

**Edexcel GCE**

# **Geography**

**Advanced**

**Unit 3: Contested Planet**

**ADVANCE INFORMATION**

January 2012

Paper Reference

**6GE03/01**

## **Information**

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## SECTION B

The following resources relate to Question 6.

### THE TECHNOLOGICAL FIX?

#### SCANDINAVIA: MOST ADVANCED PART OF THE PLANET?

Scandinavia consists of the three countries of Denmark, Norway and Sweden. All three countries are parliamentary democracies and constitutional monarchies. They share the 'continental Scandinavian' language meaning that the Norwegian, Swedish and Danish languages are very similar. Sweden and Denmark are EU members and Norway is a member of the EFTA. Norway has twice voted in referendums not to join the EU. All three countries rank very highly on almost any measure of **development** (Figure 1).

**Figure 1: World rank for three development measures**

	UN Human Development Index 2009	Economist Democracy Index 2008	World Bank GDP per capita PPP 2008
<b>Sweden</b>	7th	1st	11th
<b>Denmark</b>	16th	5th	13th
<b>Norway</b>	1st	2nd	2nd

In 2007 the New Economics Foundation (NEF) published its **Happy Planet Index** (HPI) for 30 countries in Europe (Figure 2). The HPI combines measures of life satisfaction and life expectancy with data on carbon footprints in order to assess the degree to which countries achieve high human well-being without excessive resource consumption:

$$\text{HPI} = \frac{\text{Life expectancy} + \text{life satisfaction}}{\text{Carbon footprint}}$$

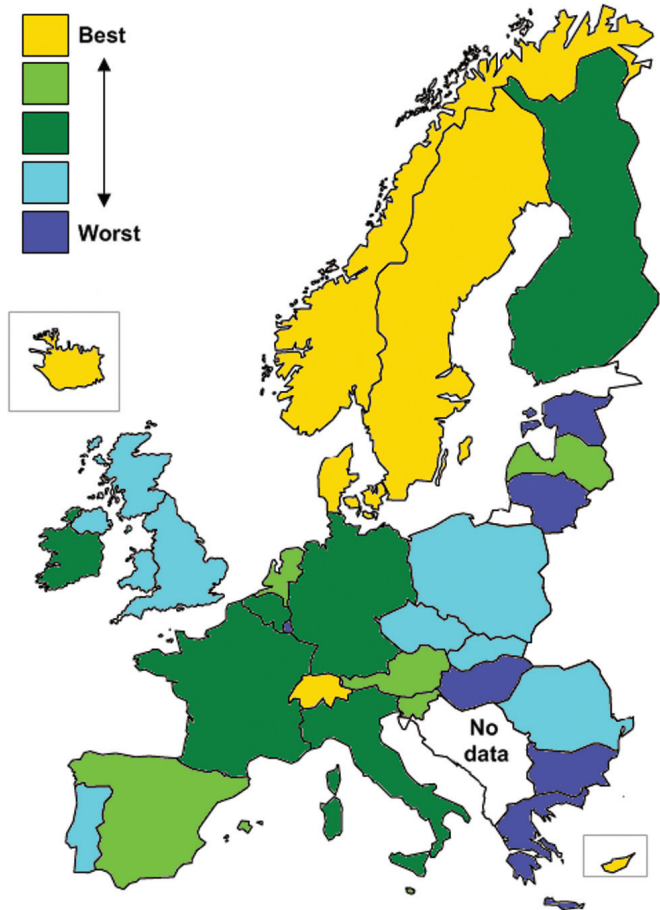
The three Scandinavian countries were ranked 2nd, 3rd and 6th in Europe.

Scandinavian countries have high levels of **ICT usage** and are very **connected**. Figure 3 shows the high scores achieved as measured by the World Economic Forum's NRI in 2009.

The NRI measures how well a country is positioned to take advantage of economic opportunities from ICT.

In 2009 internet penetration in Scandinavia was; 84% in Denmark, 91% in Norway and 89% in Sweden (the average for Europe was 56% and for the world, 27%).

**Figure 2: 2007 HPI for Europe**



**Figure 3: Network Readiness Index (NRI), 2009**

Country/ Economy	Rank	Score
<b>Sweden</b>	<b>1</b>	<b>5.65</b>
Singapore	2	5.64
Denmark	3	5.54
Switzerland	4	5.48
United States	5	5.46
Finland	6	5.44
Canada	7	5.36
Hong Kong SAR	8	5.33
Netherlands	9	5.32
Norway	10	5.22

(Source: WEF, The Global Information Technology Report 2009–2010)

**Education** levels in Scandinavia are high (Figure 4), as are levels of investment in education. Figure 5 shows how the Scandinavian countries compare in terms of spending on **research and development** and the number of new patent filings made in 2006–07.

