National and Subnational climate change policy

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Outline

- US – National
  - Review policies
  - Subsidies vs taxes
- Subnational
  - Review how cap-and-trade and carbon tax work
  - Show how they are affected by overlapping instruments
    - Subregional policy (city/ state/ etc)
    - Sectoral policy (targeted subsidies)
- Overlapping policy examples
  - RGGI
  - CAFE
  - CA AB 32
  - Federal wind subsidies

History of US climate policy

1970s: Federal energy efficiency policy targets appliances, autos and buildings

- initially motivated by energy price spikes (OPEC), but main motivation today is climate change

1992: Senate approves U.N. Framework Convention on Climate Change

- Renewable energy production tax credit (PTC) added to 1992 Energy Policy Act (by Sen. Chuck Grassley (R-IA))

1997: Senate pre-empts Kyoto Protocol (Byrd-Hagel)

- Clinton admin negotiates anyways
- Bush admin formally declares non-entry

2003-2007: Several **bipartisan** bills in the Senate

- notable McCain-Lieberman cap-and-trade bill
- Congress mandates emissions reporting (GHGRP)

US climate policy under Obama admin

2009: American Clean Energy and Security Act (aka "Waxman-Markey") narrowly passes House

- set cap on total US emissions 2012-2050
- Senate fails to pass a related measure

2014: Clean Power Plan proposed

- After failure of ACES, Obama admin decided to use executive authority to restrict emissions from coal plants
- Note: Some feel this action was *required* by *Massachusetts vs EPA (2007)*, where SC ruled EPA required to regulate CO2 under the Clean Air Act

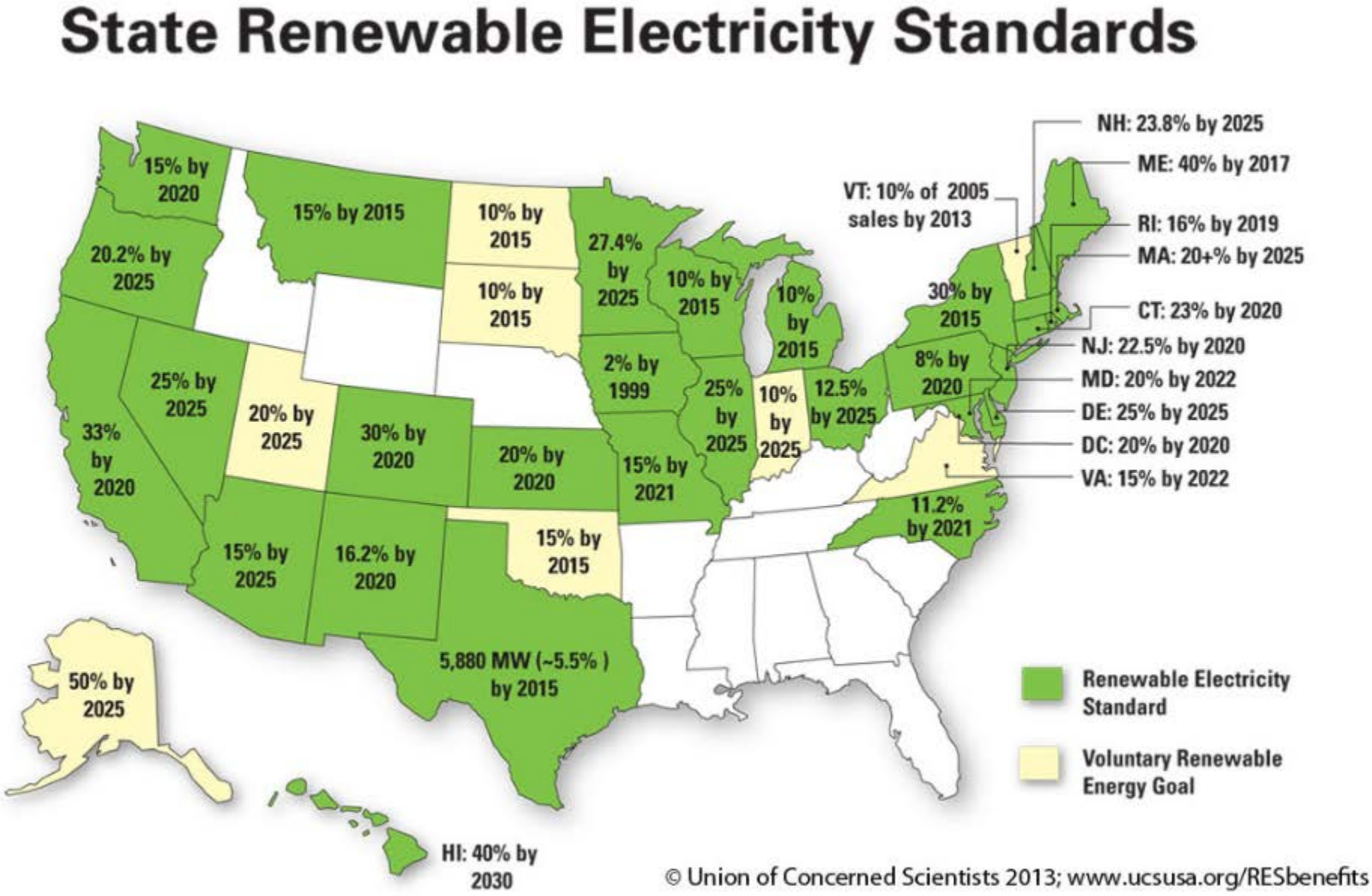
2016: Obama admin pledges US action in Paris, with CPP as the centerpiece

