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**Guide for an Integrated
Sustainable Energy Education,
First steps to climate neutral schools,
for secondary schools**

GOOD PRACTICES

February 2009

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Guide for an Integrated Sustainable Energy Education, First steps to climate neutral schools, For secondary schools

GOOD PRACTICES

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1. → Good Practice: Meadowside Primary School, Quedgeley

==> Planning and building

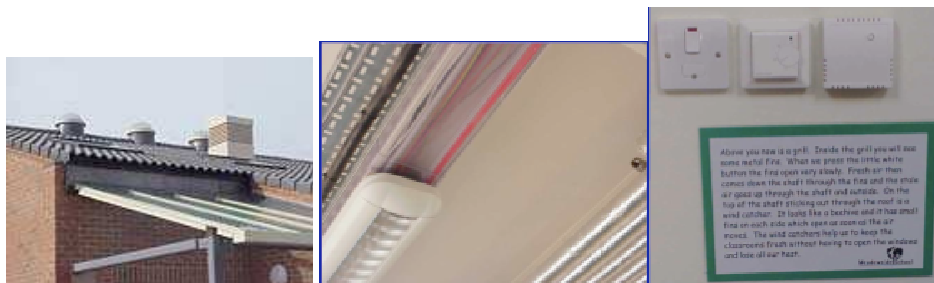
- Environmental impacts of each action examined
- Alternative products used in order to evaluate new technologies
- No more than ten year pay back period

==> The Building as an Educational Tool

- Comfortable Learning Environment
- Sun Pipes
- Sky Lights
- Large Windows
- Reflective Flooring
- Under floor Heating - Wall space free of radiators - Comfortable to sit on
- Highly efficient heating system
- Working with efficient condensing boilers - Trend Electronic Optimiser - Zoned system of control
- Passive Ventilation

Pupils actively involved into energy use evaluation

Gas Consumption Comparison	Fossil Fuel – Heating & Catering (kWh/M ² /p.a)
Good Practice	113
Typical Practice	164
Meadowside School	86



□

2. → Good Practice: Full refurbishment of a school in Klokocov

- • 1962 school building in state of disrepair
- Project by BIOMASA to retrofit school & install biomass boiler
 - Replaced windows & doors
 - Insulated outside walls & roof & improved façade
 - Replaced heat distribution pipes, installed new
 - Radiators & heat zone regulation
 - Upgraded electrical installations
- 50% energy saving
- BIOMASA promoted the project widely & raised awareness of the benefits of biomass heating systems

Better working environment for pupils & staff



The school building after reconstruction



The new biomass heating boiler

School children visit the Klokocov boiler

Name: BIOMASA Association - Contact: Ladislav Zidek
 Phone: +421 41 423 15 00 - Email: biomasa@biomasa.sk
 Website: www.biomasa.sk

3. → Good Practice: Education for Sustainable Development in Germany

Education for Sustainable Development in Germany

The Web Portal "Education for Sustainable Development (ESD)" informs about German activities within the field of ESD and the UN Decade "Education for Sustainable Development". By offering a systematic overview of themes and partners, competitions, newsletters, programmes, and other efforts involving the UN Decade, it facilitates cooperation and networks on the national level, and will be expanded as a worldwide forum to inform users about the implementation of the UN Decade and ESD. Currently, they are collecting information for the section "UN Decade International" to include ESD activities in various countries. If you would like to make a contribution to this section, by offering information on international ESD websites, examples of Good Practices, National Action Plans, publications, and other news worthy events surrounding ESD involving or within your country, then please contact us for submission. This website is a project of the German Commission for UNESCO, within the UN Decade "Education for Sustainable Development", and is financed by the Federal Ministry of Education and Research (BMBF).

There are many learn and tools for education in sustainable development to find within the search engine. Most material is in German.

<http://www.bne-portal.de>

4. → Good Practice: Eco-School programme

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Eco-School programme

Eco-Schools is a programme for environmental management and certification, and sustainable development education, for schools. The Eco-Schools Programme aims to raise students’ awareness of environmental and related sustainable development issues through classroom study together with school and community action, and provides an integrated system for environmental management of schools based on an ISO14001/EMAS approach.

