

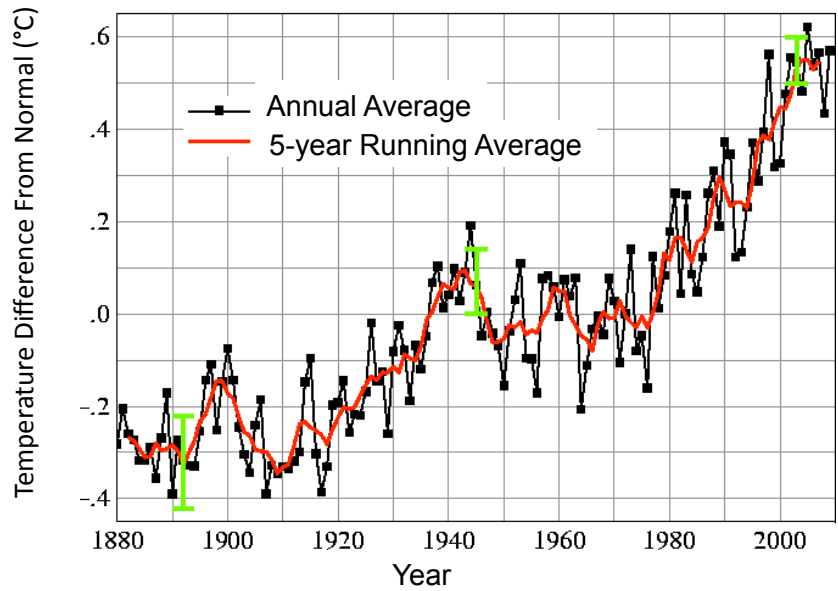
LP 6**Science Consensus and the Climate Change Debate**

# of Days	2		
Prior Knowledge	Students will have attained a basic level of the science behind global warming. Students will also likely have been exposed to elements of the global warming debate through various media sources.	California English-Language Arts Content Standards	Reading 2.8 Listening and Speaking 1.11, 1.12, 1.13
Lesson Objective	Students will be able to identify elements of scientific consensus making and analyze debates about the validity of global warming claims.	Language Goals/Demands	Teachers must be prepared to moderate discussions and arguments that may have deep seeded values based on political, religious, or social identities
Lesson Assessment		Changes for Next Time	
California State Science Standard	Investigation 1.I, 1.m		
Materials Needed	Video Projector, Laptop or Computer with Connection to Internet	What Worked Well	
Time	Student Learning Task or Activity	Teacher METHOD or Activity	
Day 1			
25 minutes	Preponderance of Evidence Activity - Students should be divided into groups. There are 10 different cards. Students will review the cards for their group, discuss the evidence, and then listen/give presentations and take notes on all the other evidence.	GROUPWORK 6.1.1 Preponderance of Evidence.ppt (to use as resource cards) 6.1.2 Preponderance of Evidence Activity Card 6.1.3 Preponderance of Evidence Graphic Organizer Pkia Video at http://www.youtube.com/watch?v=QVJuRgil0wQ or search for dam cute pika	
15 minutes	A Process of Science - Teacher presents and discusses the process of science, scientific consensus, science in policy, and political interference in science.	PRESENTATION 6.1.4 Process Science Slides	
5 minutes	Video of Commercial on Carbon Dioxide - Teacher plays video without much of an introduction. After viewing the video, the teacher asks for initial impressions.	VIDEO Play 6.1.5 Video clip for RealPlayer http://www.factcheck.org/article395.html has the video as a download http://www.youtube.com/watch?v=7sGKvDNdJNA&feature=player_ dded	

