Write your name here

| Surname | Other names |
|---|---|
| | |

Centre Number | Candidate Number

# Edexcel GCE

# Geography
## Advanced
## Unit 3: Contested Planet

Thursday 17 January 2013 – Afternoon
**Time: 2 hours 30 minutes**

Paper Reference
**6GE03/01**

**You must have:**
Resource Booklet (enclosed)

Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **TWO** questions in Section A and **ALL** parts of Section B.
- Answer the questions in the spaces provided – *there may be more space than you need.*

## Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- The quality of your written communication will be assessed in ALL your responses – *you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.*

## Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Spend approximately 80 minutes on Section A and 70 minutes on Section B.
- Check your answers if you have time at the end.

*Turn over* ▶

P41356A

1/1/1/1/1

P 4 1 3 5 6 A 0 1 3 2

PEARSON

## SECTION A

**Answer TWO questions in this section.**

**You are reminded of the need to use examples to support your arguments.**

**You are advised to spend approximately 80 minutes on Section A.**

### Water Conflicts

**1** Study Figure 1.

(a) Using Figure 1, explain the contribution that the players make to ensure safe and secure water supplies for all.

**(10)**

(b) Using named examples, assess the extent to which conflict over water supplies is inevitable.

**(15)**

**(Total for Question 1 = 25 marks)**

### Biodiversity under Threat

**2** Study Figure 2.

(a) Using Figure 2, explain why a spectrum of strategies is used to help conserve biodiversity.

**(10)**

(b) Using named examples, assess the severity of global and local threats to biodiversity.

**(15)**

**(Total for Question 2 = 25 marks)**

### Superpower Geographies

**3** Study Figure 3.

(a) Using Figure 3 and your own knowledge, explain the possible consequences of the population projections for future superpower status.

**(10)**

(b) Assess the extent to which China is a threat to the USA’s status as the only current superpower.

**(15)**

**(Total for Question 3 = 25 marks)**

**Bridging the Development Gap**

**4** Study Figure 4.

(a) Using Figure 4, explain how the groups of players have both positive and negative impacts on the development process.

**(10)**

(b) Assess the extent to which models and theories, such as the North-South divide and dependency theory, are useful in helping to understand the development gap.

**(15)**

**(Total for Question 4 = 25 marks)**

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**The Technological Fix?**

**5** Study Figure 5.

(a) Using Figure 5 and your own knowledge, explain why some methods for 'cooling the planet' appear to be better than others.

**(10)**

(b) Using named examples, assess the relative importance of political, economic and social factors in explaining unequal access to technology.

**(15)**

**(Total for Question 5 = 25 marks)**

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**Put a cross in the box indicating the first question you have chosen to answer ☒.**
**If you change your mind, put a line through the box ☒**
**and then put a cross in another box ☒.**
**You will be asked to indicate your second question choice on page 11.**

Chosen Question Number:

**Question 1** ☐ **Question 2** ☐

**Question 3** ☐ **Question 4** ☐

**Question 5** ☐

**(Total for Question = 25 marks)**

**Put a cross in the box indicating the second question you have chosen to answer ☒.**
**If you change your mind, put a line through the box ☒**
**and then put a cross in another box ☒.**

Chosen Question Number:

**Question 1** ☒ **Question 2** ☒

**Question 3** ☒ **Question 4** ☒

**Question 5** ☒



P 4 1 3 5 6 A 0 1 1 3 2

*Turn over*

**(Total for Question = 25 marks)**

**TOTAL FOR SECTION A = 50 MARKS**

## SECTION B

**Answer ALL parts of this section, referring to the advance information you have been asked to study.**

**You are reminded of the need to use examples from any part of your GCE Geography course to support your answers.**

**You are advised to spend approximately 70 minutes on Section B.**

**Energy Security**

**6** (a) Explain why energy players have such different perceptions of nuclear power.

**(12)**

(b) Evaluate the economic and political costs and benefits of developing new nuclear power stations in Western Europe to increase energy security.

**(14)**

(c) Study the three options in Figure 11. Assess the possible impacts of their development on the energy security and the environment of Western Europe.

