OLLI Study Group 395

Climate Policies: what works, what doesn't.

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Class # 2: Mitigation Policies

https://environmentaldefence.ca/2019/08/13/everything-wanted-know-carbon-pricing-afraid-ask-2/

Outline

Mitigation policies

- Standards and regulations, carbon taxes, emission trading systems
- The social cost of carbon
- Distributional and competitiveness effects of carbon pricing
- How to spend the revenues
- Returning carbon dividends to citizens.

Policies to fight climate change: mitigation, adaptation, risk management

Mitigation: measures to reduce emissions of green-house gasses.

Adaptation: measures to reduce the damage caused by climate change.

Disaster-risk management: policies that strengthen disaster preparedness, build response capacity, and promote resilience.

Three useful concepts to understand mitigation policies

- Externalities
- Discounting
- Total costs increase at an increasing rate: incremental or marginal costs increase.

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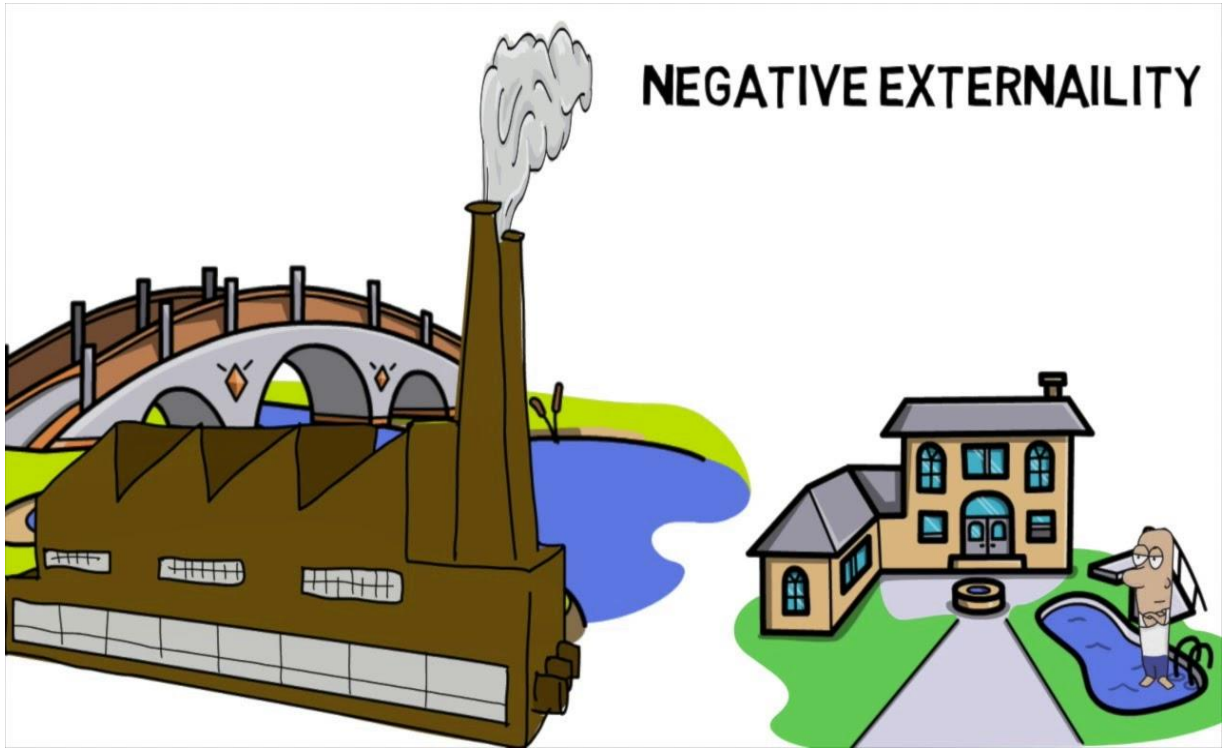
Externalities



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Externalities: positive or negative impacts of a market transaction imposed on others without any compensation: you drive a car that emits pollution but do not pay for the cost of pollution: society pays for this externality.

Firms and consumers base their decisions on private costs, which exclude the social costs of pollution: thus, production and consumption of fossil fuels generate socially inefficient amounts of GHG.

https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcQ4nQARVXKre0P-qd_KRL1C0KoBECJSbfF01w&usqp=CAU

Discounting

Discounting is the process of converting a value received in a future time period (FV) to an equivalent value received immediately (PV). The discount rate represents how much value is assigned to benefits received today rather than in the future.

PV = FV/(1+r)^t; if t=1 and we divide both sides by (1+r), FV= PV(1+r).

For example, consider a payment of $1,000 received in 200 years. Using a 3% discount rate, the present value can be calculated as follows:

PV = $1,000/(1+3%)^200 = $2.71. If r=0 the PV is $1000

PV = $1000/(1+4%)^200= $0.39 4%, which is about 7 times smaller.

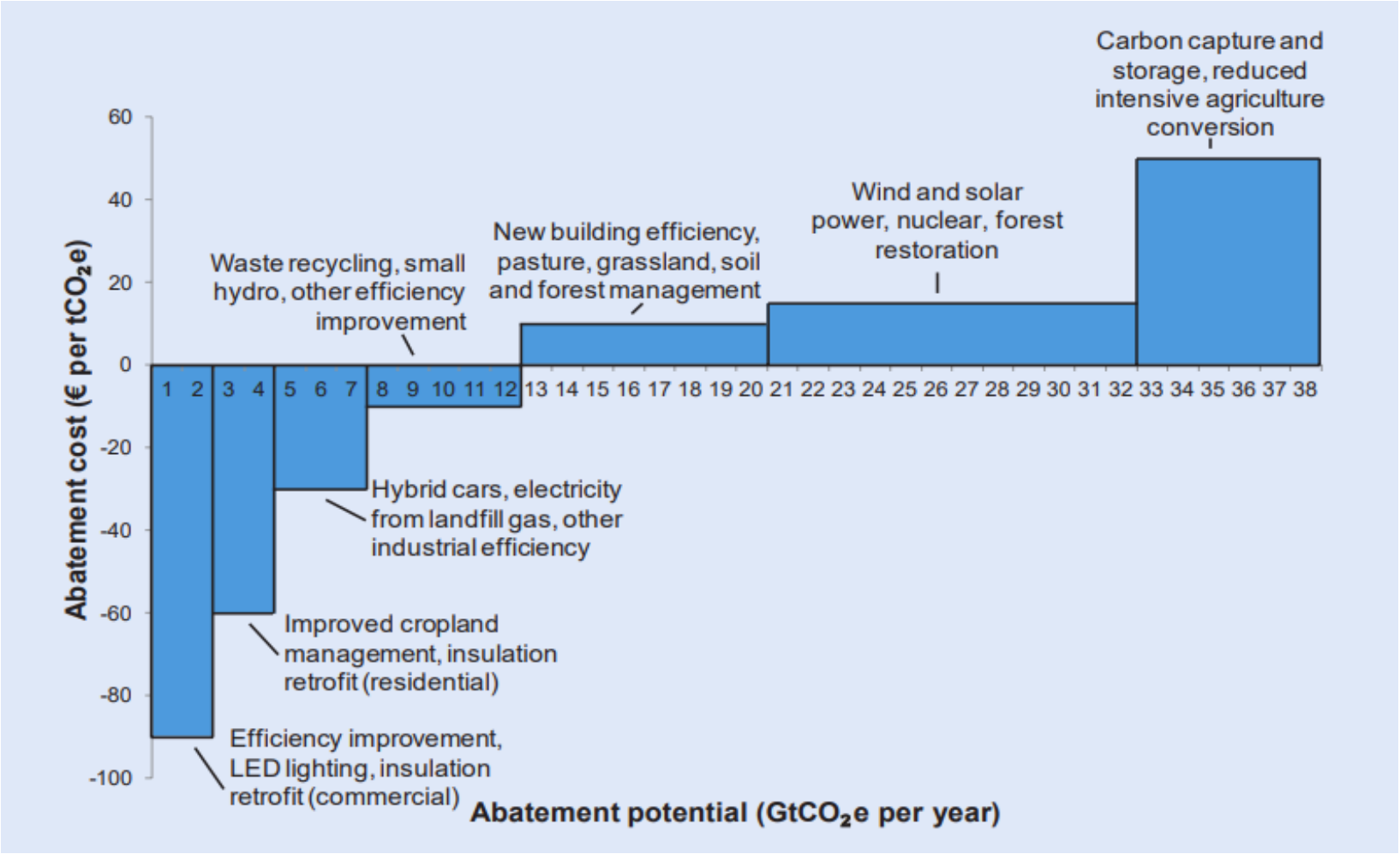
The discount rate is the rate at which society is willing to trade present benefits for future ones.

