

# Clearing the Air: Cap-and-Trade vs. Carbon Tax

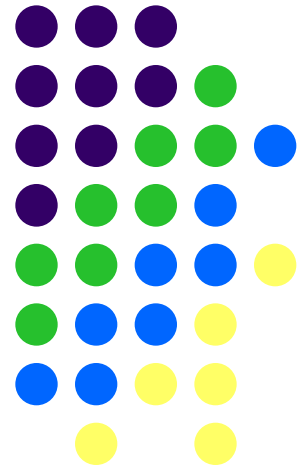
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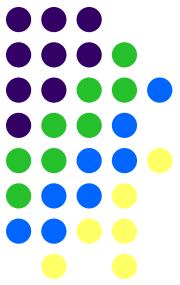


**Empowered Energy<sup>TM</sup>**

*Lori Smith Schell, Ph.D.*



# Useful Terminology



- GHG = Greenhouse Gases
- GWP = Global Warming Potential

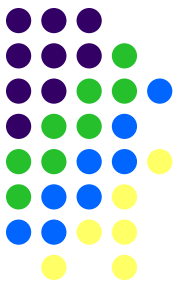
## GHG

## GWP (100 Yr)

- |   |             |
|---|-------------|
| ● Carbon Dioxide – CO <sub>2</sub>      | 1           |
| ● Methane – CH <sub>4</sub>             | 21          |
| ● Nitrous Oxide – N <sub>2</sub> O      | 310         |
| ● SF <sub>6</sub> – Sulfur Hexafluoride | 23,900      |
| ● Hydrofluorocarbons (13) – HFCs        | 140-11,700  |
| ● Perfluorocarbons (6) – PFCs           | 6,500-9,200 |
- CO<sub>2</sub>e = Carbon dioxide-equivalents
  - MT = metric tonne = 2,200 pounds
  - MMTCO<sub>2</sub>e = Million metric tonnes of CO<sub>2</sub>-equivalents

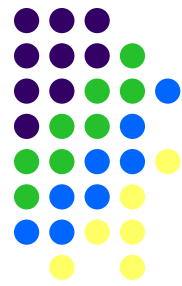
Source: U.N. Framework Convention on Climate Change website.