**(14)**

**(Total for Question 6 = 40 marks)**

**TOTAL FOR SECTION B = 40 MARKS**
**TOTAL FOR PAPER = 90 MARKS**

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Edexcel GCE

# Geography

## Advanced
## Unit 3: Contested Planet

## RESOURCE BOOKLET

Thursday 17 January 2013 – Afternoon

Paper Reference
**6GE03/01**

**Do not return the Resource Booklet with the question paper.**

*Turn over* ▶

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PEARSON

**SECTION A**

**The following resources relate to Questions 1–5**

**Figure 1 Some of the players in the supply of water**

**Figure 2 A spectrum of strategies to conserve biodiversity**

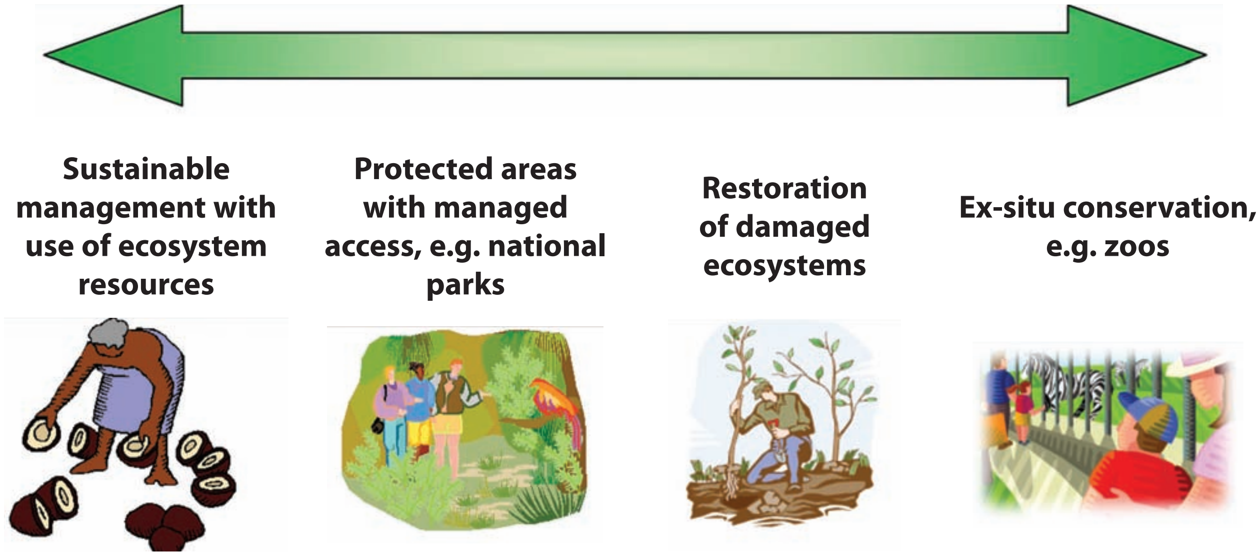

**Figure 3 Population projections to 2030 for Russia, the USA and India**

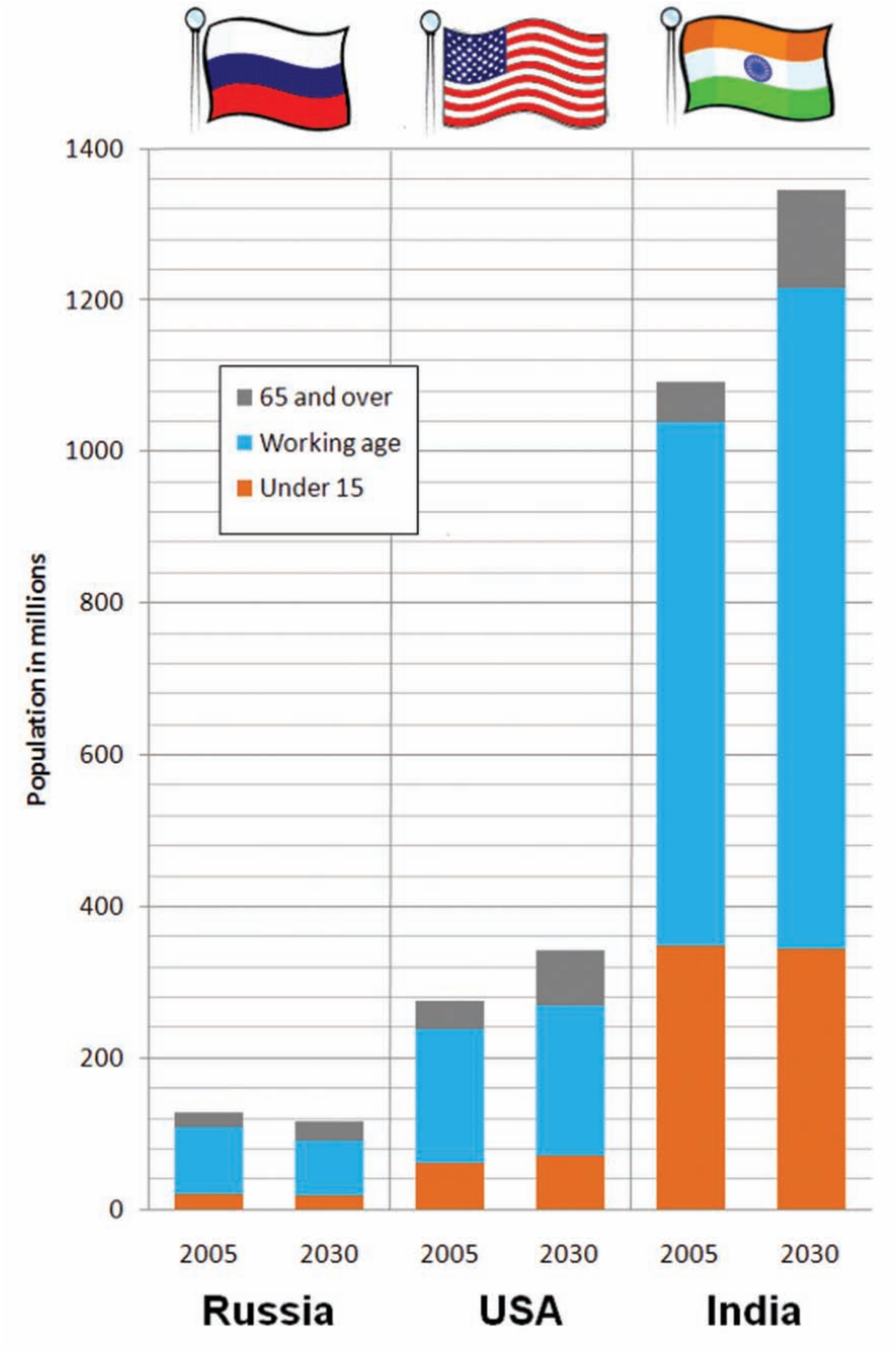

**Figure 4** Three groups of players in the development process

**Figure 5** **Geo-engineering methods compared**

| Engineering a cooler planet | | | |
|---|---|---|---|
| | **Cost of using the technology** | **Effectiveness of cooling** | **Risk of negative side effects** |
| **Space mirrors**<br>Reflective 'sunshades' launched into space to prevent solar energy reaching Earth. | $$$$ | ✔✔✔✔ | ☹☹ |
| **Carbon capture and storage**<br>Carbon dioxide from power stations is captured and stored underground in rocks. | $$$ | ✔✔✔ | ☹☹ |
| **Sulphate aerosols**<br>Sulphur dioxide is released into the stratosphere; this then reflects solar energy back into space. | $$ | ✔✔✔✔ | ☹☹☹☹ |
| **Afforestation**<br>Global programme of tree planting to sequester carbon dioxide from the air. | $ | ✔✔ | ☹ |

## SECTION B

### The following resources relate to Question 6

### ENERGY SECURITY

### SECURING WESTERN EUROPE'S ENERGY FUTURE

European nations rely on nuclear power to generate **electricity** to varying degrees (Figure 1).