The Programme incorporates seven elements, which schools at any level can adopt as a methodology. These elements have been designed to be the core of the Eco-Schools process, yet the structure is flexible enough to be adopted in any country, and at any level of schools’ previous environmental achievement. Pupil involvement throughout the process is an integral and essential factor. The participation of other stakeholders in the school and community in the decision-making process is an important step towards dialogue and cooperation, providing a good basis for citizenship education. This flexible system, with its pedagogic and practical elements, has made Eco-Schools a very successful programme with clear and tangible benefits to schools and communities, and of course to teachers and young people.

There are 46 countries around the world that run the Eco-Schools programme, linking more than 40,000 schools – from the UK to France, from Morocco to South Africa. The Eco-Schools **Green Flag**, awarded to schools with high achievement in their Programme, is a recognised and respected eco-label for environmental education and performance.

<http://www.eco-schools.org/>

Eco-Schools International Coordination

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5. → Good Practice: YEP! Project (young Energy People)

YEP! Project (young Energy People)

What policy areas was this project linked to? Energy efficiency in schools

What were its aims? To set up of a School Energy Management Team to carry out an energy audit in school by using tools and methodology put at disposal by the energy agencies, build an energy efficiency campaign in the school to improve energy consumption – repeat the same experience in a working place

Who were the partners? Coordinator: SWAE (UK), other partners: EALP (Italy), AEA (Italy), EPBP (Germany), AER (Spain), ESS (Sweden), REAC (Greece), EAP (Bulgaria)

Where did it find funding? 5 secondary schools per partner – 5 workplaces

What did the project involve?

Contact: Contact:

Rachel Close, Project Manager □ Tel (01594) 545 369 □ E-mail: rachel@swea.co.uk □ Severn Wye Energy Agency Ltd
www.youngenergypeople.com



6. → Good Practice: Passivhausschule Riedberg / FFM (Ge)

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- Wilhelm-Busch-Schule first school - Passivestandaerd in Germany (2004).
- Capacity of 400 students, kindergarten 125 children, a refectory, kitchen and a gym.
- "Passivhaus Projektierungspaket" (PHPP), need of energy is +- 59 kWh/m/a.
- Heating oil consumption of about 1.5 l/m/a
- Primary energy (electricity and heating) under 120 kWh/m²/a
- Schools and nurseries are predestined to be built as passive houses. For example, outside -12 C heat of 25 pupils and one teacher is sufficient to keep classroom warm.
- In order to build the school in passive house standard, the extra costs amount to 5.3% of the construction costs.
- According to the energy costs of 2003, the pay back period estimated as 38,6 years (without any sponsorship). The pay back period is now reduced to 10 years.
- At the moment the city of Frankfurt in may 2006 the decision was made to construct all new municipality buildings if possible in passive house standard.



7. → Good Practice: project Fifty/fifty (Ge)

The project Fifty/fifty

Fifty/fifty implements a system of financial incentives for energy saving in schools. In this system, schools get refunded 50 % of the saved costs (by their efforts in energy-saving).

The fifty/fifty-scheme is the “mother” of other similar ones, with different sorts of incentives:

Sometimes there are Competitions and sometimes the schools get a fixed amount of money, if they execute the projects.

In Berlin, there are 150 schools out of 800 taking part at these schemes. All over Germany about 4000 out of 35000. Fifty/fifty was started in 1994 in Hamburg, where all 450 schools are included.

The projects are taking place within the school lessons, so the teachers are organising the biggest part of it but UfU (or other regional organisations, some of them are organised in the “Bundesverband Schule Energie Bildung” www.schule-energie-bildung.de) helping them by the realization of lessons, especially at the Energy round tour and at some of the measurements.