# Brief History of Global Climate Change Negotiations

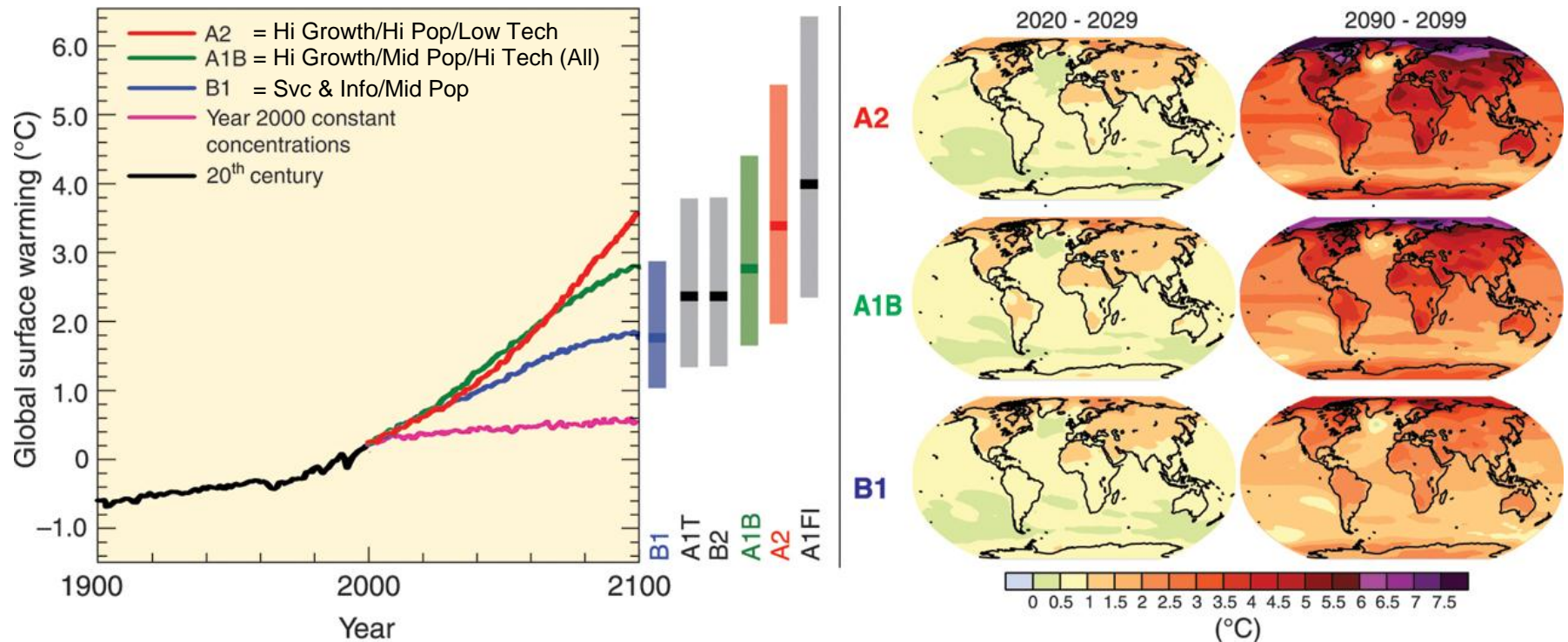


- 1989 – Intergovernmental Panel on Climate Change (“IPCC”)
  - Leading body for assessment of climate change
  - United Nations Environment Programme + World Meteorological Association
- 1992 – Rio Earth Summit
  - United Nations Framework Convention on Climate Change (“UCFCCC”)
    - **Encouraged** industrialized nations to stabilize GHG emissions
    - Conference of Parties (“COP”) to UCFCCC meets annually
- 1997 – Kyoto Protocol adopted
  - **Committed** 37 industrialized nations + the European community to binding GHG emissions reduction targets
  - Average reduction of 5% vs. 1990 from 2008-2012
  - Ratified by 184 Parties of the UNFCCC, but not the U.S.
- December 2007 – COP 13: Bali, Indonesia
  - Bali Roadmap: Complete new climate change negotiating process by 2009
- Negotiating for the Post-Kyoto Protocol world
  - December 2009 – COP 15: Copenhagen
    - Bali Roadmap negotiations not completed → COP 16: Cancun (12/10)

# Scenarios: IPCC Fourth Assessment Report (2007)

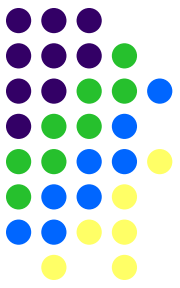


Surface Warming Relative to 1980-1999 (Various Scenarios, 2007 Data):



Source: Intergovernmental Panel on Climate Change, Fourth Assessment Report, "Climate Change 2007: Synthesis Report," 2007, Figure 3.2, p. 46.

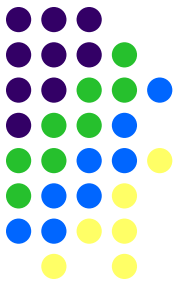
# Premise: U.S. Climate Change Legislation Likely...Someday



- Regulatory need reflects a market failure
  - Failure to monetize the true cost of GHG emissions
- Cap-and-Trade has greatest momentum; Carbon Tax proponents playing catch-up
- Type of legislation determines Congressional lead
  - Carbon Tax => Tax Committees
    - House Committee on Ways and Means
    - Senate Committee on Finance
  - Cap-and-Trade => Environmental Policy Committees
    - House Committee on Energy and Commerce
    - Senate Committee on Environment and Public Works
- Businesses just want certainty

*2009 Waxman-Markey Bill:  
American Clean Energy and  
Security Act ("ACES")*

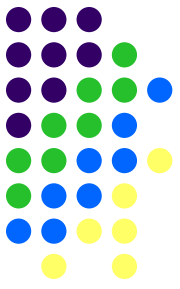
*2010 Kerry-Lieberman Draft:  
American Power Act ("APA")*



# Non-Market-Based Programs for Controlling Emissions

- Command-and-Control Regulations
  - Performance Standards
  - Energy Efficiency Programs
  - Vehicle Emissions Standards
    - Annual Emissions Checks
    - Low Carbon Fuel Requirements
    - Seasonal Oxygenated Fuel Requirements
  - Direct Regulations
    - Codes
    - Standards

