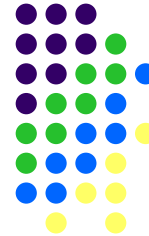


Cap-and-Trade VS. Carbon Tax: What's Ahead for California?

ICEPAG 2011
10 February 2011
Costa Mesa, California

Lori Smith Schell, Ph.D.



Useful Terminology

- GHG = Greenhouse Gases
- GWP = Global Warming Potential

<u>GHG</u>	<u>GWP (100 Yr)</u>
● Carbon Dioxide – CO ₂	1
● Methane – CH ₄	21
● Nitrous Oxide – N ₂ O	310
● SF ₆ – Sulfur Hexafluoride	23,900
● Hydrofluorocarbons (13) – HFCs	140-11,700
● Perfluorocarbons (6) – PFCs	6,500-9,200

- CO₂e = Carbon dioxide-equivalents
- MT = metric tonne = 2,200 pounds
- MMTCO₂e = Million metric tonnes of CO₂-equivalents

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

California Takes the Lead in Climate Change Legislation



- California Global Warming Solutions Act of 2006 (“AB 32”)
 - Reduce GHG emissions to 1990 levels by 2020
 - Implement cap-and-trade program as of 1/1/2012
- Other U.S. Regional Climate Change Efforts
 - RGGI
 - Western Climate Initiative
- U.S. to follow California’s lead?
 - EPA to promulgate GHG regulations under Clean Air Act in lieu of Congressional legislation
- Regulatory need reflects a market failure
 - Failure to monetize true cost of GHG emissions

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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

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Market-Based Programs for Controlling Emissions



- Cap-and-Trade: Control QUANTITY of Emissions
 - California's chosen methodology for AB32
- Carbon Tax: Control PRICE of Emissions
 - California's Reserve Auction Price hints at this
- 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 favor lower-carbon content (fuel) input and output

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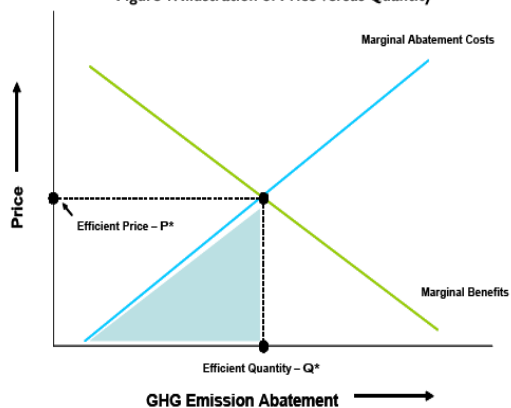
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In a Perfect World Each Would Achieve the Same Outcome



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.

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Impact of Putting a Price on CO₂



- 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 CO₂ impact on electricity prices would be:
 - Pulverized Coal Plant: 1 ton of CO₂/MWh x \$25/ton CO₂ = \$25/MWh = **2.5 cents/kWh**
 - Natural Gas Combined Cycle Plant: 0.5 ton of CO₂/MWh x \$25/ton CO₂ = \$12.50/MWh = **1.25 cents/kWh**
- Differential regional impact
 - Job gains/losses
 - Manufacturing capacity gains/losses

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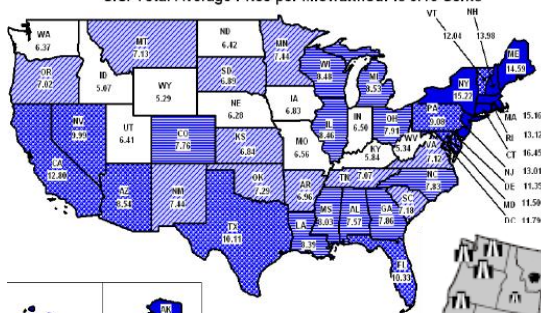
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U.S. Impacts Will Differ Significantly by Region

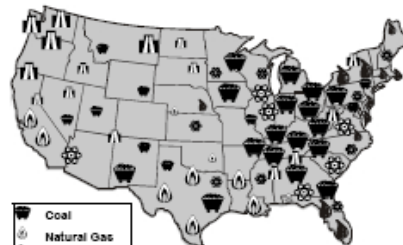


U.S. Total Average Price per kilowatthour is 9.13 Cents



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.