Unclear what happens next…

May 2017: Trump admin announces plan to withdraw from Paris agreement

October 2017: EPA Administrator Pruitt announces plans to scrap Clean Power Plan

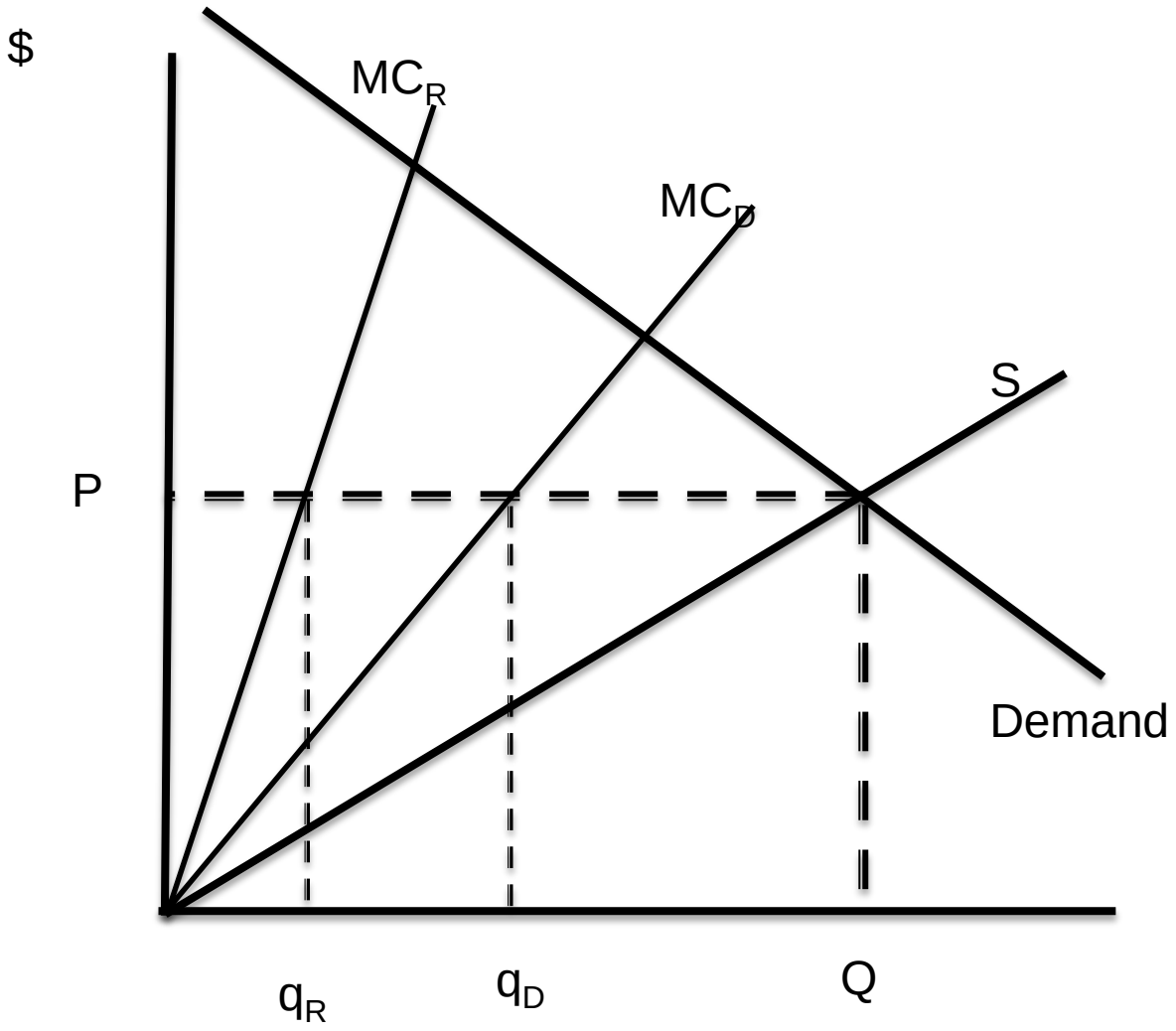
Subnational initiatives will continue



How good is this second best world?

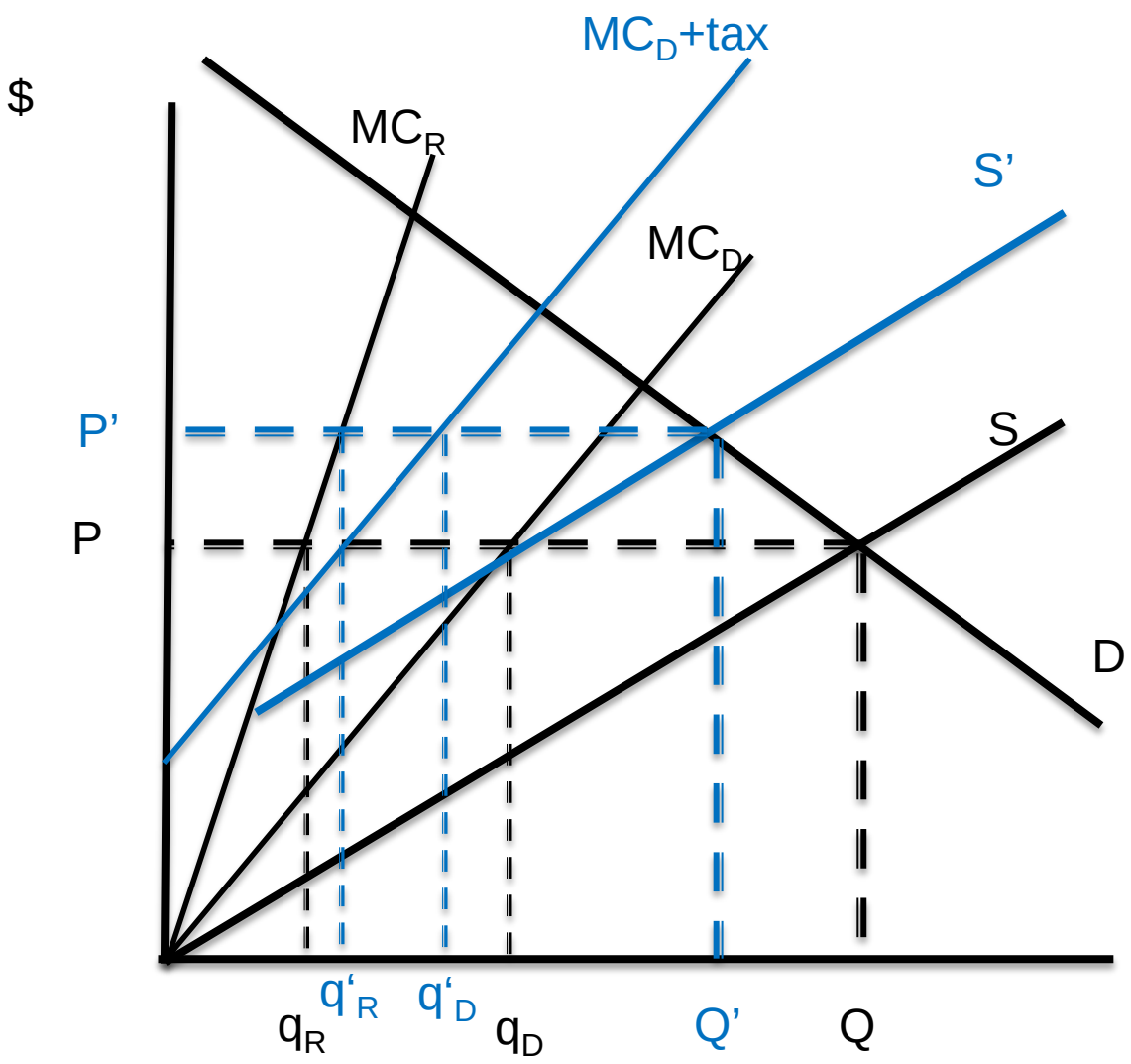
- First-best policy would be to place a price on emissions equal to their social cost
  - At the national level
- How do these “second best” policies compare?
  - Is it ok if we just subsidize renewables instead of taxing coal?
  - Can subnational policies be just as effective as national ones?

