Synapse
Energy Economics, Inc.

# Cap and Trade $CO_2$ Regulation: Efficient Mitigation or a Give-away?

ELCON Spring Workshop – Nashville, TN

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# Cap and Trade: Design Is Important


  

# The Plan…

- Chris:
  - Cap and Trade design considerations
  - Auction vs. allocation
  - Industrial user role
- Ezra:
  - Cap and Trade carbon regulation in *REGULATED* and *DEREGULATED* electricity markets
  - Example: Hypothetical Cap & Trade program impacts in PJM
  - Take-home messages
- Questions & Discussion

  

# Design Elements

- What is the baseline and how is it set?
- Apportionment: how are emissions calculated?
- Allowances: Who gets them and how are they allocated?
- Auctions: What are they? Why do they matter?
- How do these elements relate to the industrial sector

  

# Cap and Trade Fundamentals

- History: 1991 amendments to the Clean Air Act: acid rain
- 1998: Ozone Transport Region (NE and mid-Atlantic States: Nox budget program
- 2005 European Union: $CO_2$ emissions trading system
- 2009: US NE states: Regional Greenhouse Gas Initiative (RGGI)

  

# Differences Between Regulating Emissions of Acid Rain and Greenhouse Gases

## Acid Rain:

- Regulated utility environment
- Direct controls, applied upstream
- Measure reductions at stack with CEM
- Co-benefits: “what’s a co-benefit?”

## Greenhouse Gases:

- Patchwork: regulated and restructured
- Regs applied upstream, “controls”?
- CEM measure $CO_2$, but no control devices
- Co-benefits: matter, as do unintended consequences

  

# Regulated v. Patchwork

- Regulated utilities recover costs through their PSC
- Restructured utilities include costs in hourly electricity bids
- Consumers pay in both cases

  

# Direct v. Indirect Controls

- Acid rain: install scrubbers and SCR, measure reductions = simple
- GHG: limited direct options: fuel switching, nuclear, but both are expensive, have financial risks and take years to construct
- Indirect: energy efficiency, distributed generations (CHP).

  

# Baseline

- What year? Current, highest three, average of last three years
- Applicability: size threshold and basis. Count behind the meter generation?

  

# Apportionment

- What basis?
- Heat input: pounds $CO_2$ per MMBTu?
- Generation output: pounds $CO_2$ per MWh
- Population
- Consumption
- Hybrid of the above?
- How matters, and states may make the ultimate decision

  

# Allocation

- Who receives allowances?
- Generators?
- Load serving entities?
- First seller?
- Are allowances provided administratively (free), auctioned, or a mix?

  

# Industrial Sector Role in GHG

- Energy efficiency investments cost-effective (EE potential studies:1-2 c/kWh in many states)
- States also have climate plans, where EE is one of chief means to achieve reductions
- Co-benefits: new ozone standard out; ISO-NE and PJM capacity markets, generate credits for energy efficiency performance standards

  

# Auctions

- Why?
- Acid rain: generators sold allowances and invested $ in controls.
- GHG: generators sell allowances and ???
- Auction: capture portion of this revenue and direct it to programs that reduce GHG and provide ratepayer benefits

  

# Cap & Trade Regulation

…Cap and Trade allocates scarce resource (emission rights) to most efficient application…blah, blah, blah…

