Climate Innovation Policy

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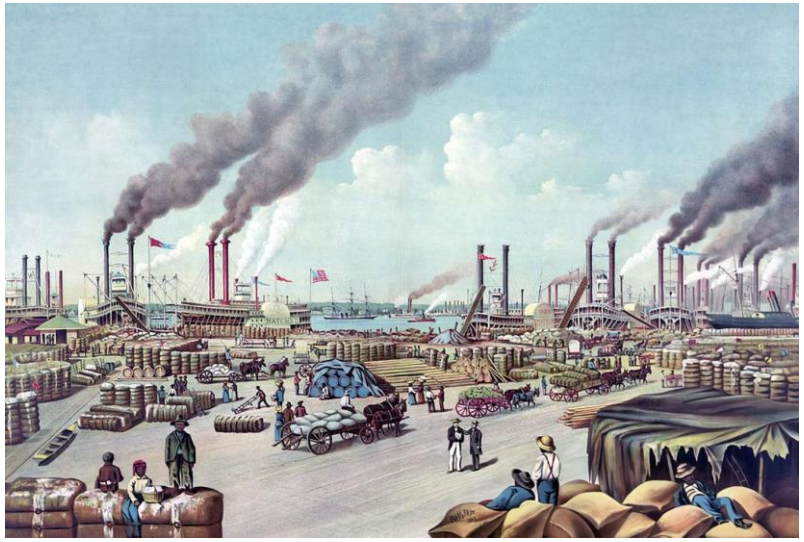
Transitions in historical perspective

Industrial Revolution
1750s – 1850s



- Shift from agrarian to industrial economy
- Profound socio-economic shifts
- Powered by fossil fuels

Green Transition
2020s – onwards?

- Sustainable and equitable economic growth
- Twin revolutions of AI and climate tech
- Powered by renewables and low-carbon energy

A thought experiment

Can the system of production and consumption that we've had for the past 250 years, and which is in large part responsible for the problem, also provide the solutions to it?

Agenda

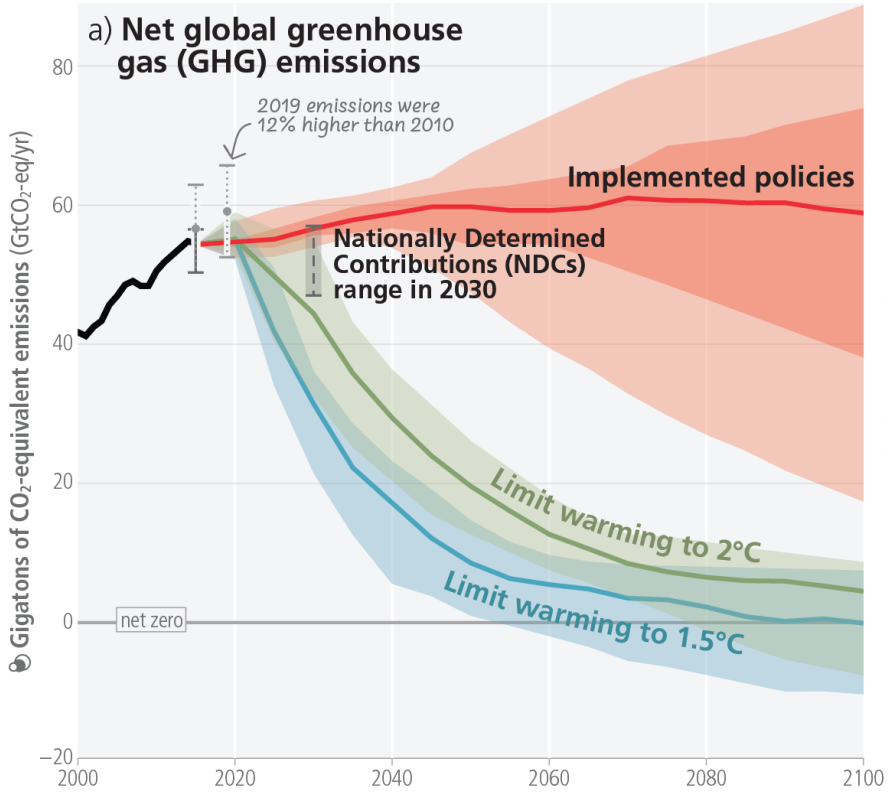
- What type of innovation do we need?
- Where does innovation come from?
- What policies and incentives spur innovation?