# Market-Based Programs for Controlling Emissions



- Carbon Tax: Control PRICE of Emissions
- Cap-and-Trade: Control QUANTITY of Emissions
- Common features:
  - Determine where compliance is measured
  - Determine who must comply (i.e., program participants)
  - Need for measurement, monitoring, reporting, enforcement
    - Penalties high enough to ensure compliance
  - Both will favor lower-carbon fuel input
  - Both will favor lower-carbon content output

# In a Perfect World Each Would Achieve the Same Outcome

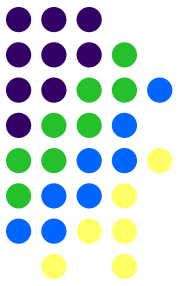
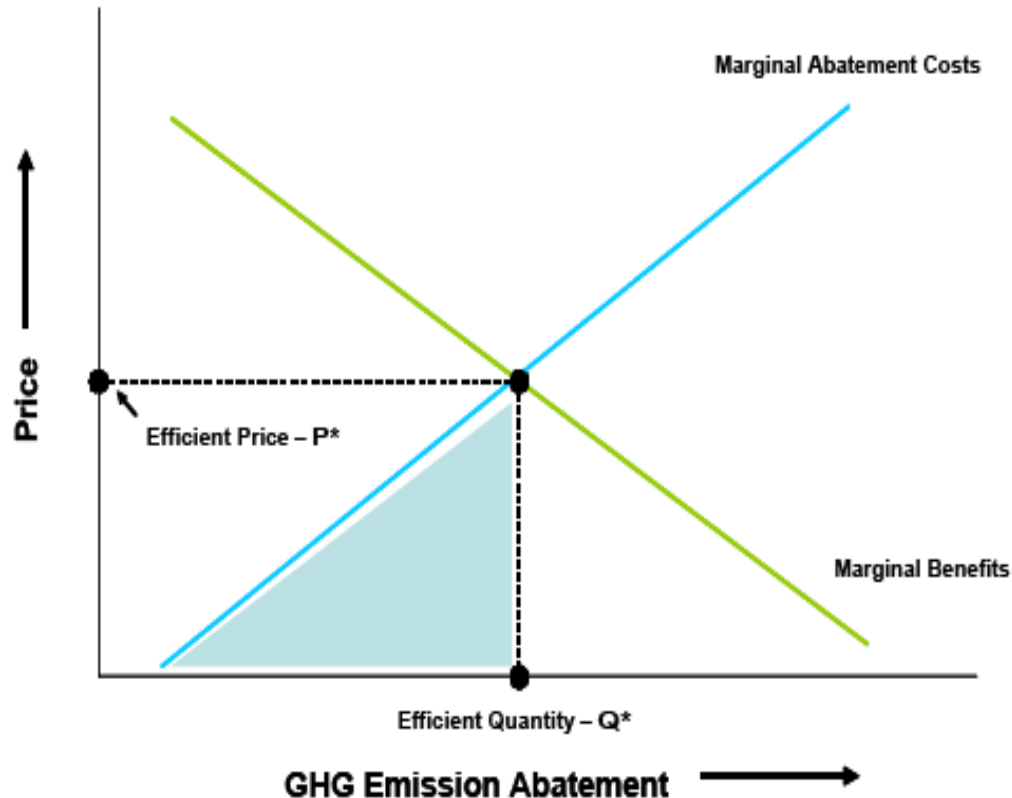


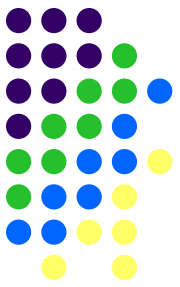
Figure 1. Illustration of Price Versus Quantity



Source: Congressional Research Service, "Carbon Tax and Greenhouse Gas Control: Options and Considerations for Congress," Figure 1, p. 4.

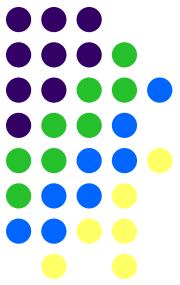


# Who Complies? Where?



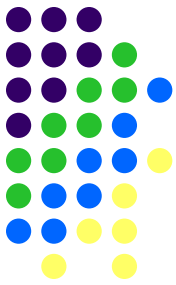
- Where to measure emissions?
  - Downstream: Output-based (e.g., per ton CO<sub>2</sub> emitted)
    - Carbon emitters pay based on CO<sub>2</sub> emissions
  - Upstream: Input-based (e.g., per MMBtu of fuel input)
    - Carbon suppliers pay based on CO<sub>2</sub> content of fuel provided
    - Significantly fewer direct program participants
    - Direct program participants ≠ GHG emitters
    - Compliance costs impact all carbon-based fuel prices
- Which sectors of the economy must comply?
  - Electricity generators/industrial boilers/fuel suppliers?
    - All facilities in sector?
    - Only those above a specified size or output level?

