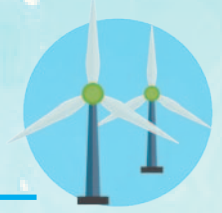Senior Secondary Liberal Studies

Learning and Teaching Exemplar

for NCS students (1)

Revamping fuel mix for electricity generation in Hong Kong

Revamping fuel mix for electricity generation in Hong Kong

A. Basic information of the lessons

Topic — Revamping fuel mix for electricity generation in Hong Kong

Relevant modules, themes and issues for enquiry

Leading **Module 6: Energy Technology and the Environment**

Theme 1: The Influence of Energy Technology

- To what extent does the development of energy technology create or solve environmental problems?
- What are the implications of environmental change on the development of energy technology?

Theme 2: The Environment and Sustainable Development

- How do the living styles of people and social development affect the environment and the use of energy?
- What responses could be made by different sectors of society, governments and international organizations regarding the future of sustainable development?

**Related** **Module 2: Hong Kong Today;**

Theme 1: Quality of Life

- Which aspects of the quality of life are seen to be more important? Which are seen to be immediate needs? Who might make the decisions? Why?
- What are the different opinions of Hong Kong residents on the priorities which constitute the quality of life?

Overall design rationale

The lessons start from examining the background for revamping fuel mix for electricity in Hong Kong. Students will identify the strengths and weaknesses of the current fuel mix with reference to the data provided and their understanding about different energy. Energy problems and the response of the government towards the problems will be discussed.
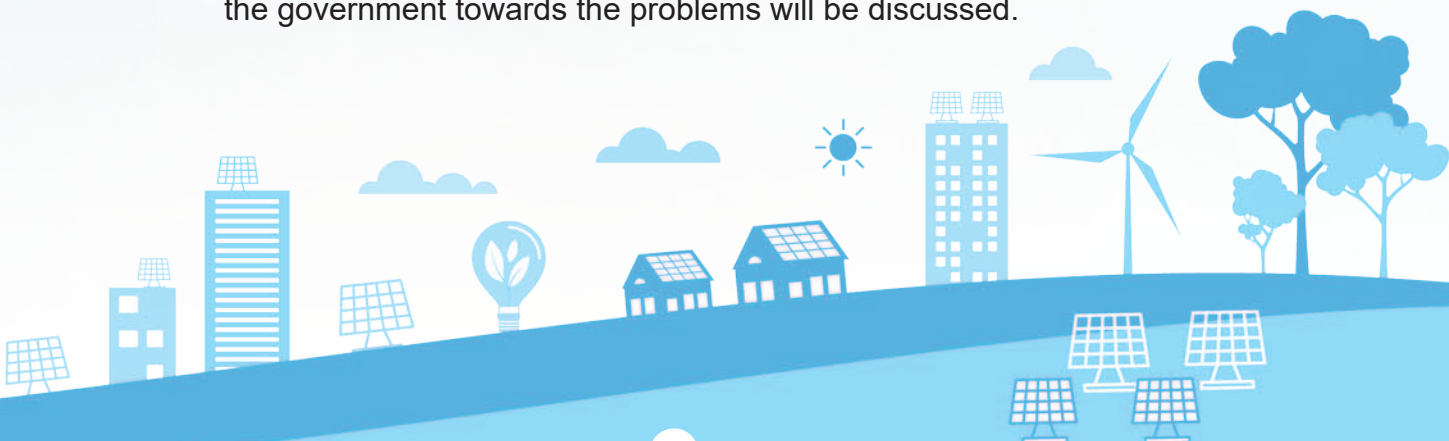
Students will discuss the criteria/ factors affecting decisions made on fuel mix with a view to design an optimal fuel mix with justification. During the discussion, emphasis would be given to the contextualization and conceptualization of the factors considered.

The lessons end by summarizing the energy problems and different measures addressing to the problems.

Time required

3 lessons (40 minutes per lesson), approximately 120 minutes in total

Learning objectives

Knowledge:

- To enhance the understanding of the pros and cons associated with different energy sources

- To understand the factors affecting decisions made on the fuel mix

- To understand and explore feasible ways to reduce energy problems

Skills:

- To develop data interpretation and processing skills

- To make conceptual observations based on the available data in exploring the issues

- To apply relevant knowledge and concepts in discussing contemporary issues

- To analyze issue from critical multiple perspectives and the skills of conceptualization and contextualization

- To respond immediately to queries

- To express ideas in speaking and writing

Values and attitudes:

- To consider personal and social issues from multiple perspectives and make sound judgments with reasoning and creativity

- To foster positive attitude towards balancing different views and comprehensive consideration

- To understand the importance of environmental protection and sustainable development, to respect natural resources, and to practise a green lifestyle

Basic Concepts for application

Basic concepts:

Energy technology, non-renewable energy, renewable energy, resource depletion, climate change, air pollution, sustainable development, green lifestyle

Other related concepts:

Quality of life, energy equity, eco-friendliness, availability, feasibility, affordability, reliability, safety, stability, sustainability, security, cost-effectiveness

Relevant learning experience at junior secondary levels

- To have a general idea about energy types and energy use
- To have a basic understanding of the pros and cons of different energy sources
- To have acquired a basic understanding of the energy problems facing Hong Kong and the world e.g. air pollution, global warming, the greenhouse effect
- To have studied some principles of power generation
- To have fostered the value about the role of individuals in environmental protection.

Catering the learning needs of NCS students

- Generally, NCS students are not strong in processing statistical data. The attached data file will offer students with different types of statistical data with a view to equipping them with necessary skills in tackling statistical data during lessons.
- Guiding questions are set after each source in the data file. The questions guide students to process the data and generalize the implication of the data step by step. The questions could be used for lesson preparation or in-class discussion.
- Audio-visual learning materials may enhance the motivation of students in learning Liberal Studies.

Lesson	Learning and teaching strategies and flow

Before class

Lesson preparation

Ask students to study the sources in the data file (Appendix 1) and answer the simple guiding questions that followed. This would facilitate the discussion and learning activities in the coming lessons.

1

Lead in (around 10 minutes)

● Remind students about the <u>**importance of electricity in people's lives and supporting the development of Hong Kong**</u> (e.g. we cannot live a day in comfort without electricity. Our lighting, home appliances, computers, entertainment, the mass transport systems e.g. MTR trains and numerous other machines are all powered by electricity). Teachers may highlight the concepts such as industrialization, urbanization, commercialization and economic development when discussing the background for the huge demand of electricity (Appendix 1 Source H).

● Tell the students that the majority of electricity consumed in Hong Kong is generated by power stations and some electricity is supplied by nuclear power plants located in Guangdong Province (Appendix 2).

Pair-work/ group work (around 15 minutes)

● Ask students to identify the characteristics of current fuel mix (e.g. 75% fossil fuel, 25% alternative/ clean energy, heavily relied on fossil fuel, not eco-friendly, not diversify etc.) (Appendix 1 Source A)

● Ask students to discuss the strengths and weaknesses of current fuel mix with reference to the data given (Appendix 1 Sources B to D) (Appendix 3). Teachers please pay attention to <u>**conceptualization**</u> and the <u>**evaluation of each strength and weakness**</u> in the context of Hong Kong.

Strengths: (Sources D, E, F, G and H)

➢ Affordable price (significant to ensure energy equity)

➢ Stable supply (significant to the development of Hong Kong and our daily lives)

Weaknesses: (Sources B, C and D)

➢ Greenhouse gas emission and its impact on global warming

➢ Air pollutant emission and its impact on health

➢ Not diversified, mainly relied on fossil fuel and non-renewable energy

- Teachers may mention other strengths of electricity supply in Hong Kong e.g. wide coverage (access to the entire population), well-developed energy infrastructure.

