

## TEACHERS' NOTES

### Introduction

Norway has close economic, cultural and historical links with the United Kingdom and is a highly relevant choice of European country to study at Key Stage 3 (see table) and GCSE. It is one of the world's most northerly countries, which has given it a challenging environment and many distinctive characteristics.

Relevance of *Look at Norway!* to the National Curriculum geography at Key Stage 3

National curriculum content	Cards						Case study
	1	2	3	4	5	6	
Skills							
Use an extended geographical vocabulary	•	•	•	•	•	•	•
Use a global atlas	•				•	•	
Use graphical techniques	•	•	•	•	•	•	•
Use secondary evidence	•			•		•	•
Place (List A)							
Physical and human features	•	•	•	•	•	•	•
Similarities and differences of two regions	•				•	•	
Degree of development					•	•	
Interdependence					•	•	
THEMES							
Geomorphological processes	•				•	•	
Weather and climate	•				•	•	
Ecosystems					•	•	
Economic activities					•	•	
Environmental issues	•	•	•	•	•	•	•

The main body of this pack consists of twelve cards, six of which are in full colour and provide basic information in a lively and informative way. The other six are photocopyable pupil activities, designed to assist comprehension, to provide extension material and give opportunities to learn and practise skills. The cards are supported by a case study of Sima hydro-electric power station, six large photographs and a poster-size map of Norway.

It will help pupils if Norway is placed in context as a modern, industrialised country with strong links to the United Kingdom.

### Historical context

The area named Norway has been inhabited for thousands of years, but the Kingdom of Norway first came into being about AD 900. The Norwegian Vikings founded many settlements in Britain, France, Ireland, Iceland and Greenland, and reached North America 500 years before Columbus.

After a period of internal feuding and the Black Death (which wiped out almost two-thirds of Norway's population), the country came under Danish rule in a union which lasted from 1380 until 1814. Thereafter, Norway was united with Sweden until the association was peacefully dissolved in 1905, when Norway became fully independent. Since 1905, Norway has gradually developed from a mainly farming and fishing society into a modern industrial nation. <None>

During World War 2, when Norway was occupied by Germany, the King and Government sought refuge in Britain. From here, the Free Norwegian Armed Forces were established and subsequently played an active part in the Allied war effort. Norway's large merchant navy made a vital contribution to the provision of Allied supplies.

In the post-war years, Norway has been an active participant in international cooperation, including in the areas of defence, trade and protection of the environment, and has enjoyed particularly close ties with other West European countries and the USA.

### Notes on the cards

#### Cards 1a/b/c/d – 'The way to the north' / Glaciers and fjords

*Card 1a* is a general introduction to Norway – 'the way to the north'. Pupils should be made aware of Norway's northerly location. Its southernmost point is at a higher latitude than Aberdeen and its most northerly point, at Nordkapp, is 1750 km further north, well within the Arctic Circle. This latitudinal extent has a great bearing on climate, vegetation and land use, and therefore on the distribution of population.

It is important to point out that, geologically, Norway is an ancient country. It contains rocks from the earliest geological periods and these have been folded, lifted up and eroded at various times. Therefore the highest mountains in southern Norway rarely have the sharp peaks which characterise the younger fold mountains of the Alps. Paradoxically, sharp peaks are more common in the north where the mountains are less high.

Most of the rocks are of sedimentary origin but, during times of mountain building, there have been some igneous intrusions and some metamorphism during which minerals, such as copper and titanium, have been formed.

There is an affinity between the mountains of Norway and those of north-west Scotland. They were formed at the same time and show the same trend.

*Card 1b* concentrates on the effect of ice on the landforms of Norway. During the Ice Age, all the mountain areas lying across the path of the westerly winds, which now experience high rainfall, then experienced heavy snowfall. The resulting accumulation of snow and ice covered the whole of Norway and at its maximum extent spread out across the North Sea to join the Scottish ice cap and reached far enough south to deposit rocks of Norwegian origin on the coast of North Yorkshire. An ice cap and glaciers still remain on some of the higher mountains of Norway and in recent years glaciers have advanced slightly, in spite of global warming.