Taxes vs subsidies



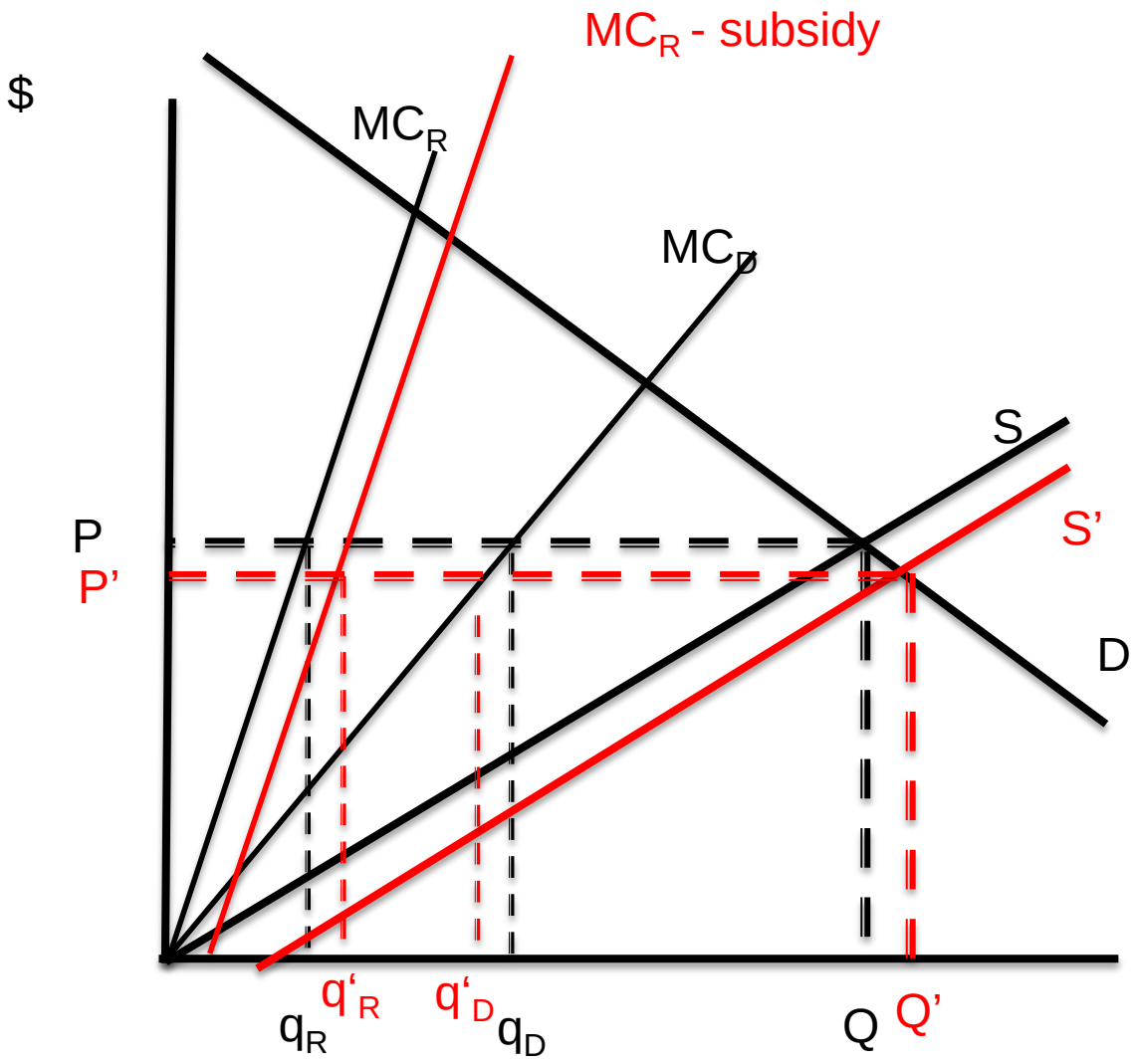
- Two sources of electricity, renewable (R), and dirty (D)
- Horizontal sum to get the aggregate supply curve
- This intersects with downward sloping demand to determine price P
- Which in turn determines how much each technology produces

How does a tax on carbon affect energy consumption?



- Now imagine we tax coal at it's social cost.
- This shifts it's supply curve up
- This shifts the aggregate supply curve out
- Which gives us new prices and quantities
  - Higher MC reduces coal supply
  - The higher price increases renewable supply
  - But total consumption declines
- Note this raises tax revenue = q'D * tax

What if we try to achieve the same outcome with by subsidizing renewables?