The challenge ahead

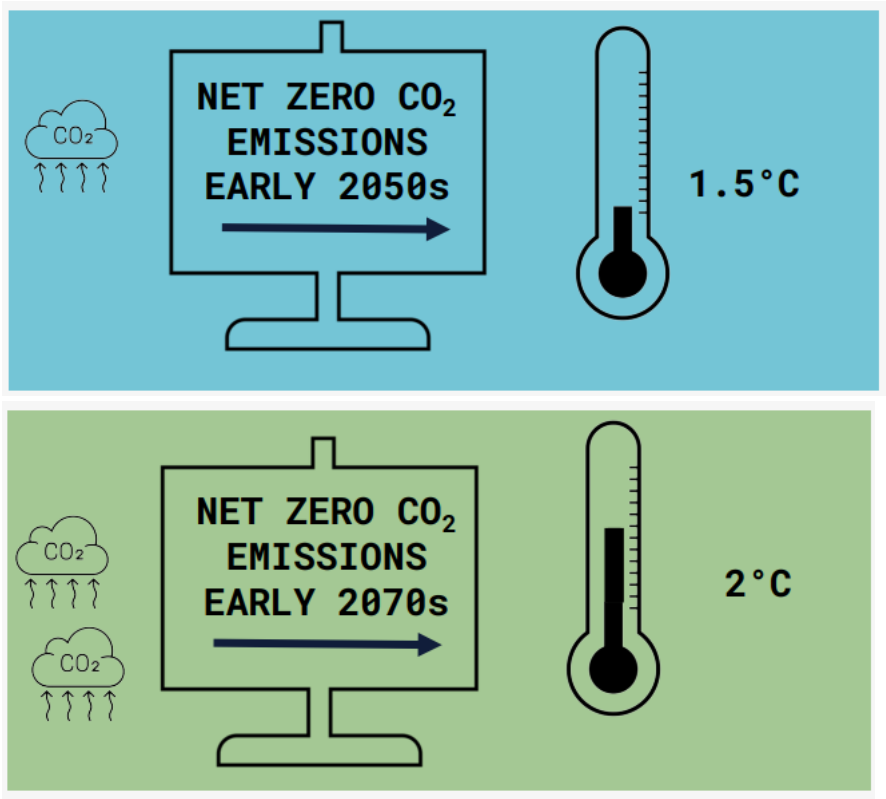
Innovation at a scale and speed unseen since the Industrial Revolution

Emissions pathways to stabilize warming

We are on track for **3.2°C warming** with no further action



Limiting warming involves **rapid**, **deep**, and **immediate** emissions reduction



