Pragmatism and Climate Policy

EES 3310/5310

Global Climate Change

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Class #37: Wednesday, April 20 2022

Reviewing Emissions Regulation Game

Review of Game

- Command and Control:
  - Each company emits the same amount
    - A: 12 total, 6 each
    - B: 16 total, 8 each
    - C: 16 total, 8 each
- Cap-and-trade:
  - Give each company equal permits.
  - Let them trade
    - A: 6 permits each, Alpha buys 1 for \$42
    - B: 8 permits each, Alpha buys 1 for \$35.5
    - C: 8 permits each, Alpha buys 1 for \$34
- Carbon Tax:
  - Put a price on CO_2 emissions
  - Each company can emit as much as it wants to
  - But it must pay the tax on every ton.
    - A: \$15/ton
    - B: \$32/ton
    - C: \$35/ton

Default

Default

Actor	Emissions	Profit	Cost	Net
Alpha	15	\$630		\$630
Beta	15	\$420		\$420
Society			−\$930	−\$930
Total	30	\$1050	−\$930	\$120

Deadweight loss = \$456 million

Optimal

Actor	Emissions	Profit	Cost	Net
Alpha	9	\$540		\$540
Beta	7	\$308		\$308
Society			−\$272	−\$272
Total	16	\$848	−\$272	\$576

Group A Results

Command & Control (Group A)

Actor	Emissions	Profit	Cost	Net
Alpha	6	\$414		\$414
Beta	6	\$276		\$276
Society			−\$156	−\$156
Total	12	\$690	−\$156	\$534

Deadweight loss = \$42 million

Optimal

Actor	Emissions	Profit	Cost	Net
Alpha	9	$540		$540
Beta	7	$308		$308
Society			−$272	−$272
Total	16	$848	−$272	$576

Cap & Trade (Group A)

Actor	Permits	Bought	Sold	Emissions	Price	Profit	Cost	Net
Alpha	6	1		7	−\$42	\$462		\$420
Beta	6		1	5	\$42	\$240		\$282
Society							−\$156	−\$156
Total	12	1	1	12		\$702	−\$156	\$546

Deadweight loss = \$30 million

Optimal

Actor	Emissions	Profit	Cost	Net
Alpha	9	$540		$540
Beta	7	$308		$308
Society			−$272	−$272
Total	16	$848	−$272	$576

Carbon Tax (Group A): \$/ton

Actor	Emissions	Tax	Profit	Cost	Net	Rebate	Net with Rebate
Alpha	12	−\$180	\$612		\$432	+\$172.5	\$604.5
Beta	11	−\$165	\$396		\$231	+\$172.5	\$403.5
Society		+\$345		−\$552	−\$207	−\$345	−\$552
Total	23		\$1008	−\$552	\$456		\$456

Deadweight loss = \$120 million

Optimal

Actor	Emissions	Profit	Cost	Net
Alpha	9	$540		$540
Beta	7	$308		$308
Society			−$272	−$272
Total	16	$848	−$272	$576

Group B Results

Command & Control (Group B)

Actor	Emissions	Profit	Cost	Net
Alpha	8	\$504		\$504
Beta	8	\$336		\$336
Society			−\$272	−\$272
Total	16	\$840	−\$272	\$568

Deadweight loss = \$8 million

Optimal

Actor	Emissions	Profit	Cost	Net
Alpha	9	$540		$540
Beta	7	$308		$308
Society			−$272	−$272
Total	16	$848	−$272	$576

Cap & Trade (Group B)

Actor	Permits	Bought	Sold	Emissions	Price	Profit	Cost	Net
Alpha	8	1		9	−\$35.5	\$540		\$504.5
Beta	8		1	7	\$35.5	\$308		\$343.5
Society							−\$272	−\$272
Total	16	1	1	16		\$848	−\$272	\$576

Deadweight loss = \$0 million

Optimal

Actor	Emissions	Profit	Cost	Net
Alpha	9	$540		$540
Beta	7	$308		$308
Society			−$272	−$272
Total	16	$848	−$272	$576

Carbon Tax (Group B): \$32/ton

Actor	Emissions	Tax	Profit	Cost	Net	Rebate	Net with Rebate
Alpha	9	−\$288	\$540		\$252	+\$256	\$508
Beta	7	−\$224	\$308		\$84	+\$256	\$340
Society		+\$512		−\$272	\$240	−\$512	−\$272
Total	16		\$848	−\$272	\$576		\$576

Deadweight loss = \$0 million

Optimal

Actor	Emissions	Profit	Cost	Net
Alpha	9	$540		$540
Beta	7	$308		$308
Society			−$272	−$272
Total	16	$848	−$272	$576

