# GEO.HU16 Sustainable Energy Use and Local Renewable Schemes

Total Marks

AQA 8035 · Calculators not allowed · about 40 minutes

Name: _____ Date: ____ / ____ / _____

**Answering guidance: Questions 8, 9 and 14 require full-sentence, extended responses. Total time suggested 40 minutes.**

**1** Define the term 'energy conservation' as used in household and community settings.

**(Total for Question 1 is 1 mark)**

---

**2** Define 'demand reduction' in the context of domestic energy use.

**(Total for Question 2 is 1 mark)**

---

**3** Describe how home insulation, for example loft insulation and cavity wall insulation, reduces household energy use.

**(Total for Question 3 is 2 marks)**

---

**4** Describe what is meant by an energy-efficient appliance and give one example relevant to kitchens.

**(Total for Question 4 is 2 marks)**

---

**5** Describe how a smart meter helps households to reduce energy demand.

**(Total for Question 5 is 2 marks)**

**6** Give TWO benefits of replacing incandescent bulbs with LED lighting in a household.

**(Total for Question 6 is 2 marks)**

---

**7** State TWO simple actions a household can take to reduce energy demand at home.

**(Total for Question 7 is 2 marks)**

---

**8** Explain two differences between large-scale renewable energy schemes such as a national wind farm and small local schemes such as community solar projects.

**(Total for Question 8 is 6 marks)**

---

**9** The Grameen Shakti solar home system programme in Bangladesh is a named example of a small-scale, appropriate renewable energy scheme. Describe the key features of Grameen Shakti's approach and explain how it improves energy access and local energy security in rural Bangladesh.

**(Total for Question 9 is 6 marks)**

**10** A household used 420 kWh of electricity in a year and after installing insulation and LEDs their use fell to 315 kWh. Calculate the percentage reduction in electricity use. Give your answer to one decimal place.

**(Total for Question 10 is 2 marks)**

---

**11** Explain TWO ways in which smart meters can help energy suppliers and consumers to reduce peak demand on the grid.

**(Total for Question 11 is 3 marks)**

---

**12** Give ONE environmental benefit of households switching from fossil-fuel heating to electric heating powered by renewable electricity.

**(Total for Question 12 is 1 mark)**

---

**13** Explain how loft insulation reduces heat loss from a house, referring to conduction and convection in your answer.

**(Total for Question 13 is 4 marks)**

**14** Assess the value of small-scale, sustainable energy schemes such as community solar or household biogas for improving local energy security in low-income rural areas.

**(Total for Question 14 is 6 marks)**

---

**15** Suggest ONE challenge that implementing a small-scale renewable energy scheme in a low-income country might face, and suggest ONE practical solution to that challenge.

**(Total for Question 15 is 2 marks)**

---

**16** Describe how community ownership and local management of a renewable scheme can improve its long-term sustainability.

**(Total for Question 16 is 2 marks)**

# Mark scheme · GEO.HU16 Sustainable Energy Use and Local Renewable Schemes

## Question 1

- **B1** reducing the amount of energy used by people or systems, for example by changing behaviour or using less energy, oe
- **Answer: Reducing the amount of energy used by people or systems, for example by changing behaviour or using less energy.**

## Question 2

- **B1** measures or actions that lower the peak or total amount of energy people need, oe
- **Answer: Measures or actions that lower the peak or total amount of energy people need.**

## Question 3

- **B1** insulation reduces heat loss through the roof and walls, keeping homes warmer for longer, oe
- **B1** this lowers the need for heating, so less energy is used and fuel bills fall, oe
- **Answer: Insulation reduces heat loss through the roof and walls, keeping homes warmer for longer; this lowers the need for heating so less energy is used and fuel bills fall.**

## Question 4

- **B1** an appliance that uses less energy to do the same job compared with an older or less efficient model, oe
- **B1** example, an A-rated refrigerator or an efficient induction hob, oe
- **Answer: An appliance that uses less energy to do the same job compared with older models; for example, an A-rated refrigerator or an efficient induction hob.**

## Question 5

- **B1** a smart meter shows real-time energy use, allowing households to see how much energy appliances use, oe
- **B1** this information encourages behaviour change, reducing waste and shifting use away from peak times, oe
- **Answer: A smart meter shows real-time energy use, allowing households to see how much appliances use; this information encourages behaviour change, reducing waste and shifting use away from peak times.**

## Question 6

- **B1** LED bulbs use much less electricity than incandescent bulbs, oe
- **B1** LEDs last longer, reducing replacement costs and waste, oe
- **Answer: LED bulbs use much less electricity than incandescent bulbs, and they last longer, reducing replacement costs and waste.**

## Question 7

- **B1** switching off lights and appliances when not in use, oe
- **B1** reducing thermostat temperature or wearing warmer clothing indoors, oe
- **Answer: Switch off lights and appliances when not in use; reduce the thermostat temperature or wear warmer clothing indoors.**

