



GENERAL CERTIFICATE OF SECONDARY EDUCATION

GEOGRAPHY C (1988)

2401/01/02/RB

Decision Making Exercise (DME) (Foundation and Higher Tier)

RESOURCE BOOKLET

This Resource Booklet should be available to candidates for up to three working weeks prior to this date.

**Friday 29 January 2010
Morning**

Duration: 1 hour 45 minutes



THE ISSUE

THE ENERGY GAP: IS THE ANSWER BLOWING IN THE WIND?

INSTRUCTIONS TO CANDIDATES

- This Resource Booklet must be handed in to your teacher at the end of each lesson. **You must not write on the booklet.**

INFORMATION FOR CANDIDATES

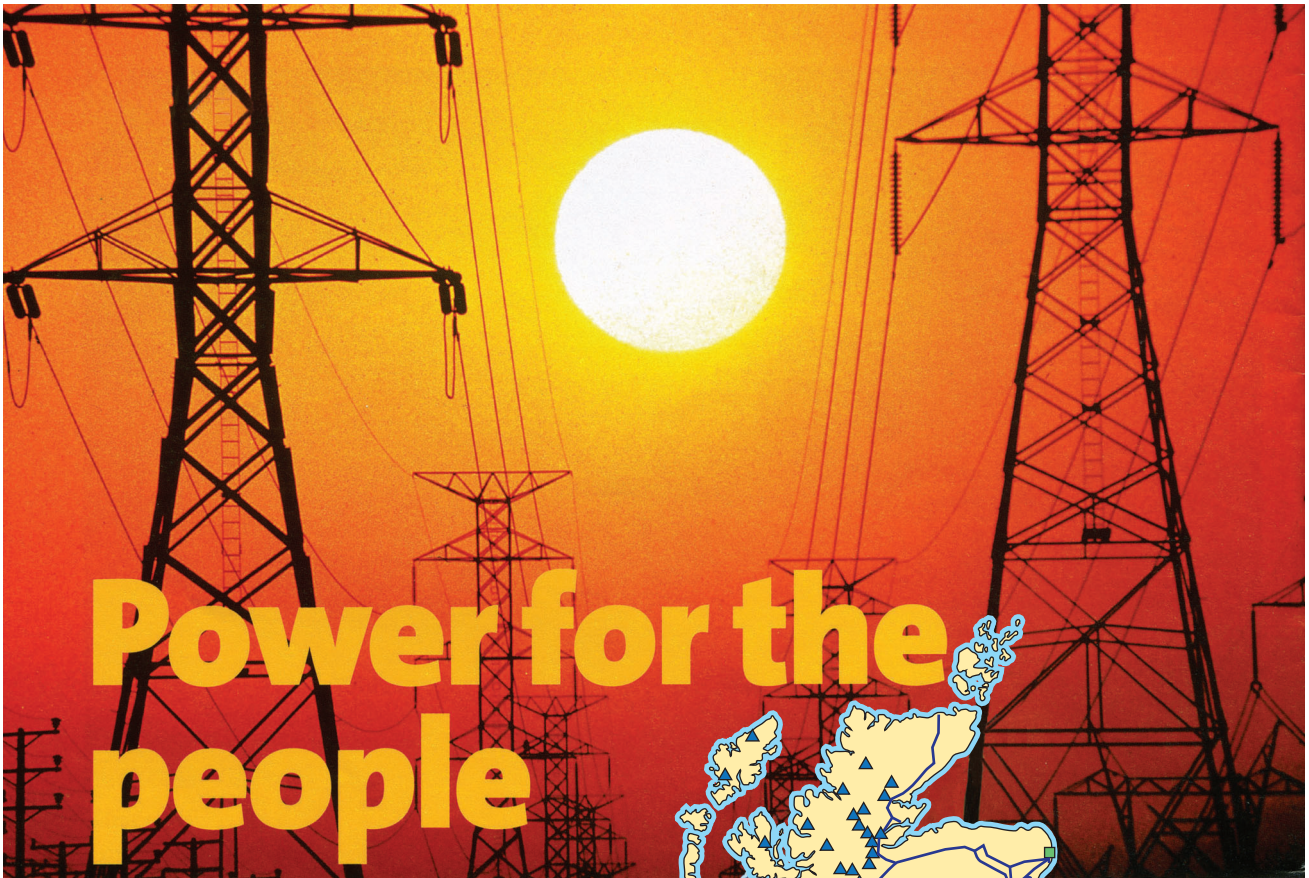
- The following abbreviations may be used:
MEDC – More Economically Developed Country.
LEDC – Less Economically Developed Country.
EU – European Union which includes the United Kingdom.
- This document consists of **12** pages. Any blank pages are indicated.

