# Robust Carbon Markets: Rethinking Quantities and Prices

Dallas Burtraw
*Resources for the Future*

Kleinman Center for Energy Policy at the University of Pennsylvania

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Recent coauthors: Karen Palmer, Amelia Keyes, Anthony Paul, Bill Shobe and Charles Holt

# Even Tom the Dancing Bug had an opinion….


## TALES of MARKET-DRIVEN CRIMES


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# Early Public Perceptions of Emissions Trading

## Media reactions to first $SO_2$ allowance trades in 1992

- "What's next, the L.A. Police Department trying to buy civil rights credits in Wisconsin?" (quote from A.P. wire)
- "Why applaud a deal that lets companies buy pollution rights? *People will die.*" (op. ed. in USA Today)

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# Basic Principles

- An emissions tax sets a price; emissions are not guaranteed
- Cap and trade sets a quantity target; the price is not specified

Marty Weitzman's *Prices **versus** Quantities* (1974) has framed economics research and policy guidance

Recent developments suggest a new perspective:

➢ *Prices **with** Quantities*

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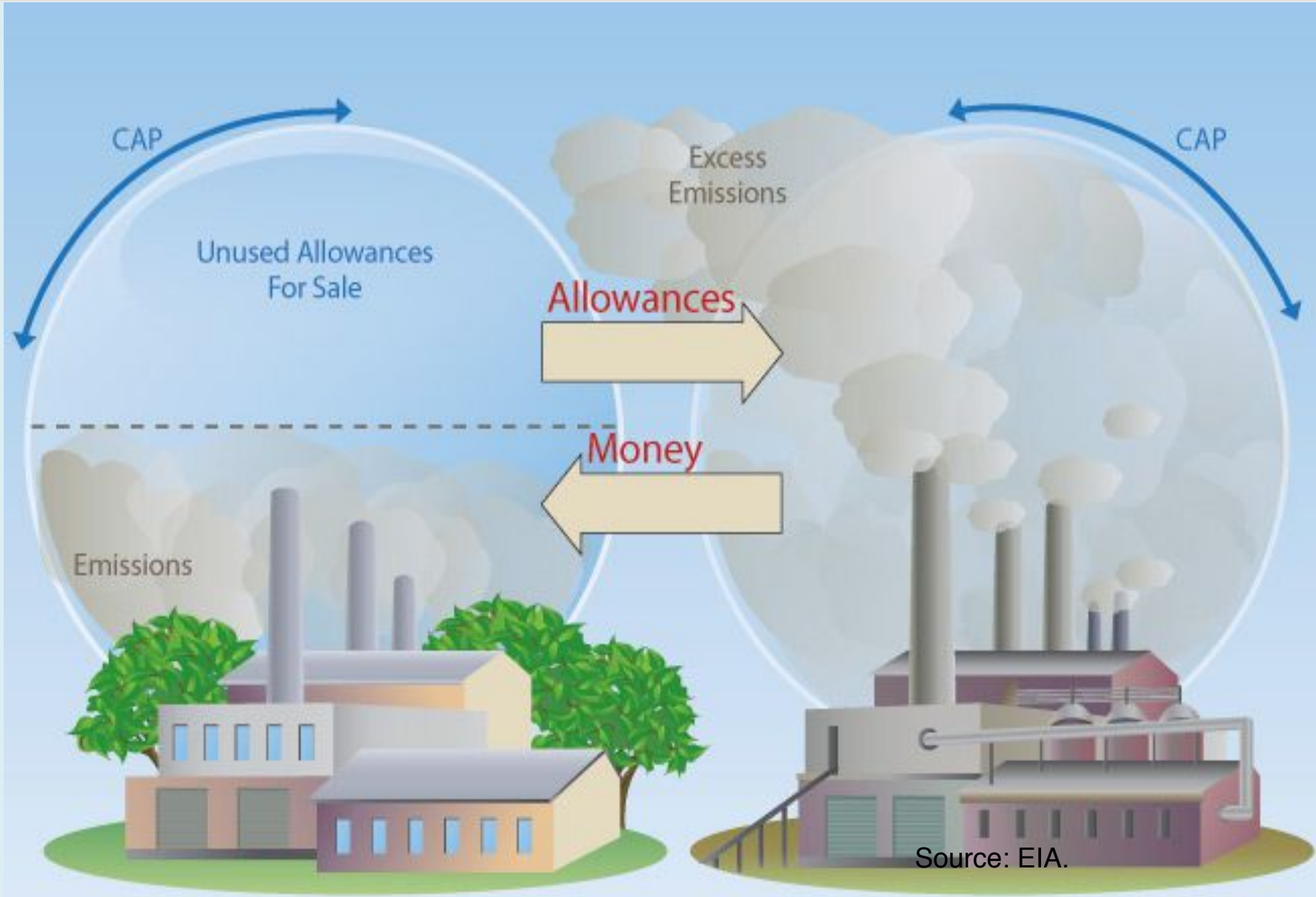
Source: EIA.

# Emissions Cap and Trade

- Regulators limit total emissions (the “cap”).
- Firms surrender one allowance per ton of emissions.
- Firms can buy or sell allowances.
- Firms that can reduce emissions at least cost will do so.

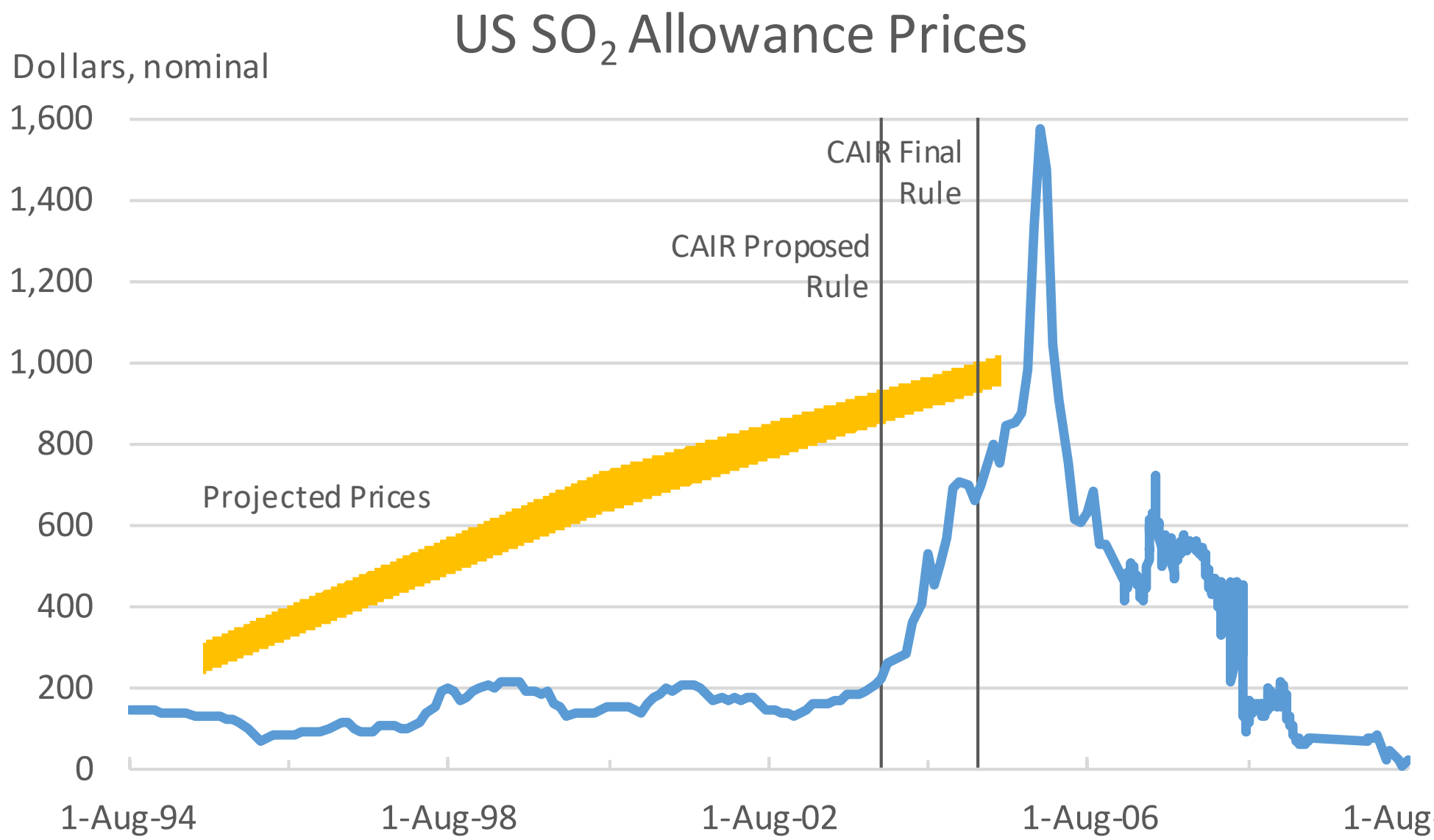



Source: EIA.

