Update on Market Simulation Group Modeling

Emissions Market Assessment Committee
Meeting
November 14, 2013

Road Map for Analysis

- Step 1: Calculate probabilities of price outcomes assuming competitive allowance market
  - POWER conference paper
  - Updates to that paper
- Step 2: Evaluate profitability of allowance withholding strategies
  - Given probabilities in step 1
  - Under different assumptions of holding limits
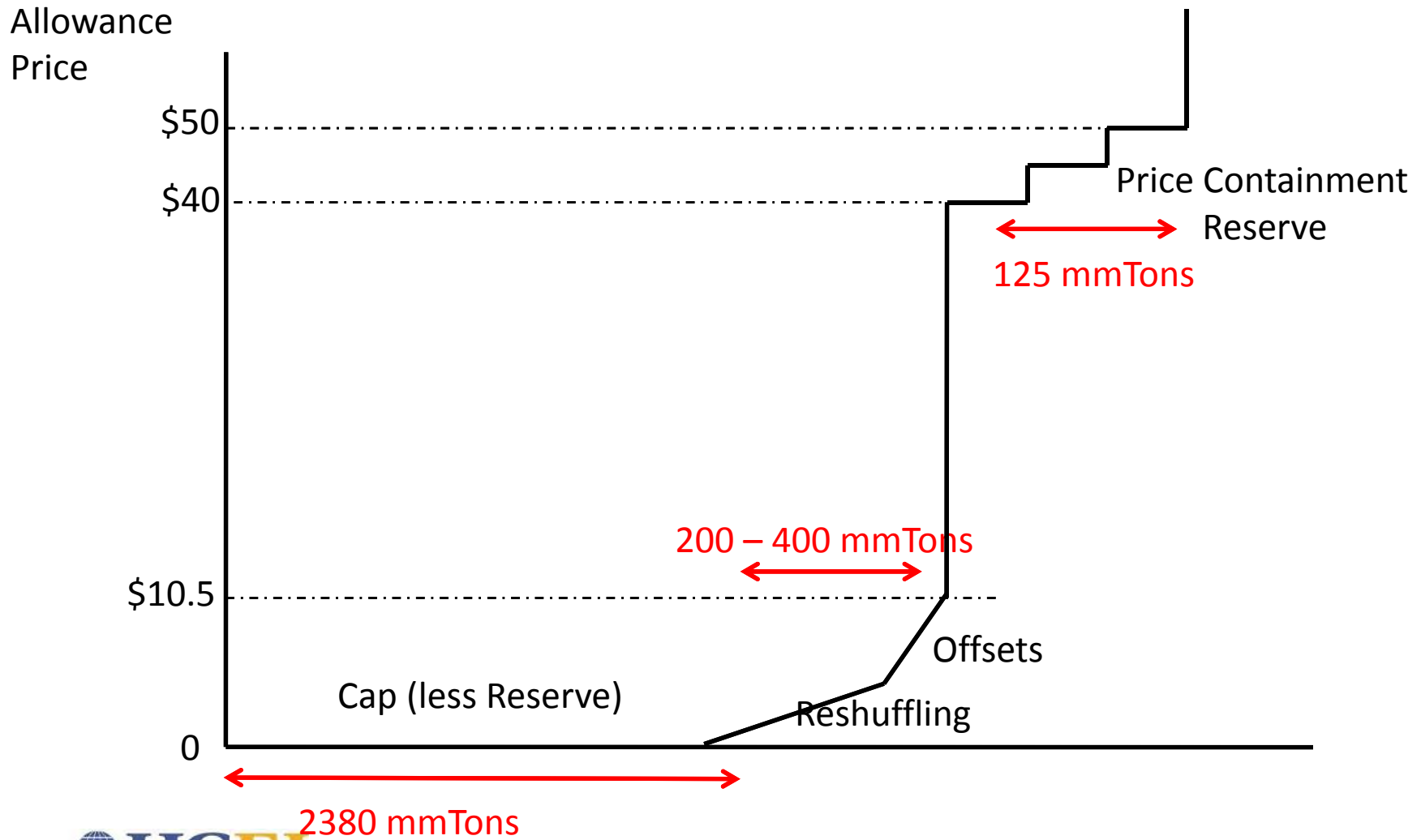 - Under different assumptions of containment price?