CONTENTS OF THE RESOURCE BOOKLET

- Resource 1 – The supply of electricity in the UK
- Resource 2 – Energy in the UK
- Resource 3 – Meeting the UK's renewable energy commitments
- Resource 4 – Wind farms in the UK (2007)
- Resource 5 – The advantages and disadvantages of wind power
- Resource 6 – The development of wind power around the world
- Resource 7 – Some people's objections to wind farms
- Resource 8 – Wind farms on the Isle of Lewis, Western Isles of Scotland
- Resource 9 – Objections to Lewis Wind Power's proposals
- Resource 10 – Isle of Lewis – proposed wind farm development areas

RESOURCE 1

The supply of electricity in the UK



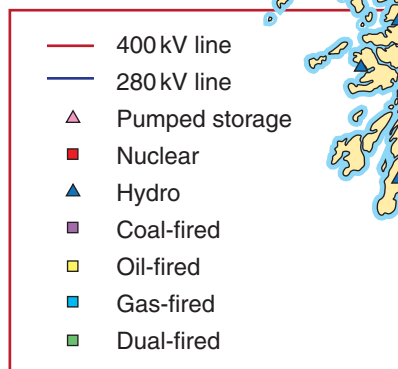
Power for the people

A modern economy like the UK depends upon an efficient system of energy provision. Energy is needed to power machines in factories, for heating and lighting homes, and for computers and other machines in offices. In the UK the energy is provided by electricity.

Energy sources

For much of the twentieth century coal-fired power stations were used to generate most of the UK's electricity. In the 1960s they produced over 75% of the electricity and oil-burning stations generated most of the rest. Nuclear power was introduced during the 1950s; the most recent nuclear power station to be opened was Sizewell B, in 1995.

At the end of the century gas-burning power generation overtook coal as the major fuel source. Gas-fired power stations are cheaper and quicker to build than coal, oil or nuclear plants, and produce less pollution. The 'dash for gas' was rapid – in 1992 gas had only a 2% share but today over 35% of the UK's power is generated from gas.



Renewable energy sources

Coal, oil and gas are fossil fuels, and will eventually run out. They are also a major source of atmospheric pollution. Many people feel that the long-term answer to our energy needs lies in non-polluting 'natural' sources of energy that are renewable and will never run out. The force of river water (hydroelectric power), tides or wind can be used to turn turbines, or energy can be harnessed from the sun (solar power). Schemes like this make a relatively small but growing contribution to our power requirements.



The electricity supply system in Great Britain

RESOURCE 2

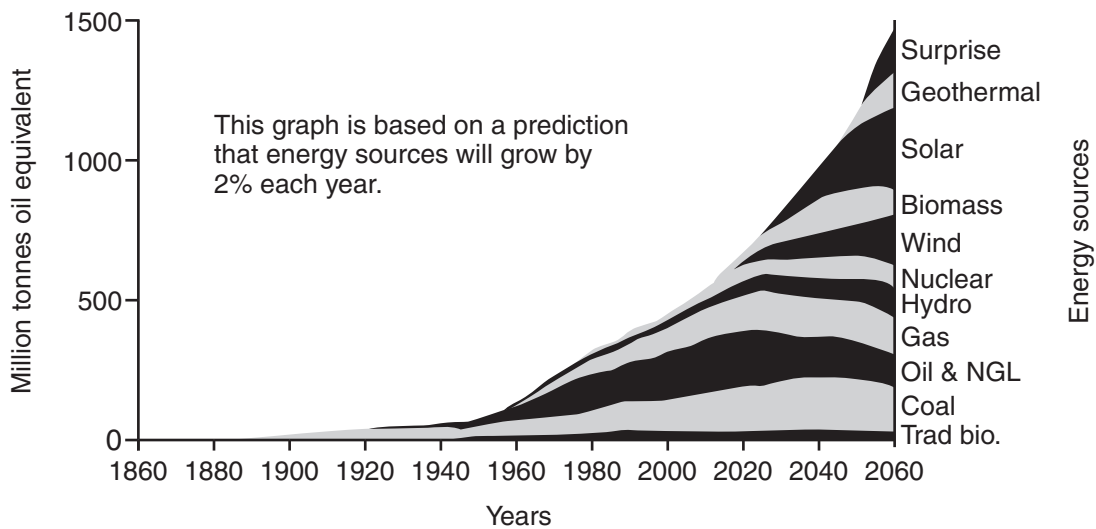
Energy in the UK

(a) Is the UK facing a large energy gap?