**Figure 4: Education in Scandinavia**

% of GDP spent on education		Population of 25–64 year olds in 2007 educated to:		
		Below upper secondary level	Upper secondary level	Tertiary level
Denmark	4.3	24	43	33
Norway	3.7	21	45	34
Sweden	4.1	16	52	32
EU average	3.5	29	46	25
OECD average	3.6	30	44	26

(Source: OECD key education stats 2010)

**Figure 5: Research & Development (R&D)**

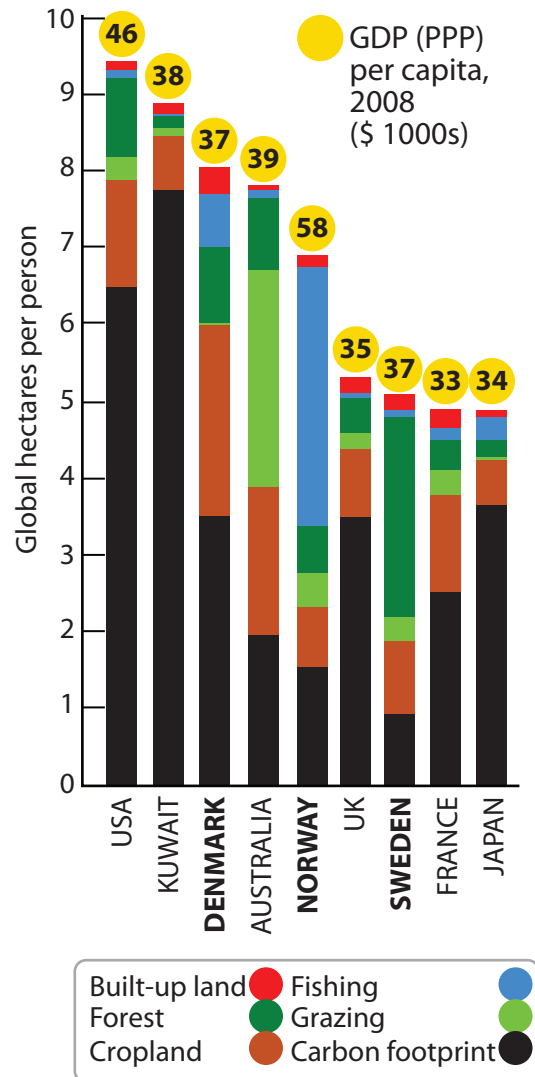
2006/07 data	Spending on R&D		Resident patent filings	
	% of GDP	Rank	Per million people	Rank
Denmark	2.6	9th	304	8th
Norway	1.7	18th	270	11th
Sweden	3.7	2nd	276	10th
Average*	1.2	–	186	–

(Source: WIPO website; \*62 reporting countries)

Not surprisingly, given the wealth and level of development in Scandinavia, **resource consumption** is high. Figure 6 shows the **ecological footprint** and its components for 2005. Total footprint levels are similar for the three countries although components differ, e.g. Sweden’s high forest component, Norway’s fishing and Denmark’s cropland. This reflects the importance of different industries within each country.

Scandinavia is often said to have made significant progress towards reducing the **negative externalities** of intensive use of technology. Scandinavia was among the first areas of the world to introduce **carbon taxes**:

**Figure 6: Ecological footprints and GDP compared for 9 developed nations**



- **Denmark** – 1992; set at about \$18 per tonne.
- **Sweden** – 1991; on all fossil fuels and some energy intensive industries at about \$37 per tonne.
- **Norway** – 1991; now covering over 60% of carbon dioxide emissions including those emitted through the production of oil and gas. The carbon tax amounts to around \$50 per tonne.

**Energy use** across the region is varied, as shown in Figure 7. Norway has large oil and gas reserves which are not present in Sweden or Denmark. Only Sweden uses nuclear power. Renewable energy use tends to be closely related to physical geography within each country.

**Figure 7: Primary energy technologies**

% of primary energy use	Norway	Sweden	Denmark	Europe average
<b>Gas</b>	16	2	21	25
<b>Oil</b>	34	26	38	35
<b>Coal</b>	3	5	23	18
<b>Nuclear</b>	–	35	–	13
<b>HEP</b>	42	11	–	2
<b>Other renewable</b>	5	21	18	7

(Source: 2009 data from IEA)

The **tax regime** in Scandinavia means that petrol and diesel are very expensive compared to the USA and some other European countries (Figure 8). Electric cars, such as the Think electric car produced by Norwegian company Think Global, can use bus lanes, qualify for free parking and are exempt from road tax and road tolls.