Forecasting and Climate Policy

- An obviously important input to policy is the likely level of future emissions
- Two dominant approaches
  - Large scale simulation models ("bottom-up") estimates based upon assumed scenarios. (e.g. Energy 2020)
  - CGE models utilizing Input-output tables with varying specificity of different sectors. (e.g. BEAR)
  - Both are are calibrated to "in sample" – sometimes a single year – observations
- Both tend to produce single "point" estimates of values – or ranges of estimates based upon specific scenarios
  - Not reflective of the full distribution of values
- In many cases information about the distribution is more important than the point estimate
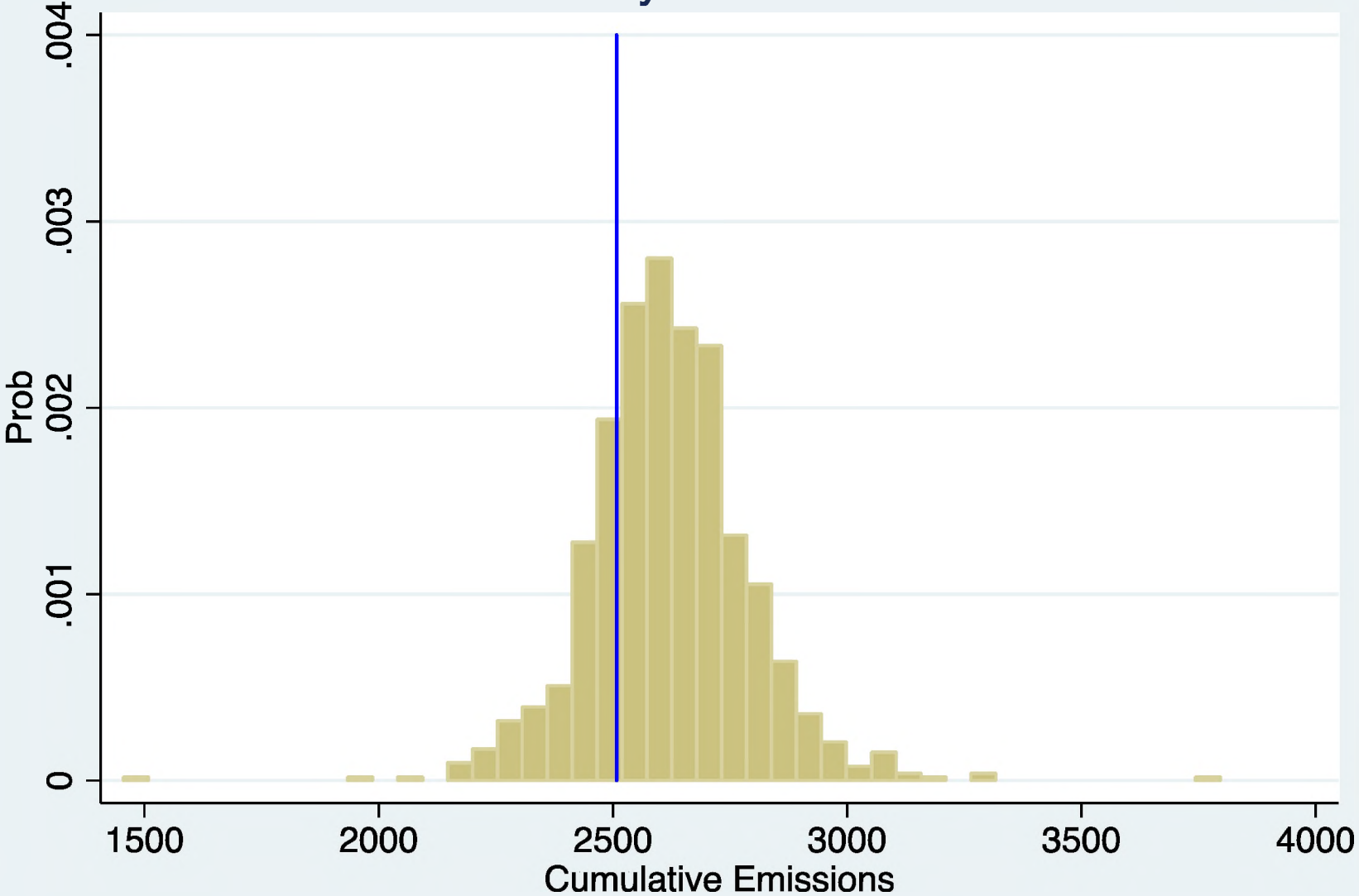 - For example if objective is to minimize losses