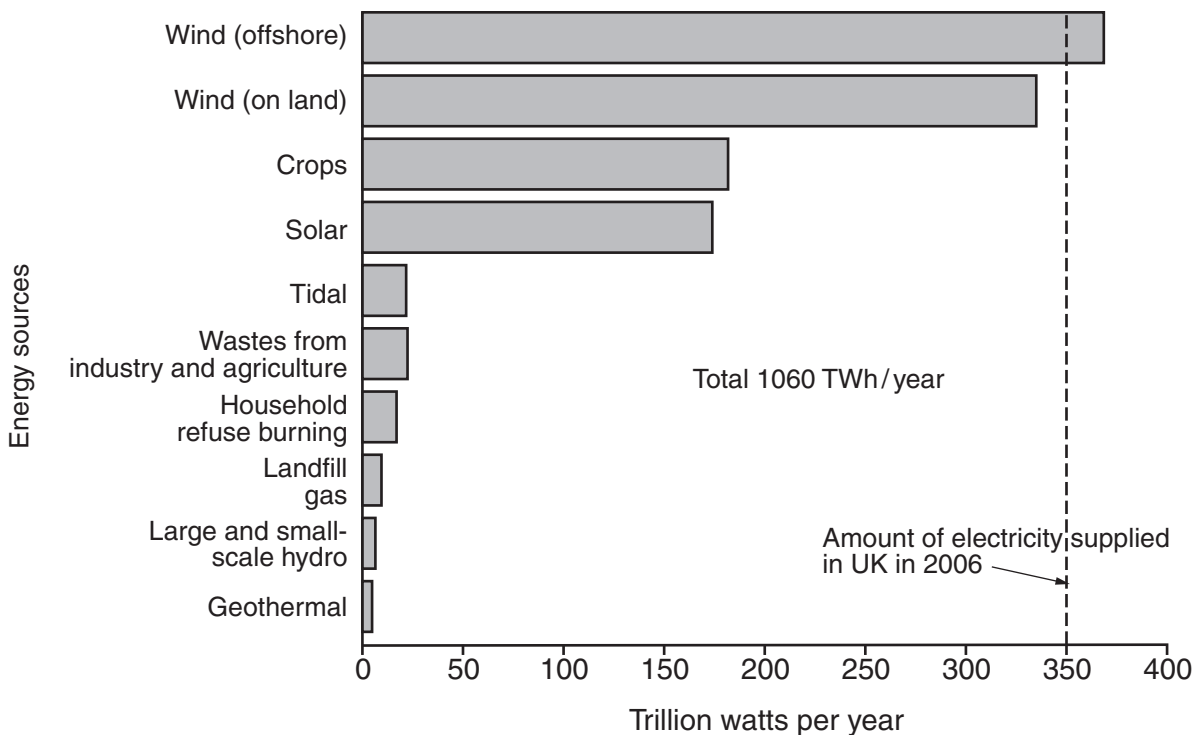
The UK could be suffering planned power blackouts within the next ten years, a senior energy expert has warned. His stark prophesy predicts the country will be plunged back to the dark days of the 1970s, when electricity was rationed and hospital staff had to carry out work by candlelight.

Within a decade, the country may be generating only about 80% of the energy it needs. A generating shortfall of 7–16GW is foreseen by 2020. The immediate issue is the closure of most British nuclear power stations and many coal-fired units while demand for electricity may continue to rise. In principle, the gap could be bridged by new power stations burning gas or coal, but this would work against short-term targets and long-term aspirations to reduce greenhouse emissions. It is hoped that renewable energy sources will supply 40% of generation by 2050.

(b) Energy use and sources



(c) Potential amounts of alternative energy in the UK using present technology



RESOURCE 3

Meeting the UK's renewable energy commitments

- (a) The EU has set the UK a target of providing 15% of its energy needs from renewable sources by 2020. Experts say that at least 20% will have to come from wind power. Less than 2% currently comes from this source and more wind farms, both on land and offshore, will need to be built to meet the 2020 targets.

Why wind energy?