Round up: Objective and necessity of revamping the fuel mix (around 10 minutes)

- Teachers may arouse students' awareness about the objectives and the **necessity of revamping the fuel mix** with reference to the weaknesses of the existing fuel mix identified in the previous discussion and some official documents (Appendix 1 Source I)

  ➤ To improve air quality in Hong Kong
  ➤ To promote sustainable development of Hong Kong
  ➤ To fulfill the target of carbon emission (a responsibility to fulfill the local target, national target, target set in the international treaties)

2 Group Discussion (around 25 minutes)

- Ask students to discuss and identify the **criteria/ factors affecting the decisions made on the fuel mix** with reference to the previous discussion about the strengths and weaknesses of existing fuel mix (Appendix 4). The discussion should contextualize to the current situation in Hong Kong. Some possible factors includes:

  ★ Eco-friendliness (environmental impact)
  ★ Affordability (pricing)
  ★ Reliability / Stability
  ★ Safety
  ★ Sustainability (permanent / abundant supply)
  ★ Security
  ★ Diversity
  ★ Cost-effectiveness
  ★ Availability
  ★ Spatial requirement
  ★ Geographical factors

  Students are expected to justify their answer, i.e. the significance of considering a specific factor.
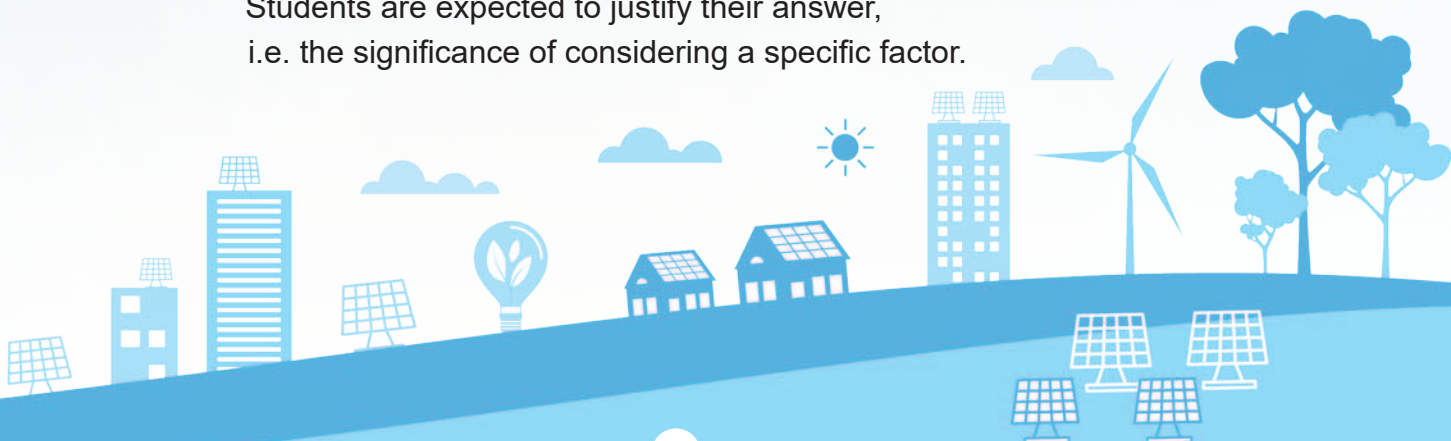
Pair-work (15 minutes)

- Ask students to think of what would the fuel mix be like if only a particular criteria/factor is adopted in Hong Kong. For example, there will be more extensive use of nuclear energy and renewable energy (not feasible to have large percentage) if eco-friendliness is picked, but then feasibility and affordability will be a concern. Or if pricing will be prioritized, the use of fossil fuel may harm the environment and health of citizens. Such discussion would arouse the attention of the students towards the importance of balancing different considerations (Appendix 5). Teacher may skip the example and guide student to draft an eco-friendly fuel mix instead.

3 Group Discussion (around 25 minutes)

- Ask students to discuss how our fuel mix should be revamped and suggest an optimal future fuel mix for electricity generation in Hong Kong. Students are required to explain the justification of the optimal fuel mix with reference to the current situation of Hong Kong, pros and cons of different energy sources and the factors identified in previous lessons. The percentage share of each energy source should be justified as well (Appendix 6).

Teacher summary (15 minutes)

- Summarize student's presentations and point out that the government needs to consider different factors when revamping the fuel mix. Compare the government's suggestion with the students' suggestion.

- Explain how industrialization, urbanization and commercialization contributed to energy problems (e.g. huge demand of energy, shortage, environmental impacts). **Various solutions to energy problems** should be highlighted e.g. revamping fuel mix, save energy (living habit, electrical appliance with high efficiency, e.g. green policy, international collaboration).

Appendix 1: Data File
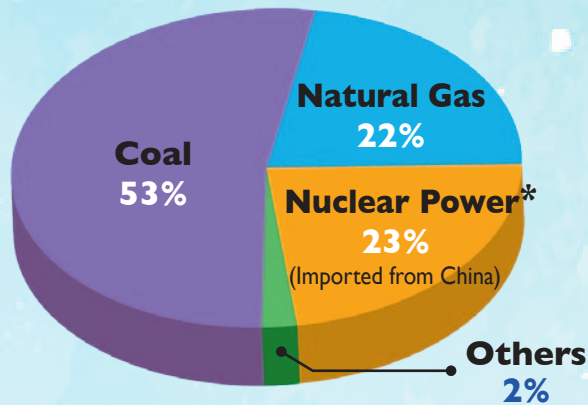
Source: Environment Bureau, HKSAR. (2014). *Future Fuel Mix for Electricity Generation Consultation Document.* Retrieved from http://www.enb.gov.hk/sites/default/files/en/node2605/Consultation%20Document.pdf
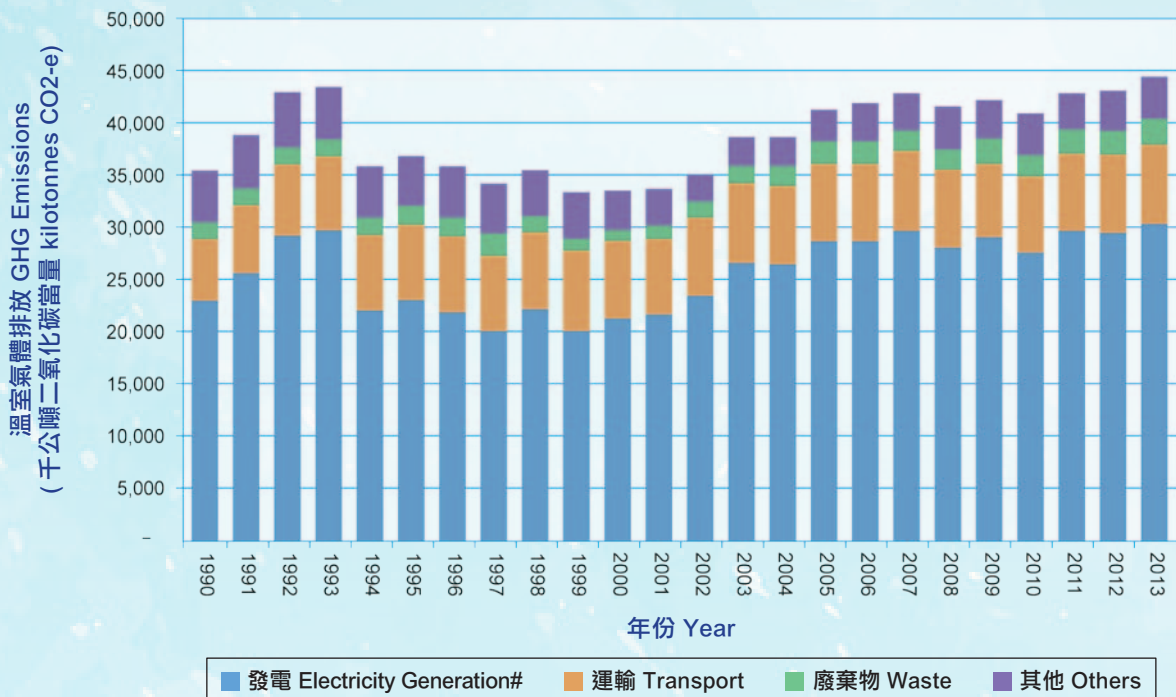
Questions:

1. What type of energy source are coal and natural gas? What are the pros and cons of using such type of energy source?

   _____

   _____

2. What type of energy source is nuclear power? What are the pros and cons of using it?

   _____

   _____

3. Identify the characteristics of the existing fuel mix for electricity generation (e.g. the majority/ the most, the least).