# Most jurisdictions embrace cap and trade. Why?

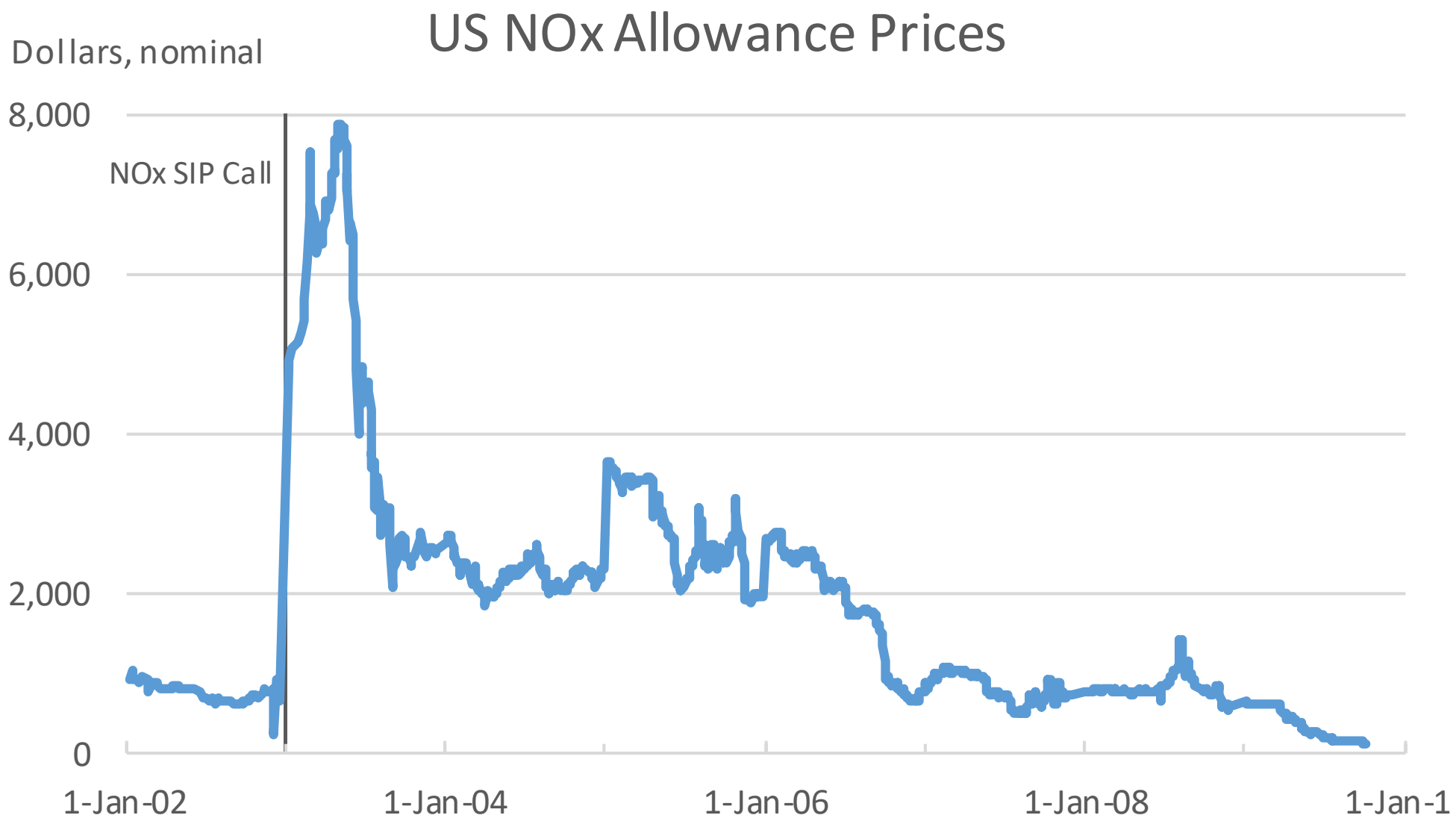
- Caps signal intermediate and long-term goals
- Use of allowance proceeds can build coalitions, and enables a lower carbon price
- Free allocation, where necessary, rather than exemptions
- Fungible allowances support longevity of program
- Opportunities for linking
- Implementation usually does not require legislation

# Markets have been successful: $SO_2$ Allowance Prices



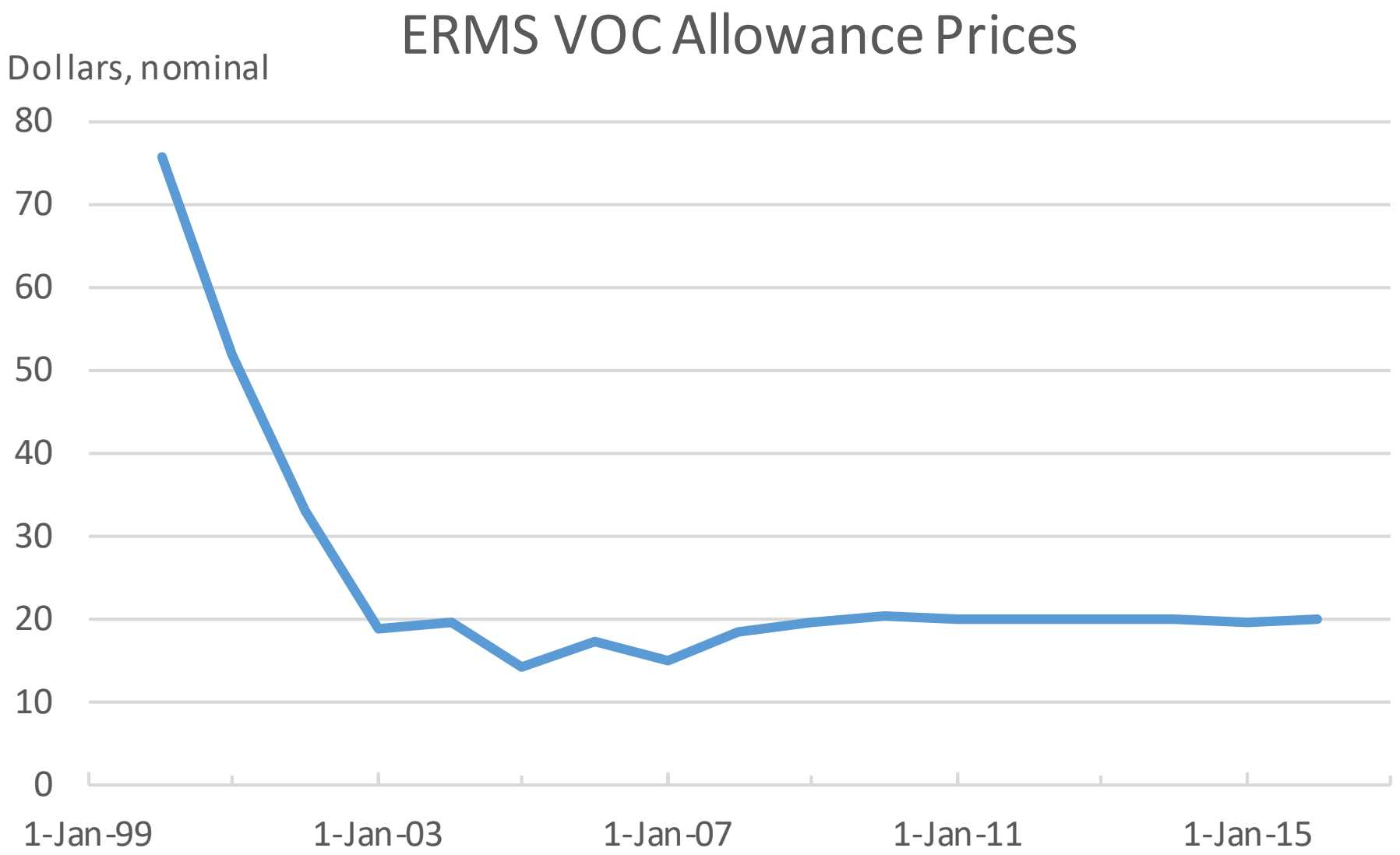

Sources: Cantor Fitzgerald; T. Huetteman.

# US NOx Allowance Prices




Source: G. Hart.

# Illinois VOC Emissions Reduction Market




Note: Auction prices are used as market prices are not available.
Source: Illinois EPA.

# Managing Costs in Trading Programs

Price Spikes are like *Rougarou* – the seldom seen mythical creature from the French Alps


**P**rice Declines are the commonly observed phenomenon.

*Why?*

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# Why the Downward Pressure on Emissions Prices?

- Over-allocation: political economy, who is in the room?
- Companion policies, serving additional concerns:
  - air quality, job creation, economic development strategies
- Sub-jurisdictional efforts, and the force of federalism
- Federal tax credits
- Program related spending
- ….Incentives work to find ways to lower costs!

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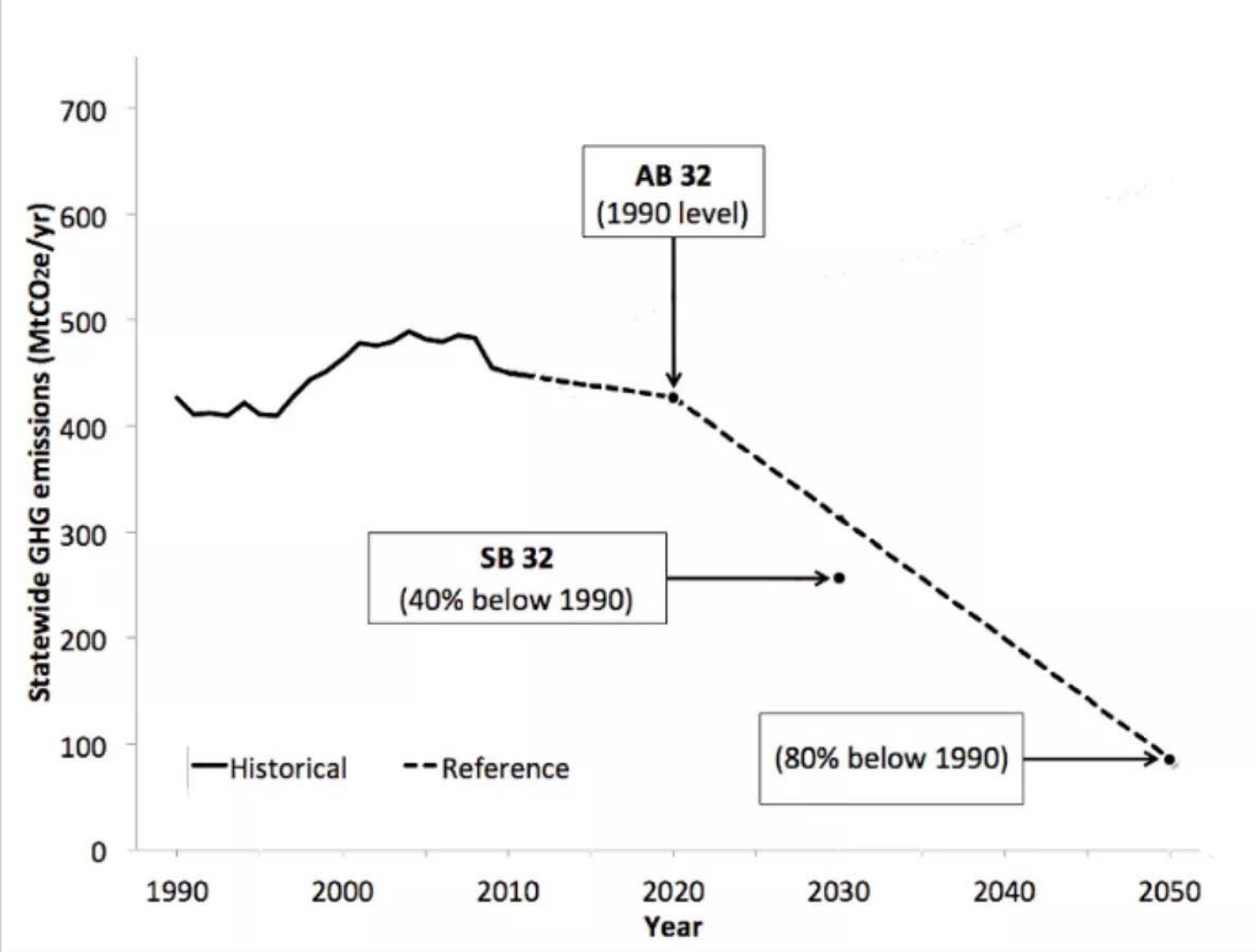
# Case Study: California



