

- Teacher guidelines for case study - Clean energy vehicles at the Beijing Winter Olympics



Generic green skills

Cognitive competencies:

- Systems and risk analysis, skills to assess, interpret and understand both the need for change and the measures required
- Ability to make judgments based on both evidence and sustainability values

Interpersonal competencies:

- Strategic and leadership skills to enable policymakers and business executives to set the right incentives and create conditions conducive to cleaner production, cleaner transportation, etc.



Learning objective

Students are expected to:

1. Understand the concept and mechanisms in relation to how clean energy vehicles (CEVs) work.
2. Investigate how much carbon emission could be reduced with clean energy vehicles.
3. Explore the environment and economic potential of clean energy vehicles in your country/local community.



Format

Small class with working groups of up to 6 people per group



Role of teacher

Facilitator and group leader



Resources needed

Laptop, whiteboard, A4 paper, pens, student worksheet, case study



Time required

Up to 180 mins (divided into 2 classes)



Assessment

The assessment will be based on:

1. The quality of your report on clean energy vehicle development.
2. Final presentation: Clear, logical, and realistic point of view about the potential of clean energy vehicles and suggestions as to how to overcome challenges related to the use of CEVs in the country or local community.

This case study is designed for students to become familiar with the basic technological background of clean energy vehicles (CEVs), which are also known as new energy vehicles (NEVs), and their potential to reduce carbon emissions. Students will be asked to investigate how much carbon emissions could be reduced if CEVs were used in their country or local community, and identify solutions to cope with current emissions difficulties for the country or local community.

Suggested teaching and learning sequences

Class 1

Before the class:

1. Form study groups.
2. Ask students to read the case study, “Clean energy vehicles at the Beijing Winter Olympics” and think about the questions below:
 - a. What are clean energy vehicles and how many types of clean energy vehicles can you identify?
 - b. What are the environmental issues caused by carbon emissions?
 - c. How do clean energy vehicles work to combat carbon emissions?

During the class:

1. Group sharing (40 mins)

- a. Help the students to go through the case study.
- b. Facilitate students’ group discussion about the pre-class questions. Ask students to summarize their group discussions on A4 paper. You can suggest students use different graphical forms to present their findings (e.g. graphs, a mind map and a tree map).
- c. Invite 2-3 groups to share their group discussions and organize students’ findings in a graph.

2. Online research and group discussion (40 mins)

- a. Facilitate students’ online research and group discussion about “how clean energy vehicles have developed in your country/region.” Suggest students focus on the questions listed below, but they are not limited to these alone. Students in the same group can focus on different questions to do online research and discuss the findings in the group. Ensure all the questions have been covered in their group.
 - i. How many clean energy vehicles have been sold in the market in China/in your country? Has there been an increase in sales over the last three years?
 - ii. Is there a developed infrastructure (recharging/maintenance) in your country?
 - iii. Is it worthwhile, economically and environmentally, to develop clean energy vehicles in your country?
 - iv. What incentives are required to stimulate consumer demand?

Each group member should focus on one question do some online research and then discuss the findings with the group.

- b. Ask students to organize the group findings into a brief report and consider the marking criteria for the report. Suggest students develop a report outline and specify who will be work on different parts of it. Each groupmate should contribute to the report.

After the class:

1. Ask the students to write up the group report.
2. Ask students to prepare a presentation of the report in class 2.

Class 2

Before the class:

1. Ask students to upload their group report to the online learning platform for sharing.
2. Ask students to read the other groups' reports and provide comments.

During the class: Group presentation with Q&A session (60 mins)

1. Facilitate students' group presentation. Ask students to formulate at least two questions with their group for each presentation, based on individual comments formulated before the class.
2. Facilitate students to discuss, collectively in class, what can be done to meet government targets for CEV production and consumption. What incentives should be in place?
3. After each group's presentation, ask students to identify any further questions they might have and provide suggestions.

After the class:

1. Ask students to improve their group report based on the comments and discussions.
2. Ask students to submit their group report as required.

Suggested answers/examples for the activities

1. Group sharing (40 mins)

- a. What are clean energy vehicles and how many types of clean energy vehicles can you identify?

Clean energy vehicles are commercial vehicles powered by renewable energy, usually hydrogen fuel cell or chemical battery, rather than petroleum.

- b. What are the environmental issues caused by carbon emissions?

