

# GCSE Geography A 2016

## Practical support to help you deliver this Edexcel specification

Edexcel GCSE Geography A offers a thematic approach to studying geography, and the content is split by physical and human geography. As with all GCSEs, the guided learning hours total 120 hours over two years. This document provides a topic guide for teaching Component 2, Topic 6, and can be adapted by centres to fit their own contexts and teaching styles. It has been produced as an example approach and is not intended to be prescriptive. The topic guides indicate resources that you can use to support your teaching. These are only suggestions and you are encouraged to use a wide range of resources to suit the needs of your own students.

The advised teaching time for Topic 6: Resource Management, is 15 guided learning hours. This requires some blending together of the detailed content. In the guidance below, suggestions are made about contextualisation or stretch challenges that may be suitable for more able students, as well as expected lesson outcomes for those less able. Please note that these are suggestions only and not specific syllabus requirements.

The two- and three-year course planners suggest the most appropriate time to introduce this material. Centres studying over two or three years might teach this topic during the initial part of the Spring Term following the Christmas break in the final year of study. A suitable sequence would be to teach all parts, then to teach Component 3, Topic 8, 8.1, looking at the UK's resource consumption and environmental sustainability challenge, before completing Topic 6 with summing up resource management and summative assessment.

Each topic begins with a quick overview followed by a more detailed explanation of the key concepts and processes, examples of teaching strategies, guidance on integrating geographical skills, and a summary of the key terminology required. The structure is suggestive, not prescriptive.

### **Synoptic linkages and case study nesting**

It is suggested that you select located examples that complement the developed and emerging/developing country case studies that are studied in Topics 2 and 5. For example, located examples in Australia or the Philippines could be revisited to study tropical storms, drought and water security. Equally, energy security could be tied to case studies of the USA or the UK, China or India which could have also been used in Topics 4 or 5.

# Topic Booklet for Component 2 Topic 6: Resource Management

## Introduction

### Quick overview

A look at global and UK distribution of food, energy and water, including the meaning of the term 'natural resource', and varying patterns of consumption at differing scales.

This section is split into two Key ideas:

6.1: A natural resource is any feature or part of the environment that can be used to meet human needs.

6.2: The patterns of the distribution and consumption of natural resources vary on a global and national scale.

The aim of this unit is to consider the management of resources initially at global and UK scales, looking at an overview of food, energy and water. There is then a choice of studying **either** Energy resource management **or** Water resource management in further depth. This introductory section is therefore to provide grounding in worldwide resources, elements of which can then be developed further through the choice of sub-topic.

The advised teaching time for the whole topic is 15 guided learning hours (i.e. Topic 6+6A **OR** Topic 6+6B), so it would be reasonable to spend up to three hours on the Topic 6 introductory section (6.1 and 6.2), to be able to spend time looking at distribution and choropleth maps and data visualisations. One of the best data visualisation sites is Gapminder, which has information on food, energy and water supplies. It is simple to use, and plots graphs and maps of the data over a variety of timescales to suit your needs (<http://www.gapminder.org/>). This also covers the integrated skills elements of this topic to look at world distribution maps, population projections and water stress maps.

### Teaching approach over three hours

Lesson 1 (1 hr)	What are natural resources and how are they classified (biotic/abiotic/renewable/non-renewable)? How are they distributed in the world and the UK?
Lesson 2 (1 hr)	How do people exploit environments for water, food and energy? An overview of how this exploitation changes these environments.
Lesson 3 (1 hr)	Global patterns of use and consumption of food, energy and water, using mapping skills to investigate.

## Lesson 1: What are natural resources, their classification and their worldwide and UK distribution?

### Overview

The first lesson could look at 6.1a and 6.2a together, which may serve to give students an overview of what and where – this is one way of teaching this, not the only way. Ensuring that students have a good grasp of the key definitions of biotic, abiotic, renewable and non-renewable will serve them well for the whole unit, therefore spending time reinforcing these may be of value, especially for less able students.

The introduction of mapping skills here is also beneficial, so that students gain a spatial awareness of resources distribution both globally and on a UK scale. Soils in England and Wales could be studied using <http://www.landis.org.uk/soilscapes/>.

- More able mappers are likely to be able to identify confidently distribution patterns without too much strategy, but can still use the divided area concept (map split into four quadrants) to aid their understanding.
- Less able students should be encouraged to divide the map into four regions using compass directions and the equator, tropics and poles, then select some specific examples and then some exceptions (the acronym GCSE – General Comment, Specifics, Exceptions can be used for any description- or distribution-style response). For the UK, try putting a north, east, south, west quadrant overlay so students can use compass directions to describe distribution.

### Key concepts and processes

The RGS student-friendly key concepts may be of use here. They are:

- Place: what are human-made and natural places like?
- Space: how do human-made and natural places fit together in the 'world jigsaw'?
- Scale: understanding the big picture as well as what we experience day to day.
- Interdependence: we all have an impact on each other.
- Physical and human processes: events can change the physical and human world.
- Environmental interaction: people use the natural world and have the ability to change it.
- Cultural understanding and diversity: people from around the world have different ways of life.

<http://www.rgs.org/OurWork/Schools/Teaching+resources/Key+Stage+3+resources/Revealing+the+importance+of+geography/How+can+we+work+with+the+Key+Concepts.htm>

These can be used for each lesson to ensure that the concepts of geography – rather than a long list of skills – are covered.

Initially, ensure that students have a grasp of key terminology. Once this is known, establish where soil and agriculture, forestry, fossil fuels, water supply,

rocks and minerals are located within the UK and globally. Gapminder may be useful here <https://www.gapminder.org/world/> . Then select coal consumption map and natural gas production graph.

The emphasis is on distribution, therefore there is no need to spend time plotting/shading maps per resource per student. Instead, a more productive approach would be to use internet research or, if resources do not permit this, printed materials to describe distribution and suggest links between certain distributions.

More able students may be able to relate this to wealth, relief, etc. from their own knowledge.

If centres are keen to develop choropleth shading mapping as a skill in its own right at this stage (NB. choropleth mapping is one of the integrated skills that students should be competent in using, but this may have been addressed in other areas of the specification), then selecting groups who produce the range between them to a very high level would be a more productive use of time than producing numerous low-quality maps. Students should be able to identify areas with a plentiful supply of resources and areas that are at risk as they lack key resources, or in the case of the very able, how this could impact on economic development.

## Useful resources

World resource mapping: <http://www.gapminder.org/>

World climate map and climate graphs:

<http://www.geoknow.net/pages/climategraphs.html>

England and Wales soils: <http://www.landis.org.uk/soilscapes/>

## Guidance on teaching

Basic misconceptions about resources are that Africa is a dry, barren wasteland and that all of America is rich and prosperous, when of course this is not the case. It may therefore be worth spending time looking at regional disparities in continents, using pictures and even climate graphs for water distribution.

Circumstances will dictate the methods available, but these are some suggestions:

### 6.1a Definitions

Use 'Root words' as a way of deciding the meaning of biotic vs abiotic, renewable vs non-renewable – this is also an excellent literacy technique.

### 6.1a Dead or Alive?

Show students a range of objects or images and get them to explain whether each one is abiotic or biotic. (Can also be done for non/renewable.)

### 6.2a Descriptions of distributions

To improve students' descriptions, select a map and seat them back to back with Student A holding the map. Student B is given a blank map identical in size and shape to Student A's but with no data on it. Student A must describe the distribution of the data on the map to Student B, who must mark it correctly in place.

## 6.2a Distributions

Use of GIS packages to identify key patterns of one resource (developing use of GIS skills). GIS is an integral area of this topic area, but the rule of thumb which is worth remembering is to cover one or two resources per lesson. This could be to look at a key concept or to develop skills related to distribution. Printed copies of a web page/map/graph which is perused and discussed as a group may be a prudent way to develop skills if computers are not easily available for each lesson. Suggested sites are included here, but this is by no means an exhaustive list.

### 6.2a Jigsaw group work – expert and share groups

Create five 'expert' groups. Give each group one of the resource groups to map – therefore supporting one another in the mapping task (ideal for mixed ability). One member from each group then moves into a new 'share' group so there is one map of each resource within the 'share' group, and describes it to the rest of this new group.

## Lesson 2: How do people exploit environments for water, food and energy? An overview of how this exploitation changes these environments

### Overview

6.1b and 6.1c look directly at the human aspects of use of the world's resources. They are based on extracting fossil fuels, fishing, farming and deforestation. This is meant to be an overview however, so there is limited time to look at each. The effects of these, such as the reduction of biodiversity, soil erosion and reduced water and air quality could be matched with each other, rather than looking at the ways first and the changes after.

### Key concepts and processes

The many interactions are the key here, and therefore teaching this as a multi-faceted area developing the interactions is vital.

Students need to know the basics of the key geographical terminology which they may not have studied previously. Fossil fuels, fishing, types of farming (arable, pastoral and mixed) and deforestation will need to be well defined, and even basic interrelationships among these may be identified by the more able (farming and deforestation, for instance).

The environmental effects to include biodiversity, soil erosion and water and air quality will need to be defined clearly at the start, as they are frequently misunderstood by students who have encountered them in the media rather than in previous education. The concepts of before and after will be apparent in this section, and changes over time would be an effective way of noting how environments have been affected by soil erosion, changes in air and water quality and deforestation.

## Useful resources

UK non-renewable mapping programme:

<http://www.ukenergywatch.org/Electricity/PowerStations>

World resource mapping: <http://www.gapminder.org/>

Looking at rainforest depletion: <https://youtu.be/6AVkjJKK3iE>

UK water and air quality: [http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=\\_e](http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e)

World water quality: <http://www.unwater.org/topics/teaching-water/en/>

World air quality: <http://aqicn.org/map/world#@g/5.5767/14.1973/0z> or <http://waqi.info/>

Soil erosion, fishing: <http://www.theglobaleducationproject.org/earth/index.php> (under THE DATA section).

## Guidance on teaching

### 6.1b and 6.1c Impact images

Remembering that the focus is overview, looking at time-lapse videos, maps and photographs to show images of the processes would be very effective.

### 6.1b and 6.1c Interrelationship

Use mind-mapping (<http://mindmapfree.com/>) to show interrelationships between how the environments are exploited and the resulting overlapping changes.

