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Level 1/Level 2 GCSE (9–1)

Geography B

PAPER 3: People and Environmental Issues

Making Geographical Decisions

Friday 16 June 2023 – Afternoon

Time: 1 hour 30 minutes

Resource Booklet

Do not return this Resource Booklet with the Question Paper.

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For some Figures there is a modified colour and modified black and white diagram. You may use whichever version is easier for you to view. Some diagrams are only in modified colour but you are then provided with a description of the diagram.

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SECTION A

People and the Biosphere

The issue: a sustainable future for Iceland.

- **The European country of Iceland is a volcanic island in the North Atlantic Ocean. Large areas of Iceland are an uninhabited wilderness.**
- **In 2019, Iceland's 350,000 citizens had an average life expectancy of 84 and a very high Gross Domestic Product (GDP) per capita of 55,000 US\$.**
- **Environmental impacts of Iceland's past economic growth include deforestation, soil erosion and pollution. The environment is now threatened by climate change.**
- **How can Iceland's government ensure a sustainable future not only for its people but also for Iceland's physical environment?**

Introduction

- **Iceland lies on a boundary between two tectonic plates. Volcanic activity has created a dramatic mountainous landscape which attracts tourists. Glaciers cover many of the island's high mountains and volcanoes.**
- **This environment provides plentiful renewable energy. Firstly, seasonal meltwater from glacial ice is used to create hydroelectric power (HEP). Secondly, volcanic activity generates ground heat that can be a power source – this is called geothermal energy.**
- **Some transnational corporations (TNCs) have been attracted to Iceland by its cheap electricity. These TNCs make aluminium and provide jobs but also have an environmental and climate impact.**
- **Carbon dioxide is also produced by Iceland's many large fishing boats and the tourist aeroplanes on which its economy depends.**
- **The carbon footprint of Iceland's citizens is one of the world's largest. An Icelandic politician recently admitted: "If everybody lived like Icelanders, we would need six planets."**

Figure 1

Iceland's ecosystems before humans first arrived 1,100 years ago

- **Parts of Iceland were originally covered with a type of taiga (boreal) forest composed of birch, pine, and spruce trees.**
- **1,100 years ago, when humans first sailed to Iceland from mainland Europe, around 25 per cent (%) of Iceland was still forested. Tundra vegetation or glaciers covered other areas.**

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Figure 1 continued.

Key

 Tundra  Glaciers  Taiga forest

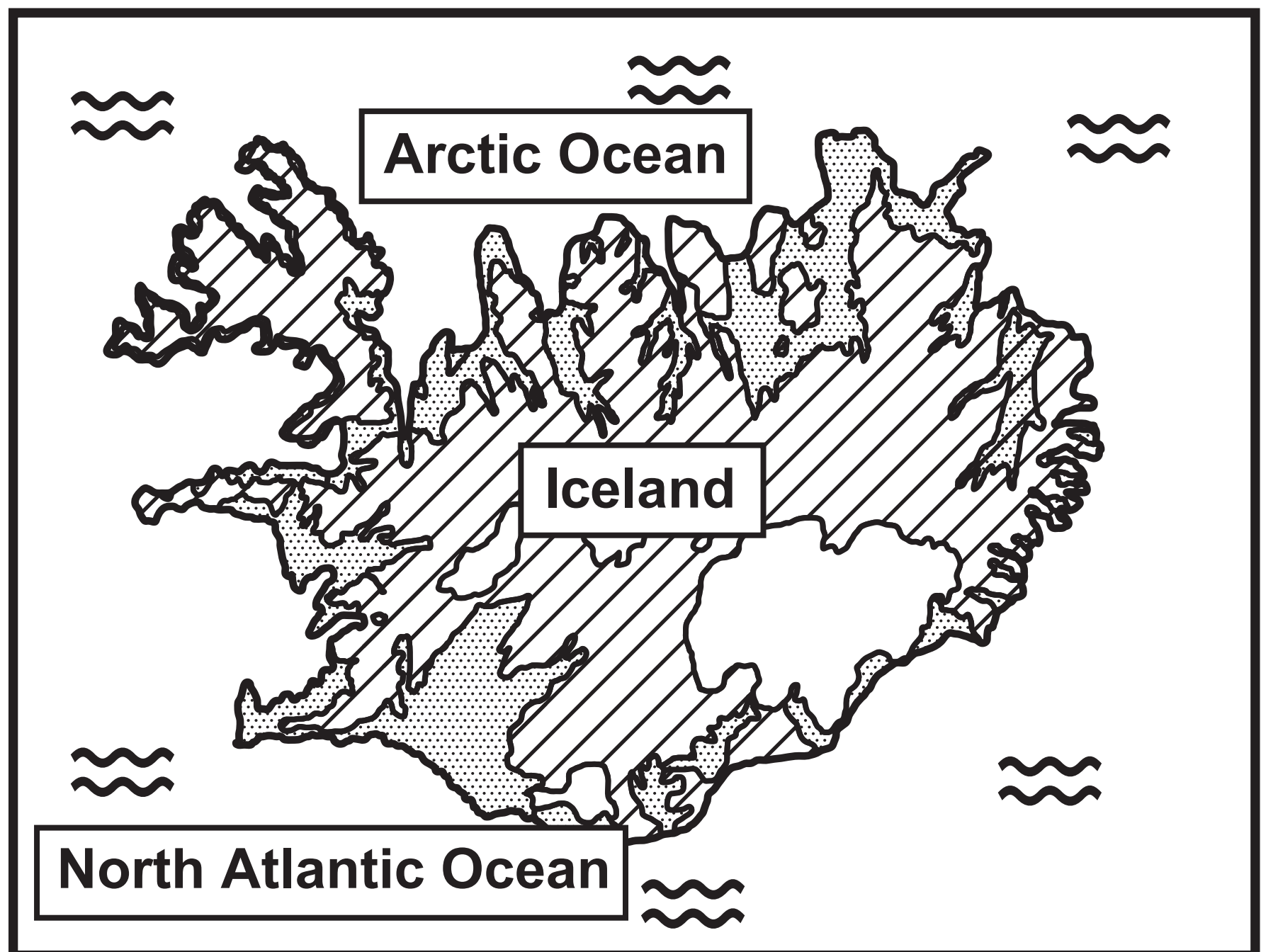
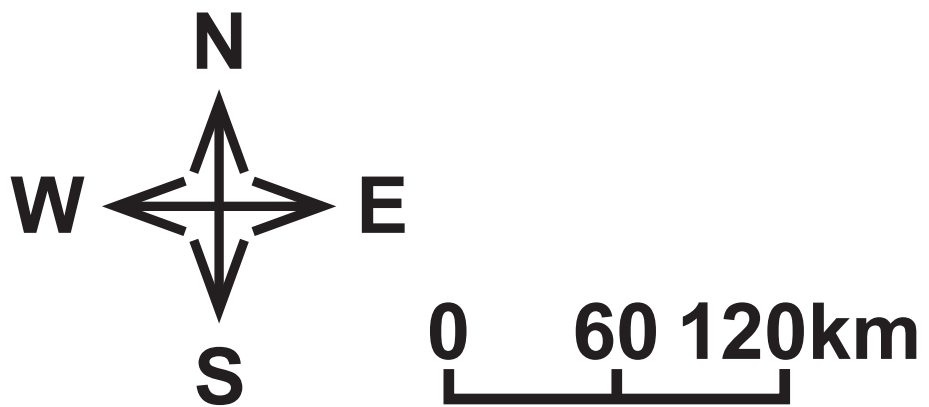


