

Sustainable Energy

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Whatever designing pupils are doing in design and technology they need to expose their work to the scrutiny of values. What they are doing has to be worth doing, and they have to justify it to themselves by asking themselves questions, such as

- What is this product for?
- Does it satisfy a human need?
- Why bother?
- Who gains from this technology? And who loses?
- What raw materials and components does it use?
- Where did they come from?
- How are they extracted?
- What pollution is caused in producing, using and disposing of this?
- What will it cost?
- What will it cost the Earth?

Ideally, they should produce the questions, after some discussion generated by their teacher. It is not difficult to generate such discussions. School pupils tend to have a strong sense of fairness and justice and a few questions on the lines of 'What is technology?' followed by 'What is it for?' will get them a long way, when asked in an environment where they feel that people actually want to know what they think and where it is OK to disagree with others.

So, once you have this perspective, what do you actually do? What sort of contexts are likely to stand up to this scrutiny?

Certainly, something which starts from a genuine human need. There is, unfortunately, no shortage of very real needs available. The world around us and the changes happening to it provide ample scope for contexts for design and technology work. Environmental issues are a vital part of pupils' education, they are usually extremely interested in them and they offer scope for design and technology activity in a great variety of areas and at different 'levels' of technology

This is well illustrated by looking at the Centre for Alternative Technology in Mid-Wales. CAT is a living example of designing in a context. It displays a variety of windmills, water turbines, solar electricity, solar water and space heating, energy-efficient buildings and organic gardens. Last year there were 93 000 day

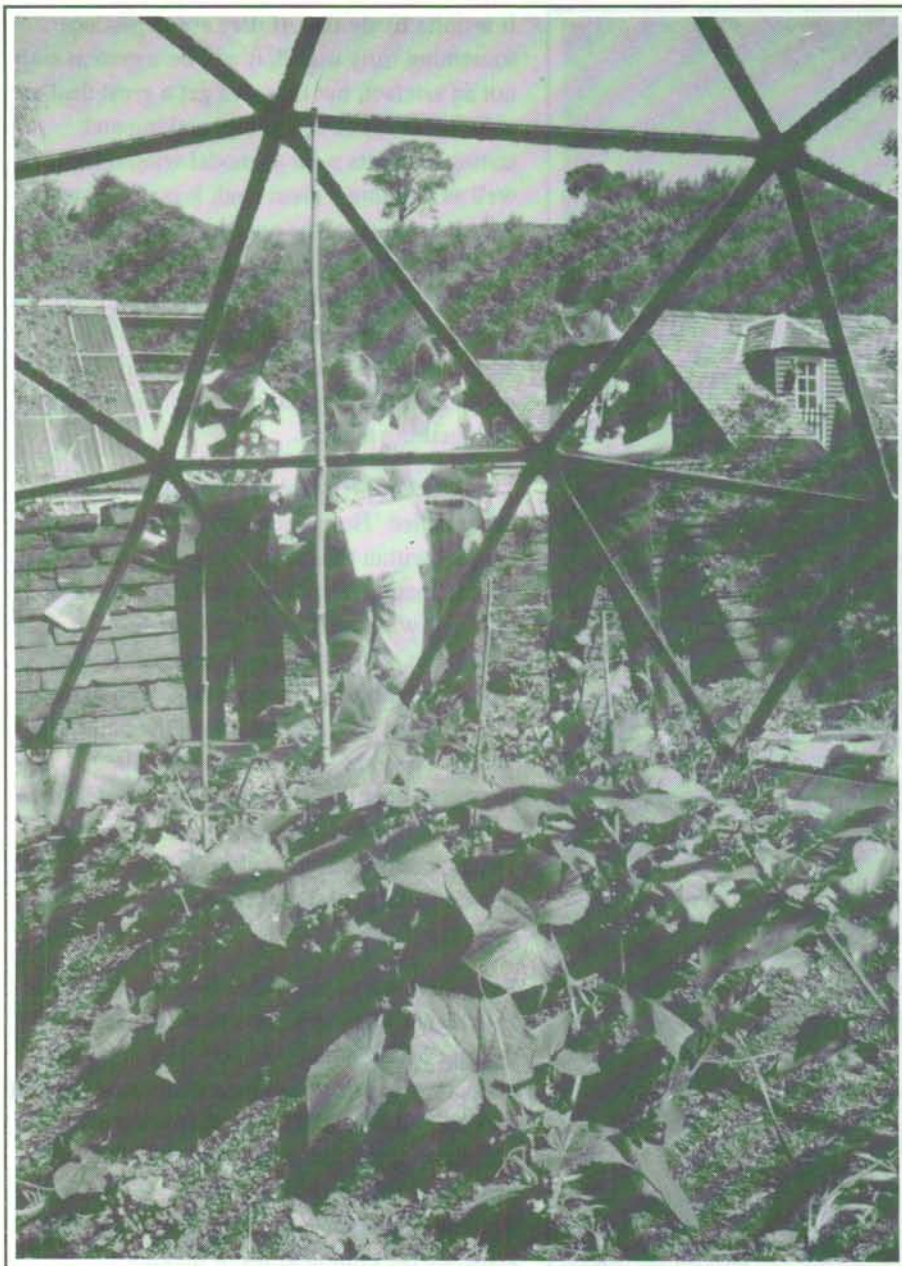
visitors and many school and college groups stayed for residential. It runs courses, produces publications and does consultancy as well as displaying the technologies in as informative and interesting a way as possible.