## Lesson 3: Global patterns of use and consumption of food, energy and water using mapping skills to investigate

### Overview

The concept of this lesson is to identify disparity between areas of the world and their consumptions.

- More able candidates will also be able to draw conclusions by comparing their findings with their maps of 6.2a (resource distribution) and their knowledge of richer and poorer areas of the world.
- Less able students will be able to express their findings per resource consumed, and with direction could assess parallels and differences between differing resources – this could be with specific direction to areas of the globe which are specifically chosen to exemplify similarities and differences.

### Key concepts and processes

The processes of reading maps and manipulating GIS packages to understand usage and consumption of food, energy and water data are vital for this Key idea. Students should look at the three resources and identify distribution and obvious shared patterns between them. They should also focus specifically on the key concepts and processes of the patterns of distribution and consumption and their inter-relationships.

## Useful resources

World resource mapping: <http://www.gapminder.org/> and <http://www.wri.org/resources/maps>

ArcGIS Earth (downloaded from <http://www.esri.com/>), to which information can be added.

Statistics: <http://www.worldometers.info/> and <http://www.poodwaddle.com/>

## Guidance on teaching

### 6.2b Using GIS as a reference tool

Use Gapminder data as a starting point, and add in additional websites to suit your students' needs, to look at usage and consumption of food, energy and water. Encourage students to look for parallels/similarities and differences between areas for these three resources.

Also encourage students to look for similarities and differences between the distribution of resources and their consumption. Identify areas of 'haves' and 'have nots' as well as areas of 'have some' and 'at risk'. In particular, illustrate this for the global scale. The most able students may be able to extend this thinking into how this affects some countries within the global economy.

## Key vocabulary for Topic 6

Abiotic	Extraction
Agriculture	Farming
Biodiversity	Fishing
Biotic	Fossil fuel
Choropleth	Mineral
Consumption	Mining
Deforestation	Non-renewable
Distribution	Renewable
Energy	Resource
Environment	Supply
Erosion	Usage
Exploitation	

# Topic Booklet for Component 2 Topic 6A: Energy resource management

## Introduction

### Quick overview

This sub-topic provides an in-depth study of energy use and management in the UK and further afield. Its aim is to deepen the understanding of the complexities surrounding energy management, both in the UK and other global locations at differing economic stages of development. This sub-topic would lend itself to being taught alongside Topic 8.1 relating to the UK's resource consumption and the sustainability of the UK's transport system, in particular sections 6.5, 6.6 and 6.7.

There is an opportunity in 6.7c to nest the sustainability case studies in section 5.8a and b and to a lesser degree 4.5e.

### This section is split into five Key ideas.

6.3 Renewable and non-renewable energy resources can be developed.

6.4 To meet demand, countries use energy resources in different proportions. This is called the energy mix.

6.5 There is increasing demand for energy that is being met by renewable and non-renewable resources.

6.6 Meeting the demands for energy resources can involve interventions by different interest groups.

6.7 Management and sustainable use of energy resources are required at a range of spatial scales from local to international.

This optional sub-topic is designed to look at energy resource management, and focuses on depth within the topic rather than breadth. Renewable and non-renewable examples are selected. UK and global patterns are identified in terms of use of energy, supply and reasons relating to changes in both supply and demand. Key skills involve the use of line graphs and further developing the use of choropleth mapping from Topic 6 above.

There are 12 hours of teaching time dedicated to this section of the syllabus. A possible breakdown is shown below.

Lesson 1 (1 hr)	Renewable and non-renewable energy – an overview and how various resources are classified.
Lesson 2 (1 hr)	Advantages and disadvantages of the production and development of one non-renewable energy resource.
Lesson 3 (1 hr)	Advantages and disadvantages of the production and development of one renewable energy resource.
Lesson 4 (1 hr)	The energy mix of the UK and other countries and the reason why energy mixes in different countries are different, including global variations.

Lesson 5 (1 hr)	Global supply and demand have changed over the last 100 years.
Lesson 6 (1 hr)	The development of non-renewable energy sources and their effect on the environment and people.
Lesson 7 (1 hr)	The development of renewable energy sources and their effect on the environment and people.
Lesson 8 (1 hr)	The role of technology in resolving energy shortages.
Lesson 9 (1 hr)	Attitudes to exploitation and consumption.
Lesson 10 (1 hr)	Why energy resources require sustainable management and use, and why different groups of people hold different views about how this can be achieved.
Lesson 11 (1 hr)	How one developed country has attempted to manage its energy resources in a sustainable way.
Lesson 12 (1 hr)	How one developing or emerging country has attempted to manage its energy resources in a sustainable way.

## Lesson 1: Renewable and non-renewable energy – an overview and how various resources are classified

### Overview

6.3a is designed as an overview of energy types, looking at the differences between renewable and non-renewable energy and a brief overview of each of the ways of making electricity/energy from resources.

- More able students may look at a range of renewable and non-renewable sources.
- Less able students may select a narrower range to investigate. They should not lose the depth of the concepts, rather breadth could be diminished.

### Key concepts and processes

As an introduction, a breadth of knowledge is required here so that students are able to define and identify the differences between resources and the way they make electricity. Students should build from their overview of resource distribution in 6.2. It is likely that many students will have a basic knowledge of the key ideas from lower school, therefore this may be more of a revision-style approach for those with this level of knowledge.

## Useful resources

Overview of resources, a brief description:

[http://www.bbc.co.uk/schools/gcsebitesize/geography/energy\\_resources/energy\\_rev2.shtml](http://www.bbc.co.uk/schools/gcsebitesize/geography/energy_resources/energy_rev2.shtml)

Suitable for lower ability or a plenary/interactive whiteboard activity undertaken at speed:

<http://www.childrensuniversity.manchester.ac.uk/interactives/science/energy/renewable/>

## Guidance on teaching

6.3a for those who are revising these ideas.

Students who know this information could develop a script for one of the many online resources looking at energy types (e.g. [try](#) a search for 'stop motion film: Renewable vs non-renewable energy sources'). Mute the soundtrack, which is aimed at younger students, and get students to produce their own soundtrack, explaining which energy sources are and are not renewable, and why. The more adventurous could produce a song or poem rather than a prose script.

6.3a for lower ability/those who find reading difficult, [try](#) searching for 'different sources of energy', 'using energy responsibly', 'educational video for kids'.

6.3a use images/photos to identify different types of power station, then discuss which are renewable and non-renewable – Google Earth could be used for this, but would require preparation for speed of access.

## Lesson 2: Advantages and disadvantages of the production and development of one non-renewable energy resource

### Overview

This is an opportunity to look in depth at one type of non-renewable energy. The focus is on its production and development, and your choice could relate to your city/country study if this nests well. Equally, a completely different type of non-renewable source than a local power station may be appropriate, to broaden the experience of the students, especially if a local power station is a key employer.

### Key concepts and processes

There is a free choice between any fossil fuel or nuclear power to suit the needs of students and the strengths of those delivering the syllabus. The emphasis must be on production and development of the non-renewable resource. Ideas based around accessibility, reserves, cost of initial discovery and excavation/mining, clean-up, transport, ramifications – health of people, environment, economy would all be valid but may not suit all energy types. It is essential that a selection is made for less able students, although more able students could suggest which of these is more important for the type of fuel source they select. More able students may move into supposition relating to the future of the resource, including whether people have the right to continue exploiting it, by looking at benefits/costs to whom and when.

More able students/those with well developed research skills could select their own type of energy and independently research its advantages and disadvantages.

### Useful resources

Pros and cons, text-based for all types of energy:

<http://renewablegreen.net/?p=124>

Role-playing parts:

<http://alternativeenergy.procon.org/view.resource.php?resourceID=001792>

Pumpkin DVDs: Debating Energy Futures; Coal, Gas and Nuclear and Global Energy Security

### Guidance on teaching

6.3b – an image could be used to start discussion about non-renewable resources:

[https://thinkexponential.files.wordpress.com/2013/02/fotolia\\_2280083\\_s.jpg](https://thinkexponential.files.wordpress.com/2013/02/fotolia_2280083_s.jpg)

6.3b – role-play could be used to look at advantages and disadvantages from different viewpoints.

## Lesson 3: Advantages and disadvantages of the production and development of one renewable energy resource

### Overview

This is an opportunity to look in depth at one type of renewable energy. The focus is on its production and development, and your choice could relate to your city/country study if this nests well. Equally, a completely different type of renewable source than a local power station may be appropriate to broaden the experience of the students, especially if a local power station is a key employer or there has been recent controversy about the building of a type of power station locally.

### Key concepts and processes

There is a free choice between all types of renewable fuel to suit the needs of students and the strengths of those delivering the syllabus. The emphasis must be on production and development of the non-renewable resource. Ideas based around accessibility, requirements, cost of initial building/equipment, clean-up/relocation, transport, ramifications – health of people, environment, economy would all be valid but may not suit all energy types. It is essential that selection is made for less able students, although more able students could suggest which of these is more important for the type of fuel source they select. More able students may move into supposition relating to the future of the resource, including whether people have the right to continue using it, by looking at benefits/costs to whom and when.

More able students/those with well-developed research skills, could select their own type of energy and independently research its advantages and disadvantages.

### Useful resources

Pros and cons text-based for all types of energy: <http://renewablegreen.net/?p=124>

Role-playing parts:

<http://alternativeenergy.procon.org/view.resource.php?resourceID=001792>

Pros and cons of renewable energy sources:

<http://www.greenworldinvestor.com/2011/04/04/pros-and-cons-of-renewable-energy-a-detailed-explanation/>

Discussion images: [http://easyenergy.com.cy/wp-content/uploads/2013/11/green\\_solar\\_wind\\_earth.jpg](http://easyenergy.com.cy/wp-content/uploads/2013/11/green_solar_wind_earth.jpg)

Pumpkin DVDs: The Greening of Energy

London Array:

<http://www.telegraph.co.uk/news/earth/energy/windpower/9427156/The-London-Array-the-worlds-largest-offshore-wind-farm.html>

Three Gorges Dam:

<https://www.theguardian.com/environment/2011/may/19/china-three-gorges-dam>

Solar energy: <http://www.theguardian.com/sustainable-business/solar-power-parks-impact-environment-soil-plants-climate>

### Guidance on teaching

6.3c – an image to start discussion about renewable resources could be used

[http://easyenergy.com.cy/wp-content/uploads/2013/11/green\\_solar\\_wind\\_earth.jpg](http://easyenergy.com.cy/wp-content/uploads/2013/11/green_solar_wind_earth.jpg)

6.3c – more able students who have selected their own resource could balloon debate their choices – the most convincing wins. This can be undertaken in groups for larger classes.

