



General Certificate of Education
Advanced Subsidiary Examination
June 2010

General Studies (Specification A)

GENA2

Unit 2 AS Science and Society

Source Booklet

Source for use with **Questions 1.1 to 1.30.**

Section A

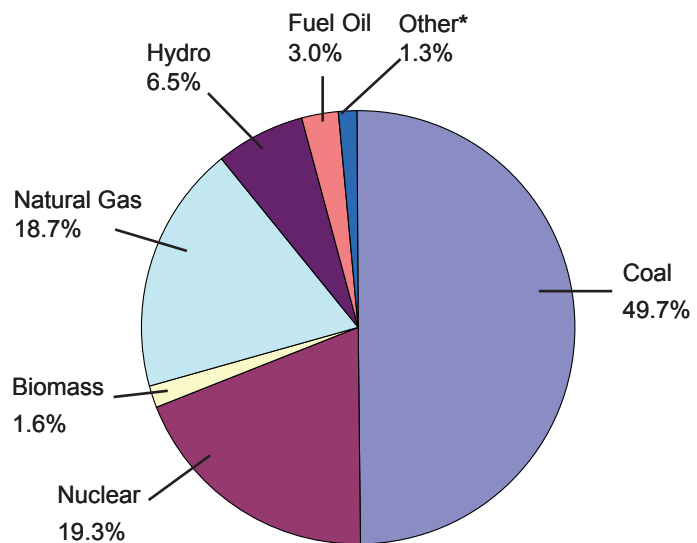
Source for **Questions 1.1 to 1.30**

Nuclear renaissance in the USA?

(1) The first nuclear reactor, in 1951, produced enough electric power from splitting the atom to illuminate four light bulbs. Today 103 commercial nuclear power plants in 31 states across the USA produce approximately 20% of the electricity used in the United States. That percentage is going to increase as more new reactors are in the planning process. Many say that we are entering a nuclear renaissance.

(2) The increasing interest in nuclear power is underscored by the fact that George W. Bush was the most pro-nuclear power president in two decades. He cautioned against US dependency on foreign energy in his State of the Union address in both 2006 and 2007. He introduced the Advanced Energy Initiative which, among other things, set up a Global Nuclear Energy Partnership under the Department of Energy (DOE). It was intended to not only reduce America's dependence on foreign fossil fuels but also encourage emissions-free nuclear energy world wide. The DOE is seeking to develop new technologies to recycle nuclear fuel, minimise waste and keep nuclear fuels out of the hands of terrorists.

Figure 1: Electric companies use a diverse mix of fuels to generate electricity



*Other includes generation by agricultural waste, batteries, chemicals, geothermal, hydrogen, landfill gas recovery, municipal solid waste, non-wood waste, pitch, purchased steam, solar, sulfur, wind and wood.

(3) The Energy Policy Act of 2005 included a number of incentives for nuclear facilities including loan guarantees for low-emission energy production technology like nuclear power. The Nuclear Power 2010 programme brings together government and industry to identify sites for new nuclear power plants, develop standards for plant designs and promote a streamlined regulatory process. To help further this process, the Standby Support programme – part of the Nuclear Power 2010 programme – helps plants to adopt new reactor designs by shepherding them through the often complicated regulatory and litigation process.

(4) In the United States the resurgence of nuclear power focuses primarily on the licensing of new facilities and to a much lesser degree on the reactor design. In the US it is cheaper to produce new fuel rods and dispose of the old rods. Other countries, however, view all spent fuel as a resource and not waste. France, England, Russia and Japan all recycle – or reprocess – their spent fuel rods to get the most out of them and to cut down on dangerous waste.

(5) DOE's partnership project is designed to encourage new technology to effectively and safely recycle spent nuclear fuel without producing separated plutonium. The idea is to extract more energy from nuclear fuel, reduce the amount of waste that requires permanent disposal and greatly reduce the risk of nuclear proliferation.

Improvements have been made

(6) Not all agree that nuclear energy is America's answer to foreign energy dependency. Many point to radioactive disasters such as Three Mile Island and Chernobyl as reasons to look to other sources of energy. Yet while Three Mile Island was the most serious nuclear accident in the United States to date, no radiation escaped from the containment building. Several positive changes resulted, including improved safety systems and new industry-wide regulations.

