

## How will the UK's electricity be generated in the future?

This activity covers the period from 2000 – 2020. It will be helpful if the students have already answered question 5 page 130 in textbook on trends in electricity generation from 1990 to 1998. In the future the UK will become a net-importer of fossil fuels (gas and oil). Until now it has been self-sufficient.

The projections shows how the UK's electricity is likely to be generated until 2020. The activity shows how such projections are used in developing energy policy.

It was found that assumptions about world energy prices had a pivotal role (the price of crude oil is the main variable since gas and coal prices are influenced by this). The projections assume two states of the world, one where energy prices are low (Scenario A) and the other where they are high (Scenario B).

### Activity A Two scenarios

This activity is based on the graphs in Figures 1 and 2. The students need clear copies of these graphs. They will also need rulers.

By comparing the projections students can see the effect of world energy prices on the total demand for electricity. They will also see how the scenarios differ in the contributions made by gas and coal. Finally they can see that the UK must remain heavily dependent on fossil fuels even if the government's aspiration to increase the renewables share to 20% by 2020 is achieved.

### Answers

1.

#### Scenario A: Low world energy prices

Year	2000	2010	2020
TOTAL (TWh)	345	390	408

#### Scenario B: High world energy prices

Year	2000	2010	2020
TOTAL (TWh)	345	371	387

If world energy prices are high the demand, i.e. total amount of energy to be generated, will be less.

### References

#### Specification

10.2 Electricity supplies

12.5d Understand that decisions about appropriate solutions to problems are influenced by a range of considerations (including technical feasibility, economic cost, social and environmental impact, ethical implications and political and religious commitments) and that these may lead to different solutions in different contexts.

#### Textbook

Chapter 10, pages 130-131  
Fig 10.3, 136-138, page 142  
Fig 10.19

### Sources

The projections are drawn from data in DTI (2000) Energy Paper 68: Energy projections for the UK. They are based on economic models. Assumptions about fossil fuel prices, economic growth and other factors are used in the models.  
[www.dti.gov.uk/energy/inform/energy\\_projections/index.shtml](http://www.dti.gov.uk/energy/inform/energy_projections/index.shtml)

This data on power generation was used for The Energy Review (2002) published by the Performance and Innovation Unit (PIU) of the Cabinet Office.

The Royal Society  
'Nuclear energy - the future climate' June 1999  
[www.royalsoc.ac.uk](http://www.royalsoc.ac.uk)

2.

**Scenario A: Low world energy prices**

Year	2000	2010	2020
Amount generated by coal (TWh)	105	38	26
Amount generated by gas (TWh)	133	236	307
Total generated by fossil fuels (TWh)	238	274	333

**Scenario B: High world energy prices**

Year	2000	2010	2020
Amount generated by coal (TWh)	105	83	49
Amount generated by gas (TWh)	133	173	264
Total generated by fossil fuels (TWh)	238	256	313

The gas share increases in both scenarios. It increases more steeply in the low energy price scenario. The share generated by coal is larger in the high world energy price scenario.

3.

Scenario A: Low world energy prices 41 TWh

Scenario B: High world energy prices 39 TWh

The fossil fuel share continues to rise in both the low and high world energy price scenarios.

**Activity B A greener future?**

This activity is based on further projections (in the form of tables) showing carbon dioxide emissions for the two scenarios. The students will need their textbooks in order to refer to Figure 10.19 'The amount of carbon dioxide released into the atmosphere when electricity is generated using different energy sources'. They also need to be aware that modern gas power stations can be 60% efficient while traditional coal power stations (textbook page 131) have efficiencies of 40% at best.

**Answers**

1. A coal power station emits more carbon dioxide than a gas power station to generate the same amount of electricity. Coal-burning power stations may improve with the introduction of 'clean coal technology'.
2. Although more electricity is generated in Scenario A the gas share is higher relative to the coal share in this scenario. As a result overall carbon dioxide emission is less.

### **Activity C Decision time**

This activity examines decisions made by the government on the future generation of electricity. The activity is focused on the responses from the Royal Society and a pressure group (Friends of the Earth) to some of the policies set out in the government's 2003 Energy White Paper 'Our Energy Future – creating a low carbon future'.

The Royal Society has argued that the nuclear option should be kept open in their report 'Nuclear Energy - the future climate' June 1999. They believe that it is vital to win back public confidence in this option.