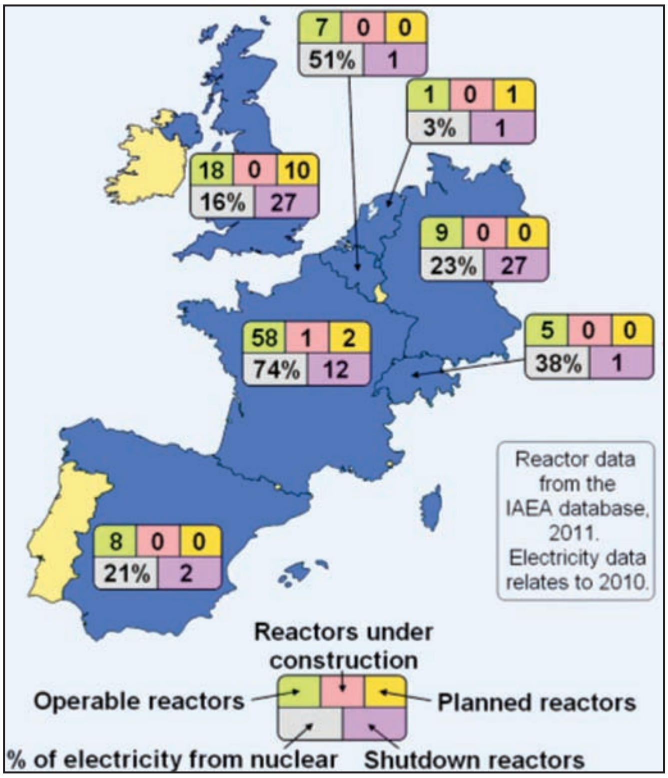


**Figure 1: Nuclear power in Western Europe**

Most nuclear power plants in Western Europe were constructed in the 3 decades after 1960 as Figure 2 shows.

| | | |
|---|---|---|
| 1950–59: **8** | 1960–69: **40** | 1970–79: **40** |
| 1980–89: **78** | 1990–99: **11** | 2000–09: **0** |

**Figure 2: Reactor construction numbers by decade for the countries in Figure 1**

In addition to operable reactors, there are many shutdown reactors undergoing **decommissioning**. Shutdown reactors reflect the fact that reactors have an operating life of 30–40 years. Many nuclear power stations in Europe operate more than one reactor. For instance, the French **Paluel** power station has four 1300MW PWR reactors. This means the number of reactors exceeds the number of nuclear power station sites. Perceptions of nuclear issues vary within the region as shown in Figure 3.

| | **Countries as on Figure 1** | | | | | |
|---|---|---|---|---|---|---|
| | **Fr** | **Sp** | **Ge** | **Be** | **N** | **UK** |
| **Q1: Nuclear energy helps limit climate change.** | | | | | | |
| % totally agree + tend to agree | 43 | 34 | 48 | 55 | 55 | 49 |
| **Q2: Nuclear energy helps to make us less dependent on fuel imports such as gas and oil.** | | | | | | |
| % totally agree + tend to agree | 70 | 54 | 72 | 77 | 78 | 72 |
| **Q3: Personally, do you see nuclear energy more as a benefit or more as a risk?** | | | | | | |
| % more as a risk | 52 | 64 | 60 | 49 | 46 | 37 |
| **Q4: The disposal of radioactive waste can be done in a safe manner.** | | | | | | |
| % totally agree + tend to agree | 25 | 38 | 26 | 52 | 55 | 53 |



**Figure 3: Opinion on nuclear issues in 6 Western European countries**

In May 2011 the governments of Switzerland and Germany made the decision to phase out nuclear power. For Switzerland this means not replacing the 5 nuclear power plants still operational in 2011. For Germany, the permanent closure of 8 reactors temporarily shut down in March 2011 and the closure of a further 9 by 2022. Despite close European ties, nuclear policy varies enormously by country (Figure 4).

| | |
|---|---|
| **France (Fr)** | Constructing new reactors |
| **Germany (Ge)** | Plans to shut remaining reactors |
| **Spain (Sp)** | No new reactors planned |
| **UK** | Considering 10 new reactors |
| **Italy** | 2011 vote rejects nuclear option |
| **Switzerland** | Plans to shut remaining reactors |
| **Belgium (Be)** | 2003 vote to shut reactors |
| **Netherlands (N)** | Considering 1 new reactor |

**Figure 4: Nuclear policy in Western Europe**

Italy is a particularly interesting case. Having voted in a 1987 referendum to close all nuclear plants, pressure grew to reverse this policy due to Italy importing 10% of its electricity from France. In June 2011 Italians voted again to reject nuclear power.