Group C Results

Command & Control (Group C)

Actor	Emissions	Profit	Cost	Net
Alpha	8	\$504		\$504
Beta	8	\$336		\$336
Society			−\$272	−\$272
Total	16	\$840	−\$272	\$568

Deadweight loss = \$8 million

Optimal

Actor	Emissions	Profit	Cost	Net
Alpha	9	$540		$540
Beta	7	$308		$308
Society			−$272	−$272
Total	16	$848	−$272	$576

Cap & Trade (Group C)

Actor	Permits	Bought	Sold	Emissions	Price	Profit	Cost	Net
Alpha	8	1		9	−\$34	\$540		\$506
Beta	8		1	7	\$34	\$308		\$342
Society							−\$272	−\$272
Total	16	1	1	16		\$848	−\$272	\$576

Deadweight loss = \$0 million

Optimal

Actor	Emissions	Profit	Cost	Net
Alpha	9	$540		$540
Beta	7	$308		$308
Society			−$272	−$272
Total	16	$848	−$272	$576

Carbon Tax (Group C): \$35/ton

Actor	Emissions	Tax	Profit	Cost	Net	Rebate	Net with Rebate
Alpha	9	−\$315	\$540		\$225	+\$262.5	\$487.5
Beta	6	−\$210	\$276		\$66	+\$262.5	\$328.5
Society		+\$525		−\$240	\$285	−\$525	−\$240
Total	15		\$816	−\$240	\$576		\$576

Deadweight loss = \$0 million

Optimal

Actor	Emissions	Profit	Cost	Net
Alpha	9	$540		$540
Beta	7	$308		$308
Society			−$272	−$272
Total	16	$848	−$272	$576

Summary of Deadweight Losses

Summary of Deadweight Losses

Group	Default	Command & Control	Cap & Trade	Tax
Group A	$456	$42	$30	$120
Group B	$456	$8	$0	$0
Group C	$456	$8	$0	$0

Group A:

- EPA had poor information
- Even so, deadweight losses from inefficient regulations were much smaller than with no regulations
- Cap and Trade performed best
- Tax performed worst

Group B:

- EPA had good information, made good estimates of optimum emissions
- Command and Control had very small deadweight losses
- Cap & Trade and Taxes had deadweight loss of \$0

Group C:

- EPA had good information, made good estimates of optimum emissions
- Command and Control had very small deadweight losses
- Cap & Trade and Taxes had deadweight loss of \$0

Summary of Net Profit/Cost

Group A

	Default	Cmd & Ctrl	Cap & Trade	Tax	Tax & Rebate
Alpha profit	630	414	420	432	604
Beta profit	420	276	282	231	404
Social cost	-930	-156	-156	-207	-552
Total	120	534	546	456	456

Group B

	Default	Cmd & Ctrl	Cap & Trade	Tax	Tax & Rebate
Alpha profit	630	504	504	252	508
Beta profit	420	336	344	84	340
Social cost	-930	-272	-272	240	-272
Total	120	568	576	576	576