The glaciers associated with the Ice Age were responsible for Norway's most dramatic scenery in the fjords of the south-west, which are the country's major tourist attraction. The melting of the ice left behind large deposits of glacial moraine, notably in the south-east of Norway, and these provide some of the flattest and most fertile land in the country.

*Card 1c Activities 1, 2 and 3* are simple exercises in atlas skills which will enable pupils to appreciate Norway's position in northern Europe and something of its relief. *Activities 4 and 5* will give an understanding of population density and distribution. A comparison with the United Kingdom shows how sparsely Norway is populated, a product of its harsh environment. The choropleth map indicates the uneven distribution with a heavy bias of population towards the south. Discussion will elicit reasons for this distribution as well as ideas for more accurate ways of showing it.

*Card 1d* Two of the activities on this card are practical. *Activity 2* encourages the pupils to think about the changes which take place when a river valley is deepened and straightened by a glacier. *Activity 4* asks pupils to draw the longitudinal section of Sognefjord using data from Card 1b. It will not be possible for the pupils to draw this completely accurately, but it should bring out the essential nature of a fjord.

#### Cards 2a/b/c/d – A variable climate/ Wetter west, drier east

These cards consider the climate of Norway and the influences that bear upon it.

*Card 2a* focuses on temperature – in Norway the most important determinants of temperature are latitude and the sea. The reasons for the general decline in temperature from the Equator and the Poles are dealt with in KS3 Science, and a revision of this topic may be necessary to ensure that pupils are familiar with the concepts involved. Pupils should readily observe that, in January, the fall in temperature in Norway is from west to east. In some years the sea remains ice free as far north as Kirkenes near the Norwegian-Russian border. At the same time, the eastern part of Norway is very cold. The

consequences of ice-free waters and ports are very important for Norwegian fishermen and shipping, including the export of Swedish iron ore from Narvik, which might otherwise have been impossible at such high latitudes.

Several points for discussion arise: the nature and distribution of ocean currents, a comparison of temperatures on the western and eastern coasts of the North Atlantic at similar latitudes, the importance of wind direction and similarities between Norway and the British Isles (and especially western Scotland). Concepts of maritime and continental climates might also be introduced.

**Card 2b** The map shows the annual rainfall, and the diagram illustrating the process of relief rain and rain shadow will help to explain the pattern.

**Card 2c** *Activity 2* is a practical activity showing average temperatures in Norway in July. The idea of differing lengths of day and night is included in *Activity 4*. Pupils should be aware of the contrast between the constant length of day and night in the Tropics and the lengthening of day or night towards the Poles. The effect this has on climate should be considered, but the completion of Figure 2 should also provoke discussion about possible social and psychological effects of very little daylight, for example depression.

**Card 2d** All the activities on this card are practical. The completion of climate graphs for Bergen and Oslo in *Activity 2* will confirm the west-east differences and will also indicate the pattern of rainfall throughout the year. Attention should be drawn to the increase in rainfall during the summer months in Oslo as a result of convection rain.

### Cards 3a/b/c/d – The forest ecosystem/ The tundra ecosystem

**Card 3a** looks at the Norwegian forest ecosystem, which is not one of great complexity: it contains relatively few species. These species are related to the climate and soils in which they grow. They are important, however, in that they cover a larger area of productive land than any other land use in Norway. Forests provide a valuable resource as the raw material for a pulp and paper industry which is a successful exporter of high-class products.

The forest ecosystem also illustrates some issues for discussion. The first of these is Norway's concern with conservation. The recovery of the tree population from near decimation at the beginning of the 20th century has been impressive. A combination of encouragement and legislation has led to replanting, and this has resulted in a yearly tree growth which is nearly twice the harvest.

Forests are also important for recreation. Norwegians are outdoor people – walkers, climbers, skiers (especially cross-country) and anglers. Many have second homes in the countryside. It is considered vital that the land is accessible for recreation.

Norwegian forests do show the effects of air-borne pollution. Some of this comes from Britain, carried on the prevailing winds. The effects have been greatest in southern Norway and have been even more apparent in lakes and rivers than in trees. The attempts to curb acid rain in Europe have had some effect, and Norway has been at the forefront in enacting legislation to reduce air-borne pollution.