6.3c – students could role-play relating to whether they agree or disagree with certain types of energy production methods (this could be cross-referenced to 6.6 – attitudes of different stakeholders).

## Lesson 4: The energy mix of the UK and other countries and the reasons energy mixes in different countries are different

### Overview

Initially, look at where the UK gets its energy from in terms of renewable vs non-renewable and its specific energy mix. This is then broadened out to look at the global variations and energy mixes for other locations. Reasons for the mixes should then be considered, including population, wealth and availability of energy resources. A global overview, followed by a range of specific countries (relating to case studies already undertaken in Topic 4) may be the most pragmatic approach here.

## Key concepts and processes

All students will benefit from finding out how much of each type of energy the UK uses. Looking at the pros and cons of non-renewable may be an eye-opener for students, especially considering many of these are imported. Looking at reasons why this is the case may therefore be helpful at the UK and global scale.

It will be useful here to select global locations that reflect place-specific usage, such as Iceland and geothermal energy. Equally, looking at case studies with differing population sizes and wealth will also help students to understand why resources are used the way they are. Using maps and statistics here will improve students' numeracy skills as they read a variety of maps and graphs to find the information they require at both a national and global level (good for UK: <http://www.gridwatch.templar.co.uk/>). Mapping of energy sources and transport/movement to end user would be helpful for students, as well as considering a risk assessment about what could interrupt supply and how likely this might be.

More able students may be able to explore the extent to which our energy mix is based on risk analysis or geopolitics. What drives the process of maintaining the status quo, making small changes in supplies as opposed to a significant shift? Who is (and why are we) managing change because of internal and external requirements and/or pressures?

## Useful resources

UK renewables mapping programme: <http://www.renewables-map.co.uk/default.asp>

UK non-renewable mapping programme:  
<http://www.ukenergywatch.org/Electricity/PowerStations>

Good for thinking about different countries and their energy mix:  
[http://www.seai.ie/Schools/Post\\_Primary/Subjects/Geography\\_JC/Pros\\_Cons1/](http://www.seai.ie/Schools/Post_Primary/Subjects/Geography_JC/Pros_Cons1/)

UK energy mix: <http://www.bbc.co.uk/news/business-24823641>

UK energy mix government statistics:  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/296183/pn\\_march\\_14.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296183/pn_march_14.pdf)

UK National Grid status (live updates): <http://www.gridwatch.templar.co.uk/>

Statistics from a green electricity provider: <https://www.ecotricity.co.uk/our-green-energy/energy-independence/our-fuel-mix>

World energy mix:  
<http://www.iea.org/publications/freepublications/publication/keyworld2014.pdf>

World energy usage – interactive map tool (2008 and 2035 comparisons):  
<http://environment.nationalgeographic.com/environment/energy/great-energy-challenge/world-electricity-mix/>

Pumpkin DVDs: Global Energy Security

## Guidance on teaching

### 6.4a and b

Students will need direction to make sense of the large amounts of data available. Country fact files broken down by energy type may make for the most

efficient way of processing this information, including sections for wealth, population size and a tick-box selection of which resources are available within the country (relate back to 6.1 and 6.2 also).

[http://www.iea.org/publications/freepublications/publication/KeyWorld\\_Statistics\\_2015.pdf](http://www.iea.org/publications/freepublications/publication/KeyWorld_Statistics_2015.pdf) is a particularly useful tool for this, and while more able students may find this document quite useful, less able students may need direction to specific pages – paper copies would also be easy to use.

Choosing countries that appear across the data would be helpful for less able students, so it may be vital for the teacher to have the deciding vote in country choice.

## Lesson 5: Global supply and demand have changed over the last 100 years

### Overview

The focus for students needs to be not only on how supply and demand have changed, but also why. Use of line graphs to see changes over time will improve students' skills and also develop skills of graphing correctly, using continuous data/change over time.

### Key concepts and processes

Data interpretation relating to world population growth, increasing wealth and improved technology – possibly to consider the process/rate/stage of development; relationship between population growth, technological innovation, demand/consumption of energy – and should help students demonstrate how and why energy consumption has increased. Map packages that show changes over time will help students to see trends and make comparisons. Students will develop their spatial awareness as well as their numeracy skills reading line graphs to gather their information.

### Useful resources

Gapminder is most useful for looking at trends over time: [www.gapminder.org](http://www.gapminder.org) ([https://www.gapminder.org/tools/#\\_chart-type=bubbles](https://www.gapminder.org/tools/#_chart-type=bubbles))

Consumption over time – graphs: <http://ourfinitemworld.com/2012/03/12/world-energy-consumption-since-1820-in-charts/>

Supply and demand graphs (line and pie) over 30 years:

<http://www.iea.org/publications/freepublications/publication/keyworld2014.pdf>

Annual stats: <http://www.enerdata.net/enerdatauk/press-and-publication/publications/world-energy-statistics-supply-and-demand.php>

Pumpkin DVDs: Global Energy Security

## Guidance on teaching

### 6.5a

Students will need to be able to identify changes in data shown on a line graph over time, showing past and projected population growth and energy consumption.

<http://ourfiniteworld.com/2012/03/12/world-energy-consumption-since-1820-in-charts/>

A living graph concept would work for information such as this, where students can identify key population and wealth increases and technological advances along the demand or supply timeline.

### 6.5a

If students have access to ICT facilities to look up their own data, they could use Gapminder to mix and match data sets, looking for trends with a selection of key countries (e.g. UK, Iceland, USA, China, India, Brazil, South Africa, Nigeria, Ethiopia, Kenya).

Image as a discussion tool: <http://www.webdesignersboise.com/renewable-energy-vs-non-renewable-energy-an-assessment-of-both-forms-of-energy-production>

## Lesson 6: The development of non-renewable energy sources and their effect on the environment and people

### Overview

Picking up from 6.3a, students need to focus on the three fossil fuels and uranium and how their use affects people and the environment in both a positive and negative way.

### Key concepts and processes

The key ideas here are based around the use of all the non-renewable resources. Less able students are likely to identify the advantages and disadvantages in isolation, whereas more able students are likely to be able to identify the reasoning behind use, using a cost-benefit analysis-style thought process. Advantages/disadvantages relating to people are likely to focus on the economic and social elements of the effects of each type of fuel. Environmental issues are likely to focus on land, air and water issues and the differing scales of impact. Habitat impacts are also likely to be considered. Spatial (immediate and distant impact) and temporal (short, medium and long term) concepts should be drawn out, as well as the degree of impact, interaction and inter-relationship of resource use on the environment and on people, both now and in the future.

### Useful resources

Pros and cons, text-based for all types of energy:  
<http://renewablegreen.net/?p=124>

## Guidance on teaching

### 6.5b

The key to this is ensuring that all types of fuel are covered and both the environmental and human elements are examined. This may therefore be best taught as a group activity where members feed back their findings to create an information bank on each fuel type. This would develop independent learning in the investigation stages and teamwork in the sharing stages.

## Lesson 7: The development of renewable energy sources and their effect on the environment and people

### Overview

Picking up from 6.3a, students need to focus on the renewable energy sources and how their use affects people and the environment in both a positive and negative way.

### Key concepts and processes

The key ideas are based around the use of HEP, solar and wind power. Less able students are likely to identify the advantages and disadvantages in isolation, whereas more able students are likely to be able to identify the reasoning behind use by using a cost-benefit analysis-style thought process.

Advantages/disadvantages relating to people are likely to focus on the economic and social elements of the effects of each type of fuel. Environmental issues are likely to focus on land, air and water issues and the differing scales of impact. Habitat impacts are also likely to be considered.

### Useful resources

World renewable energy mapping:

<http://www.geni.org/globalenergy/library/renewable-energy-resources/globalmaps.shtml>

Pros and cons, text-based for all types of energy:

<http://renewablegreen.net/?p=124>

Pros and cons of renewable:

<http://www.greenworldinvestor.com/2011/04/04/pros-and-cons-of-renewable-energy-a-detailed-explanation/>

London Array:

<http://www.telegraph.co.uk/news/earth/energy/windpower/9427156/The-London-Array-the-worlds-largest-offshore-wind-farm.html>

Three Gorges Dam:

<https://www.theguardian.com/environment/2011/may/19/china-three-gorges-dam>

Solar: <http://www.theguardian.com/sustainable-business/solar-power-parks-impact-environment-soil-plants-climate>

## Guidance on teaching

### 6.5c

The key to this is ensuring that all types of fuel are covered and both environmental and human elements are examined. This may be best taught as a group activity where members feed back their findings to create an information bank on each fuel type. This would develop independent learning in the investigation stages and teamwork in the sharing stages.

## Lesson 8: The role of technology in resolving energy shortages, including fracking

### Overview

This is a Boserupian-style approach to managing energy shortages (necessity is the mother of invention), and therefore students should be considering how we can alleviate shortages by thinking of alternative technological ways to gain energy.

### Key concepts and processes

Fracking is a relatively new method of gaining a resource/power supply and has received much (negative) media attention. Students need a good grounding in what fracking is and how it could help us have enough energy in the future when fossil fuels are depleted. More able students may critically evaluate its inception in as much as it 'can' alleviate shortages but it may not be desirable to do so, and they may question what countries such as the USA and UK facing an energy gap might do instead. Lower-ability students may take a more 'face value' approach around the basic mechanisms and possible fuel/electricity outputs of its use.

### Useful resources

What is fracking? <http://www.livescience.com/34464-what-is-fracking.html>

Dangers of fracking – mainly graphics: <http://www.dangersoffracking.com/>

<http://frack-off.org.uk/>

[https://www.foe.co.uk/campaigns/climate/issues/fracking\\_background\\_information\\_33157](https://www.foe.co.uk/campaigns/climate/issues/fracking_background_information_33157)

[https://www.theguardian.com/environment/2016/may/29/fracking-contribute-climate-change?CMP=share\\_btn\\_link](https://www.theguardian.com/environment/2016/may/29/fracking-contribute-climate-change?CMP=share_btn_link)

## Guidance on teaching

### 6.5d

An interesting approach to this topic would be whether fracking should be used to plug the energy gap, rather than whether it can. Less able students could focus on whether it is renewable/non-renewable, based on their prior learning and whether it should be used. Is it cost effective relative to other power supplies?