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Our General Approach

- Estimate probability model for future business-as-usual (BAU) emissions
  - BAU is "demand" for allowances
  - Price responsive abatement adds slope to BAU demand curve
- Consider scenarios of complimentary measure impacts
  - Measures that are *not* directly responsive to allowance prices

- Combine these to forecast distribution of future allowance prices
  - Probability of prices at floor
  - Probability of prices in allowance reserve
  - Probability at price above allowance reserve
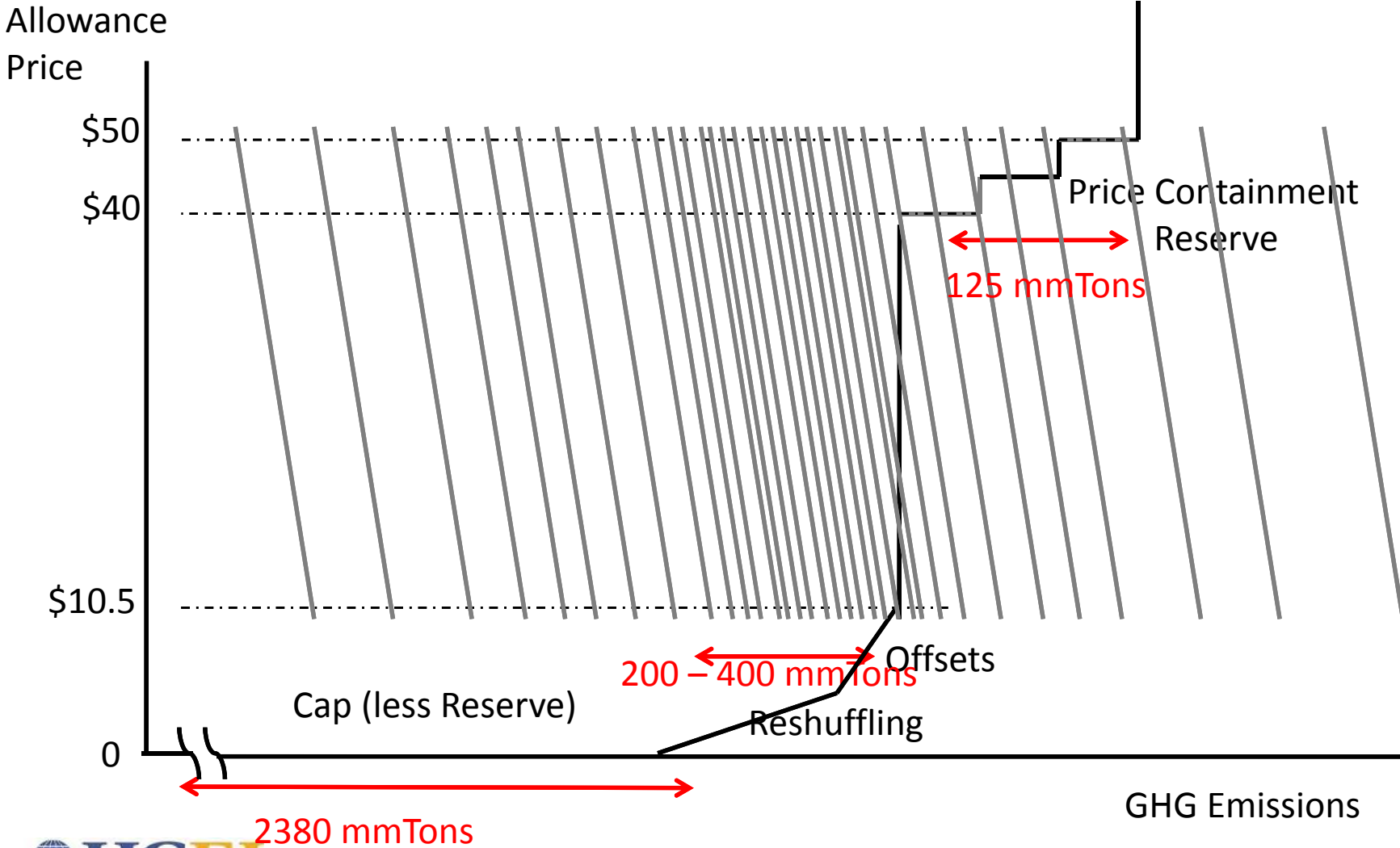
Figure 1
Supply of Allowances