Group C

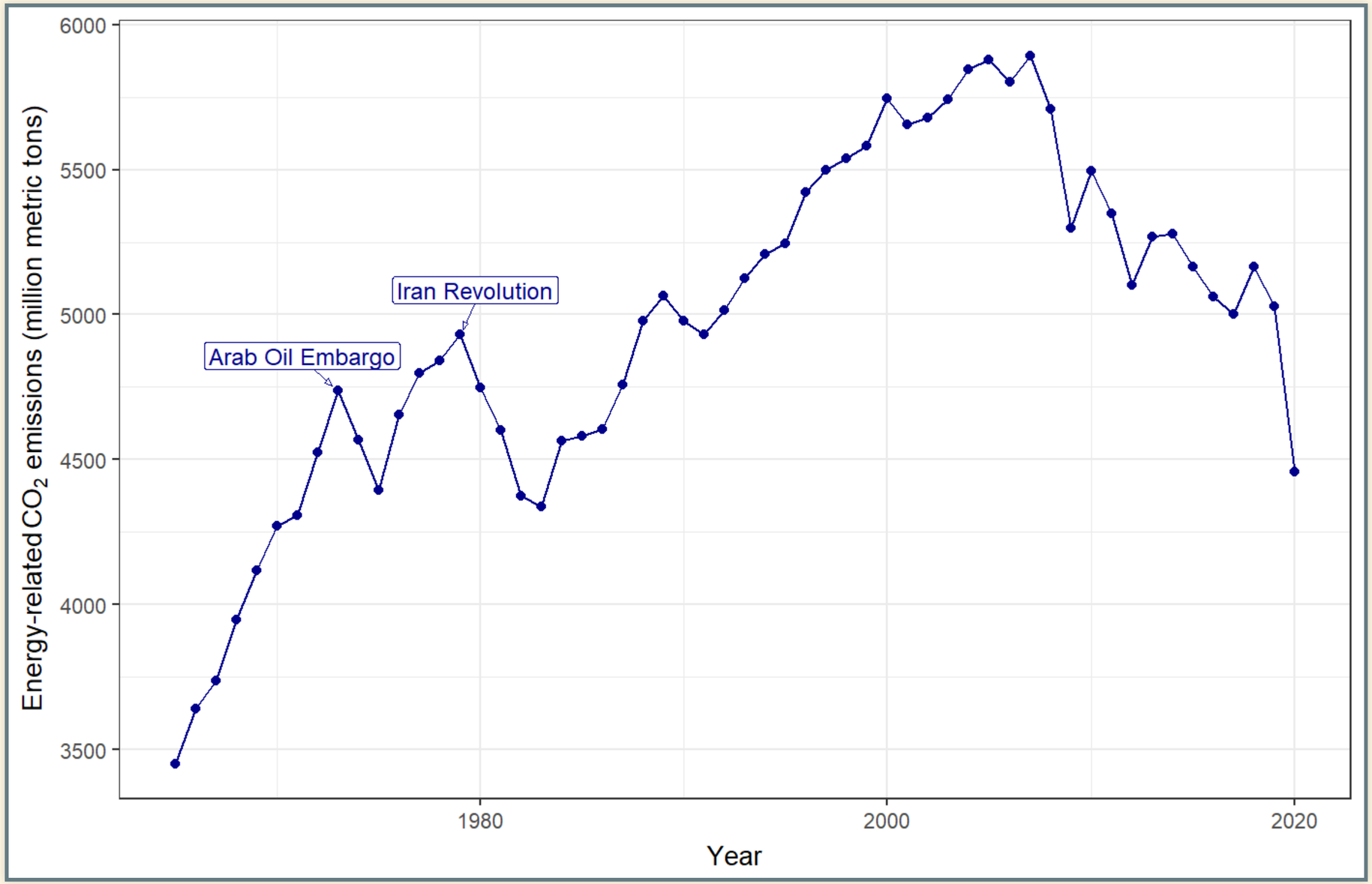
	Default	Cmd & Ctrl	Cap & Trade	Tax	Tax & Rebate
Alpha profit	630	504	506	225	488
Beta profit	420	336	342	66	328
Social cost	-930	-272	-272	285	-240
Total	120	568	576	576	576