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



- Coal
- Natural Gas
- Petroleum
- Nuclear
- Hydroelectric

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Who Complies? Where?



- Where to measure emissions?
 - Downstream: Output-based (e.g., per ton CO₂ emitted)
 - Carbon emitters pay based on CO₂ emissions
 - Upstream: Input-based (e.g., per MMBtu of fuel input)
 - Carbon suppliers pay based on CO₂ 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?

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Fundamentals of a Carbon Tax



- Control PRICE of emissions
- Fix the \$/ton of CO₂ price at the outset
 - How to set initial \$/ton of CO₂ price (i.e., tax rate)?
 - What to do with the resultant tax revenue?
- Once price is set, maximum compliance cost **known**
 - CO₂ 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 CO₂ price
- Any tax increase is politically difficult to “sell”

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Carbon Tax: As Simple as...



Form GHG		Greenhouse Gas (GHG) Tax		OMB No. 2976-0013
Department of the Treasury Internal Revenue Service		▶ Attach to Form 1120 or Form 1040.		▶ See instructions.
				2012
				Attachment Sequence No. 89
Name(s) shown on return			Your EIN or Social Security number	
1	(a) Facility Name	(b) Facility ID No.	(c) 2012 tons of GHG Emissions	
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 This is your GHG Tax		5	

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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 CO₂
 - Cap = Limited number of emissions allowances made available each compliance period (e.g., calendar year)
 - Each emissions allowance has a vintage year
 - Trading period extends beyond compliance period
- Easier to “sell” politically because (improperly) is not explicitly identified as a tax
- How to allocate emissions allowances?
- How to set yearly cap?
- How to ratchet cap down over time?

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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 using Industrial Assistance Factor, based on leakage risk

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Leakage Risk	ARB Classification	NAICS	Industry Assistance Factor (AF) by Budget Year		
			2012-2014	2015-2017	2018-2020
High	Oil and gas extraction	211111	100%	100%	100%
	Natural gas liquid extraction	211112	100%	100%	100%
	Soda ash mining and manufacturing	212391	100%	100%	100%
	Reconstituted Wood Product Manufacturing	321219	100%	100%	100%
	Paper manufacturing	322121	100%	100%	100%
	Paperboard manufacturing	322130	100%	100%	100%
	All Other Basic Inorganic Chemical Manufacturing	325188	100%	100%	100%
	Flat glass manufacturing	327211	100%	100%	100%
	Glass container manufacturing	327213	100%	100%	100%
	Cement manufacturing	327310	100%	100%	100%
	Lime manufacturing	327410	100%	100%	100%
	Iron and steel mill	331111	100%	100%	100%
	Medium	Food manufacturing	311	100%	75%
Cut and sew apparel mfg		3152	100%	75%	50%
Breweries		312120	100%	75%	50%
Sawmills		321113	100%	75%	50%
Petroleum refining		324110	100%	75%	50%
Pesticide and agricultural chemical manufacturing		325320	100%	75%	50%
Polystyrene foam product mfg		326140	100%	75%	50%
Gypsum product manufacturing		327420	100%	75%	50%
Mineral wool manufacturing		327993	100%	75%	50%
Rolled steel shape manufacturing		331221	100%	75%	50%
Secondary smelting and alloying of aluminum		331314	100%	75%	50%
Secondary smelting, refining, and alloying of nonferrous metal (except copper and aluminum)		331492	100%	75%	50%
Iron foundries		331511	100%	75%	50%
Turbine and turbine generator set units manufacturing		333611	100%	75%	50%
Low	Pharmaceutical and medicine mfg	325412	100%	50%	30%
	Aircraft manufacturing	336411	100%	50%	30%

Source: AB 32, Appendix A - Proposed Regulation Order, p. A-76.