Allowance Price

$50

$40

Price Containment Reserve

125 mmTons

200 – 400 mmTons

$10.5

Offsets

Cap (less Reserve)

Reshuffling

0

2380 mmTons

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Prob. Density of BAU Emissions

Note: Illustrative example only, not real data!

Figure 3
Supply and Demand

Factors in BAU modeling

- Macroeconomic growth and fluctuations
  - Real GSP, VMT, electricity demand
- Energy intensity trends and fluctuations
  - Transport CO_2/VMT; Power CO_2/MWh
- Supply shocks:
  - hydro-electricity, gasoline prices
- Complimentary policies
 - SB1368, LCFS, RPS, CAFE, Fed Policies/Incentives

Details vs. Forecast Accuracy

- Modeling tendency is to include many variables
  - Biofuels production, number of toasters sold, etc.
- In econometric models this can improve "in sample" fit but increase the variance of the forecast
  - (e.g. If an underlying, unimportant variable is noisy)
- When focus is on variance of forecast (e.g. of BAU emissions) there is a cost to adding too many explanatory variables
  - Can overstate the range of uncertainty
- More variables (e.g. intensities) does allow for forecasts to be limited to "feasible" paths.

Assumptions on Timing

- Main analysis assumes years/phases fully integrated over time through banking
- Aggregate emissions, complimentary measures, and abatement over 8 years
- All calculations based upon 8 year totals
- Implication is that we are evaluating "end of program" price probabilities
- At any time before EOP, prices should reflect weighted expectations of EOP prices.

