, Maintenance;
- Comfort: Hydrometrics, Vision, Acoustics, Olfactory;
- Health: Quality of Air, Water, Space.

“*NF maisons individuelles démarche HQE*®” certification for individuals homes (www.cequami.fr), “*NF bâtiments tertiaires démarche HQE*®” for non residential buildings (www.certivea.fr) and “*Habitat et Environnement*®” (www.cerqual.fr) were launched in 2005 and 2006.

Energy performance is from 10 to 20 % in comparison with normal rules.

The American concept

In 2000, the US Green Building Council (USGBC) launched its “Leadership in Energy and Environmental Design “*LEED*™ evaluation and rating program, with **six action fields**: Sustainable Site, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, Innovation and Design Process.

The label specifies **four performance levels**: certified, silver, gold, platinum.

LEED™ has currently four programs: New commercial constructions, Existing building operations, Commercial interiors projects, Core and Shell projects. Energy performance is 30% in average, compared to normal rules.

Approximately 1300 buildings are labelled.

See <http://www.usgbc.org/>

		Testing	Concept	Dissemination	Significant impact on the market
Switzerland	<i>Minergie®</i> for new construction				Each year nearly 20% of the Swiss residential market is labelled Minergie®
	<i>Minergie®</i> for retrofitting				
Germany	<i>Passivhaus</i> for new construction				
	<i>Passivhaus</i> for retrofitting				
France	<i>Effinergy®</i> for new construction				Will be compulsory in 2012
	<i>Effinergy®</i> for retrofitting				

- 1 – The driver is political with three levels:
 - the **continental** level specifies the objectives, linked or not to intercontinental agreements,
 - the **national** level defines the frame frame (governmental policy, incentives, R&D...),
 - the **local authorities** are the engine, through partnership with the building industry players, which are local

- 2 – Several green and energy efficiency models are available in one country and can be mixed

- 3 – A **system** approach of buildings has to be preferred to the component-specific one

- 4 – An **ambitious R&D programme** is necessary, mixing technical and socio-economic approaches, with a specific topic on refurbishment, linking buildings to transport and urbanism

- 5 – **Labels** for high-performance buildings and products are efficient, with **commercial, economic, financial and fiscal** instruments
- 6- The energy-efficient **refurbishment** of existing buildings, especially the households dwellings, needs a specific action plan
- 7 – Energy efficiency is a **new paradigm for the building sector**: a new way to finance, to design, to build, to renovate, to manage and to use buildings.
- 8 – **Financing** energy efficiency, through a partnership between government, local authorities and private sector, is a **key factor**
- 9 - Facilitating new **skills and training** of the construction sector actors, in partnership with them and in a decentralized manner, is the **most important success factor**

Thank you for your attention

Any question ?