Challenges of Decarbonization

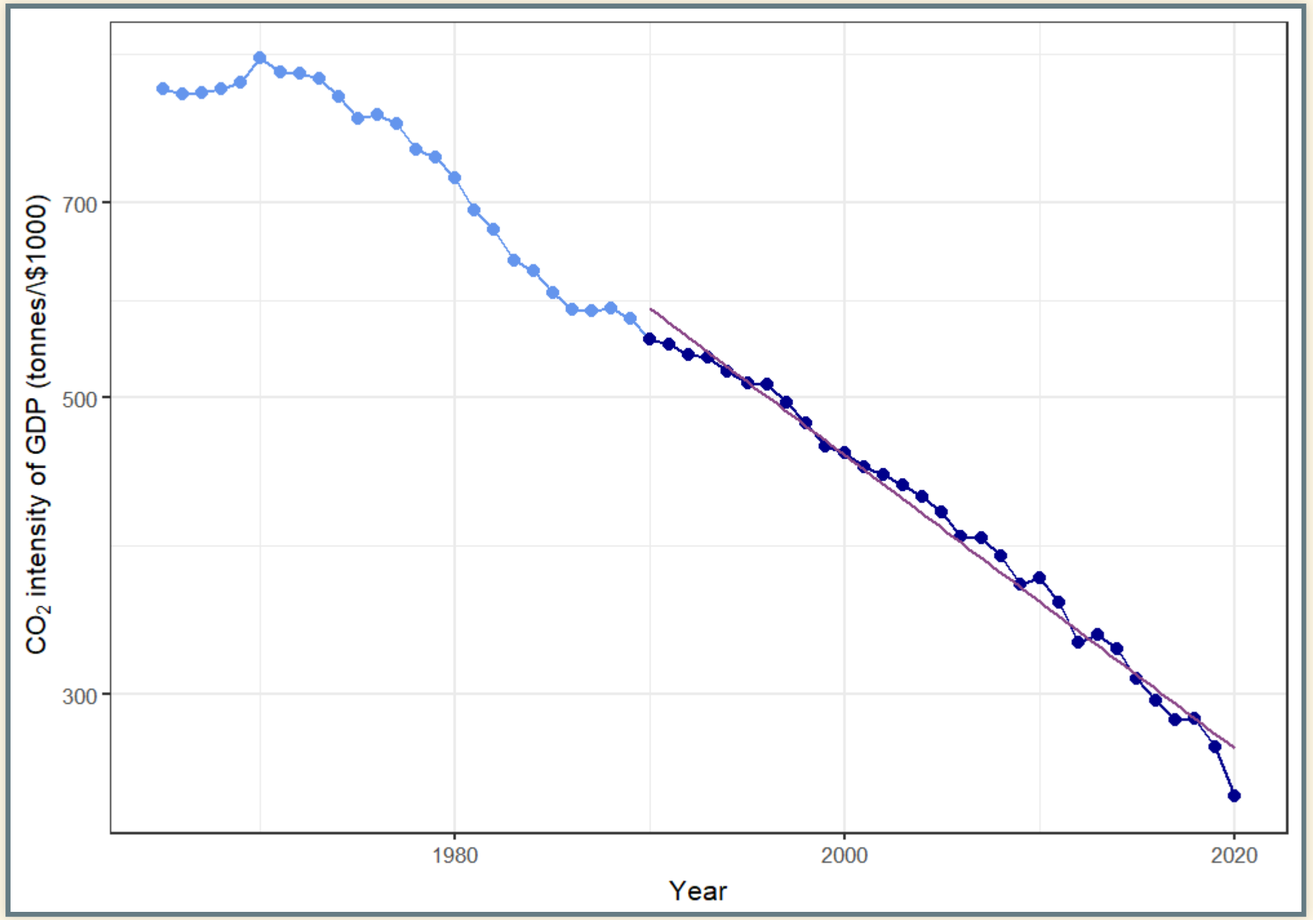
Challenges of Decarbonization

- How hard will it be to reduce CO_2 emissions?
  - Nordhaus:
    - What technology can replace fossil fuels?
    - What policies can stimulate innovation, investment, production, purchase of clean technology?
  - Pielke:
    - The biggest challenge is cost: \(RE < C\)
    - Make clean technology cheaper than fossil fuels and the problem is solved.