**Figure 8: Price of diesel and petrol compared**

US cents/ litre	Petrol	Diesel
<b>Denmark</b>	154	154
<b>Sweden</b>	138	152
<b>Norway</b>	163	163
USA	56	78
Spain	123	128

(Source: www.gtz.de, Nov 2008)

Figure 9 compares the **carbon intensity** of a number of national economies and might be seen as providing some evidence of **decoupling** economic growth from pollution for some nations.

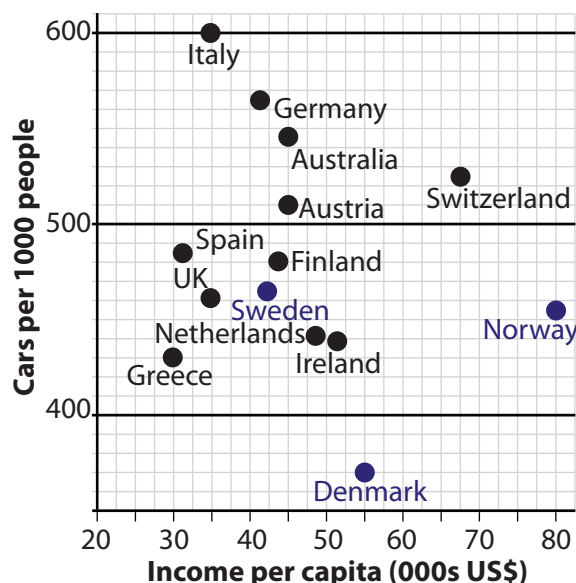
**Figure 9: GDP (\$) per tonne of carbon dioxide emitted (2006)**

Switzerland	9,300	UK	4,300
<b>Norway</b>	<b>8,400</b>	EU average	3,700
<b>Sweden</b>	<b>7,700</b>	Germany	3,600
France	5,900	Japan	3,400
<b>Denmark</b>	<b>5,100</b>	Brazil	3,100

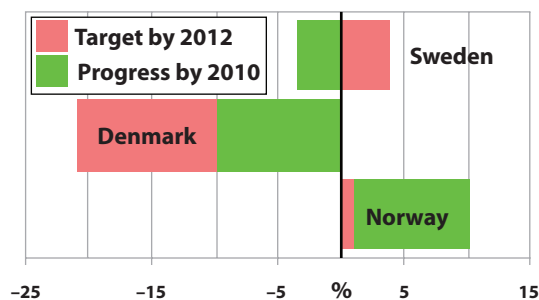
(Source: IEA, 2006)

Figure 10 compares income per capita with car ownership for a range of countries in the developed world. The three Scandinavian countries were all signatories to the 1997 **Kyoto Protocol** and progress towards their national goals is shown in Figure 11.

**Figure 10: The relationship of car ownership to income per capita (2007/08 data; nominal GDP)**



**Figure 11: Progress by 2010 towards the 2012 Kyoto Protocol emissions targets**



Scandinavia has many TNCs although they tend to be relatively small by global standards. Many of these corporations focus on **hi-tech products and services**, and are often leaders in their field (Figure 12).

**Figure 12: Two technological leaders in Scandinavian industry**

**Volvo Cars (Sweden)**

**20,000 employees in 2010**

For decades Volvo has been at the forefront of vehicle safety technology, introducing laminated safety windscreen glass in 1944, inventing the three-point safety belt which became standard on all Volvo cars in 1959 and developing SIPS in 1991.

**Vestas (Denmark)**

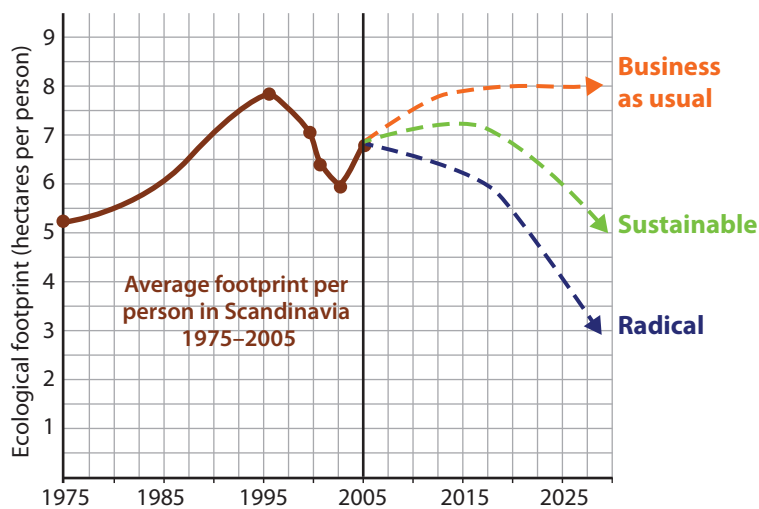
**21,000 employees in 2010**

The world's largest manufacturer of wind turbines. It built its first wind turbine in 1979. It had a turnover of over \$6.6 billion in 2009 and has installed over 40,000 wind turbines worldwide. It has been at the forefront of developing large 3MW turbines.