**Note** The government introduced a Renewables Obligation in 2002. This replaces the NFFO described in the textbook. It is an obligation placed on licensed suppliers to deliver a specified amount of energy from eligible renewable sources. This and exemption from the Climate Change Levy are measures that will support the UK renewables industry.

### **Answers**

1. A future in which emissions of carbon dioxide gas are lower than they are today. The aim is a 60% reduction in its carbon dioxide emissions by 2050.

2. See answers to Activity A.

3. Retention of skills - training (social, economic).

Nuclear power stations are very large projects – lead time is very long (technical and economic).

4. The government's ambition to generate 20 per cent of its electricity from renewables by 2020 is described as optimistic in the Royal Society press release. Friends of the Earth say the government has a long way to go to deliver the policies in the White Paper.

5. Because it is planning to phase out nuclear power by creating an energy gap which must be filled by fossil fuels. Political courage was needed to oppose pressure groups (such as the Friends of the Earth 'Dump nuclear' campaign).

The Royal Society also says that the incentive to develop new technologies would increase if fossil fuel technologies were properly saddled with the true costs and risks of emitting carbon dioxide.

# How will the UK's electricity be generated in the future?

## Two scenarios

Figure 10.3 in your textbook (page 130) shows the energy sources used to generate UK electricity from 1990 until 1998. The graphs on page 3 cover the period from 2000 until 2020. They are drawn from government projections of how electricity will be generated in the future. The projections contributed to the Government's White Paper on energy policy - Our energy future (2003).

Projections show what 'could happen' and not what 'will happen'. They are called 'projections' and not 'predictions' because they involve assumptions about future social, economic and technological developments. Rather than making a single forecast the government analysts consider a range of possibilities. Descriptions of these 'future worlds', each based on a set of consistent assumptions, are called scenarios.

Assumptions about energy prices have the greatest effect in determining the amount of electricity generated (the demand). Figures 1 and 2 show projections for the two main scenarios. Figure 1 represents the 'low energy price scenario'. Here it is assumed that world energy prices are low. Figure 2 represents the opposite situation and shows projections for high world energy prices.

You can see that the amount of electricity from nuclear power and renewable sources is very similar in the two scenarios. At present the government has no plans to build new nuclear power stations. This will mean that the amount of electricity generated by nuclear power will shrink from its current level. As part of the government's long-term strategy to reduce carbon dioxide emissions they aim for renewables to supply 10% of UK electricity in 2010. This aim is common to both scenarios.

Both low and high energy price scenarios show the UK remaining heavily dependent on fossil fuel. By around 2006 we will be using imported gas for electricity generation.

Note that the units for amount of electricity generated are TWh. The graphs show **output** i.e. the amount of electricity generated.

1. Compare the total number of TWh generated in scenarios A and B. This is the projected demand. Read values from the graphs for 2000, 2010 and 2020 and enter them in the table below

### Scenario A: Low world energy prices

Year	2000	2010	2020
TOTAL electricity generated (TWh)	345		

### Scenario B: High world energy prices

Year	2000	2010	2020
TOTAL electricity generated (TWh)	345		

How do world energy prices affect the total amount of electricity generated?

2. Compare the projected amounts generated by gas and coal in scenario A and scenario B. To do this complete the tables below for gas and coal.  
Add the energies generated by gas and coal together to find the total amount generated from fossil fuel sources.

**Scenario A: Low world energy prices**

Year	2000	2010	2020
Amount generated by coal (TWh)	105		
Amount generated by gas (TWh)	133		
Total generated by fossil fuel (TWh)	238		

**Scenario B: High world energy prices**

YEAR	2000	2010	2020
Amount generated by coal (TWh)	105		
Amount generated by gas (TWh)	133		
Total generated by fossil fuels (TWh)	238		

Compare the trends in the share generated by gas in the two scenarios.

3. In January 2000 the government announced their aim to supply 10% of UK electricity from renewables in 2010. In the projections here the renewables share continues at this level until 2020. Since then government have said, in the 2003 Energy White Paper 'Our Energy Future – creating a low carbon future', that they hope to double the renewables' share to 20% by 2020.

In Figures 1 and 2 the renewables' share in 2020 is shown as 10%. How many TWh is 10% of the total demand for each scenario?