# Companion Policies in California


- Mobile source standards
- Low Carbon Fuel Standard
- Rebates and tax breaks for electric vehicles
- Air Resources Board targets co-benefits
- Renewable electricity goals:
  60% (2030), 100% clean (2045)
- Energy efficiency: double efficiency from buildings, appliances, and industrial equipment by 2030
- Many other measures

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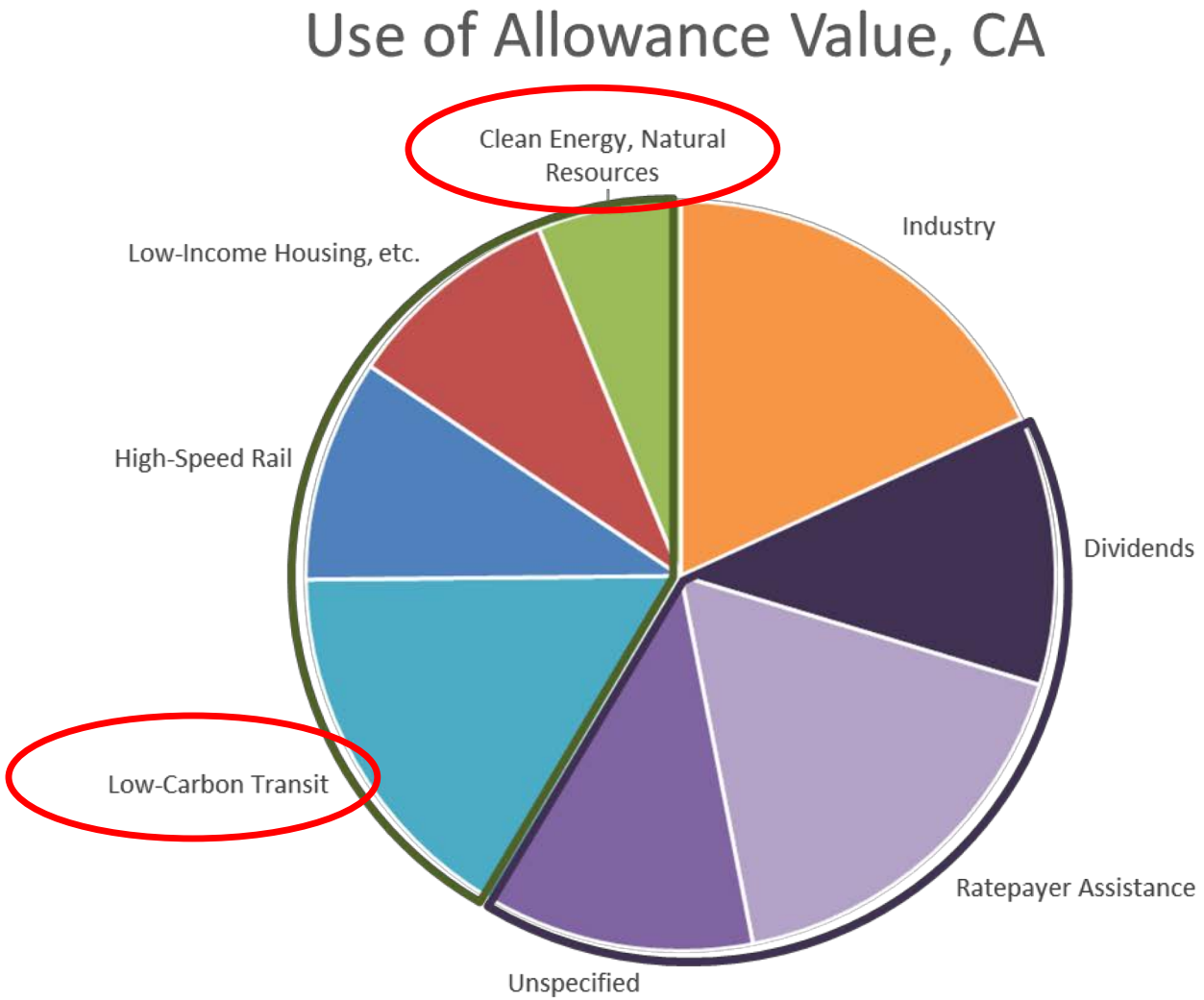
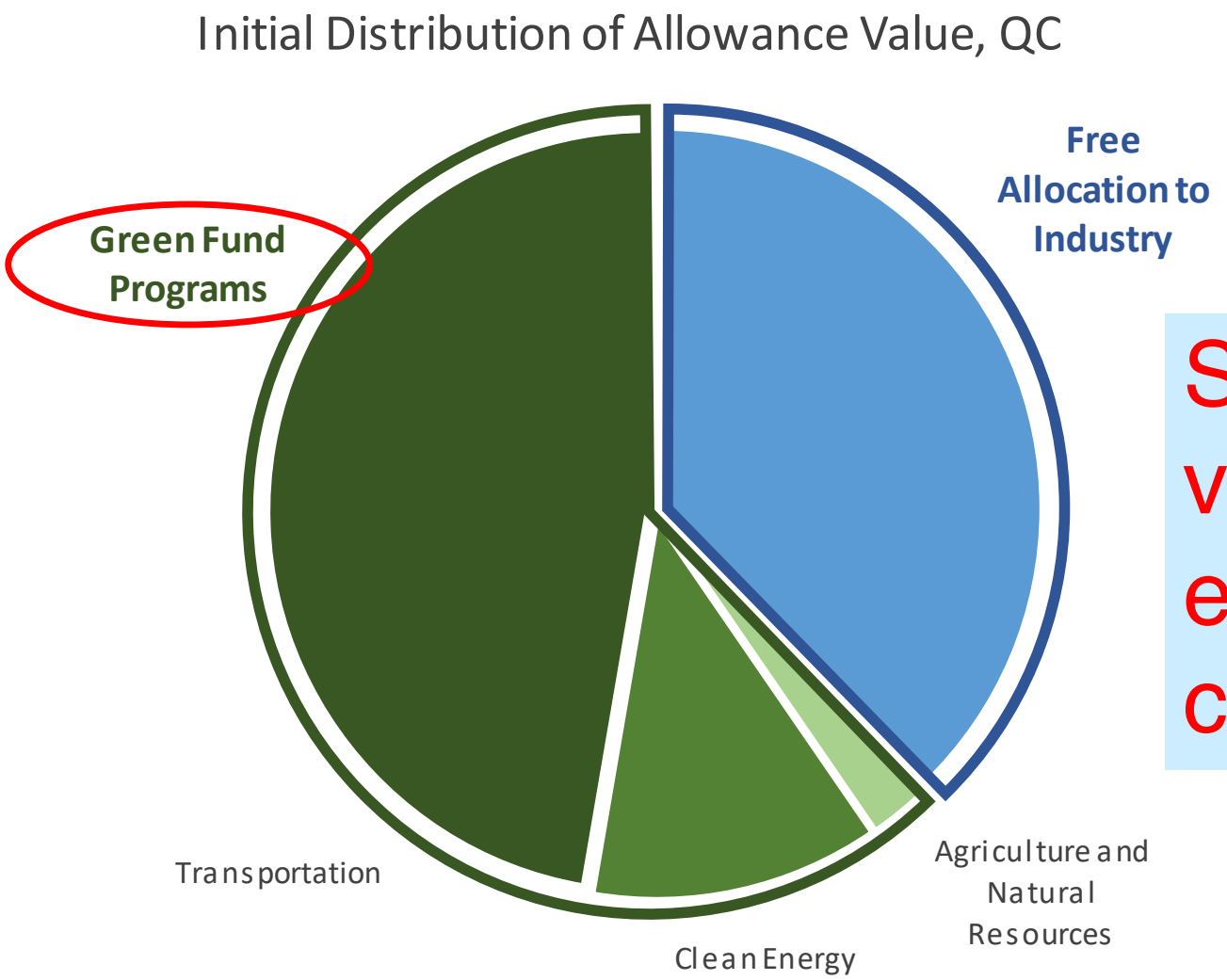
# Using Allowance Value to Advance Policy




*Allowances held in reserve (not issued) were not included in this figure. The green border indicates allowances held by the state of California while the purple border indicates allowances held by electricity suppliers