# Fundamentals of a Carbon Tax



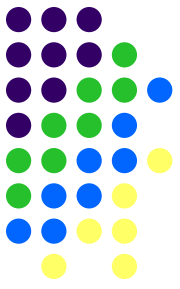
- Control PRICE of emissions
- Fix the \$/ton of CO<sub>2</sub> price at the outset
  - How to set initial \$/ton of CO<sub>2</sub> price (i.e., tax rate)?
  - What to do with the resultant tax revenue?
- Once price is set, maximum compliance cost **known**
  - CO<sub>2</sub> price is known; have price transparency
- Total amount of/reduction in emissions **uncertain**
- Administratively simpler than cap-and-trade
  - Tax collection systems already in place
- Easy to modify; only have to change \$/ton CO<sub>2</sub> price
- Any tax increase is politically difficult to “sell”

# Carbon Tax: As Simple as...



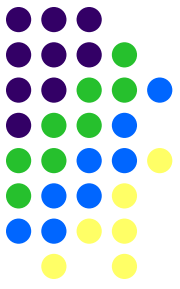
Form <b>GHG</b>  Department of the Treasury Internal Revenue Service	<h2 style="margin: 0;">Greenhouse Gas (GHG) Tax</h2> <p style="margin: 5px 0;">▶ <b>Attach to Form 1120 or Form 1040.</b>      ▶ <b>See instructions.</b></p>	OMB No. 2976-0013  <h1 style="margin: 0;">2010</h1> Attachment Sequence No. <b>89</b>	
Name(s) shown on return		Your EIN or Social Security number	
1	<b>(a) Facility Name</b> _____ _____	<b>(b) Facility ID No.</b> _____ _____	<b>(c) 2010 tons of GHG Emissions</b> _____ _____
2	Add amounts on line 1, column (c), and enter the total.....		2
3	Enter applicable GHG tax rate.....	3	
4	Multiply the amount on line 2, column (c), times tax rate on line (3)...		4
5	Enter the total from line 4, column (c), on Form 1120, line 49 or on Form 1040, line 22 <b>This is your GHG Tax</b> .....		5

# Fundamentals of Cap-and-Trade: I



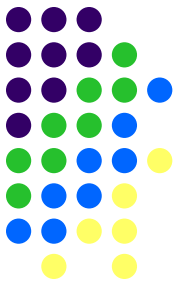
- Control QUANTITY of emissions
  - Emissions allowances are the “currency” of cap-and-trade
  - 1 Emissions Allowance = Right to emit 1 ton of CO<sub>2</sub>
  - Cap = Limited number of emissions allowances made available each compliance period (e.g., calendar year)
    - New Entrant Reserve sets aside a portion of the total cap for new facilities
  - Each emissions allowance has a vintage year
  - Trading period extends beyond compliance period
- How to set yearly cap?
- How to ratchet cap down over time?
- How to allocate emissions allowances?

# Fundamentals of Cap-and-Trade: II



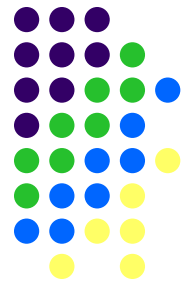
- Capped emissions allowances must be allocated
  - Free allocation based on baseline year emissions
    - Rewards participants with higher emissions in baseline year
  - Free allocation based on a performance benchmark
    - Rewards more efficient participants
    - Additional allowances available through trading or auction
  - 100% sold at auction
    - What to do with auction revenues?
  - Hybrid: Free allocation of some, auction of others
    - Free allocation initially, moving increasingly toward full auction
    - California: Initial free allocation of some emissions allowances to manage “competitiveness and economic transition issues”