**Card 3b** Although the tundra is a simple ecosystem, it has a surprisingly large range of flora and fauna. The tundra's inhabitants include the indigenous Sami people. Although most Sami are now fully integrated into mainstream Norwegian society, some have maintained elements of their identity and culture, such as herding reindeer. However, here too conservation is vital. The danger of uncontrolled growth of herds which would cause overgrazing has been largely avoided by the practice of culling. This maintains balanced herds and eliminates weaker animals.

**Card 3c** *Activities 1, 2 and 3* will help pupils understand the importance of trees to the Norwegians, whilst *Activities 4 and 5* will make them aware of the environmental issues which could threaten their future. The activities will help them to understand something of the way in which acid rain causes damage to trees.

**Card 3d** *Activities 1 and 2* will enable pupils to appreciate the relationship of the vegetation to climate and of living things to each other. For *Activity 3*, in addition to analysing the changing nature of Sami life, pupils could look at the danger to the tundra ecosystem

which might arise from better road communications and increased tourism.

### Cards 4a/b/c/d – The challenge of farming/ Fishing – a proud tradition

**Card 4a** focuses on farming in Norway, and the challenges posed by climate and relief. The total agricultural area is only 1 million hectares, about 3% of the total land area. With mountainous landscapes, a short growing season and long distances to markets, it all adds up to conditions for farming that are less than ideal. For the last few decades the number of farms has been declining steadily. However, the amount of land under cultivation has remained fairly stable.

It should be pointed out to pupils that Norwegian agricultural policy is an integral part of regional policy which is aimed at maintaining employment and settlement in rural districts. These objectives require many special measures and support schemes, including direct financial subsidy. Furthermore, there is a strong tradition of family ownership of farms in Norway, with the eldest child having the legal right to take over the farm on the death of the farmer.

Pupils should also note the dual role in many parts of the country of farmers who are also foresters. Overall, 100 000 worker-years are spent on farming and 8000 on forestry in the course of a year.

**Card 4b** considers the historical importance of fishing and current fishing practices. In the fishing industry, there is also a long tradition of dual employment – farming in the summer and fishing in the winter. However, there is now a tendency for farmers to work on oil rigs, spending alternate periods on the rig and the farm, with the family tending the farm in the farmer's absence.

The Norwegian fishing industry has also responded to the issue of overfishing. Stocks of fish dropped alarmingly in the 1960s and 1970s as a result of over-fishing brought about by a combination of factors such as echo-sounding which located shoals of fish quickly and accurately, larger ships, bigger and better nets, and fishing by other nations. However, as in other areas, Norway has tackled the problem of conservation with considerable vigour. Having established a 200-mile (320 km) economic zone off its coast in 1977, Norway was able to restrict fishing in its waters. In the 1980s strict limits were imposed on many species, which allowed stocks to recover. Catches are now quite healthy and improving, and every effort is made to sustain them.

The lengthy coastline (over 21 000 km, including fjords) is particularly well suited to fish farming, and this has been one of Norway's fastest-growing industries in recent years. Norway is now the world's leading producer of farmed (Atlantic) salmon. There are strict regulations governing the industry to ensure that production methods are environmentally friendly, to avoid disease and secure stable markets.

**Card 4c** Most of the activities on this card are designed to bring out the difficulties encountered by Norwegian farmers and to show how they adapt to the conditions in the use they make of their land. *Activity 7* includes a discussion about the reasons for farming to be continued in marginal areas.

**Card 4d** Completion of *Activities 1 and 3* will bring out the winter nature of cod fishing and the domination of northern Norway in the cod fishing industry. Here, attention should be drawn to the relatively shallow waters of the continental shelf off the Lofoten Islands where sunlight can penetrate the water and encourage the growth of plankton. *Activity 6* looks at the way in which fish stocks increased as a result of direct government intervention. Pupils could go on to discuss the implications of this, particularly the way in which the fishermen's co-operation might have been achieved.

A decision-making activity – *Activity 7* – looks at the implications of the salmon farming industry which has achieved such success. This could be made into a role play or debate.

