IB ESS YEAR 2 - Unit 4 Climate Change and Energy Production

Teacher(s)	IB ESS PLC	**Subject Group and Course**	Group 4 - ESS		
Course Part and Topic	Topic 7 Climate Change and Energy Production	**SL or HL / Year 1 or 2**	SL Year 2	**Dates**	5 weeks
Unit Description and Texts		**DP Assessment(s) for Unit**			
• Oxford Textbook Topic 7 • Topic 7.1 Energy Choices and Security • Topic 7.2 Climate Change-Causes and Impacts • Topic 7.3 Climate Change-Mitigation and Adaptation		• Formative/Summative assessment quizzes and activities/reports to check for understanding - Based in IB exam questions and format			

INQUIRY: establishing the purpose of the unit

Transfer Goals

List here one to three big, overarching, long-term goals for this unit. Transfer goals are the major goals that ask students to "transfer" or apply their knowledge, skills, and concepts at the end of the unit under new/different circumstances, and on their own without scaffolding from the teacher.

Statement of Inquiry
The choice of energy sources is controversial and complex.

Phenomenon: Climate change is making the epic California drought worse.

Review Significant Ideas

- There is a range of different energy sources available to societies that vary in their sustainability, availability, cost and sociopolitical implications.
- The choice of energy sources is controversial and complex. Energy security is an important factor in making energy choices.
- Scientists use a variety of techniques to study past, present, and possible futures of the Earth's climate.
- Climate change has been a normal feature of the Earth's history, but human activity has contributed to recent changes.
- Climate change causes widespread and significant impacts on a global scale.
- Mitigation attempts to reduce the causes of climate change.

- Adaptation attempts to manage the impacts of climate change.

ACTION: teaching and learning through inquiry

Content / Skills / Concepts - Essential Understandings	**Learning Process** *Check the boxes for any pedagogical approaches used during the unit. Aim for a variety of approaches to help facilitate learning.*
<u>Students will know the following content:</u> ● Fossil fuels contribute to the majority of humankind's energy supply, and they vary widely in the impacts of their production and their emissions; their use is expected to increase to meet global energy demand. ● Sources of energy with lower carbon dioxide emissions than fossil fuels include renewable energy (solar, biomass, hydropower, wind, wave, tidal and geothermal) and their use is expected to increase. ● Renewable energy prices and natural gas prices have fallen dramatically since 2015 due to recent technological innovations. ● Nuclear power is a low carbon low-emission non-renewable resource but is controversial due to the radioactive waste it produces and the potential scale of any accident. ● Energy security depends on adequate, reliable and affordable supply of energy that provides a degree of independence. An inequitable availability and uneven distributions of energy sources may lead to conflict. ● The energy choices adopted by a society may be influenced by availability; sustainability; scientific and technological developments; cultural attitudes; and political, economic and environmental factors. These in turn affect energy security and independence. ● Improvements in energy efficiencies and energy conservation can limit growth in energy demand and contribute to energy security. ● Climate describes how the atmosphere behaves over relatively long periods of time, whereas weather describes the conditions in the atmosphere over a short period of time. ● Weather and climate are affected by oceanic and atmospheric circulatory systems. ● Human activities are increasing levels of greenhouse gases (GHGs, such as carbon	Learning experiences and strategies/planning for self-supporting learning: ☒ Lecture □ Socratic seminar ☒ Small group/pair work ☒ PowerPoint lecture/notes ☒ Individual presentations ☒ Group presentations ☒ Student lecture/leading □Interdisciplinary learning Details: *Students will learn through a combination of presentations, team/small group work, activities surrounding threats to and conservation of biodiversity.* Other(s): Use of social media - Instagram/Twitter for increased awareness - creation of a children's book, game,

dioxide, methane and water vapor) in the atmosphere, which leads to: – an increase in the mean global temperature – increased frequency and intensity of extreme weather events – the potential for long-term changes in climate and weather patterns – rise in sea level. ● The potential impacts of climate change may vary from one location to another and may be perceived as either adverse or beneficial. These impacts may include changes in water availability, distribution of biomes and crop growing areas, loss of biodiversity and ecosystem services, coastal inundation, ocean acidification, and damage to human health. ● Both negative and positive feedback mechanisms are associated with climate change and may involve very long time lags. ● There has been significant debate due to conflicting EVSs surrounding responses to climate change. ● Global climate models are complex and there is a degree of uncertainty regarding the accuracy of their predictions -- the most accurate predictions are only available for short time frames ● Mitigation involves reduction and/or stabilization of GHG emissions and their removal from the atmosphere. ● Mitigation strategies to reduce GHGs in general may include: – reduction of energy consumption – reduction of emissions of oxides of nitrogen and methane from agriculture – use of alternatives to fossil fuels – geo-engineering. ● Mitigation strategies for carbon dioxide removal (CDR techniques) include: – protecting and enhancing carbon sinks through land management; for example, through the UN collaborative programme on reducing emissions from deforestation and forest degradation in developing countries (UN-REDD) – using biomass as a fuel source – using carbon capture and storage (CCS) – enhancing carbon dioxide absorption by the oceans through either fertilizing oceans with compounds of nitrogen, phosphorus and iron to encourage the biological pump, or increasing upwellings to release nutrients to the surface. ● Even if mitigation strategies drastically reduce future emissions of GHGs, past emissions will continue to have an effect for decades to come. ● Adaptation strategies can be used to reduce adverse affects and maximize any positive effects. Examples of adaptations include flood defenses, vaccination programmes, desalinization plants and planting of crops in previously unsuitable climates. ● Adaptive capacity varies from place to place and can be dependent on financial and technological resources. MEDCs can provide economic and technological support to LEDCs.	etc to inform the younger generation of issues surrounding biodiversity **Formative assessment(s):** Quizzes In class activities Case studies Research assignments Role-playing study (EN-Roads from MIT Sloan Business School) **Guidance:** ❖ **Strengths and weaknesses of the use of fossil fuels, of a renewable source of energy, and of nuclear power should be considered.** ❖ **Use case studies to highlight the energy choices of different countries.** ❖ **GHGs are those atmospheric gases that absorb infrared radiation, causing global temperatures to be higher than they would otherwise be.** ❖ **Students should be able to distinguish between the natural and the enhanced greenhouse effect and to identify a variety of human activities that contribute to GHG emissions.** ❖ **Students must understand the concept of tipping points and how it might be applied to climate change.** ❖ **A minimum of two different viewpoints should be considered** ❖ **CCS is carried out by carbon dioxide being compressed, transported and stored permanently underground (geological sites used as repositories) or chemically fixed to form a carbonate.** ❖ **Mitigation is the use of technology and substitution to reduce resource inputs and emissions per unit of output.** ❖ **Adaptation is the adjustment of natural or human systems in response to actual or expected climatic**

