



# Preview of Analysis of an Emissions Containment Reserve (ECR)

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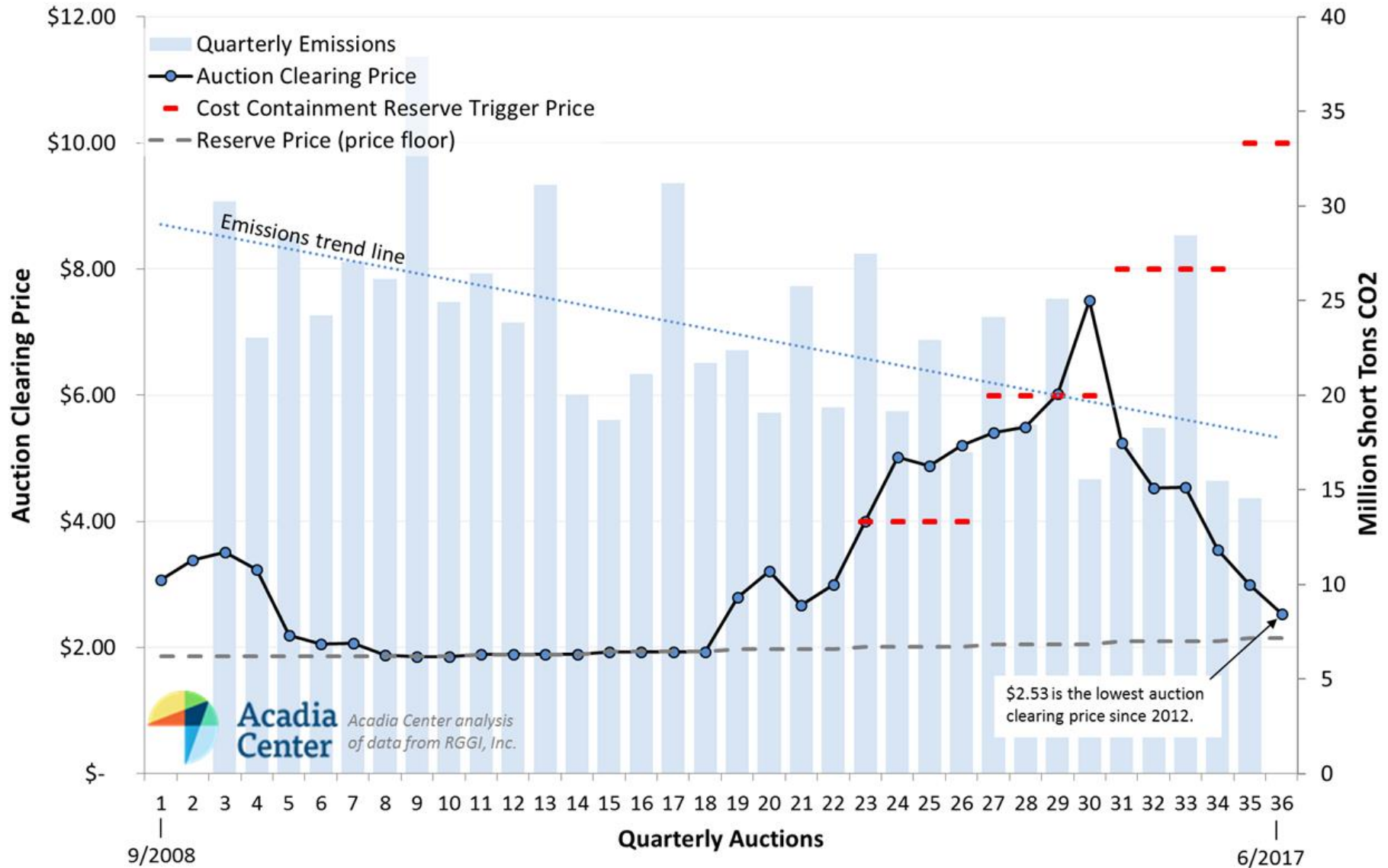
*This webinar is a joint effort by the Nicholas Institute for Environmental Policy Solutions at Duke University, the Georgetown Climate Center and Resources for the Future (RFF), and organized by the Collaborative for RGGI Progress*

14 June 2017



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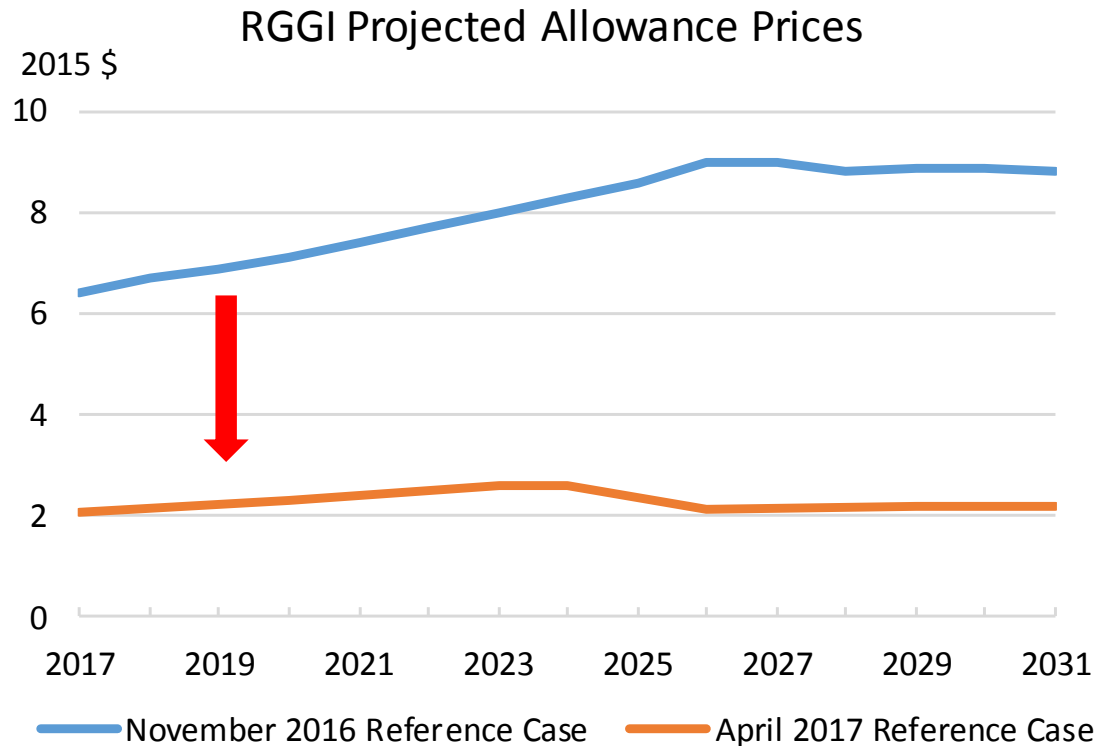
# RGGI Experience with Allowance Prices



# Why Cost and Emissions Containment?

- Prices in a market-based program are uncertain.
  - One finds volatility of natural gas prices and electricity demand.
  - Uncertain operation of existing nuclear fleet.
  - Program investments in energy efficiency reduce electricity demand.
  - Federal and state programs provide incentives for renewables.
  - There is uncertainty about future regulatory changes.
- The possibility for a slack emissions cap is real.
- Sudden or extreme outcomes affect investment.
- If cost or emissions containment measures are triggered, the program continues to function between program reviews.