Spending allowance value to reduce emissions already covered by the cap

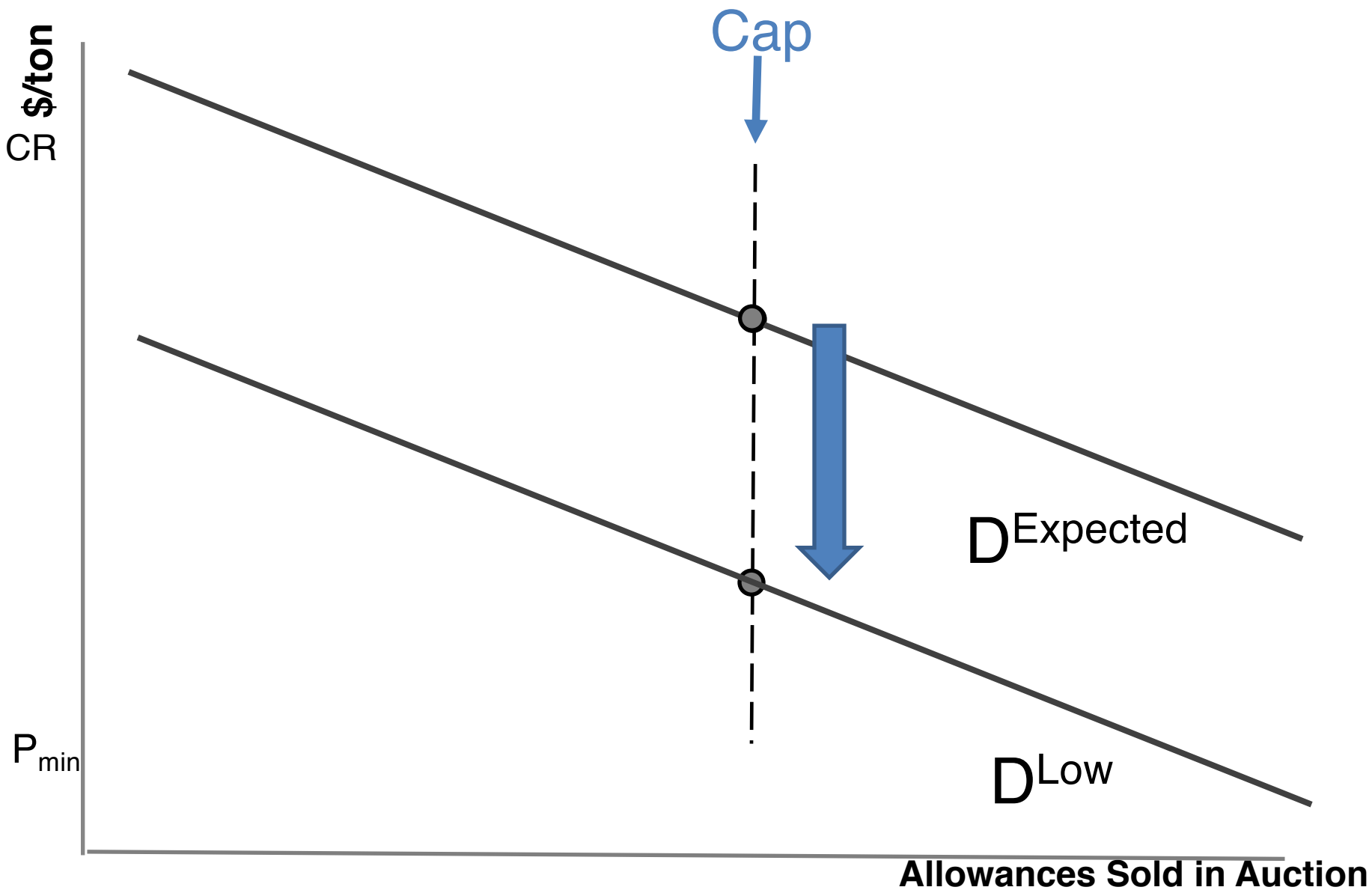
# Quebec Distribution of Allowance Value




Spending allowance value to reduce emissions already covered by the cap

*This figure shows distribution of allowance value for 2013-2017.
Source: Quebec MDDELCC

# If No Price Floor Then Prices Change; Emissions Do Not

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# Shouldn’t Low Prices be a Good Thing?!

- Falling prices erode the payoff to early actors and the price signal for further investments
- Falling prices undermine market confidence, inviting further companion policies
  **=>** *a vicious cycle?*


➢A fixed supply of allowances creates a *waterbed* effect

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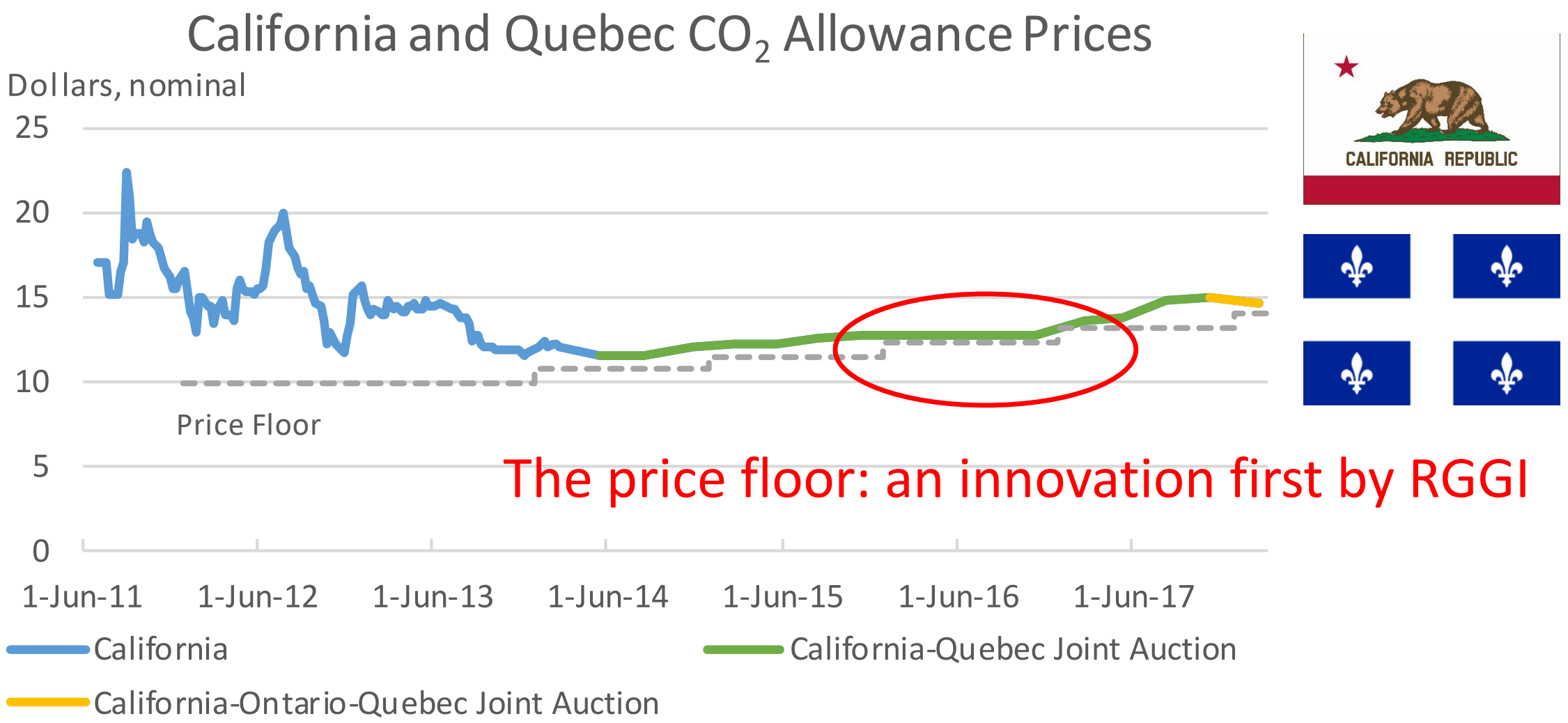
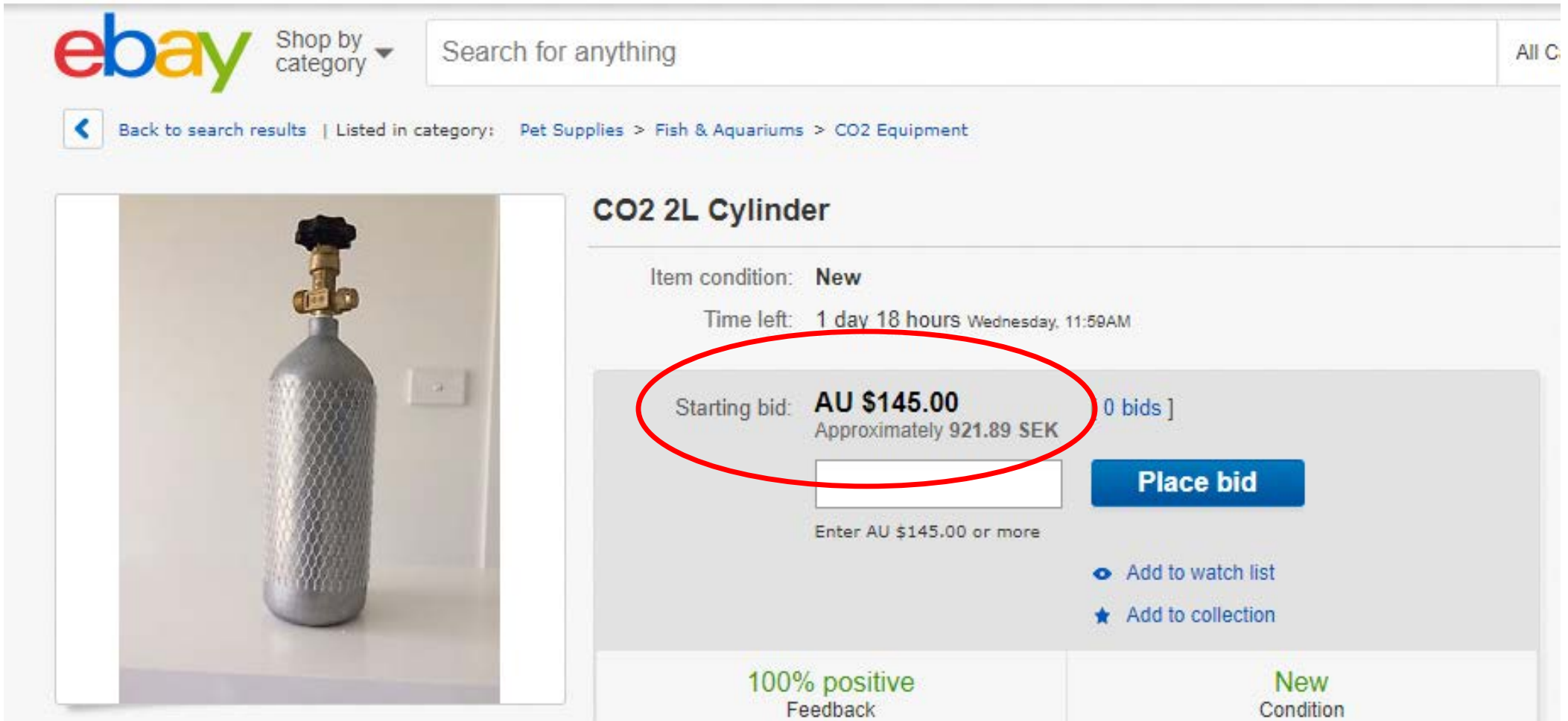
# California and Quebec Allowance Prices




The price floor: an innovation first by RGGI

Note: Auction prices are used where market prices are not available.
Sources: Thomson Reuters; California ARB; Quebec MDDELCC.