Fifty-Fifty: www.ufu.de

Unabhängiges Institut für Umweltfragen e.V. (Ge)

8 → Good Practice: Kvernhuset Ungdomsskole (No)

- Kvernhuset Ungdomsskole, Fredrikstad, Norway,(2002)
- Designed on principles of sustainability, natural ventilation, and maximum flexibility.
- Technical solutions
 - A natural thermal ventilation system using underground ducts,
 - A heat pump running on thermal energy,
 - Skylights and translucent facades to conserve daylight.
- Measures to make a fantastic learning tool for the school's curriculum.
- Air treatment plant&heating ensure good indoor air quality and best energy efficiency.
- Energy: Est 120 kWh/m²/yr, -100 kWh/m²/yr is electricity and 20 kWh/yr for heating oil.
- During the concept stage involved the local population,
- Areas into three wings dedicated towards water, energy and natural growth issues
- Features allowing the pupils to learn through observation, utilisation and enhancement of diversified interests, as well as adapt their perspective to a sustainable way of life
- Insulation has been simply screened with glass for children to inquire
- Water and sewage pipes have been with glass partitions for questions to appear
- Layout is designed allowing for contacts between individuals.
- Pupils informed about features of their school, including building management system
- Pupils guide the visitors through the building complex



Photography - Geir Carlsen

Pir II Arkitektkontor
 Fax: 73 98 40 90
 firmapost@pir2.no
 www.pir2.no

9. → Good Practice: Agenda21-scolaire (Fr)

Agenda21-scolaire

The approach of an Agenda21-scolaire (Programme of Agenda21 for Schools) is a French action plan for realising sustainable development at the level of schools, implemented with internal and external partners. The Agenda21-scolaire is open to all schools sectors, and is a voluntary and process to develop based on needs of a school. It's based upon temporary or continued action during a whole school year and reproducible each year.

The characteristics of an agenda 21-scolaire are:

- Educational project in search of sustainable development
- Learning in action
- Participation process
- Driven by a action team with the support of the schools direction
- Based upon a identification of problems

The approach of the agenda21 scolaire is composed of different phases. The Comité21 identifies 6 main phases:

1. Impulsion of program
2. Organisation of project team
3. Making common diagnostics
4. Definition of action lines and establish the Agenda21
5. Development and implementation of the 1ts action plans
6. Evaluation of the action plans

Programs as the Eco-schools are completely in the same line.

Comité 21 - « Guide méthodologique de l'Agenda 21 scolaire » :
 Méthodologie pour conduire une démarche Agenda 21 au sein d'un établissement scolaire. (édition 2006) ® www.comite21.org -

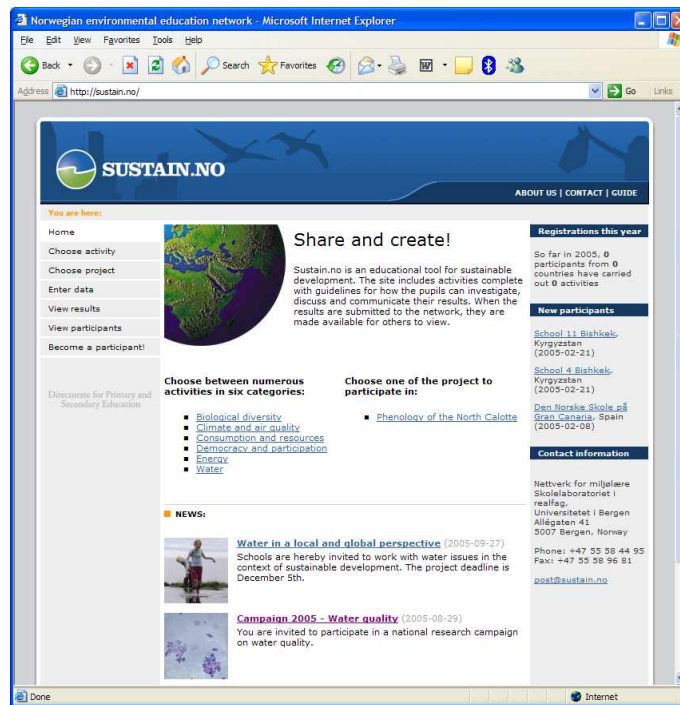
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10. → Good Practice: SUSTAIN.NO

SUSTAIN.NO

It is possible to insert the student’s data into a database from an Internet based support network for schools that was established in 1997 after several years of research and development work. The program has evolved to support Education for Sustainable Development. It is mostly used by Norwegian schools, but a growing number of other European schools using the website in order to compare their daily gathered data with visual tools their energy use with their peers. The website is www.sustain.no.