Source: https://www.rff.org/publications/explainers/discounting-101/

Total abatement costs increase at an increasing rate

- Emissions reduction costs a lot of money. Without mitigation policies, emissions are free.
- How much does it cost to reduce pollution?
  •Total costs increase at an increasing rate: **incremental or marginal costs increase**.
- Global estimates of abatement costs vary widely, depending on different assumptions made by modelers on available technological costs and their costs.
  - For example, renewable energy is currently the cheapest source of energy, (without accounting for the intermittency of renewable energy generation). **Some new technologies may be very expensive in the short run but become cheaper in the longer run.**
- Supporting innovation is crucial: innovations such as carbon capture technologies are necessary in achieving net-zero greenhouse gas emissions at a low cost.

Global GHG abatement cost curve for 2030



- **In the long run, the cost of policies** such as building insulation, increased efficiency, and waste recycling is **negative**; and the total CO2 reduction is 12 billion tons per year.
- **Implementing all these actions** would cost less than 1 percent of global GDP in 2030 and result in a reduction of 38 bn tons per year.
- Total global CO2 emissions are projected to rise to 70 tons by 2030. Thus instead of emitting 70 CO2 equivalent tons per year in 2030, we would be emitting only 32 tons.

Environmental and Natural Resource Economics 2017.pdf, page 352. McKinsey & Company. 2009. Pathways to a Low-Carbon Economy. http://www.mckinsey.com/business-functions/ sustainability-and-resource-productivity/our-insights/pathways-to-a-low-carbon-economy.

Climate Change Mitigation policies

- Command and control policies: technology or design standards, performance standards.
  - These policies are reasonably effective when abatement costs are similar across regulated sources.
- Carbon taxes
  - A carbon tax is imposed on the carbon content of fossil fuels. It is the most efficient instrument to reduce emissions.
- Emissions Trading Systems
  - ETS set a cap on total GHG emissions and require emitters to hold a permit for each ton of CO_2 that they emit. Permits are allocated through (i) auctioning; (ii) free allocation based on historical emission levels or (iii) emissions per unit of output.

Command and control policies

Command and control policies: prescribe how much pollution an individual source or plant is allowed to emit and/ or what types of control equipment it must use to meet such requirements.

- **Technology or design standards**, mandate the **specific control technologies** or production processes that an individual pollution source must use to meet the emissions standard. Example: all new automobiles must include a catalytic converter to reduce tailpipe emissions.
- **Performance-based Standards.** They require that polluters meet a source-level emissions standard, but allow them to choose among available methods to comply with the standard. Example : building performance standards.

  Efficiency standards for machinery and appliances, are regulations that mandate efficiency criteria. Examples include standards for the average fuel economy (miles per gallon etc.); and for the energy use of refrigerators, lighting, heating equipment.

Source: https://www.epa.gov/sites/default/files/2017-09/documents/ee-0568-04.pdf

Corporate Average Fuel Economy Standards (CAFE)

- **The purpose of CAFE, first established by Congress in 1985, is to reduce energy consumption by increasing the fuel efficiency of cars and light trucks.**

- The Energy Independence and Security Act of 2007, raised CAFE of America's cars, light trucks, and SUVs to a combined average of **at least 35 miles per gallon (mpg) by 2020**—a 10 mpg increase over 2007 levels—and required standards to be met at maximum feasible levels through 2030.

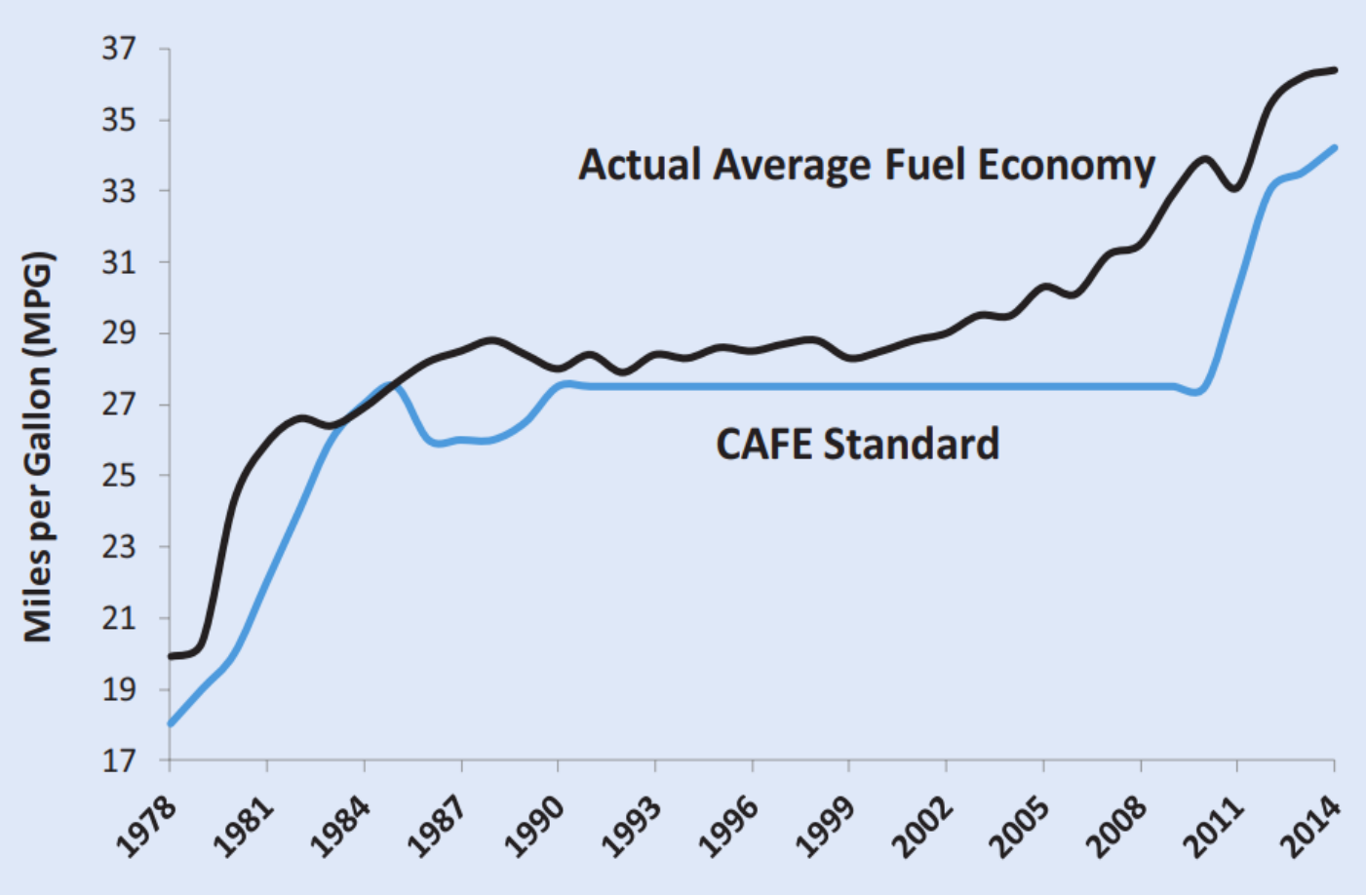
- In **August 2012** the Obama Administration announced new rules, nearly doubling the fuel efficiency of new vehicles by 2025. The combined CAFE standard for cars and light trucks was scheduled to rise from **29.7 (mpg) in 2012 to 54.5 mpg** in 2025. The new rules were endorsed by 13 major automakers.

- In August 2018, under Trump's presidency, the EPA and Department of Transportation, proposed **freezing the fuel economy goals to the 2021 target of 37 mpg,** and eliminating the legal waiver that allows states like California to set more stringent standards. New CAFE targets went into **effect in June 2020 beginning with the 2021 model year, increasing at a rate of 1.5 percent per year**, far lower than the nearly 5 percent increase they replace.

- Biden, 2022: Fuel economy targets for cars and light trucks **each increase 8 percent for 2024 MY, 8 percent for 2025 MY, and 10 percent for 2026 MY.** NHTSA projects that the updated targets lead to an industry-wide average of **49 MPG by the 2026 model year** given a fleet mix of 48 percent passenger cars and 52 percent light trucks

CAFE standards in the US. After the standards were met, automakers did not make further efficiency gains.

CAFE Standards and actual average fuel economy in the US, 1978-2014



CAFE standards create inefficiencies:

- A “rebound effect”: as CAFE standards reduce the cost of driving, people begin to drive more.
- Incentivize consumers to use older vehicles that emit more pollutants.
- By creating separate standards for passenger vehicles and light trucks, CAFE may have helped incentivize an increase in the number of new trucks and SUVs (because light trucks have lower standards).