CAT's mission statement says that it is concerned with the search for globally sustainable, whole and ecologically sound technologies and ways of life. It aims to inform and educate by displaying a variety of technologies that will use energy efficiently, minimise the use of fossil fuel and use sustainable sources of energy.

The products of designing at CAT include, not only a great deal of energy-related hardware in daily use, but also models to illustrate technologies, different types of garden and outdoor environment, buildings, graphics to interest and inform visitors and healthy and attractive food in the restaurant.

You could see CAT's 'context' as the very broad one of the worrying state of the world, or as the somewhat more focused one of developing a visitor centre focusing on solutions to environmental problems in a derelict slate quarry in rural Wales. From there you can narrow your focus down to specific contexts which have led to particular products. For example, there was a problem of access to the site. The only entrance, for all but a few cars, was by walking up a steep track. This was fine, if tedious, for most people, but extremely difficult for a reasonable proportion of the potential visitors. The solution found to be appropriate by CAT was a computer-controlled, water-balanced cliff railway, as there is no shortage of water and it creates an added attraction to draw visitors to the site. There are, however, likely to be very few other situations where this would be an appropriate method of transport.

How do you go about setting a context in a school? If you want to allow your pupils very broad scope you could look at the state of the world, problems of global warming, pollution, the depletion of fossil fuels and the inefficient use of energy, raw materials and human resources and then let them identify any problem they see as appropriate within these broad parameters and design for it. If this apparent vagueness unnerves you then you can narrow it down as much as you like and look at energy use within the school or a specific aspect of energy use in the building, the



Greenhouse in the organic garden

potential for utilising renewable sources of energy in the area, the problem of waste in the building or the locality, transport systems in the area or improving the environment of a specific very small area.

Providing the background information is not as much of a problem as it might seem. There are many books and other resources that describe the problems, available at virtually every level. There are a couple of good slide sets and many useful TV programmes, some of which might be already available in your school, perhaps in the geography department. (This is fruitful ground for cross-curricula work, as 'the environment' appears in various subjects of the National Curriculum.)

What about engaging the pupils' interest? This does not appear to be a problem. There seems to be enormous interest in environmental issues in schools, sometimes even more from the pupils than the teachers. This is a huge advantage when it comes to doing projects in this area because pupils' motivation tends to be very high. Not only are they concerned about the issues but they also see this work as 'real'. They can look at a context, identify actual problems and design systems, artefacts or even environments and, in doing so, they could, perhaps, produce something that saves energy and saves the school or their parents money.