Perspective: US CO_2 Emissions

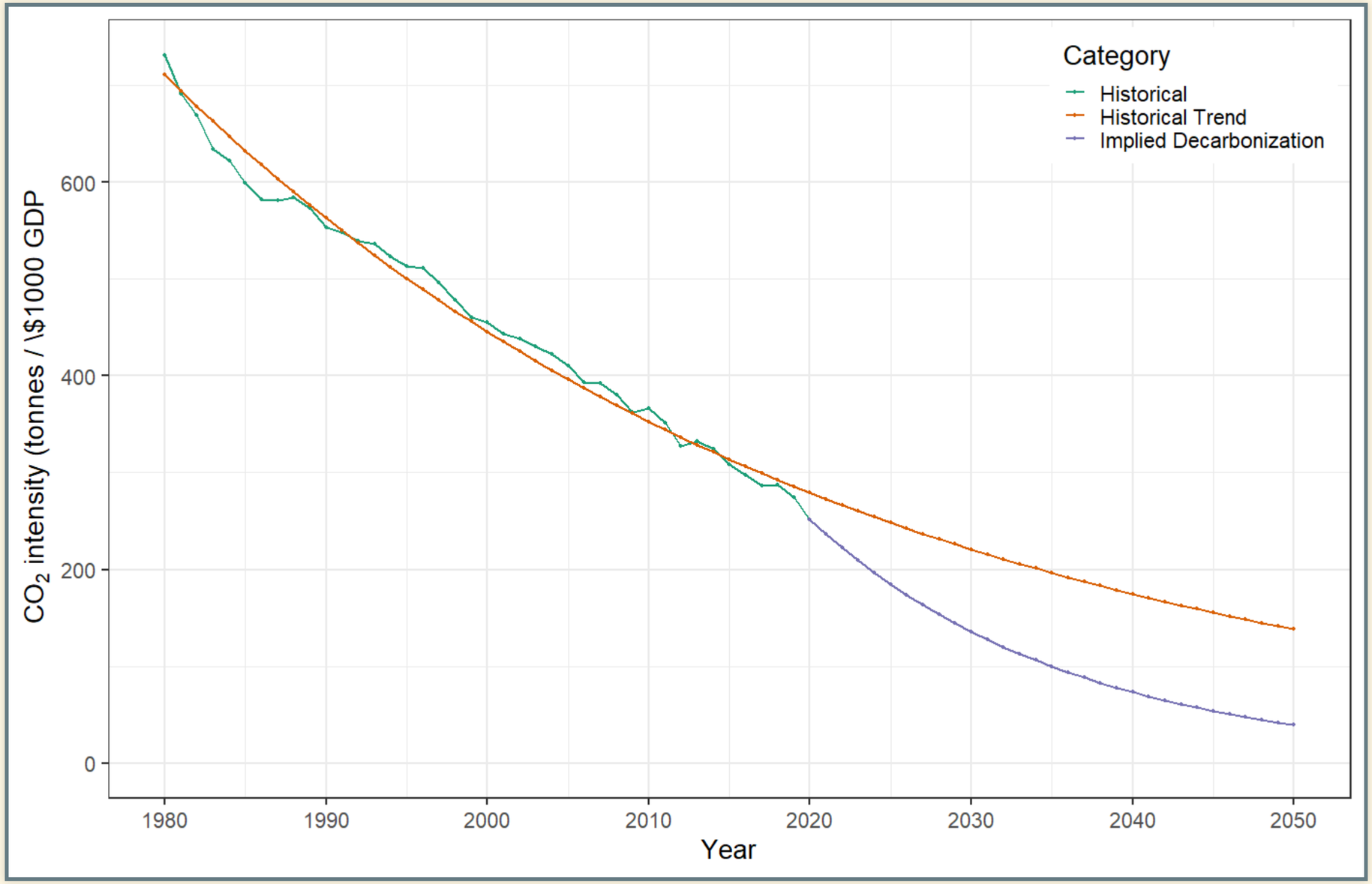


Rate of Decarbonization



- 2009 policy goal: US emissions 83% less than 2005 by 2050
- *ef* must drop by 6.2% per year
- Actual rate has been about 2.3% per > year

Implied Decarbonization



Pielke’s Views

Tax on death?

- What do you think of Pielke's argument?