## Lesson 9: Attitudes to exploitation and consumption

### Overview

Students need to be aware that there are conflicting views on how to manage energy consumption both nationally and globally, and that there is a balance between the social, economic, environmental and political aspects of energy management.

This could be linked/nested into the case studies in Topic 4 if desired.

### Key concepts and processes

Stakeholders hold differing views at local, national and global levels when considering how to manage energy exploitation and consumption. Students need to be able to see the difference in approaches and to appreciate why different stakeholders hold their views. This could be achieved by looking at some well-chosen scenario-based located examples through a role-play-based strategy where students look at exploitation/consumption from the viewpoint of a local person, the organisation owning the power plant and the government of the country in which it is situated.

### Useful resources

Background reading for staff rather than a resource for students (note date):  
[http://ec.europa.eu/public\\_opinion/archives/ebs/ebs\\_247\\_en.pdf](http://ec.europa.eu/public_opinion/archives/ebs/ebs_247_en.pdf)

Pros and cons, text-based for all types of energy:  
<http://renewablegreen.net/?p=124>

Role-playing parts:  
<http://alternativeenergy.procon.org/view.resource.php?resourceID=001792>

### Guidance on teaching

#### 6.6a

NIMBY - Consider the views of stakeholders (a local person, the government and the power company) towards opening a new power plant (in any country) of the student's choice. What will the key arguments be? Who is most likely to win in such circumstances, and why?

## Lesson 10: Why energy resources require sustainable management and use, and why different views are held by different groups of people as to how this can be achieved

### Overview

This covers 6.7a and b, and is an opportunity for students to look at why there is a need for sustainable management of energy resources before looking at their own energy use and how their use and that of others impacts on global patterns. Students need to gain an appreciation of how energy consumption needs to be sustainable and managed.

## Key concepts and processes

Students can calculate their own carbon and ecological footprints using the online calculators which can give a starting point as to whether the way they live is sustainable. This can progress into what sustainability is, why we need to manage resources in a sustainable manner and how we can do so. Looking at contrasting locations here may be of benefit to show how different approaches can impact on local areas, as well as international agreements and their success.

## Useful resources

Carbon footprint: <http://www.carbonindependent.org/>

Ecological/carbon footprint: <http://ecologicalfootprint.com/>

<http://calculator.bioregional.com/>

<https://www3.epa.gov/carbon-footprint-calculator/>

Masdar and Masdar city: <http://www.masdar.ae/>

Other Masdar video resources available by searching for 'Masdar sustainable'.

China (teacher info): <http://www.chinabusinessreview.com/environmentally-friendly-consumers-emerge/>

## Guidance on teaching

### 6.7a

Most students enjoy looking at their carbon/ecological footprint, and this is a good starting point for thinking about why we need to live sustainably. They could widen this to look at their closest urban area and the country as a whole.

### 6.7a and b

Students could be given viewpoints from a variety of stakeholders and asked to say whose opinion each one is likely to be and why. They could also write a viewpoint from one of the stakeholders and express why they think this stakeholder would hold this view.

**6.7a and b** – DME – this could be undertaken for any location which is sustainable.

How sustainable is Masdar? Can a city of this scale ever be truly sustainable? Does marketing it as a tourist attraction defeat the purpose of its sustainability if people then want to visit it?

## Lesson 11: How one developed country has attempted to manage their energy resources in a sustainable way

### Overview

This requires use of a located example and could be nested within 4.5e, which is a case study of a major UK city and how it can be sustainable.

## Key concepts and processes

This is essentially looking at reuse, recycling, and how traffic improvements, industry, building materials and regulations, etc. have become more sustainable.

The located example refers to a country, so relevant examples can be drawn from a range of locally-based projects to suit centre settings. Urban or rural fieldwork could be linked to this strand as applicable.

## Useful resources

General:

[http://www.bbc.co.uk/schools/gcsebitesize/geography/sustainability/sustainable\\_living\\_rev1.shtml](http://www.bbc.co.uk/schools/gcsebitesize/geography/sustainability/sustainable_living_rev1.shtml)

<http://indy100.independent.co.uk/article/these-are-the-most-sustainable-cities-in-the-world--IJh0YR6fhx>

Sustainable UK cities: <https://www.forumforthefuture.org/project/sustainable-cities-index/overview>

<http://www.sustainablecities.org.uk/>

Sustainable US cities: <http://www.sustainablecities.org.uk/>

Sustainable cities index: <http://i100.independent.co.uk/article/these-are-the-most-sustainable-cities-in-the-world--IJh0YR6fhx>

<https://youtu.be/HfTUU3ow1E>

[http://www.bbc.co.uk/schools/gcsebitesize/geography/sustainability/sustainable\\_living\\_rev1.shtml](http://www.bbc.co.uk/schools/gcsebitesize/geography/sustainability/sustainable_living_rev1.shtml)

## Guidance on teaching

### 6.7c

If possible, when undertaking urban/rural fieldwork, sustainability could be one of the elements studied in relation to evidence of recycling or traffic schemes.

### 6.7c

Use of personal experience will bring this topic to life for students – looking at their own carbon footprint and their own recycling and transport methods is helpful.

## Lesson 12: How one developing or emerging country has attempted to manage its energy resources in a sustainable way

### Overview

This requires use of a located example, and could be nested within 5.8a and b, which is a case study of an emerging or developing country.

## Key concepts and processes

This is essentially looking at how behaviours have been changed to show how countries have tried to manage their resources. It looks at reuse, recycling, and how traffic improvements, industry, building materials and regulations, etc. have been managed in a more sustainable way. The located example refers to a country, so relevant examples can be drawn from a range of locally-based projects to suit centre settings. Urban or rural fieldwork could be linked to this

strand if the centre undertakes overseas fieldwork as applicable. For those centres choosing Brazil, Curitiba is a useful example.

### Useful resources

World renewable energy mapping:

<http://www.geni.org/globalenergy/library/renewable-energy-resources/globalmaps.shtml>

Dubai: <http://www.diamond-developers.ae/thesustainablecity/why-sustainable-city.html>

Masdar and Masdar city:

<http://www.masdar.ae/>

Or search on YouTube for 'Masdar'.

Pumpkin DVDs: Energy Security – India's sustainable solutions

Curitiba:

[http://www.bbc.co.uk/schools/gcsebitesize/geography/urban\\_environments/urbanisation\\_ledcs\\_rev4.shtml](http://www.bbc.co.uk/schools/gcsebitesize/geography/urban_environments/urbanisation_ledcs_rev4.shtml)

<https://www.theguardian.com/cities/2016/may/06/story-of-cities-37-mayor-jaime-lerner-curitiba-brazil-green-capital-global-icon>

### Guidance on teaching

#### 6.7c

Using the country from 5.8a and 5.8b may help students to further their knowledge of this in-depth case study. However, if centres are looking for breadth of learning, this could be a good opportunity to look at a case study with some different concepts.

#### 6.7c

Use of images (or overseas fieldwork)

Many students will not have seen the places they are studying here. Videos and images as stimuli are therefore more likely to be useful, and images could be used to ask students how they think the country has been made more sustainable. Changes over time, looking at photos along a timeline or using Google Earth to investigate, will also improve students' knowledge. Students could also predict ways the country could become more sustainable if it was wealthier or had fewer people, etc.

### Key vocabulary for Topic 6A

Availability	Non-renewable
Carbon footprint	Population
Choropleth	Production
Composition	Proportion
Consumption	Renewable
Continuous	Resource
Demand	Stakeholder
Development	Supply



Ecological footprint	Sustainable
Energy mix	Technology
Exploitation	Uranium
Fossil fuel	
Fracking	
Intervention	
Management	

### Overview of assessment

This topic is examined in Component Two, Section C and the question is worth 30 (+ 4 SPaG) marks (from a total of 90 + 4 SPaG), and should take approximately 30 minutes to complete.

# Topic Booklet for Component 2 Topic 6B: Water resource management

## Introduction

### Quick overview

This sub-topic provides an in-depth study of water use and management in the UK and further afield, including emerging or developing and developed economies, and at a variety of scales (global, regional and local). Its aim is to deepen students' understanding of the complexities surrounding water management both in the UK and other global locations at differing economic stages of development, how water supplies are often divided within and between countries and how this affects relationships between stakeholders within regions.

This sub-topic would lend itself to being taught alongside Topic 8.1a, relating to the UK's resource consumption, and 8.3b, relating to river management, particularly sections 6.8, 6.11 and 6.12. There are strong links with Topic 2: drought and global circulation of the atmosphere, and sub-topic 1B: rivers.

There is an opportunity in 6.12 to nest the sustainability case studies in section 5.7 and 5.8 and to a lesser degree 4.5e.

### This section is split into five Key ideas.

6.8 The supply of fresh water varies globally.

6.9 There are differences between the water consumption patterns of developing countries and developed countries.

6.10 Countries at different levels of development have water-supply problems.

6.11 Meeting the demand for water resources could involve technology and interventions by different interest groups.

6.12 Management and sustainable use of water resources are required at a range of spatial scales from local to international.

This optional sub-topic is designed to look at water resource management. It focuses on depth within the topic rather than breadth. Management and supply examples are selected. UK and global patterns are identified in terms of use and supply of water, and reasons relating to the changes in both supply and demand. Key skills involve the use of distribution maps, line graphs and further developing the use of choropleth mapping from Topic 6 above, and water-stress maps at UK and world scales.

There are 12 hours of teaching time dedicated to this section of the syllabus. A possible breakdown is shown below.

Lesson 1 (1 hr)	Global distribution of fresh water and how its availability varies on a global, national and local scale.
Lesson 2 (1 hr)	Areas of the world with a water surplus and water deficit and why this is the case.