<http://support.sustain.no>

11. → Good Practice: The Display Campaign

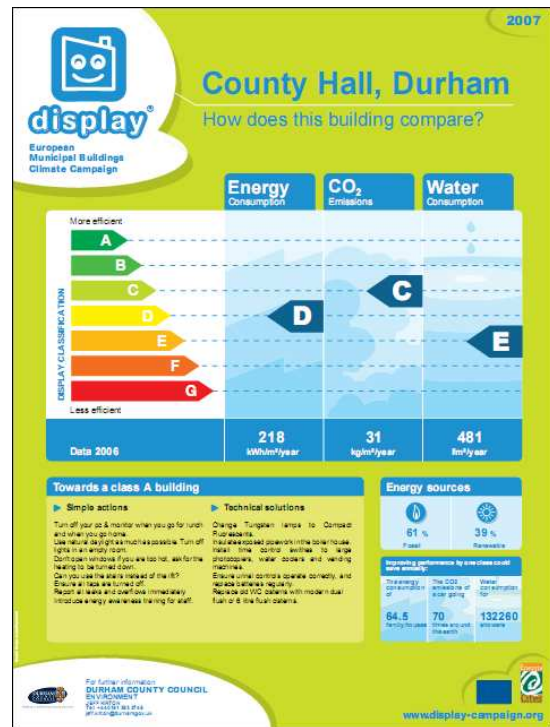
Energy Performance Certificate (EPC) or Display Energy Certificate (DEC)

School buildings that have a floor area in excess of 1000m² are required to have a Energy Performance Certificate (EPC) or a Display Energy Certificate (DEC). This certificate presents the actual energy use of a building (converted to CO₂) mostly on an A-G scale where A has the lowest CO₂ emissions (best) and G the highest CO₂ emissions (worst). The certificate is similar to those that are required for fridges and other new white goods.

This Energy Certificate shows how a buildings energy use performs against a benchmark and is based on the buildings actual annual energy consumption. This will have to be displayed in a prominent place visible to the public. It must be updated each year and will need to be accompanied by an 'advisory report' listing measures to improve the performance.

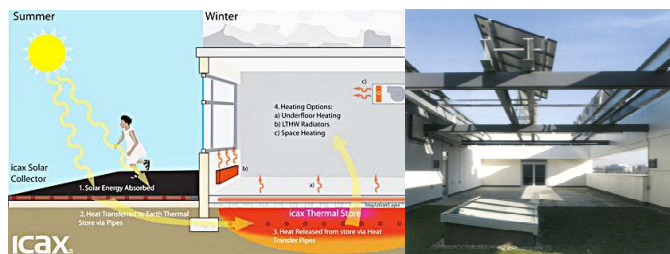
This energy certificate can be used for educational mains and even simulated by the students as exercise.

The Display Campaign is using the same concept, but uses «Energy, CO₂ and Water » rating from A to G as an educational tool, integrated into a project learning strategy. (www.display-campaign.org)



12. → Good Practice: Howe Dell primary school, Hatfield (UK)