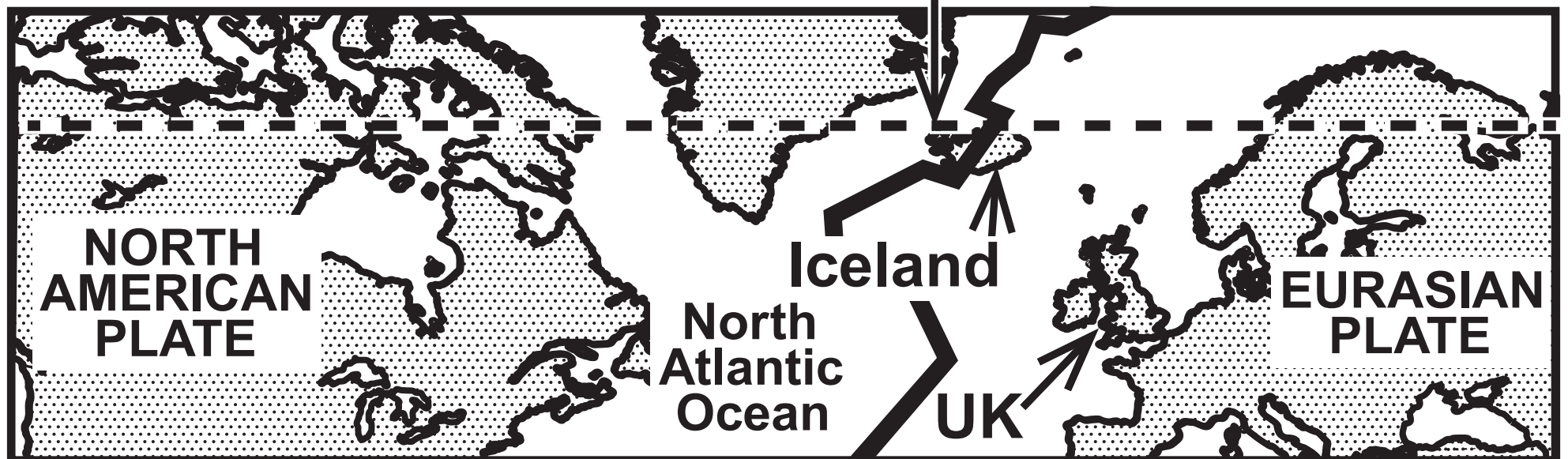
Figure 2

The location and physical geography of Iceland

Key

- Mid–Atlantic Ridge
(a tectonic plate boundary)
- - - - Arctic Circle

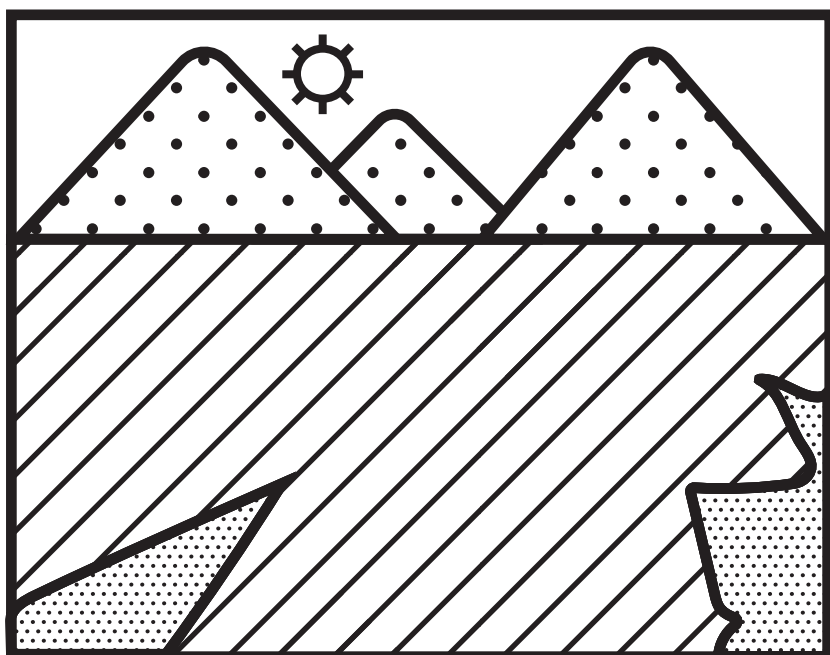
Iceland is located on a divergent plate boundary.



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Figure 2 continued.

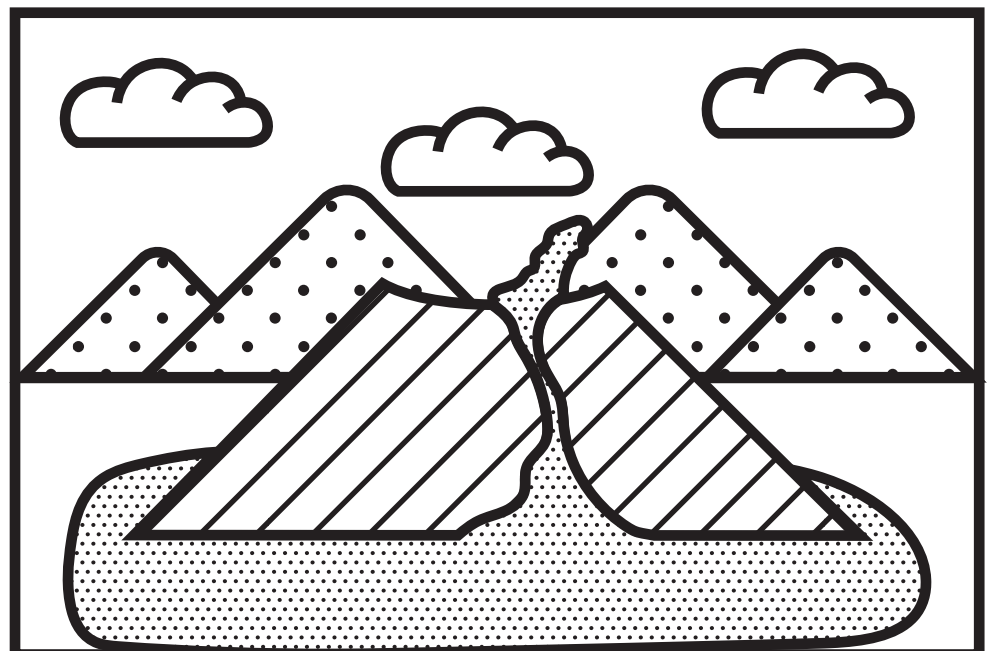
Some highland areas in central Iceland are covered with ice.



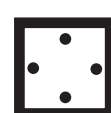



KEY

-  Snow covered mountains
-  Glacier
-  Sea ice
-  Sun

Iceland is an active volcanic hotspot.



KEY

-  Snow covered mountains
-  Volcano
-  Lava
-  Clouds

SECTION B

Forests Under Threat

Figure 3

Causes of forest and biodiversity loss in Iceland

Forest and biodiversity loss in Iceland

Some of Iceland's taiga tree species died out naturally due to climate change during the last ice age.

The first Icelanders were Vikings who sailed there from northern Europe. The forest was an important resource for them.

The descendants of the Vikings cleared more forest for sheep grazing. By 1900, less than 1% of Iceland was still forested.

Strong winds have eroded Iceland's soil in many places where taiga forest has disappeared.