# Price floors are auction “reserve prices”




- Most auctions have them!

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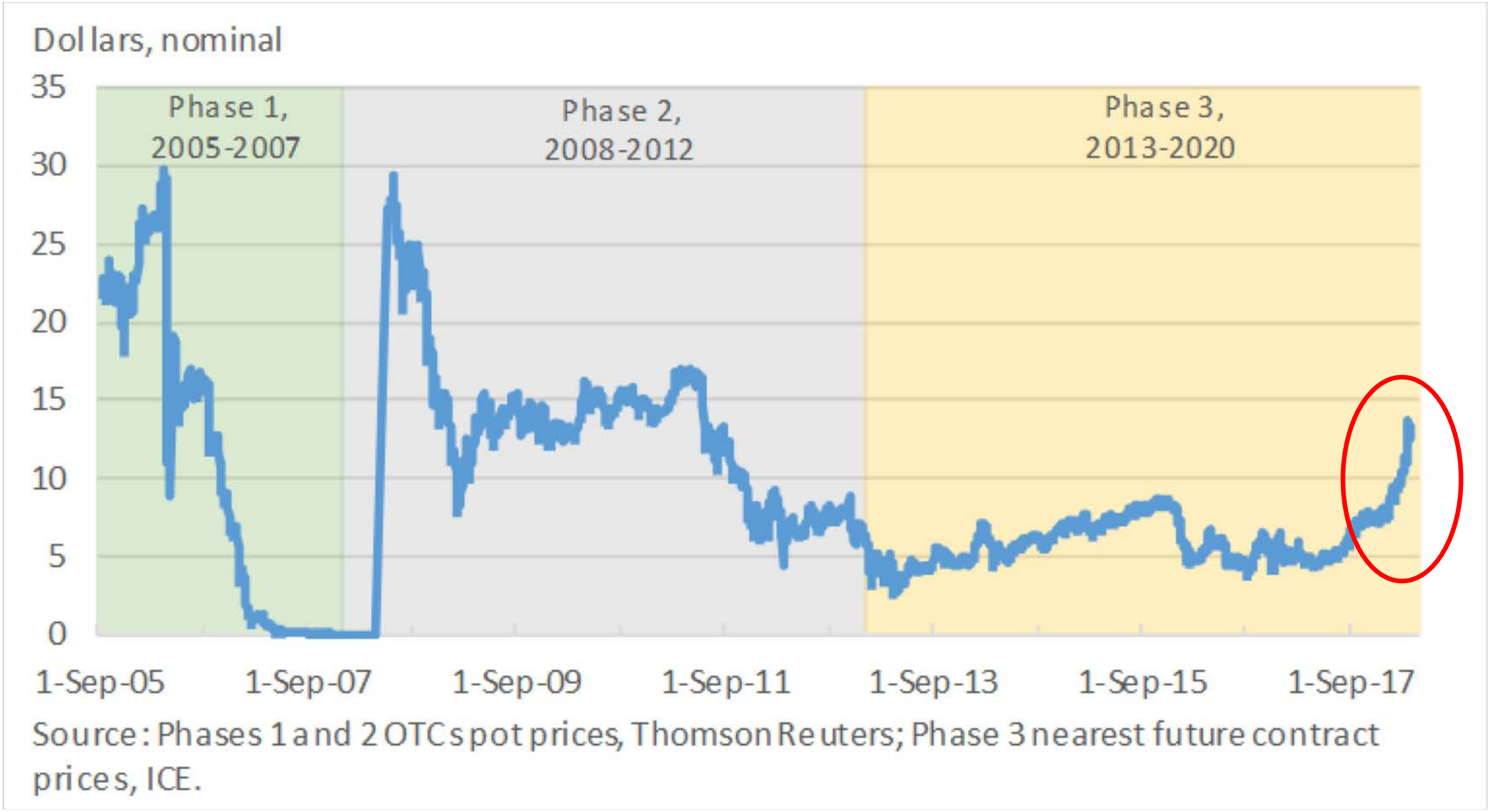
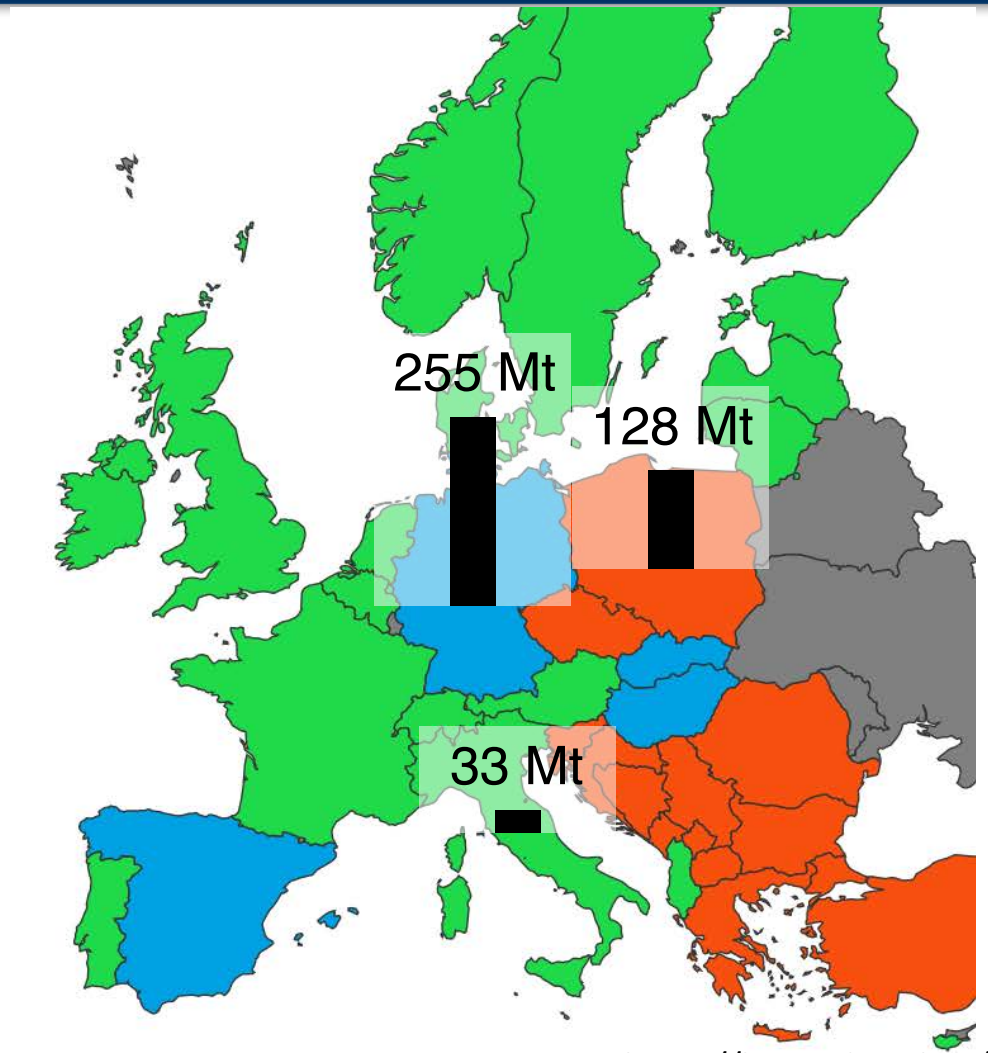
# European Experience



# The Coal Phase-Out

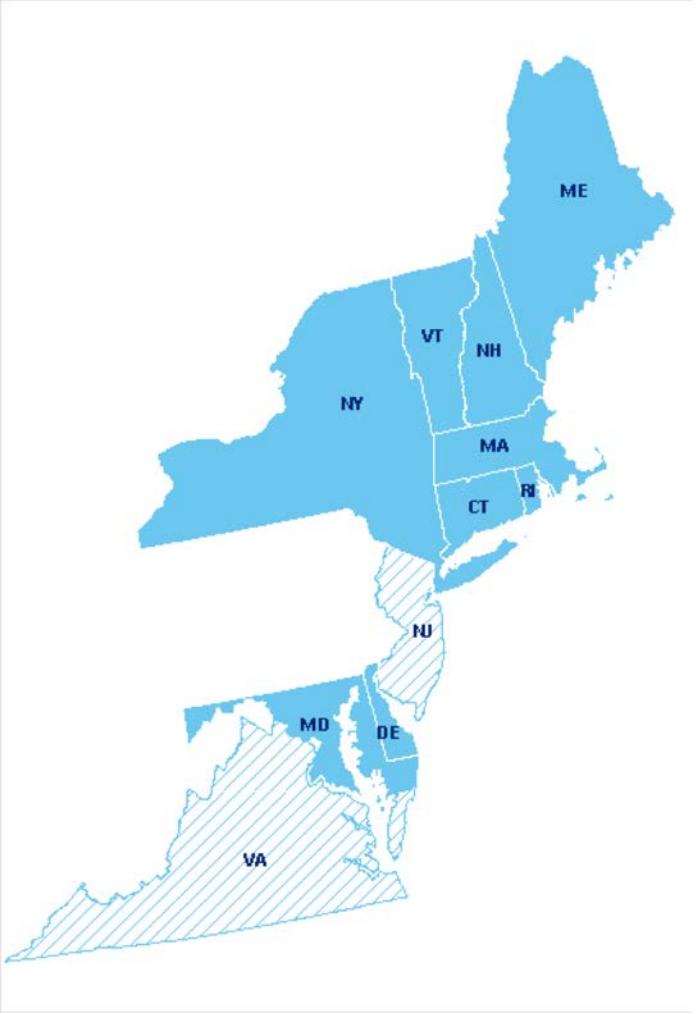
## What is the role for member state policies?