- Electricity from solar panels + Toilets flush with collected rainwater
- Hot water by solar thermal absorption panels on the sedum covered green roof
- Classroom fixtures like desks and counter-tops are made from recycled materials.
- Skylights that flood the classrooms and corridors with daylight, cutting lighting bills, and specified super-thick exterior walls and thick window glass to reduce heat loss.
- Ordinary playground tarmac is an Interseasonal Heat Transfer (IHT) system (world's first IHT system underneath the playground). Pipes running under the playground collect solar heat and transfer it to soils under the building foundation, where insulation and the natural properties of the soil allow the heat to be stored until it is needed, even months later.
- The building itself functions as part of the curriculum: Students "can see how many kilojoules are pumped out by the wind turbines and how it relates to kettle or toaster uses,"
- The school has an eight-pupil-strong "Eco-Squad" (members change every term)
- The school's curriculum also incorporates sustainable education principles
- It won the Eco-Schools Green Flag award for the environmentally aware additions to classes.
- The green section of the curriculum aims to teach pupils the interdependence of peoples and countries, the need to promote sustainable development and an awareness of their personal responsibility for the environment.



13. → BGood Practice: Tolosano Primary School (It)

City of Faenza (It) - Tolosano Primary School

- Primary school constructed in 1950, refurbished in 2003-2006
- Main measures:
 - Setting of a digital controller for boiler plants
 - Building envelope (insulating fiberglass layer)
 - Thermal Plant (Old boiler→4 condensing boilers)
- Savings of 42.8% of the primary energy for heating
- Primary heating energy consumption lower by 160 542kWh



City of Faenza

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14. → Good Practice: Schools' Global Footprint (Uk)

The Schools' Global Footprint resource has been developed in collaboration with the WWF to help the students to understand their environmental effect have on the planet and how to reduce this impact.

The Schools' Global Footprint has a **Global Footprint Calculator** to help to work out the quantity of resources that the students and the school use, compared with what is available in the world. You can see if this is sustainable for the future and you'll get suggestions on how to reduce your impact on the planet.

There is a part « **Schools' Global Footprint calculator for learners** » where a **personal and the school's** Ecological Footprint is worked out and find out what can one do to reduce your impact on the planet.

Another part « **Resources for teachers** » provides practical, curriculum-based teaching and learning ideas, designed for primary and secondary schools. The Schools' Global Footprint is intended to act as a stimulus for change.

When aligned with the Eco Schools programme, this resource provides a useful process for identifying and implementing solutions that can help reduce ecological impact.

The **Global Footprint Calculator** is has six sections, which you can work through, filling in the calculator pages as you go.



<http://www.ltscotland.org.uk/sustainabledevelopment/findresources/globalfootprint/learners/footprintcalculator/index.asp>

15. → Good Practice: Relighting in Byšice Primary School (Cz)

Case study in Energy Efficient Lighting in Schools

Relighting in Byšice Primary School (Cz)

The schools teacher and pupils has won a competition within the Kyoto in the Home educational project, for bringing specific improvement of lighting in two of its classrooms.

The original, decades-old luminaries, who twinkled and buzzed, had high electricity consumption, and light hardly got through the yellowed covers. Therefore, new, state-of-the-art and highly energy-efficient lighting have replaced this obsolete system.

They used TCS 160 2 Philips units with the consumption of 58W to light the classrooms. They are fluorescent luminaries, fitted with a reticule with special optics evenly diffusing light and concurrently preventing dazzle. TCS 260 1 luminaries with the consumption of 80W have been used to light the blackboards. They are special lighting units providing even, glare less illumination.

Environmental education and training is important not only for school children and future energy consumers. In the case of the Primary School in Byšice it has also brought about specific improvement of lighting in two of its classrooms. The school's teachers and pupils have won a competition within the Kyoto in the Home educational project

The first prize, donated by Philips, was complete renovation and modernisation Of lighting in two classrooms, including delivery of light sources.

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Philips used TCS 160 2 units with the consumption of 58W to light the classrooms. They are fluorescent luminaries, fitted with a reticule with special optics evenly diffusing light and concurrently preventing dazzle. TCS 260 1 luminaries with the consumption of 80W have been used to light the blackboards. They are special lighting units providing even, glare less illumination.

The luminaries were installed in three rows, each with three pieces, in such a manner that light is directed on to benches overhead from the left. A total of 9 luminaries (each containing two 58W fluorescent lamps) above the benches and two luminaries above the blackboard were installed in each classroom.