Figure 4

Replanting Iceland’s forest

Economic benefits	Environmental benefits	Social benefits
<ul style="list-style-type: none">• Wood production• Forestry work	<ul style="list-style-type: none">• Biodiversity gains• Soil protection• Carbon storage	<ul style="list-style-type: none">• Recreation• Flood risk reduction

- Iceland’s government plans to replant half of Iceland’s lost taiga forest by **2100**. **3** million fast-growing pine trees are planted each year.
- Not everyone supports forest replanting because it changes the landscape that international tourists want to see. New forest can create many benefits though.

Consuming Energy Resources

Figure 5 – Information

Information about Iceland’s three main economic sectors and its capital city, Reykjavik

Sector	% of Iceland’s earnings	Characteristics of sector (2018 data)	Threats to sector
Fishing & food	27	<ul style="list-style-type: none">• 5,000 people work on fishing vessels.• 20,000 people work in food processing or support roles like ship repairs.	<ul style="list-style-type: none">• Marine ecosystem health is threatened by rising ocean temperatures.• Some species may vanish altogether.

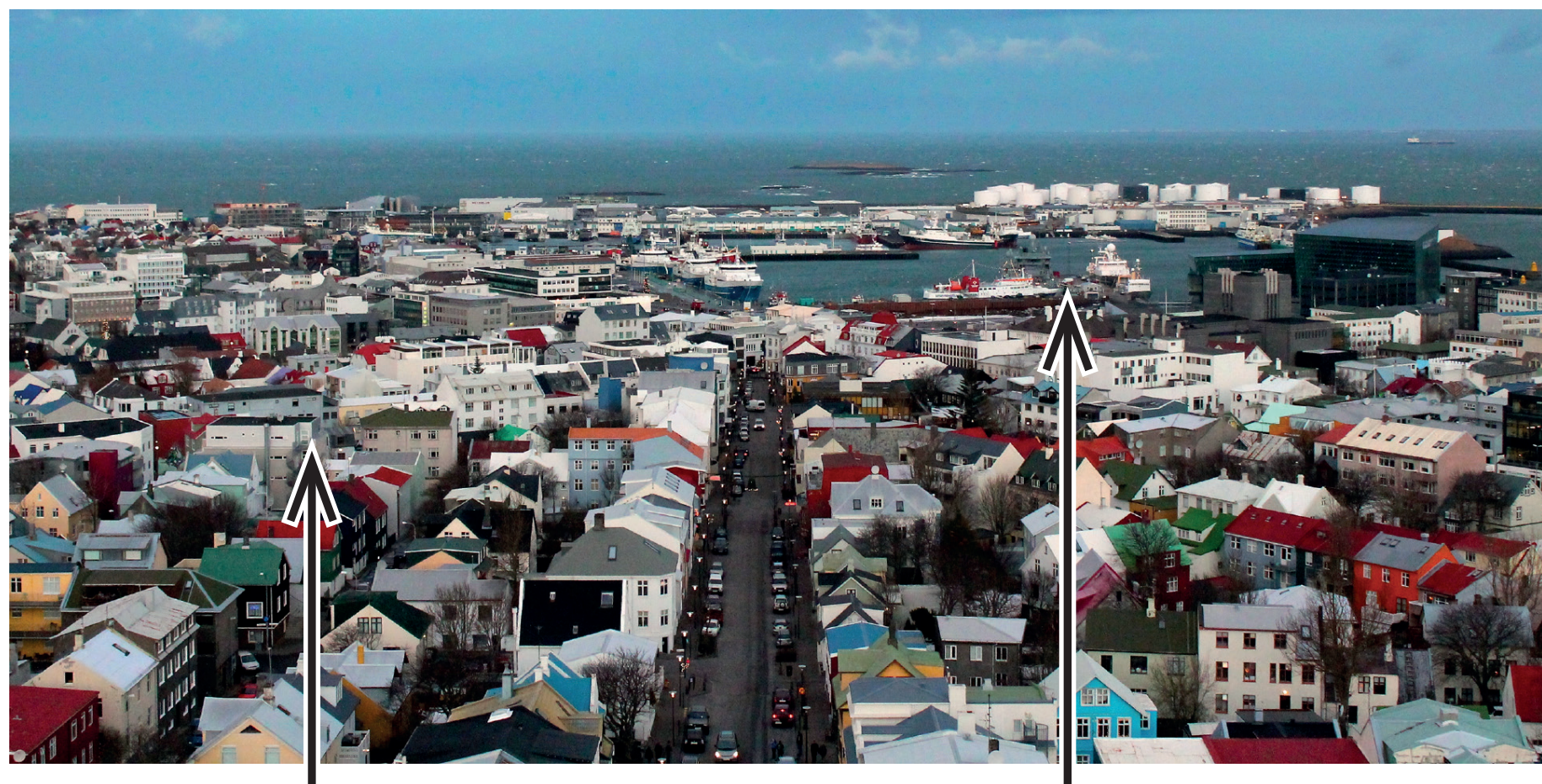
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Figure 5 – Information continued.