10 minutes	Students work in groups to analyze the commercial using the transcript and questions on task card.	GROUP WORK See 6.1.6 Transcript of commercial Use 6.1.7 Task card for student analysis
Day 2		
3 min	Bellwork: Perhaps you have heard debates about global warming. Write down different arguments that you have heard in the media about global warming.	INDIVIDUAL SEAT WORK
5 min	Teacher-led Discussion What are some of the major debates over global warming that you wrote down for bellwork? - Have students share what they have heard and where they have heard it. Write some of these ideas on the board and note the sources - Tell students that they will be watching segments from a video called "The Global Warming Swindle". On their handout, they will be asked to write down some of the major arguments that the video makes. They can also write notes about what they think about the argument to the side as they will be talking about these in groups after the video.	TEACHER-LED DISCUSSION
20 min	Watch Global Warming Swindle Parts 1 & 2 - Use the note guide to write down the major arguments that the movie makes	WATCH VIDEO Student Handout 6.2.1: Video Guide Part 1 Link: http://www.youtube.com/watch?v=6TqqWJugXzs Part 2 Link: http://www.youtube.com/watch?v=L5rGpDMN8lw&NR=1
8 min	Teacher-led Discussion - Based on your note guide, what are some of the major arguments that the film makes? - What are their sources of evidence? - What is your response to these claims?	TEACHER-LED DISCUSSION
14 min	Watch the Global Warming Debate Rebuttal	WATCH VIDEO Part 1 Link: http://www.youtube.com/watch?v=IljGynF4qkE&feature=related Part 2 Link (only need to watch first few minutes): http://www.youtube.com/watch?v=goDsc9laSQ8&feature=related

6 min	Class Discussion How did both of the films use evidence? What kind of experts can you trust? What must you think about when viewing media critically about climate change?	TEACHER-LED DISCUSSION
HW	Read strategy wedge table to prepare for mitigation wedge activity	7.1.4 Wedge Strategies Table

Temperature (1880- 2005)