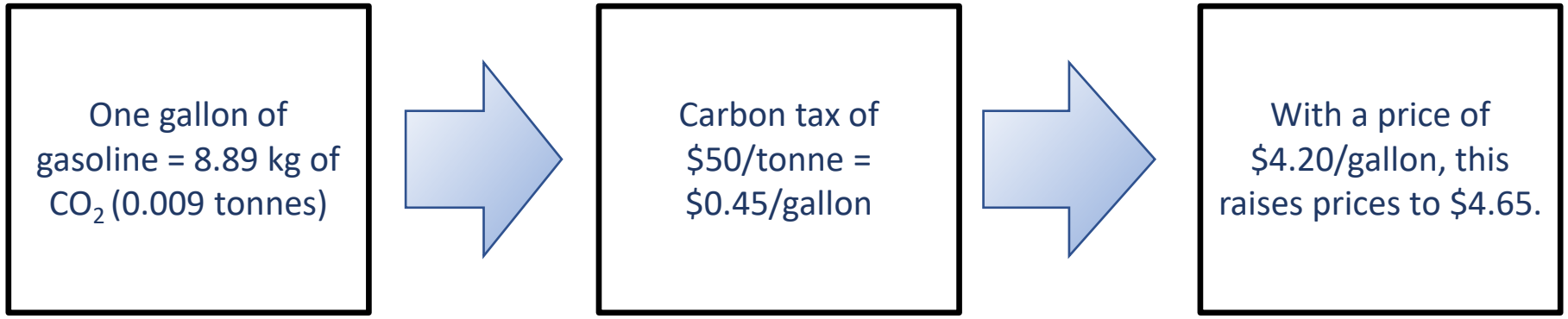
Source: Environmental and Natural Resource Economics book. A Contemporary Approach. ByJonathan M. Harris, Brian Roach. Edition 5th Edition, page 180

Carbon taxes

*By correcting a well-known market failure, a carbon tax will send a powerful price signal that harnesses the invisible hand of the marketplace to steer economic actors towards a low-carbon future…(*Statement signed by 28 Nobel Laureate Economists, 15 Former Chairs of the Council of Economic Advisers, 4 Former Chairs of the Federal Reserve and 3623 U.S. Economists. *January 17, 2019).*

A carbon tax is a price set per ton of carbon or, more commonly, per ton of CO2 emitted.

- A $1 tax per ton of CO2 is equal to a $3.7 tax per ton of carbon, because carbon constitutes roughly 3/11 of the weight of CO2 .

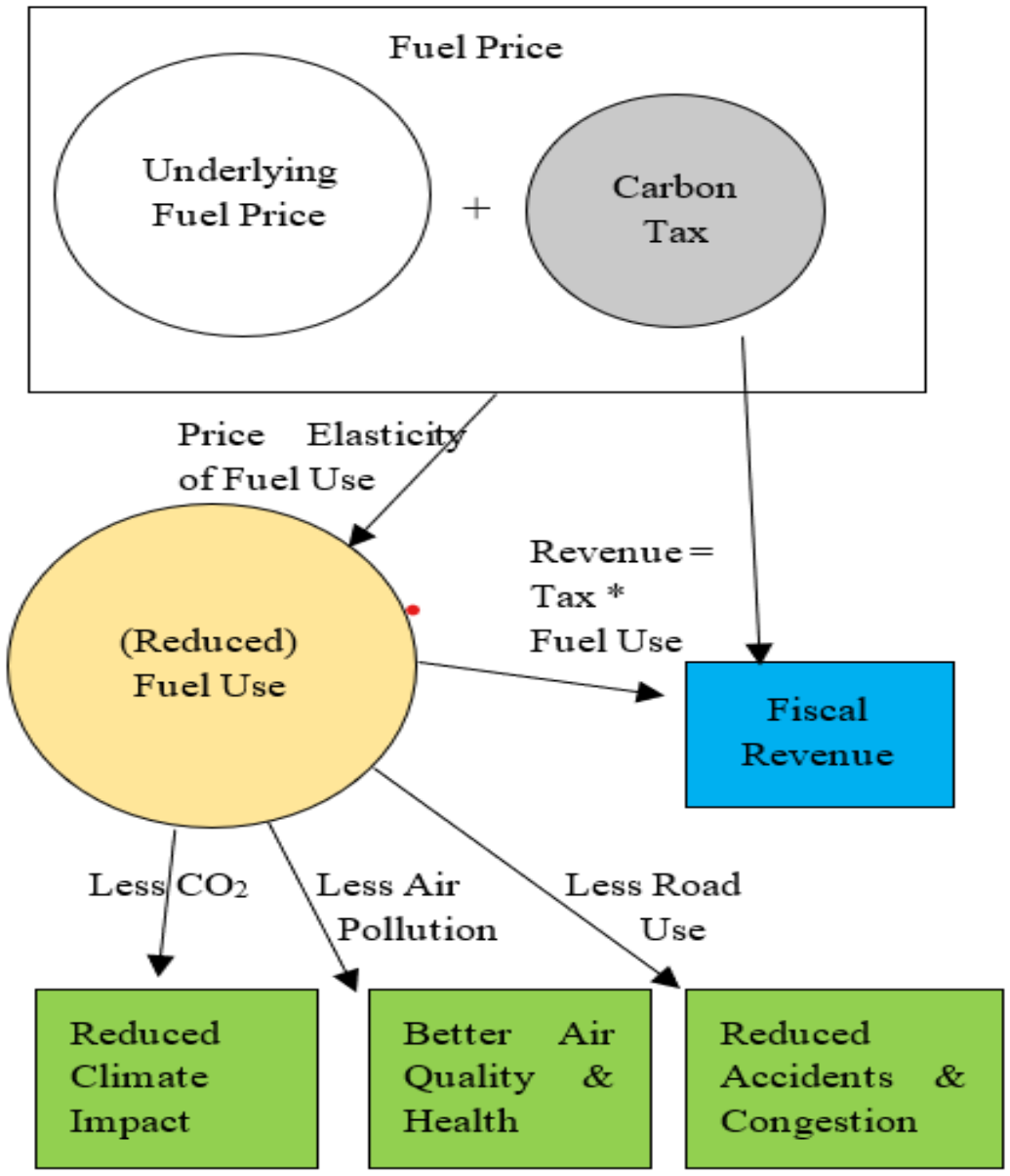


Source: Calculated from U.S. Department of Energy data.

Carbon taxation

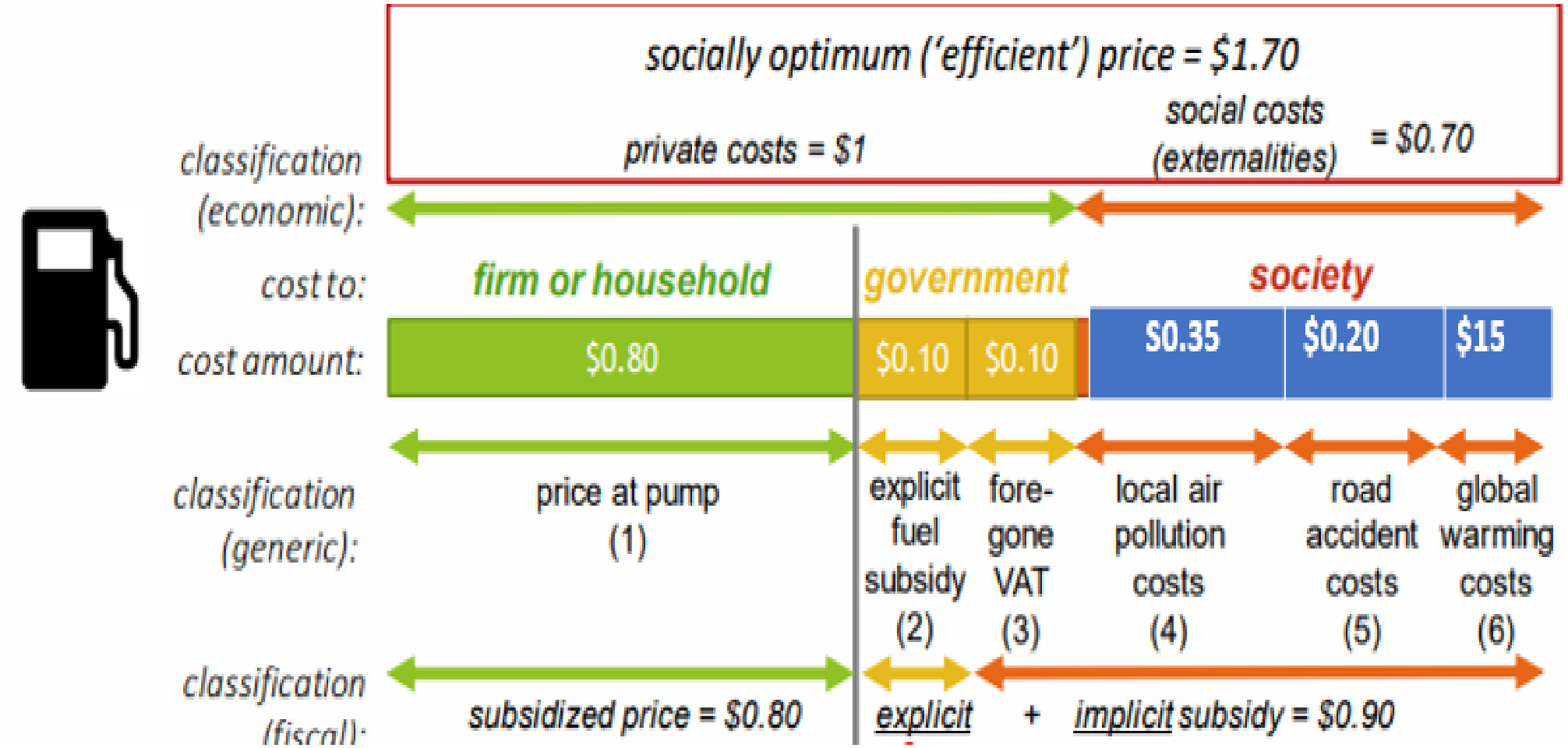
- **A carbon tax is a charge** on the carbon content of fossil fuels. To the extent that it is passed forward it leads to increases in the prices of fossil fuels, thus encouraging emissions-reductions and clean-technology investment.
- **Carbon taxes are an efficient method of raising revenue.** Such taxes require relatively little administration; they apply to the informal as well as the formal sector. If the revenues are used to reduce distortive taxes (e.g. on labor) produces broader benefits to the economy.
- **Carbon price policies are cost-effective** because all emissions sources covered are priced at the same rate. – so firms face the same incentives to reduce emissions up to the point where the cost of the last ton reduced equals the price on emissions.

