

Interaction Between Renewable Energy Markets and Carbon Markets: Optimal Policies to Meet Societal Goals

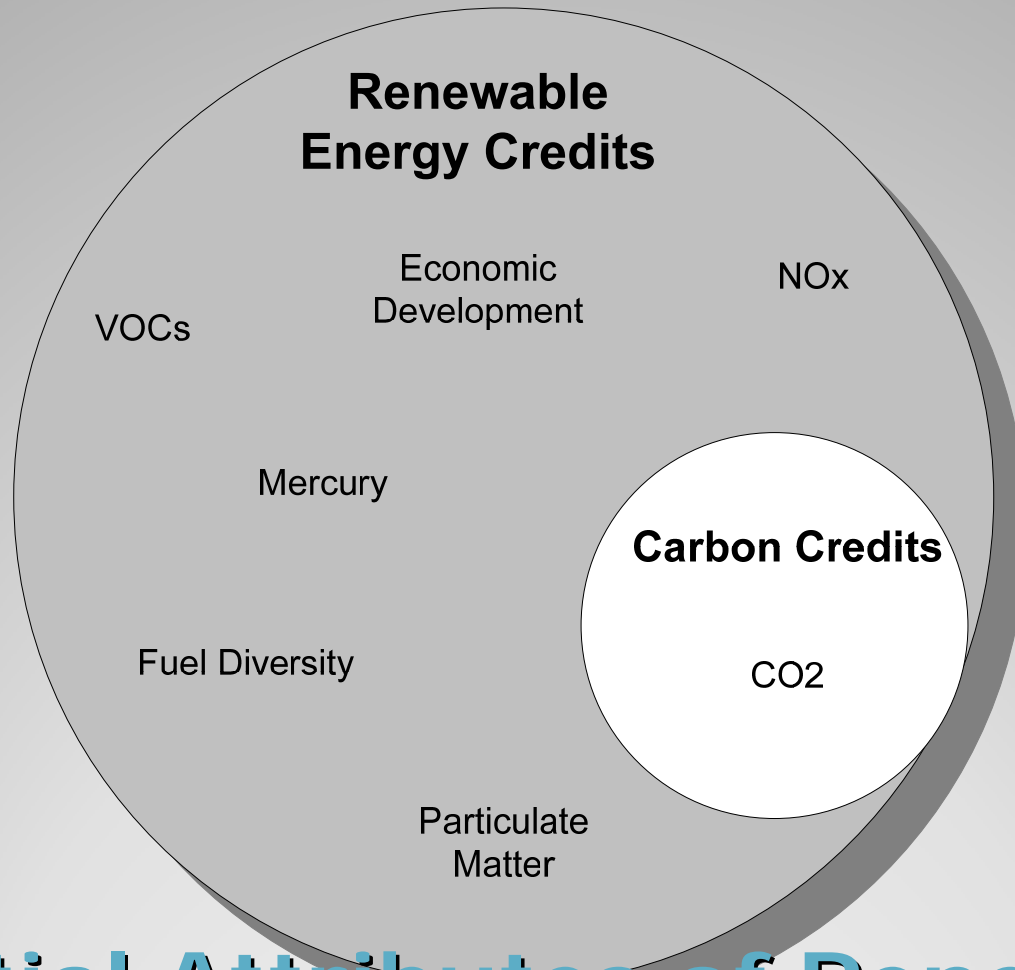
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- I. Problem Overview
- II. Cap and Trade Basics
- III. Policy Recommendations and Projections
- IV. Final Matrix

Outline

“Separate and evolving public policy debates are currently shaping renewable energy markets and carbon markets without attention to how each market affects the other, yet the markets have overlapping goals with respect to reducing CO₂ emissions.”