When it comes to looking at ideas of what is possible, it should be possible to provide real examples of energy efficiency and renewable energy technologies to back up images on film and in print. A visit to CAT, preferably residential, enables pupils to see a great variety of artefacts and systems. They can see many ways of saving energy in the home, several types of solar water heating panel, a variety of windmills, large and small, from old water pumps to the sophisticated design of the blade of a modern 250kW aero-generator, a water wheel and a highly efficient water turbine, a number of sets of photovoltaic cells generating electricity directly from solar energy, electronic controls maximising the usefulness of the various technologies, buildings designed to save energy and make use of solar energy, as well as beautiful organic gardens. You could also use the site to do some very interesting work on materials and structures if you wanted to.

If they stay in the part of the residential accommodation called the 'Euro-Cabins' they also get the opportunity to manage their own energy system, to monitor their energy use for heating, cooking, relaxing and working, and to decide when to turn on their own water turbine. This has proved to be tremendously successful in, not only enabling them to learn an enormous amount at first hand about energy consumption and how to save it, but also providing a wonderful opportunity to learn about many of the principles of electricity, mechanisms, etc. as well as all the social education of living and working together.

Unfortunately, nowadays many schools feel that they are not in a position to take advantage of such an opportunity, so they have to see what they can make of what is around them. There are examples of energy saving and even



Pupil testing own design of solar water heater.

using renewable sources all around the country if you know what you are looking for. There are over 30 000 solar water heating systems in use around the country, mostly on houses and at least one heating a primary school swimming pool in London, so it should be possible to locate one. Pupils could see examples of insulating and draft-proofing materials, types of thermostat and energy-efficient light bulbs.

They can measure the energy use in the school or their own homes, look at the energy consumption of the appliances they use and consider better management or other solutions. They might well come up with some ideas that would lead to energy saving in the school. There are some publications that deal with exactly that.

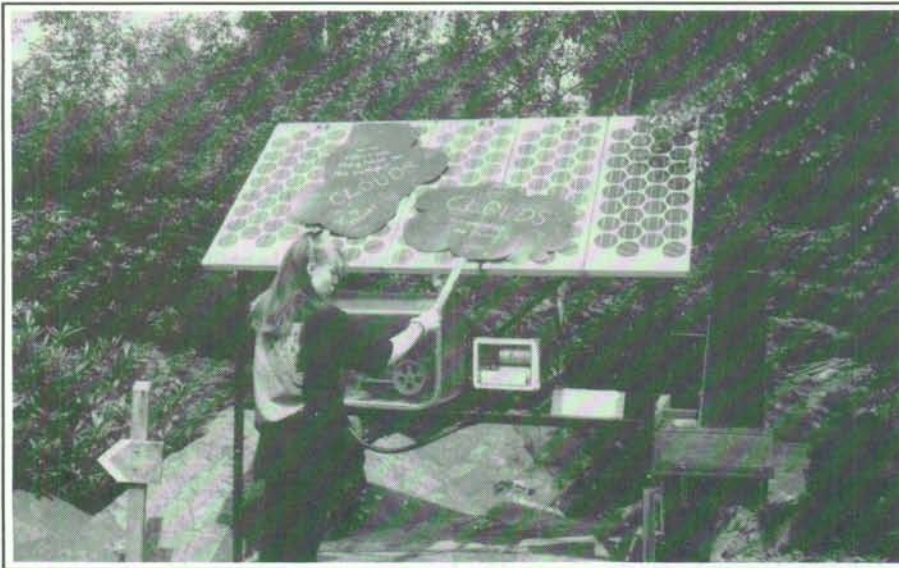
It is quite likely that, if they are to produce something truly useful, it will be a system and not an artefact, but they can get a great deal of enjoyment out of designing, making and testing artefacts such as model windmills, as well as learning a great deal. It is important that they consider the appropriateness of a particular technology in a particular location but, having realised that their back garden is an inappropriate place to bother to erect a windmill, there is no reason why they should not look at the national potential and go ahead with making models.