Preponderance of Evidence Resource Card 1

<http://data.giss.nasa.gov/gistemp/graphs/>

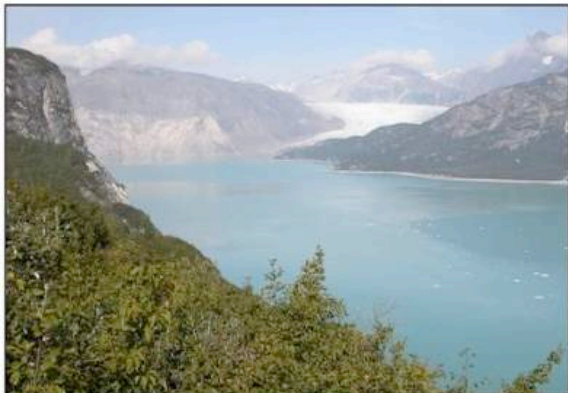
Shrinking Glaciers

Muir Glacier, Alaska

August 1941



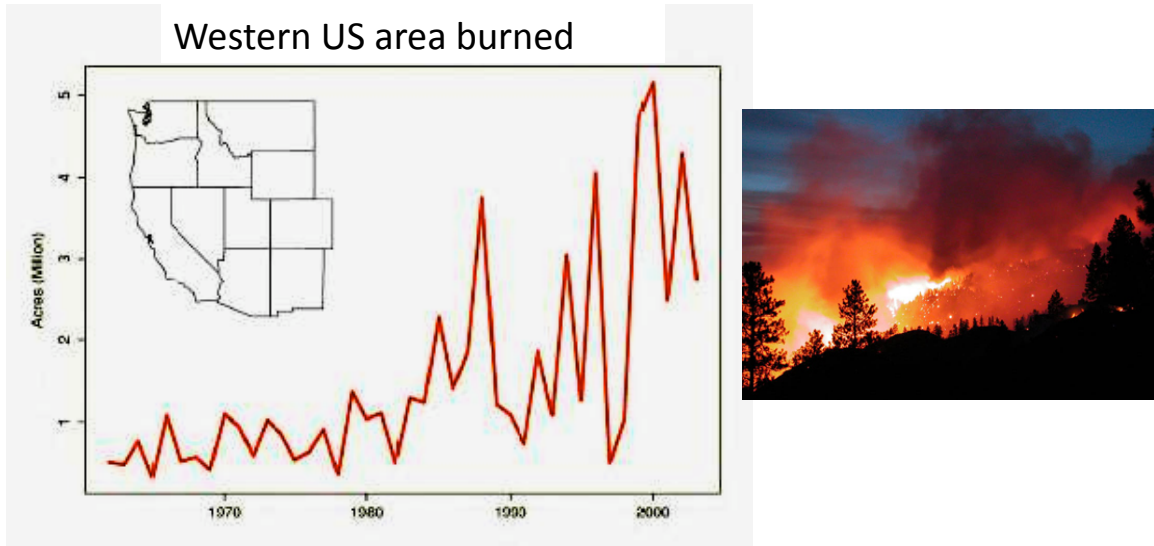
August 2004



NSIDC/WDC for Glaciology, Boulder, compiler. 2002, updated 2006. *Online glacier photograph database*. Boulder, CO: National Snow and Ice Data Center.