Effects of a carbon tax



Source: I. Parry, R. de Mooji, M. Keen, Fiscal Policy to mitigate climate change, IMF 2012.

The social cost of carbon



Calculating the social cost of carbon (SCC)

Social cost of carbon: it captures the cost of an additional ton of carbon-dioxide pollution in a single number. It is the discounted value of the economic damage - accumulated over time - of a metric ton of CO2 released into the atmosphere.

To calculate the SCC dollar amount, integrate the following steps:

- Predict future emissions based on population, growth, and other factors.
- Model future climate responses, such as temp. increase and sea level rise.
- Assess the economic impact that these climatic changes will have on agriculture, health, energy use, and other aspects of the economy.
- Convert future damages into their present day value and add them up to determine total damages.

These four steps are completed to obtain a baseline value for the damages of emissions. Then, the modeling process is repeated with a small additional amount of emissions to see how much it changes the total cost of damages. The increase in damages from the additional emissions provides an estimate of the SCC.

Source: https://www.rff.org/publications/explainers/social-cost-carbon-101/

SCC: calculation considerations

- The SCC is used in benefit-cost analysis, which has been a **required part** of federal regulatory analysis since 1981. Two factors are crucial for the calculations of the SCC:

1. The discount rate: A high discount rate means that future effects are considered much less significant than present effects.

2. Impacts can be calculated based on global damages (the total effects of emissions felt all around the world) or they can be limited to domestic damages.

- Because of **uncertainty**, SCC is best represented by a range of possible values. US government for four different discount rates (7%, 5%, 3%, and 2.5%).

Effects of different discount rates on global and domestic estimates of the SCC in 2020

Discount Rate	Global SCC ($ per ton CO_2)	Domestic (US) SCC ($ per ton CO_2)
2.5%	75	10
3%	50	7
5%	14	2
7%	5	1

Obama administration : SCC= $43 a ton
Trump administration: SCC= $3-5 a ton
Biden administration: SCC around $51 a ton.

In practice, most countries start with a very low price of carbon ($5) and a schedule to increase it over-time.

https://www.rff.org/publications/explainers/social-cost-carbon-101/

Emissions Trading Systems (1)

Emissions Trading Systems (ETS) work on the principle of **cap-and-trade**:

(i) limits aggregate emissions by setting a “cap” on maximum emissions.

(ii) The regulating authority:

- sets a cap on total mass emissions for a group of sources for a fixed compliance period (e.g., 1 year).
- divides the cap into allowances, each representing an authorization to emit a specific quantity of pollutant (e.g., 1 ton of SO2) and distributes allowances (no cost or through an or auction).

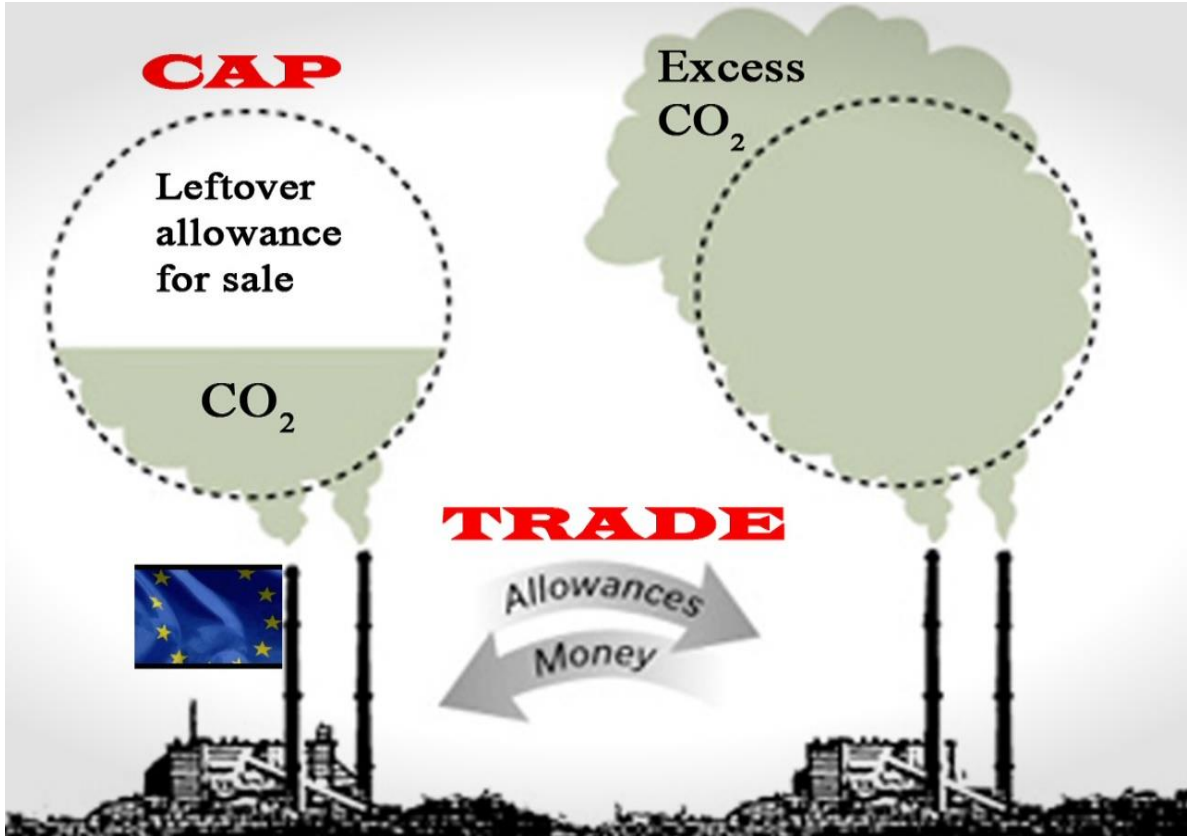
- Emitting firms are mandated to buy carbon allowances if they want to emit*.
- An established market enables trading of allowances among firms. Polluters who face high marginal abatement costs to purchase allowances from polluters with low marginal abatement costs.
- An ETS provides certainty over the quantity of emissions reduced, but not on the price at which this is achieved. ETSs are more complex to create and administer than carbon taxes.

https://www.epa.gov/sites/default/files/2016-03/documents/tools.pdf

Emissions Trading Systems (2)

Design features that increase flexibility and allow policymakers to exercise some degree of control over carbon prices and allowance supply:

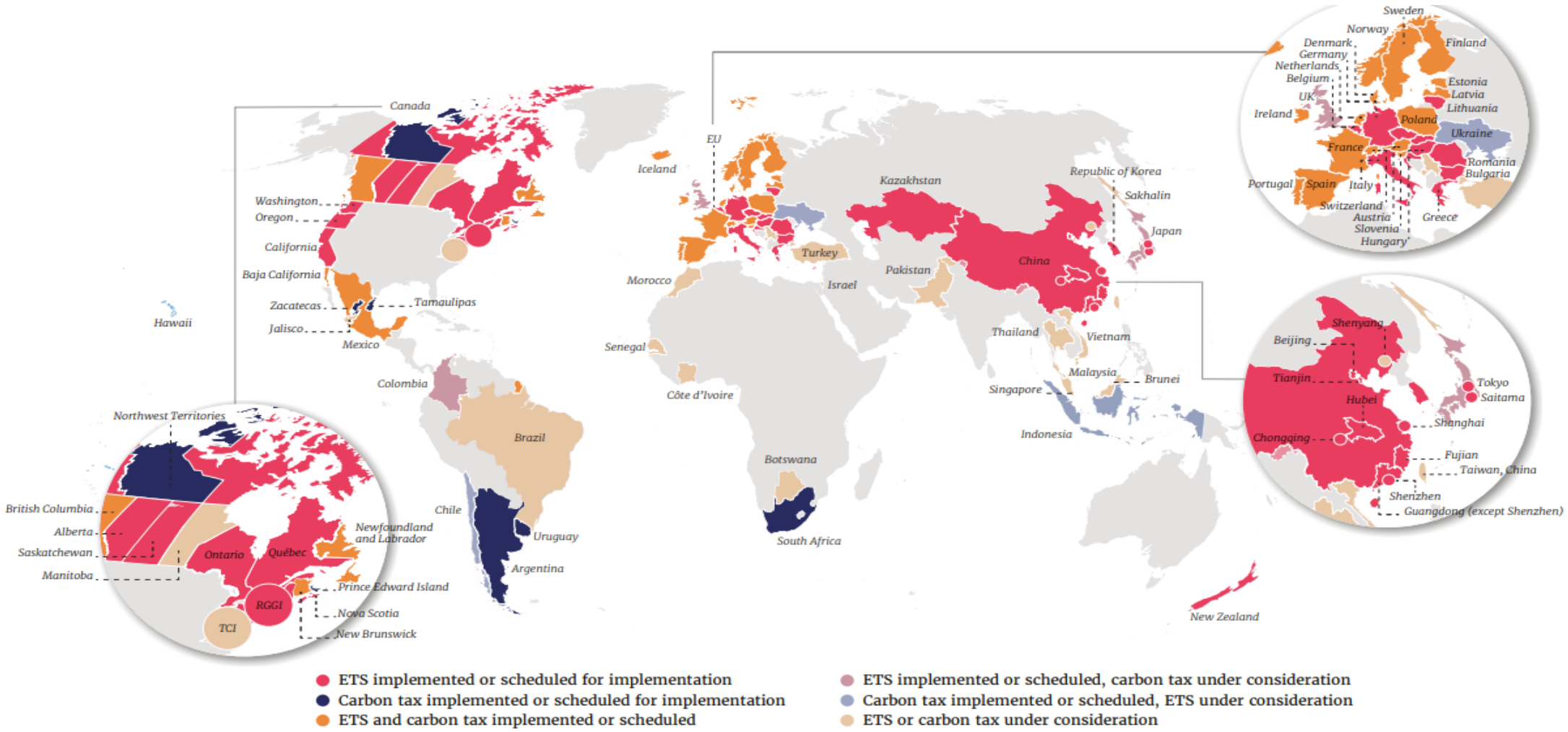
- **Entities can be allowed to keep ('bank') surplus allowances for later use**, and in some cases, to borrow allowances from future compliance periods.
- Policymakers can place limits on the range of possible prices through a **price collar** (price ceiling and floor).
- **Linking domestic ETS is linked with another system has many benefits:** trading can also take place across borders, bolstering international cooperation on climate goals, improving cost effectiveness of the combined system.



https://www.epa.gov/sites/default/files/2016-03/documents/tools.pdf

http://www.climatereview.net/Movie%20Screenshots/High%20Res/Cap%20and%20Trade%20Mechanism.jpg

Map of carbon taxes and emissions trading systems, 2021



Source: "World Bank. 2022. State and Trends of Carbon Pricing 2022. State and Trends of Carbon Pricing;. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/37455 License: CC BY 3.0 IGO."

California cap and trade system

The Cap-and-Trade Program sets a statewide limit on sources responsible for 85 percent of California's GHG emissions.

The Cap: Set in 2013 at about 2 percent below the emissions level forecast for 2012; Declines about 2 percent in 2014; Declines about 3 percent annually from 2015 to 2020

Banking of allowances is allowed to guard against shortages and price swings;

Offsets: allowed for up to 8 percent of a facility's compliance obligation. Restricted to projects in five areas: forestry, urban forestry, dairy digesters, destruction of ozone depleting substances, and mine methane capture. Offsets must be independently verified.

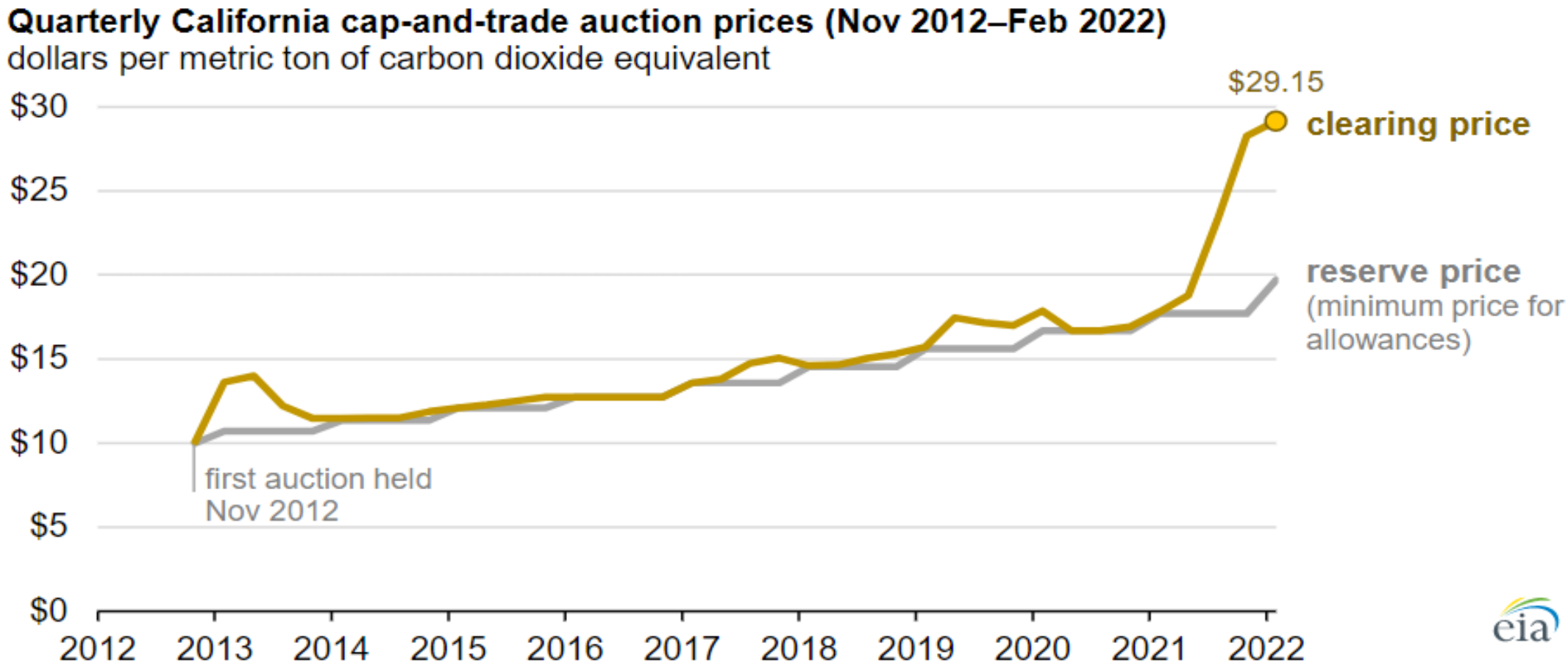
Proceeds

- Proceeds are split between the state and utilities that use the revenue to offset compliance costs.

https://ww2.arb.ca.gov/sites/default/files/cap-and-trade/guidance/cap_trade_overview.p

ALLOWANCES	OFFSETS
Allowances are issued by the ARB	Offsets can only come from projects under approved protocols
Allocated to industry or through ARB-hosted quarterly auctions	Quantitative usage limit of 8%
Irrevocable when used for compliance	Vintage-less and can be used at anytime for compliance
Allowances have vintages associated with them that restrict usage	Buyer Liability Risk

California auction prices are increasing



Source: Graph by the U.S. Energy Information Administration, based on California Air Resources Board data
Note: Prices are for the current vintage allowances sold in each auction.

Comparisons of policy instruments

	CO_2 tax	Cap and trade	Traditional regulation *(e.g., source-specific emissions standards)*
Certainty over CO_2 price or cost?	Yes. The tax establishes a well-defined price.	No. But price volatility can be limited by design features, such as a safety valve (price cap) or borrowing.	No.
Certainty over emissions?	No. Emissions vary with prevailing energy demand and fuel prices.	Yes, in its traditional form (over capped emissions sources). No, with the use of additional cost containment mechanisms.	No; regulating the rate of emissions leaves the level uncertain.
Efficiently encourages least-cost emissions reductions?	Yes.	Yes.	No, but tradable standards are more efficient than non-tradable standards.
Ability to raise revenue?	Yes. Results in maximum revenue generation compared to other options (assuming cap-and-trade alternative includes substantial free allocation of allowances).	Traditionally—with a largely free allocation—no. Growing interest in a substantial allowance auction suggests opportunity to raise at least some revenue now and possibly transition to a complete auction that generates maximum revenue in the future.	No.
Incentives for R&D in clean technologies?	Yes. Stable CO_2 price is needed to induce innovation.	Yes. However, uncertainty over permit prices could weaken innovation incentives.	Yes and no. Standards encourage specific technologies, but not broad innovation.
Harm to competitiveness?	Yes, though if other taxes are reduced through revenue recycling, competitiveness of the broader economy can be improved.	Yes (as with a tax), but giving firms free allowances offsets potentially harmful effects on profitability.	Somewhat. Regulations increase the cost of manufacturing but, unlike taxes or tradable permits, do not raise the price of fossil energy.
Practical or political obstacles to implementation?	Yes. New taxes have been very unpopular.	Yes. Identifying a reasonable allocation and target is difficult.	Yes. Setting the level of the standard is difficult.
New institutional requirements?	Minimal.	Yes, but experience with existing trading programs suggests that markets (for trading permits and exchanging information across firms and time periods) arise quickly and relatively inexpensively.	Minimal (unless tradable).