Scenario A: Low world energy prices \_\_\_\_\_ TWh

Scenario B: High world energy prices \_\_\_\_\_ TWh

Now consider the situation if the renewables share is double i.e. 20%. Will the fossil fuel share still continue to rise in (a) the low world energy price scenario, (b) the high world energy price scenario?

Scenario A: world energy prices low

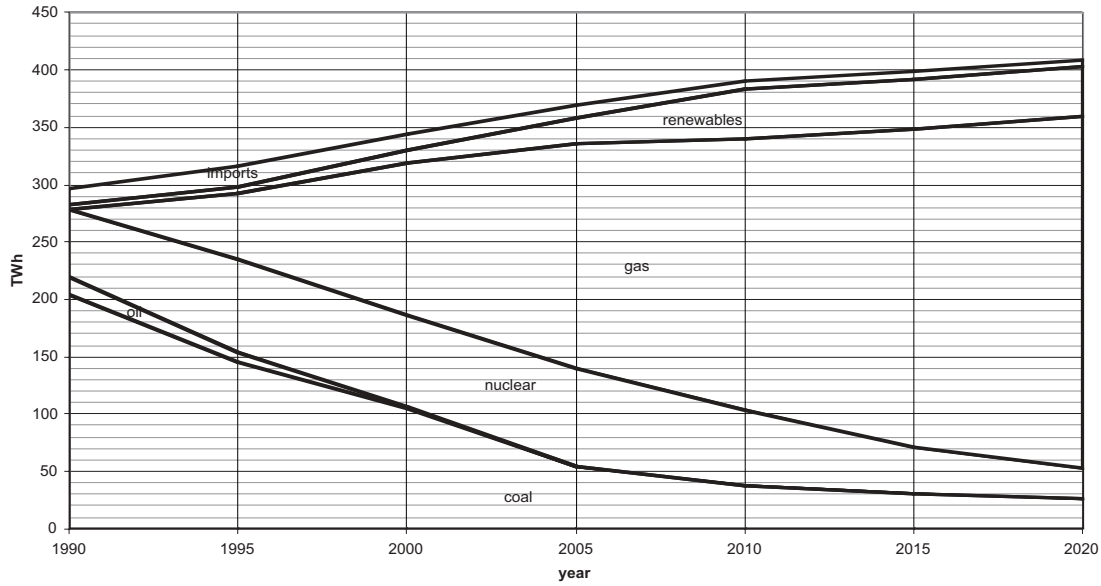


Figure 1

Scenario B: world energy prices high

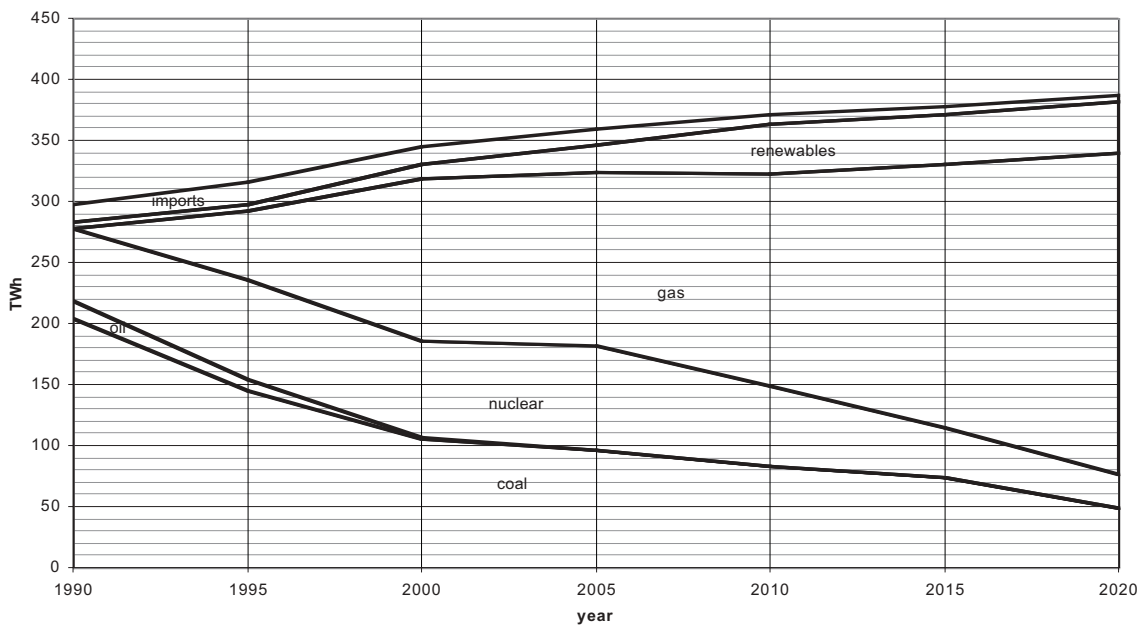


Figure 2

**B A greener future?**

Tables 1 and 2 show projections of carbon dioxide emissions in the UK for the two scenarios in A. Plot the projections as graphs on the same time axes as Figure 3.