Problem Statement



Potential Attributes of Renewable Energy Credit vs. Carbon Credits

1. RE markets (RPSs and voluntary), not RE in general
2. Focused on the ability of RE markets to lower a cap in a cap and trade environment
3. In projection scenarios 2-4, I assume GHG cap implemented by 2010, and ends in 2020

Problem Boundaries

In the U.S. RE markets have formed, at least in part, because of their ability to reduce emissions



- RE markets may not have the opportunity to reduce emissions under cap and trade

- Decline in RE markets

- Emissions goals harder to reach
- More expensive

Problem Example

- Enhances our understanding and knowledge of the roles, limitations and interaction of renewable energy markets and carbon markets (and tools)
- Fills a void in the existing literature
- Relevance primarily in the field of energy policy, also has policy and economic undertones

Theoretical Value

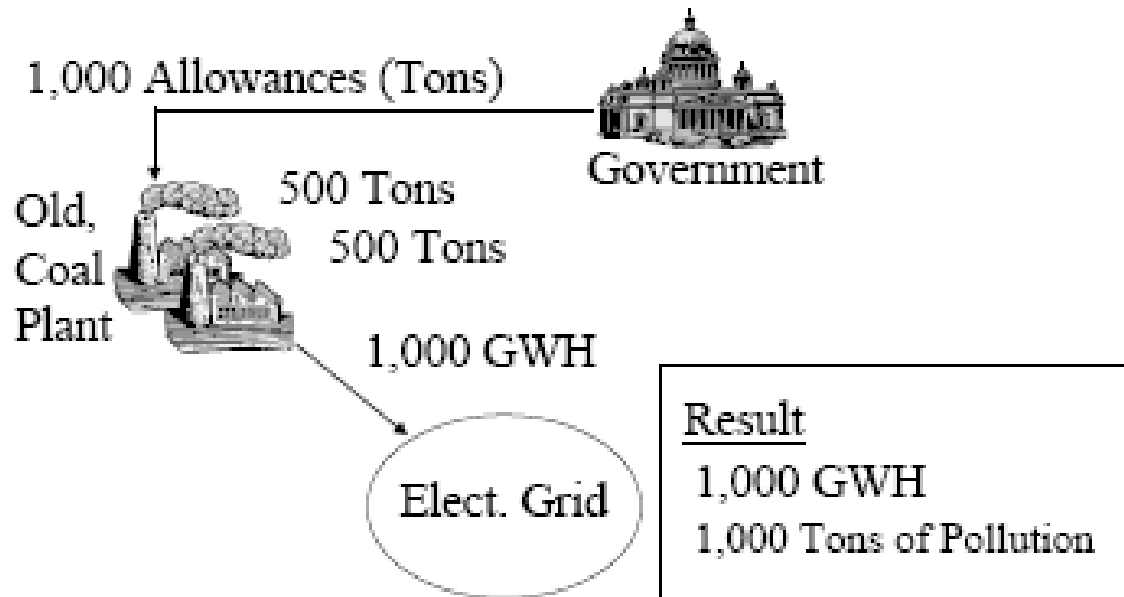
- Provides recommendations for policymakers designing these markets and tools
 - Matrix
- Includes a thorough overview of existing markets and interaction issues
 - Recommendations are politically relevant and useful for extrapolation for similar scenarios
- Projects impacts of various policy scenarios

Practical Value

- Purpose:
 - Cost-effective emissions reductions that are real and verifiable
- Sets limit/cap on emissions (e.g. SO₂, NO_x, CO₂)
- Allowance distribution equal to the cap
 - 1 allowance=right to emit one ton of emissions
- Regulated entities:
 - Reduce emissions (e.g. fuel switching, DSM, adding controls)
 - OR, purchase/sell allowances from market
 - Must have allowances equivalent to emissions
- Trading allows for emission reductions to take place at lowest cost
- Emissions level will remain at the cap unless allowances are retired or cap is lowered over time