Sector	% of Iceland's earnings	Characteristics of sector (2018 data)	Threats to sector
Tourism	33	<ul style="list-style-type: none">• 27,000 people work in air travel, hotels, coaches and visitor attractions.• 3 million tourists visited in 2018.	<ul style="list-style-type: none">• Almost all tourists arrive by air.• Volcanic eruptions and major global events can affect air travel.
Aluminium manufacturing	36	<ul style="list-style-type: none">• 4,000 people work in aluminium metal production.• The factories are mainly owned by foreign TNCs.	<ul style="list-style-type: none">• TNCs might relocate elsewhere if costs in Iceland rise.• Demand is linked to global economic growth.

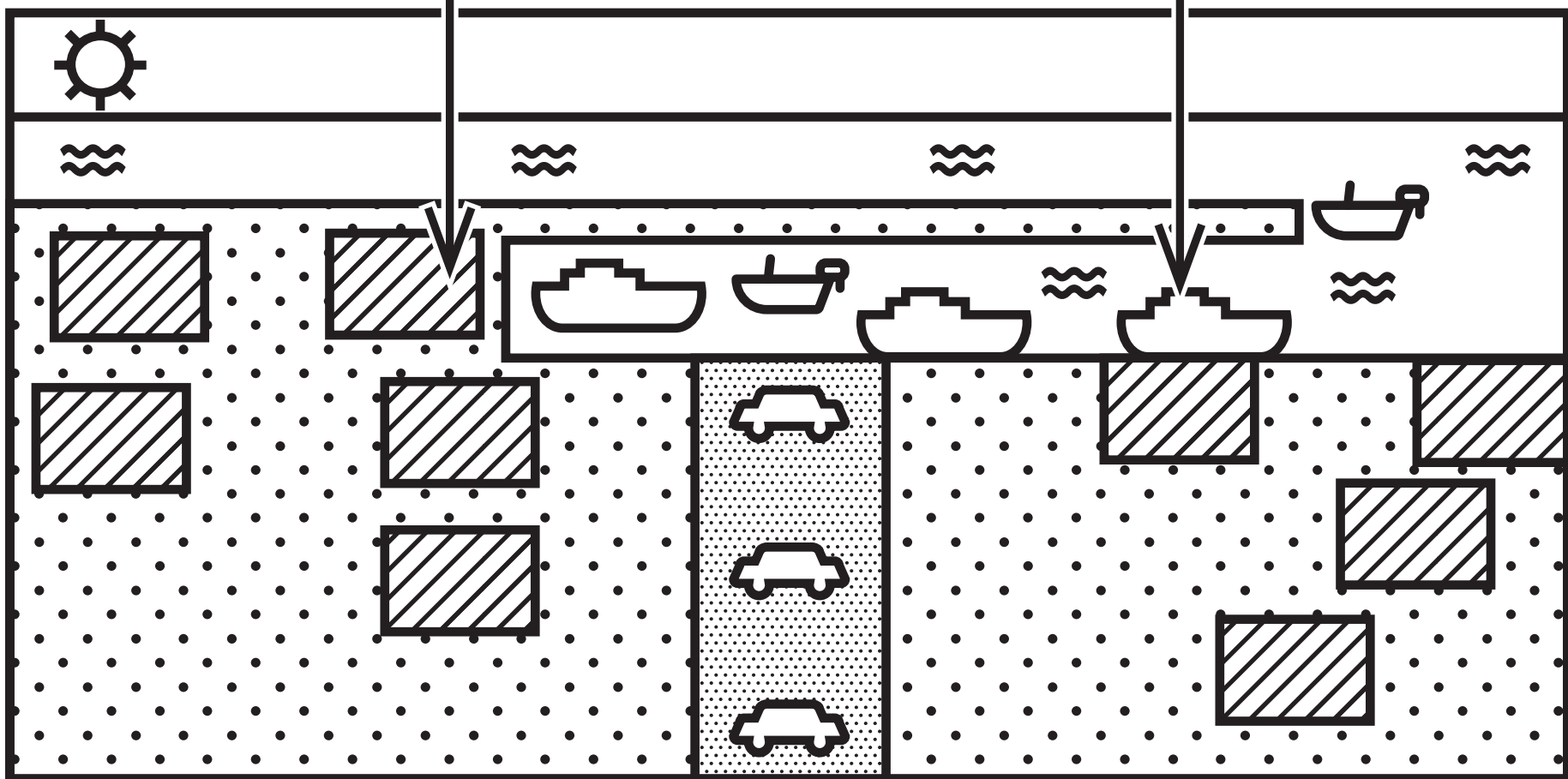
Figure 5 – Diagram

Information about Iceland’s three main economic sectors and its capital city, Reykjavik



Many hotels in Reykjavik are heated using cheap geothermal energy.

Fishing vessels and cruise ships use the harbour in Reykjavik.



KEY

-  Hotels  Buildings  Cars  Road  Sea
-  Cruise ships  Fishing vessels  Sun

Figure 6

An energy profile of Iceland

% contribution to Iceland's energy mix				
YEAR	Hydroelectric power	Geothermal energy	Imported oil	Imported coal
2005	18	56	23	3
2010	19	66	X	2
2018	20	62	16	2

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Figure 6 continued.