Trajectories of Allowance Prices: Assuming a limited containment reserve
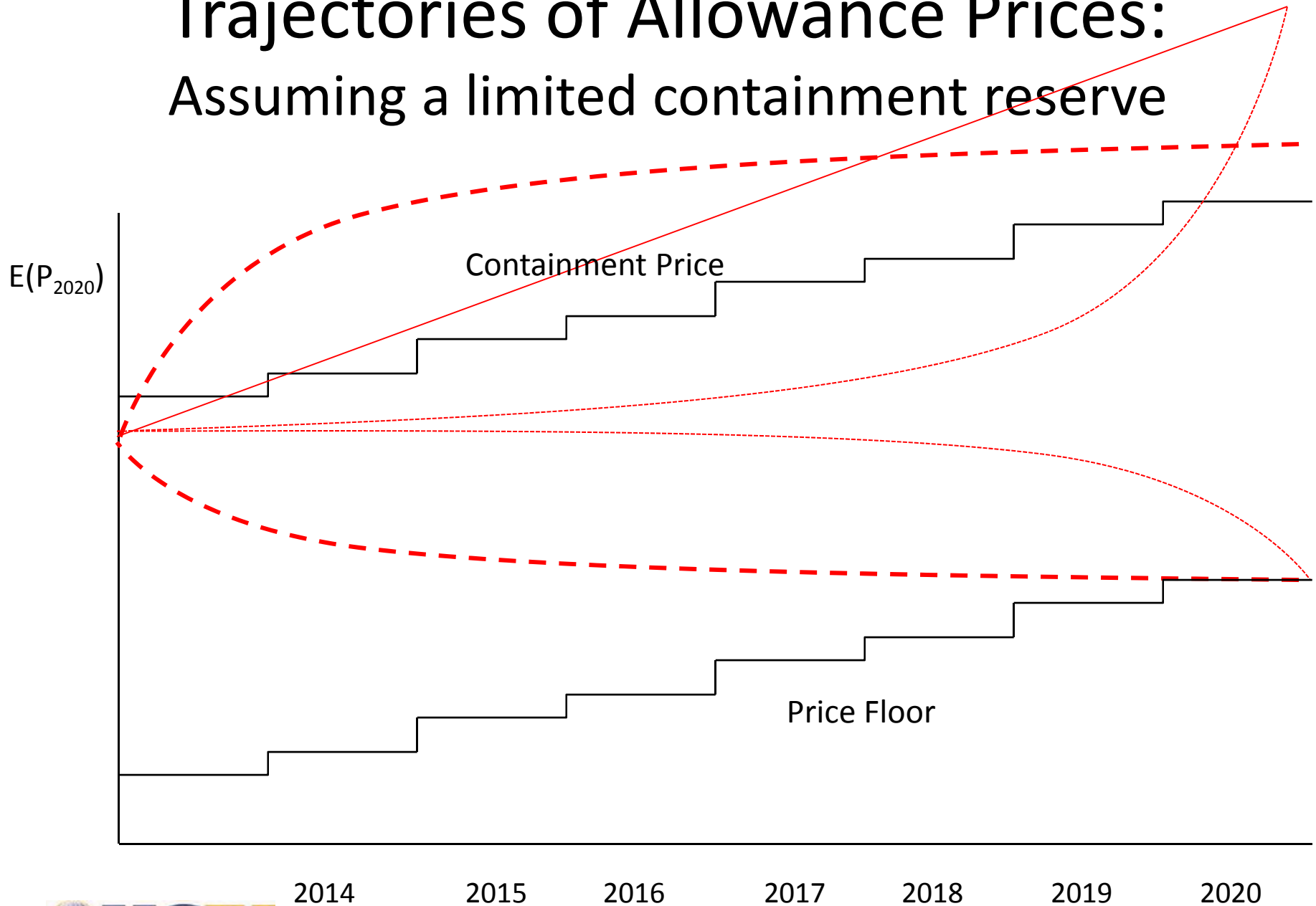
Possible Trajectories of Allowance Prices:
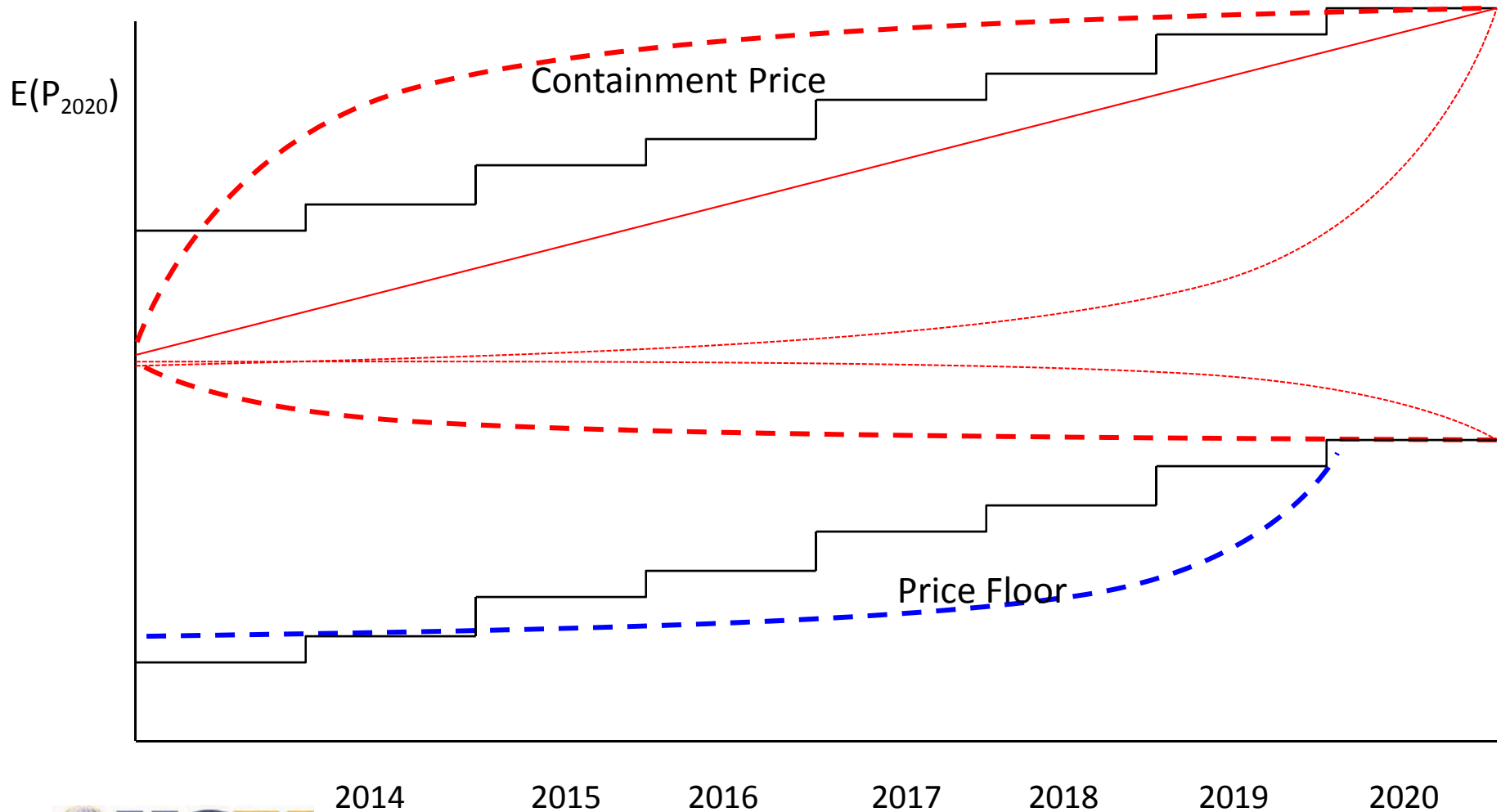