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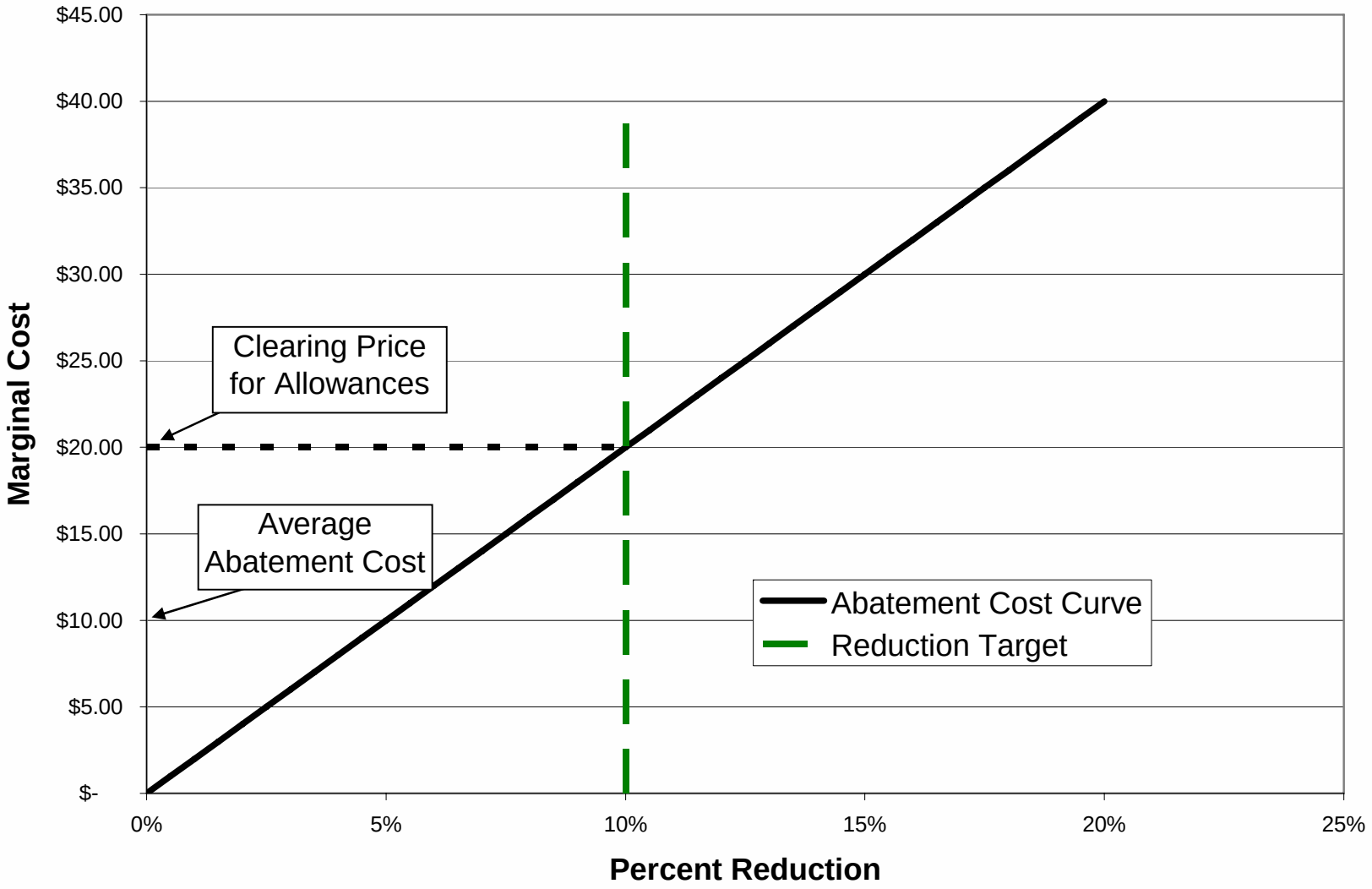