Lesson 3 (1 hr)	How and why supply and demand for water has changed in the past 50 years owing to human intervention.
Lesson 4 (1 hr)	The proportion of water used by agriculture, industry and domestically in developed countries and emerging or developing countries.
Lesson 5 (1 hr)	Why there are differences in water usage between developed and emerging or developing countries.
Lesson 6 (1 hr)	Why the UK has water-supply problems.
Lesson 7 (1 hr)	Why emerging or developing countries have water-supply problems.
Lesson 8 (1 hr)	How technology (desalination) can resolve water-resource shortages.
Lesson 9 (1 hr)	How attitudes to the exploitation and consumption of water resources vary with different stakeholders (individuals, organisations and governments).
Lesson 10 (1 hr)	Why water resources require sustainable management and how different views held by individuals, organisations and governments impact on the management and sustainable use of water resources.
Lesson 11 (1 hr)	How one developed country has attempted to manage its water resources in a sustainable way.
Lesson 12 (1 hr)	How one emerging or developing country has attempted to manage its water resources in a sustainable way.

## Lesson 1: Global distribution of fresh water and how the availability of fresh water varies on a global, national and local scale

### Overview

6.8 is designed as an overview of where fresh water is and how available it is for human use and consumption based on climate, wealth and infrastructures.

- Less able students should focus on the logistics of water in its natural state at this introductory stage, i.e. cold environments may have glaciers which are less useful than water in its liquid state in temperate regions versus areas severely lacking water which are desert.
- More able students are likely to be able to make more in-depth assumptions based on their knowledge from air masses and global circulation about why water availability varies from one location to another and the impacts this may have on nations' ability to develop.

## Key concepts and processes

By way of introduction, students need to know where the world has water – both saline and fresh – and how it is stored (lakes, rivers, seas, oceans). Students of all abilities should know the amount of water that is useful/available for humans to utilise. This should build from their overview of resource distribution in 6.2. Many students will have a basic knowledge of the Key ideas from lower school, therefore this may be more of a revision-style approach for those with this level of knowledge.

## Useful resources

### Websites

Good for an initial overview with maps and many basic key terms, so especially good as an overview for non-specialists or teachers new to GCSE Geography: [https://cnx.org/contents/1A\\_1pEgD@1/Human-Impact-on-Fresh-Water-So](https://cnx.org/contents/1A_1pEgD@1/Human-Impact-on-Fresh-Water-So)

A series of world maps which can be used to show supply and demand issues across the globe, also useful for developing map skills relating to distribution: <http://www.fastcoexist.com/1681298/an-incredibly-detailed-map-shows-the-potential-of-global-water-risks>

The UN's position and some useful graphics: <http://phys.org/news/2015-03-looming-crisis.html>

A site which is best suited to less able students and looks at some case-study areas showing parched areas and some river-conflict areas – not overwhelming in its information so quite accessible: [http://whyfiles.org/131fresh\\_water/2.html](http://whyfiles.org/131fresh_water/2.html)

An interactive site – world and also by country: <http://www.unwater.org/kwip>

### Videos

<http://www.un.org/waterforlifedecade/scarcity.shtml> use the links on the right-hand side of the page to look at videos on water scarcity – for further videos from the UN, use this link to access their library:

[http://www.un.org/waterforlifedecade/video\\_library.shtml](http://www.un.org/waterforlifedecade/video_library.shtml)

'Where do we get our fresh water from?' video:

<http://ed.ted.com/lessons/where-we-get-our-fresh-water-christiana-z-peppard>

BBC site with videos and images which cover the whole unit (use, dirty water, desalination): <http://www.bbc.co.uk/guides/z3qdd2p>

Good starting point and overview site and good NASA video introducing water cycle and the impact of climatic features and atmosphere on water:

<https://freshwaterwatch.thewaterhub.org/content/water-limited-resource>

Vital water graphics which can be used by students to research or as stimulus for discussion: <http://www.unep.org/dewa/vitalwater/article42.html>

National water footprints: <http://www.igd.com/Research/Sustainability/National-water-footprints/>

## Guidance on teaching

### 6.8a

Graphs showing the amount of availability of fresh water would be a useful starting point for students, such as a divided bar or pie chart. There are many other visual representations available online to choose from, depending on which graphical skills you wish to develop in your students.

<http://www.unep.org/dewa/vitalwater/article42.html> is a really good starting point.

This could be built on to look at demand and renewable sources and what these are. With a focus on choropleth shading in this unit, maps can be assessed for how good their shading is to test students' understanding of the true skill of choropleth shading (i.e. one colour in grades/shades). Line graphs are also a focus for this unit, so noting and examining change over time could be addressed in this way.

Choropleth-style maps of projections could also be looked at for 6.8b – global scale availability looking at distribution patterns and changes to these patterns. For national and local scales, a brief overview of the Nile could be used in terms of distance from the river/river flow (physical) and management strategies in place (human/political). This should be focused on availability at this stage, as we look at the challenges of a sustainable water supply later in the unit. There are many other choices of location available here, such as California, USA/Mexico, for which there are also many resources available online (legacy Edexcel AS/A2 Geography specification resources could be used here).

## Lesson 2: Areas of the world with a water surplus and water deficit and why this is the case

### Overview

6.8c is focused on the geographical location of places with water and places without – i.e. surplus and deficit, so students should first learn these key terms to be able to access the concepts of water being unevenly distributed and available. This could relate simply to physical presence, but further development could also include the amount of demand relative to the available water. All students should have a grasp of both these ideas (rather than limiting the less able to where water is abundant or scarce). Linking this to the concept of overpopulation and correct use of this term would also be beneficial.

### Key concepts and processes

Key concepts include firstly where most fresh water is found and why. Referring back to climate/biome maps will be easily accessible content for all students – both lower and higher ability, as they can identify areas that are desert, areas where the water is mainly frozen, etc. More able students will be able to relate these to global circulation patterns from Topic 2 to understand why this is the case.

Students should know methods whereby water is supplied from surface water and groundwater for use/consumption.

## Useful resources

This link offers world maps – some of which are choropleth shaded – to show a variety of water factors such as renewable water resources per capita, location of rivers and lakes, and individual country files <http://www.unwater.org/kwip>

Water-risk interactive map which allows predictions, present-day and possible impacts of climate change: <http://www.wri.org/applications/maps/aqueduct-atlas/#x=8.00&y=0.09&s=ws!20!28!c&t=waterrisk&w=def&g=0&i=BWS-16!WSV-4!SV-2!HFO-4!DRO-4!STOR-8!GW-8!WRI-4!ECOS-2!MC-4!WCG-8!ECOV-2!&tr=ind-1!prj-1&l=3&b=terrain&m=group> – does regions rather than whole countries, so good for more able students – uses choropleth shading.

Water map – click on country to find water information (stress figures) – easy to use and understand:  
<http://www.theguardian.com/news/datablog/interactive/2011/jun/27/data-store-water> – good for less able students – uses choropleth shading.

## Guidance on teaching

### 6.8c

Students will need clarity on the Key ideas in this section and how water is readily available in some locations but not in others, and that this is not always influenced by national boundaries. Students need to be secure in the ideas of 'surplus', 'deficit' and 'distribution', so for less able students this is where the focus should lie. Relating this to reasons is also vital – as suggested in the key concepts, this can be undertaken on a variety of levels to suit students' needs/abilities.

Rather than draw or colour endless maps, students should be encouraged to draw conclusions and relationships between information with which they are presented or, if ICT permits, be able to research and identify patterns for themselves.

Locating areas that are overpopulated with regard to water availability should also be achievable by students of all abilities by comparing world maps of population distribution and water availability. Gapminder may be a useful tool for this exercise: <https://www.gapminder.org/world/> or the wri interactive risk map could be used (listed above under useful resources).

More able students could identify from this exercise that it is not whole countries or regions that are in surplus or deficit, whereas less able students could maintain a more country-by-country focus (possibly using the *Guardian* water map tool).

A graphic such as (ENVIRONMENT Liquid Planet) from: <http://indy100.independent.co.uk/article/the-countries-facing-the-worst-water-shortages--xJgNhXkGyyZ> could be used as a starter activity to look at visual representations of the issues and also to identify some of the key vocabulary. The UK could be used as a good example of a country with deficit in the south and east and surplus in the north and west, using simple rainfall data and population data – exemplifying that it is not always a financial issue that people do not have enough water, but that money can help to solve the problem.

## Lesson 3: How and why supply and demand for water has changed in the past 50 years due to human intervention

### Overview

Students need to use line graphs to understand how water use has changed in the world and why water use has increased. Rising populations and increasing domestic and industrial use in some countries should be at the centre of students' learning. Students should also understand that the use of water in some places is more vital than others (subsistence agriculture versus swimming pools, for instance). They should also look at how supplying water has changed both in terms of how and why changes have been actioned (for larger populations, for instance) and how improving technology can increase or reduce demand. Less able students can stay with looking at this as a more generalised concept, whereas more able students may be able to look more regionally at population explosions and areas of the world that have rapidly industrialised, for instance.

### Key concepts and processes

The basic concepts of this lesson are the difference between use for necessity and luxury and the imbalance of supply and demand between the two. Students should know the concept that the poorer you are the less likely you are to have the water you need to survive, and the richer you are the more likely you are to have more water than you need. Equally, the idea that richer people have clean water which they are likely to use for luxury purposes, but poorer people are more likely to have unclean water which they must use for basic hygiene and drinking, which compounds their lack of wealth.

Less able students may take these concepts at face value, whereas more able students may challenge the premise that all poorer or developing countries have unclean and unsafe water supplies for all, and that all richer or more developed countries have cleaner and safer supplies for all.

Modernisation and industrialisation are key areas to be considered: labour-saving devices can save water compared with the same machines 30 years ago, but may still use more water than the equivalent manual method (washing-up by hand versus a dishwasher, for example), whereas industrialisation by MNCs may not have a water-saving agenda. This mis-match of demand and supply could be considered by more able students.

### Useful resources

Video clip – search for the animation accompanying TakePart's latest documentary 'Last Call at the Oasis', named 'How much water do we really use everyday?'