Several high profile accidents have had an impact on the debate over the use of nuclear power (Figure 5).

| Serious nuclear accidents measured on the **International Nuclear Events Scale** (INES) 1–7 | |
|---|---|
| Windscale reactor fire, UK, 1957 | 5 |
| Idaho Falls, USA, 1961 | 4 |
| Saint-Laurent plant, France, 1969 | 4 |
| Bohunice plant, Czechoslovakia, 1977 | 4 |
| Three Mile Island, USA, 1979 | 5 |
| Chernobyl, Ukraine (USSR), 1986 | 7 |
| Tokaimura uranium plant, Japan, 1999 | 4 |
| Fukushima meltdowns, Japan, 2011. | 7 |

**Figure 5: Selected serious nuclear power accidents (scale 4 and above)**

Nuclear power requires **uranium** as a fuel source. This is mined and processed into useable fuel. Used fuel can be **reprocessed** (recycled), at high cost. The main global uranium reserves are shown in Figure 6.

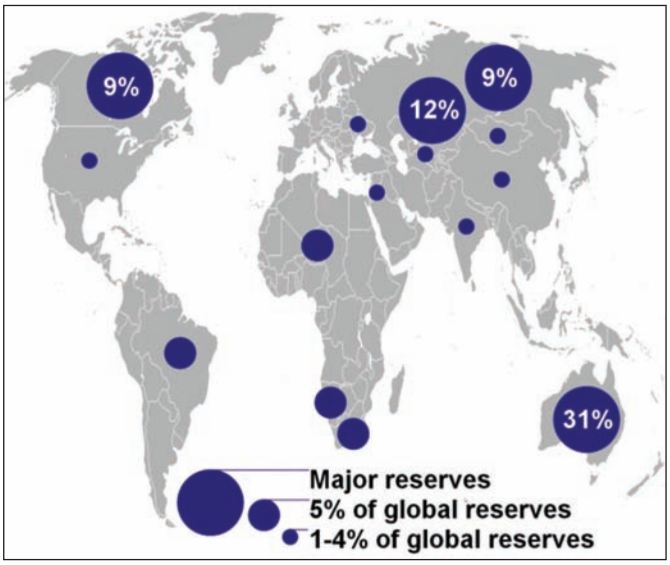


**Figure 6: Global uranium reserves in 2010**

Alongside the well-known controversies surrounding nuclear power plant accidents the **nuclear fuel cycle** raises other issues:

- Uranium mining is potentially hazardous to the environment and human health, especially if poorly regulated.
- Transport of uranium, nuclear fuel, spent and reprocessed fuel raises safety and terrorist interception fears.
- Disposal of high-level nuclear waste is a largely unresolved issue despite the civilian nuclear industry's 60-year history.

In 2010 around 28% of uranium was mined in underground mines, 25% by **opencast mining** and 41% by **in-situ leaching (ISL)**. The latter uses acids or carbonate to leach the uranium from underground ore bodies. There are major mining companies that operate uranium mines and sell uranium. In 2010, just six companies traded 72% of all uranium worldwide (Figure 7).

| **% of world uranium supply in 2010 by company and country of origin** | | |
|---|---|---|
| Cameco | 16 | Canada |
| Areva | 16 | France (state owned) |
| Kazatomprom | 15 | Kazakhstan (state owned) |
| Rio Tinto | 12 | UK/Australia |
| ARMZ | 8 | Russia (state owned) |
| Uranium One | 5 | Canada (51% owned by ARMZ) |

**Figure 7: Major uranium mining and trading companies**

There are a number of major companies that build nuclear reactors (Figure 8). Regulations differ between countries so reactors need to be designed for specific markets.