### Cards 5a/b/c/d – Energy from oil and gas/ Energy from water

Norway is rich in energy resources. The Norwegian continental shelf contains large amounts of crude oil and gas. In addition, the many mountains and waterfalls provide an ample source of hydro-electricity. The pupil cards on this topic are supported by a case study on the Sima hydro-electric power station.

**Card 5a** Oil and natural gas provide a large proportion of Norway's wealth. The major part of it is exported – the result of a small population and hydro-electric power available for home consumption.

Norway's production of crude oil now exceeds 3 million barrels per day and is expected to increase in the years to come. More than 90% of the oil from Norway's continental shelf is exported, making Norway the world's second largest oil exporter after Saudi Arabia.

Moreover, Norway's production of petroleum gas is increasing rapidly and will soon make Norway the fifth largest gas exporter in the world. The Troll gas field alone, with its massive platform rising 472 metres from the ocean floor off the coast of Bergen, will meet 25% of western Europe's gas needs by 2010. Additional gas fields are known to exist further north in the Norwegian Sea. The present and future importance of exports can be gauged in part by the network of pipelines shown on the map in Figure A, and there is the likelihood of a further gas pipeline which will supply France.

Proven oil and gas reserves in the Norwegian sector amount to some 50–60% of Western Europe's total reserves. Pupils should be warned, however, that estimates of reserves are unreliable and are usually underestimated. Current estimates never allow for the discovery of new fields or for the development of new extraction technology.

Environmental considerations are an integral part of Norway's petroleum policy, and fuels which will increase carbon dioxide levels are heavily taxed. Discussions are now going on in Norway about the building of two gas-fired power stations at Kollsnes and Kårstø in western Norway. Electricity from these power stations is intended for export. Gas-fired power stations pollute more than hydro-electric ones. Quite a few Norwegians are therefore opposed to gas-fired power stations. However, if electricity generated by gas were exported to Norway's Scandinavian neighbours, replacing that produced by their own even more polluting coal-fired plants, the total pollution levels in these countries would still be reduced.

**Card 5b** About 25–30% of Norway's 4000 river systems have been exploited for the production of hydro-electricity, and almost all of the country's electricity is supplied from this source. Norway has over 550 generating plants in operation, including some 200 underground installations, 250 dams over 15 metres in height and more than 3500 kilometres of hydro-electric power tunnels. The card makes the link between the availability of plentiful energy and the development of heavy industry.

Pupils should appreciate the difference between power stations which use a large volume of water but have a short head and those with a large head of water but a small volume. The former are found mainly in the longer river systems of eastern Norway, whereas the latter have been built to use the short, steep rivers of the west, sometimes combining the flow of several rivers – as the case study example of Sima shows. A link is made between the location of large power stations and population density.

Environmental aspects of hydro-electric power stations are further explored in the case study.

**Card 5c** The construction of graphs in *Activity 1* will show the level of production in the years 1988–94. Comparison here might be made with the UK, which started to develop its oil and gas fields earlier than Norway. The UK's production of crude oil is today somewhat lower than Norway's. Its gas production is at present nearly double that of Norway, but Norway's estimated gas reserves are larger. It is likely that the bulk of oil and gas production will continue to be exported to other European countries.

**Card 5d** *Activity 2* draws attention to the different types of power station in Norway and asks pupils to summarise their differences. It is followed by questions related to the overall distribution of power stations in Norway as a whole. Pupils could discuss how important the following are in locating a power station: rainfall and relief; the demand from towns and cities.

*Activity 4* asks pupils to use their knowledge of the different regions to analyse the pattern of electricity production and consumption on a particular day. Production and consumption are constantly changing. It should be stressed that electricity cannot easily be stored and must be used as soon as it is produced. However, electricity can be quickly transmitted from one region to another, and Figure 1 shows the extent to which this was done on one day.

The map also shows that some electricity was exported to Sweden. Transmission between Scandinavian countries takes place

under a free trade agreement. Norway exports electricity at times of plentiful rainfall and imports it from thermal power stations in Sweden or Denmark when rainfall is low.