Cap & Trade Basics

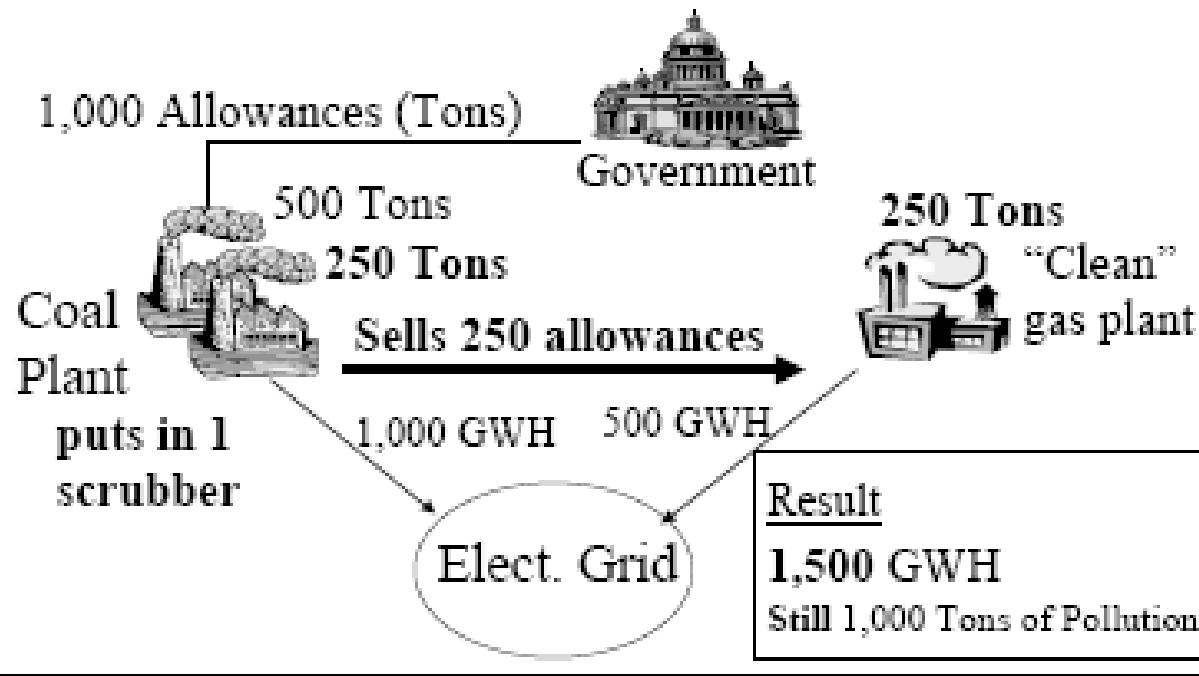
Current System
1,000 GWH
(SO₂ Allowances Capped at 1,000 = 1,000 Tons)