- **A country's 'energy mix' is the range of different energy sources that are used.**
- **Fossil fuel use for making electricity has fallen as renewable energy sources have increased. However, oil is still needed for shipping, aeroplanes and road vehicles.**
- **Renewable energy was developed rapidly in the 1970s when Iceland could not afford to import the oil it needed because of a large global price increase.**
- **Hydroelectric power (HEP) was developed by building large dams and reservoirs.**
- **Geothermal energy was developed by drilling into rock and drawing up hot water. Electricity can be generated using steam from this water. 90% of Icelandic houses are now heated using geothermal energy.**

Figure 7

Renewable energy use by selected European countries, 2018

The United Nations has described Iceland's use of renewable energy as: "A model for the world."

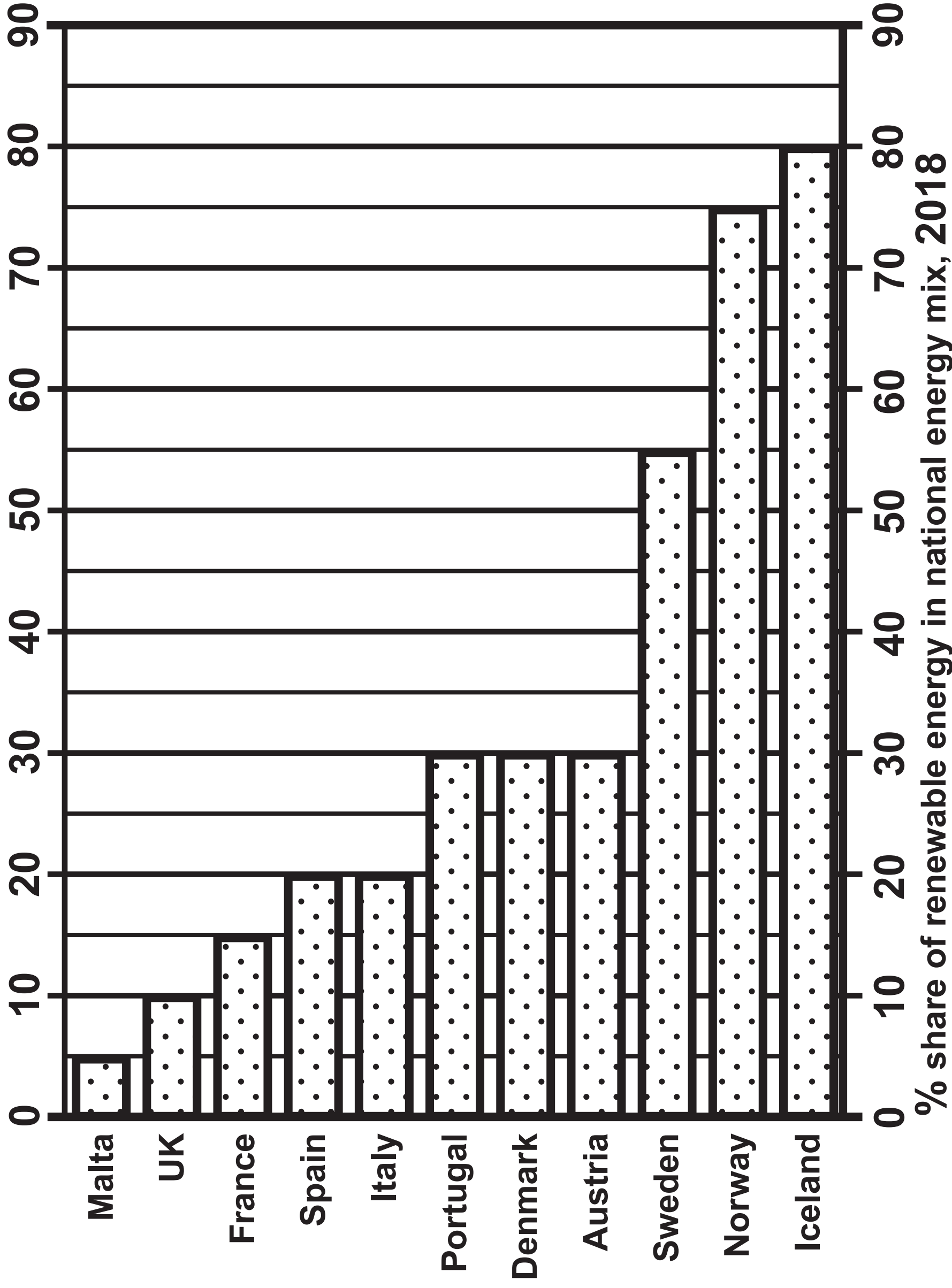


Figure 8 – Information

Information about renewable energy and aluminium production in Iceland

- **TNCs produce aluminium at coastal sites close to power stations. Rocks containing a mineral called bauxite are shipped to Iceland where they are processed to make aluminium. Three-quarters of all Iceland's electricity is used in this process.**
- **Aluminium is Iceland's most valuable export. It is used to make cars, aeroplanes and phones. Very few countries produce more aluminium than Iceland.**
- **The TNCs are attracted by low taxes and low energy prices set by Iceland's government.**