- Let's pick a subsidy that gives the same q'R at the old price
- This shifts the aggregate supply curve **down**
- So total quantity Q must go up (people use more energy)
- Which in turn means that coal supply is higher than with the tax (but still lower than the baseline)
- Note that unlike the tax, we also have to **spend** subsidy cost q'R * subsidy
  - Opposite of the double dividend

Taxes vs subsidies summary

- Problem comes from an externality on coal
- When we try to correct it, some of that reduction in coal use switches to substitutes
- Politically, it is appealing to try to just jump to this outcome by subsidizing clean energy
- But this actually *subsidizes* energy (with no corresponding externality justification)
  - Coal consumption will go down, but will still be above the social optimum
  - Plus we have to raise tax revenue to pay for the subsidy. This has DWL

Overlapping policy instruments

u – q = e

baseline – abatement = emissions

- With no policy, we have baseline "unconstrained" emissions **u**
- Some policy (standard, tax, cap) causes firms to reduce baseline emissions with costly abatement **q**
- Resulting in policy emissions **e**
- Today we consider what happens if multiple overlapping policies are placed on the same polluters
  - ie there is a federal subsidy for wind energy, and California also has a cap-and-trade program on carbon emissions
- Reading: Goulder and Stavins (2011)

Recap - Price instrument (taxes)

$$\mathbf{u - q = e}$$

- Any remaining emissions **e** are taxed at price **T**
- Firms chose abatement **q** to minimize their total costs of complying with the policy:

$$\text{Total cost}(q) = C(q) + T(u - q)$$

- Solution: Firms reduce emissions until marginal cost of abatement equals the tax

$$MC(q) = T$$

Recap - Quantity instrument (cap-and-trade)

- Government issues a limited number of emission permits
  - Mandates sum of total reductions **Q**
- Permits are tradeable, and clear at price **P**
- Firms again chose **q** to minimize their total costs of compliance:

$$\text{Total cost}(q) = C(q) + P(u - q)$$

- Solution: Firms reduce until marginal cost of abatement equals the permit price

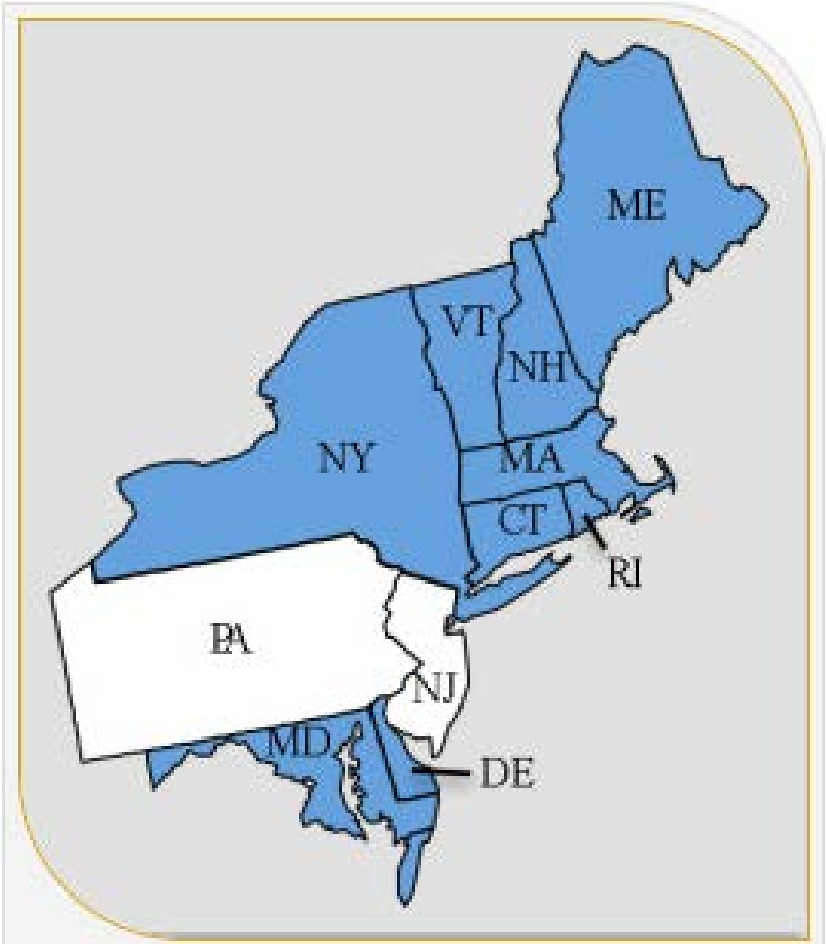
$$MC(q) = P$$

Recap – Price vs quantity instruments

- Tax locks in a **marginal price** of polluting
  - Quantity of emissions floats depending on MC
- Cap locks in a **quantity** of pollution
  - Marginal price floats to ensure cap is met
- Thus, under a cap, marginal price of polluting depends on actions of all other polluters
  - If one polluter's demand for permits changes, this changes all other polluters marginal cost of polluting
- A tax does not have this problem
- This has important implications for policies which affect some regulated entities but not others