Source: Parry & Pizer - Emissions Trading Versus CO2 Taxes Versus Standards.pdf

Redistribution effects of carbon pricing

Carbon taxation can have regressive effects on income distribution as it negatively affects the incomes of poorer households more than wealthier households as a proportion of income.

- **The effect might be less strong in** poorer countries: the poor tend to spend a lower portion of income on polluting goods than poorer households in wealthy countries.

- **Distributional and poverty effects depend on various factors**:
  - Fossil fuel consumption patterns, tax bases, revenue usage
  - Demand responses, factor incomes, production structures
- **Compensation methods include**:
  - universal basic income and conditional or unconditional cash transfers
  - tax rebates and raising income tax thresholds
  - increasing progressive social spending – health, education, social safety nets
  - increasing public investment where this benefits the poorest, e.g. public transportation, energy access

Competitiveness effects and solutions

Higher carbon prices than in trading partners create a trade distortion, leading to:

- Concerns about jobs and growth: (i) jobs and industrial production may move abroad because of changes in the cost of manufacturing goods; (ii) Especially relevant for energy-intensive, trade-exposed (EITE) industries
- Environmental concerns: “Carbon leakage” is when production shifting abroad raises foreign emissions, offsetting the domestic emissions reduction from carbon pricing.

A **border carbon adjustment**, or BCA, consists of charges on imports, and sometimes rebates on exports.

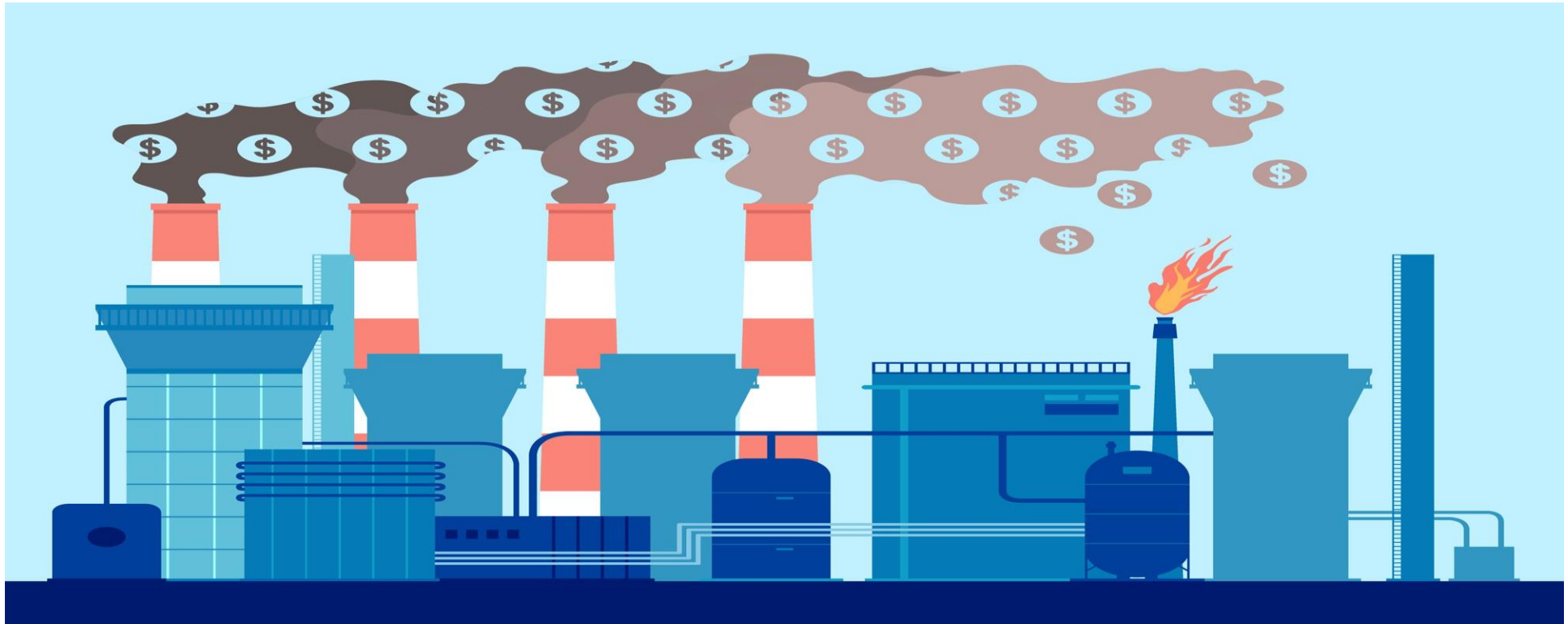
➢ BCAs could help address both concerns – charging for the CO2 “embodied” in imports (and probably rebating for exports). Provides an alternative to existing EITE industry support mechanisms such as free allowances.

➢ BCAs may also encourage carbon pricing abroad

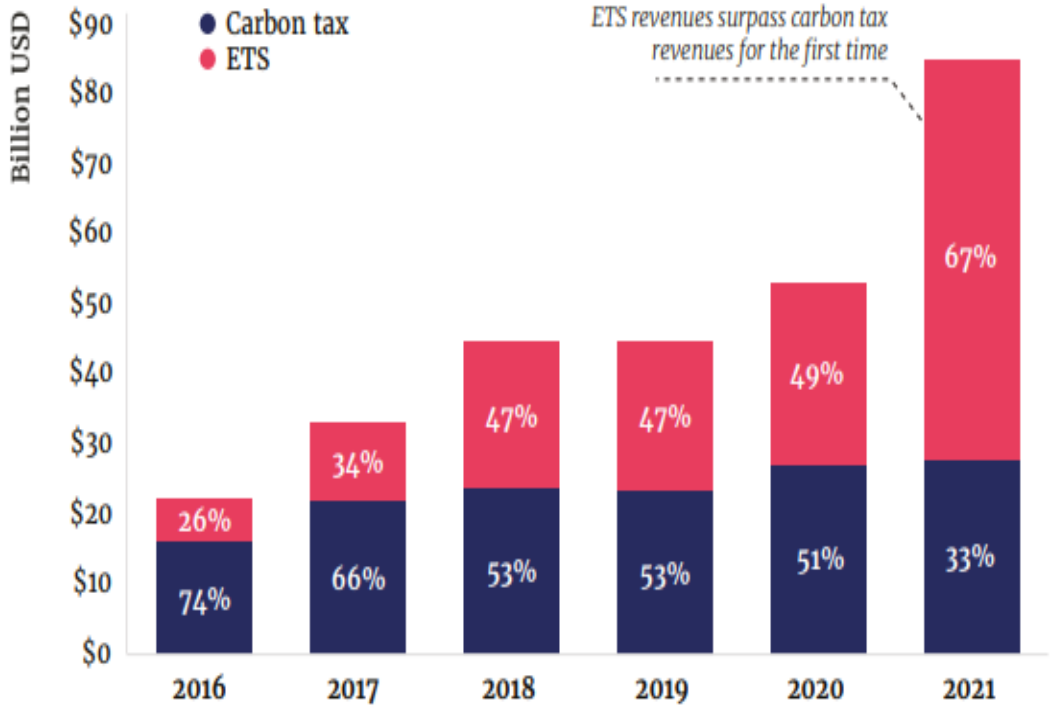
➢ But international cooperation on carbon pricing is superior to BCAs, notably in cutting global emissions.