Source: https://beyond-coal.eu/

# The Regional Greenhouse Gas Initiative (RGGI)

- Began in 2009, introducing an auction with price floor
- Applies to power sector $CO_2$ emissions
- Includes Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont
- Virginia and New Jersey to join in 2020
- Cap going forward falls 3% per year



# State Level Policies under RGGI Cap

- New York: Clean Energy Standard requires 50% of electricity from wind and solar by 2030
- Maryland: 40% reduction in GHG emissions by 2030
- Massachusetts: Kane decision, fossil free electricity by 2035 and economy-wide by 2050?
- Virginia: $850 million on efficiency; achieve 5 GW renewables
- Rhode Island, etc.

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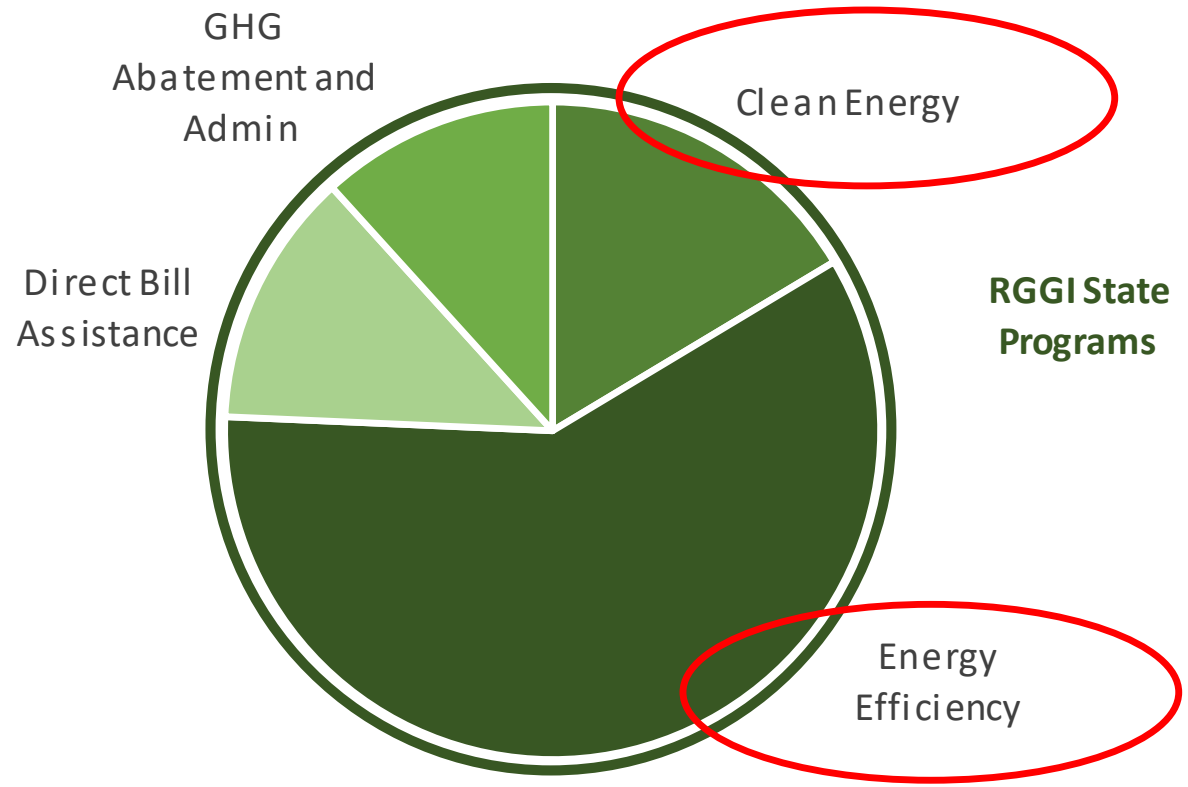
# Using Allowance Value in RGGI

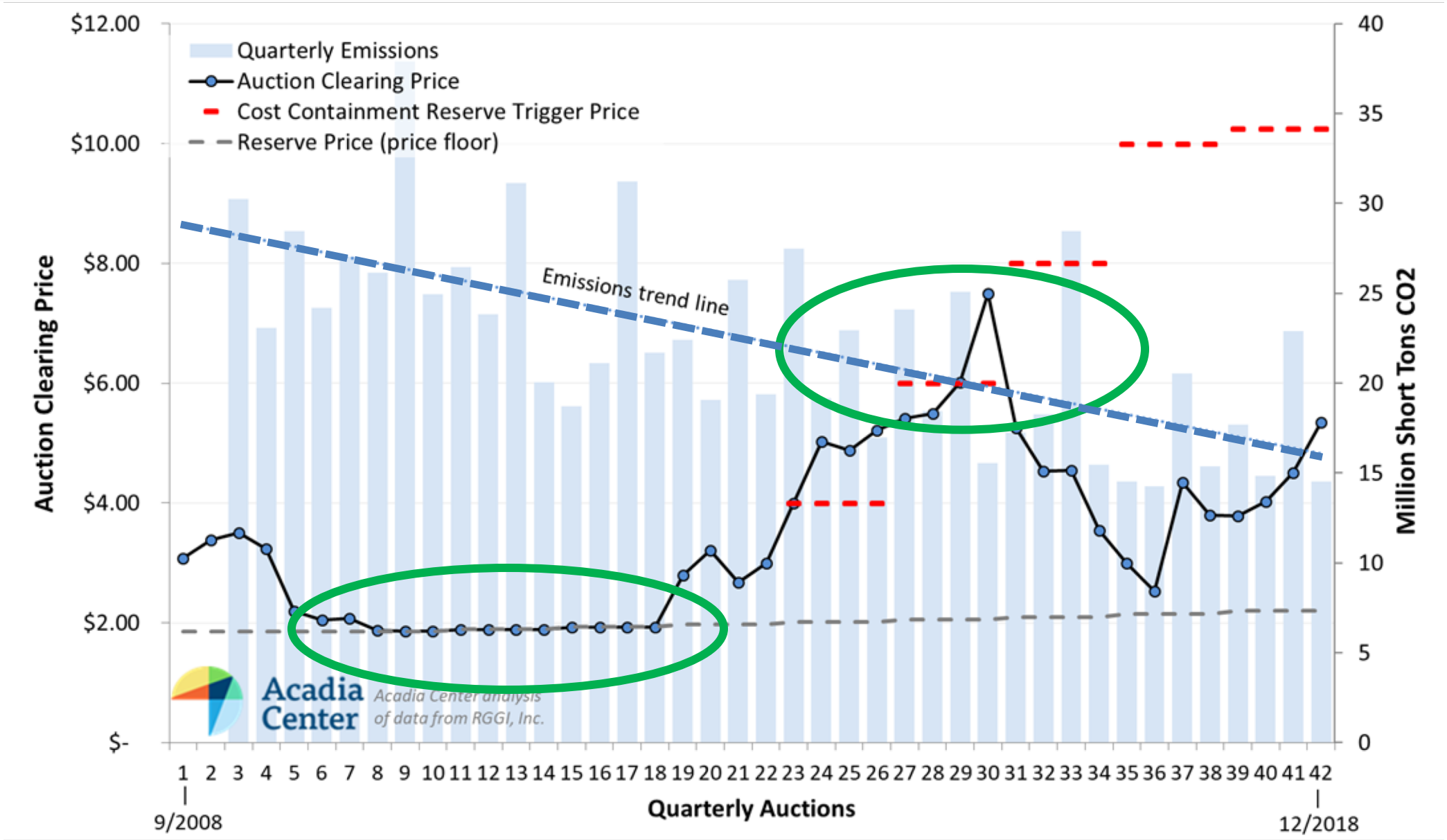
## Initial Distribution of Allowance Value, RGGI




Spending allowance value to reduce emissions already covered by the cap

*This figure shows distribution of allowances for 2012-2014. State set-aside allowances and allowances unsold at auction are not included.
Source: Hibbard, et al., 2015

# RGGI's Price Floor Was Crucial

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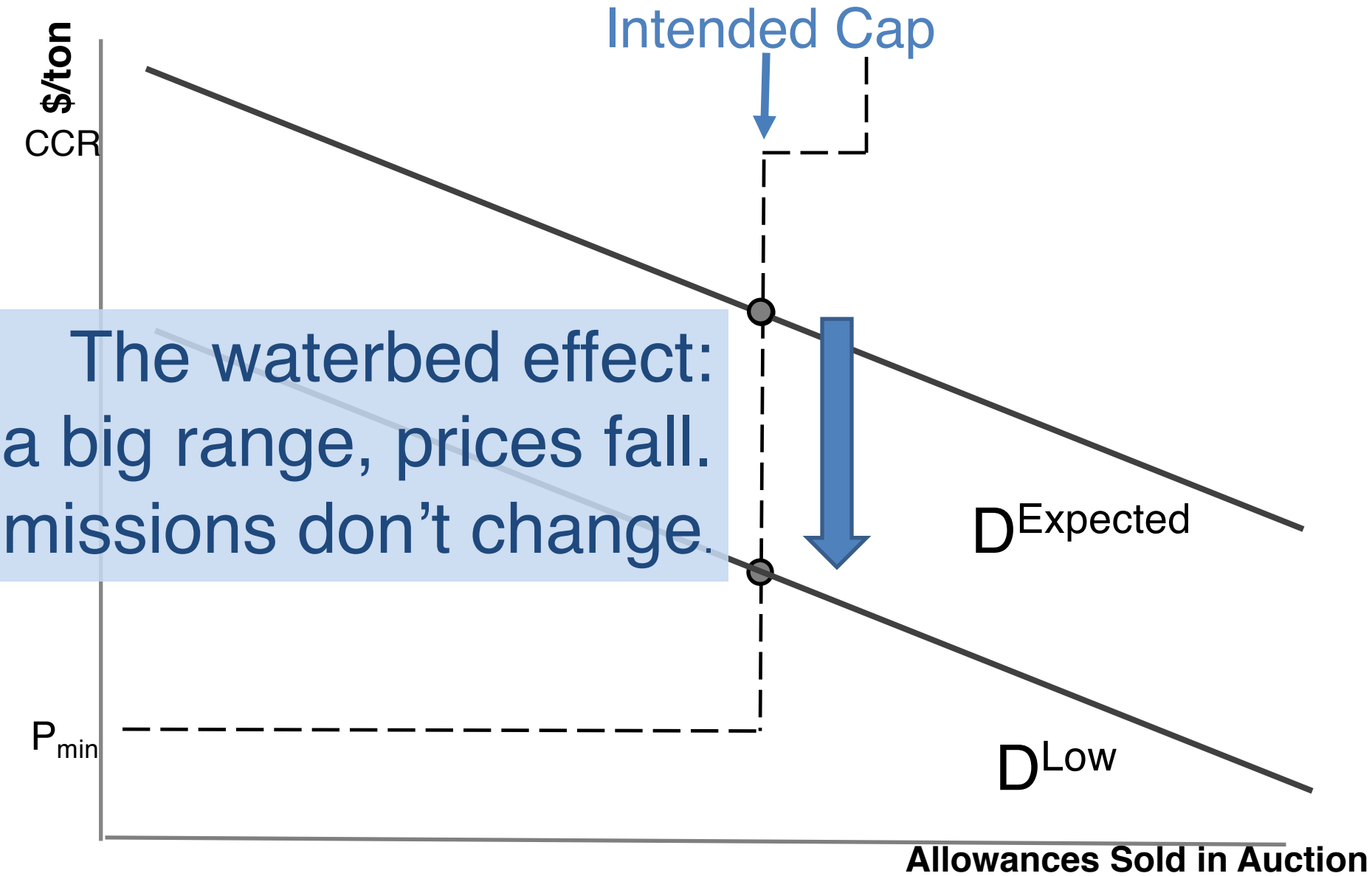
# Effect of State Polices & Secular Trends in RGGI