Line graph of water consumption by continent:

[http://www.wrsc.org/attach\\_image/global-water-consumption-1900-2025](http://www.wrsc.org/attach_image/global-water-consumption-1900-2025)

Useful graphic, possibly for a starter activity: <https://globenewswire.com/news-release/2016/03/21/821823/0/en/World-Water-Day-2016-Theme-Water-and-Jobs-Underscores-Inherent-Investment-Opportunities-in-Optimizing-Global-Supply.html>

Daily life/US usage including simple pie chart (good for lower ability although in American English):

[https://www3.epa.gov/watersense/our\\_water/water\\_use\\_today.html](https://www3.epa.gov/watersense/our_water/water_use_today.html)

How we use water – text-based resource:

<http://sustainability.about.com/od/Sustainability/a/How-We-Use-Water.htm>

Tips for conserving water: <http://greenliving.about.com/od/greenathome/fl/12-Easy-Tips-for-Conserving-Water-at-Home.htm>

Hidden water use: <http://www.mnn.com/food/beverages/sponsorstory/six-ways-we-all-use-water-without-knowing-it>

Water uses (obvious uses): [http://www.skwirk.com/p-c\\_s-11\\_u-90\\_t-182\\_c-586/nsw/science-technology/sailing-sinking-soaring/properties-of-water/how-do-we-use-water-](http://www.skwirk.com/p-c_s-11_u-90_t-182_c-586/nsw/science-technology/sailing-sinking-soaring/properties-of-water/how-do-we-use-water-)

Water footprints to create beef – good for comparing measurements and how much they differ for one product to be made – more likely to be useful for more able students: <http://www.gracelinks.org/blog/1143/beef-the-king-of-the-big-water-footprints>

## Guidance on teaching

### 6.8d

Students should use a line graph; there are many available for a range of abilities within the links above. This is a good starting point for global consumption [http://www.wrsc.org/attach\\_image/global-water-consumption-1900-2025](http://www.wrsc.org/attach_image/global-water-consumption-1900-2025). Water supply and demand could be looked at on a variety of spatial and temporal levels, so globally from 1950 to present day, then looking at a range of countries such as a post-industrialised nation (UK/USA), an emerging/industrialising economy (China/India) and a developing economy (Chad/Ethiopia). Students should have a solid idea of what water is used for beyond their own daily use, but a water footprint could be used to focus how they use water beyond just washing and drinking. Students should be able to identify uses of water domestically, agriculturally and industrially. They should be able to suggest which are vital for life, improving quality of life or pure luxury.

They should also look at the idea that the use of pipelines and channels to transport water from reservoirs and rivers may lead to significant wastage. An image to start thought and discussion such as <https://globenewswire.com/news-release/2016/03/21/821823/0/en/World-Water-Day-2016-Theme-Water-and-Jobs-Underscores-Inherent-Investment-Opportunities-in-Optimizing-Global-Supply.html> could be used to aid understanding of why overuse of water is an increasingly important issue.

Line graphs such as <http://www.lenntech.com/specific-questions-water-quantities.htm> could be used to ascertain how ineffective water transport is and also as a starting point to consider whether anything has changed since 2003 – this is an older graph – although 6.8d looks at the last 50 years, so on this occasion this is valid.

A living graph concept would work for information such as this, where students can identify key population and wealth increases/changes and technological advances along the demand timeline.

## Lesson 4: The proportion of water used by agriculture, industry and domestically in developed countries and emerging or developing countries

### Overview

Students will need to understand the key terms: domestic, agriculture and industry – although they should be familiar with these from previous lessons in this and other topics.

Students will look at how water use varies between developed and developing/emerging economies by looking at a range of graphs and maps, to improve their skills as well as their knowledge.

Less able students are most likely to look at typical scenarios, whereas more able students may be able to look at atypical nations and discuss why their use falls outside expected parameters.

### Key concepts and processes

Students need to know which uses relate to which level of economic development by looking at a range of data. Pre-industrialised nations have more agricultural use, whereas in industrialised nations the industry sector uses more. Domestic use increases with development as people use labour-saving devices in their homes, which are often water-rich and use private pools, baths, showers and water as part of their relaxation and recreation activities. The focus is description as this is developed into explanation in Lesson 5.

### Useful resources

Agriculture (teacher info):

[http://www.zaragoza.es/contenidos/medioambiente/onu//newsletter12/880\\_eng.pdf](http://www.zaragoza.es/contenidos/medioambiente/onu//newsletter12/880_eng.pdf)

Agriculture: <http://www.unwater.org/statistics/statistics-detail/en/c/246663/>

Agriculture (world map despite web address):

<http://www.uruguaycountryinformation.com/rainfallmap.htm>

Industry: <http://www.unwater.org/statistics/statistics-detail/en/c/246658/>

Europe: <http://www.eea.europa.eu/themes/water/water-resources/water-use-by-sectors>

Pie charts showing comparison between four differing nations:

[http://www.bbc.co.uk/schools/gcsebitesize/geography/water\\_rivers/water\\_usage\\_rev1.shtml](http://www.bbc.co.uk/schools/gcsebitesize/geography/water_rivers/water_usage_rev1.shtml) -

Industrial water use by country map:

<http://www.indexmundi.com/blog/index.php/2013/04/04/industrial-water-consumption-by-country/>

Interactive database using tables and graphs and maps that you can click on by country: [http://www.fao.org/nr/water/aquastat/water\\_use/index.stm](http://www.fao.org/nr/water/aquastat/water_use/index.stm)

Interactive world map showing water use:

[http://www.fao.org/nr/water/aquastat/maps/World-Map.WithA.Twith\\_eng.htm](http://www.fao.org/nr/water/aquastat/maps/World-Map.WithA.Twith_eng.htm)

Russia – quite a nice blog page which gives clear information but in smaller chunks so better for less able students:

<https://env3400spring2013russia.wordpress.com/2013/04/18/water-use-by-industry/>

## Guidance on teaching

NB. In many resources the term 'Municipal' is used rather than 'Domestic'.

Some teachers may prefer to teach the content of Lessons 4 and 5 together over two hours.

### 6.9a

There is a wealth of creative resources available showing the split between the three uses. Students could take information from one of these to create their own pie charts, or they could evaluate which of the ways of showing the information is more easily understood and what each is showing. The following links show a variety of differing presentation methods.

Water droplets:

[https://env3400spring2013russia.files.wordpress.com/2013/04/droplets\\_590.png](https://env3400spring2013russia.files.wordpress.com/2013/04/droplets_590.png)

Bar charts: <http://www.unep.org/dewa/vitalwater/jpg/0211-withdrawcons-sector-EN.jpg>

World maps: <http://www.unep.org/dewa/vitalwater/jpg/0214-freshwatertypo-EN.jpg> or <http://nthodygeography.blogspot.co.uk/2014/02/physical-or-economic-water-scarcity.html>

Pie charts:

[http://www.bbc.co.uk/schools/gcsebitesize/geography/water\\_rivers/water\\_usage\\_rev1.shtml](http://www.bbc.co.uk/schools/gcsebitesize/geography/water_rivers/water_usage_rev1.shtml)

A cartogram such as 'Industrial water use by country' from <http://www.indexmundi.com/blog/wp-content/uploads/2013/04/world-water-consumption-in-industry.jpg> could be used as a starter or plenary activity to discuss this style of map and how it shows the world proportionally according to water consumption – less able students may benefit from a standard projection of a world map alongside to help distinguish the difference in shapes/sizes.

Less able students will be able to ascertain a country's level of development by a simple look at the agricultural/industrial split. They should know the difference between a developing, emerging and developed economy by being reading this information from a graph, i.e. agricultural use relates to pre-industrialisation and is related to a developing economy, and as an economy emerges and industrialises, the use of water for industry will increase, while agricultural use will decrease.

More able students may be able to challenge these basic views based on knowledge of population and water availability, using some additional research or from previous lessons in this unit. They could also make forecasts to suggest how a country's water use may change in the future.

## Lesson 5: Why there are differences in water usage between developed and emerging or developing countries

### Overview

This lesson focuses on the reasons for the differences in water usage between developed and developing/emerging economies. There are very strong links with Lessons 3 and 4, and this lesson will draw the themes of these lessons together. Some teachers may prefer to teach the content of Lessons 4 and 5 together over two hours.

### Key concepts and processes

Students will need to focus on lifestyle differences as well as economic structure, i.e. looking at small- and larger-scale reasons why more water is used per person in developed society, including social factors.

Concepts and resources from Lessons 3 and 4 remain relevant here, as these looked at descriptions pertinent to this lesson, which focuses more on the explanation for the differences. Wealth, cost of water, the cleanliness of the water available, the method by which it is acquired and the amount available per capita are key to understanding why there are differences in use – not just volume but also looking at normal usage by way of how easy it is to obtain good quality water and how time consuming this may be for people.

### Useful resources

Infographic – the secret life of drinking water:

<http://edition.cnn.com/SPECIALS/road-to-rio/secret-life-drinking-water/>

Water management article: <https://gigaom.com/2012/05/02/the-importance-of-water-management-to-the-smart-city-2/>

Global demand for water and management of its usage – presented as easy-to-access bullet points looking at both MEDCs and LEDCs (their terminology):

<https://omega7geo.wordpress.com/2013/10/25/water-usage/>

Charity-based well project gives both videos and information:

<https://www.water4.org/get-involved/you/water4more/> and

<https://www.water4.org/what-we-do/>

### Guidance on teaching

#### 6.9b

Returning to choropleth-style shading, which is one of the key skills within this unit, a map such as

[http://newsimg.bbc.co.uk/media/images/41421000/gif/41421084\\_national\\_water2\\_map416.gif](http://newsimg.bbc.co.uk/media/images/41421000/gif/41421084_national_water2_map416.gif) could be used as a starter activity to identify locations in the world and their water footprint, as well as discussing the value of using this dual-colour system to represent different zones, and whether the colour change is made at the correct stage in the spectrum considering the units – this latter challenge could stretch more able students.

Equally, an information-based graphic, e.g. <http://edition.cnn.com/SPECIALS/road-to-rio/secret-life-drinking-water/> looking

at availability of water and its safety, could be a useful stimulus for less able students who struggle with large amounts of text.

## Lesson 6: Why the UK has water-supply problems

### Overview

Students now have a solid overview of where water is available and scarce on a global scale, and have the opportunity to look at more detailed examples of a variety of countries starting with the UK.

### Key concepts and processes

The UK has multiple supply issues, including imbalances in the supply and demand for rainfall, seasonal imbalances between summer, autumn, winter and spring, and ageing infrastructure including both sewage and water pipes. Students may not be familiar with large-scale pipeline and water-movement projects from north to south or from Wales to Birmingham for example, nor may they be familiar with the idea of reservoirs – these should all be addressed as part of the UK's supply mechanisms. The imbalance of the population distribution should also be noted at this stage, with the south-east and the area surrounding the capital having the largest populations and highest population density.

