One hundred percent renewable

Gordon Proven **has a vision, 100% renewable energy. The head of one of the UK's most successful renewable energy companies thinks small systems and distributed storage is the (only) way ahead.**

Gordon Proven receives a Smart award for new Scottish technology from George Kynoch MP

SOME claim that the *only* energy option for the future is nuclear. I agree; but it must be nuclear fusion and we must use the existing giant fusion reactor already operating efficiently and safely at some distance from here — the sun.

The sun provides safe, reliable, everlasting (for our short time horizons) energy, arriving on Earth in a diffuse form. We therefore have to cast a wide net to collect this widely distributed bounty. Our uses of energy are also diffuse, and are spread over the earth, just like the incoming solar. Perversely, in developed countries at least, existing energy production tends to be distorted into very large central generation plants sitting at the apex of a vast spider's web, distributing the power to diffuse users — a pattern driven by a striving for thermodynamic efficiency supported with incomplete economics.

External costs of fossil fuel are for the most part outwith the formal market and barely admitted by generators and users, yet they are very real. Only now are the die-hard sceptics conceding the greenhouse effect, perhaps because insurance companies are now seeing the climate related monetary losses stack up. Let's hope it is not too late to stop a runaway greenhouse effect. And although earth-bound nuclear, in comparison to fossil fuels, won't push up the temperature quite so much, it has other insidious pollutants which we cannot see or feel, Chernobyl being one of many major disasters still reverberating. Essentially, I think that a payback period of 10,000 plus years is rather uneconomic; but even more I think it is morally indefensible to leave our descendants with a dangerous and costly long-term problem for the sake of our 30 years of electricity.

There is another way. Most countries on Earth have an abundance of solar energy, mainly unused. In my home country, Scotland, it tends to be available in secondary forms such as wind, hydro, wave, and tidal. More than enough energy from these sources exists to supply Scotland now and into the future. Current proposals say we may rise to 10% or even 20% of our energy needs from new renewable energy, particularly from wind power; I say we should be striving for 100%. By definition, in the long term, that is all we have. Earth-bound nuclear power and thermal power stations can be phased out as we build a diffuse infrastructure of small-scale wind, micro hydro, solar and others. Table 1 shows a comparison between present conventional generation and a possible mix of renewable energies. It is to be treated as illustrative, but nonetheless indicative of the possibilities. If a major wave power program were undertaken, it alone could supply our needs. The eventual mix will be determined by cost and practicality, but the sources are here.

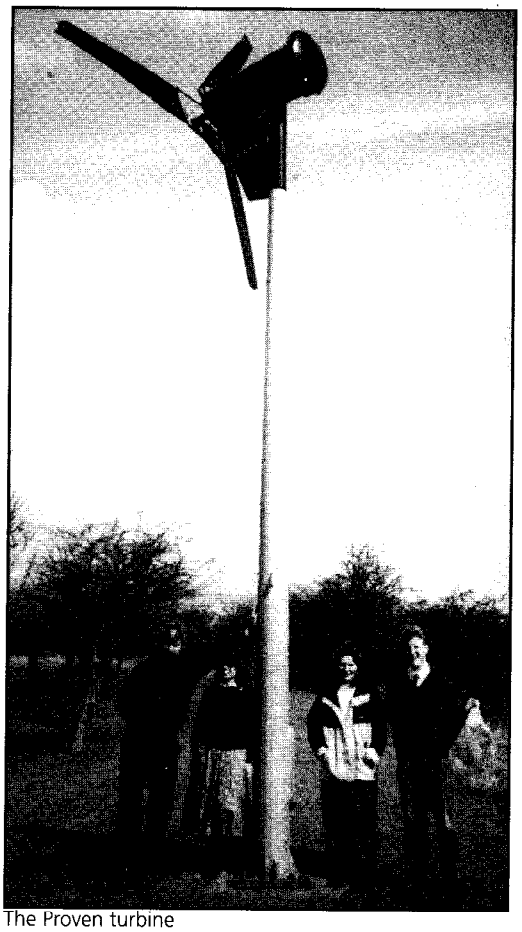
Advancing Technology

Local renewable energy production will become the norm in the future. Every house, farm, school, factory and office will have appropriate solar (in the broad sense) energy collectors. By using small-scale wind turbines attached to existing buildings and connected to the grid through existing outlets, any perceived landscape intrusion is minimal and no extra grid infrastructure is needed. Combined output from mass-produced and installed small wind turbines can easily compete with 200 10MW wind farms; but they should not compete they are complementary.

Small wind turbines and other systems are becoming more and more reliable, easy to use and available to the general public. Proven wind turbines are now (at last) seeing a snowballing sales effect as people realise the technology works and is available. More and more sophisticated, but user friendly controls make the systems less demanding and more useful. New generations of quiet, reliable wind turbines are being developed. Buying and using a wind turbine (or other solar energy collector) must become as easy as buying and using a TV, and hopefully easier to use than a video recorder.