Carbon can trap heat from the atmosphere and prevent it from escaping the earth's surface. This causes climate change, which negatively influences human health and productivity.

- c. How do clean energy vehicles work to combat carbon emissions?

Carbon emissions from transportation amounted to 11% of the total annual carbon emissions in China in 2019, which is equivalent to approx. 10 billion tons of carbon dioxide. 86.76% of transport carbon emissions came from the roads, in particular from heavy trucks, buses, cars and other vehicles. Since there is no fuel combustion from clean energy vehicles, billions of tons of carbon dioxide could be saved.

2. Online research and group discussion (40 mins)

- i. How many clean energy vehicles have been sold in the market in China/in your country? Has there been an increase in sales over the last three years?

The answer should be based on data taken from media reports or research journals, which identify trends in conventional cars sales and clean energy vehicles sales. Students will also need to know how much carbon emissions have been reduced from these sales.

- ii. Is there a developed infrastructure (recharging/maintenance) in your country?

The answer should outline a general picture of clean energy vehicle infrastructure, including the factories that produce clean energy vehicles, the number of recharging stations, household recharging poles, government regulations or policies about clean energy vehicles recharging infrastructure and government policy frameworks for clean energy vehicles.

iii. Is it worthwhile, economically and environmentally, to develop clean energy vehicles in your country?

You can suggest students use the SWOT (strength, weakness, opportunities, and threat) analysis of the clean energy vehicles industry in the country and provide their own opinions about how to develop the industry. It is suggested they analyze it from the perspective of the environment and economic impacts on the developing clean energy vehicle industry.

iv. What incentives are required to stimulate consumer demand?

Students are encouraged to research and compare the policies frameworks related to the clean energy vehicle industry from other countries (e.g., US, EU, China and ASEAN countries). Consider the SWOT analysis from the previous question, and design policies such as subsidies for car purchase and charging facility installations, tax rebate for clean energy vehicles manufacturers etc.

3. Key content of the report and presentation

- a. The current market of clean energy vehicles, the infrastructure of recharging/refueling sites, the policy frameworks, the clean energy vehicles industry etc.
- b. Current carbon emissions from the transport industry and reasonable forecasts about carbon emission reduction with clean energy vehicles.
- c. Reasonable potentials and difficulties related to clean energy vehicle development within the country, including what should be done to meet government targets for CEV production and consumption. What incentives should be in place?

The marking criteria for the report is included in the Appendix.

Reference:

- Li, X., Tan, X., Wu, R., Xu, H., Zhong, Z., Li, Y., Zheng, C., Wang, R. and Qiao, Y., 2021. Paths for Carbon Peak and Carbon Neutrality in Transport Sector in China. *Chinese Journal of Engineering Science*, 23(6), p.15.
- Liu, H., 2019. Technology and Development of Hydrogen Fuel Cell for Vehicles. *SHANGHAI ENERGY CONSERVATION*, 08(2019), pp.674-678.
- Luo, Z., 2022. China's New Energy Vehicle Industry and Technology Development Status and Countermeasures. *Automobile Applied Technology*, 1(5), pp.158-162.
- Wang, Y., 2022. Video: Hydrogen vehicles fuel Beijing Winter Games. [online] Govt.chinadaily.com.cn. Available at: <https://govt.chinadaily.com.cn/s/202202/18/WS620f0963498e6a12c121f5e1/video-hydrogen-vehicles-fuel-beijing-winter-games.html> [Accessed 18 February 2022].
- Wu, C., 2022. Beijing 2022 Winter Olympics set to become first Olympic Games fully powered by green energy. [online] Hb.dzcom. Available at: <http://hb.dzwww.com/p/p6iCC1IBC6.html> [Accessed 21 November 2021].
- Zheng, X., 2022. Clean energy vehicles take road to future at the Winter Olympics. [online] Chinadaily.com.cn. Available at: <http://www.chinadaily.com.cn/a/202202/09/WS6202fa2ea310cdd39bc85717.html> [Accessed 9 February 2022].