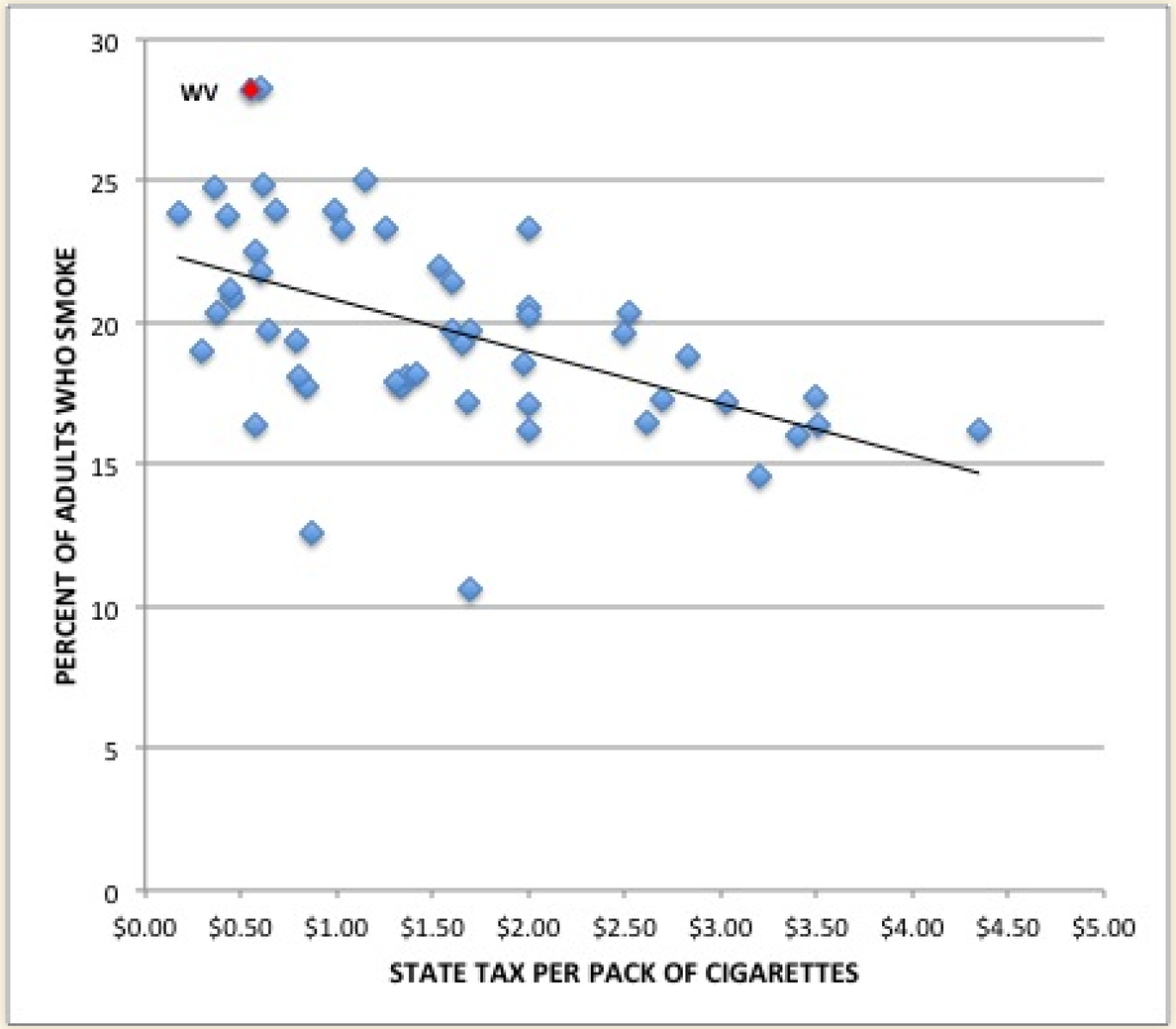
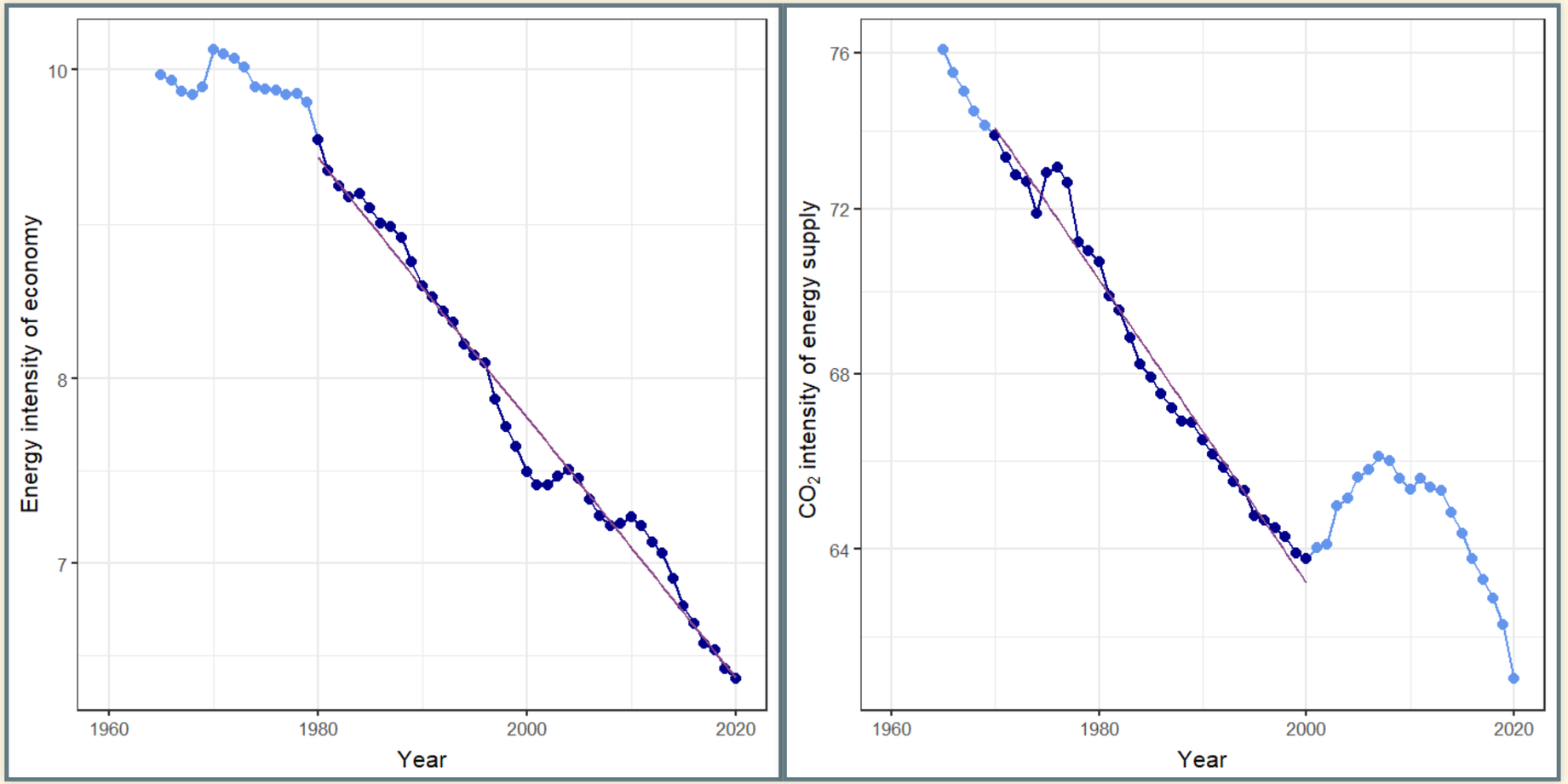