In 2011, the UK Health and Safety Executive was evaluating designs from Areva and Westinghouse for the UK's planned new reactors. The last UK nuclear power plant to open was **Sizewell B** in 1995 at a cost of £2 billion. Prior to this, 7 plants were built using the British AGR design (Advanced Gas-cooled Reactor) which was eventually deemed unreliable and costly, despite being a sophisticated design. The operating reactors in the UK are owned and run by EDF Energy, a subsidiary of EDF (Electricité de France). As of 2011, the UK was planning a total of 16GW of new nuclear capacity (possibly 10 reactors) at a cost of £40 billion. Estimates suggest this could create 30,000 jobs by 2025.

| | |
|---|---|
| **Areva** (France) *EPR reactor* | Company with 70,000+ employees specialising in reactor design |
| **Westinghouse** (USA) *AP1000 pressurised water reactor* | Company owned by Toshiba; 11,000+ employees |
| **GE Hitachi** (USA/Jap) *ESBWR reactor* | Part of GE Energy, employs around 3,000 people |
| **Mitsubishi Heavy Industries** (Japan) *APWR reactor* | Employing 60,000+ people |

**Figure 8: TNCs that construct nuclear reactors**.

There has never been a consensus on the economic cost of nuclear energy. Some costs are fixed, such as the **capital cost** of building new power plants. Other costs are variable, such as the cost of fuel. The costs of **decommissioning** and **waste disposal** are not always clear.

- In 2009 the Dutch company Delta estimated the cost of a new reactor at Borssele at €4–5 billion.
- In 2010 EDF announced its new reactor at Flamanville could cost €5 billion not the €3.3 billion initially estimated.
- In 2009 it was reported that the new Olkiluoto 3 reactor in Finland was 3 years behind schedule and 50% over budget.

Neutral, direct comparisons between different electricity generating sources are rare. One published comparison from 2010 is shown in Figure 9. This shows fossil fuel generating options with and without **Carbon Capture and Storage** (CCS). It assumes any new coal plants would be built with Flue Gas De-sulphurisation (FGD) and that carbon emissions would be subject to a **carbon tax**. Not included is the possible need for **standby generating capacity** if renewables such as wind power were adopted widely.

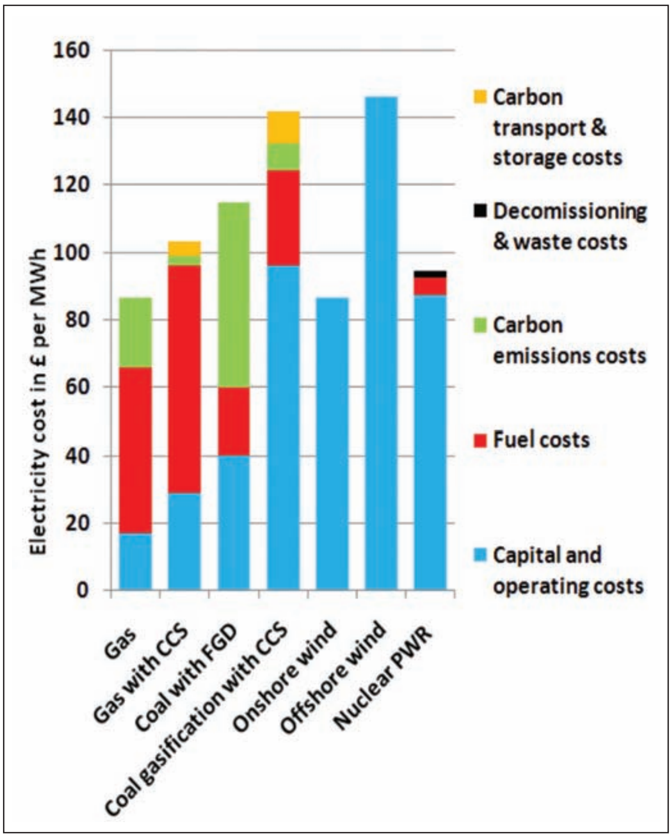


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**Figure 9: Electricity generation costs compared**

There are alternatives to nuclear power that might contribute to the future of energy supply in Western Europe and help plug the **energy gap**. They include development of new fossil fuels and renewable energy. These require careful consideration as each has different advantages and disadvantages, as shown in Figure 10:

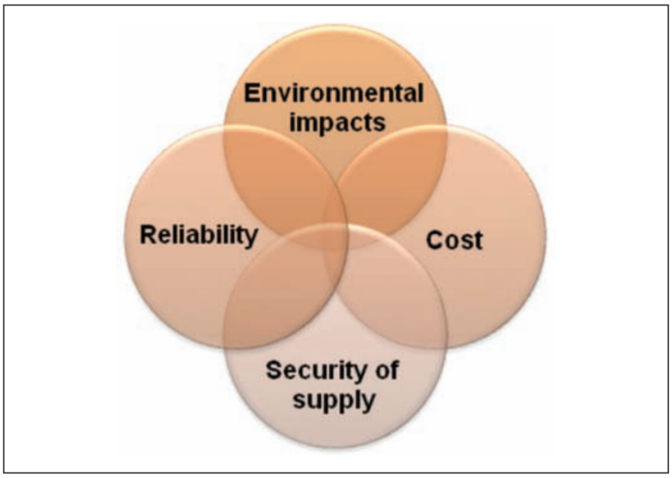
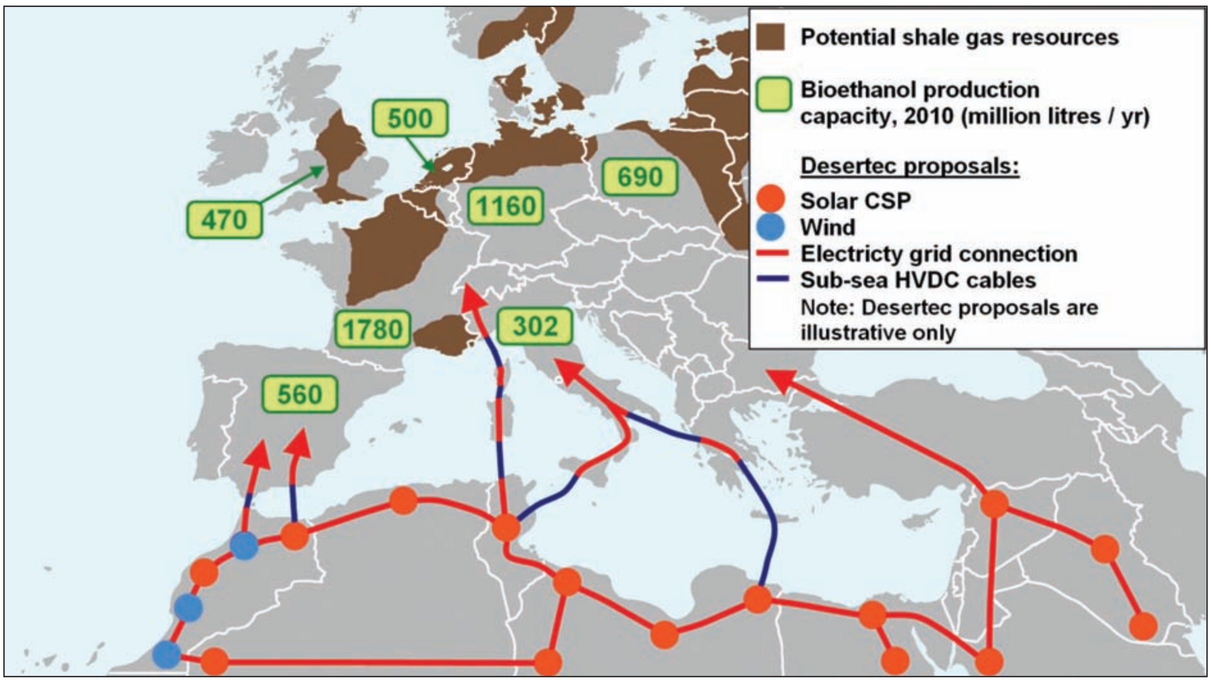



**Figure 10: Criteria to assess energy resources**

Figure 11 outlines some of the options that are being, or could be, developed for Western Europe.