The waterbed effect:
Over a big range, prices fall.
Regional emissions don't change.

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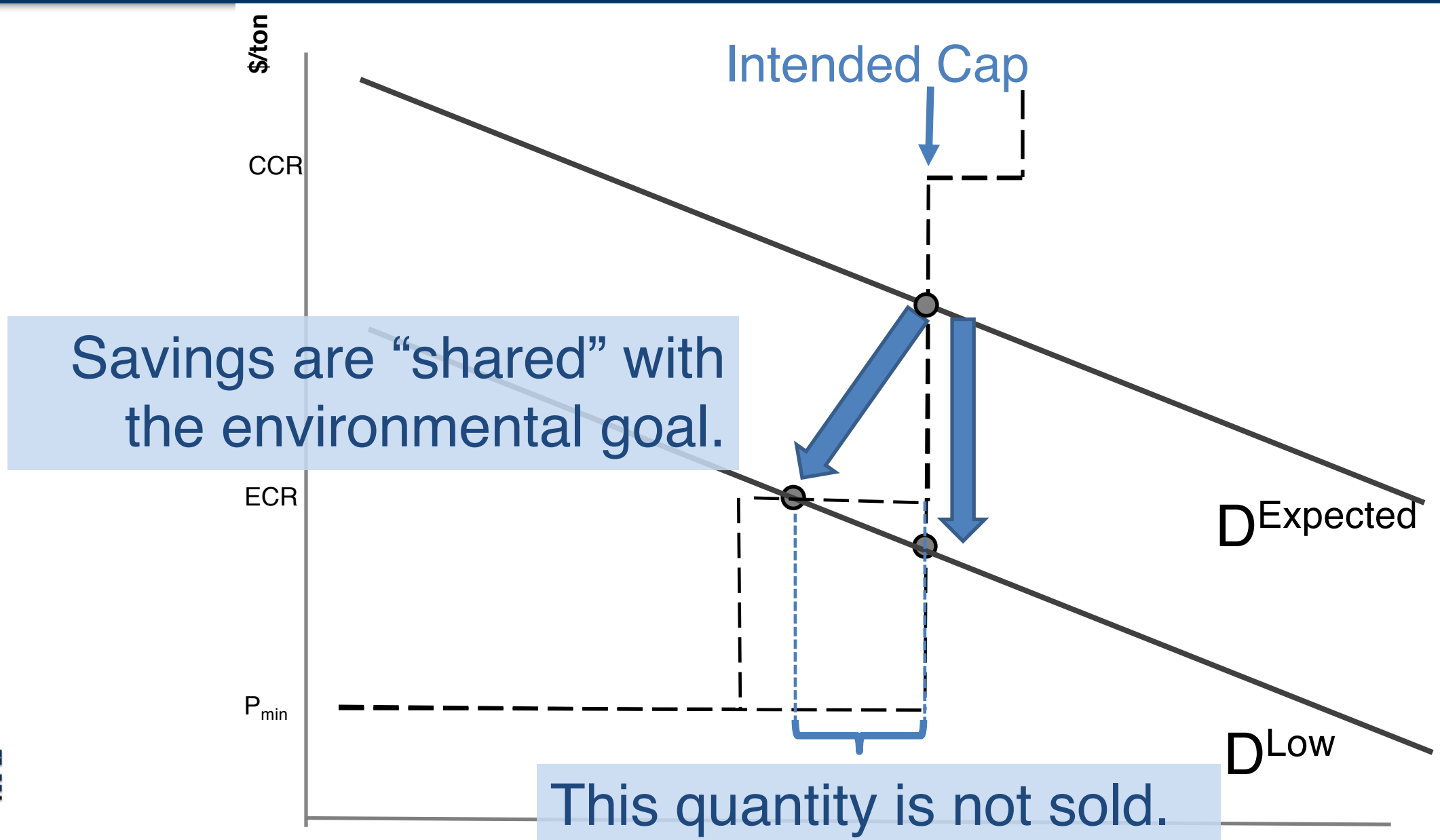
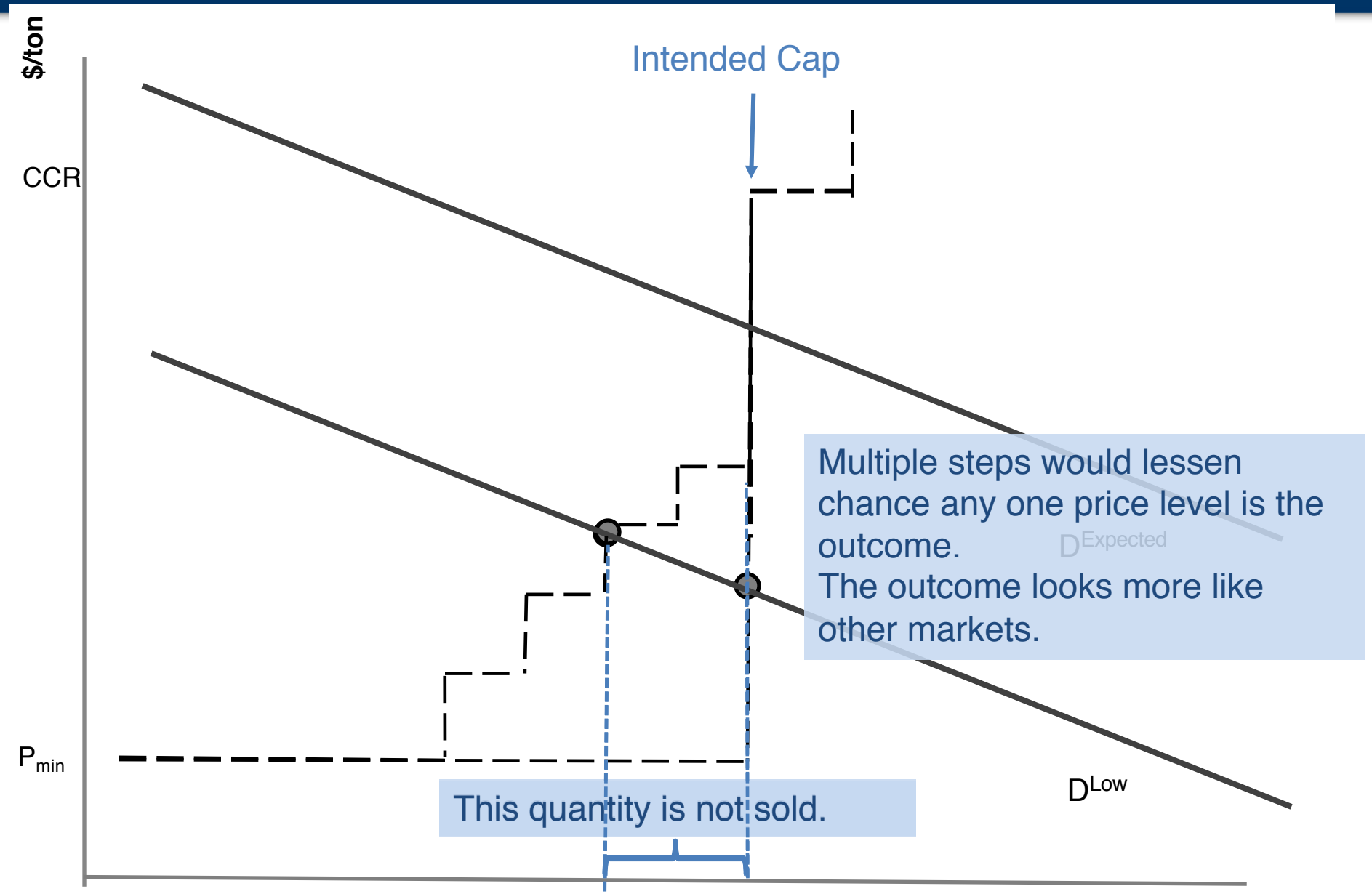
# RGGI's new ECR innovation: an "adaptive cap"



# A Supply Schedule with the ECR



# RGGI's Decision in 2016 Review (2017)

- Cap reduced by 30% from 2021-2030
- Maintains auction reserve price rising at 2.5%/year
- Cost containment reserve: 10% of cap, $13 in 2021 rising at 7%/year
- (Single step) Emissions Containment Reserve (!)
  - 10% of emissions budgets, $6 in 2021 rising at 7% per year
  - Introduces a *soft* price "step" above the *hard* price floor.
  - It yields a supply schedule analogous to commodity markets
  - Empowers voluntary actions