Image credit: Brandon Merritt, West Virginia Center on Budget & Policy

Challenge of decarbonizing



- Trend in *e* (1980–present): -0.9% per year.
- Trend in *f* (1970–2000): -0.5% per year.
  - Trend reversed in 2000, but rapid decrease since around 2008.
- So far: Decarbonization driven much more by efficiency than clean energy.
- Rebound: greater efficiency → more consumption.

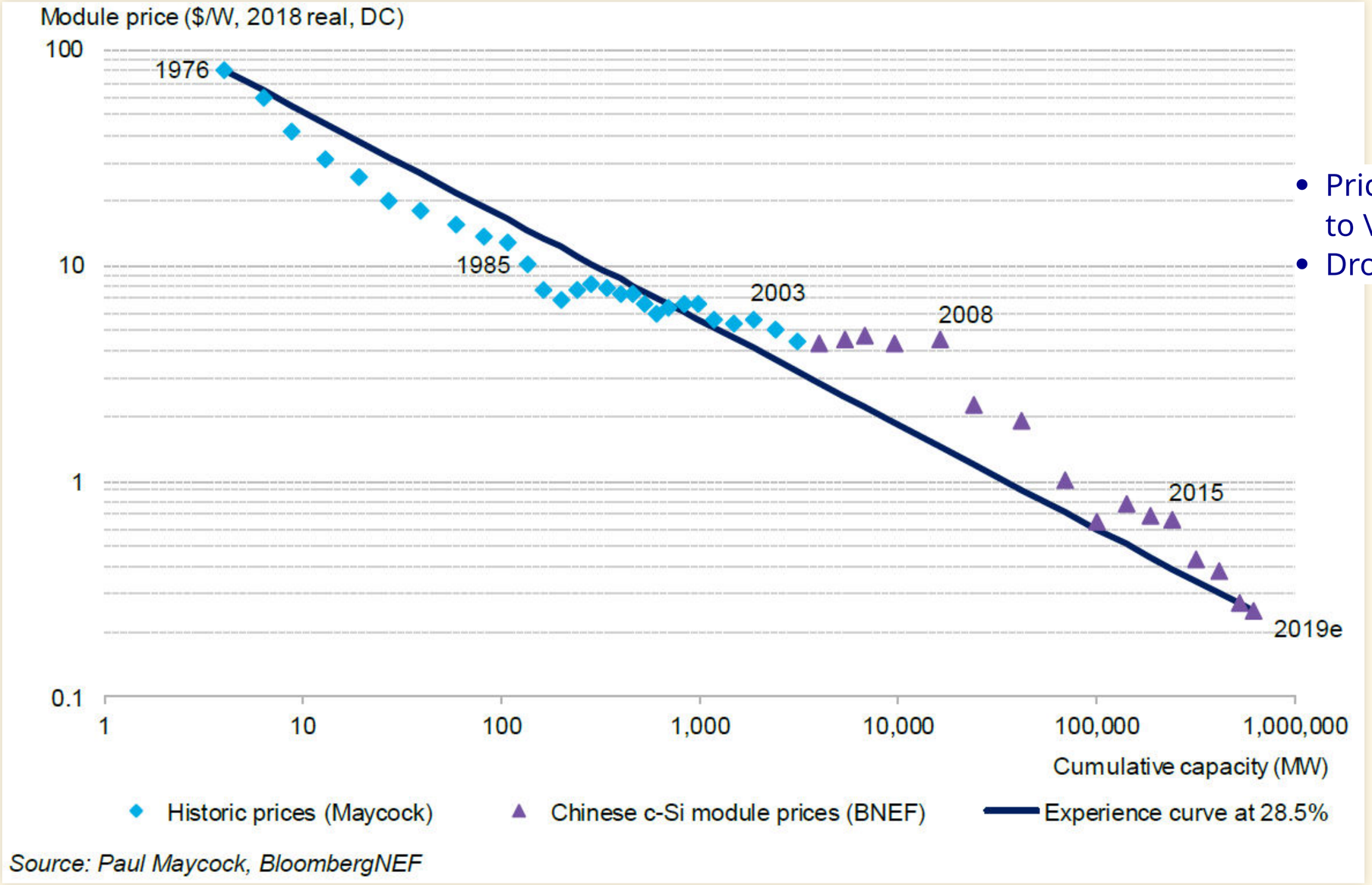
Energy Poverty

Photo credit: Rebecca Blackwell, Associated Press

- 1.1 billion people (17% of planet) lack access to electricity
- Over 3 billion (38%) lack clean cooking facilities
- In many nations in Africa and Asia 80–95% of the population is energy-poor.