**Table 1 Emission projections for Scenario A - low world energy price**

Year	1990	1995	2000	2005	2010	2015	2020
MtC	54.1	44.1	40.3	33.5	33.5	35.9	37.1

**Table 2 Emission projections for Scenario B - high world energy price**

Year	1990	1995	2000	2005	2010	2015	2020
MtC	54.1	44.1	40.3	38.0	37.6	39.4	37.8

The unit MtC measures the amount of carbon dioxide produced. It is megatonnes of carbon per year (corresponding to units used in Chapter 12, page 157, Figure 12.3).

1. Which of the two fossil fuels emits the most carbon dioxide when it is used to generate electricity? Compare the emissions for generating 1 TWh of electrical energy (textbook page 142, Figure 10.19).
2. The amount of electricity generated in Scenario A – low world energy prices is higher than in Scenario B – high world energy prices. In spite of this the projections show that the amount of carbon dioxide generated in Scenario A is lower than in Scenario B. Explain this.

**Emission projections**

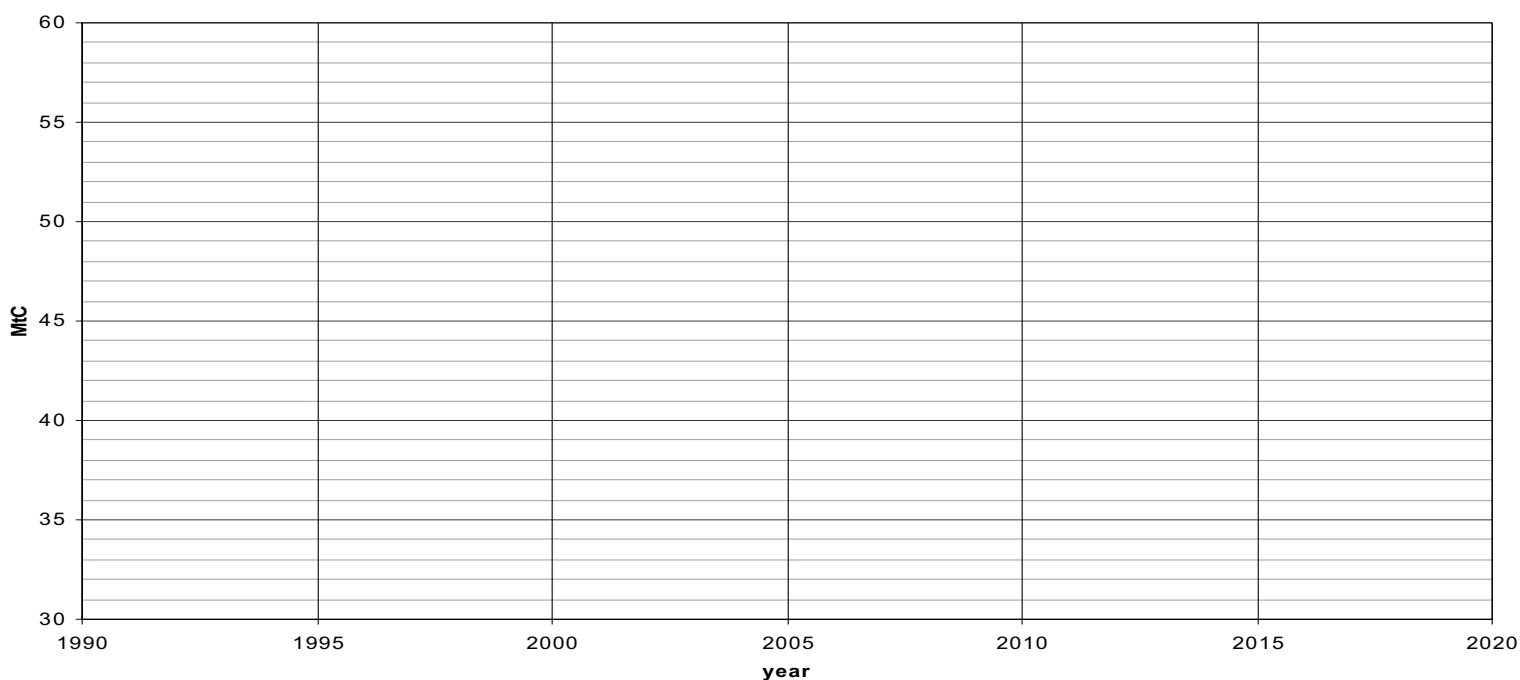


Figure 3

***C Decision time***

In 2003 the government published an Energy White Paper ‘Our Energy Future – creating a low carbon future’. It set out policies that aim to put the UK on a path to a 60% reduction in its carbon dioxide emissions by 2050.

Policies relating to electricity generation in the future include:

Renewables to supply 10% of UK electricity in 2010

An aspiration that (if strategies are successful) renewables will supply 20% of UK electricity in 2020

No proposals to build new nuclear power stations. Existing power stations will be phased out although the government claim that they are ‘keeping the nuclear energy option open’.

The Royal Society issued a Media release on the publication of the Government’s White paper: They said:

“There is much to welcome in the White Paper, but overall it says one thing yet appears to do another. It rightly acknowledges the need for the UK to make cuts of 60 per cent in our carbon dioxide emissions over the next 50 years to avert the worst effects of climate change. But it then sets out policies that seem to make us more reliant on fossil fuels for electricity generation by 2020. It is difficult to see how a substantial decrease in carbon dioxide emissions can be achieved without reducing our reliance on coal, oil and gas to generate electricity.

“Unfortunately the White Paper shows a lack of political courage to make the hard decisions necessary to move this country away from its dependence on fossil fuels. The biggest challenge was how to respond to the planned phasing out of nuclear power without creating an energy gap that must be filled by fossil fuels. But the White Paper outlines a future in which nuclear power could be shut down faster than renewables and energy efficiency measures can confidently make up the shortfall. Even if the UK achieves the optimistic “ambition” of generating 20 per cent of its electricity from renewables by 2020, the Government’s own figures suggest that this will not make up for the energy gap that will open up as our nuclear capacity declines by two-thirds.