Information about renewable energy and aluminium production in Iceland

Key

● Renewable energy source

▲ Aluminium production

■ Capital city

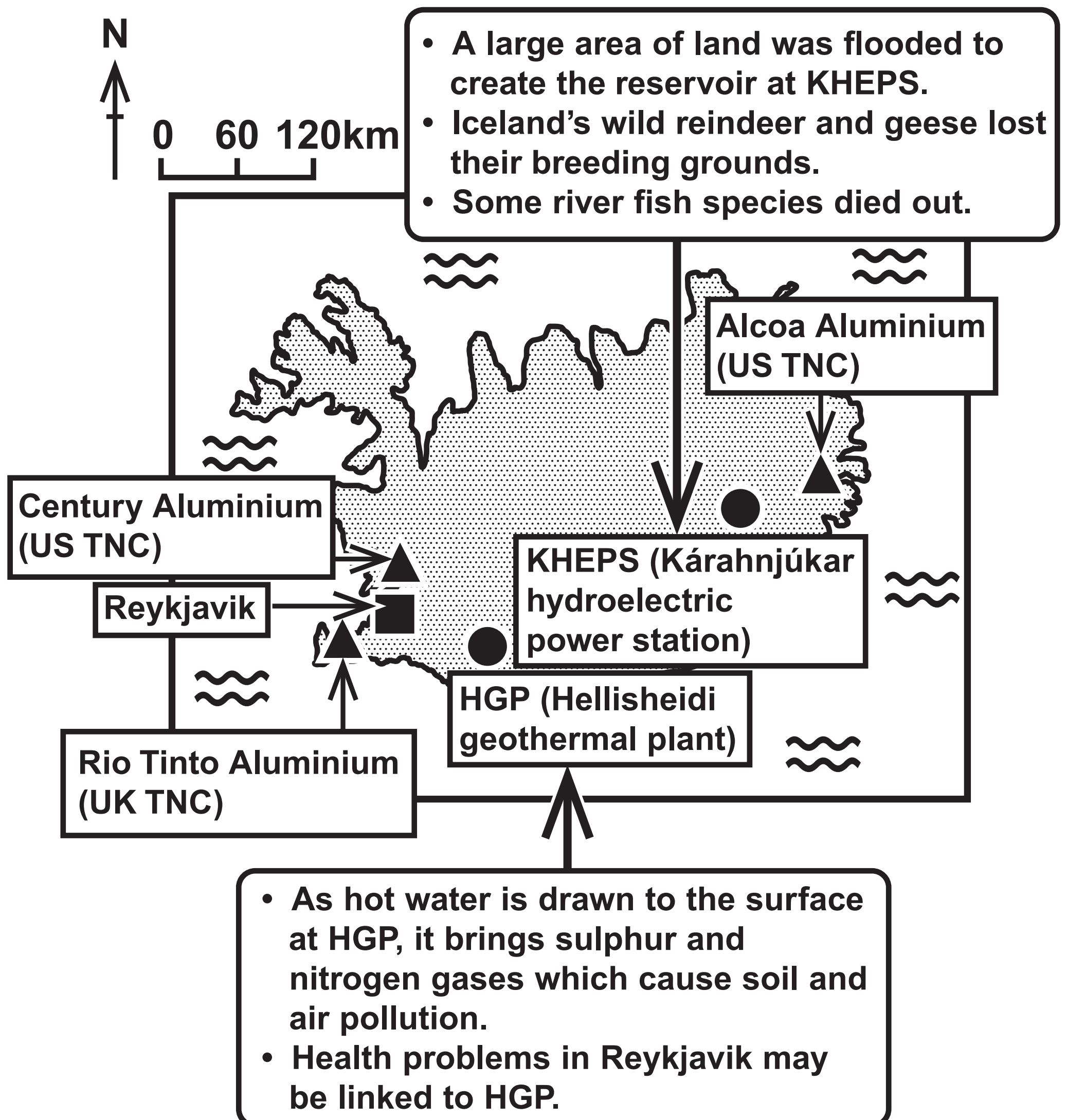


Figure 9

Temperature rises in Iceland and other Arctic regions, 1990–2021

- **Climate change is causing the temperature to rise even faster in Arctic areas than in many other parts of the world.**
- **Changes in ocean water temperature mean that Arctic fish species such as cod may vanish due to habitat loss.**

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Figure 9 continued.