That aspect of technology that cannot escape being called 'Home Economics' sits very happily within this area. It is great fun to build model boats powered with solar cells, water turbines, windmills or solar water heating panels but, saving energy is much cheaper, easier and more environmentally benign than generating it, and that begins in the buildings we use every day. This cannot be called anything other than 'Home Economics'. There is huge scope for looking at saving heating energy, energy efficiency, as well as fun things like designing solar devices to cook marshmallows.

Recycling is a popular area for projects. There is a danger that the work which focuses on dealing with the end products may actually encourage pupils to produce more waste so that they can recycle it. There are all sorts of interesting pros and cons with regard to producing waste, re-using things, recycling them and using them to produce energy. These illustrate the complexities of making technological choices and the limitations of what individuals can do when not supported by Government action.

The complexity of issues is very obvious when it comes to recycling, but it is there with any technological choice. There is no such thing as a technology which has no impact on the environment. What is important is that that impact is evaluated and that people are encouraged to make technological choices based on full and accurate information on all the factors involved.

Of course this involves both value judgement and economic choices. Pupils have to consider what the cost of a particular technology will be, not only the here-and-now financial cost, but also the environmental and human costs, now and in the future. There will be longer



Pupil experimenting with solar electric pump.

term financial costs, some not now obvious, such as the likely cost of the fuel required to run a system in 20 years time or the cost to the NHS of dealing with health problems caused, but there are also human costs, both now and in the future, to those who produce things as well as to the consumers.

Work on environmental and energy issues seems to offer everything to technology teaching — a context full of very real problems all around us, an economic awareness perspective, the need to evaluate technologies, a vital role for 'Home Economics', the potential for work at whatever level you like on electronics, mechanisms, energy, structures and materials. It also provides an interesting life for the teacher as the possible outcomes are various and, to some extent, unpredictable.

■ Resources

Slide sets:

Renewable Energy for Today and Tomorrow (International Centre for Conservation Education) — Looks at 'conventional' energy sources as well as renewables and energy saving; excellent overview (60 slides).

* *Efficient Use of Energy* (British Gas) — some very attractively produced slides plus worksheets and ideas.

Many TV programmes, but particularly useful:

* *Energy and Materials* — a series of short programmes by Thames TV, first broadcast in 1991 (KS 4) Design and Technology

Books and packs:

Energy Without End (Michael Flood, FOE) — very good overview, suitable for A-level and some KS 4 pupils.

* *Energy Efficiency in Buildings — How to Bring Down Energy Costs in Schools* (Energy Efficiency Office, February 1990) — all schools should have been sent a copy by the Department of Energy.

Green Your School — Action Pack for Secondary Schools (FOE) — very useful, on A4, photocopyable sheets.

The Eco-School — The School Design Project (Paulton & Simmonds) — not comprehensive but very good on the areas it does deal with.

Green Technology 1 (KS 2) (Green Teacher Resources) — very practical basis for design and technology projects — photocopyable.

CAT publications:

Teachers' Guides to Renewable Energy Projects

No. 1 *Wind Power*

No. 2 *Water Power*

No. 3 *Solar Electricity*

Practical hints for teachers to avoid pitfalls and achieve success. Useful at all levels.

Pupils' Resource Booklets

Wind Power

Water Power

Solar Power

Background information for pupils, (KS 3 and 4) plus a variety of other information sheets, not written specifically for schools, including *Energy in the Home* (No. 1 and No. 2)

CREATE (Kenley House, 25 Bridgeman Terrace, Wigan WN1 1SY) have a number of useful publications.

*Items marked with * are not available by mail order from CAT.*