# Fundamentals of Cap-and-Trade: III



- Easier to “sell” politically because (improperly) is not explicitly identified as a tax
- Administratively more difficult than carbon tax
  - Allowances must be tracked by vintage and owner
  - Trading market requires property right certainty
- More difficult to modify; all allocations have to be reviewed unless changes limited to pro rata
- Resultant price of emissions allowances uncertain
  - Existing cap-and-trade programs have experienced significant price volatility

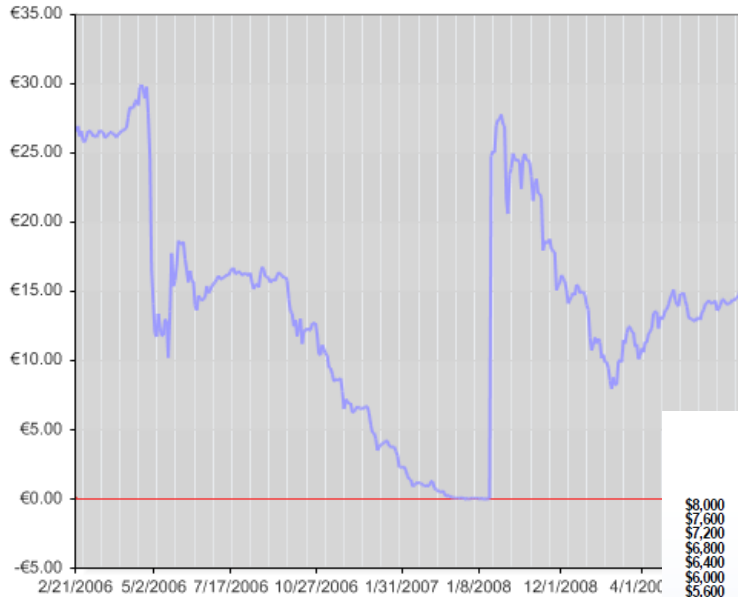
# Examples of Cap-and-Trade Pricing Volatility



European CO<sub>2</sub> Prices (\$/tonne)

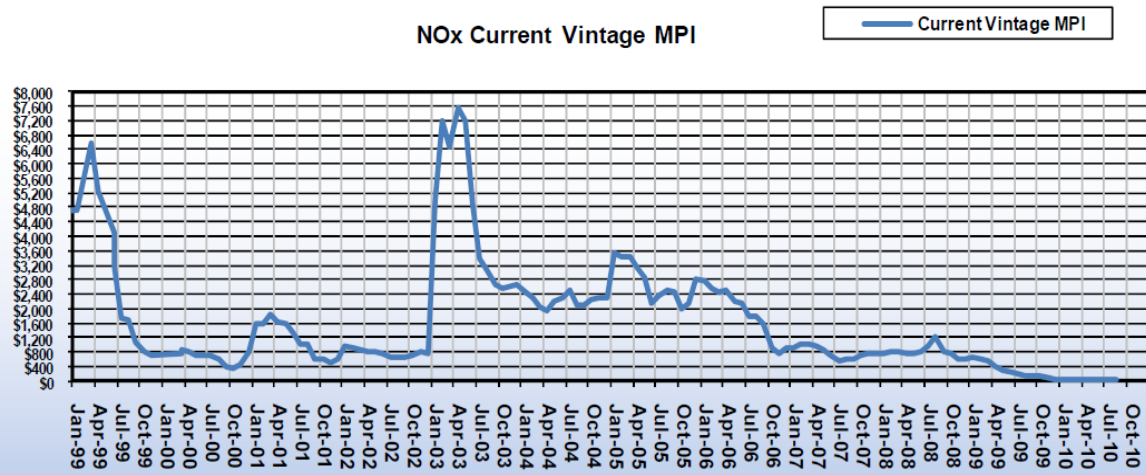
EU ETS – 27 European States

- Phase I – 2005-2007
- Phase II – 2008-2012
- Phase III – 2013-2020



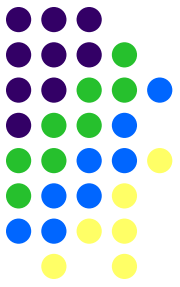
Source: CantorCO2e website.

Northeastern U.S. NO<sub>x</sub> Prices (\$/ton)



Source: CantorCO2e, "Monthly Market Price Indices," August 2010, p. 3.