Source: IPCC, AR6, Synthesis Report, 2023

1.5°C hinges on massive clean tech push

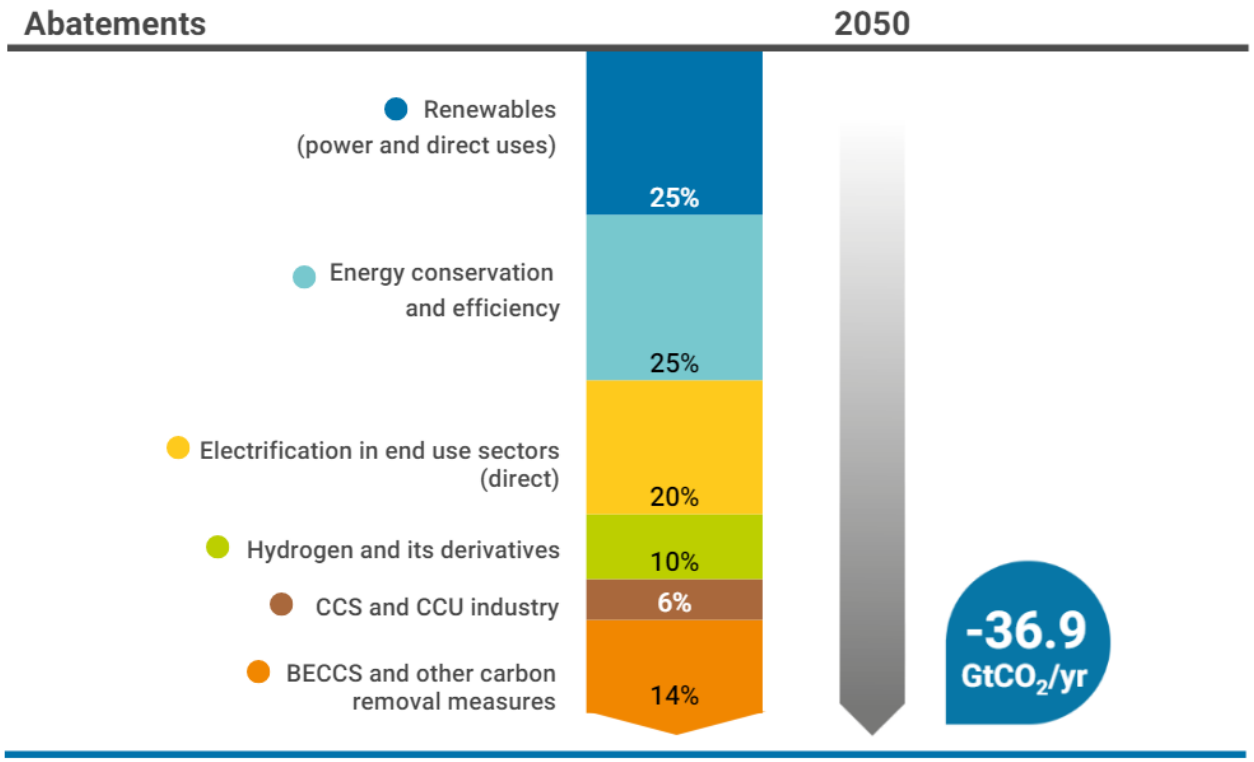


FIGURE S.4 Carbon emissions abatements under the 1.5°C Scenario (%)

Source: IRENA, 2022

- All net zero scenarios involve **moving away from fossil fuels** without Carbon Capture and Storage (CCS) to low-carbon sources such as renewables
- Demand-side and **energy efficiency** measures are key
- **Carbon Dioxide Removal** (CDR) methods are needed in most scenarios
- Agriculture, forestry, and land-use can deliver GHG reductions but **cannot compensate for delay** in mitigation

What type of tech do we need?

Power sector

- Major transitions required
- Challenges: infrastructure and transmission

Carbon removal

- Required to counterbalance emissions in hard-to-abate sectors
- Needs greater investment and R&D

Alternative fuels

- Blue and green hydrogen will be cost-competitive
- Synthetic biofuels and chemicals science still under development

Roadmap

- Now to 2030 – transition requirements hinge on government spending to upscale deployment of existing tech & subsidize otherwise unprofitable changes
- 2050 and beyond – focus on new innovations & capitalizing on public infrastructure

Beyond technological innovation

Demand reduction and lifestyle changes

- Potential to bring down global emissions by 40-70% by 2050[1]

Closing the investment gap

- Financial flows are 3-6x lower than they need to be by 2030[1]

Technology and green industrial policies

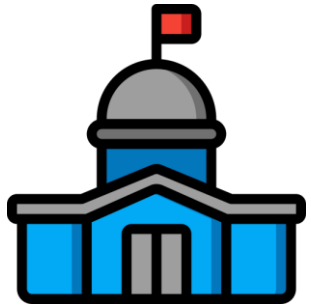
- If clean tech is the "hardware" of the green transition, the state provides the "software"

