Chapter 11: Fundamentals of Climate Change Policy
April 13, 2026

Quiz 5

Image source: https://www.tdk.com/en/featured_stories/entry_063-environmental-responsibility.html

Chapter 11: Fundamentals of Climate Change Policy

- Earth is warming (Ch 2).
- Human activities are dominant cause (Ch 7).
- Warming over current century will likely be several degrees C above the present (Ch 8).
- Such warming carries risk, some of which serious or even catastrophic for people and ecosystems (Ch 9).
- How we respond can be split into 4 categories:

1) **Adaptation:** responding to negative impacts of climate change (e.g., seawalls, relocating).

2) **Mitigation:** policies/actions that avoid climate change by preventing impacts from occurring.

3) **Solar Radiation Management:** active manipulation of climate system to reduce amount of sunlight absorbed by Earth system (energy-in).

4) **CO_2 Removal:** active manipulation of carbon cycle to hasten removal of CO_2 from atmosphere.

11.1 Adaptation

To extent we do not avoid climate change, we must adapt.

Can be left to **individuals**, but *some* adaptive responses require substantial resources or societal coordination (e.g., building seawall for entire community).

Can be left to **government**, organization of decisions, providing $, and technical expertise.

Without government assistance, residents in New Orleans left with: **(1)** moving out of city, **(2)** trying to protect individual home, or **(3)** living under constant threat of flooding.

Generally agreed upon that adaptation requires government involvement:

1) In addition to direct aid, governments can implement regulations to encourage citizens to adapt (e.g., freshwater conservation practices to improve availability).
2) Conversely, governments can remove regulations, increasing our vulnerability (e.g., flood insurance).
3) Governments can provide reliable information about climate change to assist people in planning.

11.1 Adaptation

Because adaptive responses require large resources, poorest populations most vulnerable and least likely to adapt:

- *During Hurricane Katrina (2005) rich citizens left town while poor were often unable to evacuate.*

Primary reliance on adaptation means rich populations adapt more successfully than poor populations:

- *Rich populations acquired wealth by consuming energy, are responsible for most modern climate change, and are able to adapt to climate impacts.*
- *Poor populations consumed less energy, are responsible for very little modern climate change, and are least able to adapt to climate impacts.*

Solution: rich populations could help poor populations adapt by sharing resources.

11.1 Adaptation

While some **countries** do contribute, evidence suggests other wealthy countries not willing to give amounts necessary for successful adaptation:

What is considered successful adaptation?

- *Is standard just survival?*
- *Is standard maintenance of standard of living, as measured by GDP?*

Bottom line on adaptation:

- *With some unavoidable committed future climate change, adaptation must be part of response.*

11.2 Mitigation

Refers primarily **to reductions in GHG emissions** to prevent climate change.

Renewable (clean) Energy: energy sources not depleted when used

- **Solar energy:** *Solar photovoltaic & and Solar thermal tech*
- **Wind**
- **Biomass & Biofuels**
- **Hydroelectric power**
- **Nuclear energy**
- **Geothermal energy**
- **Carbon Capture & Storage (CCS)**
- **Others?**

$$I = P \times A \times T \qquad \text{[Eqn. 8.1]}$$

$$T = EI \times CI \qquad \text{[Eqn. 8.2]}$$

Developing renewable energy comes with technical, economic, and social **challenges**, such as:

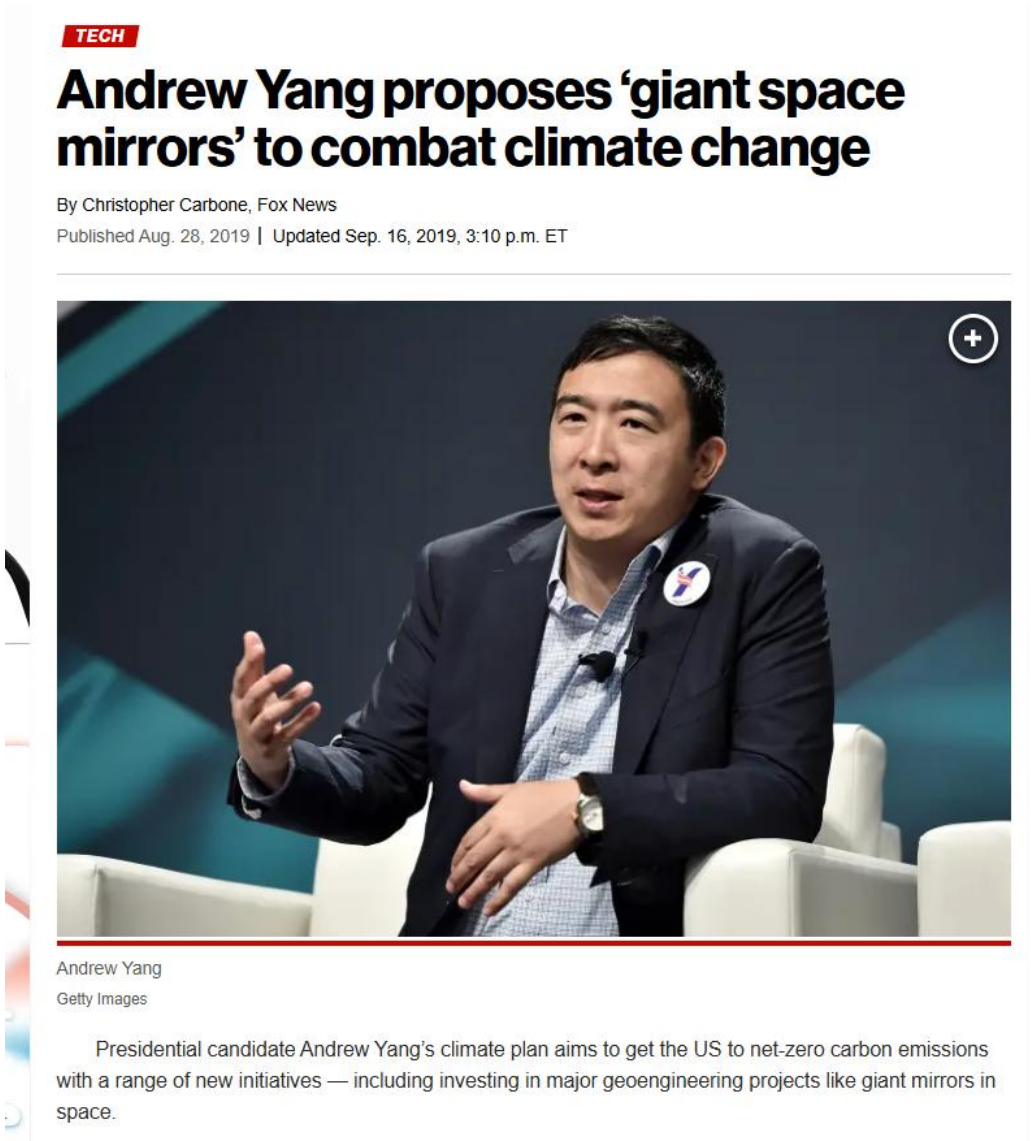
- Intermittency and Reliability
- Energy Storage Limitations
- High Initial Costs
- Infrastructure and Grid Integration
- Land and Resource Use
- Geographic Limitations
- Supply Chain and Materials
- Policy and Regulatory Barriers
- Public Acceptance
- Others

11.3 Solar Radiation Management

Solar Radiation Management: active manipulation of climate system to reduce amount of sunlight absorbed by Earth system (energy-in and energy-out):

(1) Common suggestion to inject aerosols into atmosphere, such as sulfur dioxide (SO2) into stratosphere, replicating mechanism by which volcanoes cool Earth.
(2) Increase reflectivity of clouds by making particles in clouds smaller

Bottom line on solar radiation management: *Appealing but risky*.