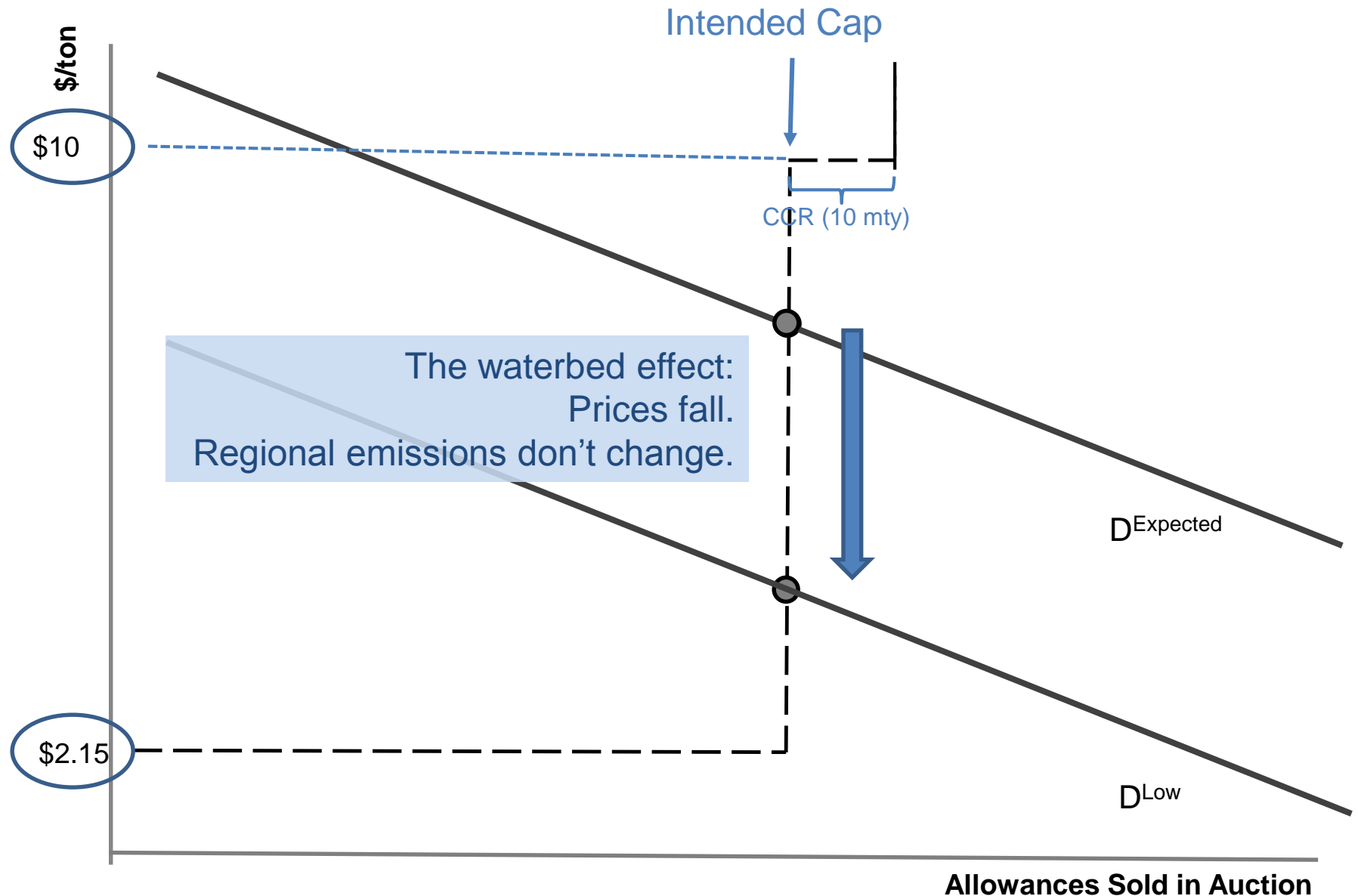
# Potentially Unanticipated Outcomes Are Illustrated in Changes in Assumptions *from November 2016 to April 2017*



Source: RGGI

- Projected emissions allowance prices are on average about \$5.75 lower in the April 2017 reference case than in the November 2016 reference case for 2020.
- A range of model inputs have been updated:
  - Natural gas price projections (from AEO 2015 to AEO 2017)
  - Regional energy demand projections
  - Projections for cost and performance of renewables and natural gas
- The April 2017 model now incorporates imports of renewables from Quebec and Ontario
- Both reference cases include the adjusted cap and the Clean Power Plan. Removing the Clean Power Plan has virtually no effect on allowance price projections.

# A Supply Schedule **without** the ECR



# What is the Emissions Containment Reserve?

- The ECR would introduce a *soft* price “step” or “steps” above the *hard* price floor.
- It yields a supply schedule analogous to commodity markets.
- If the auction price falls below a given step, a quantity (“lot”) of allowances would not enter the market.

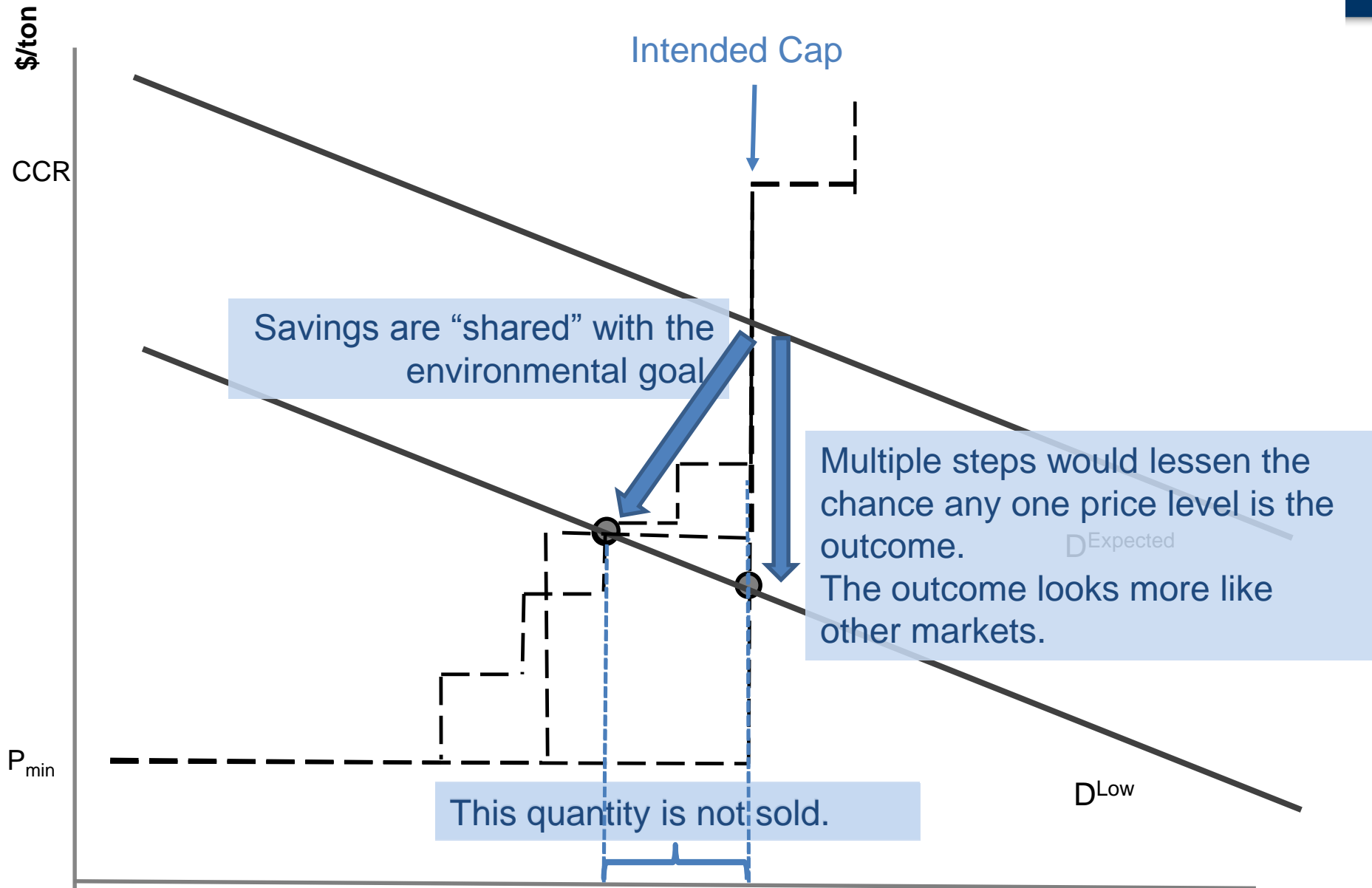
# Why would RGGI consider this new feature?