- Thanks to its position on the edge of the continent, the UK is the windiest place in Europe. The UK receives about 40% of Europe's wind energy.
- Since the 1980s, technology has been available to allow wind power to generate large enough amounts of electricity to make it commercially viable.
- There are now over 1000 wind turbines at over 100 sites in the UK.
- There are large offshore wind farms at Blyth, North Hoyle and Scroby Sands.

(b) The relative costs of power generation (2008)

Energy source	Nuclear	Coal	Onshore wind	Offshore wind
Cost per kWh.	2.2p	2.5p	3.7 - 5.4p	5.5 – 7.2p

(c) Types of wind farm



Onshore wind farm at Eaglesham, Scotland



Offshore wind farm at North Hoyle, Wales

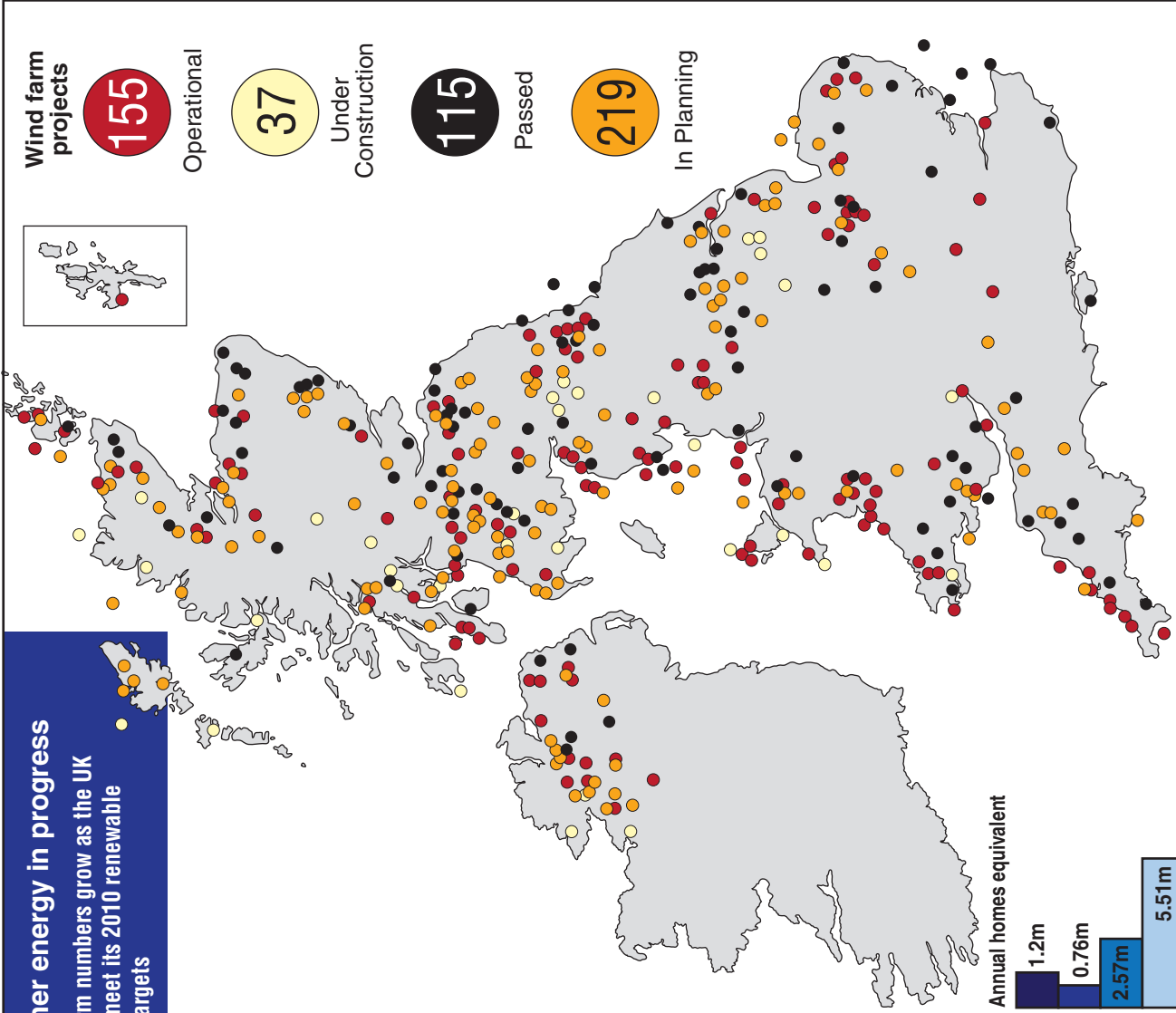
RESOURCE 4

Wind farms in the UK (2007)