### Useful resources

Water strategy for England – good background document for teachers:

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/69346/pb13562-future-water-080204.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69346/pb13562-future-water-080204.pdf)

Video and pdf download looking at sustainable water use:

<http://www.leafuk.org/leaf/farmers/ssw.eb> and

<http://www.leafuk.org/resources/000/691/685/SSW.pdf>

Met Office blog on rainfall, including maps:

<https://blog.metoffice.gov.uk/2016/01/08/reporting-the-weather-across-the-uk/>

Census data for the UK:

<http://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/2011censuspopulationandhouseholdestimatesforenglandandwales/2012-07-16>

Excellent series of photos looking at water shortages around the UK:

<http://www.dailymail.co.uk/news/article-2103809/UK-drought-2012-Water-companies-say-mustnt-spend-FOUR-minutes-shower.html>

Kielder Water reservoir – background information document:

[http://tyneriverstrust.org/wp-content/uploads/2013/10/Kielder\\_Operating\\_Manual.pdf](http://tyneriverstrust.org/wp-content/uploads/2013/10/Kielder_Operating_Manual.pdf)

Shortages including reasons and solutions – text-based resource:

<http://www.out-law.com/en/articles/2012/june/uk-must-modernise-aging-water-infrastructure-or-face-more-shortages-says-report/>

Infrastructure – Water Services Infrastructure Guide – Gov.uk:

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/292913/gean0107blIn-e-e.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/292913/gean0107blIn-e-e.pdf)

Severn Trent infrastructure report:

<http://media.aws.stwater.co.uk/upload/pdf/KPMG-Financing-Water-Infrastructure.pdf>

## Guidance on teaching

### 6.10a

Students could initially look at rainfall and areas of water stress, moving into population distribution. England is more easily compared, as resources are more widely available, but more able students will be able to research and access maps relating to Wales, Scotland and Northern Ireland and compare them with England to create a more rounded, fuller picture. More able students will also be able to look at seasonal rainfall patterns to gain a better understanding of why supply is lowest when demand is highest.

A comparison of maps related to rainfall, population density/distribution and water stress would make a sensible starting point. More able students could be given just the rainfall and population maps and asked to predict which areas are most likely to have the most stress, while less able students may need a more structured approach. Choropleth shading is used again as one of the key integrated skills for this unit.

Maps from <http://harlow.jdi-consult.net/documents/pics3/Figure23.jpg> and <https://blog.metoffice.gov.uk/2016/01/08/reporting-the-weather-across-the-uk/> and

[http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/resources/eandwmap2small\\_tcm77-272502.png](http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/resources/eandwmap2small_tcm77-272502.png) would be reasonable starting maps for this task.

Students can then consider how these issues might be compounded by ageing water and sewage pipes and seasonality. This could lead into what this looks like at a local level, using photographs: <http://www.dailymail.co.uk/news/article-2103809/UK-drought-2012-Water-companies-say-mustnt-spend-FOUR-minutes-shower.html>. At this stage, students do not need to consider how to manage the issue sustainably, as this is considered in Lesson 11.

## Lesson 7: Why emerging or developing countries have water–supply problems

### Overview

Students now look at a developing or emerging country. Although India and Egypt have been used here, it is possible to use any developing or emerging nation. Nesting this within 5.8a and b (which is a case study of an emerging or developing country) would be appropriate.

### Key concepts and processes

Developing and emerging economies have different supply problems from the UK, such as access to only untreated water, pollution of water courses and low annual rainfall. An example (or examples if preferred) should be selected that will illustrate all three of these issues. Exponential or rapid population growth in regions or whole nations should also be considered a key concept here, as cities

that are experiencing increasing urbanisation are unable to provide water for their growing population. Government choices relating to MNC industries and industrialisation should also be included here. These may challenge more able students to consider not just an absence of water as an issue, but also its misuse as a reason why some emerging or developing countries do not have enough clean water for their people.

## Useful resources

Water Aid website – improving supplies for lower income countries:

<http://www.wateraid.org/uk/what-we-do/our-approach>

Managing water usage in lower income countries:

[http://www.bbc.co.uk/schools/gcsebitesize/geography/water\\_rivers/water\\_usage\\_rev5.shtml](http://www.bbc.co.uk/schools/gcsebitesize/geography/water_rivers/water_usage_rev5.shtml)

India case study website – informative image and text relating to consumption and shortage: <https://akshar100.wordpress.com/2013/03/29/a-dry-holi-for-what/>

World areas of water stress:

<https://safewaters.wordpress.com/2010/09/29/human-rights-water-map-shows-billions-at-risk-of-water-insecurity/>

Nile case study website – Nile basin ‘jumping off point’ with links and information to all aspects of water usage from the Nile: <http://www.nilebasin-knowledgemap.com/>

Disputes relating to the Nile’s water usage:

<http://www.futuredirections.org.au/publication/conflict-on-the-nile-the-future-of-transboundary-water-disputes-over-the-world-s-longest-river/>

Text-based information source – quite complex language, would suit use by teachers or more able students: <https://www.unesco-ihe.org/stories/networking-nile>

## Guidance on teaching

### 6.10b

In order to see how unclean water may be the only option for some people, students should look at population pressures on desert fringes, or population density close to large industrial areas – both of which are major issues for water availability/clean water. A well chosen example that links to previous learning will ensure that students can build on their knowledge. Students will be able to consider water supply in rural and urban areas, and more able students may be able to compare these. An infographic such as the links below may be a good starting point for less able students, as a range of reasons are considered in a succinct fashion.

India: <https://akshar100.files.wordpress.com/2013/03/screen-shot-2013-03-28-at-1-17-19-pm.png>

Egypt: [http://www.tadamun.info/wp-content/uploads/2013/11/TAD\\_UI04\\_facts\\_about\\_access\\_to\\_water\\_in\\_egypt\\_EN.png](http://www.tadamun.info/wp-content/uploads/2013/11/TAD_UI04_facts_about_access_to_water_in_egypt_EN.png)

## Lesson 8: How technology (desalination) can resolve water-resource shortages

### Overview

This is a Boserupian-style approach to managing water shortages (necessity is the mother of invention) and therefore students should be considering how we can alleviate shortages by thinking of alternative technological ways to gain water.

### Key concepts and processes

Desalination is an expensive process which is often used by nations that are very short of water but have wealth by other means (such as Iran using its oil wealth to desalinate sea water for consumption as fresh water is scarce). Many students will not be aware of its use on a large scale, although they may be aware of its possibility from science lessons.

Students should be made aware of the process and possibility of using desalination to combat water shortages.

### Useful resources

A company website with useful graphics and modern forward thinking as to how to use technology to solve water-shortage problems:

<http://www.acquainnovations.com/corporate/>

Look at sections 5 and 6 to show desalination and its potential costs:

<http://www.bbc.co.uk/guides/z3qdd2p>

### Guidance on teaching

#### 6.11b

As students may be new to this concept, a simple graphic such as the one in section 5 of <http://www.bbc.co.uk/guides/z3qdd2p#zyj887h> may be helpful in describing the process of desalination.

Students could then use Gapminder to look at countries that use desalination, how use over time has changed and grown and how much it is used. More able students could look at the pros and cons of its use, including costs (financial and environmental). (In gapminder: <https://www.gapminder.org/world/> choose water/desalination.)

## Lesson 9: How attitudes to the exploitation and consumption of water resources vary with different stakeholders (individuals, organisations and governments)

### Overview

Students need to be aware that there are differing views on how to manage water consumption both nationally and globally, and that there is a balance between the social, economic, environmental and political aspects of water management.

This could be linked/nested into the case studies in Topic 4 if desired.

### Key concepts and processes

Stakeholders hold differing views at local, national and global levels when considering how to manage water exploitation and consumption. Students need to understand what governments (local, regional and national) and types of organisations are (industries, charities, global institutions like the UN, trade agreements like the EU), their role and purpose, so they are able to apply their attitudes to water consumption and exploitation. An understanding of how the EU and UN (and other institutions) interact with governments, charities and companies would also be useful for students to be able to apply this knowledge to a particular scenario. More able students may also be able to consider the power dynamic and some of the geopolitics of these interactions, however this is not a requirement so could be omitted to make this more focused for less able students.

### Useful resources

Water charity that provide wells – all the website is useful:

<https://www.water4.org/resources/videos/> and <https://www.water4.org/get-involved/you/water4more/>

A nice water footprint activity, although you will have to choose your US state (it may be worth telling students to all use the same one so you get a comparable response): <http://gracelinks.org/blog/1284/we-re-all-water-stakeholders> and <http://www.gracelinks.org/1408/water-footprint-calculator>

UN website – good maps and stats:

<http://www.un.org/waterforlifedecade/scarcity.shtml>

Water Aid – charity: <http://www.wateraid.org/uk/what-we-do/our-approach>

Global water thinktank focused on sustainable water use:

<http://pacinst.org/issues/sustainable-water-management-local-to-global/>

Water footprints of differing products: <http://gracelinks.org/1394/water-issues>

LEDCs and appropriate technology:

[http://www.bbc.co.uk/schools/gcsebitesize/geography/water\\_rivers/water\\_usage\\_rev5.shtml](http://www.bbc.co.uk/schools/gcsebitesize/geography/water_rivers/water_usage_rev5.shtml)

UK teacher resource as government water strategy – requires proficient readers:

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/69346/pb13562-future-water-080204.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69346/pb13562-future-water-080204.pdf)

TNCs and water bottling:

[http://www.discover.ltd.uk/downloads/examples/GlobalisationTNCsandBottledWaterWJEC\\_2009.pdf](http://www.discover.ltd.uk/downloads/examples/GlobalisationTNCsandBottledWaterWJEC_2009.pdf)

TNCs and Europe water bottling – proficient readers or teachers only:

<http://archive.corporateeurope.org/water/infobrief1.htm>

Walkers crisps production efficiency:

<http://scotland.lovefoodhatewaste.com/node/3820> including video

Different Nile stakeholders: <http://www.nilebasin-knowledgemap.com/> and

<https://www.unesco-ihe.org/stories/networking-nile>

## Guidance on teaching

### 6.11a

A suitable starter would be to consider areas of the world that suffer from water scarcity, based on a map such as 'Global physical and economic water scarcity' from <http://www.un.org/waterforlifedecade/scarcity.shtml>

Students need to be able to see the difference in approaches and to appreciate why different stakeholders hold their views. This could be achieved by looking at some well-chosen scenario-based located examples through a role-play strategy where students look at exploitation/consumption from the viewpoint of: a local person, a UK resident, the UK foreign minister, a senior manager of the TNC operating in the area, a representative from the UN, a representative from Water Aid and a person from the government of the country in which it is situated.