   _____

   _____
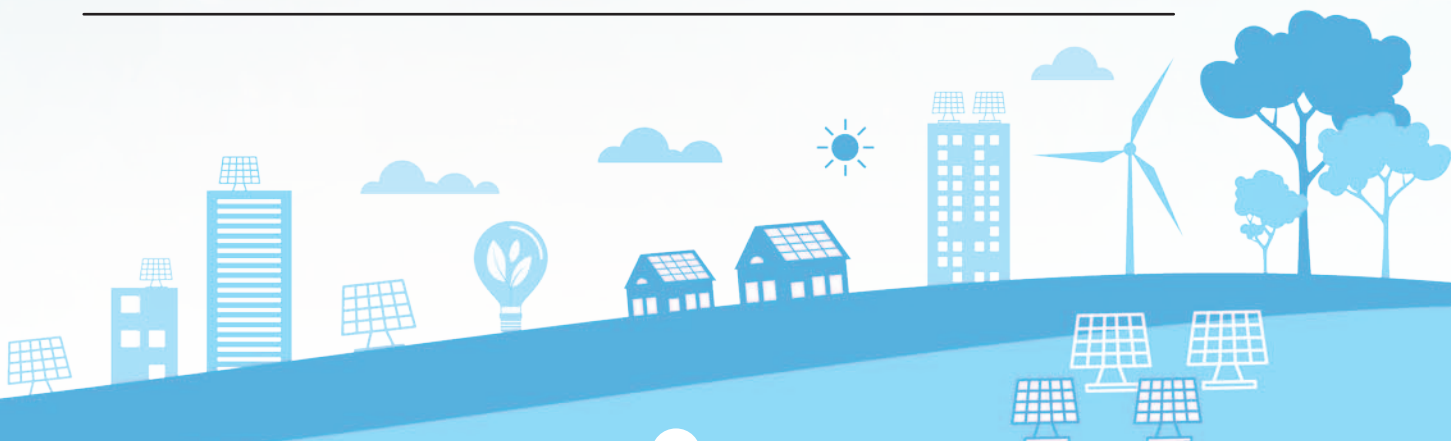
Source: Environment Bureau. (2017). Greenhouse Gas Emission Trends of Hong Kong from 1990-2013.
https://www.climateready.gov.hk/files/pdf/HKGHG_Trend_201612.pdf

Questions:

1. Among the four sources of greenhouse gas (GHG) emission shown in Source B, which contributed to the largest emission in all years.

   _____

2. With reference to Source A, explain your findings in question 1.

   _____

3. Identify and explain the impact of greenhouse gas emission to the world.

   _____

   _____

   _____

2015 年排放清單
2015 Emission Inventory
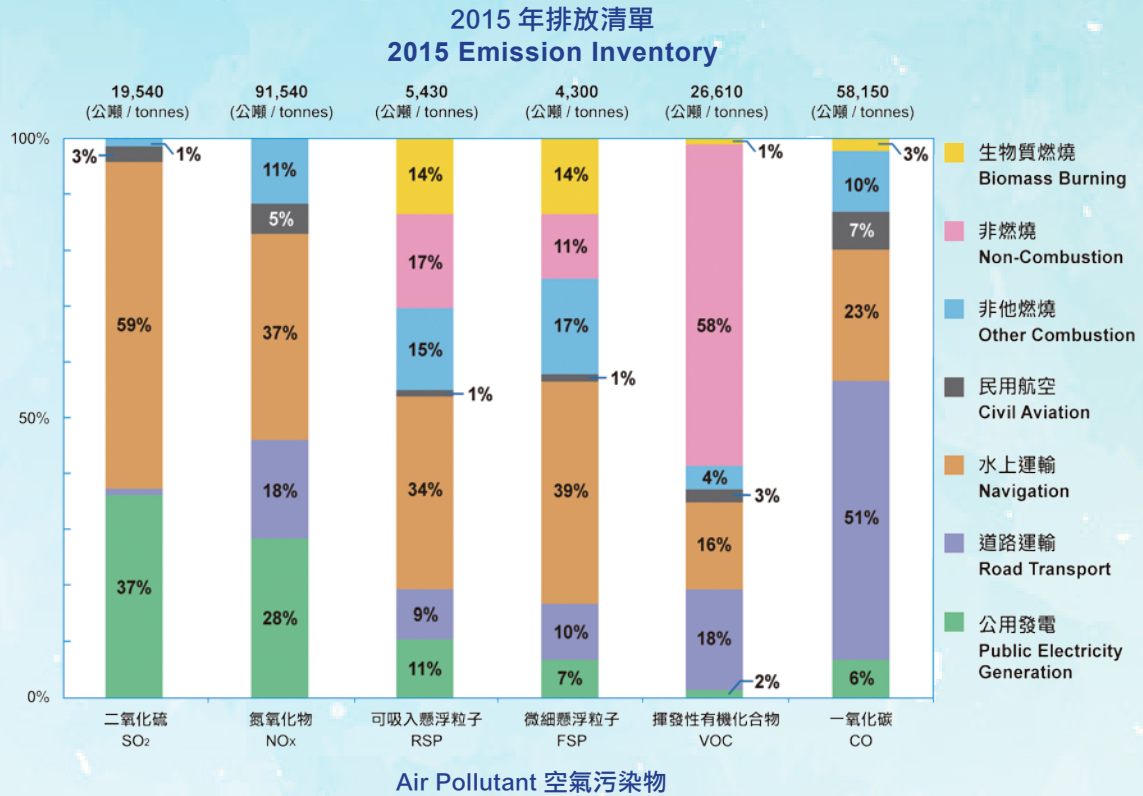
Source: Environmental Protection Department. (2015). 2015 Emission Inventory. Retrieved from http://www.epd.gov.hk/epd/english/environmentinhk/air/data/emission_inve.html

Questions:

1. Which air pollutant does public electricity generation contributes the most?

_____

_____

2. Identify and explain the impact of air pollutants on the quality of life of Hong Kong people.

_____

_____

_____

_____
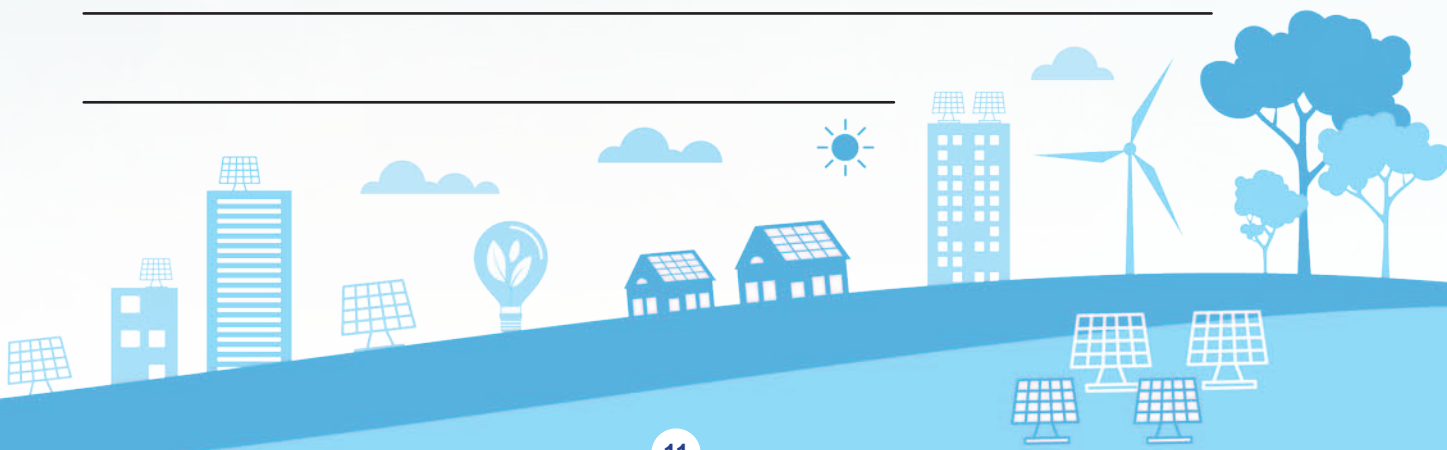
The following table compares different energy sources.

	Coal	Natural Gas	Nuclear Power	Renewable Powers
Air pollutants emission level	High to extreme high	Moderate	Low	Low
CO$_2$ emission level	High to extreme high	Low	Low	Low
Availability	Becoming lesser	abundant	abundant	Unlimited (constrained locally)
Present energy cost per unit (HK$)	Around 30.5 to 50.4 cents	Around 1.2 dollars	Around 50 to 60 cents	Estimated minimum 2 dollars
Price trend	Consistently low	Consistently increasing	Consistently stable	Unstable
Safety	High	High	Low to moderate	High

Source: Adapted from the data sources on the Internet.