- https://www.rff.org/publications/explainers/border-carbon-adjustments-101/

How to spend carbon revenues



So many ideas on how to spend the revenues



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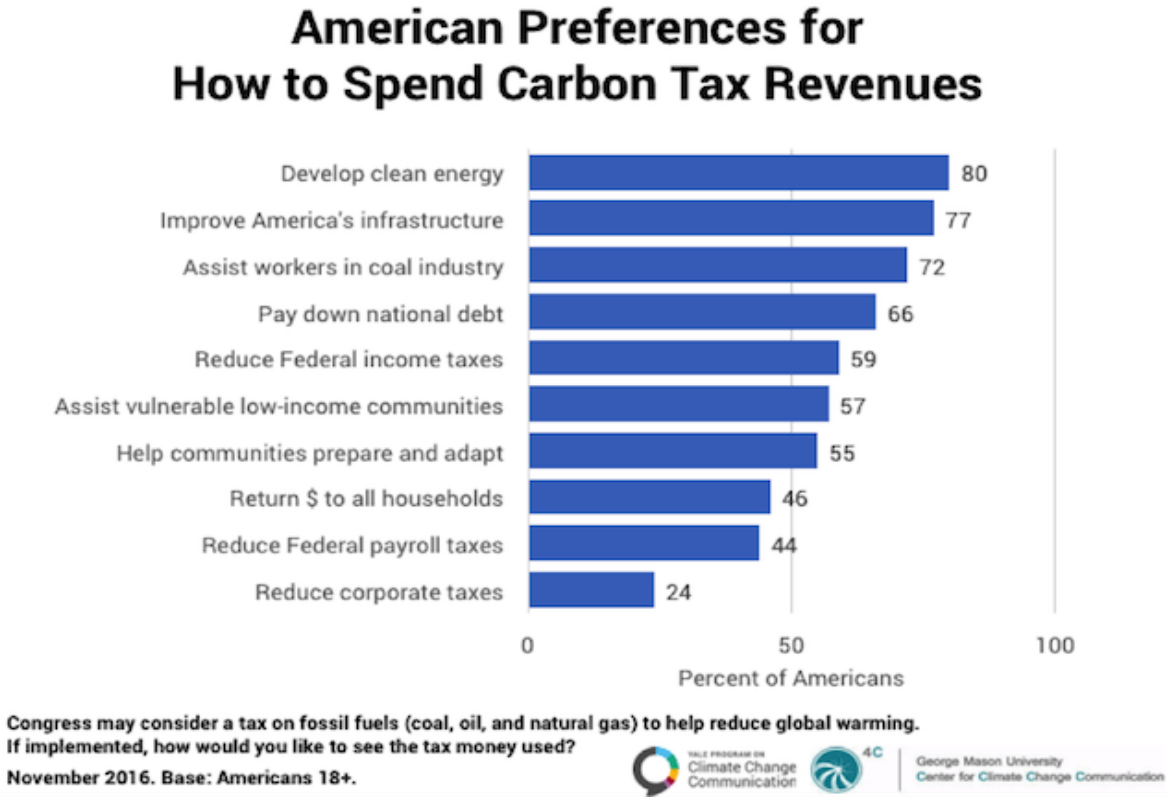
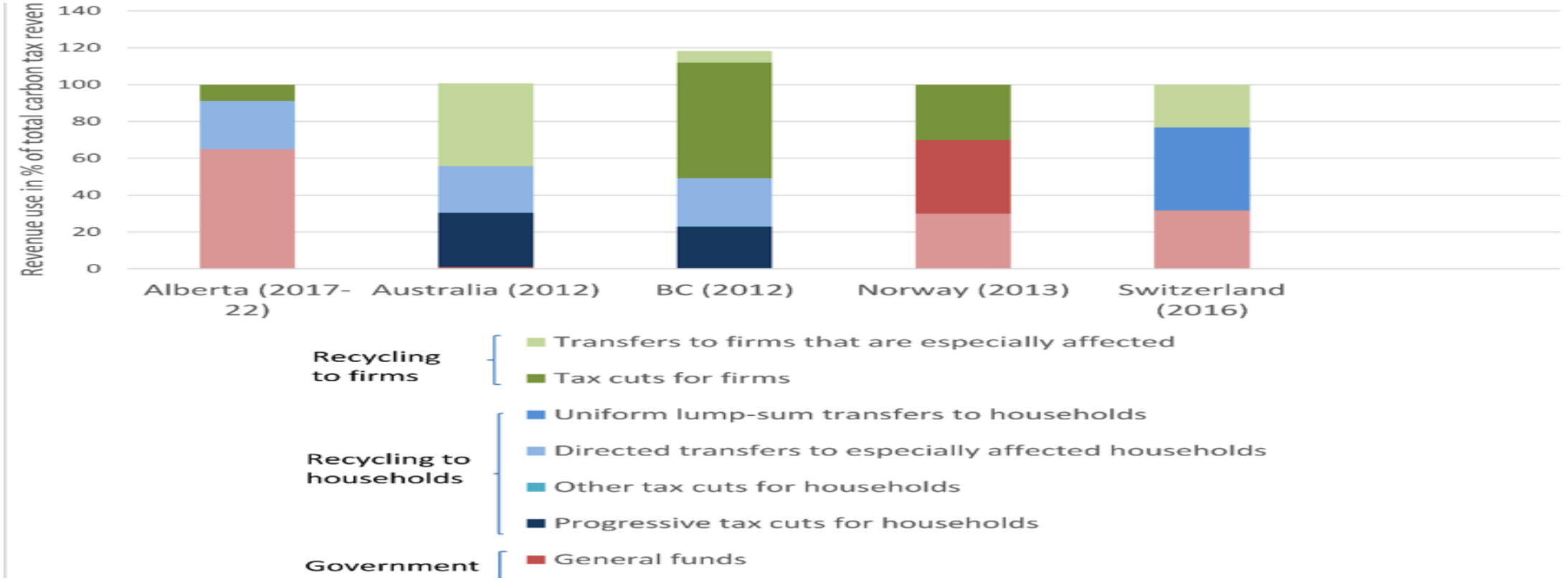


http://climatecommunication.yale.edu/wp-content/uploads/2017/10/friendsnoteoct12.png

How carbon revenues are spent in the real world



In 2013 total carbon revenues totaled $28.3 billion. In 2018 carbon pricing instruments raised about $44.6 billion.

Co-Benefits of alternative ways to spend the revenues of environmental tax reforms

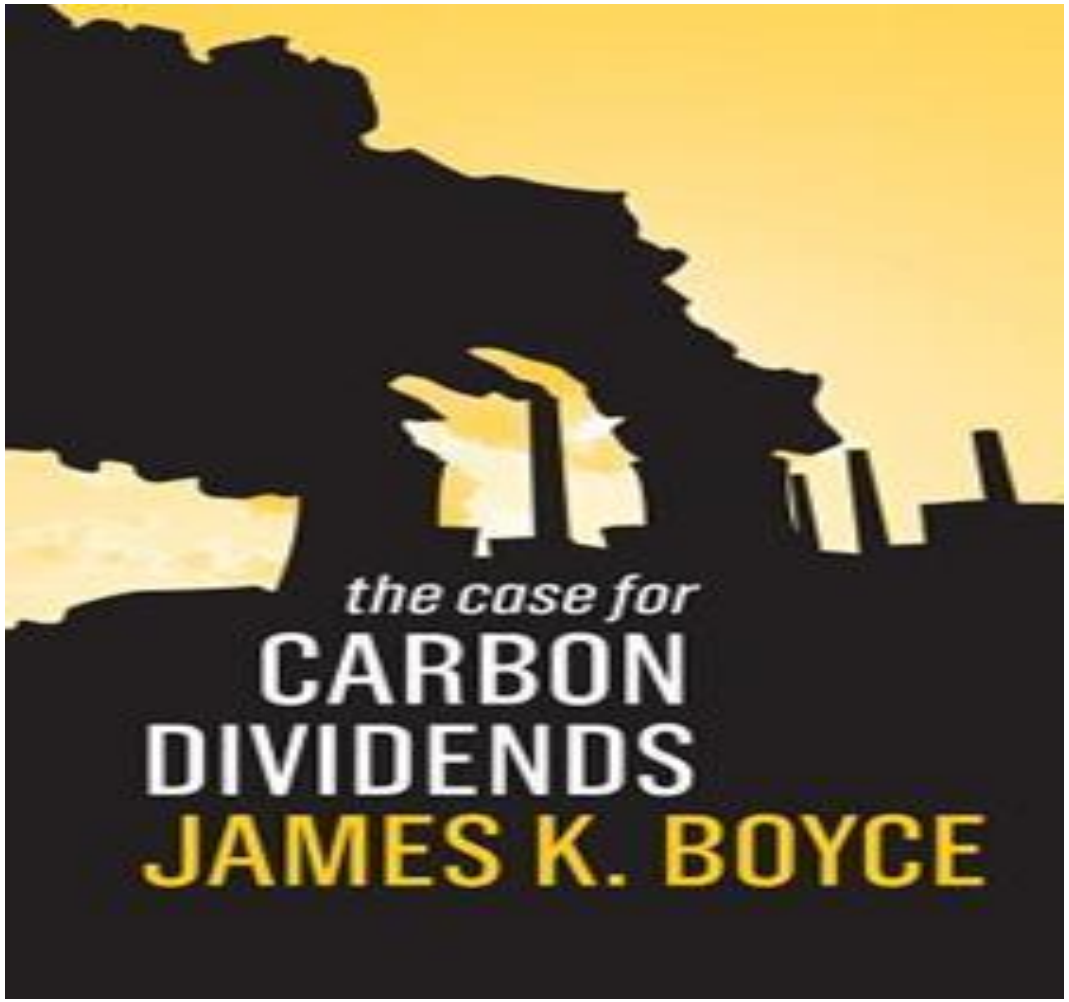
- Increased output and employment, **if revenues are used to lower distortive taxes on labor.**
- **Welfare gains**, if revenues are spent on education, health, and other public goods.
- **Greater economic resilience**, if revenues are spent on adaptation (e.g., investment in climate-resilient infrastructure).
- **More rapid technological change and increased investment** in low-carbon sectors and production models.
- **Development co-benefits** (non-economic, non-emissions benefits):
  - Better air quality – and improvements in human health (reduced morbidity and mortality)
  - Fewer road accidents – fuel taxes can help cut costly road accidents
  - Less congestion – fuel taxes can reduce costly congestion
  - Increased energy security.