- Some states and constituencies (firms, schools, cities) are taking additional actions.
- Under a regional cap this leads to *the waterbed effect*.
- Prices fall, and emissions go up somewhere else.



- Indeed, price trends are again headed down.

# A Supply Schedule **with** the ECR





# Modeling unanticipated outcomes

Our base case is comparable to ICF assumptions in [November 2016](#).

We model the [3.5% reference scenario](#) from this starting point. (Hence, our price forecasts do not substitute for the updated ICF modeling.)

Allowances not sold due to the ECR are not returned to the market.

We identify the impact of unanticipated potential outcomes:

- **Secular Outcomes**

- Low Demand Growth: electricity demand is lower nationally
- Low Natural Gas Resource/High Natural Gas Prices

- **Policy Outcomes**

- Energy Efficiency: across RGGI region \$2.5/MWh system benefit charge after 2020
- Renewables: 5% increase in 2020 and 10% increase in 2025 in state RPS programs

- **Resource Outcomes**

- Nuclear: delayed retirement
- Hydro: expanded hydro (1050 MW @ 100% capacity factor) from Quebec to New England

# High level results

Across over a dozen exploratory scenarios we find...

- Virtually no effect on electricity prices
- Change in resource mix is small and in predictable directions
- Coal use tracks allowance prices; SO<sub>2</sub> emissions fall by up to 9%
- Model results on the size of the bank are unpredictable

In scenarios where the ECR plays its most influential role (see next slide)...

- Allowance value increases by up to 20%
- Program related spending increases proportionately
- Incremental leakage from ECR remains around 30%

Whenever the ECR is in effect...

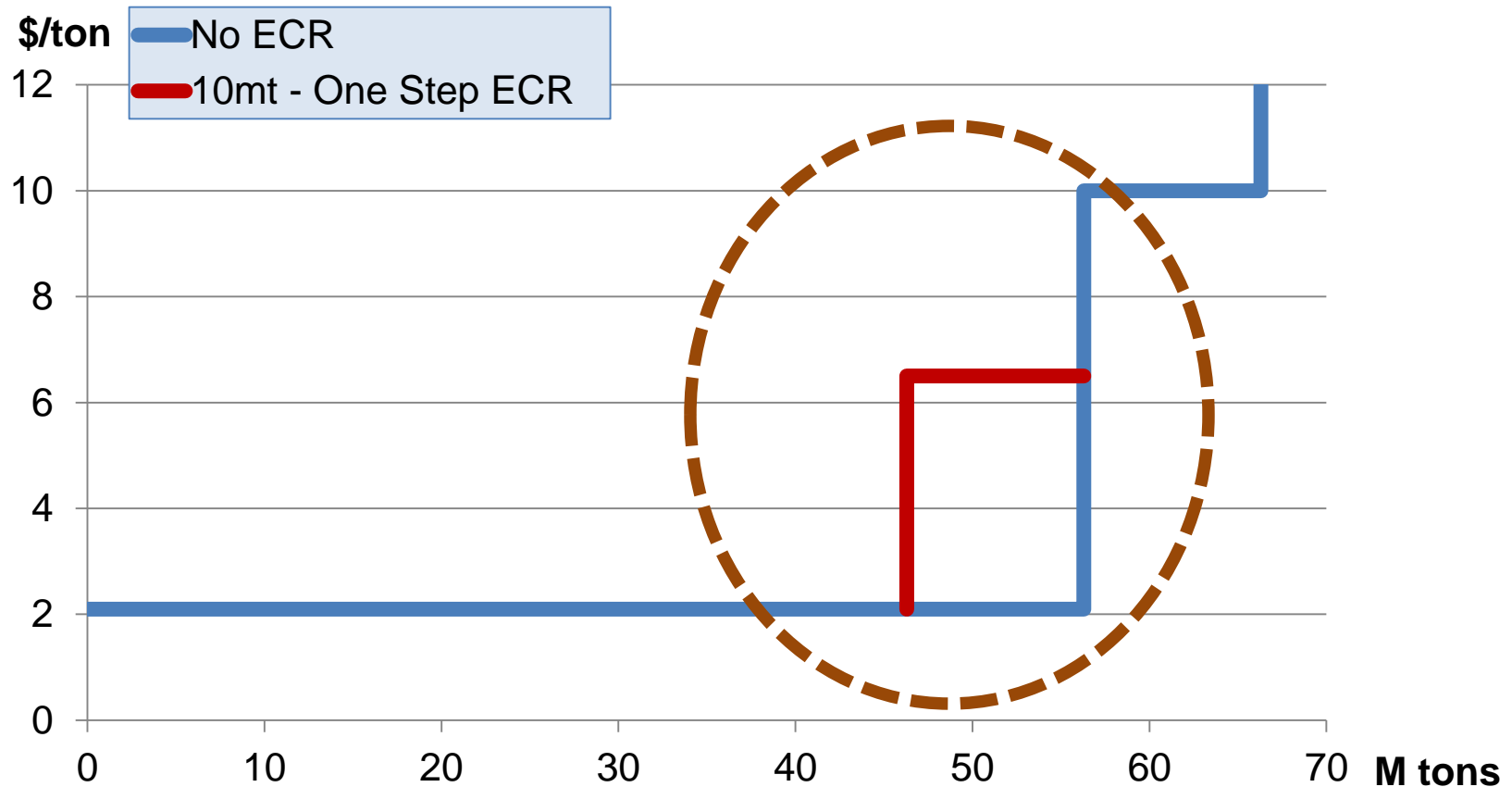
- It allows advantageous changes in the demand for emissions allowances to be *shared* between the economy and the environment