**Figure 11: Three options for closing the energy gap?**

| SHALE GAS | BIOETHANOL | CONCENTRATED SOLAR POWER (CSP) |
|---|---|---|
| **Natural gas** (methane) trapped in impermeable rocks. The rock requires fracturing ('fracking') to create fissures allowing the gas to escape. | **Ethanol** distilled from crops such as wheat and maize. Petrol can be blended with 5–10% bioethanol and used in most cars. | CSP uses mirrors to concentrate the Sun's energy on to a small area, heating fluid which powers a steam turbine and generates electricity. |
| **ExxonMobil** is exploring for shale gas (or tight gas) in Lower Saxony and North Rhine-Westphalia in Germany. Germany currently imports 90% of its natural gas. One estimate suggests there may be 8 trillion cubic feet of technically recoverable shale gas in Germany.<br>• Extraction is by drilling and 'fracking'. Water, sand and chemicals are forced into rocks underground to fracture the rock and release natural gas.<br>• Environmental concerns focus on possible groundwater pollution and even the generation of earthquakes. | **Ensus** opened Europe's largest bioethanol refinery in 2010. Located on Teesside in the UK, the £250 million Ensus refinery could use up to 1.2 million tonnes of wheat per year to produce 400 million litres of bioethanol (plus 350,000 tonnes of animal feed, 350,000 tonnes of $CO_2$ for the drinks industry).<br>• Ensus invested £9 million in new oxidisers in 2010 after residents complained of 'brewery like' smells.<br>• In May 2011 the plant was temporarily shut down due to poor market conditions.<br>• Bioethanol produced from crops is often referred to as **first generation** biofuel. | **Desertec Foundation** is a non-profit organisation set up in 2009 to promote the idea of 'clean power from deserts'. It proposes using High Voltage Direct Current (HVDC) sub-sea and land-based cables to transmit electricity from North Africa and the Middle East to areas of high demand in Europe.<br>• CSP plants, and wind farms, are located around the fringes of deserts in the MENA region in areas of North Saharan steppe and woodland, and Atlantic Coastal desert.<br>• 15% of Europe's electricity needs could be supplied, as well as dramatically increasing electrical power availability in MENA. |



**View 1**
"Nor would new nuclear power stations address the anticipated gap in our future energy supply. This is because nuclear power only produces electricity and so only marginally deals with our need for services like hot water and central heating which are mainly met by gas. Its overall contribution to total energy demand is too small to make a difference to the UK's energy security."
**Greenpeace UK, 2011**

**View 2**
"It appears that the vast majority of the European public agrees that nuclear power is advantageous because it allows EU countries to diversify their energy sources, as well as decrease their dependence on oil, and because it emits less greenhouse gases than, for instance, oil and coal."
**International Atomic Energy Agency bulletin 2008**

**View 3**
"The union Unite, which represents 40,000 workers in energy and utilities, called on the Government to "get on with the job" of creating the right environment for low-carbon energy power, including commissioning the first new build nuclear power station for a generation at Hinkley Point."
**Independent article, 2011**

**View 4**
"Nuclear power generates less than 4% of UK energy consumption and globally only 3.1%. Even trying to maintain, let alone increase, such levels would raise more intractable problems: additional waste, terrorism risk, compromised foreign policy, proliferation, hidden costs, accidents and even the future reliability of uranium imports. Nuclear power is a threat to energy and national security."
**Friends of the Earth, 2007**

**View 5**
"Unconventional gas resources would allow Germans to 'emancipate themselves' from the 'energy-hegemony of Russia.' The development of new resources would also be attractive to the German energy mix: as increased power production from gas and gas-fired plants would generate only about half as much $CO_2$ emissions as coal power plant."
**Natural Gas for Europe website reporting on an article in 'Der Spiegel', 2010**

**View 6**
"Nuclear is the only low-carbon base-load source we have. It currently gives us 80% of all our low-carbon electricity in the UK. It offers security of supply which puts Britain in a good position, and it helps us lead the way in delivering a low-carbon economy."
**Nuclear Industry Association (UK), Chief Executive Keith Parker, 2011**

**Websites for further research:**

The UK Nuclear Industry Association
http://www.niauk.org/

The International Atomic Energy Agency
http://www.iaea.org/

Website of the Desertec Foundation
http://www.desertec.org/

The European Renewable Ethanol Foundation
http://www.epure.org/

Edexcel a product of Pearson Education Ltd. gratefully acknowledges the following sources:

*Special Eurobarometer 324, Europeans and Nuclear Safety Report*, European Commission, 2009
*UK Electricity Generation Costs Update*, Mott MacDonald, commissioned by the Department of Energy and Climate Change DECC, June 2010