TECH

Andrew Yang proposes 'giant space mirrors' to combat climate change

By Christopher Carbone, Fox News

Published Aug. 28, 2019 | Updated Sep. 16, 2019, 3:10 p.m. ET

Andrew Yang

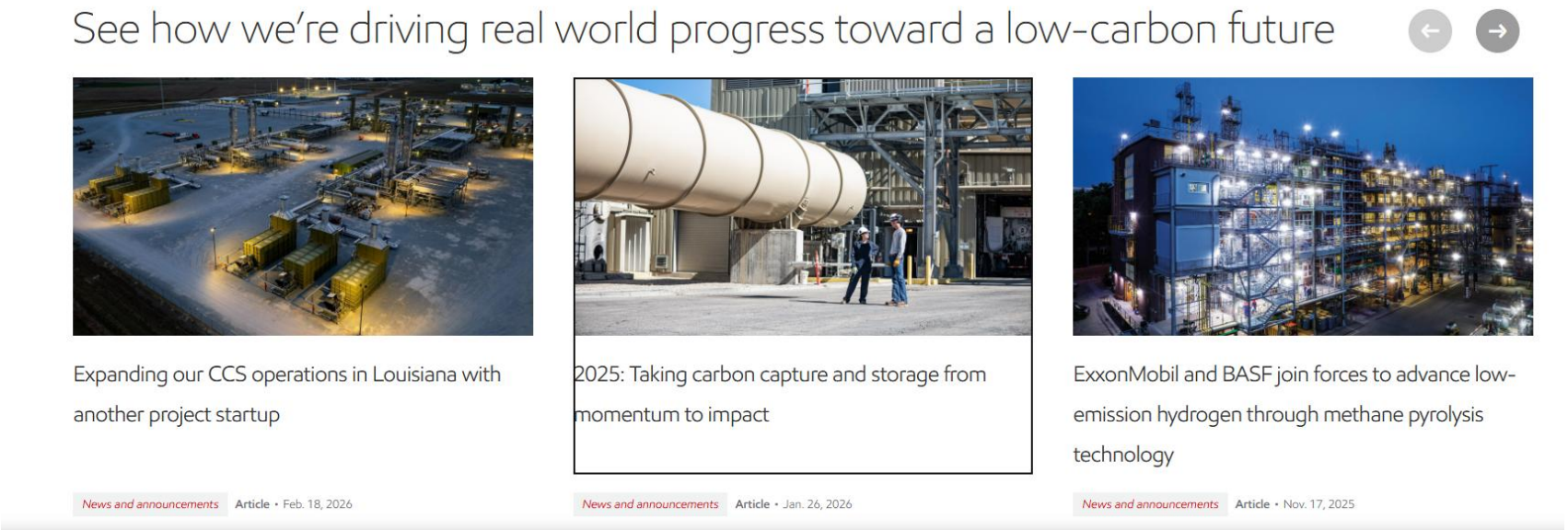
Getty Images

Presidential candidate Andrew Yang's climate plan aims to get the US to net-zero carbon emissions with a range of new initiatives — including investing in major geoengineering projects like giant mirrors in space.

11.4 Carbon Dioxide Removal

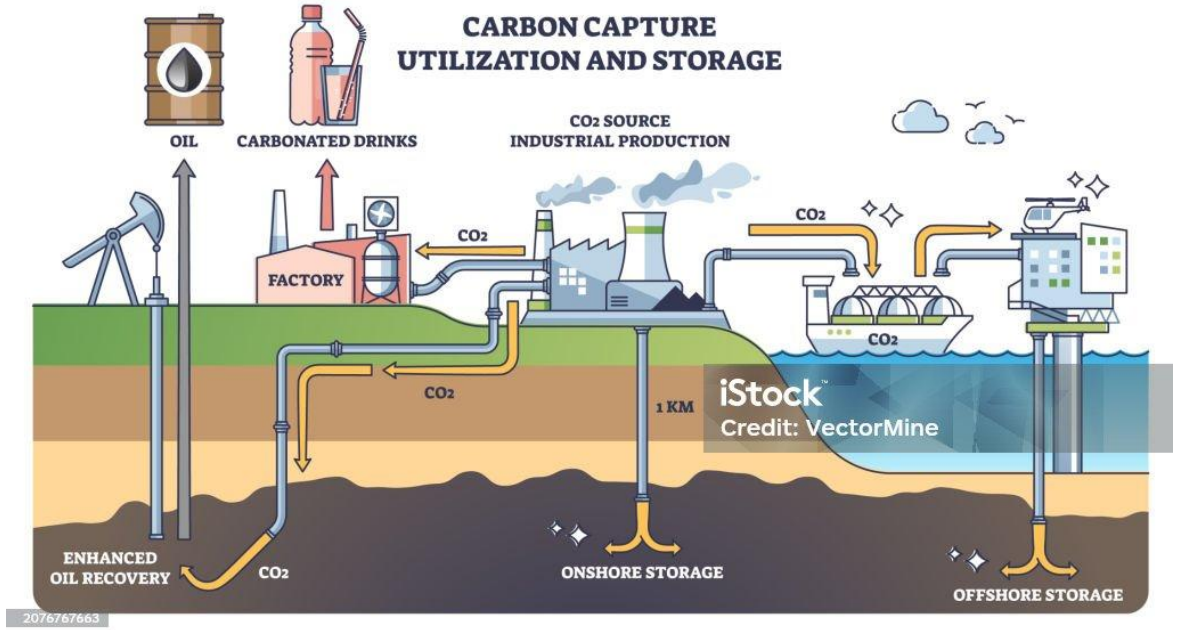
Refers to efforts to modify C cycle so that CO_2 rapidly removed from atmosphere.