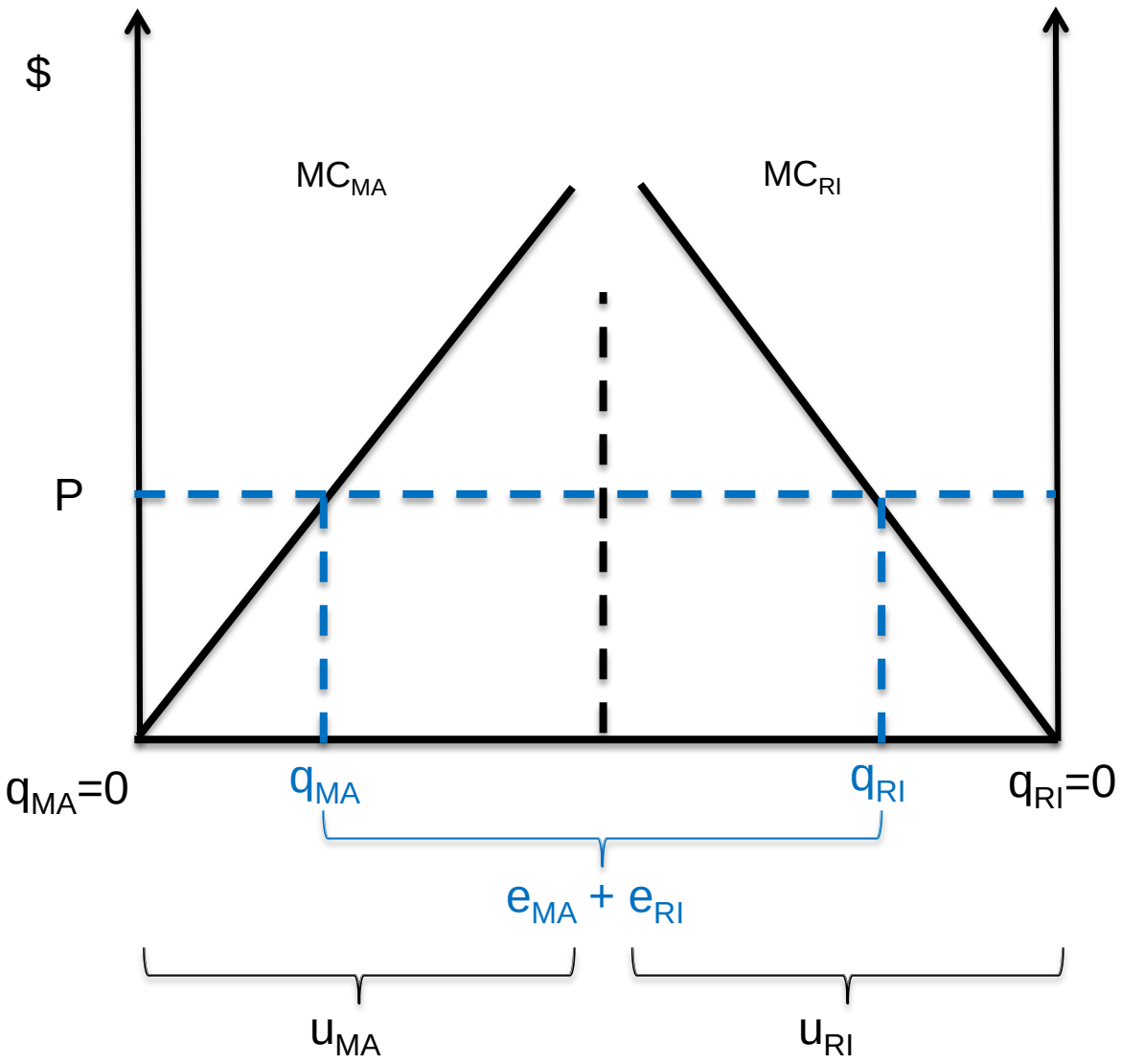
Example: Regional Greenhouse Gas Initiative (RGGI)

- Since 2008, 11 (now 9) states have capped emissions from the electric power sector
- Cap declines 2.5 percent each year until 2020
- 100% auctioning (revenue mostly for climate projects)
- **Trading of emissions permits across states**



RGGI States

Graphing a two state cap-and-trade policy



- Take our two axis graph and spread the x-axis out to equal the unconstrained emissions for Massachusetts and Rhode Island
- Policy places a cap on total emissions: $e_{MA} + e_{RI} <= E$
- Permit price P adjusts to ensure emissions below cap
- In this example, since MC and U are equal across states, so are resulting emissions.

What if some RGGI states want to do more?

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August 1, 2016

Mass. Clean Energy Bill Propels State to Head of the Pack

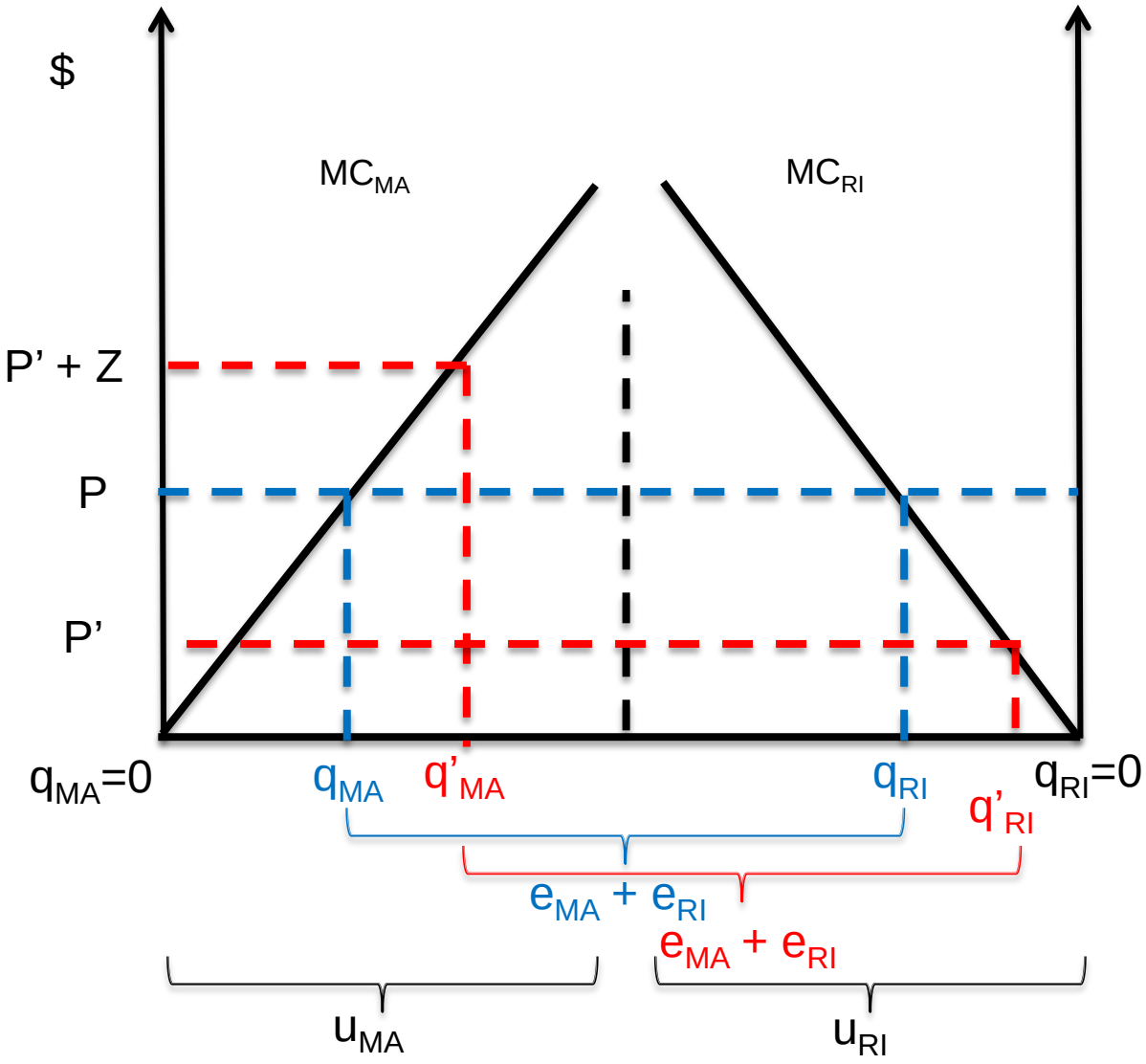
Statement by UCS President Ken Kimmell and Senior Energy Analyst John Rogers