**Figure 13: Three ecological footprint scenarios and three technologies**

### Carbon Capture and Storage technology (CCS), Norway

- In 1996 the world's first operational CCS opened in the **Sleipner West** North Sea gas field off the Norwegian coast. It is operated by Norwegian company **Statoil**. Between 1996 and 2008 11 million tonnes of carbon dioxide, a by-product of natural gas extraction, was pumped into the porous sandstone Utsira formation.
- In 2009 Statoil also began building a carbon technology centre at its oil refinery in Mongstad, with a capacity to capture 100,000 tonnes of flue gas carbon dioxide each year. This facility is designed to act as a test bed for further research into CCS and could eventually be up-scaled to capture 1.5 million tonnes per year.



### Urban transport technology in Copenhagen, Denmark

- Copenhagen has about 350km of cycle paths and 20km of cycle lanes, plus over 40km of green cycle routes (with a further 60km+ planned). It costs \$1.5 million to build 1km of cycle path compared to \$160 million to build 1km of metro or \$17.6 million for 1km of motorway. 37% of people working or studying in Copenhagen cycle, clocking up over 1 million cycled kilometres per day. Traffic lights are co-ordinated to favour cyclists (called 'green waves') and all taxis have bike racks. Bikes can be taken on Copenhagen's metro and trains.
- Copenhagen has a relatively new driverless Metro system, opened in 2002, with two lines. A third 'circle' line called the Cityringen is being constructed at a cost of \$2.9 billion and is due to open in 2018.

### Biogas technology Gothenberg, Sweden

- GoBiGas is a project underway in Gothenberg run by the municipality owned company Göteborg Energi.
- The company already runs a district heating network in the city which supplies heat (via 1000 km of pipes) to 90% of all apartment blocks and is being expanded to supply single family homes.
- The GoBiGas plant aims to replace imported Danish natural gas with biomethane through the gasification of forestry waste (roots, branches, leaves).
- The plant is expected to have an overall energy efficiency of 90%. Construction is planned to take place between 2012 and 2016. Costs are estimated at \$32 million+ and the project may attract some EU funding.

## Views on Scandinavia

### View 1:

"One of Norway's flagship CCS projects is run by the state-owned gas company, Gassco. But it has revealed that the estimated costs have rocketed from \$0.7 billion in 2007 to \$1.9 billion now. *'The CCS costs are big and higher than we initially thought,'* said Sigve Apeland from Gassco. The company is trying to capture, transport and store 1.1 million tonnes of carbon dioxide a year from the Naturkraft gas-fired power plant at Kårstø. Gassco told the environment company, ENDS, that the escalating costs were mostly due to the difficulties of actually capturing the carbon. It is a process that absorbs a lot of energy, which makes it expensive."

**The Herald, Scotland, May 2010**

### View 2:

"Humanity slides into the red today and begins racking up an ecological overdraft driven by unsustainable exploitation of the world's resources, according to a report by the sustainable development organisation, Global Footprint Network. In little more than nine months, humans have used up all that nature can replenish in one year, and for the rest of 2006 are destined to eat into the planet's ecological capital, the study claims."

**The Guardian, October 9th 2006**

### View 3:

"Given that over 60% of global greenhouse gas (GHG) emissions come from the energy sector, increased access to energy must be coupled with a transition from carbon-intensive to low-carbon energy systems."

**UNCTAD Report, 2010**

### View 4:

"More humane societies are usually smaller, like the Scandinavian countries and Holland. In such countries, it is often much easier to reach consensus and cooperation. They often find it easier to implement new and innovative technologies."

**An American economist**

### View 5:

"Sweden recently declared that it will create an energy and transportation economy that runs free of oil by the year 2020. The groundwork for this radical declaration was laid in the 1980s by Sweden's eco-municipality movement, which successfully incorporated sustainability into municipal planning and development. Before former Norwegian Prime Minister Gro Harlem Brundtland became a household name in international environmental circles, Sweden was stimulating local economic growth in ways that were good for people and the planet. The town of Overtornea – Sweden's first eco-municipality, – was an early adopter of what we now call sustainable development, which *'meets the needs of the present without compromising the ability of future generations to meet their own needs.'*"

**CityMayors website**

### Websites for further research:

The New Economics Foundation website contains details of the HPI.

<http://www.happyplanetindex.org/>

The WWF website can be used to access the current, and past, Living Planet reports.

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

The website of Copenhagen city, which is in English, and contains details of transport in the city.

<http://www.kk.dk/>

The website of Statoil

<http://www.statoil.com/>

The website of Göteborg Energi

<http://www.goteborgenergi.se>

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