Input Distribution

Source: Harmon and Hirschhorn

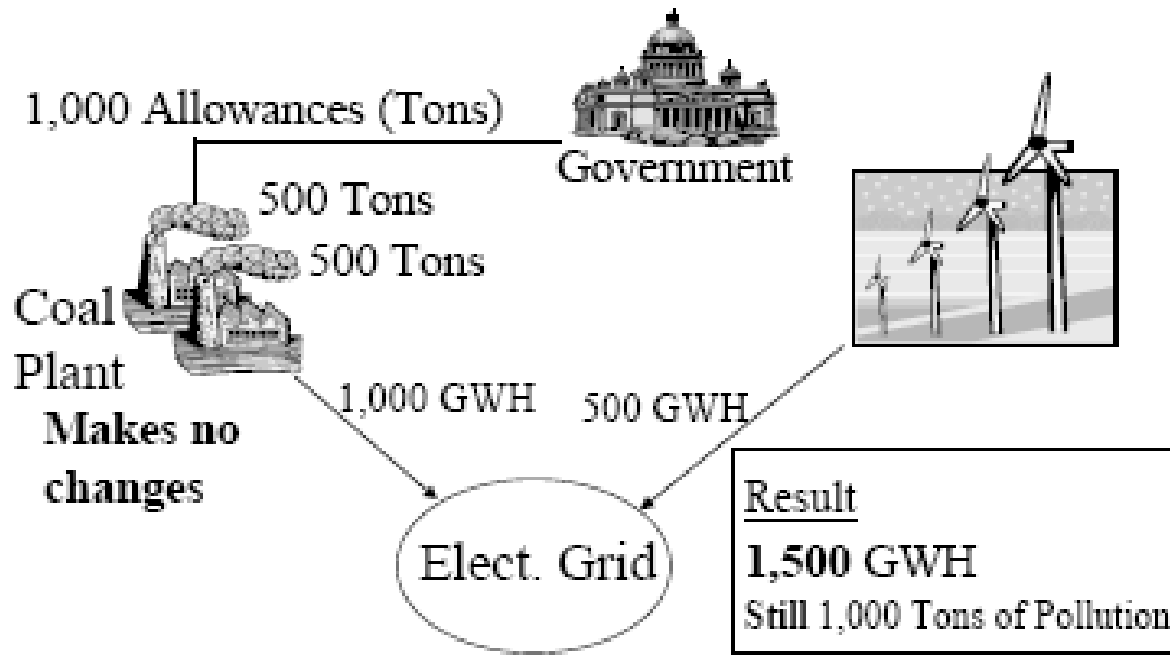
Current System
Add 500 GWH with "Clean" Natural Gas
(Allowances Remain Capped at 1,000)



Addition of Gas Plant

Source: Harmon and Hirschhorn

Current System
Add 500 GWH with Wind
(Allowances Remain Capped at 1,000)