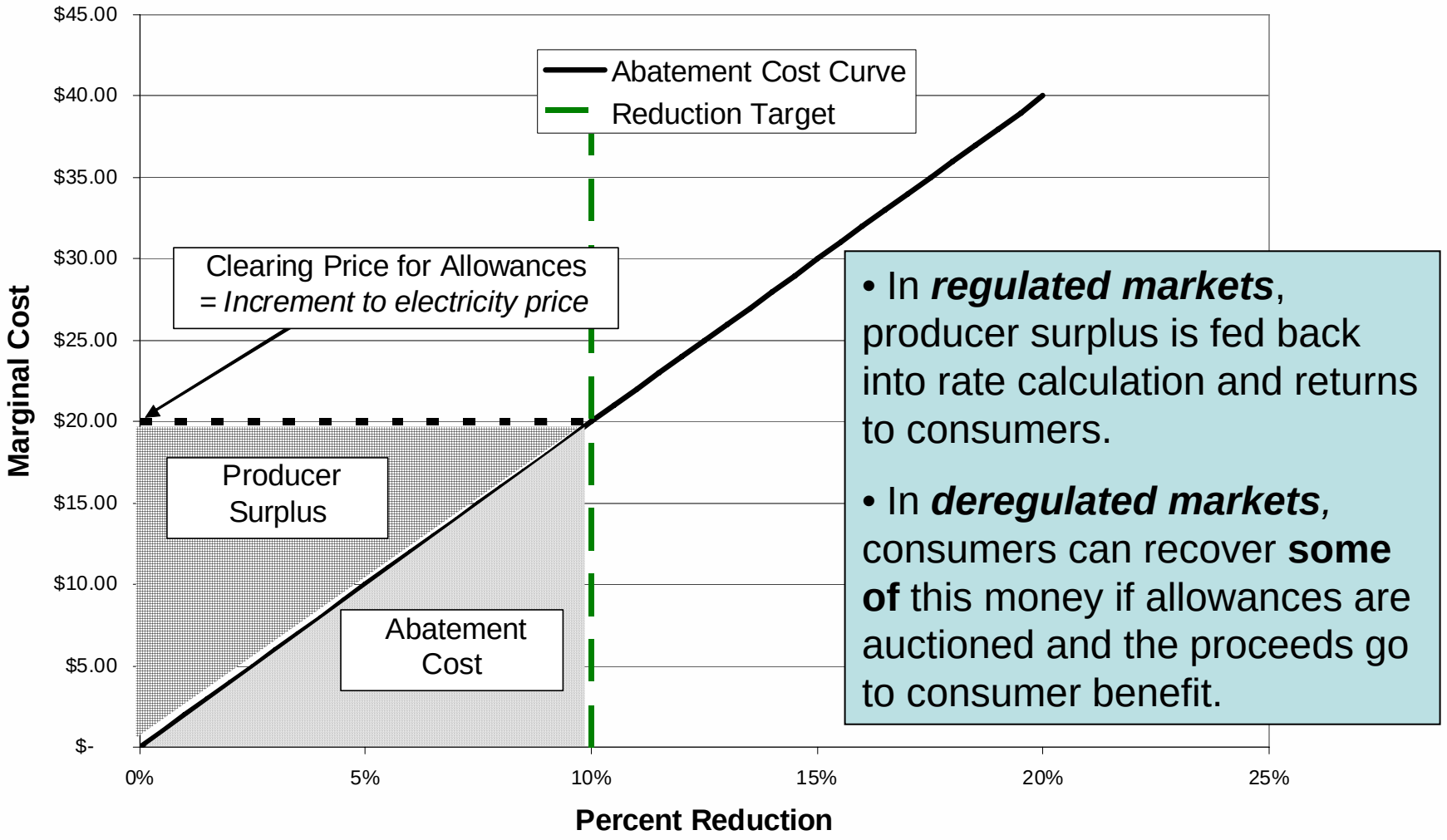
# What they show you…