# Allowance price impacts of unanticipated outcomes

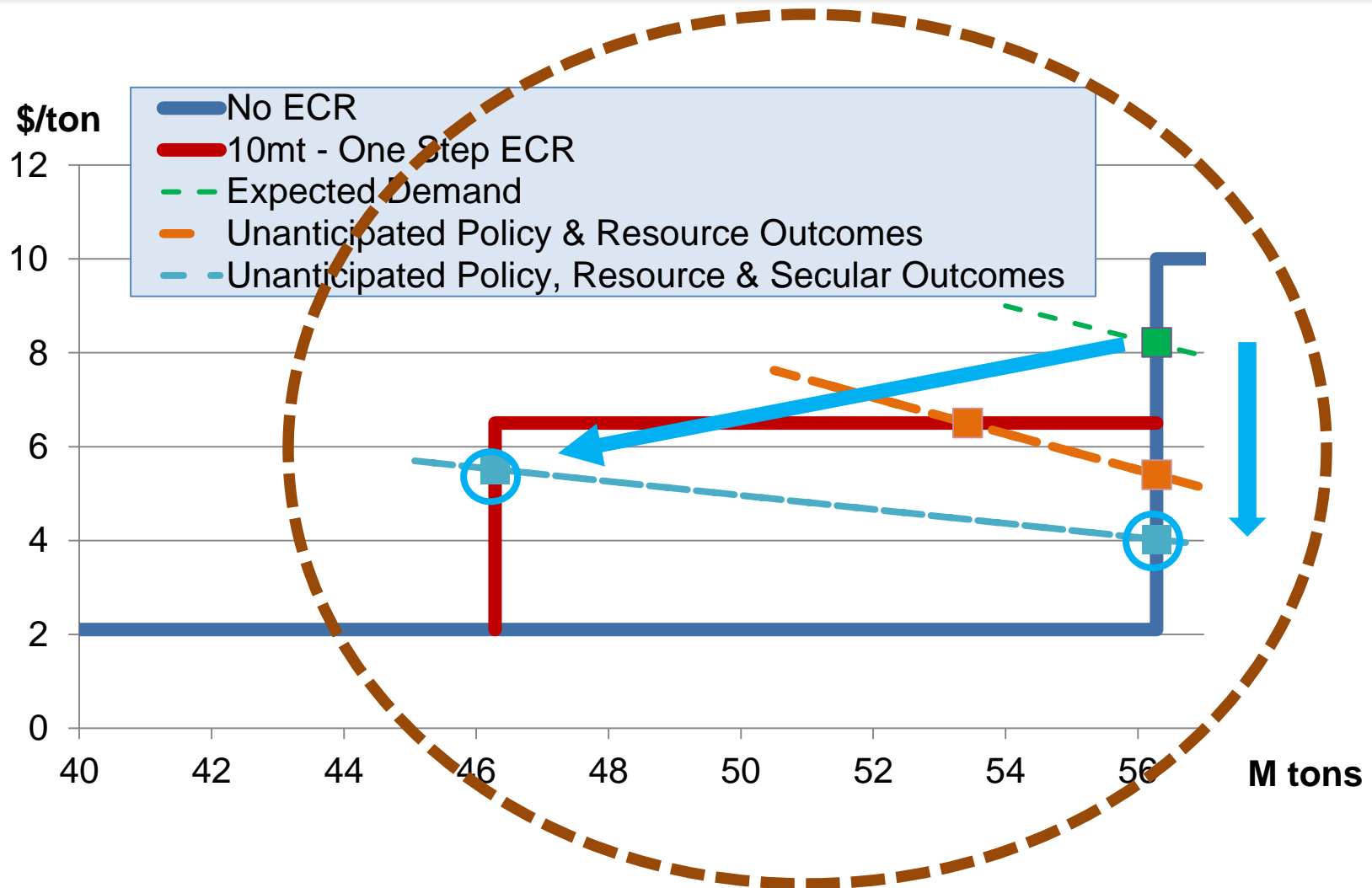
Allowance prices [\$ / ton] with No ECR in 2020 under various uncertainties

Ref Case	Low Demand	High NG Prices	More EE	Expanded RPS	Hydro from Quebec	Delay Nuke Retirement
8.2	8.0	8.6	7.4	7.5	7.7	7.0
Uncertainties modeled as packages						
Secular	7.4					
Policy			7.0			
Resource					7.0	
Sec+Pol	5.2					
Sec+Res	5.2				5.2	
Pol+Res			5.5			
All	4.0					

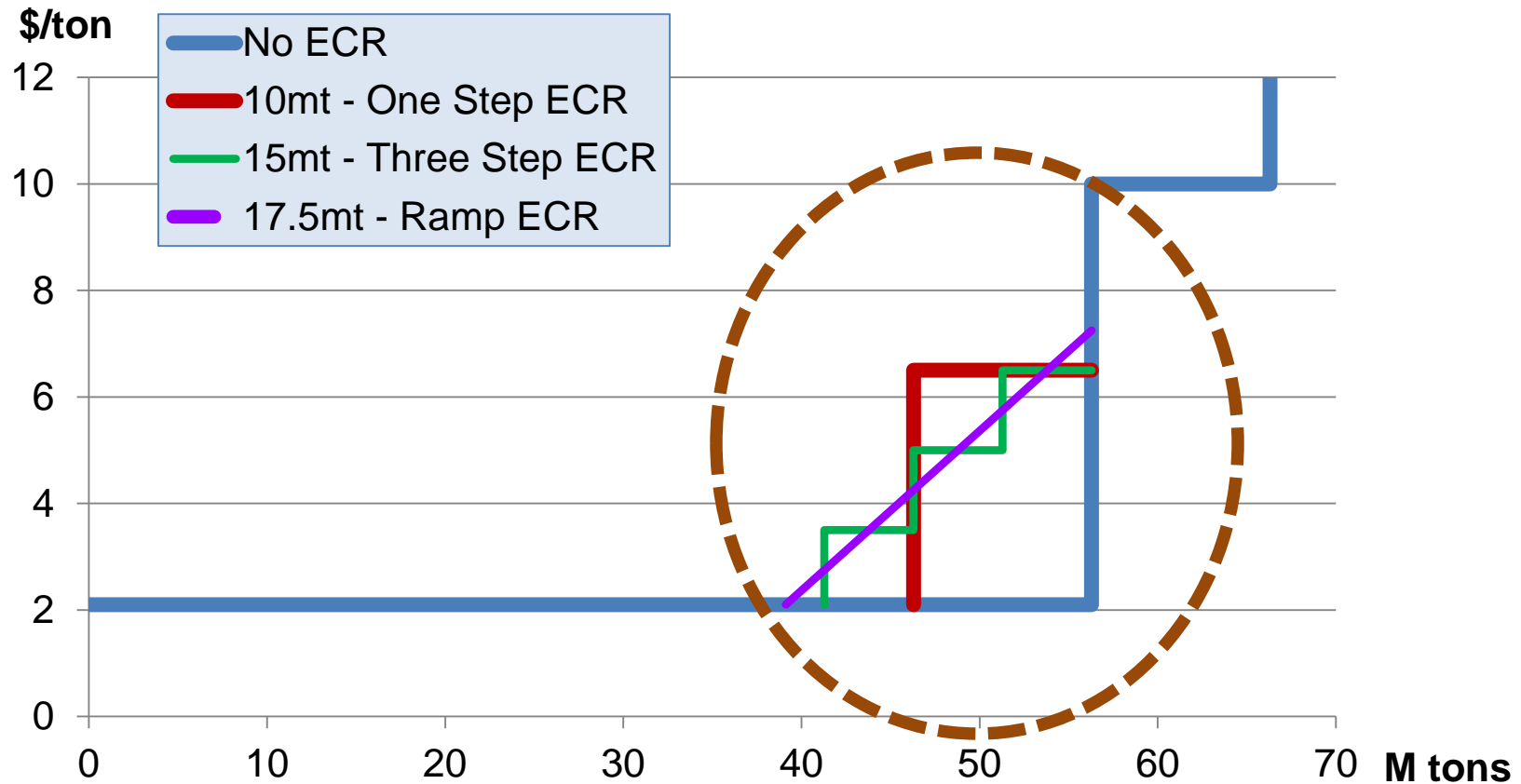
# Simulation modeling in RGGI of a 10 million ton, one step ECR at \$6.50 in 2020