Preponderance of Evidence Resource Card 2

Increasing Wildfire Risk

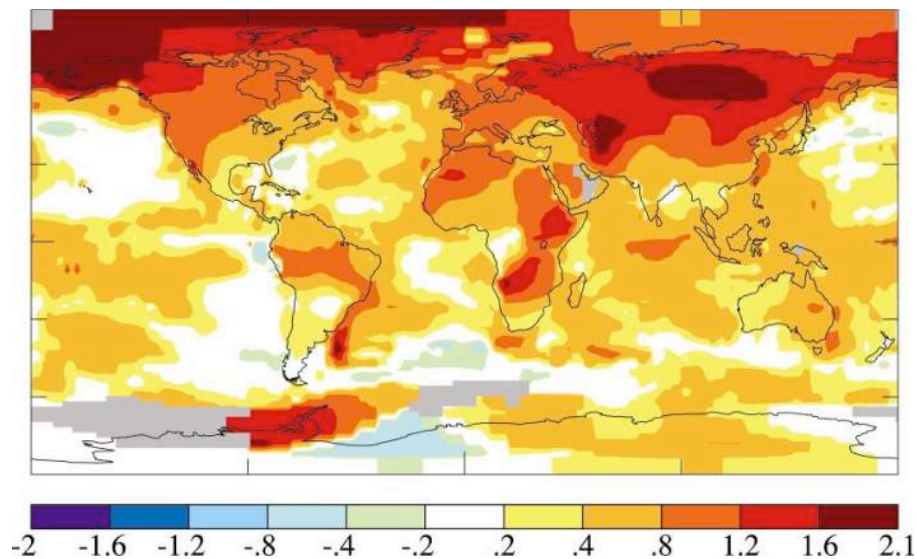


Source: Westerling et al. 2006

Preponderance of Evidence Resource Card 3

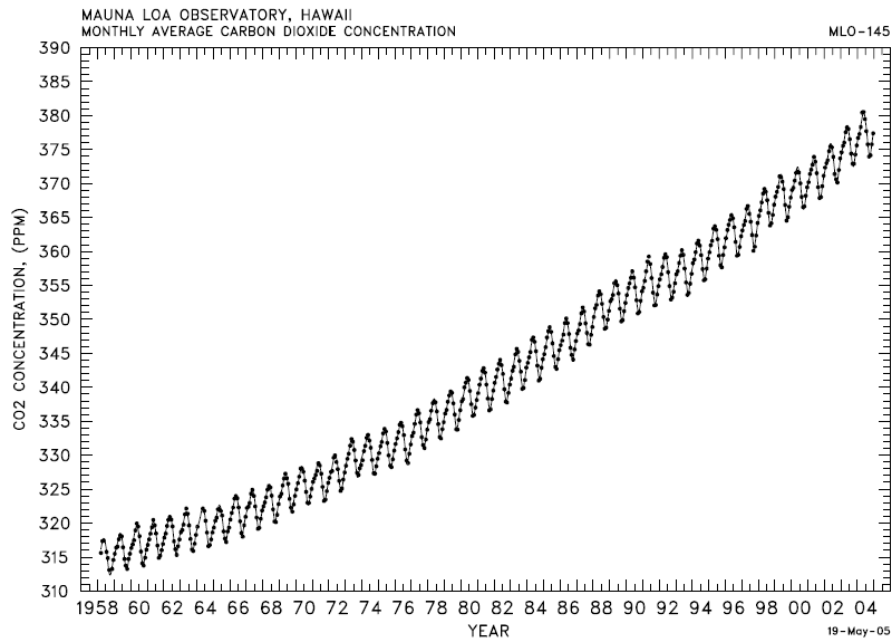
Average Surface Temperature Changes

Average Surface Temp in 2001-2005 vs 1951-1980



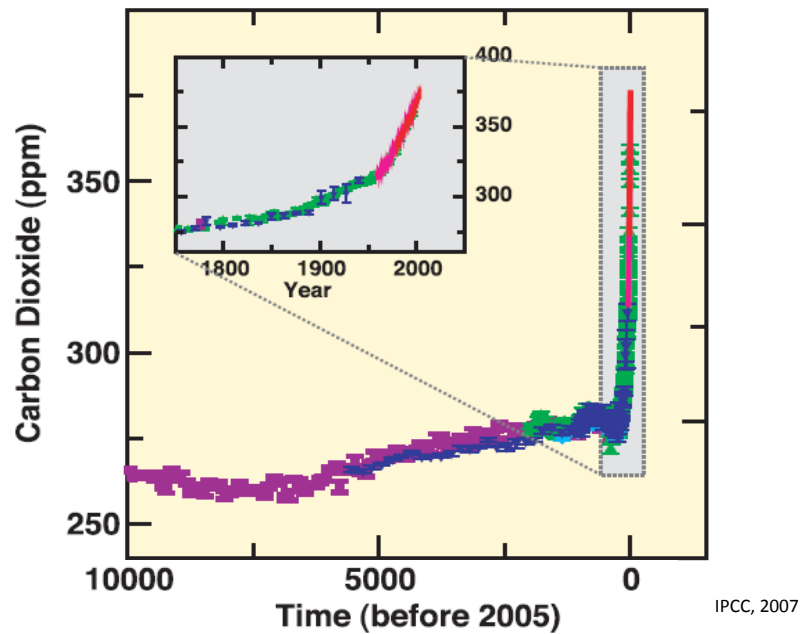
Preponderance of Evidence Resource Card 4

Keeling Curve - CO₂ Concentration



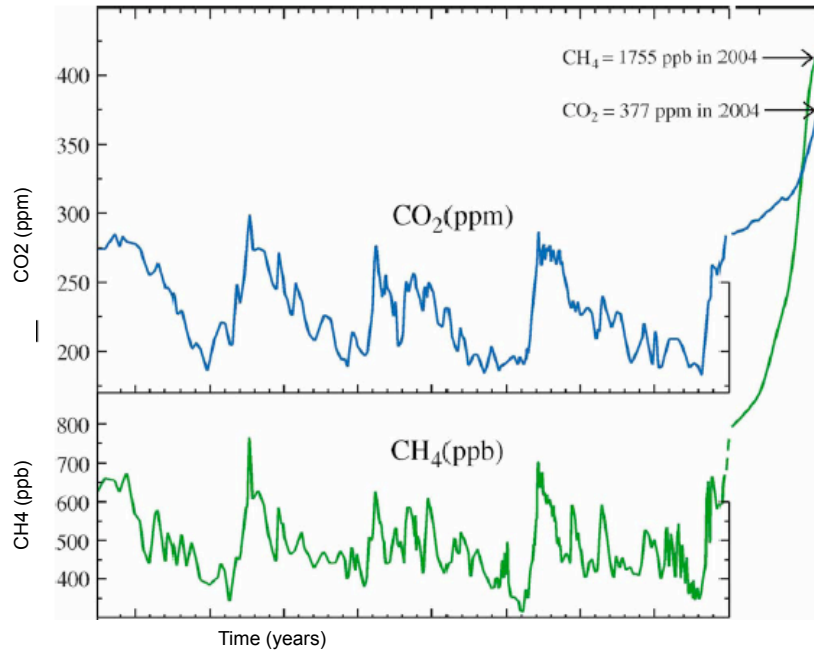
Preponderance of Evidence Resource Card 5