# What they may neglect to mention…



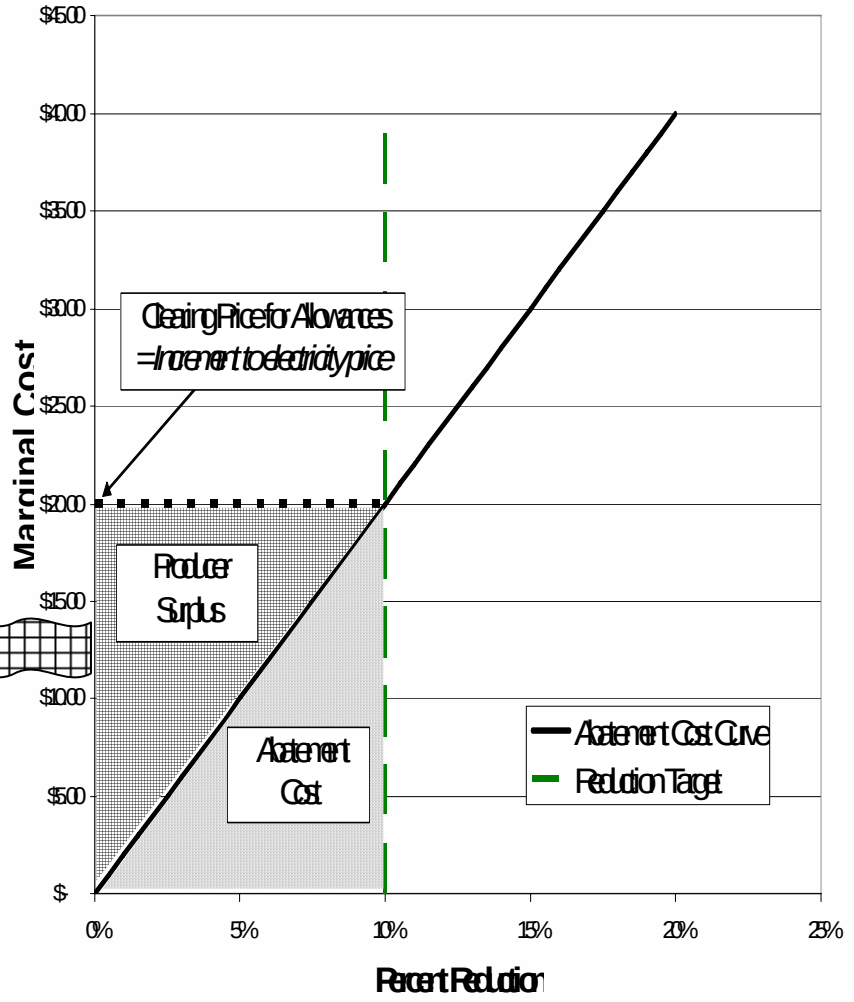

- In ***regulated markets***, producer surplus is fed back into rate calculation and returns to consumers.
- In ***deregulated markets***, consumers can recover **some of** this money if allowances are auctioned and the proceeds go to consumer benefit.

# Oh, and this…

Payoff for existing low-carbon resources (primarily nuclear) in **deregulated** electricity markets:

- *Additional revenue: $Billions*
- *Additional cost: $0*



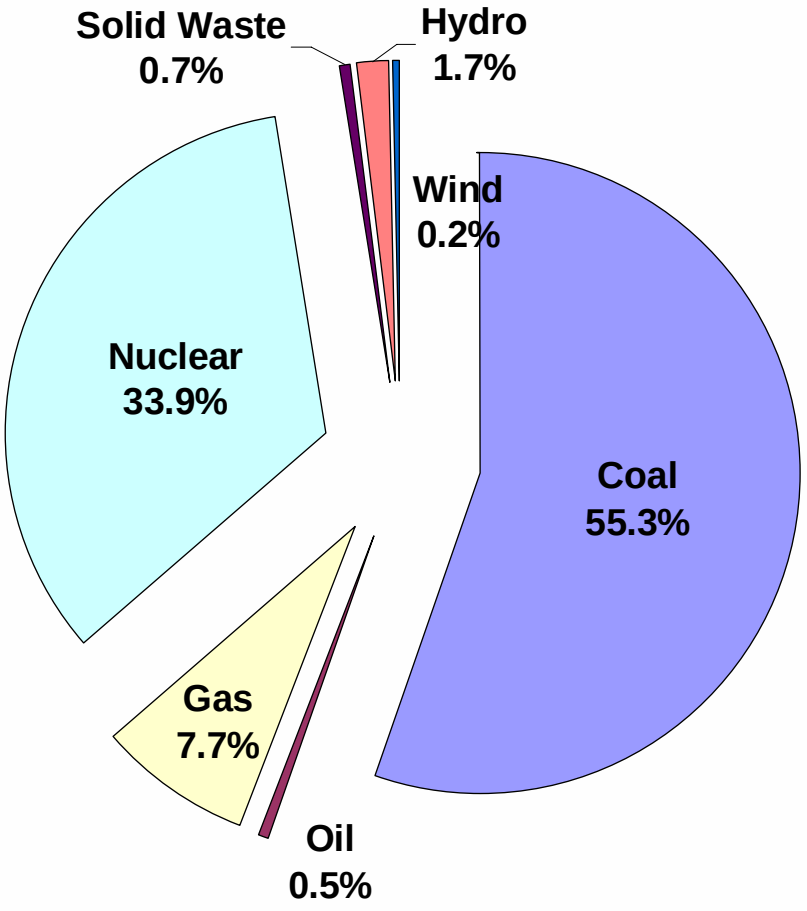

  