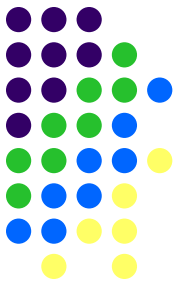
# Cap-and-Trade Variations to Reduce Price Volatility



- Banking
  - Encourages early compliance
  - Use banked emissions allowances in later years
- Borrowing
  - Use later vintage allowances for current compliance
- Safety Valve
  - Set a threshold price on emissions allowances
    - Issue additional emissions allowances
    - Suspend compliance requirements
- Offsets
  - Allow out-of-region (or non-participant) emissions reductions to count toward program compliance
  - Limited quantities allowed
  - May be difficult to authenticate actual out-of-region reductions
  - Could also be used with carbon tax

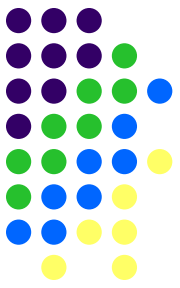


# Total Compliance Costs Differ Depending on Program Type



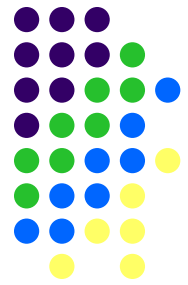
- Carbon tax
  - No ability to trade
  - Everyone in the sector pays the same tax rate
  - Compliance cost differences not exploited
- Trading under cap-and-trade
  - Takes advantage of compliance cost differences to minimize total *societal* compliance costs
  - Freely allocated allowances create profit potential
  - Fear of Enron-type abuses with trading

# Impact of Putting a Price on CO<sub>2</sub>

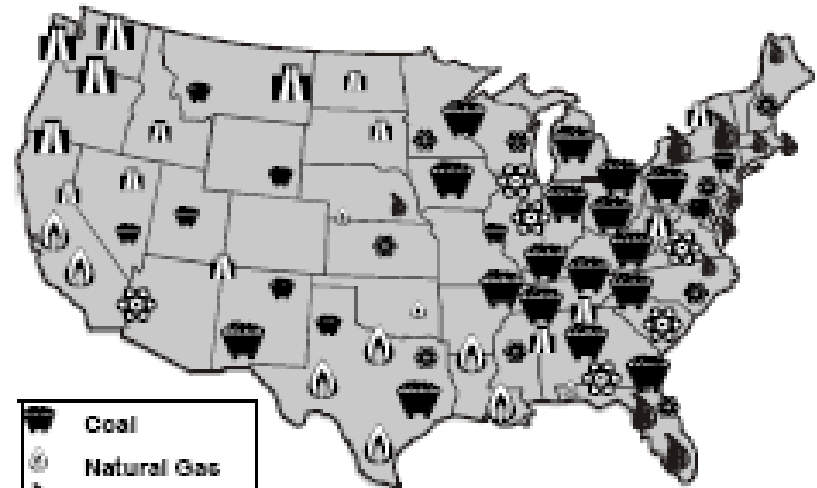
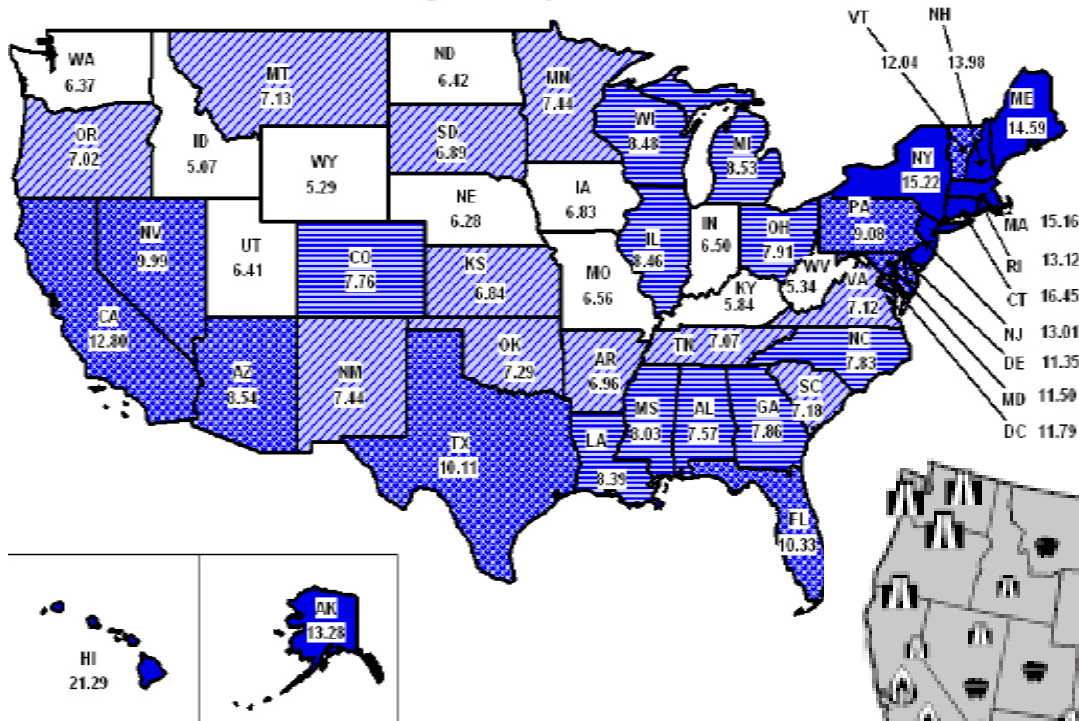