Nordhaus’s Perspective

Innovation



- Price has dropped from
  to \$0.22/Watt in 2019.
- Dropped 99.7% (a facto

Source: Paul Maycock, Bloomberg New Energy Finance

Innovation Policy

- Knowing price of CO_2 will rise provides incentive to invest in R&D
- Valley of Death:
  - Technology looks promising in laboratory
  - Potential for big profits
  - Many years, lots of money to turn laboratory device into product
    - Product development might fail
    - Product might not sell
    - Competitors might copy product
    - Valley of death
  - Double externality
    1. Inventors don’t get all the value of their inventions
    2. Polluters don’t pay the costs of pollution
  - Government support to cross valley of death

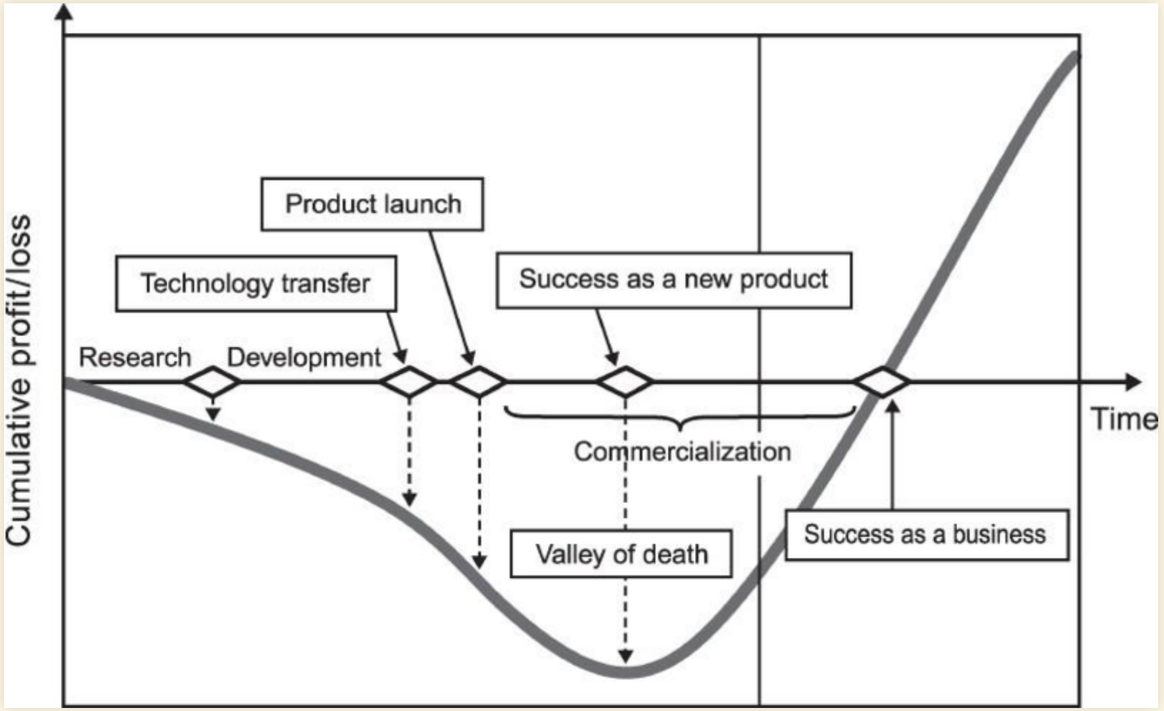


Image: Osawa & Miyazaki, Asian Journal of Technology Innovation **14**, 93 (2006) doi: 10.1080/19761597.2006.9668620

Pielke’s Policy Proposal

Pielke's Policy Proposal:

- Competition within government
- Public-works model
- Demonstration projects
- Government as consumer of energy innovations
  - Federal government is the largest consumer of energy in the U.S.
    - 350,000 buildings
    - 600,000 vehicles
- \$5/ton carbon tax (\$0.04 per gallon gas)
  - invest in clean-energy R&D
- Monitor progress
- Develop "plan B" (geoengineering)

Obliquity

- Appeal to people who don’t care about climate change
  - Cheaper energy
  - Reduce pollution (smog, etc.)
  - Reduce dependence on foreign oil