Cambridge, Mass. (August 1, 2016)—The Massachusetts House and Senate have approved a comprehensive energy bill that will result in up to 40 percent of the state's electricity coming from hydropower, wind, and other sources by 2030, which will position Massachusetts once again as a clean energy leader, according to the Union of Concerned Scientists.

How renewable portfolio standards work

- An RPS is a mandate that a certain share **(s)** of electricity come from renewable sources
- An RPS of 20% mandates that R/(R+D)=s=.2
  - Where R = renewable; D = dirty generation
- Operationally:
  - Every time a renewable plant generates power it creates a credit
  - Every time a dirty plant generates power it has to procure **s/(1-s)** credits at total cost Z
  - Where Z floats to clear the market

What happens if MA passes an RPS?

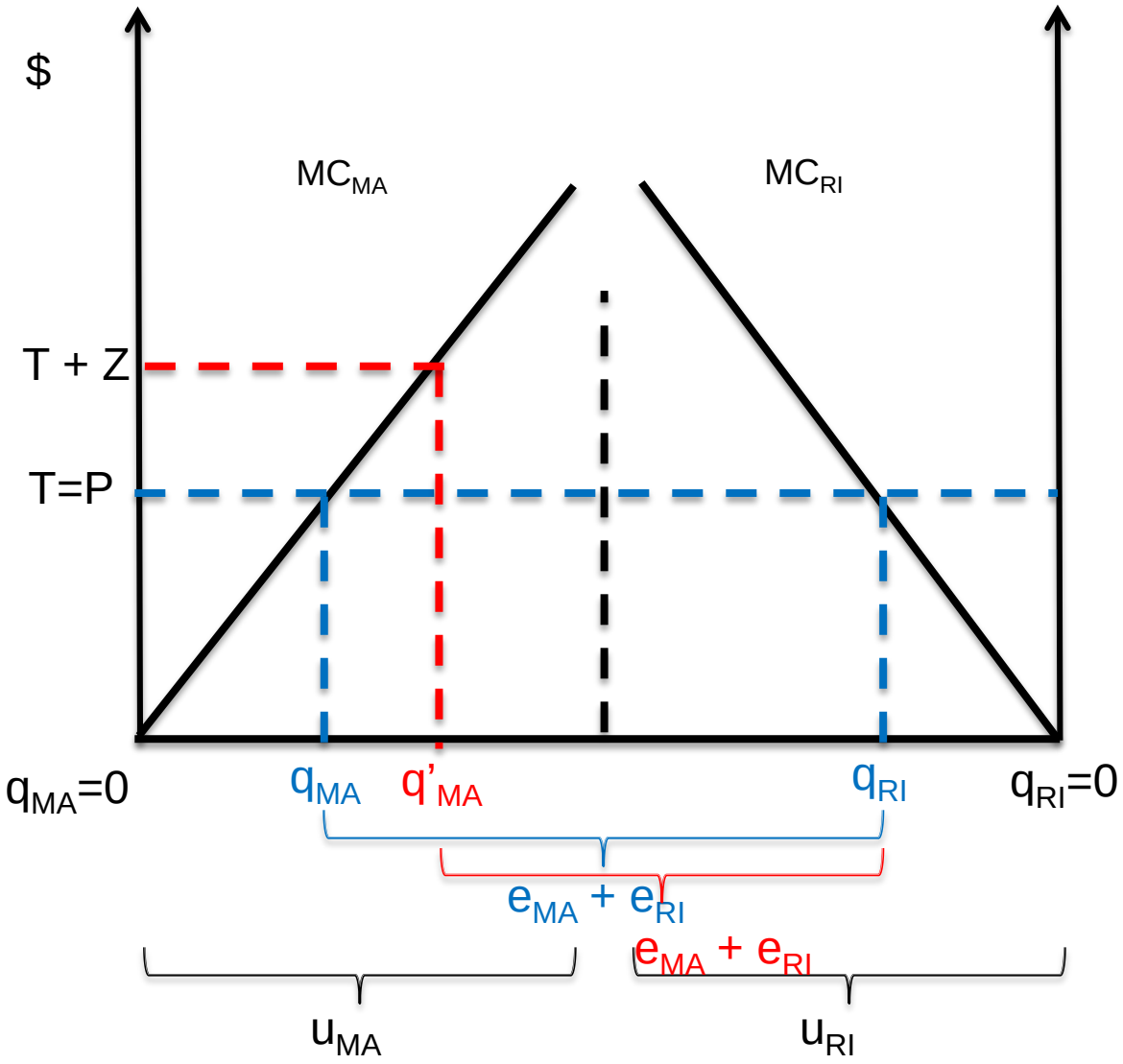


- Imagine the RPS is more strict than RGGI
- Polluters in MA now have to procure RPS credits as well as emission permits
  - MC(q) = P + Z
- Total emissions in MA decline
- Increases supply of permits for other RGGI states
  - If regional cap is fixed, MA effort reduces the effort RI must do
  - Price declines: P' < P

Result:

- Total emissions unchanged
- Policy no longer cost effective

What if RGGI had used a tax instead?



- Could set the tax such that emissions same as the cap
- Now, if MA enacts an RPS, polluters need to by credits and pay the tax T
  - marginal cost is T +Z, total emissions in MA decline
- However, since the tax does not depend on the quantity of emissions, the marginal cost of polluting in RI is unaffected
- Result: total emissions now decline
  - Policy still not cost effective

What if MA had a policy that was less stringent than RGGI?

