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<1969/c>	The UK's efforts on the renewable front (excluding fusion) are currently channelled mainly into wind and geothermal energy. Renewable sources of energy generally require larger investment than conventional energy except in the case of high temperature geothermal and some types of bio conversion. Production costs for the renewables and, even more so, for synthetics are far higher than for coal, oil or gas. Despite the sophisticated techniques involved in enhanced recovery of oil and recovery of heavy oil, both investment and production costs are lower than for tar sands, oil shale and for the renewables. Nuclear power has long lead times (particularly in the US) and requires a higher investment than many synthetics. However its energy production costs are lower. Wind Power The power of the winds, worldwide, may be estimated at three or four times total world energy consumption. However, it will never be practicable to convert more than a small percentage of this into useful energy. Nevertheless, a project is under consideration in the US for some 300,000 windmills spread across the plains which would supply some 200,000 MW of electricity, more than half the present US installed capacity. For most parts of the world, however, the most convenient and effective sites for wind generators would tend to be coastal or offshore where winds are stronger and space is not at a premium. The major factors governing the use of wind generators are as follows. Power available from the wind obeys the 'rate of the wind speed' by which a doubling of wind speed increases the power available by a factor of eight. This means that higher wind speeds must be sought - one reason for the choice of coastal and offshore sites. The second point is that power available is proportionate to the square of the propeller diameter. Thirdly, output increases with the height of the blades since, lower down, wind speed is reduced by friction. **The largest** wind generator in operation is probably the NASA MOD 1 at Boone, in North Carolina (sponsored by the US Department of Energy) which has **a 200 foot diameter** and is capable of generating two megawatts of peak power. Modern computer technology renders generation more efficient; a microprocessor predicts wind behaviour and adjusts the wind generator to maintain maximum performance. What is reputed to be the most sophisticated and expensive windmill in the world is to be built at a cost of £10.5 million in the Orkneys. This will generate at a cost of 10 pence per kilowatt-hour but the Department of Energy has stated that 20 to 30 such aerogenerators could produce electricity for one-third of this cost. At Richborough in Kent the UK's CEGB is to construct a 4 MW turbine with
	**a span of 90 metres**
Key: **Footprint ConEn1** **Footprint ConEn2** **Footprint ConEn3**	. This may be expanded into a 'wind farm' of ten units. The generation cost of 10p per unit compares with an estimate of 2.5p for the proposed PWR at Sizewell. One advantage of wind power is that it would tend to generate best when weather is bad which is also the time of peak need for electricity in many countries. However, as with other renewables the lack of control over the matching of electrical output to

	demand is a disadvantage. Increased usage of renewable energy sources, most of which will mainly convert energy into electricity, will necessitate better methods of storage of electrical energy than at present. Possibilities include the use of surplus electricity to compress oil into huge reservoirs, the electrolysis of water into hydrogen and oxygen and pumped storage (see Electricity section). According to a Swedish study of the economics of wind power in 1979 recommending the construction of 700 offshore windmills, the total cost of generation by this method was comparable with that of AGR generation at a ratio of 1 (nuclear) to 1.2 (wind power). Although capital and operating costs of the wind generators were higher, the disparity was reduced by the absence of fuel costs. (Estimated nuclear 1.70 p/Kwh - wind 2.00 p/Kwh). A large aerogenerator programme is at present underway in the Netherlands where it is hoped that wind will be supplying about one quarter of Dutch electricity demand by the year 2000. However, this will necessitate some 5,000 aerogenerators and strong environmental objections are expected. As the renewable energy sources develop they will inevitably quickly lose their present quaint, pastoral image and the concepts of noise and horizon pollution will assume as significant a rôle in the public bestiary as do atmospheric and nuclear pollution today. The level of noise pollution from one of the larger aerogenerators which during high winds would achieve supersonic speeds at the end of the blade would certainly be of formidable proportions. In the Altamont Pass in California some 2000 microprocessor controlled windmills have been erected to supply commercial electricity. Where climatic and environmental factors make land-based aerogenerators impossible, costs would be high. According to an assessment commissioned by the Department of Energy the cost of the support structure alone for one offshore wind turbine (excluding the turbine) would be £3 million while one machine would cost £34,000 per year to maintain. The support facilities on shore for a 200-machine 600 MW cluster of wind generators would be around £25 million while transmission costs were estimated at four times that for a conventional 600 MW power station (all at mid-1979 prices). It has been estimated that the capital cost of a 1,000 MW installation on the UK coast could be comparable with the cost of a