The respective standard requires the illumination level of 300 Lux in the classroom and 500 Lux on the blackboard. When it comes to specialist study rooms or classrooms intended for art lessons, the illumination of 500 Lux is required. Furthermore, the standard prescribes that only light sources with the colour rendering of $Ra > 80$ be used in schools. Colour rendering determines how realistically colours are rendered by light.

Low-quality fluorescent lamps with poor colour rendering can cause eye tiredness, restlessness and headaches, and they also have a significantly shorter service life.

We are pleased that the Kyoto in the Home project, organised in the Czech Republic by SEVEN in cooperation with the Regional Environmental Centre, has made information about the possibilities of energy savings and use of renewable energy sources accessible to hundreds of pupils throughout the Czech Republic.

The prize-winning school has been shown a practical example of how efficient and high-quality lighting represents a combination of lower operating costs and quality service.

Further information: Kyoto in the Home project:

<http://www.kyotoinhome.info/>

Byšice Primary School: <http://www.zsbysice.cz/>

Philips Lighting: http://www.lighting.philips.com/cz_cs/

16. → Good Practice: Herringthorpe Junior and Infant School (Uk)

- Herringthorpe Junior and Infant school were two separate schools on the same site.
- Reuse parts existing building structure after demolition incorporation in landscape
- In addition to involving the client with design development, participation by the children was encouraged through the school. To this end, the head teacher has contracted local artists through the Creative Partnerships Programme and the children will be involved in making artwork for integration directly into the building fabric.

- Within corridors, high-level roof lights add daylight to the space. Roof lights at the rear of the rooms increase natural daylight and provide cross ventilation.

- A number of key elements to provide an environmentally friendly building were:
 - Natural ventilation
 - Control of carbon dioxide levels in key areas
 - Maximising natural light but avoiding glare and solar overheating
 - Sustainable heating
 - Energy efficiency
 - User friendly local control
 - Minimising use of VOCs
 - Improving ecology



- Calculated CO2 emission rate for the notional building 49.94 KgCO2 /m2/annum
- Improvement factor 0.15
- LZC benchmark 0.10
- Building Target CO2 emissions rating (TER) for building as designed 38.17 KgCO2/m2/annum
- Building CO2 emissions rating (BER) for building as designed 12.56 KgCO2/m2/annum
- Projected building energy usage for building as designed 133.33 kWh/m2/annum

17. → Good Practice: Neubau Hauptschule Klaus – Weiler (At)

Neubau Hauptschule Klaus – Weiler – Fraxern

The main parts of this new school are building following the principles of a passive building. This school came from a competition for the design, with clear economic and energy guidelines, for an urgently needed refurbishment of an old school building due to exorbitant costs of operation. After a record construction time of only 18 months upon nominating the winner of the competition, operations were commenced at the school building, which consumes less than 15 kWh/m² total energy per year and fulfils the Voralberg passive-house guidelines.

The L-shaped building houses classrooms, library and adjoining rooms with a wide is a three-storey space corridor located in the centre, rhythmically interrupted by the foot bridges providing access to the classrooms. This simple but spatially appealing structure is on the one hand rooted in the logics of economy; on the other hand it is a result of the sophisticated structure crafted from wooden elements, the material of choice that helped to achieve such short construction times. Controlled ventilation ducts, constantly supplying fresh air inside the classrooms, follow a similarly systematic pattern.

Collectors of the technical unit are well dimensioned and positioned easily accessible above the adjoining rooms. The compact and despite its complexity well-structured concept helped to minimize costs and maximize energy efficiency.

The architects succeeded in achieving construction costs of only three per cent above that of a conventional construction project, while reducing energy costs by 70 per cent compared to the old school building.

No cutbacks were required in terms of architectural details. The classrooms are bright and on the east side they benefit from the sky light of the central building section.