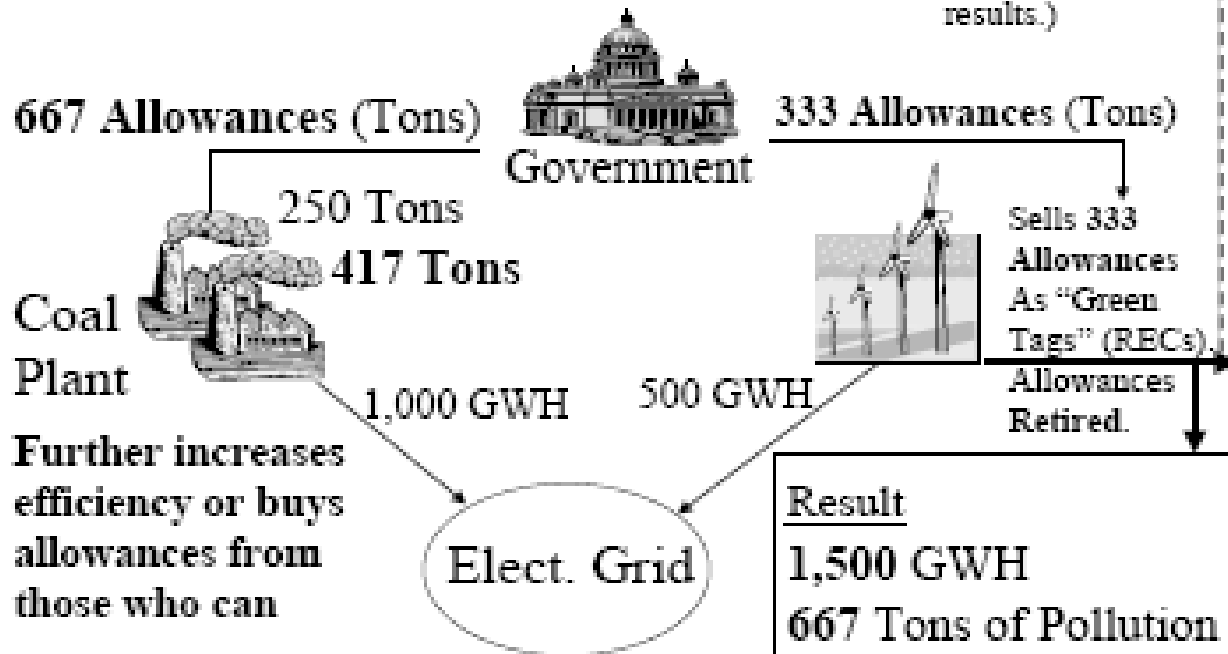


Addition of Wind Plant

Source: Harmon and Hirschhorn

Output-Based System
Add 500 GWH with Wind
(Allowances Remain Capped at 1,000)

Or, they can sell allowances to emitters. (No pollution reduction results.)



Output Distribution

Source: Harmon and Hirschhorn

- First, RPS should clearly state emissions reductions as intended purpose
- Next, RECs should include all environmental attributes, including relevant allowances
- Or, allowances should be retired on behalf of RPS
- Or, if no allowances, RPS should be considered when setting cap
- If none of this occurs, RPS will not lower emissions below the cap

If RPS Intention is Emissions Reduction...

- **Output-based Distribution**
 - + Creates standard method for evaluating all generation facilities
 - Allowances should only go to emitters
 - Inclusive to all, including nuclear
- **Set-asides**
 - + Prior experience
 - No guarantee of receiving allowances

Policy Options for Including RE

- When designing set-asides
 - Large (but fair) conversion rates
 - Lower project size requirements
 - All generators eligible
 - Maximize eligibility period and contract length
 - Reduce administrative difficulties
 - Consider sanctions
 - Education *be clear about overlap with other mandates*

Lessons Learned re: set-asides

- Retire Allowances on Behalf of RE
 - +Straightforward method, accounting for all RE
 - RE does not receive allowances
- Set and Lower the Cap Inclusive to RE
 - +Can account for all RE
 - One of many factors
 - RE does not receive allowances

Policy Options (cont'd)

Scenario

Key Variables

1) **Business as Usual, *no* federal level cap and trade for GHGs (“S1”)**

(used as base for comparison to show how markets would grow without complications)