# Some definitions…

- ***Regulated*** implies responsible, hands-on utility regulators who carefully balance rates with cost-based revenue requirements
- ***Allowance Allocation*** means 100% of emissions allowances are given to emitters, free of charge, in some proportion to their historic carbon emissions
- ***Allowance Auction*** means 100% of emission allowances are auctioned off, with the proceeds used for the benefit of consumers in some wise and reasonable way.

# PJM GWh Production in 2007



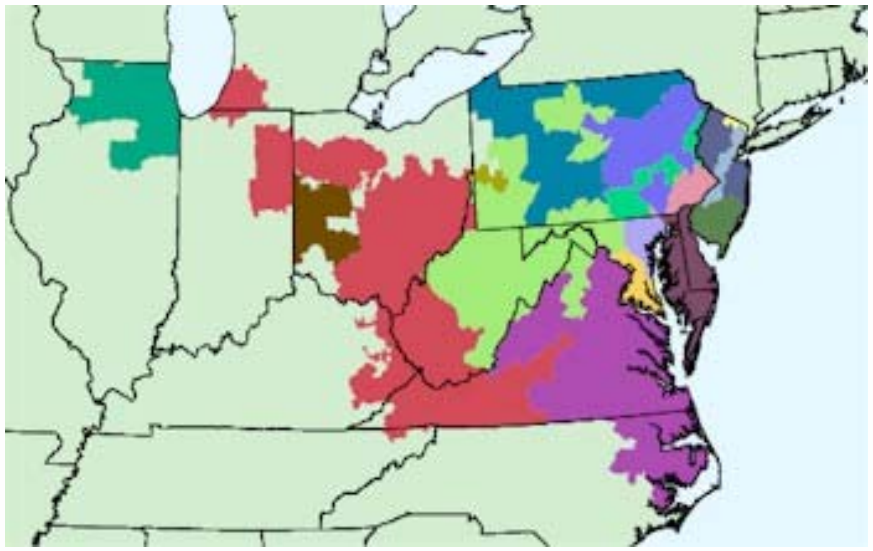

*Source: PJM 2007 State of the Market Report*

Two Questions:

1. *Who gets the benefit of higher electricity prices?*
2. *Who pays the price?*

# Example 1: PJM under Federal Cap & Trade



- *Reduction target:* to 90% of BAU
- *Allowance trading price:* $20
- *Average cost of abatement:* $10

Four scenarios:

- *Regulated with allocation*
- *Regulated with auction*
- *Deregulated with allocation*
- *Deregulated with auction*

# Calculating the price impact

Under LMP, only the marginal unit(s) affect the price; thus the price impact of $CO_2$ allowance costs will be based on the marginal emission rate for each hour and region.

| Technology | 2007 Time on Margin | CO2 Emission Rate (tons/MWh) |
|---|---|---|
| Coal | 70% | 1.05 |
| Misc | 2% | |
| Natural Gas | 24% | 0.66 |
| Nuclear | 0% | |
| Petroleum | 5% | 0.98 |

*Sources:*
PJM 2007 State of the Market report (marginal units)
http://www.eia.doe.gov/cneaf/electricity/page/co2_report/co2emiss.pdf