(1) Tree planting
(2) Iron addition to ocean stimulates growth of phytoplankton (organisms die and move C to ocean floor).
(3) Direct Air Capture: removal of CO_2 from air chemically:



11.4 Carbon Dioxide Removal

Bioenergy With Carbon Capture & Storage (BECCS): grow plants, then burn plants for energy, then capture the CO_2 produced, and then store CO_2 (likely in deep underground depleted oil and gas wells).



11.4 Carbon Dioxide Removal

14 hours ago - Energy & Climate

Exclusive: JPMorgan strikes carbon removal deal that doubles as wildfire prevention

Amy Harder

Add Axios on Google

Illustration: Sarah Grillo/Axios

JPMorganChase has inked a deal with a startup to remove carbon from the air — a step that could also prevent wildfires, Axios has learned.

Why it matters: The purchase signals that the carbon removal industry is pushing ahead despite policy setbacks — and highlights how near-term benefits can help drive deals.

Driving the news: Graphyte, a carbon removal company founded in 2023, will supply 60,000 tons of removal credits over 10 years from an existing Arkansas project and a planned facility in Arizona enabled by the deal.

- Financial terms weren't disclosed.

The big picture: Carbon removal — which pulls CO_2 from the atmosphere — is seen as critical to meeting climate goals.

- But the market is still in its early stages and has faced setbacks as President Trump rolls back supportive policies.

How it works: Deals vary widely, from nature-based carbon projects to more durable — and often more expensive — approaches like direct air capture or mineralization.

- Graphyte falls somewhere in between, compressing agricultural and forestry waste and storing it underground to keep carbon from re-entering the atmosphere.

The intrigue: The Arizona facility would use material from forest thinning projects, which reduce wildfire risk but often lack strong commercial markets.

- Taylor Wright, JPMorgan's head of operational sustainability, cited Graphyte's proven technology as one reason behind the deal.

https://www.axios.com/2026/04/09/carbon-removal-wildfire-prevention-jpmorgan

11.5 Putting It Together

(a) Baseline scenario, in which no effort made to address climate change. “Dangerous” threshold is warming limit that we do not want to exceed.
(b) Successful climate response for high “dangerous” threshold that relies entirely on mitigation and adaptation.
(c) Climate response for low “dangerous” threshold where mitigation alone fails to stay below threshold.
(d) Climate response for low threshold that is composed of mitigation and CO_2 removal but has overshoot.
(e) Climate response for low threshold that is composed of mitigation and CO_2 removal but has overshoot.
(f) Summary of total potential response.

- Combination of all policy tools to stay below threshold.
- Adaptation to committed warming still required.