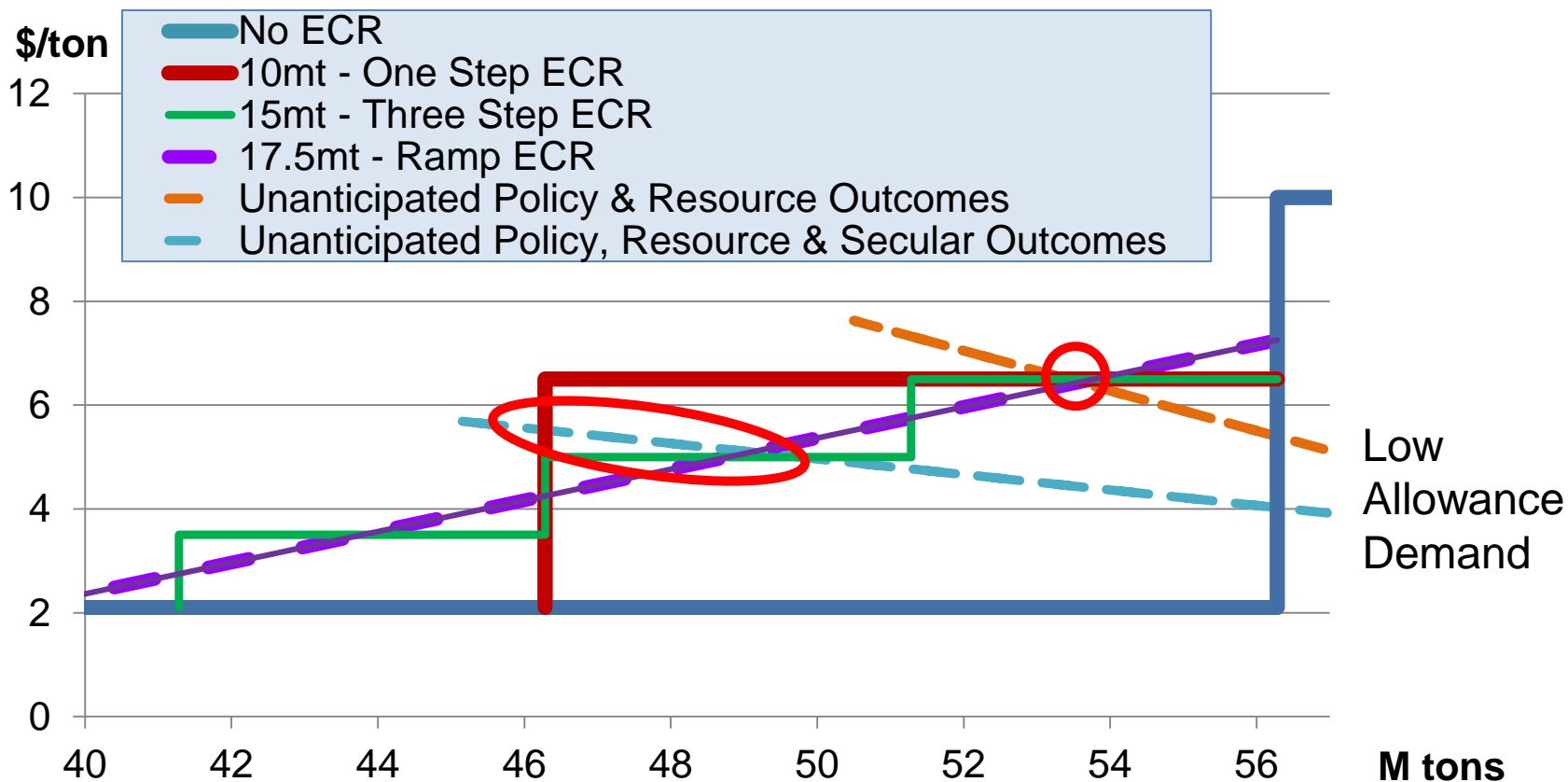
# Close up look: the ECR “sharing” outcome in 2020



# Three different approaches to an Emissions Containment Reserve



# Close up look: the ECR “sharing” outcome in 2020



# Implications

- ❑ An ECR does not prevent prices from dropping below the ECR's price step(s).
- ❑ Additional efforts by states and constituencies in the RGGI region would be accommodated with lower emissions.
- ❑ To paraphrase state staff, the "negotiated cap balances costs and benefits of emissions reductions..."
  - "...If reductions cost significantly less than we anticipated, then we got that balance point wrong..."
  - The ECR would yield additional investments, air quality benefits, and GHG reductions at costs that are lower than were expected.



# Designing the Emissions Containment Reserve

- ❑ Program review already addresses the level of the cap including possible adjustment for the bank
  - This decision will identify the anticipated emissions quantity and allowance price combination that balances costs and benefits in the program.
- ❑ Program review also addresses the minimum auction price and what to do with unsold allowances
- ❑ We argue good program design should next consider potential unanticipated outcomes that may cause the price to deviate from expectation.
  - The ECR requires similar considerations as the Cost Containment Reserve.
    - What are the ECR price step(s) and quantity(ies)?
    - What to do with unsold allowances?

# Repeat Slide: High Level Modeling Results

Across over a dozen exploratory scenarios we find...

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Whenever the ECR is in effect...

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# It's the Long-run Supply that Counts

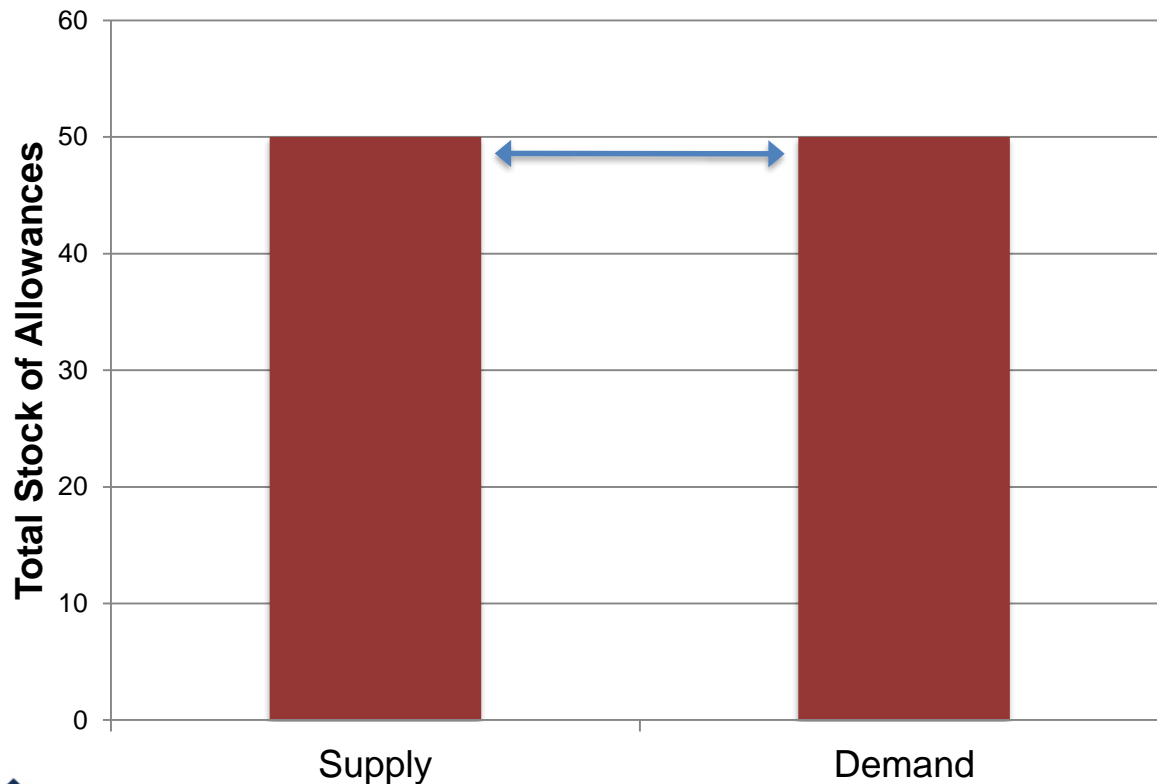
In markets for storable commodities (like allowances, for example), the current price and the plan for accumulation of a stock of the commodity depend on

- the expected, **long-run total** supply compared to
- the expected, **long-run total** demand

The objective of the ECR, is to keep these things in balance even as other policies and external events change.