“The White Paper does show a firm commitment to more renewables and energy efficiency measures. The Royal Society welcomes this as a good start. The incentive to develop these technologies would increase if fossil fuel technologies were properly saddled with the true costs and risks of emitting carbon dioxide.....

Friends of the Earth welcomed the White Paper on their website:

Friends of the Earth are “celebrating” a recent victory after thirty years of campaigning against nuclear power. The Government has published The White Paper that finally acknowledges nuclear power is not the answer to old energy problems.

The paper’s publication follows intense campaigning by Friends of the Earth online supporters through the “Dump Nuclear” website during 2002.

The White Paper wants to see:-

20% of energy from renewables by 2020.

60% cut in carbon emissions by 2050.

The decision to back renewable energy and promote increased energy efficiency has to be a positive step forward but without careful planning these targets could be hard to meet. For the first time it seems that climate change has been placed at the heart of energy policy and this has to be congratulated. We are however concerned that the government has got a long way to go to deliver the policies and measures that will ensure the vision outlined in the White Paper is met.

1. The title of the White Paper is ‘Our Energy Future – creating a low carbon future’. What do you understand by ‘low carbon future’?
2. Do you agree with the comment that the policies ‘seem to make us more reliant on fossil fuels for electricity generation by 2020’ (See your answers to activity A).
3. Friends of the Earth are ‘celebrating’ the victory of their campaign against nuclear energy while the Royal Society are concerned that nuclear power could be shut down faster than renewables and energy efficiency measures can make up the shortfall.  
  
Give reasons why the decline in nuclear power might be difficult to reverse? In each case say whether the argument is economic, social, technical or environmental.
4. The Royal Society and Friends of the Earth both welcome the commitment to renewable energy and efficiency. What else do they agree on?
5. In what way can the White Paper be seen to show a lack of political courage ?

*This document has been downloaded from the Science for Public Understanding website [www.scpub.org](http://www.scpub.org)*