- Imagine the RPS was totally redundant
  - Share of renewables under RGGI was already higher **s**
- Since the quantity supplied under RGGI exceeds the minimum set by the law, there is excess supply, and the permit price will go to zero
  - Can check this by looking at data on **Z**
- The result is that the state level policy has no effect on either emissions or cost effectiveness under either a tax or cap

Another example: Fuel economy standards

- Since the 1970's US has set Corporate Average Fuel Economy (CAFE) standards
- Mandate that across all cars sold in the US, the average fuel economy (miles per gallon) has to be above the federal mandate (currently 35.5 mpg)
- Basically acts like a quantity instrument (although an inefficient one):
  - For every Escape SUV Ford sells, it needs to find someone to buy a Fiesta
  - Allows for trading across firms

Pavley standards may result in 100% leakage under CAFE

- Currently at least 14 states have limits on GHG per mile
  - "Pavley standards"— named after sponsor of CA legislation requiring manufacturers to reduce per-mile GHG emissions by about 30 percent by 2016

- How do you think this interacts with CAFÉ?

Pavley standards may result in 100% leakage under CAFE

- GHG and fuel economy closely related.
  - If Pavley laws bind, effectively raises the fuel economy requirements for manufacturers in these states
- But CAFE is a national averaging policy
  - If it binds, manufacture wants to reduce fuel economy in non-Pavley states
- Increased hybrids in Pavley states will be offset but increased gas guzzlers elsewhere

Leakage can also occur across sectors

- CA has a cap and trade program (Assembly Bill 32)
  - Currently covers large industrial plants and electric power sector
  - Caps emissions at 10% below 1990 levels
- In addition, CA passed a 33% renewable portfolio standard
- What do you think the impact of this RPS will be given that CA has a quantity based instrument in place?

Two quantity based instruments in CA

- Cap would have set the marginal cost of electric power sector equal the MC industrial facilities
- Assuming RPS is binding, it requires additional reductions in electric power sector and fewer reductions from industrial facilities
- Marginal costs no longer equal, so total cost of the program must have gone up

This “belt and suspenders” approach to climate policy is very common

- 2009 Waxman-Markey cap-and-trade bill included renewable standards and energy efficiency subsidies
- CA has a low carbon fuel standard and green vehicle subsidies
- Are there any good reasons for this?

This “belt and suspenders” approach to climate policy is very common

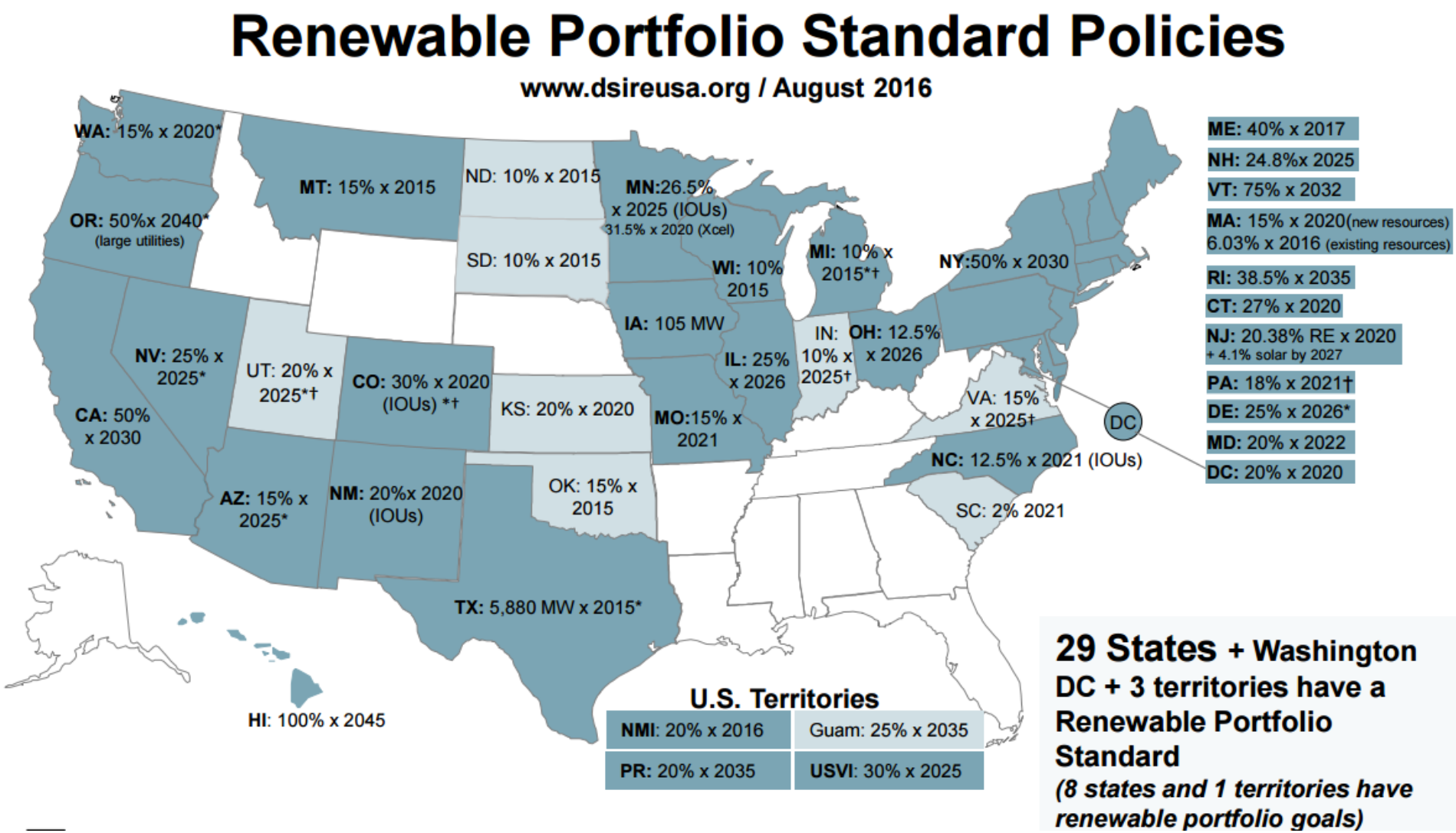
- Can possibly think of some justifications related to infant industries/ learning/ innovation
- But government record identifying those is pretty bad.
- Instead, this probably reflects regulators misunderstanding of or lack of faith in market based approaches

How might state level caps interact with federal price policies?