# Long-run market expectations set today's price

Long-run Supply and Demand



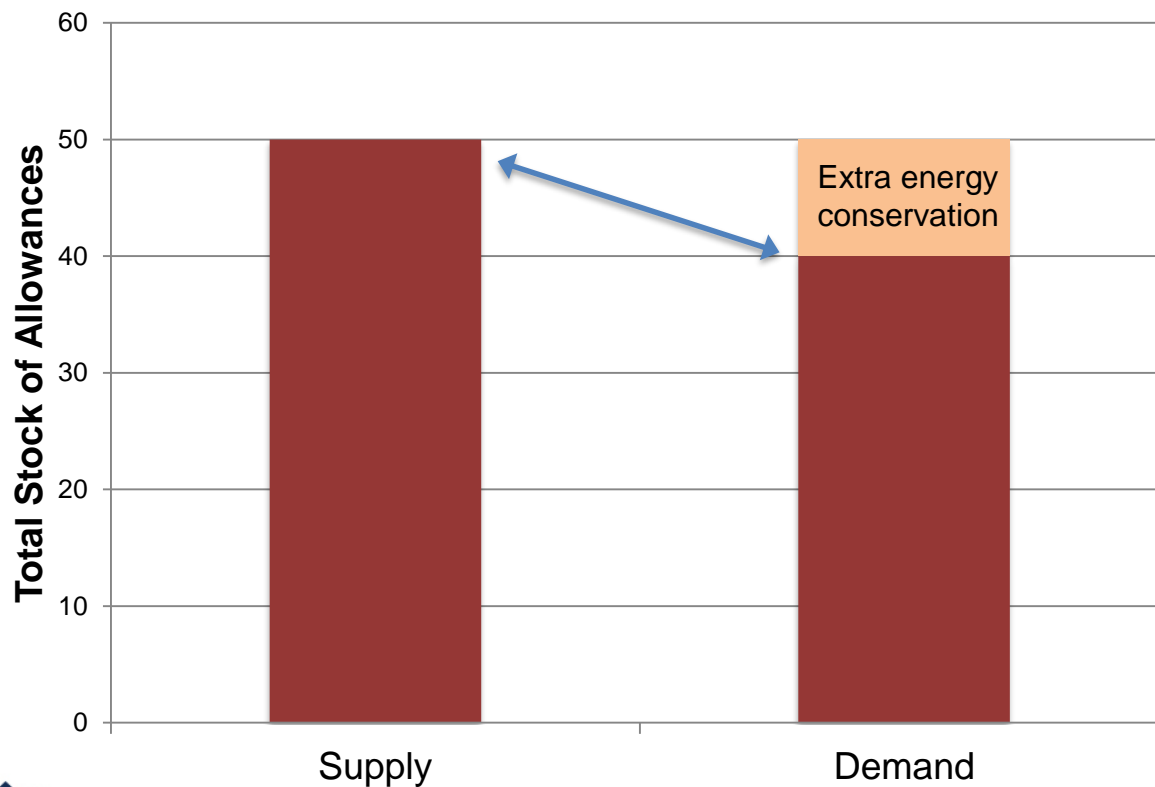
In this example:

The long-run supply equals long-run demand at a price of \$8

Bank grows and then shrinks as the cap declines

# Long-run market expectations set today's price

Long-run Supply and Demand



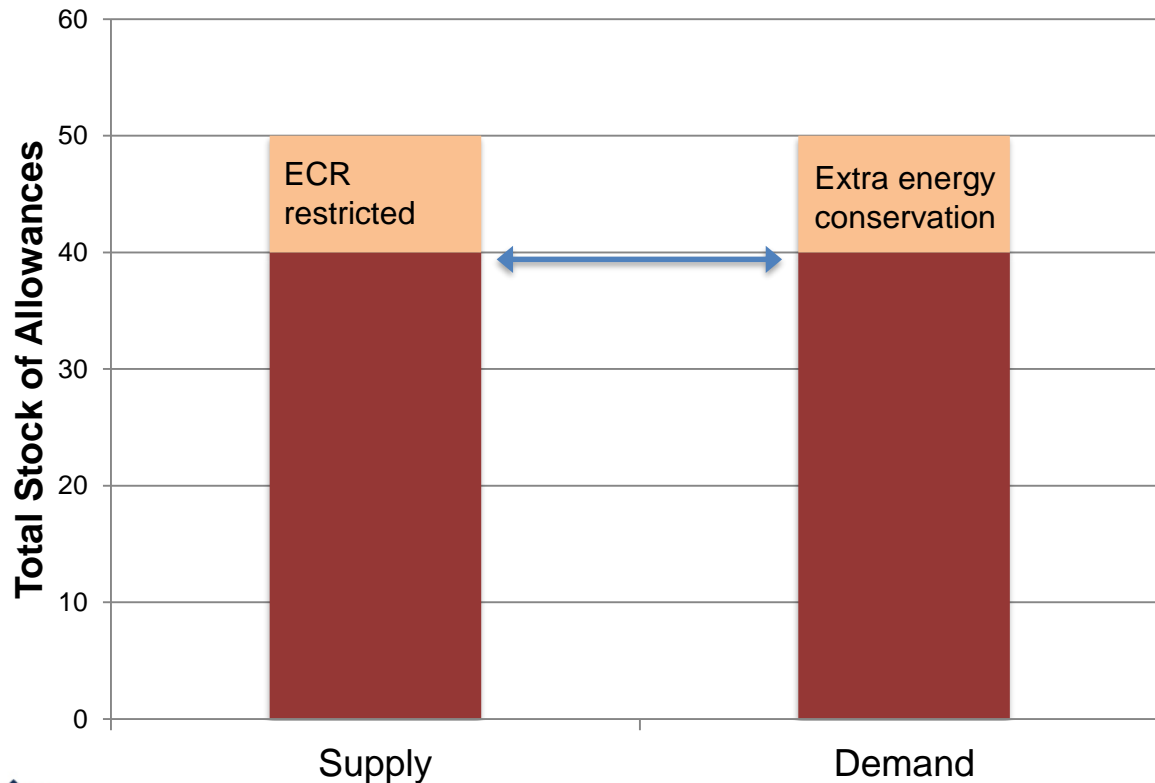
Extra energy conservation reduces demand

Today's price falls (possibly to the reserve price)

Bank grows (depends on cap path over time)

# Long-run market expectations set today's price

Long-run Supply and Demand



Price returns to around \$8

Bank returns to "normal" levels

# Laboratory Experiments

Experiments at the University of Virginia Economics Laboratory examine performance of this market design in a behavioral setting.  
(with Bill Shobe and Charlie Holt)

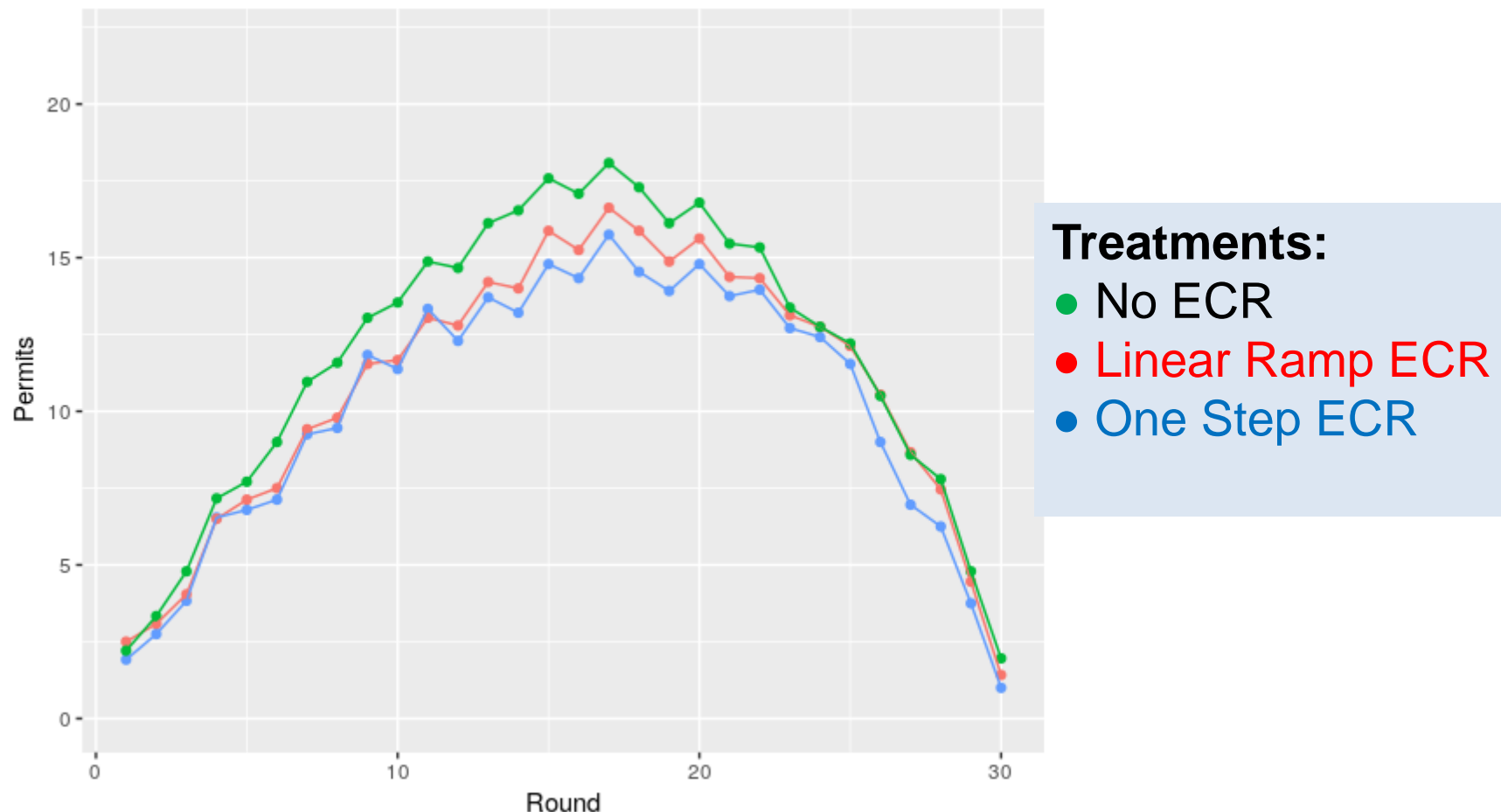
Comparing:

- No ECR
- One step ECR
- Linear ramp ECR

Some (very) early results:

- ☐ Students understand the ECR and make coherent intertemporal decisions.
- ☐ Deviations from the theoretical market equilibrium are less costly with the ramp than with the one step ECR.
- ☐ The size of the bank is reduced under the ECR as anticipated.
- ☐ Prices are higher under the ECR. Difference in revenues is relatively small.

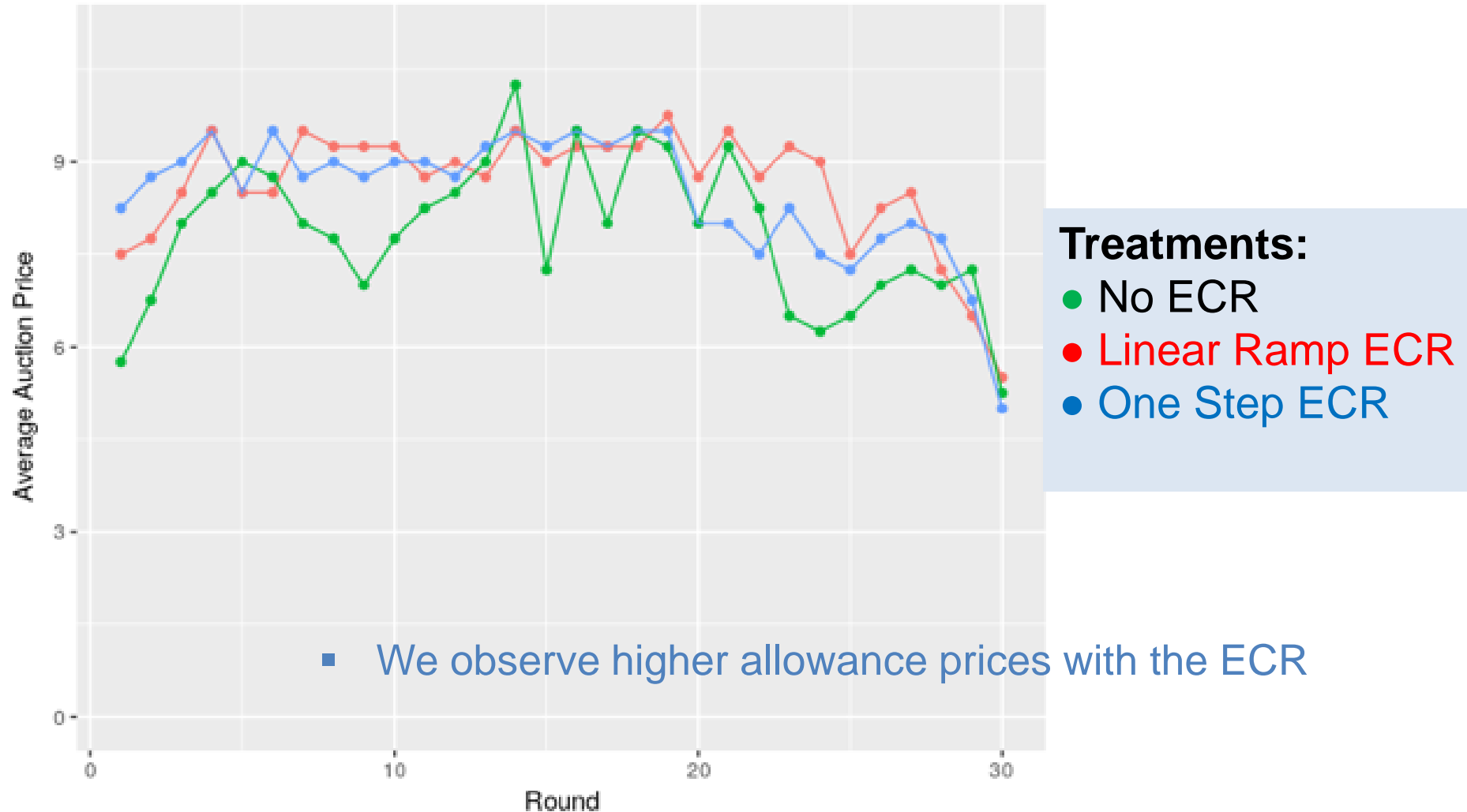
# Total Banked Permits by Treatment by Round



- In the laboratory we observe a smaller bank with the ECR



# Average Auction Price by Treatment by Round



- We observe higher allowance prices with the ECR

# Extra Slide: Laboratory Experiments Setup

- Cap declines from 66 at 1 permit per period, so goes from 66 to 37 over 30 rounds
- There is no spot market trading. The only way to get permits is via auction
- Each bidder can make up to 6 bids. [But for high emitters each bid is for 2 permits]
- 12 subjects, 6 “coal”, 6 “natural gas”
- 30 rounds
- 4 capacity units (plants) for each subject
- Each capacity unit produces one unit of output per round if it is run.
- banking is unlimited
- Output price varies between \$30 and \$40 with probability of 50% each
- Costs of production: uniform on  $[10, 28]$  for low emitters and  $[1, 28]$  for high emitters.
- Long-run, Walrasian price over the 30 sessions: \$8
- Reserve price: \$5
- Step function at \$8 for 16 permits (25% of the initial cap).
-

# Respondents

## **What are the Opportunities and Challenges Presented by the ECR?**

- *Mark Scorsolini, Energy Trader – Green Products, PSEG*
- *Nancy Seidman, Senior Advisor - US Programs, Regulatory Assistance Project*
- *Travis Madsen, Senior Program Manager for Global Warming Solutions, Environment America*
- *Lois New, Director, Office of Climate Change, New York State Department of Environmental Conservation*

# What are Opportunities & Challenges Presented by the ECR?

**Mark Scorsolini**

*Energy Trader – Green Products,  
PSEG*





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# ECR Opportunities & Challenges Climate Advocates' Perspective

Travis Madsen  
State Climate Campaign Director  
*Environment America Research & Policy Center*