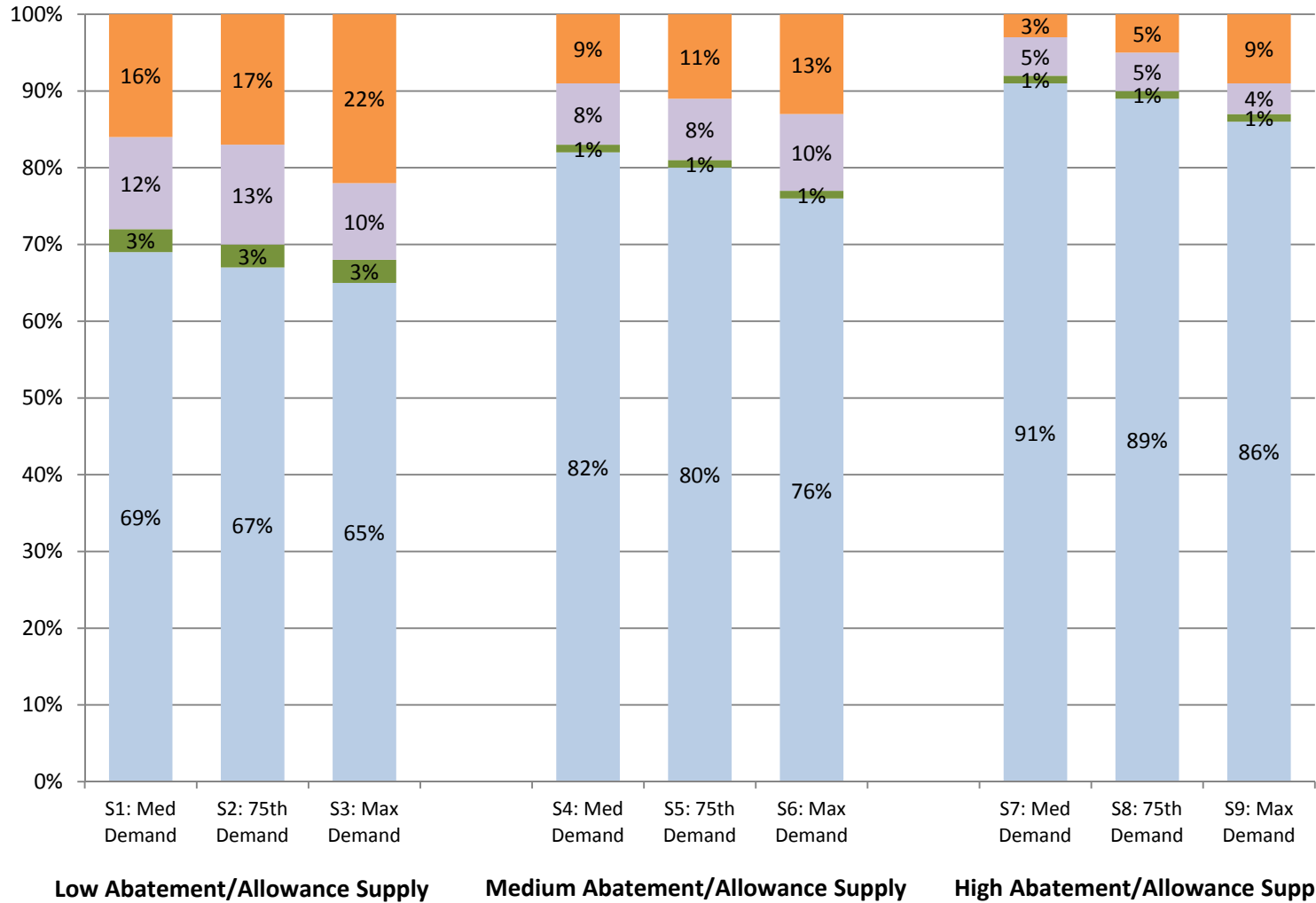## Assuming a firm containment price