Increasing CO₂ Concentration



Preponderance of Evidence Resource Card 6

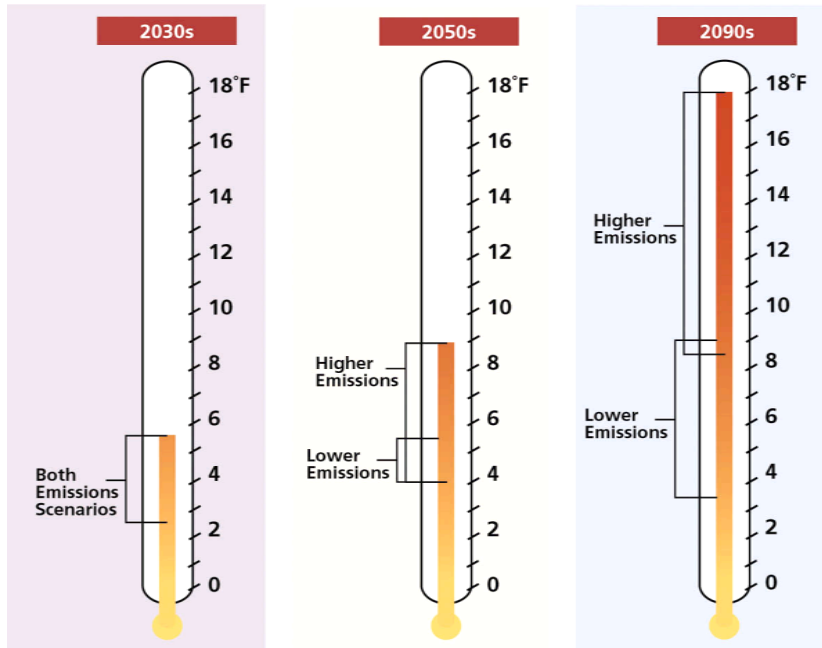
Ice Core Records



Preponderance of Evidence Resource Card 7

Source: Hansen, *Clim. Change*, **68**, 269, 2005.

Projected Changes in CA Summer Temperature



Preponderance of Evidence Resource Card 8

UCS

Species Shifting

1900
>7,800 ft


2004
>9,500 ft

Pika

Species that are sensitive to temperature conditions can only move up the mountainside as conditions get too warm for them lower down.