14 June 2017



# Big Picture: Global Warming is Worsening



**#Climate Can't Wait**



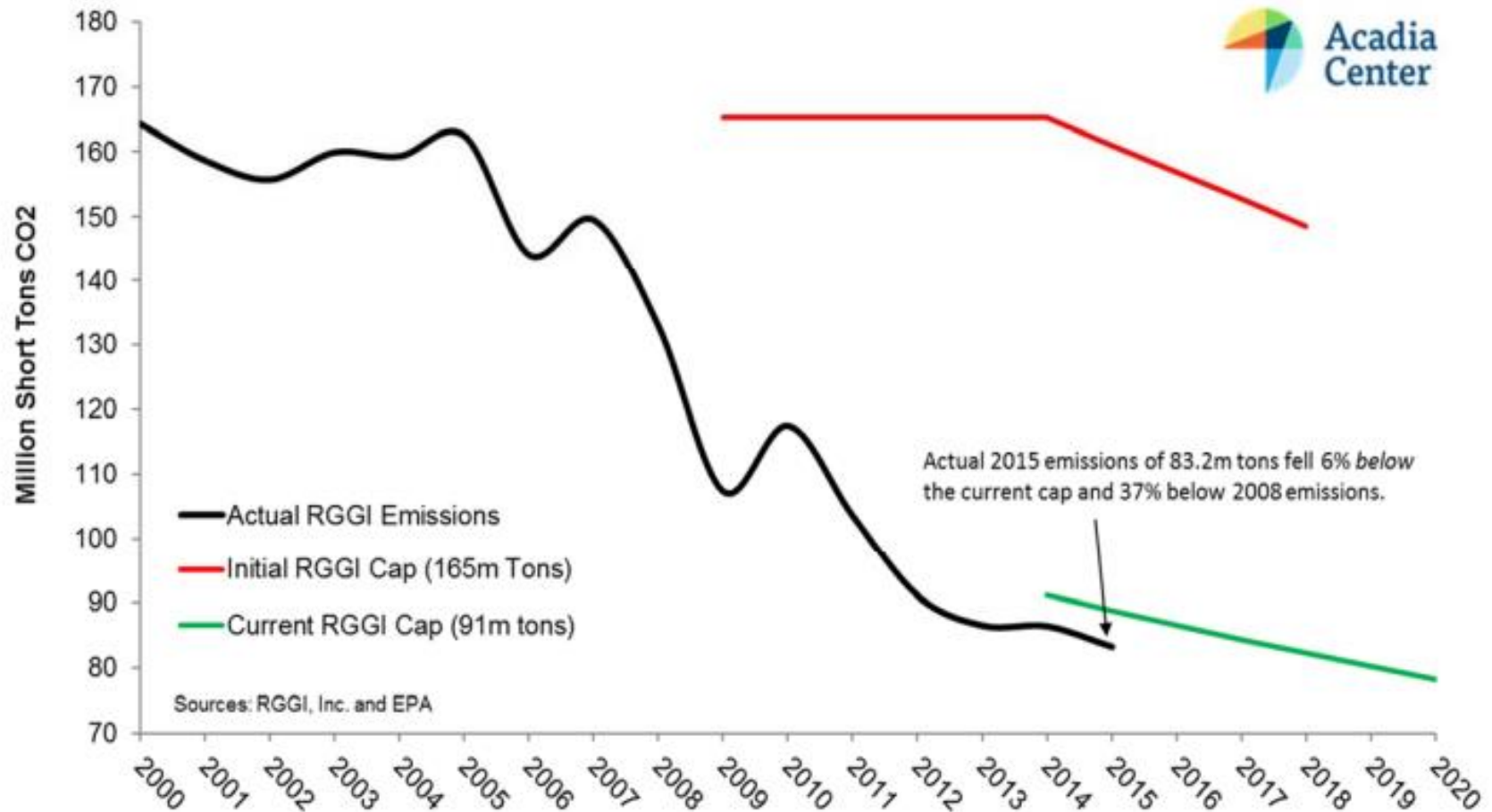
# Our Job: Cut Pollution

- Cut pollution as fast as possible
- Lead others toward greater ambition



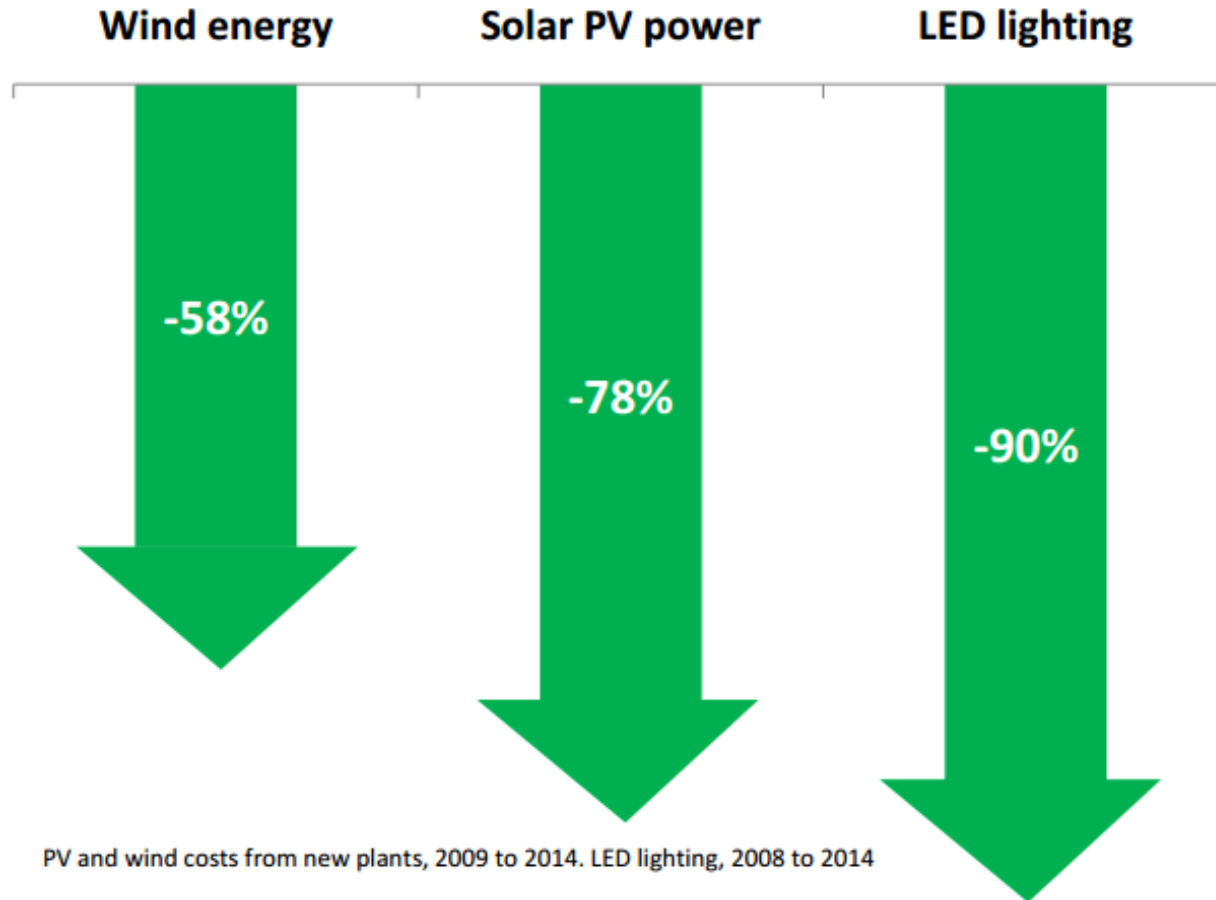


# RGGI So Far: Opportunities to Cut Pollution Have Proven Abundant and Cheap



# Declining Costs of Clean Energy

Figure ES-3. Recent Cost Declines in Clean Energy Technologies<sup>9</sup>



# So How Can We Make RGGI Work Better?

- Chart an ambitious course
- Create a guardrail to keep us on track (ECR)



# Question for Presenters

- How can we design the ECR to be most effective
  - In cutting pollution?
  - In inspiring others' ambition?

# What are Opportunities & Challenges Presented by the ECR?

## **Lois New**

*Director, Office of Climate Change,  
New York State Department of Environmental Conservation*





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