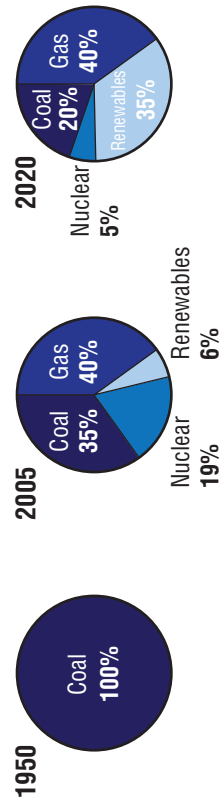
Greener energy in progress
Wind farm numbers grow as the UK tries to meet its 2010 renewable energy targets

Wind farm projects

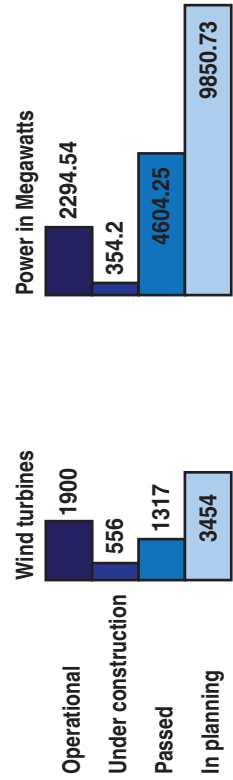
- Operational: 155
- Under Construction: 37
- Passed: 115
- In Planning: 219



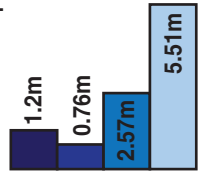
Blueprint for a greener future



Turbine power



Annual homes equivalent



RESOURCE 5**The advantages and disadvantages of wind power**

Advantages
The wind is free and with modern technology it can be captured efficiently. The energy is renewable.
Once wind turbines are built, the energy they produce does not cause greenhouse gases or other pollutants.
Each turbine takes up only a small plot of land and the land below can still be used for agriculture or leisure pursuits.
Many people find wind farms an interesting feature of the landscape. Some have visitor centres for tourists.
Remote areas that are not connected to the electricity power grid can use wind turbines to produce their own supply.
Wind turbines have a role to play in both MEDCs and LEDCs for renewable energy production.
Single turbines are available in a range of sizes to suit residents and businesses in towns and villages.
Wind energy is available everywhere so no one country is totally dependent on external supplies, such as oil and gas.





Disadvantages

The strength of the wind is not constant, so turbines do not produce the same amount of electricity all the time.

Many people feel that the countryside should be left untouched by such large structures.

Wind turbines can be noisy. Each one can generate the same level of noise as a family car travelling at 70 mph.

Many people see wind turbines as unsightly and ugly, especially if viewed from their own property.

When wind turbines are being manufactured, some pollution is produced. Therefore, wind power is not totally clean.

Large wind farms are needed. Even the large turbines serve only 500 homes.

Planning permission is difficult to get because wind farms often cause protests from local residents and environmentalists.

Many suitable sites for wind farms are far away from centres of population so transmission costs may be high.