Questions:

1. Which energy source/ energy sources shown in Source D is/are:

   (a) the most eco-friendly _____

   (b) the cheapest _____

   (c) getting more expensive _____

   (d) relatively not safe _____

   (e) facing shortage _____

2. Describe the pros and cons of the following energy sources with reference to Source D and your answer to question 1.

   (a) Coal: _____ but _____

   (b) Natural gas: _____ but _____

   (c) Nuclear power: _____ but _____

   (d) Renewable power: _____ but _____

Information on electricity generation using different energy sources

Sources of electricity generation		Capacity factor (%) *	Cost of generating electricity (US$/megawatt-hour)	Carbon dioxide emission (tonne/gigawatt-hour)
Coal		85	100	888
Natural gas		87	67	499
Nuclear		90	108	29
Water (hydro)		52	90	26
Wind	Onshore	34	87	26
	Offshore	37	222	

* Capacity factor is the ration of the actual amount of electricity produced in a given period to the maximum amount possible.

Source: Adapted from the data sources on the Internet.

1. Which energy source / sources is/are:

   (a) the cheapest _____

   (b) the most expensive _____

   (c) the most cost-effective _____

   (d) the least cost-effective _____

   (e) the most eco-friendly _____

   (f) the least eco-friendly _____

2. From your own knowledge, explain one more disadvantage of using wind power.

   _____

3. Among all the energy sources shown in Source E, which one is the least feasible to be developed in Hong Kong. Explain your answer with reference to your own knowledge.
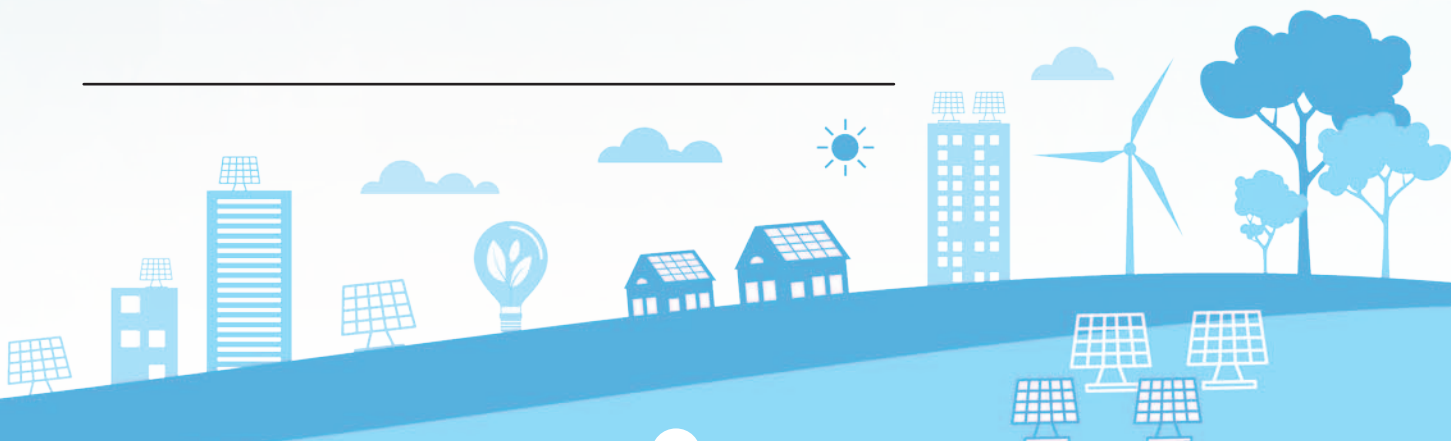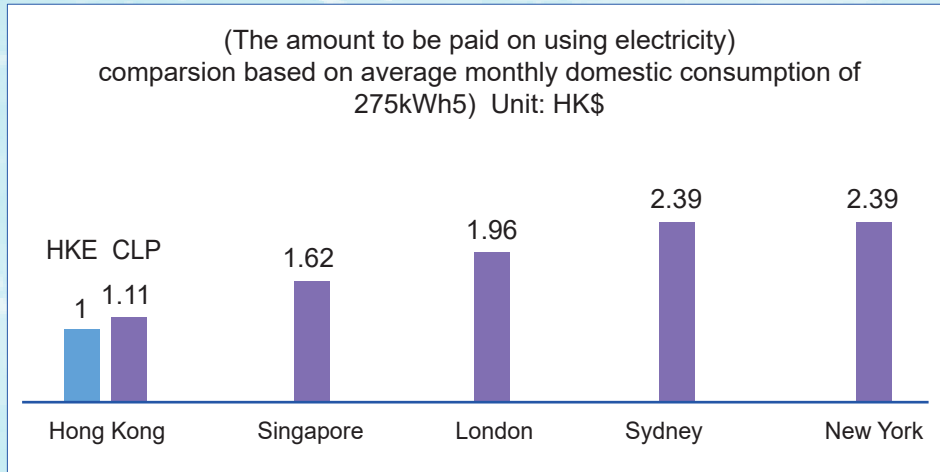
   _____

   _____

Electricity tariff of Hong Kong and other cities

Table 1

(The amount to be paid on using electricity)
comparsion based on average monthly domestic consumption of
275kWh5) Unit: HK$

|	HKE	CLP	Singapore	London	Sydney	New York
Hong Kong	1	1.11	1.62	1.96	2.39	2.39

Remarks:
HKE: The Hong Kong Electric Company; CLP: the China Light and Power Co.
For Hong Kong, net tariff for 2015 is adopted. For other cities, tariff and exchange rate at November 2014
are adopted. The overall average net tariff of CLP and HKE for 2015 is $1.14 and $1.35 respectively.

Source: Environment Bureau. (2015). Public Consultation on the Future Development of the Electricity Market.
http://www.enb.gov.hk/sites/default/files/en/node3428/EMR_condoc_e.pdf

% share of household expenditure on electricity supply

Table 2
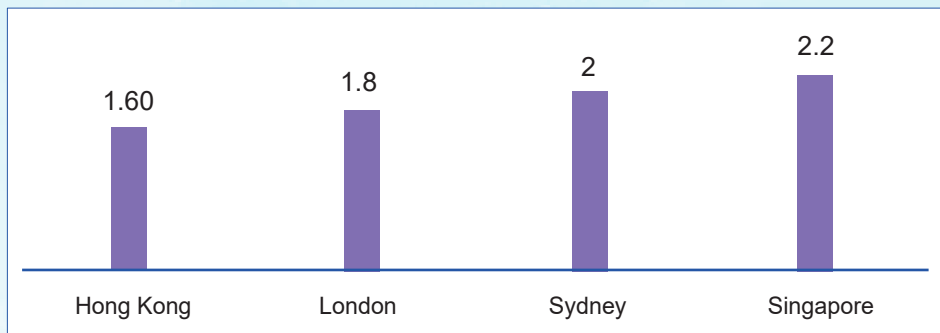
Hong Kong	London	Sydney	Singapore
1.60	1.8	2	2.2