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- There are international efforts and conferences to address mitigation and adaptation strategies for climate change; for example, the Intergovernmental Panel on Climate Change (IPCC), National Adaptation Programmes of Action (NAPAs) and the United Nations Framework Convention on Climate Change (UNFCCC).

<u>Students will develop the following skills:</u>

- Evaluate the advantages and disadvantages of different energy sources.
- Discuss the factors that affect the choice of energy sources adopted by different societies.
- Discuss the factors that affect energy security.
- Evaluate the energy strategy of a given society.
- Discuss the feedback mechanisms that would be associated with a change in mean global temperature.
- Evaluate contrasting viewpoints on the issue of climate change.
- Discuss mitigation and adaptation strategies to deal with impacts of climate change.
- Evaluate the effectiveness of international climate change talks.

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stimuli or their effects, which either moderates harm or exploits beneficial opportunities.
Two mitigation and two adaptation strategies should be considered

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International Mindedness:

- **Choice of energy sources can have impacts at both local and global level as emissions of greenhouse gasses can contribute to global climatic change.**
- **Political and economic situations around the world can affect energy security and choice of options.**
- **The impacts of climate change are global and require coordinated international action.**
- **The impacts of climate change are global and require global mitigation.**

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Summative assessments:
Group project
Summative assessment over each subtopic and over Topic 7 all

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Differentiation:

☒ Affirm identity - build self-esteem

☒ Value prior knowledge

☒ Scaffold learning

☒ Extend learning

Details:

- *SWD/504 – Accommodations Provided*
- *ELL – Reading & Vocabulary Support*
- *Intervention Support*
- *Extensions – Enrichment Tasks and Project*

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Approaches to Learning (ATL) *Check the boxes for any explicit approaches to learning connections made during the unit. For more information on ATL, please see the guide.*
☒ Thinking ☒ Social ☒ Communication ☒Self-management ☒ Research Details: This topic provides students with a vast amount of information that can be studied in many ways. The ATLs used for this subtopic will vary depending on the individual students and groups approach to showing their understanding of the material

Language and Learning	**TOK Connections**	**CAS Connections**
Check the boxes for any explicit language and learning connections made during the unit. For more information on the IB's approach to language and learning, please see the guide.	*Check the boxes for any explicit TOK connections made during the unit*	*Check the boxes for any explicit CAS connections. If you check any of the boxes, provide a brief note in the "details" section explaining how students engaged in CAS for this unit.*

☒ Activating background knowledge ☒ Scaffolding for new learning ☒ Acquisition of new learning through practice □ Demonstrating proficiency Details: *Students will acquire new vocabulary dealing with climate change and the impacts humans have on climate* *Connections:* *ESS: Energy and equilibria (1.3); sustainability (1.4); resource use in society (8.2); human population carrying capacity (8.4).* *ESS: Systems and models (1.2); energy and equilibria (1.3); threats to biodiversity (3.3); access to fresh water; human population carrying capacity (8.4)* *ESS: Humans and pollution (1.5)*	☒ Personal and shared knowledge ☒ Ways of knowing ☒ Areas of knowledge ☒ The knowledge framework Details: The choice of energy sources is controversial and complex—how can we distinguish between a scientific claim and a pseudoscience claim when making choices? There has been considerable debate about the causes of climate change— does our interpretation of knowledge from the past allow us to reliably predict the future? There is a degree of uncertainty in the extent and effect of climate change— how can we be confident of the ethical responsibilities that may arise from knowledge when that knowledge is often provisional or incomplete?	☒ Creativity ☒ Activity ☒ Service Details: Recycling initiatives Reducing wastes Reusing materials

Resources

List and attach (if applicable) any resources used in this unit

- Oxford Environmental Systems and Societies ISBN 978-0-19-833256-5
- Biozone Environmental Science Student Workbook ISBN 978-1-927173-55-8
- Hodder Education Environmental Systems and Societies Study and Revision Guide ISBN 978-1-471-89973-7

- IB ESS Schoology Group

REFLECTION: considering the planning, process, and impact of the inquiry

What worked well *List the portions of the unit (content, assessment, planning) that were successful*	**What didn't work well** *List the portions of the unit (content, assessment, planning) that were not as successful as hoped*	**Notes / Changes / Suggestions** *List any notes, suggestions, or considerations for the future teaching of this unit*
Mitigations and Adaptations Strategies Assignment Personal Viewpoint Essay Global Warming and Climate Change	Webquest links need to be updated.	Encourage students to be able to answer IB questions and practice test taking strategies more frequently