Rounding the circle is distributed, grid-connected energy storage — the final piece of the jigsaw, and a small problem to be overcome if we are to have large-scale deployment of renewable energy systems. Storage is needed with any energy system, but is more important with renewable energy because of its inherent intermittent nature. Pump storage schemes such as Loch Awe/ Cruachan do a little, but for serious national energy storage I again propose the diffuse answer — a 10 to 20 kW grid integrated energy store in every house, farm, factory, building, providing 50,000 MW of instantly available energy store. All forms of diffuse energy input to the grid can now be efficiently used; peak generation problems disappear; the system is extremely robust; the grid becomes a true energy exchange network, an energy internet. Of course there are things which will have to change — the 1998 so-called 'opening up' of the electricity market has so many obstacles to true market development that it will tend to act as a barrier to progress.

With a grid-integrated energy store and associated 'solar' energy collection system in every building, the Grid has a new role:


The Proven turbine

facilitating the trading of energy on a grand scale. Each store can buy and sell to the grid, the buying having a premium over the selling, like a stock exchange, and the premium paying for the Grid. Large power users can draw from many diffuse suppliers. The Grid and each building will become extremely reliable — since each house has a built in back-up system, supply cuts like the Scottish Borders problems this winter will be unknown.

Not only grid changes are needed — political, social, and economic attitudes have to adapt as well — but technical advances will certainly open up political choices. Proven World Friendly Energy, along with European partners, are making a small start, by starting research on just such an energy store device which can in the short term be used for off-grid storage, back-up systems, and electric vehicles, but at the same time can in the long term fulfil the grid integrated energy store technical requirements.

Political channels

Local Authorities now have an obligation to strategise how they would cut energy use in all their area's housing (council and private) by 30%, a target well within the means of a combination of conservation and small-scale renewables. Hopefully this will stimulate renewable energy growth further and help get us started on a virtuous circle of reducing fossil/nuclear energy needs and reducing renewable energy capital costs. Large-scale wind farms are already competitive against other sources at face value, and even more competitive when external costs are included.

We must aim to make renewable energy lower in cost than any of the polluting sources. This is happening gradually through technical advances, but will be helped by 'polluter pays' taxes such as the carbon tax. There is no need for this to be an extra tax burden, rather a shifting of the tax weighting. This is, after all, what governments should do — use their tax powers to discourage harmful activity and encourage beneficial activity for the good of people and country.

Governments of course have other concerns than energy, but avoiding the destruction of our world should have some priority. Major social problems like unemployment are arguably a political choice and not an economic necessity. We are now more wealthy than we have ever been, thanks to vast increases in people productivity which in turn is the result of technological progress and good education. How this wealth is distributed is a political decision. There is no reason why more people could not be employed with fewer hours — the reduction in hours would probably result in even higher productivity. Production, installation and maintenance of large numbers of small-scale renewable energy systems will create many new jobs, far more than equivalent conventional large-scale energy projects, and more integrated into society.

One of the elusive goals of government is 'the feel good factor'. How can people feel good when they are reduced to serfs on an economic treadmill? As well as reducing polluting energy use, the widespread use of small-scale renewable energy empowers and enriches people's self-sufficiency and self esteem and reduces the 'big brother' feeling of being at the mercy of big business. People need to build some feeling of security and self determination before the feel good factor has any chance of returning; quite apart from the fact that it is difficult to feel good if you know your everyday activity is destroying our environment. Although there is a good deal of technical R&D required, it may be that social and political developments are in greatest need of some innovative development. ❑

table 1

Conventional Generation

Station	No. Units	Peak, MW(each)	Peak, MW
Hunterston B	2	600	1,200
Torness	2	600	1,200
Longannet	4	600	2,400
Peterhead	2	600	1,200
Cockenzie	4	500	2,000
Total peak power			8,000

Renewables

Type	No.	Capacity, MW	Average*, MW
Windfarms	50	10	200
Wave	50	10	250
Tide flow	50	20	500
Wind turbines			
Farms	50,000	0.04	500
Country houses	200,000	0.006	300
Urban houses	240,000	0.002	86.4
Micro hydro			
Farms	2,000	0.02	40
Hotels	1,000	0.02	20
Houses	10,000	0.005	50
Solar			
Houses	1,200,000	0.005	750
CHP			
Houses	800,000	0.001	800
Total average power, peaking in winter (1)			3496.4

* Wind, wave, tide and solar are all multiplied down by a production factor

(1) Peak winter demand about 5,500 MW

Storage

Each house uses about 3 MWhr/yr or 0.000342 MW/hr

For 2,400,000 houses in Scotland, this represents 822 MW hourly supply

A two-day energy store at each house would therefore add up to 39,452 MWh, or 0.016 MWh/house

Proven Engineering Products
Moorfield Industrial Estate
Kilmarnock
Ayrshire
KA2 OBA

Tel: 01563 543020
Fax: 01563 539119

Gordon Proven is Managing Director of Proven Engineering Products.