[1] IPCC, AR6, Synthesis Report, 2022

The state vs. private sector

Government intervention in markets

Public vs. private sector



Full state control

- Centrally planned economy
- State ownership of major industries
- Public provision of goods & services

Full private control

- Market-driven economy
- Minimal state intervention
- Goods & services primarily from private sector

How to build a low-carbon economy

For successful climate mitigation, we need two things:

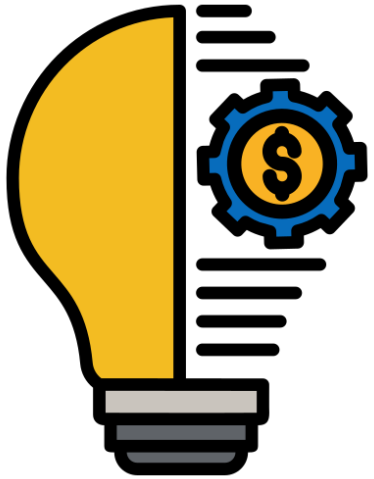
1. **Stop** burning fossil fuels
2. **Start** building the low-carbon economy

Another way of cutting it:

- increase supply and demand for **renewables**
- decrease supply and demand for **fossil fuels**

The green transition requires a radical transformation of our systems of consumption and production

Where does innovation come from?