- Automatically calculates “carbon footprint” cost
  - Increases price of high carbon-content products
  - Provides incentive for lower carbon-content products
  - Encourages new carbon-reduction technologies
- Simplified illustration of economic impacts:
  - At \$25/ton CO<sub>2</sub> impact on electricity prices would be:
    - Pulverized Coal Plant: 1 ton of CO<sub>2</sub>/MWh x \$25/ton CO<sub>2</sub> = \$25/MWh = **2.5 cents/kWh**
    - Natural Gas Combined Cycle Plant: 0.5 ton of CO<sub>2</sub>/MWh x \$25/ton CO<sub>2</sub> = \$12.50/MWh = **1.25 cents/kWh**
- Differential regional impact
  - Job gains/losses
  - Manufacturing capacity gains/losses

# Regional Impacts Will Differ Significantly

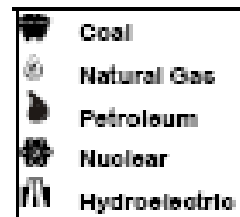


U.S. Total Average Price per kilowatthour is 9.13 Cents

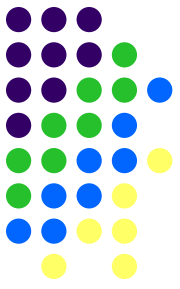


Source: U.S. Department of Energy, Energy Information Administration, "Electric Power Annual 2007," January 2009, Fig. 7.4, p. 63.

Source: U.S. Department of Energy, Energy Information Administration, "The Changing Structure of the Electric Power Industry 2000: An Update," October 2000, Fig. 5, p. 12.

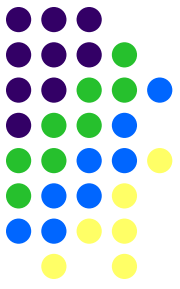


# Revenue Recycling: Political Dream or Nightmare?



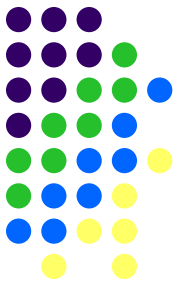
- Promote climate change policy objectives
  - Invest in research & development
  - Stimulate new technologies and greater energy efficiency
- Rebate revenue back to affected consumers
  - Dampens desired consumer behavior modification
  - Difficult to design an equitable rebate
    - Who defines “equitable”?
  - One proposal: Flat per capita dividend
    - Transparent & simple; less subject to manipulation
    - Progressive (poorer consumers ► greater “+” impact)
    - Regional redistribution impact raises equity issues
- Reduce the national debt
- [Add your favorite political cause here]

# Broader Issues



- International and regional compatibility of different climate change programs
  - Compliance enforcement
    - Changing political regimes
    - Differential program commitment
  - Leakage
    - Less likely the larger the region included in the program
- Equity issues between industrialized and developing countries
  - Fair to limit developing country growth?
    - Emissions tend to increase with economic growth
  - One example: Performance-based cap-and-trade
    - Linked to economic growth
    - Favored by developing countries (e.g., China, India, Brazil)

# Cap-and-Trade vs. Carbon Tax: Two Sides of the Same Coin



**Carbon Tax: Control Cost of Emissions**

*Someone has  
to pay...*



**Cap-and-Trade: Control *Quantity* of Emissions**