2) **Federal level cap for GHGs (“S2”)**

Renewables are not accounted for

3) **Federal level cap for GHGs (“S3”)**

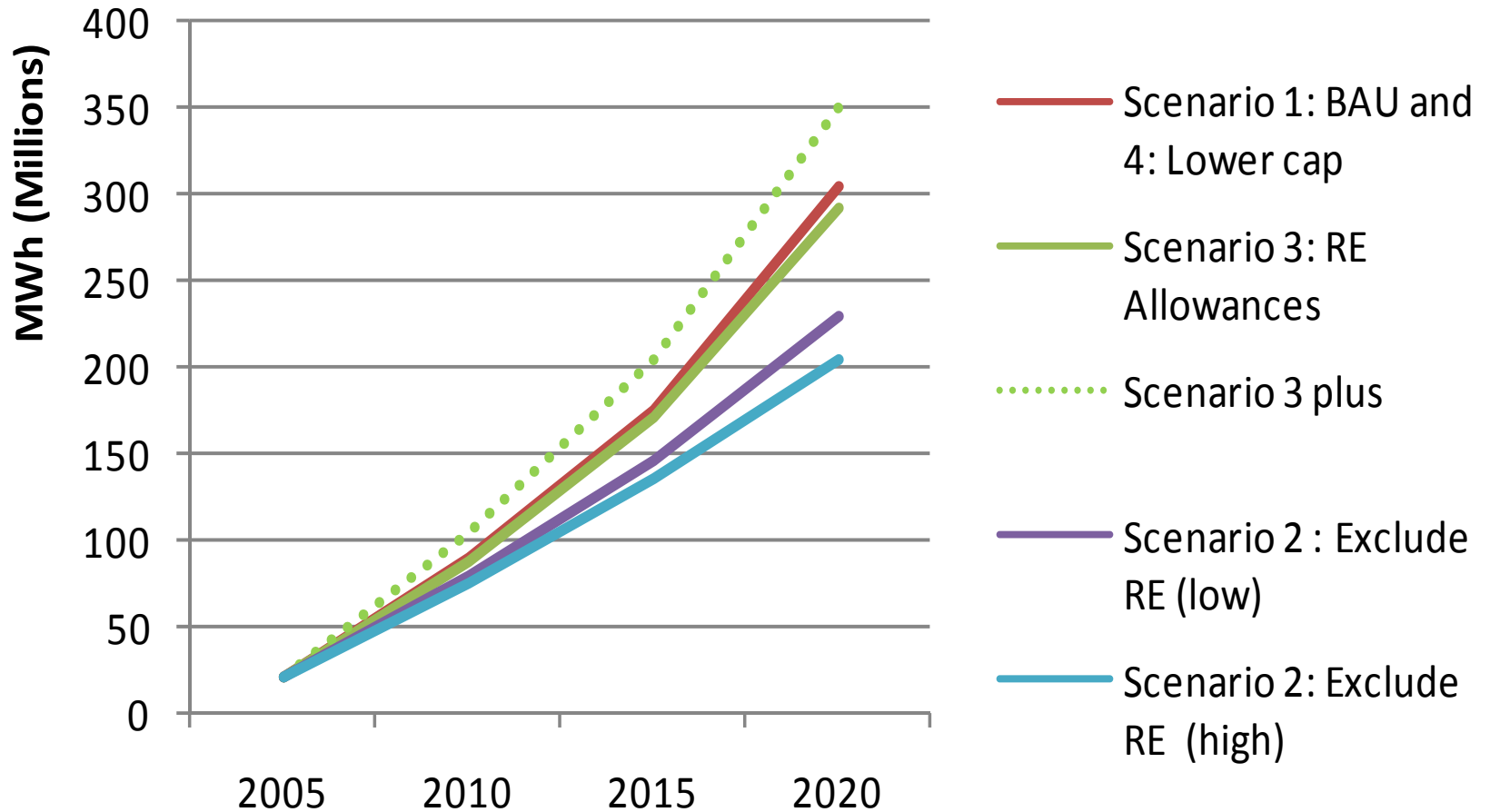
Renewables receive allowances