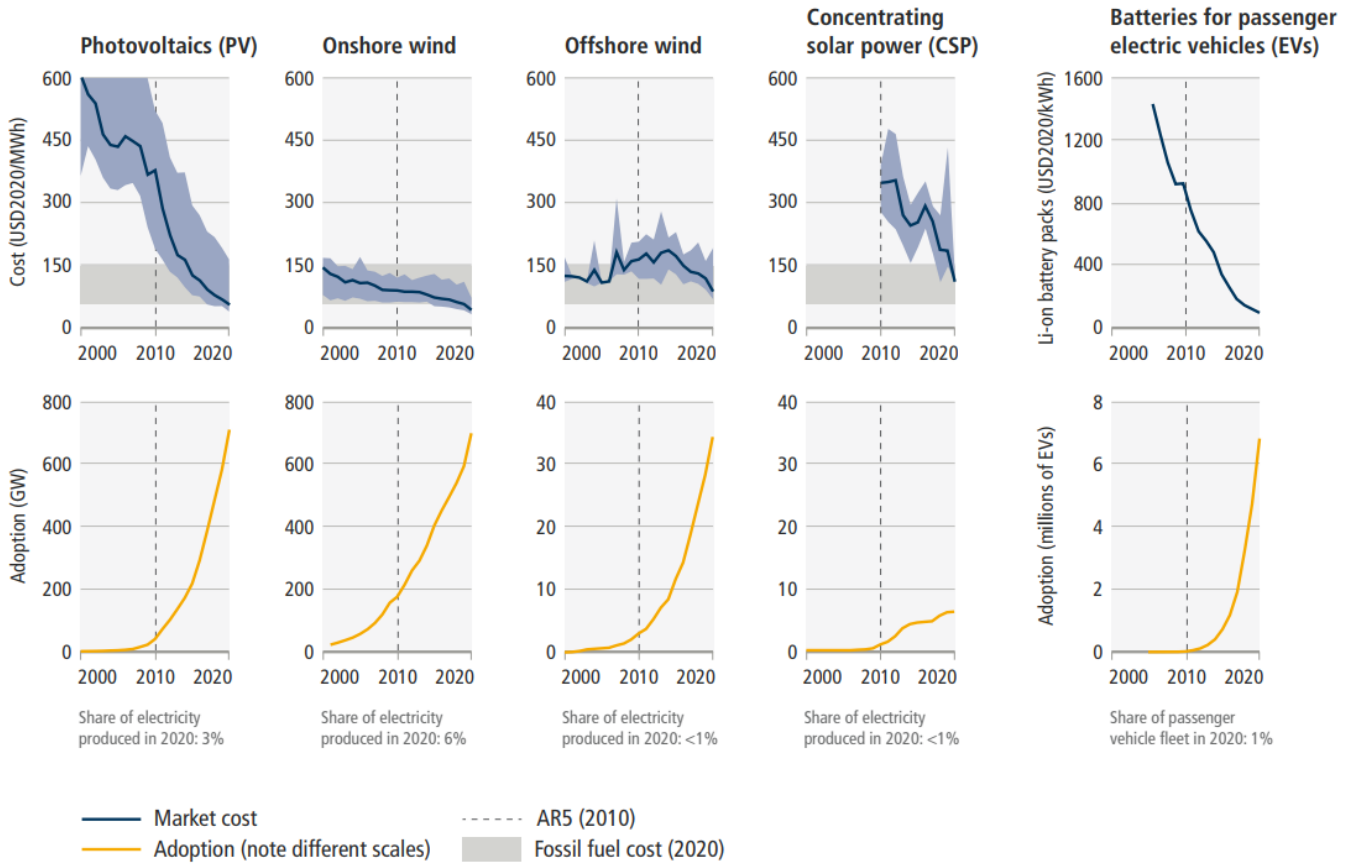
Research & Development

Finance & Investment

Regulation & Legislation

Some of it is just good business

The unit costs of some forms of renewable energy and of batteries for passenger EVs have fallen, and their use continues to rise.



Source: IPCC, AR6 report, Working Group III, 2022

But sometimes the market needs a push

- Not just “fixing” markets, but actively shaping markets by creating demand for sustainable technologies
- Public investment can crowd in private investment by reducing perceived risk
- Public institutions can act as coordinators between universities, public agencies, and private firms to foster innovation ecosystems
- International collaboration such as joint R&D ventures and shared technology standards

Role of the state in climate innovation

State as an insurer

- De-risking investments
- Cap downside risk for investors

State as a signal provider

- Provide clear and credible signals from the future
- Standardization to prevent greenwashing

State as a market maker

- Green industrial policy can nurture green companies until they are competitive
- Setting strategic vision and goals

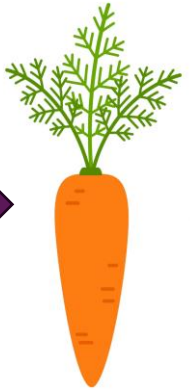
Sticks and carrots

How does the state steer the economy towards low-carbon?

Encouraging green + discouraging brown

Sticks

Carrots



- Carbon taxes
- Fees
- Forbidding market access

- Emissions reduction targets
- Renewable energy mandates
- Standards for green technologies

- Subsidies
- Rebates
- Guaranteed return on green investments

Polluter Pays Principle

Climate change is one of the biggest **market failures** of the last 2 centuries

Carbon pricing mechanisms are designed to remedy this

Forces producers to **internalize the true social cost of carbon** and incentivizes consumers to make better decisions

Least-cost way to reduce emissions

Carbon pricing has a long history

- Historically, climate policy has focused on **“sticks”** to discourage emissions of fossil fuels
  - Acid Rain Program in the USA
  - EU Emissions Trading Scheme
  - Carbon taxes in 27 countries
- Recent policy developments are turning towards **“carrots”** to encourage the adoption and upscaling of green tech
  - Inflation Reduction Act in the USA
  - “Green Deal Industrial Plan for the Net-Zero Age” (Net Zero Plan) of the European Green Deal

Finance and investment

- Public financing alone will not be sufficient to meet current funding gaps
- We need **$4 - 5 trillion a year** from now until 2050[1,2,3]
- How do we catalyze private sector investment in the transition?
  - Incentives for green startups
  - Subsidies for sustainable projects
  - Tax breaks for clean energy initiatives
  - "Green" financial products (e.g., green bonds)
  - De-risking (e.g., loan guarantees)