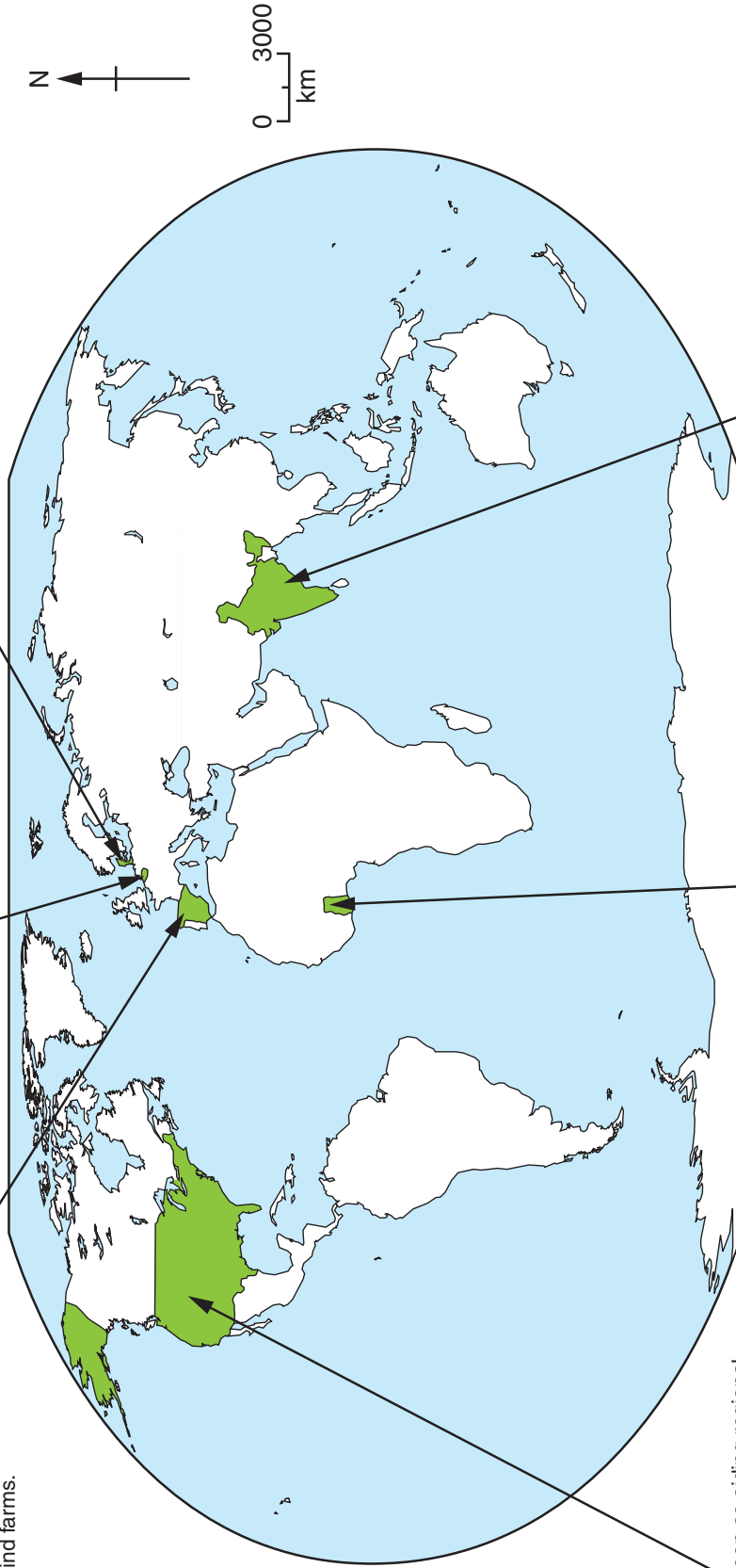
RESOURCE 6

The development of wind power around the world

Denmark - Wind power provided 20% of electricity in 2007 and Danish companies produce almost half of the world's wind turbines. The country has very large offshore wind resources and large areas of shallow water for easy construction. On land, there are many wind turbine cooperatives where families buy shares in a local turbine. There have been few objections to wind power in Denmark because the country needed to reduce its reliance on fossil fuels for both cost and environmental reasons.

Netherlands - there is a long history of windmills. Modern turbines are now being built, but the lack of space has meant that progress has been slow. The first major offshore wind farm only opened in 2007 and the Dutch plan to generate 9% of electricity from renewable sources by 2012. The government has mapped out sites for 65 wind farms in the North Sea, but there are many objections.

Spain - the third largest producer of wind energy in the world. Wind power gives 6% of its energy needs. There are increasing objections to wind farms from both conservationists and the tourist industry. On Spain's Atlantic coast, bird lovers, fishermen and tourist officials have joined forces to oppose the creation of offshore wind farms.



USA - wind power is seen as aiding regional economic development, increasing power generation options, protecting the local environment and increasing national security. It could provide 20% of electricity needs by 2030 providing production costs can be lowered. States such as Texas, California and Iowa lead the way in terms of wind energy produced.

Ghana - wind power is being developed to help provide rural communities with a more reliable source of electricity. The aim is to not only enhance energy generation but to benefit local craftsmen. In the village school at Kpenu in the Volta Region, school children now use a computer and a television more often.

India - the development of wind power began in the 1990s and has increased rapidly. It now has the fourth largest installed wind power capacity in the world and is the leading LEDC for wind power. One of the leading global wind turbine manufacturers is Indian and there have been few objections to turbines. In Tamil Nadu, the Muppandal wind farm is the largest in Asia and provides the previously poor villagers with electricity for work.