Source: Environment Bureau. (2015). Public Consultation on the Future Development of the Electricity
Market. http://www.enb.gov.hk/sites/default/files/en/node3428/EMR_condoc_e.pdf
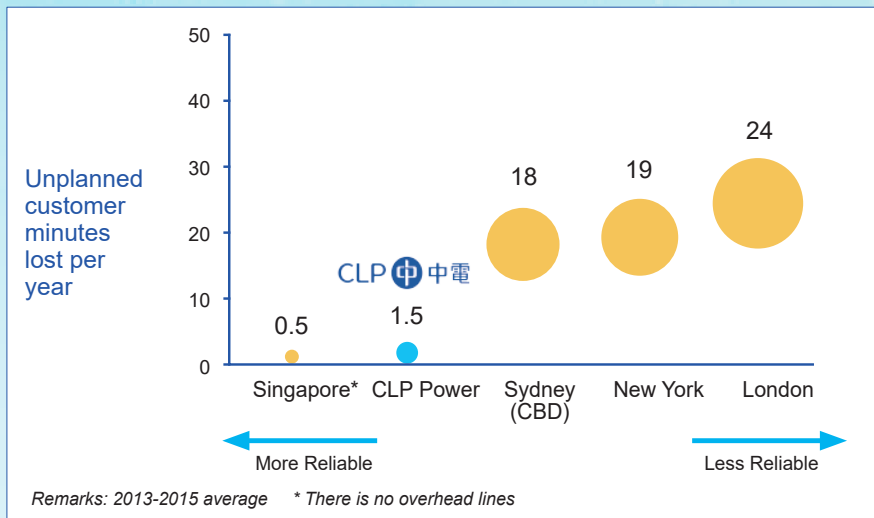
Questions:

1. How would you describe the electricity tariff (how much you pay for using electricity)
    of Hong Kong when comparing with other cities? Explain your answer with reference
    to Table 1 and Table 2 in Source F.

_____

_____
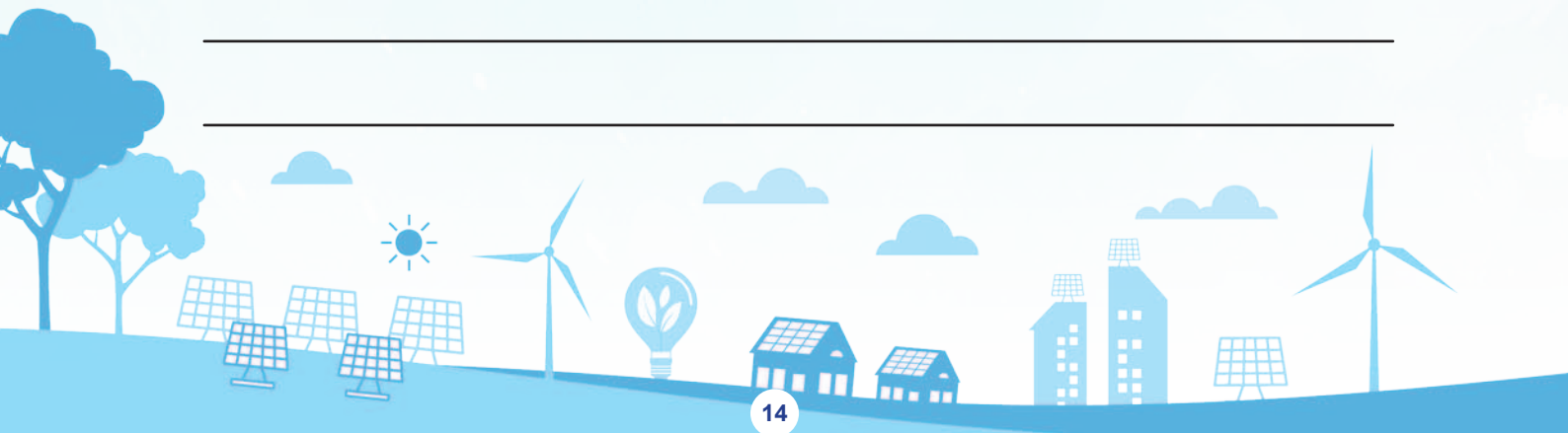
Information on electricity generation using different energy sources

Source: CLP Power Hong Kong Limited. (2017). 2017 Electricity Tariff. Retrieved from https://www.clp.com.hk/en/customer-service/frequency-asked-questions/2017-electricity-tariff#1

Hong Kong has been ranked number 3 among some 138 economies in respect of electricity supply quality in World Economic Forum's Global Competitiveness Report in 2016-2017.

Source: World Economic Forum. (2017).The Global Competitiveness Report 2016–2017. Retrieved from http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf

Question:

1. How would you describe the electricity supply in Hong Kong when comparing with other cities shown in Source G?

_____

SOURCE H Electricity Consumption by Sectors in Hong Kong

Year	Residential	Commercial	Industrial	Transport	Total
2010	39344 (26%)	97894 (65%)	11082 (7%)	2540 (2%)	150859
2011	39872 (26%)	99594 (66%)	9530 (6%)	2609 (2%)	151605
2012	41189 (27%)	101813 (66%)	9356 (6%)	2722 (2%)	155079
2013	39941 (26%)	101480 (66%)	9144 (6%)	2796 (2%)	153362
2014	43415 (27%)	102627 (65%)	9230 (6%)	2875 (2%)	158147

Unit: Terajoule

Source: Census and Statistics Department. (2016). Hong Kong Energy Statistics Annual Report. Retrieved from https://www.censtatd.gov.hk/hkstat/sub/sp90.jsp?productCode=B1100002

Question:

1. Describe the trends shown in Source H. (trend=increase / decrease; find out the difference between the year 2010 and 2017 in each sector)

   Residential sectors had <u>a/an decrease/increase</u> in electricity consumption from

   _____ terajoule in 2010 to _____ terajoule in 2014.

   How about the other sectors? _____

2. Identify the pattern shown in Source H. (pattern=phenomenon that repeats itself)

   _____

SOURCE I

> The China national target announced in 2009 is to reduce carbon intensity by 40% to 45% by 2020 as compared with the level in 2005. Hong Kong's climate change target, first proposed in 2010, is to reduce carbon intensity by 50% to 60% by 2020 as compared with the level in 2005.

Source: Environment Bureau. (2015). Hong Kong Climate Change Report 2015. Retrieved from http://www.enb.gov.hk/sites/default/files/pdf/ClimateChangeEng.pdf

> The Paris Agreement came into force on 4 November 2016, succeeding the Kyoto Protocol. As decided by the Central People's Government, the Paris Agreement applies to the Hong Kog Special Administrative Region.

Source: Environment Bureau. (2017). Hong Kong Climate Action Plan 2030+. Retrieved from http://www.enb.gov.hk/sites/default/files/pdf/ClimateActionPlanEng.pdf

Question:

1. Explain the following terms by searching relevant information from your textbook or from the internet:

   a) Carbon intensity

   _____

   b) The Paris Agreement (the Paris Climatic Conference)

   _____

2. What should Hong Kong do in response to the target set by the two documents mentioned in Source I?

   _____
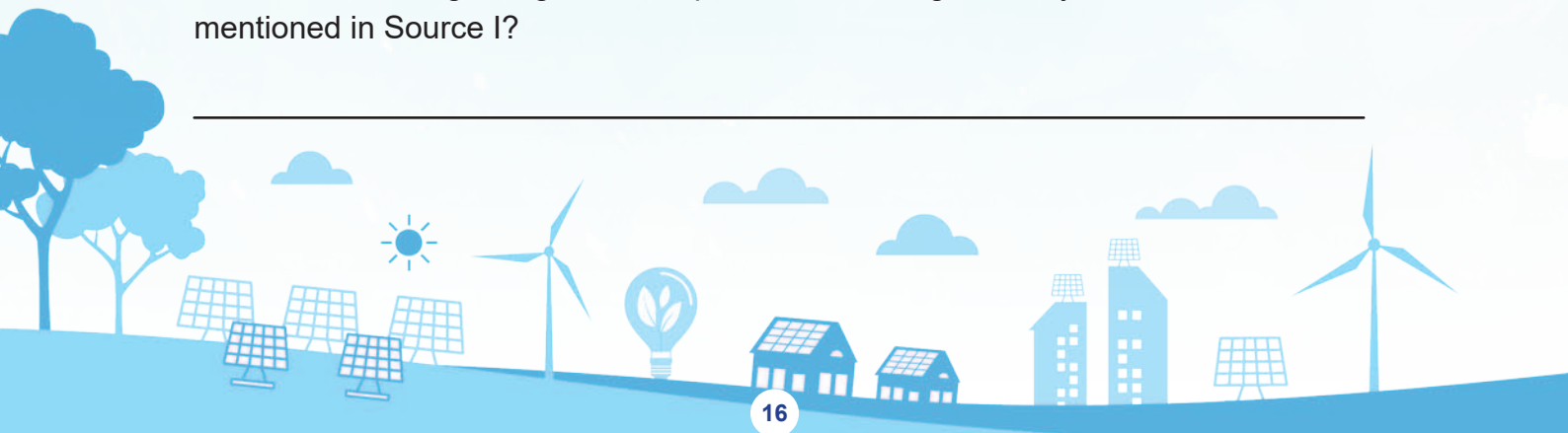
SOURCE J — Major nuclear disasters

Date	Location of accident	Description of accident or incident	Dead	INES level*
April 26, 1986	Chernobyl disaster, Ukraine	Overheating, steam explosion, fire, and meltdown, necessitating the evacuation of 300,000 people from Chernobyl and dispersing radioactive material across Europe	30 direct, 19 not entirely related and 15 minors due to thyroid cancer, as of 2008.	7
March 12, 2011	Fukushima, Japan	A tsunami flooded and damaged the 5 active reactor plants drowning two workers. Loss of backup electrical power led to overheating, meltdowns, and evacuations. One man died suddenly while carrying equipment during the clean-up.	2+	7

* International nuclear event scale (7= major accident)

Source: Adapted from online data sources.