4) **Federal level cap for GHGs (“S4”)**

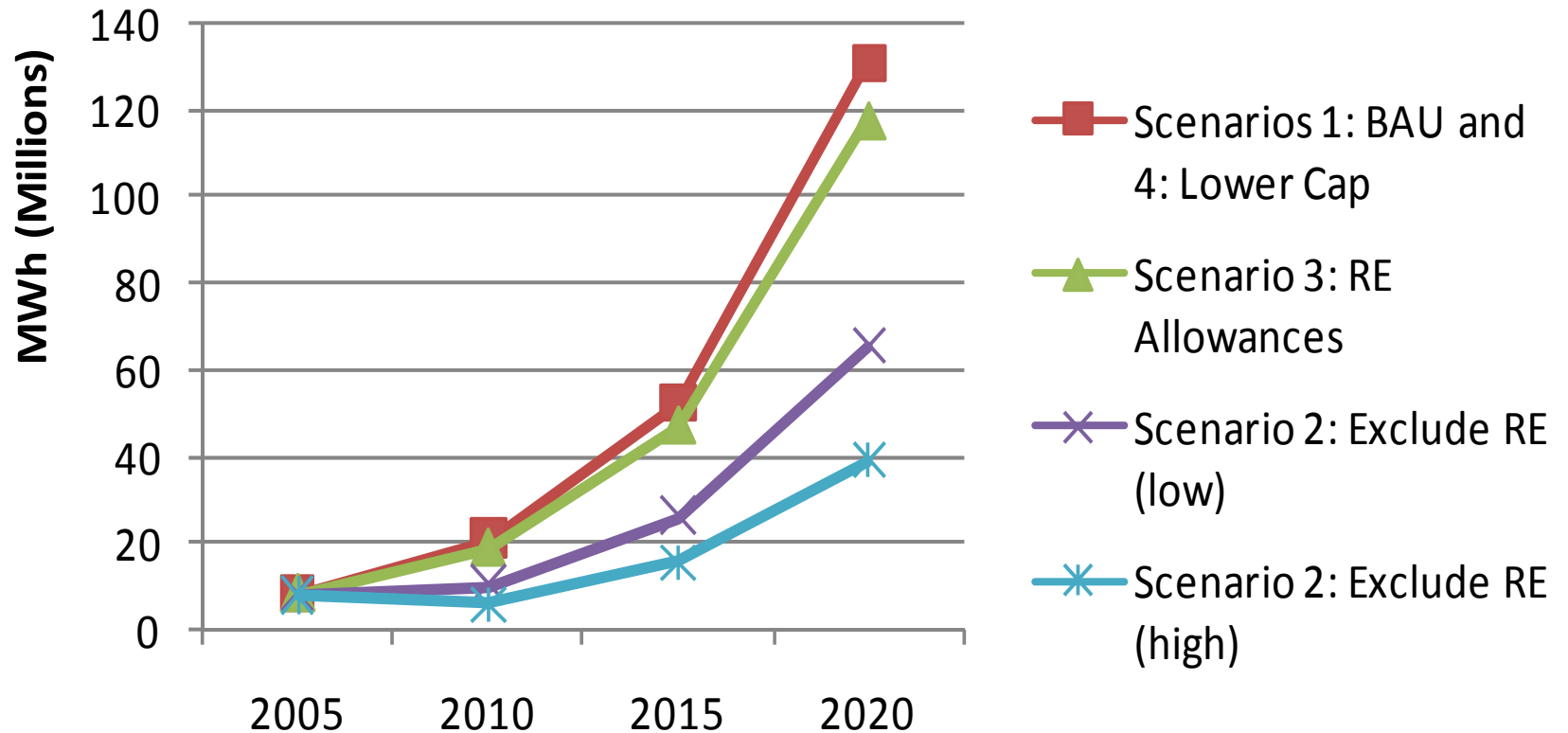
Allowances are retired on behalf of renewables
OR cap is set and lowered to account for generation from renewables