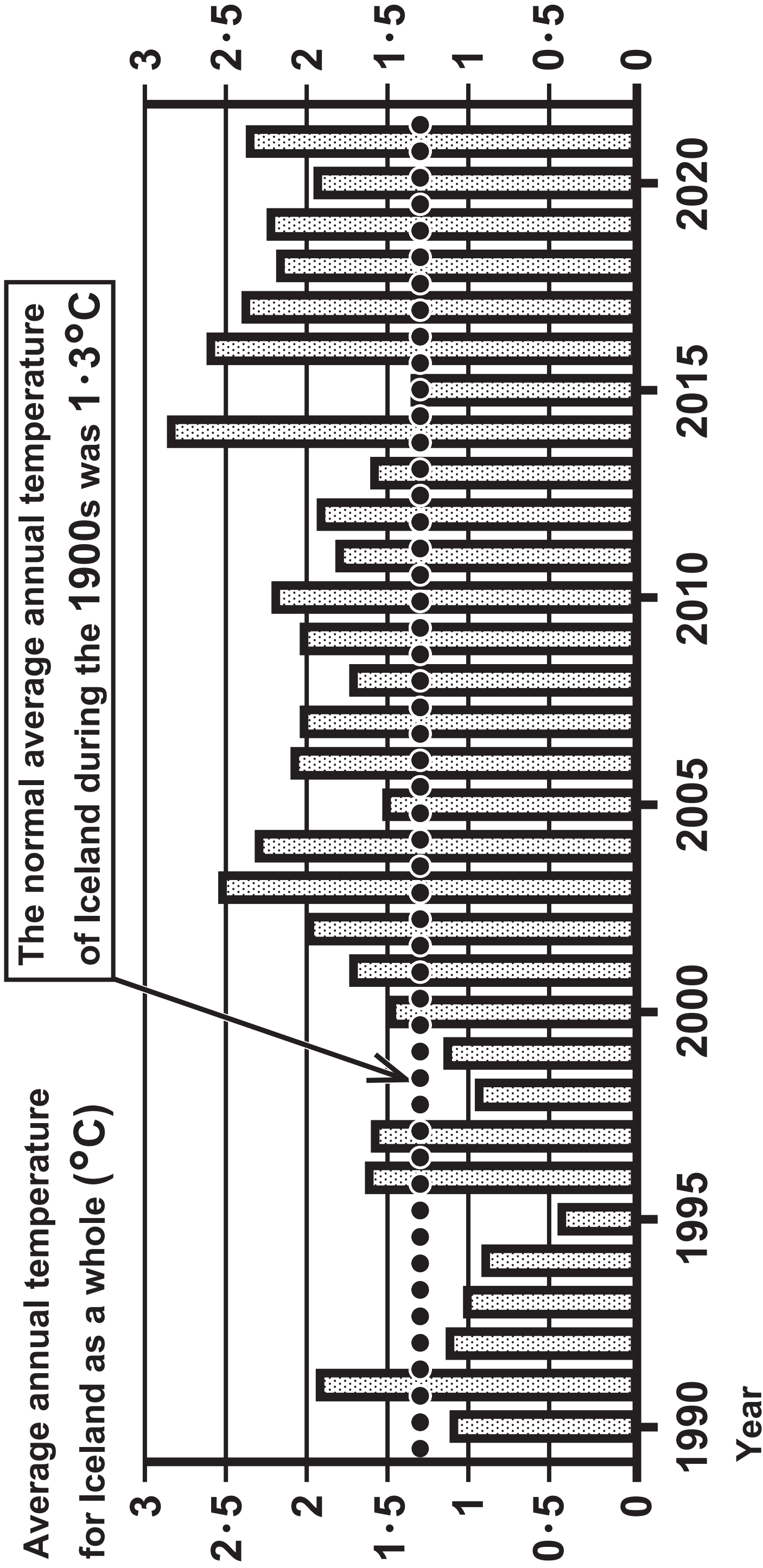


Figure 10

New Climate Action Plan goals introduced by Iceland’s government in 2020

	Category	Climate Action Plan goals
1	Roads & shipping	<ul style="list-style-type: none">• Reduce emissions from road traffic by 20% and from shipping by 40%.• Ban new petrol and diesel vehicles after 2030.
2	Aircraft & industry	<ul style="list-style-type: none">• Join global efforts to reduce aircraft emissions.• Develop carbon capture and storage (CCS) technology.• Reduce emissions by 43% in line with European Union (EU) targets.

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Figure 10 continued.

Category		Climate Action Plan goals
3	Energy production	<ul style="list-style-type: none">• Promote and support renewable energy.• Reduce emissions from energy production by 43%.• Encourage citizens to conserve energy.
4	Forestry & land use	<ul style="list-style-type: none">• Replanting enough new taiga trees to increase carbon storage by 500%.
Although Iceland's overall emissions have fallen by one-third since 1970, the average carbon footprint size of an Icelandic citizen remains almost double that of a UK citizen. As a result, new Climate Action Plan goals for 2030 have been introduced.		

Acknowledgements

Pearson Education Ltd. gratefully acknowledges all the following sources used in the preparation of this paper:

Figure 1 adapted from: <https://www.cbd.int/doc/world/is/is-nr-01-en.pdf>

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Figure 7 based on and adapted from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Share_of_energy_from_renewable_sources_2018_infograph.jpg

Figure 8 adapted from: <https://www.savingiceland.org/2017/08/icelands-troubled-environment/>

Figure 9 adapted from: <https://tradingeconomics.com/iceland/temperature>

Figure 10 adapted from: <https://www.government.is/library/01-Ministries/Ministry-for-The-Environment/201004%20Umhverfisraduneytid%20Adgerdaaaetlun%20EN%20V2.pdf>