Following the March 2011 Fukushima nuclear disaster, Germany has permanently shut down eight of its 17 reactors and pledged to close the rest by the end of 2022. Italy voted overwhelmingly to keep their country non-nuclear. Switzerland and Spain have banned the construction of new reactors. Japan's prime minister has called for a dramatic reduction in Japan's reliance on nuclear power.

Audio-visual references:

1. Chernobyl: What happened 30 years ago? (BBC News)
   http://www.bbc.com/news/world-europe-36132698

2. Japan 311 Great Earthquake and Tsunami
   https://www.youtube.com/watch?v=GWbiOEoc3PM

3. Fukushima Daiichi Nuclear Disaster
   https://www.youtube.com/watch?v=zwk_53DEp44

SOURCE K — Audio visual references:

1. 20150308 ATV 時事追擊 扶貧與環保 (ATV News Magazine – poverty and environmental protection)
   https://www.youtube.com/watch?v=sDwOFNskXUg

2. 20140615 RTHK 鏗鏘集 用電思源 (RTHK Hong Kong Connection – consider its source when using energy)
   https://www.youtube.com/watch?v=4I7b0WDHY8Y

Appendix 2: Where does OUR electricity come from?
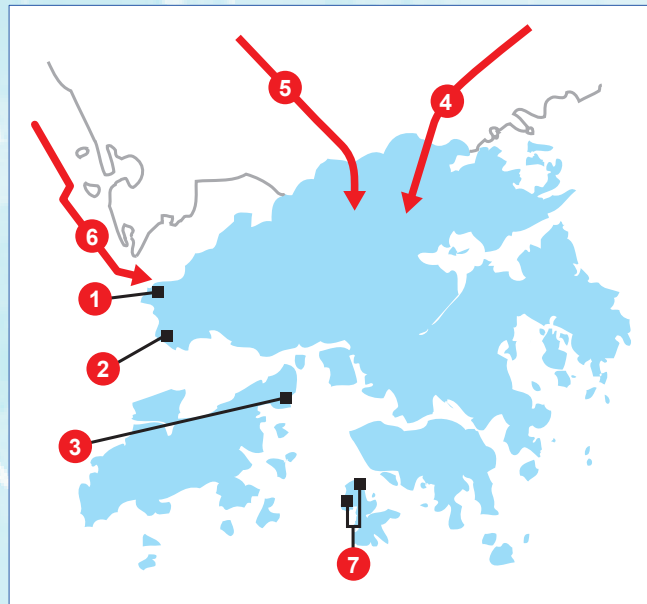
The China Light and Power Company: mainly supply electricity to Kowloon and the New Territories, including the Lantau Island, Cheung Chau and other outlying islands.

1. Black Point Power Station (Gross capacity: 2,500MW): One of the world's largest gas-fired (natural gas) power stations

2. Castle Peak Power Station: a coal-fired power station

3. Penny's Bay Power Station: run on ultra low-sulphur diesel

4. Guangdong Daya Bay Nuclear Power Station: generated by nuclear energy, capacity purchase by CLP up to 70%

5. Guangzhou Pumped Storage Power Station: Uses hydro technology to recover stored energy for backup purposes or to accommodate peak demand

6. Importing natural gas from Central Asia (Turkmenistan)via the 9,000 km second West-to-East Pipeline in 2013

Hong Kong Electric Company: mainly supply electricity to Hong Kong Island, Ap Lei Chau and Lamma Island

7. Lamma Island Power Station: run on coal, natural gas, wind and solar

Remark: some buildings of the governmental or public funded institutions or non-profit making organizations install facilities for non-renewable energy.

Source: Adapted from online data sources.
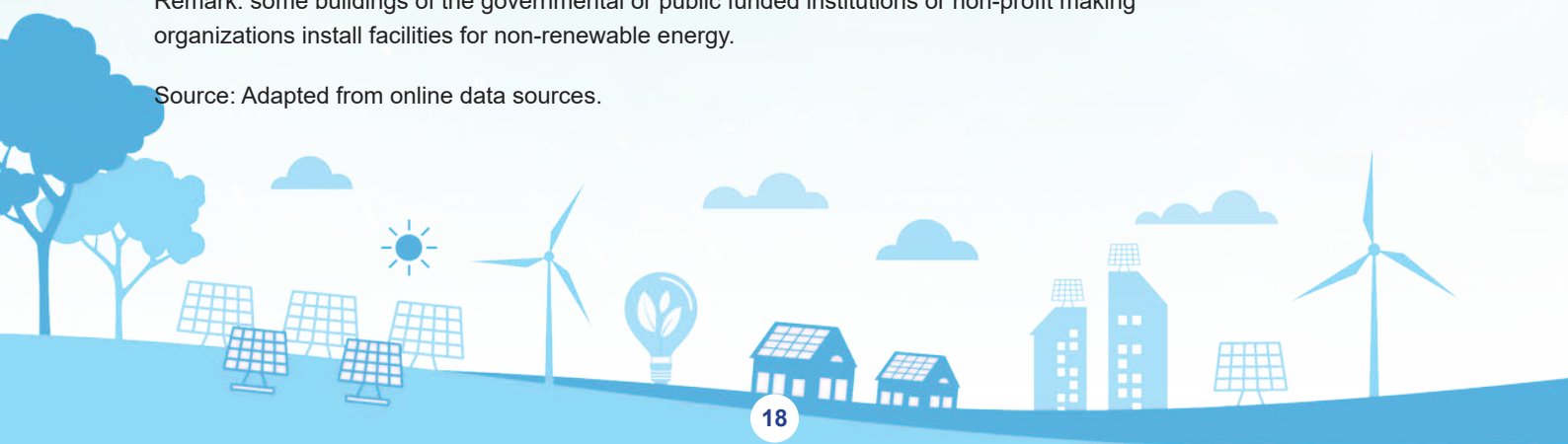
## Appendix 3: Strengths and weaknesses of existing fuel mix

Strengths	Weaknesses

Appendix 4: Criteria / factors affecting the decisions made on fuel mix

| Factors / criteria (give brief explanation of the meaning)	Justification / significance (Why is the factor important in Hong Kong?)
1.	
2.	
3.	
4.	
5.	
6.	
7.	

Appendix 5: What would be the fuel mix if a particular criterion/ factor is adopted in Hong Kong?