(7) Most do agree, however, that meeting the current and future energy needs in the United States is approaching a crisis. The demand for energy is expected to jump by 50% in the next 25 years. Some experts say the United States will have to import 65% of its oil and 30% of its gas by 2015. Domestically, fossil fuels will get harder to extract and will be located far from where they are needed. A limited foreign oil supply and competition from growing needs in China and India will make it more difficult and more expensive to depend on foreign imports. At the same time, there is an increasing demand for clean energy. Individual states are implementing stricter environmental and air quality standards and the federal government is expected to do the same.

(8) Nuclear energy is a possible solution to this growing dilemma. As a clean energy source, it meets environmental standards. It is cheaper than coal, and development costs for a nuclear plant are less than that of a coal plant. One nuclear power station in Arizona generates more electricity annually than any other US power plant of any kind. The three-unit 3875-megawatt nuclear plant produced 25.8 million megawatt-hours of electricity in 2005, enough for 4 million homes.

(9) In 2005, the state of Vermont generated the greatest percentage – 72% – of its electricity from nuclear energy of any state. New Jersey and South Carolina generated more than half of their electricity from nuclear energy, while Connecticut and Illinois were around the 50% mark.

(10) Why is nuclear energy so popular? For starters, of all energy sources nuclear power has the lowest impact on the environment, including water, land, habitat, species and air resources. Nuclear energy is also eco-efficient – producing the most electricity in relation to its environmental impact.

(11) Nuclear energy is the world's largest source of emission-free energy. It produces no controlled air pollutants, such as sulfur and particulates, or greenhouse gases. The use of nuclear energy in place of other energy sources helps keep the air clean, preserves the Earth's climate, avoids ground-level ozone formation and reduces acid rain. In 2005, US nuclear plants prevented 3.32 million tons of sulfur dioxide, 1.05 million tons of nitrogen oxide and 681.9 million metric tons of carbon dioxide from entering the Earth's atmosphere.

(12) Nuclear power plants were responsible for more than a third of the total voluntary reductions in greenhouse gas emissions reported by US companies in 2004 according to the Energy Information Administration. Emission reductions from using nuclear energy amounted to 143 million metric tons of carbon dioxide, 36% of the total carbon dioxide equivalent reductions reported.