Appendix: Marking criteria for the report

Levels Criteria	Excellent	Very Good	Good	Satisfactory
<p>Identification of key data and information related to the clean energy vehicle industry, and quantity and depth of background research.</p>	<p>All information and data is conveyed in an accurate, relevant and succinct manner, leading to an excellent description of the overall picture of the clean energy vehicle development status in the country. There is clear evidence of comprehensive research to obtain information from multiple sources, including relevant company reports, media news, research journals etc.</p>	<p>Majority of information and data is conveyed in an accurate, relevant and succinct manner, leading to a general description of the overall picture of the clean energy vehicle development status in the country. There is strong evidence of wider research to obtain information from multiple sources.</p>	<p>Some omissions of data and information presented in relation to the clean energy vehicle development status in the country. There is some evidence that research was conducted as it extends beyond the information found in the case study.</p>	<p>Major omissions and inaccuracies in terms of data and information presented in relation to the clean energy vehicle development status in the country. Limited research was conducted and it is mainly confined to clean energy vehicle sales, charging center numbers etc.</p>
<p>Quality of analysis of data and information related to the clean energy vehicle industry.</p>	<p>All relevant economical and environmental impacts of the clean energy vehicle industry are identified, calculated and analyzed. A full understanding about the clean energy vehicle industry is evident, along with its environmental and economical development in the report.</p>	<p>Most of the economical and environmental impacts of the clean energy vehicle industry are identified and supported with adequate calculations and analysis. A major understanding about the clean energy vehicle industry is evident, along with its environmental and economical development in the report.</p>	<p>Some economical and environmental impacts of the clean energy vehicle industry are identified. The identification, calculation and analysis of the details show some understanding but lack depth. The understanding of the clean energy vehicle industry, along with its environmental and economical development is partially expressed.</p>	<p>The identification of economical and environmental impacts of the clean energy vehicle industry is lacking detail and is poorly supported with a minimal understanding and calculations. There is a minimal understanding about the clean energy vehicle industry and its impact on sustainable development, including carbon emissions, air pollution and economical sustainability.</p>

<p>Conclusions about the analysis of the clean energy vehicle industry and recommendations in the form of a development plan for your country/region.</p>	<p>Exceptional summary and clear analysis and findings about the clean energy vehicle industry. The report critically discusses the strengths and weaknesses of the clean energy vehicle industry, as well as its threats and challenges. An outstanding attempt is made to complete a thorough plan and/or lists of recommendations that cover the views of government, companies and society comprehensively.</p>	<p>Specific summary of the analysis and findings about the clean energy vehicle industry. The report critically discusses the strengths and weaknesses. A good attempt is made to consolidate a thorough plan and/or lists of recommendations that cover the views of government, companies and society.</p>	<p>General summary of the analysis and findings about the clean energy vehicle industry with some discussion related to analysis and suggestions. A reasonable attempt is made to complete a brief plan, or lists of suggestions, that cover some views of government, companies and society.</p>	<p>Brief summary of the analysis and findings about the clean energy vehicle industry, but with little in-depth discussion related to analysis and suggestions. A fair attempt is made to consolidate a general plan and/or lists of recommendations in any one of the views of government, companies and society.</p>
<p>Quality of document presentation in terms of writing style, grammar, spelling, referencing, formatting and use of appropriate tables, charts and graphs.</p>	<p>The submitted report is presented in a coherent writing style with paragraphs and sections within the report that are linked together to maintain writing flow. Information is presented in a clear, concise and succinct manner. The report has no spelling or grammar errors. Tables, charts and graphs are presented in a uniform and consistent format throughout the report. References are properly cited both within the text and in the bibliography.</p>	<p>The submitted report contains minimal grammar and spelling errors. The flow of writing is maintained for the majority of the document. References are properly cited. Tables, charts and graphs are presented in a uniform and consistent format throughout the report.</p>	<p>The writing style is coherent and the flow of writing is maintained for most of the report. Sentences, for the most part, are well constructed to convey the meaning of the information presented. The report only contains a few spelling and grammatical errors. Data is presented in appropriate formats, e.g. charts, tables and graphs, and for most part the format is consistent and the information can be understood fairly easily. Referencing throughout the report is appropriately documented, but may contain a few errors.</p>	<p>Writing style is reasonably coherent, but some paragraphs are not well linked and the flow of writing is disrupted. Spelling and grammar errors are frequent throughout the report. The report lacks consistency both in terms of text and data, e.g. inconsistent use of headings, sub-headings etc., that cause misunderstandings and are difficult to read. There is some evidence of referencing in the report, but it may be limited or incorrect.</p>