RESOURCE 7**Some people's objections to wind farms****Conservationist**

Wind farms are disastrous for wildlife that inhabits the sea and sky around our coasts. Seal breeding levels have been badly affected along North Sea coasts.

**Weather expert**

Very high wind speeds can damage the blades of turbines, knocking them out of action and requiring expensive repairs.

**Horse racing trainer**

The noise and flicker of the blades of a wind turbine near stables can spook the horses and cause an accident.

**Energy expert**

Wind turbines, on average, give about 20% of their maximum power over a three-month period. You would need over 24 000 turbines to replace one coal-fired power station.

**Doctor**

Wind turbines which rotate quickly could cause epileptic seizures due to the constantly flickering blades.

**Local councillor**

It is difficult to think of a worse act of cultural vandalism than putting turbines near our Grade 1 listed parish church. The 120 metre high towers would be a terrible eyesore and spoil the views for local people. Property prices would be adversely affected.

**Planning inspector**

A wind farm's impact on the landscape is often far too great to allow development. For aesthetic or environmental reasons many selected sites are not in the right place.

**Professor of Economics**

Onshore wind is the costliest form of electricity for the least output, and offshore wind will be even more expensive. The consumer will have to absorb these costs.

**Newspaper reporter**

Wind farms offshore leave many questions unanswered about corrosion, shipping safety and shoreline intrusion. Wind unreliability and intermittency makes it an ineffective source of electricity.

RESOURCE 8**Wind farms on the Isle of Lewis, Western Isles of Scotland.****Factfile**

Location	Largest island of the Western Isles or Outer Hebrides of Scotland
Population	18 489, mostly on the east coast
Main town	Stornoway
Altitude	Lower land to the north, higher land to the south
Wildlife	Eagles, red deer and seals found in conservation areas
Geography	Sandy beaches give way to a peat-covered plateau in the centre of the island. Apart from one village, all settlements are on the coast. There are 11 peaks over 300 metres. The coastline has many sea lochs with some high cliffs.
Geology	Mainly igneous rocks
Climate	Cool, moist, with frequent high winds

Proposals for wind farms

The company, Lewis Wind Power, wishes to develop part of the island as a wind farm, building 181 wind turbines and associated roads, substations and power lines. The site would supply enough 'green energy' for 20% of Scotland's domestic electricity. The project would take 3–4 years to complete.

Lewis Wind Power state that the advantages of this project include:

- stimulating the local economy by buying goods and services locally
- setting up a turbine manufacture and assembly yard on the island
- helping to develop 'green jobs' and sustainable industry in the area
- injecting a large amount of revenue into the area from renting of land
- generating enough renewable energy to help meet UK targets
- stopping the continuing decline in population in the area.