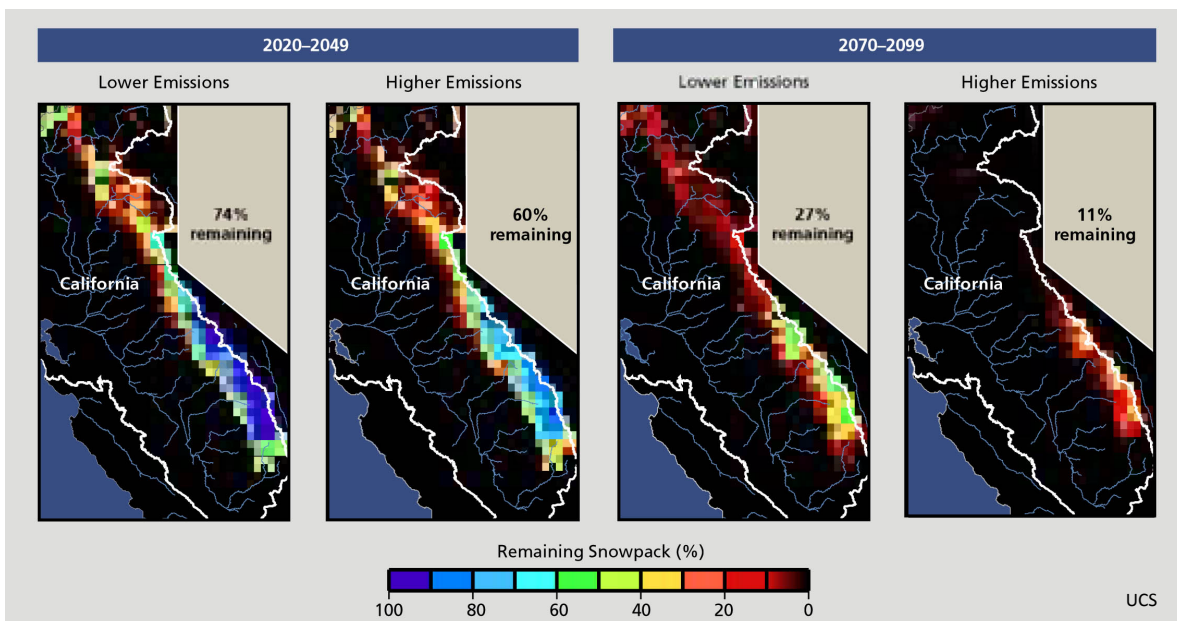
In the Sierras, Pika were seen at 7,800 feet and above in 1900. By 2004, they were not seen below 9,500 feet. This trend is expected to continue.

The mountains rise as high as 12,000 feet, but the rocky hillsides where Pika live do not reach that high.



Preponderance of Evidence Resource Card 9

Diminishing Sierra Snowpack Percentage Remaining, Relative to 1961-1990



Preponderance of Evidence Resource Card 10

Preponderance of Evidence

As a group, examine the resources and discuss the following questions:

- Describe the evidence presented for the observed changes in the physical world or in the biological systems.
- Given what we know, how does the increase of atmospheric CO₂ cause these changes?
- What human activities contribute to the increase of CO₂ in the atmosphere?

Individually, complete the summary report. Record your conversation and the reports from the other groups.

Name _____ Period _____

6.1.3 Graphic Organizer

Preponderance of Evidence

Slide Name	Evidence
Temperature 1880-2000	
Shrinking Glaciers	
Increasing Wildfire Risk	
Keeling Curve – CO₂ Concentration	
Average Surface Temperature Changes	
Increasing CO₂ Concentration	

Ice Core Records	
Projected Changes in CA Summer Temperatures	
Species Shifting	
Diminishing Sierra Snowpack	

How do we know what is 'good science'?

- Scientists follow logical paths that refine our knowledge
 - uses quality data and methods to arrive at a defensible position
- The modern scientific process looks somewhat like this:
- Idea → Research → Conclusions → Publication → Feedback → Research
- All scientific ideas are subject to challenge and modification

Quality Control

- The scientific community polices itself for quality
 - publication of research results
 - independent scientists believe the paper is 'good science'
 - uses quality data and methods to arrive at a defensible position
- This does not necessarily mean "correct science"
 - all experiments must have repeatable results

Slides are modified from the Union of Concerned Scientists, Scientific Integrity Curriculum Guide, 2nd Edition

More Quality Control

- Research results that do not agree with other results are published as long as it is 'good science'
- Over time, science is self-correcting
- An open debate of theories pushes out weak ideas until a strong consensus is reached

For example, the scientific consensus supporting a geocentric model of the solar system and the fixed-plate theory for the earth's crust were both overturned. The geocentric model was replaced when observation, physics, and mathematics advanced to the point where a more accurate, heliocentric model could be produced. Mounting evidence against the fixed-plate theory overturned this incorrect consensus and gave us our modern theory of continental drift.