In the summer, the demand for electricity will be lower, so production will be reduced. This enables the reservoirs to fill up before the winter and can be regarded as a way of storing energy.

### Cards 6a/b/c/d – Industry and research/Trade and international relations

**Card 6a** explores the nature of Norwegian industry, which has been determined largely by four main factors: its raw materials; its small population, which precludes large-scale labour-intensive industries; the availability of hydro-electricity and its long association with the sea.

The traditional manufacturing industries such as metal processing, fish processing and the pulp and paper industry are still important to Norway. However, much of Norwegian industry is now more diverse and advanced. High-technology products represent an important part of the country's economy. Norway develops and exports advanced offshore technology and is at the forefront of technological developments in areas within engineering and construction, energy generation, telecommunications and data processing, the manufacture of car components, the aerospace industry, the construction of high-speed ships and the production of timber and building materials. Furthermore, environmental technology is one of Norway's fastest-growing exports.

*Card 6b* continues the theme of an export-led economy by looking at Norway's trade, its shipping interests and its interdependence with other countries. The importance of the rich countries' contribution to foreign aid is highlighted. In this respect Norway is one of the world's greatest contributors.

*Card 6c* Pupils investigate the country's occupation structure in *Activity 2*, and then go on, in *Activity 3*, to compare it with another developed country (United Kingdom) and a developing country (Nigeria).

*Card 6d* In *Activity 1*, the completion of a map showing Norway's main trading partners will bring out Norway's close relationship with the European Union, though it has chosen not to be a member.

The issue of the nature of development is raised in *Activity 3*, and pupils are provided with statistical data (in addition to the occupation structures on *Card 6C*) from which to draw conclusions. They should be encouraged to consider the value of non-material as well as material benefits and might suggest indicators which have not been included on the activity cards.

*Activity 3* concludes with a final discussion about the quality of life in Norway and the United Kingdom. It is open-ended and will depend on the ability, interests and maturity of the pupils concerned.

### Cards CS a/b/c/d/e/f – Case study: Sima power station

The case study begins with a close look at the Sima power station, the second largest in Norway. It illustrates the features of many large schemes:

- the collecting of water from several catchment areas
- the storage of water in upland reservoirs to ensure continuity of supply in dry seasons or years
- the sophisticated tunnel engineering involved
- the use made of mountainous relief to achieve a considerable head of water in order to maximise the generation of electricity.

The case study brings out some environmental and social issues. The construction of a road reduces the isolation of mountain farmers, but it may also encourage visitors and increase the risk of damage to fragile environments. Does the building of upland reservoirs, or the regulation of water supply to a waterfall, have similar benefits and drawbacks?

The issue of renewable and non-renewable resources is also raised. This is likely to be the subject of prolonged debate in Norway for a long time. Most of the best sites for hydro-electric power have already been developed. The availability of natural gas offshore is a possible alternative source of electricity, especially as the gas fields are estimated to have a life of up to 100 years. The Norwegian authorities are looking to reduce the net imports of electricity by encouraging better energy efficiency, promoting the use of bio-energy, and improving and expanding the existing hydro-electricity system.

There is at present a debate in Norway about the desirability of building two gas-fired power stations at Kollsnes and Kårstø in western Norway. Electricity from these plants would be intended for export. Advocates and opponents of the plants both claim to be fighting for a global reduction of discharges of greenhouse gases.

In addition to student activities involving comprehension and data interpretation, suggestions are made for discussion, role play and debate.

### Norway on the Internet

The following site contains information, in English, provided by the Norwegian Government:

<http://odin.dep.no/html/english/norway.html>

It contains a wealth of data, including:

- Introducing Norway for young people  
<http://odin.dep.no/ud/publ/96/norway/>
- Facts and figures about Norway  
<http://odin.dep.no/ud/publ/minifakta/index.htm>

Facts and figures are provided on a number of topics. Those most relevant to *Look at Norway!* are:

- Geography
- Climate
- Environment
- Demographic data, Health
- Consumption, Living conditions, Wages
- Foreign trade
- Industries
- Energy
- Transport and communications, Tourism

There are also links to other Internet sites with information about Norway go to <http://www.lookatnorway.org.uk>

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