The typical landscape of central Lewis

RESOURCE 9

Objections to Lewis Wind Power’s proposals

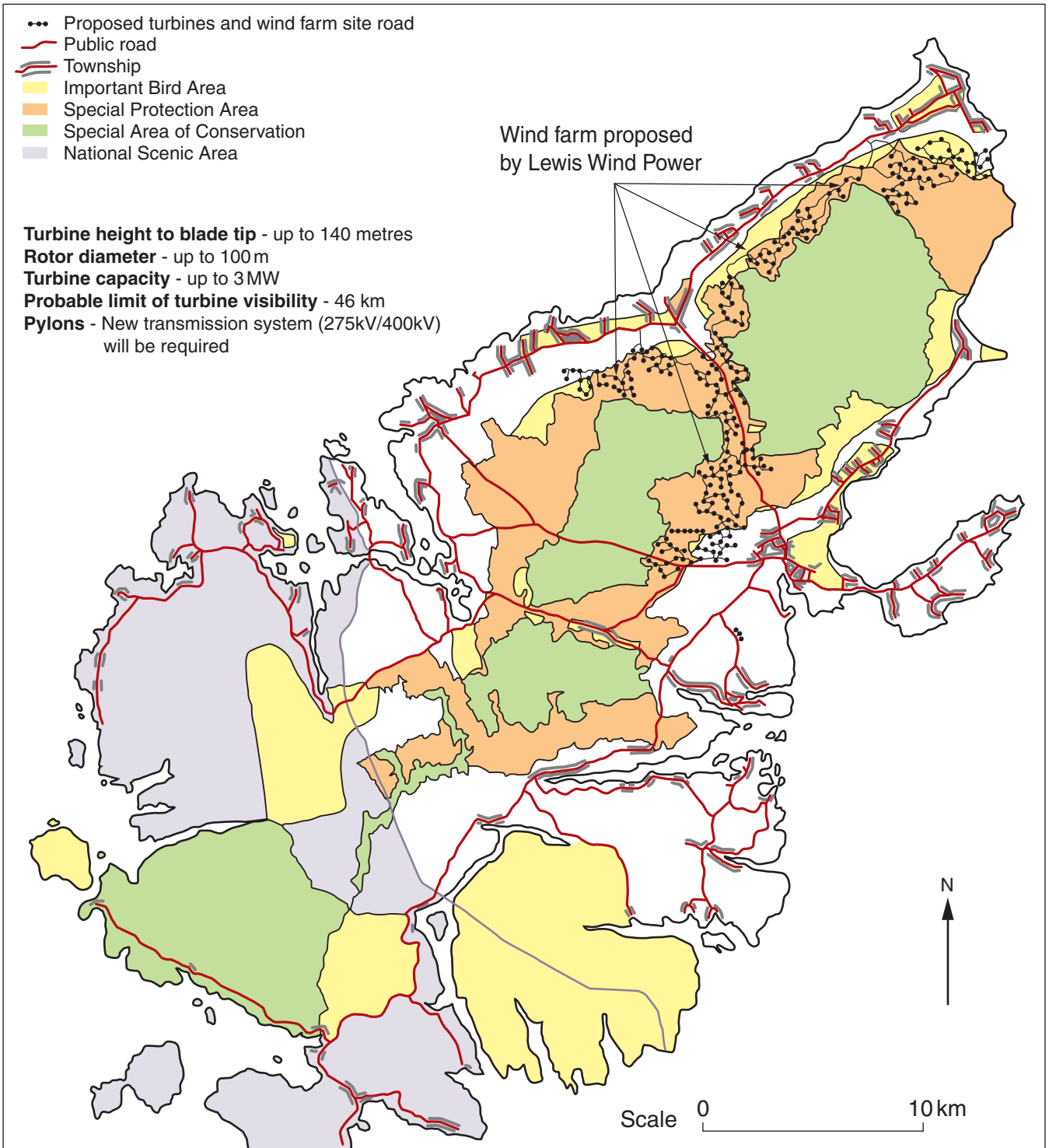
<p style="text-align: center;"><u>The Scottish Parliament</u></p> <p>Reasons:</p> <ol style="list-style-type: none"> 1) Adverse impacts on the Lewis Peatland Protection Area. 2) Huge public opposition – 11 000 objections received. 3) It would mean building 140 km of road, 8 electrical sub-stations, 137 pylons and 5 small rock quarries. 	<p style="text-align: center;"><u>Moorlands Without Turbines Group</u></p> <p>Reasons:</p> <ol style="list-style-type: none"> 1) Irreversible damage to one of the country’s most important wetland sites. 2) Would not get through the European Habitats Directive. 3) Environmental vandalism – blanket bog is as rare as the rainforest.
<p style="text-align: center;"><u>RSPB</u></p> <p>Reasons:</p> <ol style="list-style-type: none"> 1) The environmental impact could be 30 times worse than expected. 2) Could result in the loss of 20 red-throated divers, 50 merlin and 50 golden eagles. 3) 350 pairs of golden plover and 300 pairs of dunlin could be displaced from the island. 	<p style="text-align: center;"><u>Greenpeace</u></p> <p>Reasons:</p> <ol style="list-style-type: none"> 1) The laying of an undersea cable could disturb rare marine habitats. 2) A variety of rare birds and marine wildlife could be displaced or killed by the development. 3) The scheme is far too big for such a small island.
<p style="text-align: center;"><u>Local Crofters</u></p> <p>Reasons:</p> <ol style="list-style-type: none"> 1) Crofters rely on common grazing land and 50% could be lost if the scheme goes ahead. 2) Most years about 5000 lambs are sold on the mainland which brings in a large revenue. 3) The environment, the landscape and the peatlands are worth more than any wind farm. 	<p style="text-align: center;"><u>The Church of Scotland</u></p> <p>Reasons:</p> <ol style="list-style-type: none"> 1) Many villagers on the Island practise restraint, religious observance and a disdain for worldly goods. 2) Opposition in Lewis is not just from the middle class, but from all classes. 3) The compensation offered is no more than bribery.

What the landscape may look like



RESOURCE 10

Isle of Lewis – proposed wind farm development areas



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