Climate Policy for the present generation

James Boyce's Case for Carbon Dividends

The book argues that*:*

- We can fight both climate change and widening inequality.
- We can bring win-win solutions that bring tangible benefits in the present generation while safeguarding the planet for future generations.



Carbon dividends: how does it work?

- A carbon dividends strategy puts a price on carbon emissions and returns the money to the people.
  - Those who consume more pay more; those who consume less pay less.
  - Dividends recycle the revenue in equal payments to every resident.
  - Most households would get more in dividends than they pay in higher fuel prices.
  - The most affluent—who consume more of just about everything, including fossil fuels—would pay more, but they can afford it.
- Politically, dividends pass the win-win test for viable climate policy, bringing here-and-now benefits today while protecting the planet for people tomorrow.

The case for carbon dividends

Energy Innovation and Carbon Dividend Act of 2021

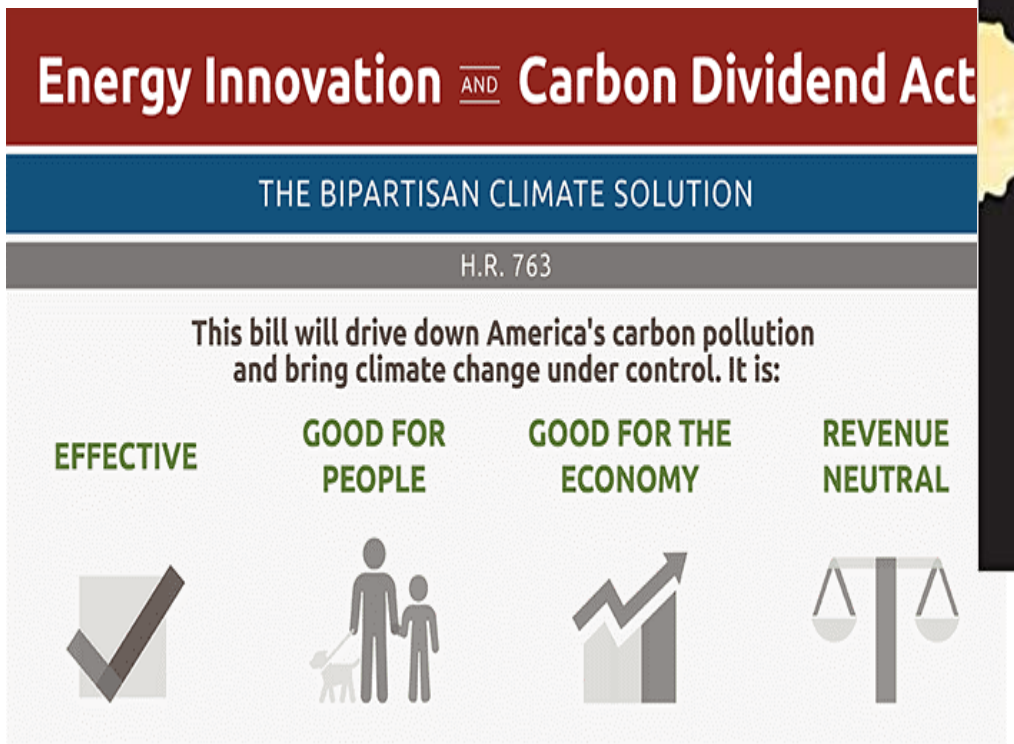
- **This bill imposes a fee on the carbon content of fuels**, including crude oil, natural gas, coal, or any other product derived from those fuels that will be used so as to emit greenhouse gases into the atmosphere.
- **The fee is imposed on the producers or importers of the fuels and is equal to the greenhouse gas content of the fuel multiplied by the carbon fee rate.** The rate begins at $15 per metric ton of CO2-e in 2021, increases by $10 each year, and is subject to further adjustments based on the progress in meeting specified emissions reduction targets.
- The bill includes:
  - exemptions for fuels used for agricultural or no emitting purposes,
  - exemptions for fuels used by the Armed Forces,
  - rebates for facilities that capture and sequester carbon dioxide, and
  - border adjustment provisions that require certain fees or refunds for carbon-intensive products that are exported or imported.
- **The fees must be deposited into a Carbon Dividend Trust Fund and used for administrative expenses and dividend payments to U.S. citizens or lawful residents**. The fees must be decommissioned when emissions levels and monthly dividend payments fall below specified levels.

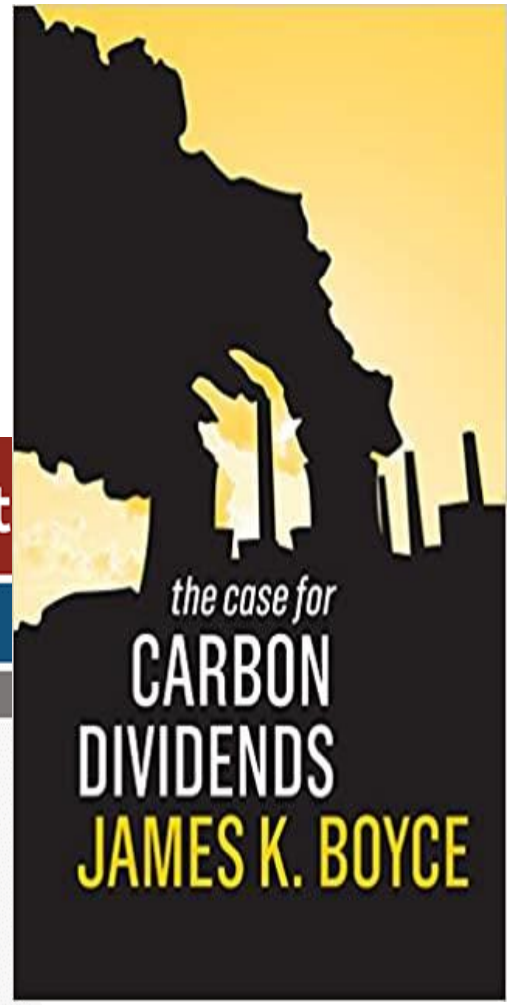
S4CD

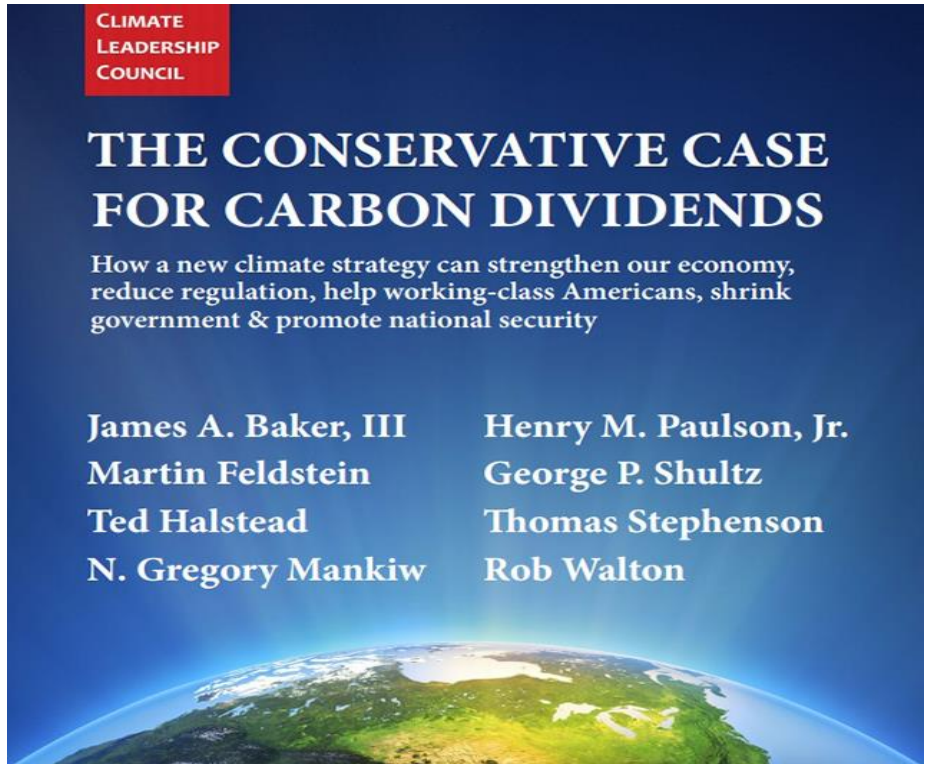
STUDENTS FOR CARBON DIVIDENDS

AFCD

Americans for Carbon Dividends







Issues for discussion

- Why have we been so ineffective in dealing with climate mitigation?
- The Energy Innovation and Carbon Dividend Act of 2021 was introduced into the House on 04/01/2021. It is the most broadly supported carbon pricing bill in Congress. It is practically dead. Why?

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