Students can also create their own view of how they feel about water management, consumption and exploitation.

To increase the challenge of this activity, students could rank the stakeholders in order according to who they believe holds the most power and consequently is most likely to be tasked with making decisions, and what impact this is likely to have on the locality. This structure could also be used in Lesson 10, as these lessons could be linked using the same stakeholders to look at management and sustainable use of water resources.

## **Lesson 10: Why water resources require sustainable management and how different views held by individuals, organisations and governments impact on the management and sustainable use of water resources**

### **Overview**

This lesson relates directly to 6.11a, as stakeholders are a common theme within this learning. Students need to be aware of the need to sustainably manage water, and should be familiar with different stakeholders' views about what sustainable use and management is. They should appreciate why views differ depending on social, environmental, political and economic factors.

## Key concepts and processes

Students should initially learn the Key ideas relating to sustainability and management of a resource. They should understand how sustainable management protects present and future use and why this is vital for water resource management. Students may consider the concept of what will happen if a location runs out of water (conflict, forced migration and refugees, etc).

## Useful resources

See Lesson 9 above.

## Guidance on teaching

### 6.12a and b

Students should try to create a definition for management and sustainability before looking at some accepted definitions and identifying whether they are useful when applied to water management and sustainability.

Students could use this image:

<https://thebrightestman.wikispaces.com/file/view/2007-627P-water-price-scale.jpg/76034627/256x264/2007-627P-water-price-scale.jpg> to consider how increasing cost could be one element of managing water use and making it sustainable. More able students could consider whether this is a sensible strategy in light of who is most likely to be able to afford the additional costs, and the consequences related to this. Less able students could focus more on other strategies that may be sustainable to make water management more effective.

Students could then maintain their roles from Lesson 9 to consider whether sustainability is high on each person's agenda; more able students could consider how much sway each stakeholder may have in projecting and implementing their views.

All students should be able to select groups that are likely to be more/less sympathetic to sustainable management, and why these views are held.

Students could revisit the ideas of management and sustainability in the plenary.

## Lesson 11: How one developed country has attempted to manage its water resources in a sustainable way.

### Overview

Students need to look at case-specific strategies that have been used in a developed country to create sustainable management of water as a resource. There is no requirement to use the UK, but this may be easy to nest into other case studies used within other units and follows on from 6.10a.

## Key concepts and processes

Students should look at a range of strategies relating to reducing wastage of water and ensuring that water is moved to the correct location as required. They should understand the concept of using a reservoir to store water for future use. A range of spatial strategies should be considered relating to national policy and how governments persuade people to use less water, regional management and local/individual choices. Ideas such as water meters, hosepipe bans and agricultural management systems for irrigation are some of the possibilities. If a large country is chosen, regional disparities could also be a focus.

All students should consider:

- the demand for water for labour-saving devices
- the impact of a throw-away society on demand for water in developed nations
- whether they personally are likely to change their water use (cut shower times, have fewer baths, use greywater, etc.).

## Useful resources

EU water statistics and graphs, plus a lot of background information as text: [http://ec.europa.eu/eurostat/statistics-explained/index.php/Water\\_statistics](http://ec.europa.eu/eurostat/statistics-explained/index.php/Water_statistics)

RGS Water policy in the UK – the challenges:

[https://www.rgs.org/NR/rdonlyres/4D9A57E4-A053-47DC-9A76-BDBEF0EA0F5C/0/RGSIBGPolicyDocumentWater\\_732pp.pdf](https://www.rgs.org/NR/rdonlyres/4D9A57E4-A053-47DC-9A76-BDBEF0EA0F5C/0/RGSIBGPolicyDocumentWater_732pp.pdf)

UK – the government’s water strategy for England – a little dated but split into manageable text chunks which are numbered for ease of reference:

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/69346/pb13562-future-water-080204.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69346/pb13562-future-water-080204.pdf)

Sustainable water use in farming: <http://www.leafuk.org/leaf/farmers/ssw.eb>

Greywater recycling: <http://thegreenhome.co.uk/heating-renewables/rainwater-harvesting/what-is-grey-water-recycling/>

## Guidance on teaching

### 6.12c

Students could use ‘The UK’s Water Footprint’ diagram from <http://www.igd.com/Research/Sustainability/National-water-footprints/> to ascertain the need for sustainable management of water and how imports mean that a wider group of people/other regions’ water contribute to UK water use than may be initially apparent.

Students could use examples of a dam project, an agricultural project and domestic measures to collate case study-based information using jigsaw group work with teacher-created resource packs for less able students or for those without access to ICT facilities.

More able students could research their own case studies within parameters (dam and pipeline projects, stopping water-wastage initiatives, the role of greywater, etc.) to ensure relevant information is collated.

## Lesson 12: How one emerging or developing country has attempted to manage its water resources in a sustainable way

### Overview

Students need to look at case-specific strategies that have been used in a developing/emerging country to create sustainable management of water as a resource.

There is no requirement to use case studies that have been taught in other areas of the specification, but this may suit some students, particularly less able students, as it favours lower content, so more time can be allocated to skills/elsewhere.

### Key concepts and processes

Students should look at a range of strategies relating to reducing wastage of water and water cleanliness. Attention could be paid to the population increase and/or the role of industrialisation and how this has impacted on water supplies in terms of demand and water quality. The case study selected will determine the types of projects selected, but a range of scales are required to meet the 6.12 requirements.

### Useful resources

Management of water uses in LEDCs:

[http://www.bbc.co.uk/schools/gcsebitesize/geography/water\\_rivers/water\\_usage\\_rev5.shtml](http://www.bbc.co.uk/schools/gcsebitesize/geography/water_rivers/water_usage_rev5.shtml)

Charity website explaining how water can be provided in lower-income countries:

<http://www.wateraid.org/uk/what-we-do/our-approach>

India case study material: [http://www.wateraid.org/uk/where-we-work/page/india?id=UN0000,RA/TPG,Online,RA/TPG/01A&gclid=CjwKEAjwn7e8BRCUqZiP\\_vnrtBkSJAC\\_lp4HWf8RmKZkR-48rec5ktDI3yFjWtIzgwAkm-S6febSghoCQwLw\\_wcB&gclsrc=aw.ds](http://www.wateraid.org/uk/where-we-work/page/india?id=UN0000,RA/TPG,Online,RA/TPG/01A&gclid=CjwKEAjwn7e8BRCUqZiP_vnrtBkSJAC_lp4HWf8RmKZkR-48rec5ktDI3yFjWtIzgwAkm-S6febSghoCQwLw_wcB&gclsrc=aw.ds)

Urban water management in India:

<http://www.waterworld.com/articles/wwi/print/volume-30/issue-2/technology-case-studies/urban-water-management-in-india.html>

A collection of resources relating to India's water management issues:

<http://www.iwmi.cgiar.org/2013/06/indias-water-future-global-challenges-and-local-solutions/>

Nagpur's smart water management: <http://www.hindustantimes.com/real-estate/nagpur-s-smart-water-management-is-an-example-for-other-cities-across-india/story-FcNySvOjIMY9GVsMPqN2rL.html>

Teacher resource – in-depth text articles:

<http://www.eastasiaforum.org/2011/02/08/indias-water-management-challenge/>  
and

<http://www.eastasiaforum.org/2014/02/20/how-can-asia-protect-its-water-resources/>

India's water crisis – teacher resource as requires very proficient readers:

<http://www.nbr.org/research/activity.aspx?id=356>

Other

WWF sustainable water management strategies:

[http://www.wwf.org.uk/what\\_we\\_do/making\\_the\\_links/livelihoods\\_and\\_natural\\_resources/sustainable\\_water\\_management.cfm](http://www.wwf.org.uk/what_we_do/making_the_links/livelihoods_and_natural_resources/sustainable_water_management.cfm)

Pakistan's water woes – proficient readers/teachers only:

<http://www.eastasiaforum.org/2013/09/12/pakistans-water-woes/>

One Drop charity water management and sustainability – look at the Projects tab for specific examples by project/country: [https://www.onedrop.org/en/news-event/water-management-and-sustainability/?gclid=CjwKEAjwn7e8BRCUqZiP\\_vnrtBkSJAC\\_lp4HI1uNcx6Xj-Vy6O3WeI1nL-00dSSgKIg6Ys8hzsFpchoCosrw\\_wcB](https://www.onedrop.org/en/news-event/water-management-and-sustainability/?gclid=CjwKEAjwn7e8BRCUqZiP_vnrtBkSJAC_lp4HI1uNcx6Xj-Vy6O3WeI1nL-00dSSgKIg6Ys8hzsFpchoCosrw_wcB)

## Guidance on teaching

### 6.12c

Whether the students think the country you are studying is likely to become water scarce in the future may depend on whether an emerging or developing economy has been selected. You could ask students to suggest which they think it will be and to justify their reasons. (It could also relate to location, of course!) Students could then use examples of a large-scale project (possibly a dam project), an agricultural project (possibly small-scale relating to aid) and domestic measures (relating to water safety) to collate case-study-based information using jigsaw group work with teacher-created resource packs for less able students or for those without access to ICT facilities.

More able students could research their own case studies within parameters (dam projects, aid, water safety, appropriate technology, etc.) to ensure relevant information is collated.

## Key vocabulary for Topic 6B

Agriculture	Necessity
Aquifer	Overpopulation
Availability	Pollution
Choropleth	Population
Composition	Production
Consumption	Proportion
Continuous	Rainwater harvesting
Dam	Reservoir
Deficit	Resource
Demand	Saline/Salt water
Desert	Sprinkler systems
Desertification	Seasonal
Development	Stakeholder
Domestic/Municipal	Supply
Disease	Surplus
Emerging country	Sustainable
Exploitation	Technology



Groundwater	Vector-borne disease
Hippo bags	Water-borne disease
Luxury	Water meters
Industry	Water scarcity
Infrastructure	Water stress
Intervention	Water surplus
Management	

### **Overview of assessment**

This topic is examined in Component Two, Section C and the question is worth 30 (+4 SPGST) marks (from a total of 90 + 4 SPGST) and should take approximately 30 minutes to complete.