Example:

- renewable energy
- nuclear energy

10%

90%
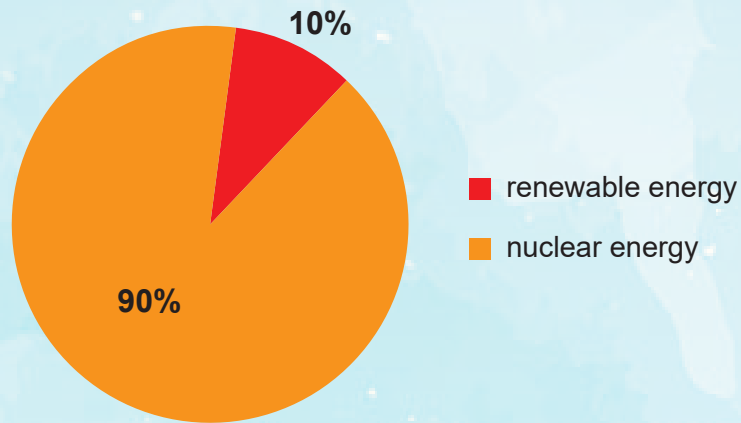
e.g. eco-friendliness

(Explanation: with reference to Sources D and E, CO_2 emission and air pollutant emission level of renewable energy and nuclear energy are low. Air pollution and global warming problems will be eased. Using nuclear energy is more feasible than renewable energy due to physical/environmental constraints. So,only 10% share of fuel mix allocated to renewable energy is recommended.)
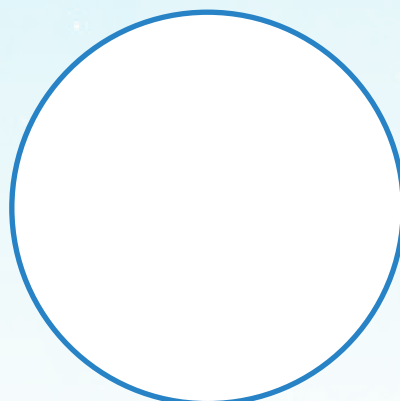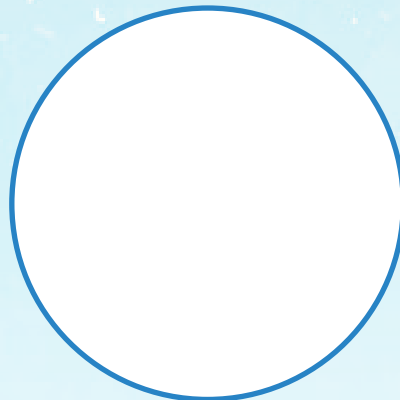
Appendix 6: Revamping the fuel mix

Suggest an optimal Hong Kong's future fuel mix for electricity generation. Justify your view with reference to the sources and your own knowledge.

You can make use of the following table to be your draft:

Energy		Percentage (%)	Reasons for using / not using (consider the pros and cons of each energy)
Non-renewable	Coal		
	Oil		
	Natural gas		
	Nuclear		
Renewable	Wind		
	Solar		
	Others: _____		
		Total: 100%	

Optimal Hong Kong's future fuel mix for electricity generation

(use different colour to shade different sectors and indicate the percentage)

Justification:

(You should explain your choice and the percentage share with evidence. You can first explain the reasons for having specific energy with the highest /lowest percentage share. You may also pay attention to the overall design of the fuel mix e.g. is it diversify enough).

Suggested structure for the essay :

_____ % of _(energy source)_ would be used because of (a concept indicating its advantage) . According to Source _____ , (cite relevant clue to support your answer). It shows that _(energy source)_ is (summarize the implication of the clue) . It is important to Hong Kong because (explain in the context of Hong Kong/ how Hong Kong could be benefitted) . Only _____% / more than _____% is used because (explain why atparticular percentage share is suggested).

    Sample: 10% of hydro energy would be used because it is eco-friendly. According to Source E, the carbon emission of hydro energy is 26 tons/gigawatt-hour which is very low. It shows that hydro energy is eco-friendly. In Hong Kong, air pollution problem is serious. Using more eco-friendly energy will alleviate the air pollution problem in Hong Kong. Only 10% is used because it is not very feasible to develop large scale HEP project in Hong Kong. …

_____

_____

_____

_____

_____

_____

_____

-- End of Appendix --
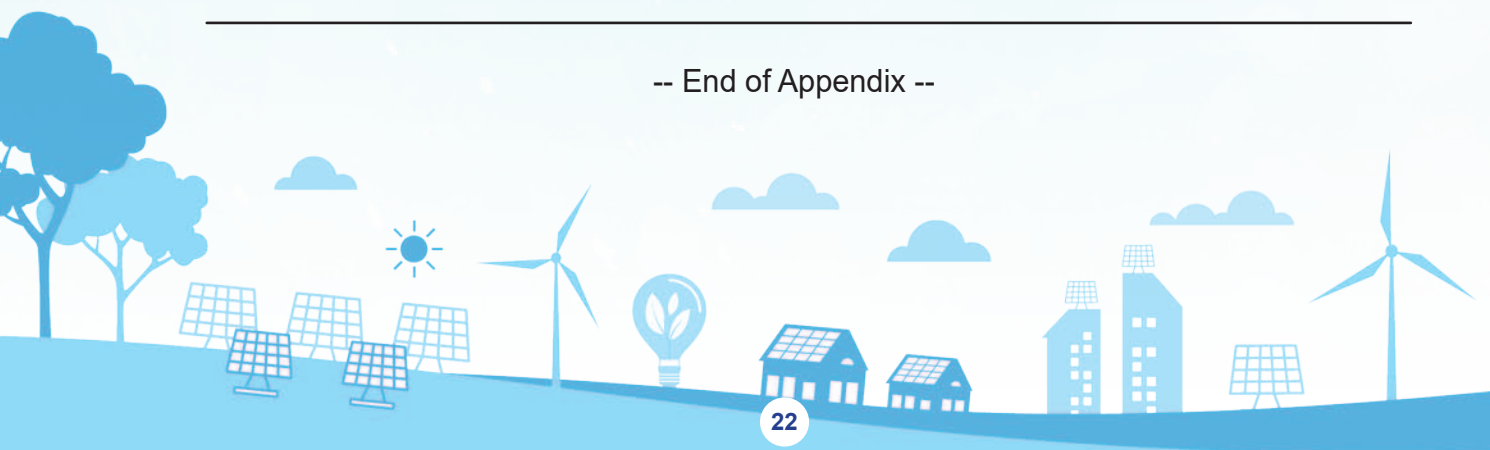
Guidelines for Teachers

(P.9) Questions:

1. What type of energy source are coal and natural gas? What are the pros and cons of using such type of energy source?

ans.: fossil fuel – advantage: cheaper price, disadvantage: air pollution etc.)

2. What type of energy source is nuclear power? What are the pros and cons of using it?

ans.: non-renewable energy – advantage: abundant supply though non-renewable, disadvantage: safety concern, etc

3. Identify the characteristics of the existing fuel mix for electricity generation (e.g. the majority/ the most, the least).

ans.: majority – fossil fuel, mostly coal, very little proportion of renewable energy etc.

(P.10) Questions:

1. Among the four sources of greenhouse gas (GHG) emission shown in Source B, which contributed to the largest emission in all years.

ans.: electricity generation

2. With reference to Source A, explain your findings in question 1.

ans.: mainly burning of fossil fuel

3. Identify and explain the impact of greenhouse gas emission to the world.

ans.: Gases that trap heat in the atmosphere are called greenhouse gases. Examples of greenhouse gases e.g. carbon dioxide, methane, nitrous oxide, and ozone. They will intensify global warming problem in the world. Impacts such as increase in temperature of the Earth's surface, extreme weather will occur.