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California Compliance Periods and “Covered Entities”



	Budget Year	Annual Allowance Budget (Millions of CA GHG Allowances)
First Compliance Period	2012	165.8
	2013	162.8
	2014	159.7
Second Compliance Period	2015	394.5
	2016	382.4
	2017	370.4
Third Compliance Period	2018	358.3
	2019	346.3
	2020	334.2

Phase-In of Covered Entities (> 25,000 MT CO₂e per year):

- I. Industrial Facilities + First Deliverers of Electricity
 - Generating Facilities
 - Electricity Importers

DOWNSTREAM FOCUS
- II. Fuel Deliverers (Net of Covered Entity Deliveries)

UPSTREAM FOCUS



Source: AB 32, Appendix A - Proposed Regulation Order, p. A-60.

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Fundamentals of Cap-and-Trade: III



- 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

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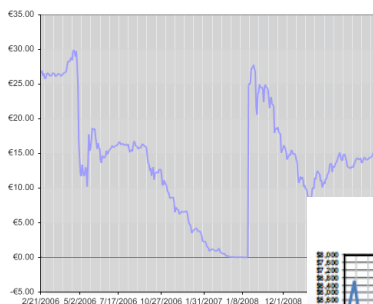
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Examples of Cap-and-Trade Pricing Volatility



European CO₂ Prices (\$/tonne)

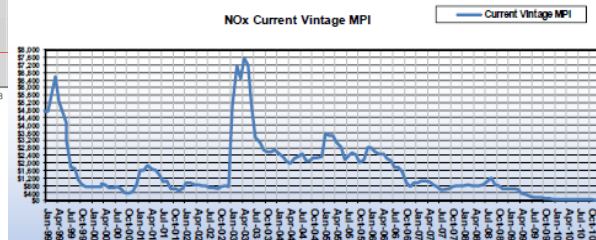


Source: CantorCO2e website.

EU ETS – 27 European States

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

Northeastern U.S. NO_x Prices (\$/ton)



Source: CantorCO2e, "Monthly Market Price Indices," December 2010, p. 3.
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California's Attempt to Limit Market Price Volatility



- Mandated: Quarterly Auctions
 - 12th Business Day of First Month in Quarter
- Allowance Price Containment Account
 - Period 1: 1% Period 2: 4% Period 3: 7%
- Auction Reserve Price
 - 2012 Auctions: Auction Reserve Price
 - 2012 Vintage = \$10.00/MT CO₂e
 - 2015 Vintage: \$11.58/MT CO₂e
 - Subsequent Year Auctions:
 - Escalates at inflation rate + 5% per year

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Cap-and-Trade Variations to Reduce Price Volatility



- Offsets
 - Allow out-of-region (or non-participant) emissions reductions to count toward program compliance
 - Limited quantities allowed (e.g., 8% in California)
 - May be difficult to authenticate actual out-of-region reductions
 - Offset rules account for > 1/3 of proposed California AB32 regulations
 - Could also be used with carbon tax
- Banking
 - Encourages early compliance
 - Use banked emissions allowances in later years
- Borrowing
 - Use later vintage allowances for current compliance
- Safety Valve (vs. California's Auction Reserve Price)
 - Set a threshold price on emissions allowances
 - Issue additional emissions allowances
 - Suspend compliance requirements

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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
 - Limited by California's Auction Reserve Price
 - Freely allocated allowances create profit potential
 - Fear of Enron-type abuses with trading

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Revenue Recycling: Political Dream or Nightmare?



- 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
- Promote climate change policy objectives
 - Invest in research & development
 - Stimulate new technologies and greater energy efficiency
- Reduce state (or national) debt
- [Add your favorite political cause here]

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Broader Issues



- International and regional program compatibility
 - Linkage: Compliance enforcement
 - Changing political regimes
 - Differential program commitment
 - Leakage: Compliance avoidance
 - Less likely the larger the region included in the program
- Equity issues: Industrialized vs. developing countries
 - Fair to limit developing country growth?
 - Emissions tend to increase with economic growth
 - One example: Performance-based cap-and-trade
 - Cap linked to economic growth
 - Favored by developing countries (e.g., China, India, Brazil)

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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

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