- Have talked about overlapping quantity instruments

- What happens if states have a quantity instrument but the federal government passes a price instrument?

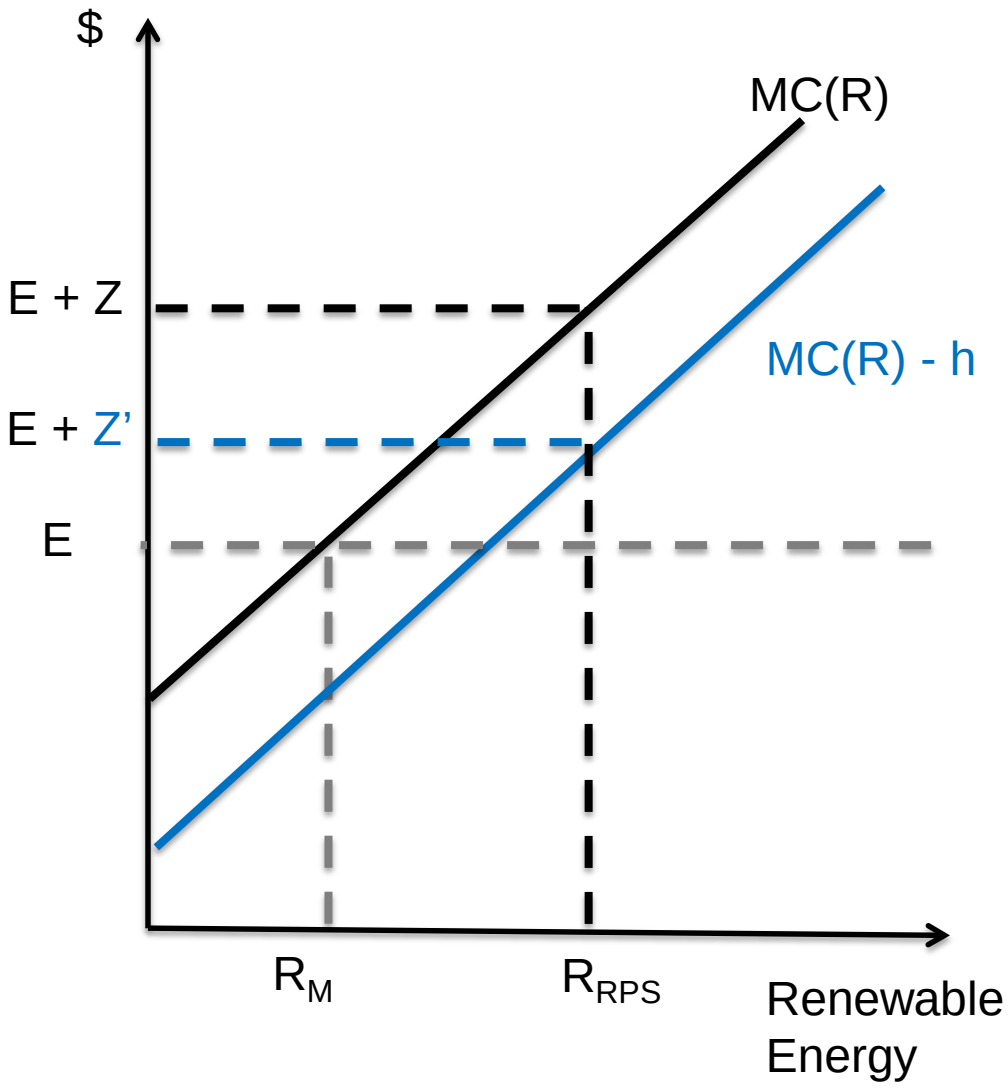
More than half the electric power grid covered under state RPSs



In addition, the federal government has generous subsidies for renewable energy

- Federal production tax credit pays wind farms $23/MWh
  - Almost a 50% increase in revenue
- Solar plants have 30% of their investment costs paid for by the federal investment tax credit.
- These policies are very expensive
  - Recent PTC extension scored at about $5 billion
- Are they doing any good?

How do federal renewable subsidies affect RPS states?



- E is the price of electricity
  - Without policy, quantity of renewable energy would be R_M
- State policy mandates R >= R_{RPS}
  - To achieve goal, polluters pay permit price Z
- A federal subsidy reduces the marginal cost of renewable energy by **h**
- If MC – h intersects E to the left of R_{RPS} , the state policy still binds
  - Subsidy has no impact on the quantity of renewables in the state
- Only effect is to lower the permit price Z that polluters have to pay
  - So this is like a subsidy from federal taxpayers to polluters

What about “green” electricity packages?

Your Renewable Energy Mix Options:

Our green power program adds a small premium to your electric bill. For most households, it only adds $15-20 per month or 45-74 cents per day. Your total payments toward *New England GreenStart* and *New England Wind* are **100% federally tax-deductible**.

Your rate per kWh is determined by the renewable energy option you choose. You can select from two renewable energy options, which differ in price and content:

Biggest Impact

New England Wind℠	
MIX	**100% wind power from Massachusetts wind turbines (Class I)**
RATE	**3.8 cents/kWh** in addition to your normal electric bill

New England GreenStart℠	
MIX	**25% Massachusetts wind, solar and anaerobic digester gas (Class I)** **75% New England low-impact hydropower**
RATE	**2.4 cents/kWh** in addition to your normal electric bill

Summary on overlapping instruments

- Future of climate action seems to be bottom up
  - Broad regional/ national / international coalitions will form over broadly popular measures
  - Smaller coalitions will pledge to do more
- But subgroup's ability to further reduce CO2 emissions is limited by the structure of the broader arrangement
  - If an overarching quantity policy is in place, the result is 100% leakage
- Remember: GHGs are uniformly mixing pollutants
- Under either a tax or cap, stricter subgroup policy undermines cost effectiveness