Figure 5
Allowance Price Probabilities by Scenario

Changes to March Report

- Update to include 2012 data where available
  - Economy (GSP) grew faster than anticipated
    - Increases median forecast, reduces range of forecast
- Account for retirement of SONGS
- New method for modeling complimentary policies
  - Explicitly account for trends as part of compliance
  - Avoids "double counting" effect of comp. policies
- More detailed decomposition of price-responses
  - Examine implications of natural gas allocations

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Comp. Policies Skew Probabilities of Emissions
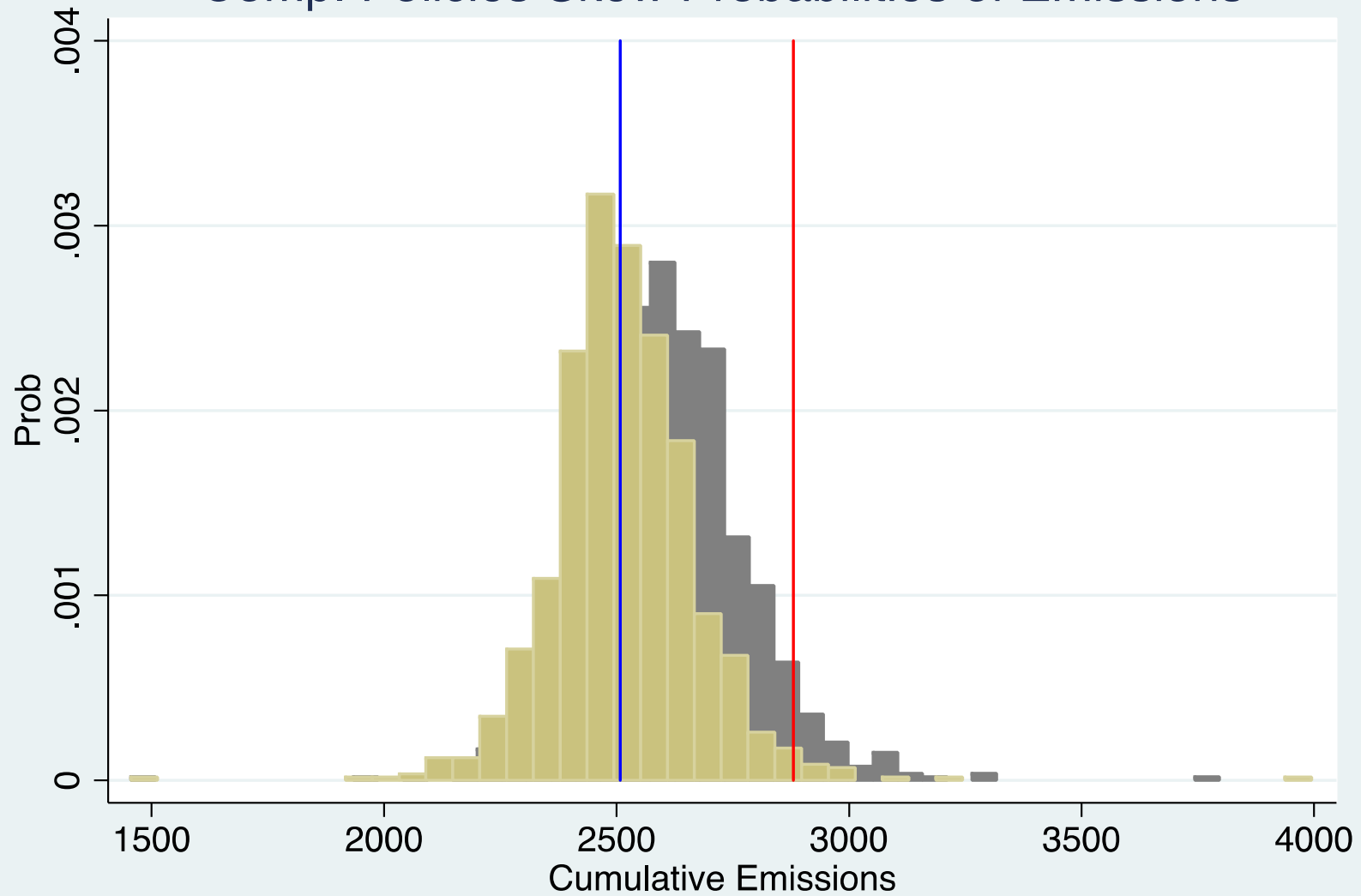
Note: Illustrative example only, not real data!

Schedule

- Updated "competitive" market forecasts by end of year

- Evaluation of manipulation strategies by March 2014