[1] International Energy Agency, "Net Zero by 2050 – A Roadmap for the Global Energy Sector", 2021
[2] International Renewable Energy Agency, "World Energy Transitions Outlook: 1.5°C Pathway", 2021
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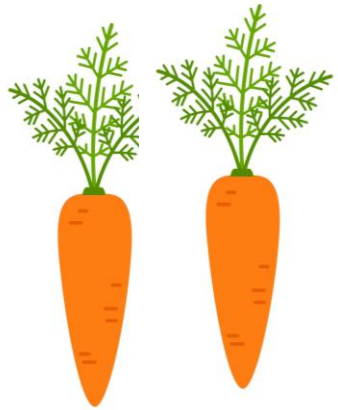

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Innovation requires more carrots

- Green tech can be high-risk and high-reward
- Often requires substantial upfront investment
- Private sector can be unwilling to take these risks
- Need to **de-risk investments**
- Ensure innovators and investors capture value from investments

Implementing policies

Why climate innovation policy differs across countries and sectors

Why implementing climate policy is hard

Benefits of reducing greenhouse gas emissions are far away in the **future** and **diffuse**.

Costs of reducing greenhouse gas emissions are **immediate**, **visible**, and tend to fall on **specific groups**.

The political economy of climate change is all about difficult trade-offs

Climate as a social & political problem

Gilets Jaune demonstration in France (2018)

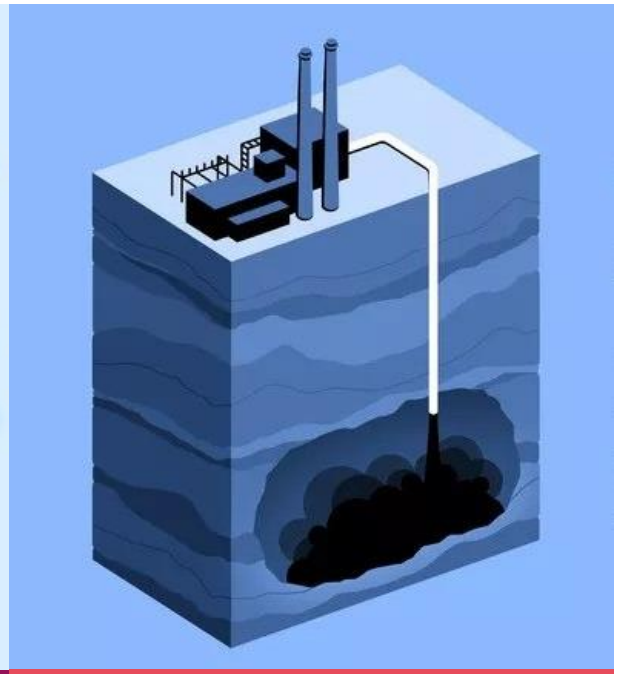
- Disagreements around equity and fairness in climate change
- Disagreements on types of policies that should be implemented to address climate change
- Climate innovation policy can be the subject of political contestation

AI used in green policies

Solar panels in Germany

Wind in Denmark

Smart grid in California



Carbon capture in Canada

Key take-aways

📌 **Capitalizing on AI to spur the transition to a low-carbon economy will nonetheless require systemic shifts in our economy.**

📌 **If AI is the hardware of innovation, then policy and regulatory frameworks are the software.**

📌 **Economies vary in the degree and extent to which state and market interact in promoting the use of clean technology – this is often explained by sectoral differences.**

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Three conjectures

This Climate Tech Boom Is Recession-Proof

Investors are rushing toward the technologies that will speed up the race to zero emissions and stop global warming going out of control.

Bloomberg, 27 September 2022

'Recession Resilient' Climate Start-Ups Shine in Tech Downturn

Tech workers and investors are flocking to start-ups that aim to combat climate change.

New York Times, 30 January 2023

- **Bullish outlook**, but there is a tangible chance of vastly different outcomes
- The intersection of **twin revolutions**: artificial intelligence and the green economy
- Transformative moment in history, but needs to be **navigated carefully**

Thank you! Questions?

Read more

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