(P.11) Questions:

1. Which air pollutant does public electricity generation contribute the most?

ans.: SO_2

2. Identify and explain the impact of air pollutants on the quality of life of Hong Kong people.
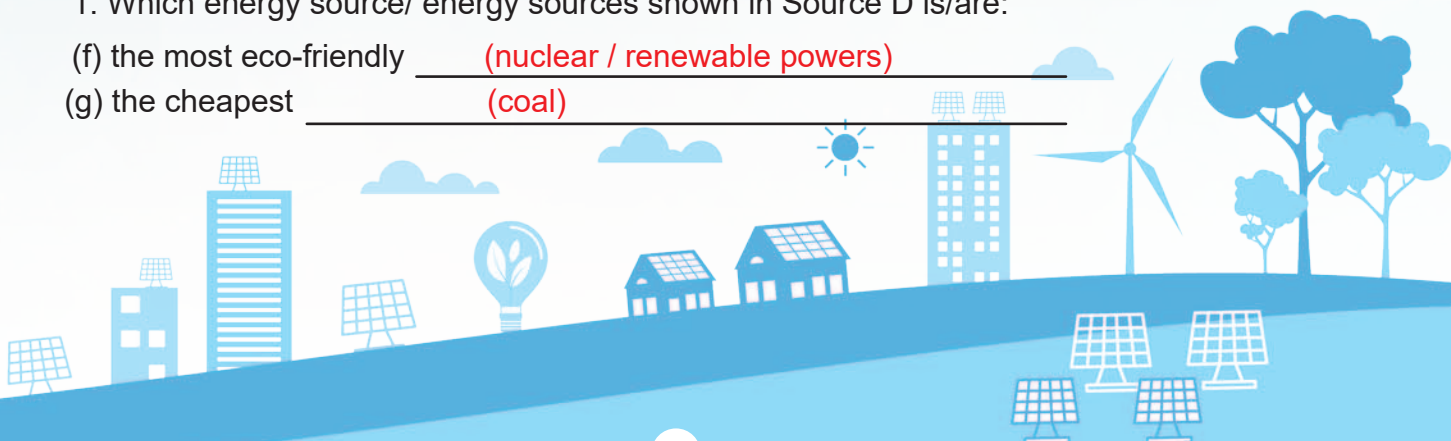
ans.: health problem such as respiratory disease

(P.12) Questions:

1. Which energy source/ energy sources shown in Source D is/are:

(f) the most eco-friendly   (nuclear / renewable powers)

(g) the cheapest   (coal)

(h) getting more expensive _____ (natural gas) _____

(i) relatively not safe _____ (nuclear energy) _____

(j) facing shortage _____ (coal) _____

2. Describe the pros and cons of the following energy sources with reference to Source D and your answer to question 1.

(e) Coal: ___ cheap ___ but ___ not eco-friendly _____

(f) Natural gas: ___ eco-friendly ___ but ___ getting more expensive _____

(g) Nuclear power: ___ abundant ___ but ___ not safe _____

(h) Renewable power: ___ eco-friendly ___ but ___ costly _____

(P.13) Questions:

1. Which energy source / sources is/are:

(g) the cheapest _____ (natural gas) _____

(h) the most expensive _____ (offshore wind) _____

(i) the most cost-effective ___ (natural gas) _____

(j) the least cost-effective ___ (offshore wind) _____

(k) the most eco-friendly ___ (water / wind) _____

(i) the least eco-friendly ___ (coal) _____

2. From your own knowledge, explain one more disadvantage of using wind power.

(e.g. unstable, spatial requirement) _____

3. Among all the energy sources shown in Source E, which one is the least feasible to be developed in Hong Kong. Explain your answer with reference to your own knowledge.

ans.: e.g. water, due to the lack of large-scale falling water _____

(P.14) Question:

1. How would you describe the electricity tariff (how much you pay for using electricity) of Hong Kong when comparing with other cities? Explain your answer with reference to Table 1 and Table 2 in Source F.

ans.: low – Table 1 shows that the electricity tariff of Hong Kong only cost 1-1.1 which is much lower than other developed cities such as London and New York. Table 2 shows that the percentage share Hong Kong household expenditure on electricity supply is lower than other cities such as London and Sydney.
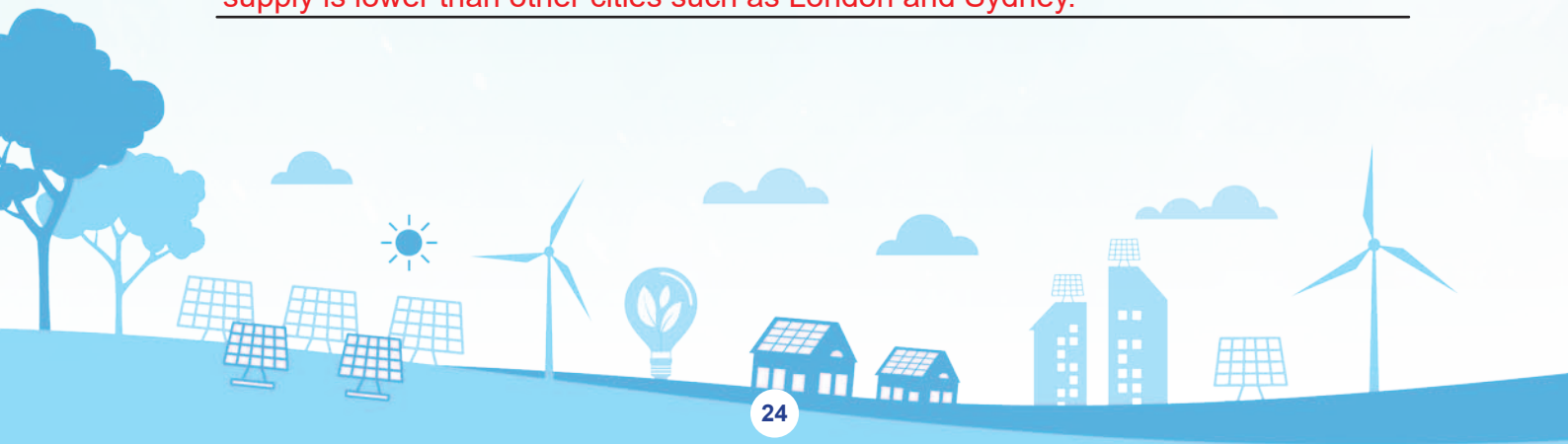
(P.15) Question:

1. How would you describe the electricity supply in Hong Kong when comparing with other cities shown in Source G?

ans.: <u>stable/ reliable</u>

(P.16) Questions:

1. Describe the trends shown in Source H. (trend=increase / decrease; find out the difference between the year 2010 and 2017 in each sector)

Residential sectors had a/an decrease/increase in electricity consumption from <u>39344</u> terajoule in 2010 to <u>43415</u> terajoule in 2014.
How about the other sectors? <u>Commercial: increase; industrial: increase etc.</u>

2. Identify the pattern shown in Source H. (pattern=phenomenon that repeats itself)

ans.: <u>commercial sector consumes the most</u>

Question:

1. Explain the following terms by searching relevant information from your textbook or from the internet:

(c) Carbon intensity

ans.: <u>An emission intensity is the average emission rate of a given pollutant from a given source relative to the intensity of a specific activity; for example grams of carbon dioxide released per megajoule of energy produced/the amount of carbon (in terms of weight) emitted per unit of energy consumed</u>

(d) The Paris Agreement (the Paris Climatic Conference)

ans.: <u>An agreement about carbon emission reduction resulted in an international conference</u>

2. What should Hong Kong do in response to the target set by the two documents mentioned in Source I?
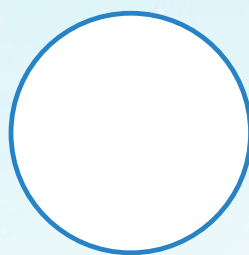
ans.: <u>carbon emission reduction</u>

(P.19) Appendix 3: Strength and weakness of existing fuel mix

Strength	Weakness
e.g. Affordability	e.g. Not eco-friendly / environmentally unfriendly
e.g. stable supply of electricity	e.g. lack diversity

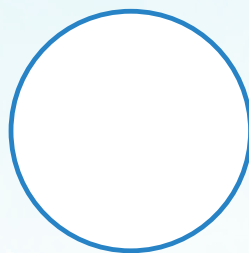| Factors / criteria (give brief explanation of the meaning)	Justification / significance (Why is the factor important in Hong Kong?)
1. e.g. eco-friendliness - good/harmful to the environment? - emission of CO_2 / air pollutant?	e.g. air pollution is quite serious in Hong Kong e.g. Hong Kong has to meet the target of reducing carbon intensity / emission set in the Paris Agreement and Hong Kong's Climate Action Plan
2. e.g. safety - possibility of disaster that would cause human, material, economic or environmental loss	
3. e.g. availability - can we get access to? (e.g. physical, economic, technological consideration)	
4. e.g. diversity - more than one choice? - would it be too heavily depended on a particular energy?	
5. e.g. cost-effectiveness - is it worth by comparing the financial cost / environment cost with outcome?	
6. e.g. sustainability - is there a long term supply?	

(P.20) Appendix 5: What would be the fuel mix if a particular criterion/ factor is adopted in Hong Kong?

_____ e.g. cost _____

_____ e.g. safety _____