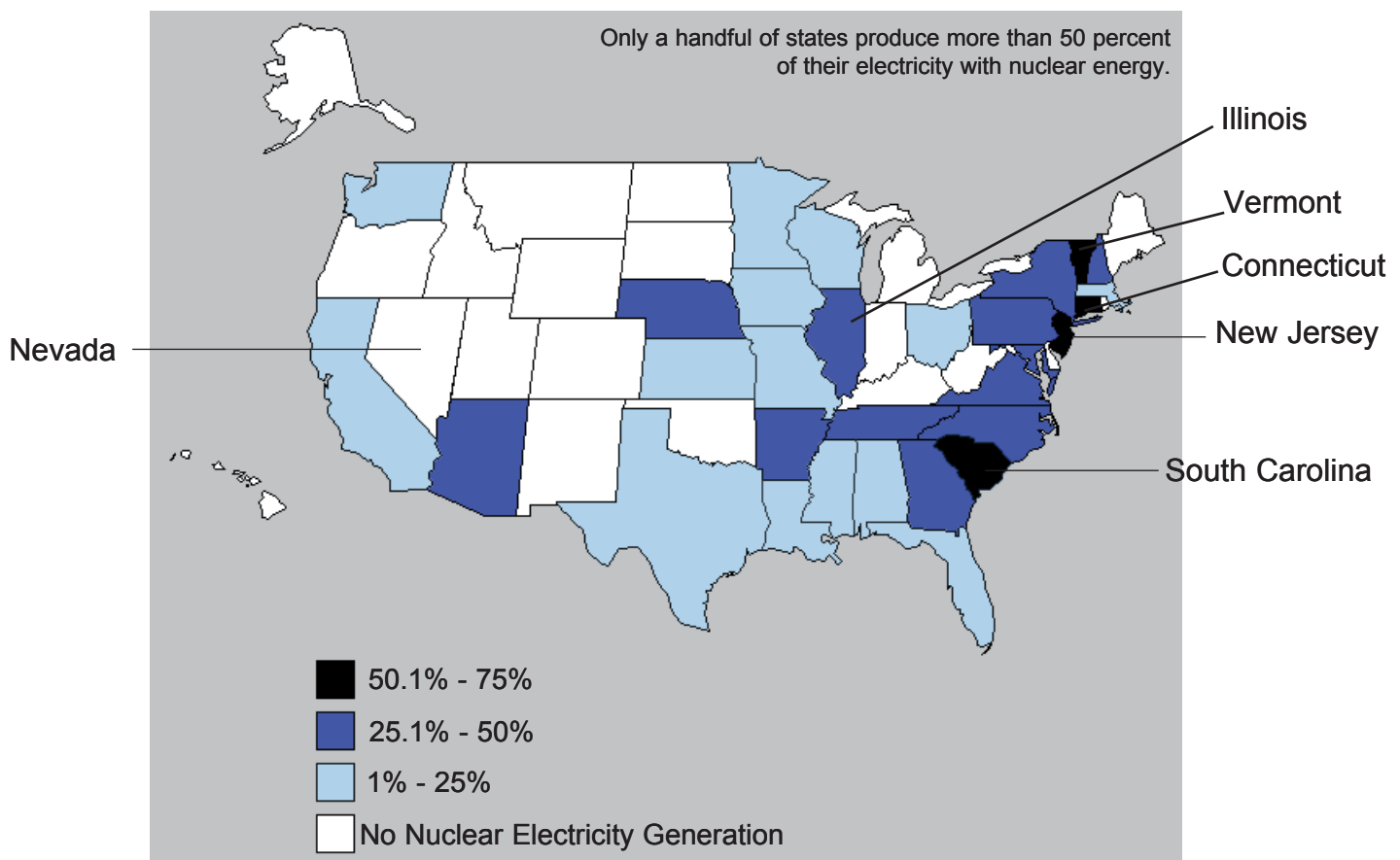
Turn over ►

Trouble in paradise?

(13) While nuclear generators don't emit pollutants, they do produce radioactive waste and have the potential to leak radiation. The operators, however, work hard to ensure that the waste is carefully contained, packaged and safely stored. Spent fuel generated from the production of electricity is currently stored onsite at nuclear power plants. Congress has approved Yucca Mountain, Nevada, as a geologic repository for the nation's high-level waste and spent nuclear fuel, but it is not expected to be opened until 2020. According to the DOE, Yucca Mountain will accommodate all the used commercial nuclear fuel that ever has been or will be generated by the country's nuclear power plants.

(14) With Yucca Mountain on the horizon, waste storage problems could be solved. Still, many question the placement of the site and whether it will ever meet all that is promised. Many in Nevada question the site of the repository because almost all present reactors are in the east, which means transporting dangerous waste across the country. They are also not convinced of the scientific suitability of Yucca Mountain.

Figure 2: Percentage of Nuclear Generated Energy, 2005



The bottom line

(15) While there continues to be some disagreement over the safety of nuclear power, the energy issues facing the United States are genuine. Energy experts agree that the United States needs to find a balanced mix of resources to lessen dependency on foreign oil. "If becoming independent from foreign oil truly is a national priority, we need to begin developing alternatives that will reduce our reliance on other nations" says New Mexico's Representative John Heaton. "Over the next 50 years, the gap between projected energy demand and projected energy production in the United States will need to be bridged. In order to remain competitive in the global economy, we will have to find a way to fill this shortfall."

A worldwide solution?

(16) Thirty countries, including the United States, operate more than 440 nuclear power reactors, producing 16% of the world's electricity. In 2007 there were 29 new nuclear power plants under construction in 12 other countries and 30 being proposed in the United States. Other countries are investing in nuclear power because they see it as an efficient, clean and cheap way to provide power to their citizens. France generates almost 80% of its electricity from nuclear power. Lithuania is close behind at nearly 70%. Slovakia, Belgium, Ukraine, Sweden, Republic of Korea, Bulgaria and Slovenia all generate about 50% of their electricity needs from nuclear power. In total 16 countries rely on nuclear energy to supply at least one-quarter of their total electricity.

Source: Adapted from 'Nuclear renaissance? Many are looking at nuclear energy as a solution to our energy needs and foreign oil dependency'. L SIKKEMA and M SAVAGE, *State Legislatures* 33.3, March 2007

Source of data for Figures 1 and 2: US Department of Energy: Energy Information Administration (EIA), 2005 data

Figure 1 image: CHRISTOPHER HAGER, Jupiter Images

END OF SOURCE

There are no sources printed on this page

There are no sources printed on this page

There are no sources printed on this page

ACKNOWLEDGEMENT OF COPYRIGHT-HOLDERS AND PUBLISHERS

Permission to reproduce all copyright material has been applied for. In some cases efforts to contact copyright-holders have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements in future if notified.

Copyright © 2010 AQA and its licensors. All rights reserved.

M/INSERT TO/June10/GENA2