Exterior solar shading prevents glare and generation of heat. To maintain sufficient view a low ribbon glazing positioned toward the inside is placed just below the tall windowsills and permits a good view while providing shading. The developed areas of the central section are divided into small spaces between the footbridges by skylights and tall lockers that provide screening, thus transforming the long corridor into a lively meeting place during recess. The footbridges feature glass handrails that enhance the transparency of this space even further, where diagonal views enliven everyday life at school.

The recess hall and library are outfitted with floor heating given their large volume, permitting speedy drying of the entrance area in case of wet conditions. The building unit housing the classrooms is equipped with a controlled ventilation system that generates heating or cooling as required. An additional heating register facilitates temperature control in each room. In summer and winter the air is pre-heated or pre-cooled, respectively, to 18° Celsius via Earth Coupling. A calorific value gas tank generates heat. Fittings for a planned biomass-heating unit have been installed. Residual heat is extracted from exhaust air and a number of other measures ensure high-energy efficiency, which is further optimized by the facility manager via special computer software. As a successful pilot project the school building received several awards in the categories of architecture and energy efficiency.



Indication of energy: 15 kWh/m²*a
 Way of construction: Construction en bois
 Useful Surface: 4'520 m²
 Lieu: Klaus-Weiler

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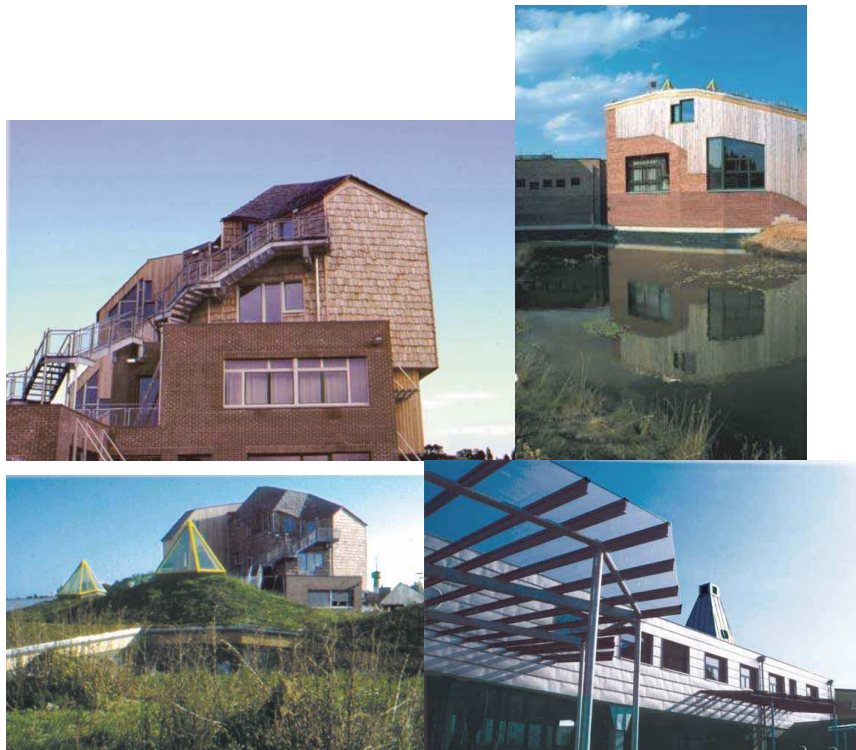
18. → Good Practice: Lycée Jacquard, HQE, Caudry, France

The Caudry College is one of the first constructed using HQE procedure (High Environmental Quality). Some of the significant actions:

- Equal amounts of infill and spoil.
- Long-lasting materials with low energy rating and with non-leaching treatments.
- Non-toxic.
- Amount of PVC limited to 2.5 tons. Heavy materials produced less than 200 km
- Building is flexible and neutral with large, modular spaces (building can be converted into housing).
- Thermal comfort: insulation from the outside, no thermal bridges, and window solar protection.

The main aims are:

- To use renewable energies and free gains, Canadian wells, photovoltaic cells, solar collectors.
- Choice of locally produced materials with low emissions.
- Rain water management.
- Optimisation of natural lighting.
- Highly efficient heating and double flow ventilation.



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