### Question 8

- **B1** difference 1: scale and output, e.g. large wind farms generate high total power for the grid while community solar supplies smaller, local demand, oe
- **B1** linked detail for difference 1, e.g. large schemes benefit many consumers but need major grid connections and investment, oe
- **B1** difference 2: control and ownership, e.g. large schemes are often commercial or state-owned while local schemes may be community owned, oe
- **B1** linked detail for difference 2, e.g. local ownership can increase local benefits and acceptance but may limit expansion, oe
- **B1** additional point: environmental and social impacts differ, e.g. large schemes may affect landscapes and require long planning, whereas small schemes have lower visual impact and are more adaptable, oe
- **B1** linked detail: small schemes can increase local energy security and keep revenue local, but may be less reliable without storage or backup, oe
- **Answer: Large wind farms generate much higher total power and feed the national grid but need major investment and grid connection; community solar supplies smaller local demand, often with lower output. Large schemes tend to be commercial or state-owned and can have larger landscape impacts, while local schemes are often community owned, giving local benefits and acceptance though they may be harder to expand and need storage to improve reliability.**

### Question 9

- **B1** description 1: Grameen Shakti installs solar home systems in rural homes, often with small household panels and batteries, oe
- **B1** description 2: the programme uses local technicians and microfinance-style payment plans to make installations affordable, oe
- **B1** description 3: training and local maintenance support are provided so systems remain operational, oe
- **B1** explanation 1: small-scale solar gives reliable basic electricity where grid supply is absent or unreliable, improving energy access, oe
- **B1** explanation 2: local training and ownership increase resilience and reduce dependence on distant providers, improving local energy security, oe
- **B1** explanation 3: payments and microfinance enable poorer households to afford systems, spreading benefits and supporting wider uptake, oe
- **Answer: Grameen Shakti installs small solar home systems with panels and batteries in rural homes, using local technicians and affordable payment plans and providing training and maintenance; this gives reliable basic electricity where the grid is absent or unreliable, increases resilience by building local skills and reducing dependence on distant providers, and makes systems affordable so more households gain energy access.**

### Question 10

- **M1** 420 - 315 seen or (420 - 315) / 420 x 100 seen, oe
- **A1** 25.0% cao
- **Answer: 25.0%.**

### Question 11

- **B1** way 1, e.g. they provide half-hourly or real-time data so suppliers can see peak periods and manage supply, oe
- **B1** linked detail for way 1, e.g. suppliers can use this to plan demand response or offer incentives to shift use away from peaks, oe
- **B1** way 2, e.g. consumers can receive feedback and time-of-use tariffs, encouraging them to run appliances at off-peak times, oe
- **Answer: Smart meters give real-time data so suppliers can identify peak periods and plan demand response or incentives; they also allow consumers to see usage and use time-of-use tariffs, encouraging them to run appliances at off-peak times.**

### Question 12

- **B1** reduction in carbon dioxide emissions if the electricity comes from renewable sources, oe
- **Answer: Reduction in carbon dioxide emissions if the electricity is generated from renewable sources.**

### Question 13

- **B1** insulation reduces heat conduction by trapping air and using low-conductivity material between warm and cold zones, oe
- **B1** linked detail for conduction, e.g. material slows transfer of heat through roof structure, oe
- **B1** insulation reduces convection by preventing warm air rising into the loft space and circulating away, oe
- **B1** linked effect, e.g. this keeps heat in the living space so less energy is needed for heating, oe
- **Answer: Loft insulation traps air and uses low-conductivity material to reduce heat conduction through the roof and prevents warm air rising and circulating away, reducing convection; together this keeps heat in the living space so less energy is needed for heating.**

### Question 14

- **Level 3** (5-6): A well-developed assessment that evaluates benefits and limitations of small-scale schemes with relevant examples, balances evidence about local energy security and sustainability, and reaches a clear, justified conclusion.
- **Level 2** (3-4): A clear assessment that describes both advantages and disadvantages of small-scale schemes with some supporting details, leading to a basic conclusion.
- **Level 1** (1-2): Simple points about small-scale schemes are made, such as one advantage or one disadvantage, with little development or justification.
- **Indicative content:**
  - Advantages: increase local energy access where grid is absent, provide reliable basic electricity or cooking fuel, reduce dependence on imported fuels and long supply chains, keep economic benefits within the community, and use appropriate technology that local people can maintain.
  - Limitations: limited total output so cannot serve large industrial demand, may require batteries or backup to be reliable, initial costs can be a barrier despite microfinance, technical skills and maintenance must be sustained, and projects can be vulnerable to weather variability or theft.
  - Evaluation points: compare local resilience and social benefits against scale and reliability issues; examples such as Grameen Shakti show uptake and local maintenance can succeed; a balanced conclusion may argue small-scale schemes are valuable for basic energy security but often need support, storage and links to wider infrastructure for broader development impact.

### Question 15

- **B1** challenge, e.g. lack of upfront finance for purchasing equipment, oe
- **B1** solution, e.g. use microfinance, payment plans or government subsidies to spread the cost, oe
- **Answer: Challenge: lack of upfront finance for equipment. Solution: use microfinance, affordable payment plans or subsidies to spread the cost.**

### Question 16

- **B1** community ownership increases local engagement and a sense of responsibility, leading to better care and lower vandalism, oe
- **B1** local management builds skills and ensures maintenance can be done quickly, improving uptime and long-term functioning, oe
- **Answer: Community ownership increases local engagement and responsibility, reducing vandalism, while local management builds skills for maintenance so systems remain operational, improving long-term sustainability.**