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# Analogy: *Adding Quantity Assurance to a Carbon Tax*

- Taxes could be revised to hit quantity targets
- Automatic adjustments to taxes based on recent quantities suggested in several recent papers

➢ Policies proposals embody this approach

  – Swiss Carbon Tax (adjust if cumulative emissions exceed target)

  – Whitehouse Schatz Bill (S1548)

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# Takeaway Idea: Innovation in Carbon Markets

- Carbon pricing is imperative, but not sufficient
- Carbon pricing is enabled by companion policies
- Emissions targets are the consequence of scientifically informed regulatory negotiation
- Out-of-market (voluntary) reductions are essential to achieving long-run goals
- RGGI's innovation moves toward an enduring model

# Thank you.

burtraw@rff.org

RESOURCES FOR THE FUTURE

# Insights from the Literature

- Policy Sequencing
  - Pahle, Burtraw, Edenhofer et al. (2018); Meckling, Sterner, Wagner (2017); Meckling et al. (2015); Beh et al. (2015); Asturias et al. (2016); North (1990); Arthur (1994).
- Optimal policy design with uncertainty
  - Relative slopes matter for instrument choice: Weitzman (1976)
  - Combine Ps and Qs: Roberts and Spence (1976), Pizer (2002)
  - Real world proposals: Aldy and Pizer (2009), Murray et al (2009)
- Other features to manage cost volatility
  - Banking: Cronshaw and Kruse (1996), Rubin (1996), Kling and Rubin (1997), Fell et al. (2012a), Pizer and Prest (2016), Weitzman (2018)
  - Offsets: Fell et al. (2012b), and others
  - Linking: Burtraw et al. (2013), Jaffee et al. (2009), Bodansky et al. (2015), Flachsland et al. (2009)

❖ Two sided cost containment

- Investment incentives: Burtraw, Palmer, Kahn (2010), Grull and Taschini (2011), Salant, Shobe, Uler (2018)
- Two-sided reserves: Fell et al. (2012c).

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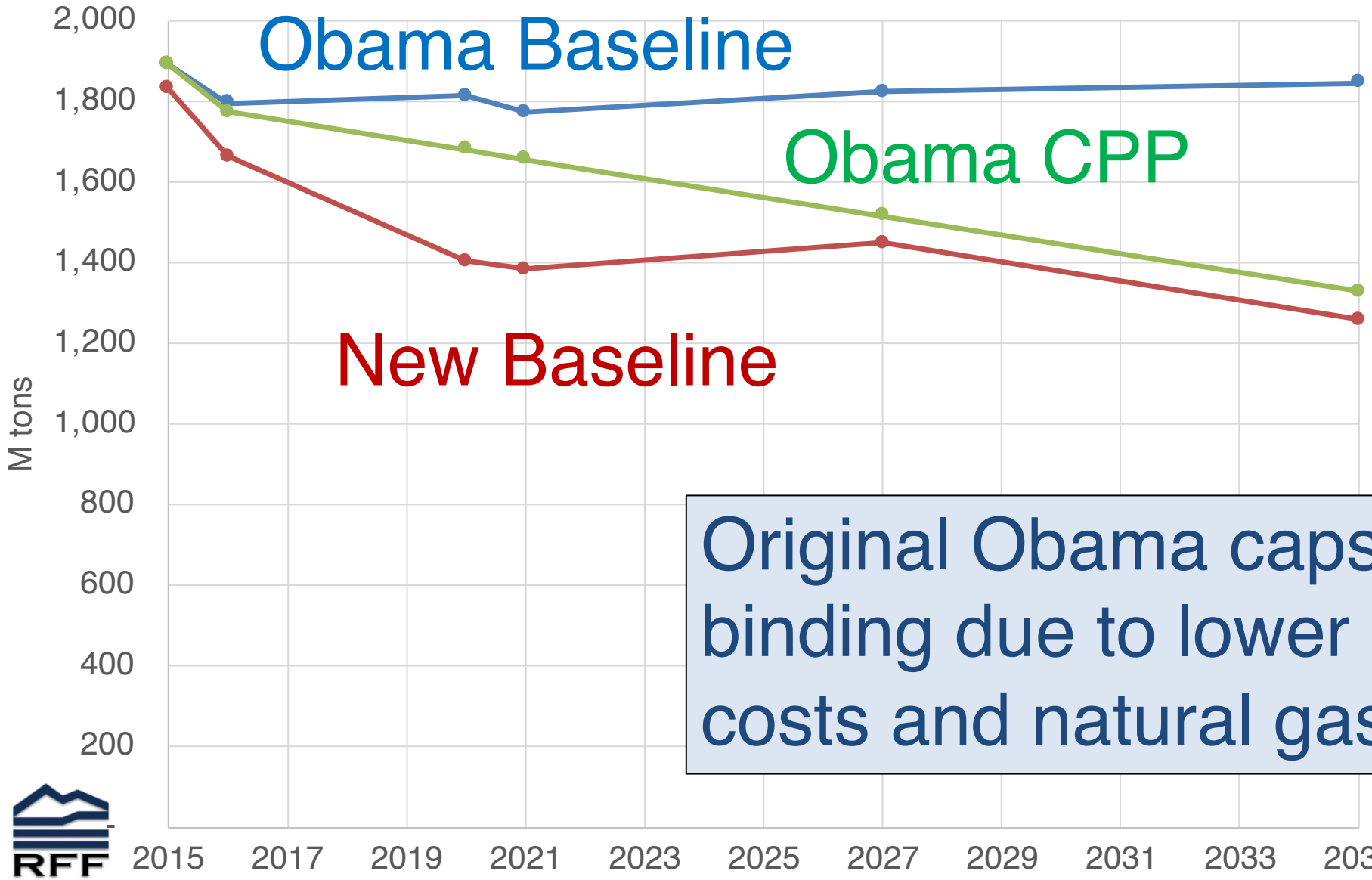
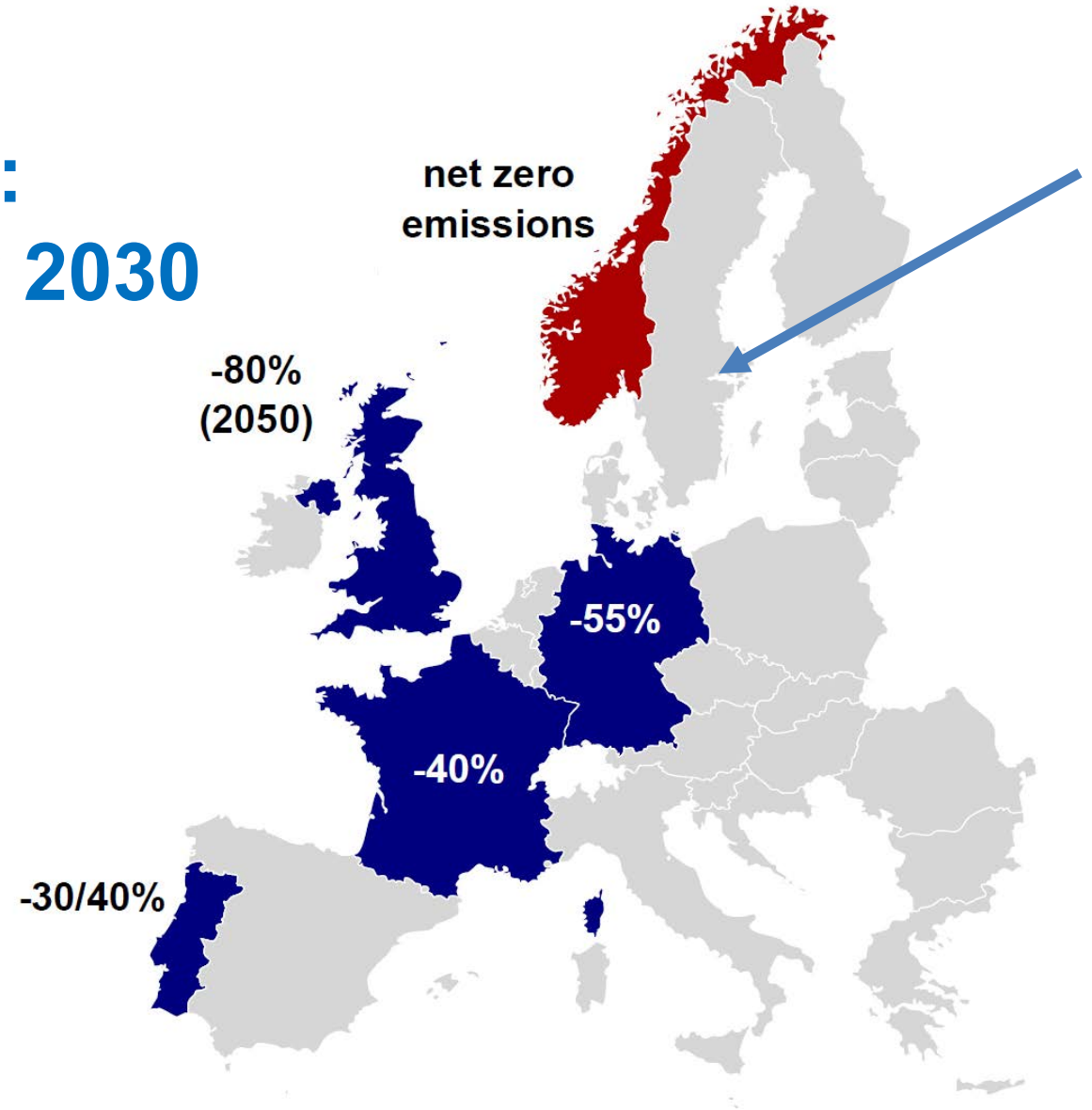
# Regulatory Costs Also Tend to Fall




Original Obama caps are not binding due to lower renewables costs and natural gas prices

# Post 2020 climate targets in EU member states

**EU goal:**
**-40% by 2030**




Add Sweden:
Net zero by
2045

*Source:*
*National factsheets on the State of the Energy Union / Climatechangenews.com*

*Missing:*
Sweden: net zero (2045)

M. Pahle, Potsdam Climate Institute

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# California Scoping Plan Policy Mix