Scientific Consensus

- When the scientific community comes to a consensus, this means the idea has
 - withstood rigorous testing = 'good science'
 - represents our best understanding of the subject being studied
- Some uncertainty will always remain
- Scientists strive to minimize uncertainty to reasonable levels

Intergovernmental Panel on Climate Change (IPCC)

- It reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change.
- Thousands of scientists from all over the world contribute to the work of the IPCC on a voluntary basis.
- Differing viewpoints existing within the scientific community are reflected in the IPCC reports.

The IPCC was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) to provide the world with a clear scientific view on the current state of climate change and its potential environmental and socio-economic consequences.

The IPCC Fourth Assessment (2007) states:

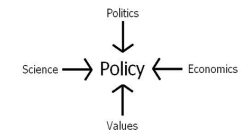
- “Most of the observed warming over the last 50 years is very likely to have been due to the increase in greenhouse gas concentration” (“very likely” is defined as >90% likelihood)
- It is “extremely unlikely” that all observed warming could be due to natural cycles (“extremely unlikely” is defined as <5% likelihood)

Appearances of an ongoing debate

- In the United States, political interference in climate change science contributes to the appearance of an ongoing debate about the causes
- Journalism and other media provide equal coverage to climate deniers as to the consensus of the IPCC

Science in the Policy Arena

- Science is an important factor in decisions the government makes about health, security, and sustainability
- Science is only one aspect of the policy process
- Manipulation or suppression of science before it enters the public policy arena is not OK



Consequences of Political Interference in Climate Change

- Interference: Political appointees with no scientific training edited EPA climate reports and barred climate scientists from speaking to the press
- Consequence: The public becomes misinformed about the harmful consequences of climate change, indirectly supporting policy inaction



6.1.5 Transcript of the Commercial

Transcript of the 60 second commercial

Global Warming/Energy

From the COMPETITIVE ENTERPRISE INSTITUTE

There's something in these pictures you can't see

It's essential to life.

We breathe it out.

Plants breathe it in.

It comes from animal life, the oceans, the earth,
and the fuels we find in it.

It's called carbon dioxide---CO₂.

The fuels that produce CO₂ have
freed us from a world of back-breaking labor,
lighting up our lives,
allowing us to create and move
the things we need, the people we love.

Now some politicians want to label carbon dioxide a pollutant.

Imagine if they succeed.

What would our lives be like then?

Carbon dioxide.

They call it pollution.

We call it life.

6.1.6 Task Card

You will be analyzing this commercial more closely by reading the transcript and thinking about the message and meaning of the commercial.

WHAT TO DO:

Read the transcript to yourself.

Some of the statements in this transcript could be tested and other statements are opinions.

- Put a + next to all statements that could be tested and comment on whether you think this statement is true or false.
- Put a ? next to any statement that is an opinion and underline the words that make you think this.

DISCUSSION:

As a group, discuss the following questions.

1. What is the message of the commercial?
2. The commercial implies that it will be bad for society if carbon dioxide is legally called a pollutant. Do you agree?
3. What do you “imagine if they succeed”? Is your image of success the same image that the author implied?

INDIVIDUALLY:

Do you agree with the message?

How can you know or figure out whether to accept the claims of this commercial?

Student Handout 6.2.1

The Climate Change Debate

While you are watching the video segments, “The Global Warming Swindle” write down the major arguments that the video makes about global warming. You may not end up using all of the spaces. Next to these arguments, write down the evidence that the video cites as support for these arguments.

Arguments	Evidence
1.	
2.	
3.	
4.	