Policy Scenarios

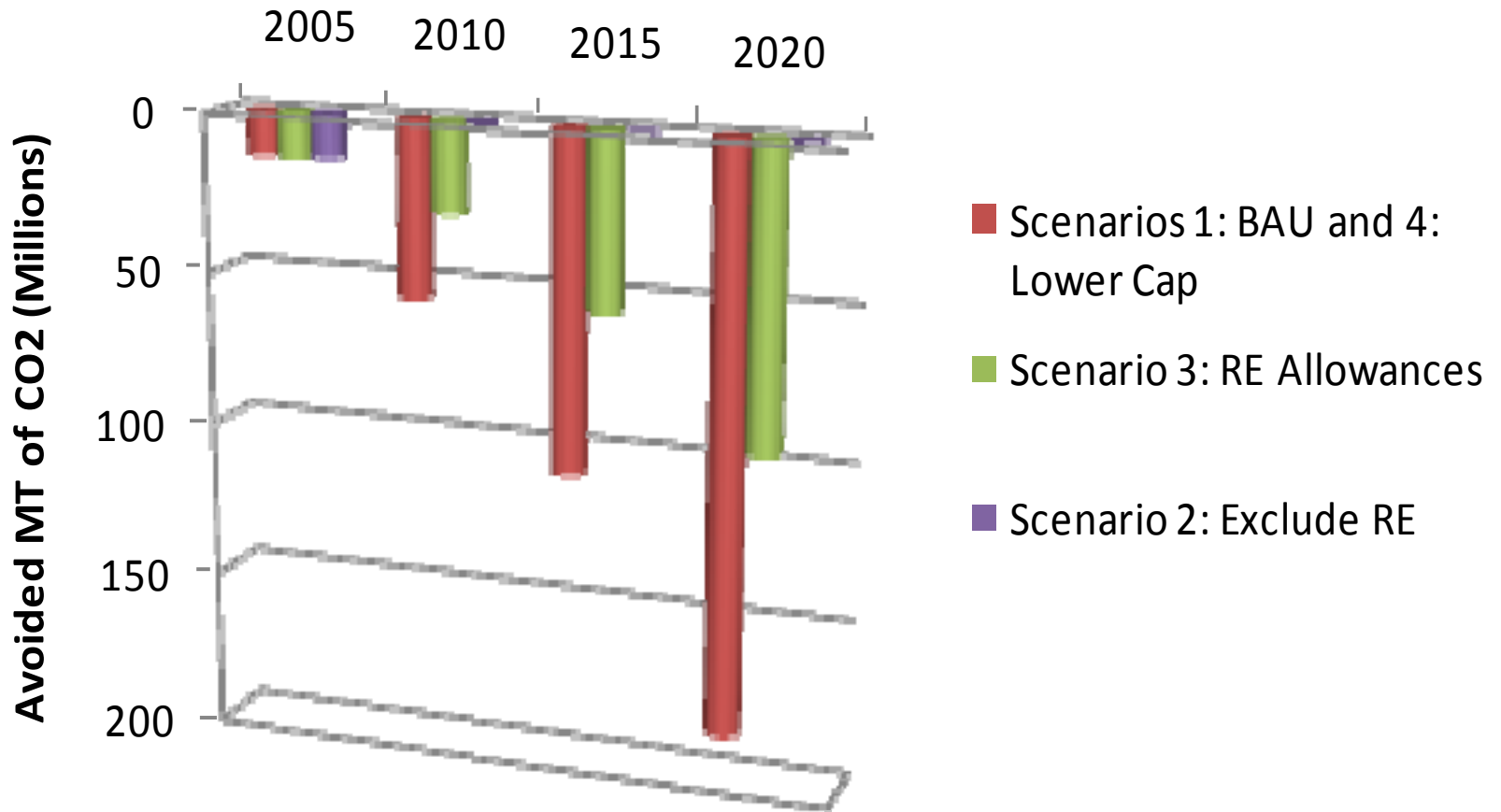
Total RE Market Growth- All Scenarios














Projections for Voluntary RE Market: All Scenarios



Avoided Emissions for RE Markets- All Scenarios



	SCENARIOS			
	S-1	S-2	S-3	S-4
REC PRICES				
CARBON CREDIT PRICES				
ELECTRICITY PRICE	\$79/MWh*			

 Smallest Increase
  Medium Increase
  Largest Increase
  Decrease

* Source: EIA 2007

Comparison of Prices –All Scenarios

POLICY GOALS	POLICY OPTIONS				
	GHG Cap & Trade Give renewable energy allowances	GHG Cap & Trade Retire allowances on behalf of renewable energy or adjust cap to account for expected demand for renewable energy electricity	GHG Cap & Trade Exclude renewables	RPS Require that allowances are retired for compliance	Voluntary Renewable Energy Market Retire allowance with renewable energy product (eg. REC)
REDUCE EMISSIONS	✓	★	✗	✓	✓
INCREASE RENEWABLE ENERGY	★	✓	✗	✗	✓*
SUSTAIN VOLUNTARY RENEWABLE ENERGY MARKET	✓	★	✗	Not Applicable	✓
REDUCE ELECTRICITY COSTS	✓	?	?	✗	✗

★ Best Option

✓ Yes

✗ No/Worst Option

* Only when emissions reductions below the cap are preferred.

Final Matrix

Thank You.

Questions?
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