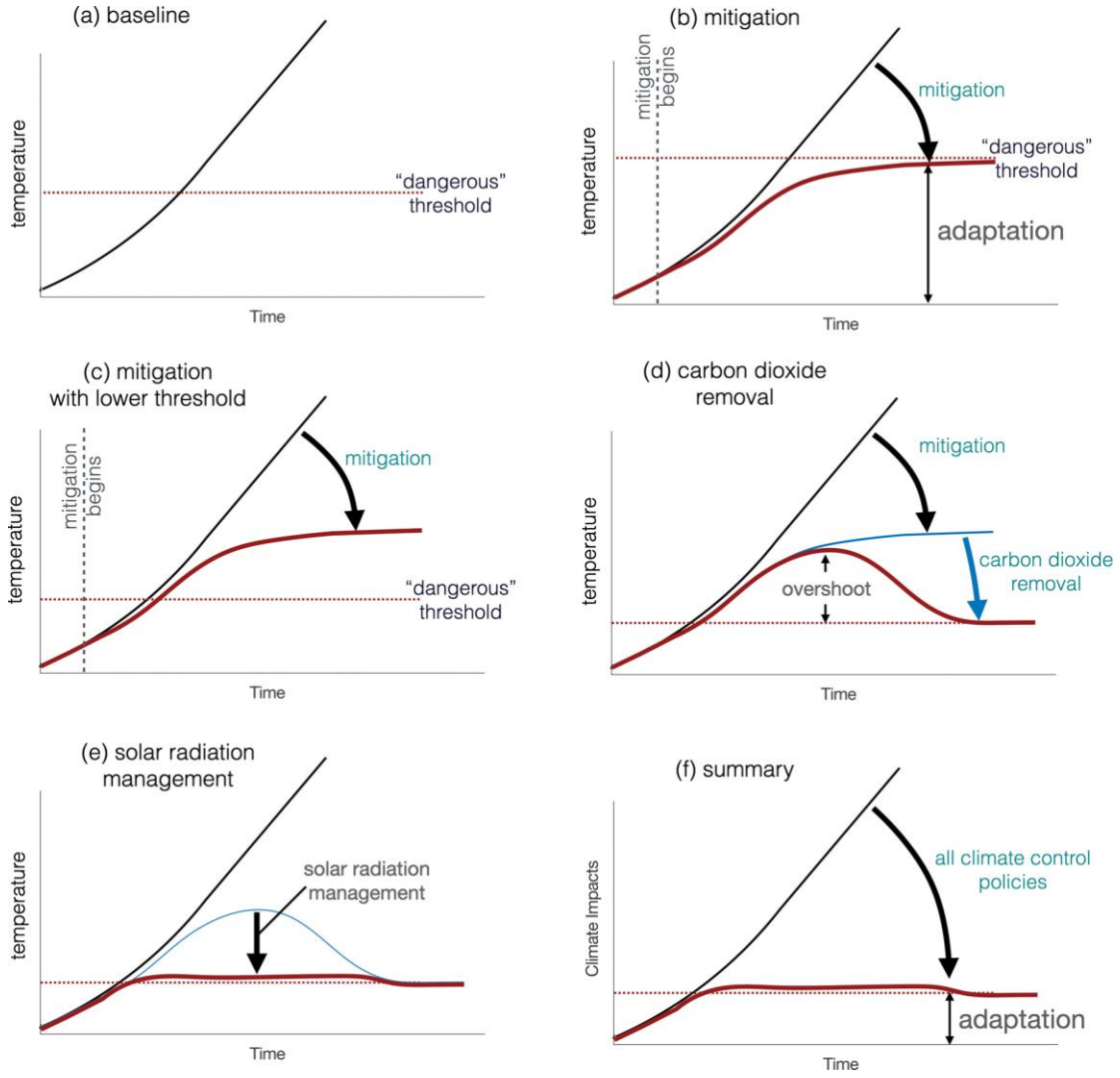


Fig. 11.1: Our policy options to respond to climate change.

Ch 11: Fundamentals of Climate Change Policy

TERMS

Adaptation
BECCS
Carbon capture and storage
Carbon dioxide removal
Carbon-free/climate-safe energy sources
Carbon sequestration
Direct air capture
Geoengineering
Mitigation
Overshoot
Renewable energy
Solar radiation management

Chapter 12: Mitigation Policies
April 15, 2026

12.1 The Economic Basis of Climate Change
12.2 Conventional Regulations
12.3 Market-Based Regulations
12.4 Information and Voluntary Methods
12.5 Putting the Approaches Together
Terms
Problems

Guest Lecture by Moriz Steins