# Calculating the price impact

- *Weighted average emission rate in PJM:*

  ***0.95 tons $CO_2$ per MWh produced***

- *Average price impact of a $20 allowance:*

  *0.95 x $20 =* ***$19/MWh***

# Balance Sheet #1: Cap-and-trade in a regulated market with free allocation of allowances

| | Coal | Oil | Gas | Nuclear | Solid Waste | Hydro | Wind | Consumers |
|---|---|---|---|---|---|---|---|---|
| **Million Ton Allowances Allocated** | 375 | 3 | 31 | 0 | 0 | 0 | 0 | |
| **Value of allowances @$20/ton** | $ - | $ - | $ - | $ - | $ - | $ - | $ - | ***$ 8,169*** |
| **Cost of 10% abatement @ $10/ton average cost** | $ (416) | $ (3) | $ (35) | $ - | $ - | $ - | $ - | |
| **Cost of allowances for remaining 90%** | $ - | $ - | $ - | $ - | $ - | $ - | $ - | ***$ (8,169)*** |
| ***Sum of allowance and abatement costs*** | *$ (416)* | *$ (3)* | *$ (35)* | *$ -* | *$ -* | *$ -* | *$ -* | |
| ***Price impact*** | *$ 416* | *$ 3* | *$ 35* | *$ -* | *$ -* | *$ -* | *$ -* | ***$ (454)*** |
| **Net Gain (Loss)** | **$ -** | **$ -** | **$ -** | **$ -** | **$ -** | **$ -** | **$ -** | **$ (454)** |

*All dollar values are in US $Million*

# Balance Sheet #2: Cap-and-trade in a regulated market with auction of allowances to benefit consumers

| | Coal | Oil | Gas | Nuclear | Solid Waste | Hydro | Wind | Consumers |
|---|---|---|---|---|---|---|---|---|
| **Million Ton Allowances Allocated** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ***408*** |
| **Value of allowances @$20/ton** | $ - | $ - | $ - | $ - | $ - | $ - | $ - | ***$ 8,169*** |
| **Cost of 10% abatement @ $10/ton average cost** | $ (416) | $ (3) | $ (35) | $ - | $ - | $ - | $ - | |
| **Cost of allowances for remaining 90%** | $ (7,491) | $ (54) | $ (625) | $ - | $ - | $ - | $ - | |
| ***Sum of allowance and abatement costs*** | *$ (7,907)* | *$ (57)* | *$ (659)* | *$ -* | *$ -* | *$ -* | *$ -* | ***$ 8,169*** |
| ***Price impact*** | *$ 7,907* | *$ 57* | *$ 659* | *$ -* | *$ -* | *$ -* | *$ -* | ***$ (8,623)*** |
| **Net Gain (Loss)** | **$ -** | **$ -** | **$ -** | **$ -** | **$ -** | **$ -** | **$ -** | **$ (454)** |

*All dollar values are in US $Million*

# Balance Sheet #3: Cap-and-trade in a deregulated market with free allocation of allowances

| | Coal | Oil | Gas | Nuclear | Solid Waste | Hydro | Wind | Consumers |
|---|---|---|---|---|---|---|---|---|
| **Million Ton Allowances Allocated** | 375 | 3 | 31 | 0 | 0 | 0 | 0 | ***0*** |
| **Value of allowances @$20/ton** | $ 7,491 | $ 54 | $ 625 | $ - | $ - | $ - | $ - | ***$ -*** |
| **Cost of 10% abatement @ $10/ton average cost** | $ (416) | $ (3) | $ (35) | $ - | $ - | $ - | $ - | |
| **Cost of allowances for remaining 90%** | $ (7,491) | $ (54) | $ (625) | $ - | $ - | $ - | $ - | |
| ***Sum of allowance and abatement costs*** | *$ (416)* | *$ (3)* | *$ (35)* | *$ -* | *$ -* | *$ -* | *$ -* | ***$ -*** |
| ***Price impact*** | *$ 7,422* | *$ 66* | *$ 1,031* | *$ 4,549* | *$ 87* | *$ 233* | *$ 24* | ***$ (13,413)*** |
| **Net Gain (Loss)** | **$ 7,006** | **$ 64** | **$ 997** | **$ 4,549** | **$ 87** | **$ 233** | **$ 24** | **$ (13,413)** |

*All dollar values are in US $Million*

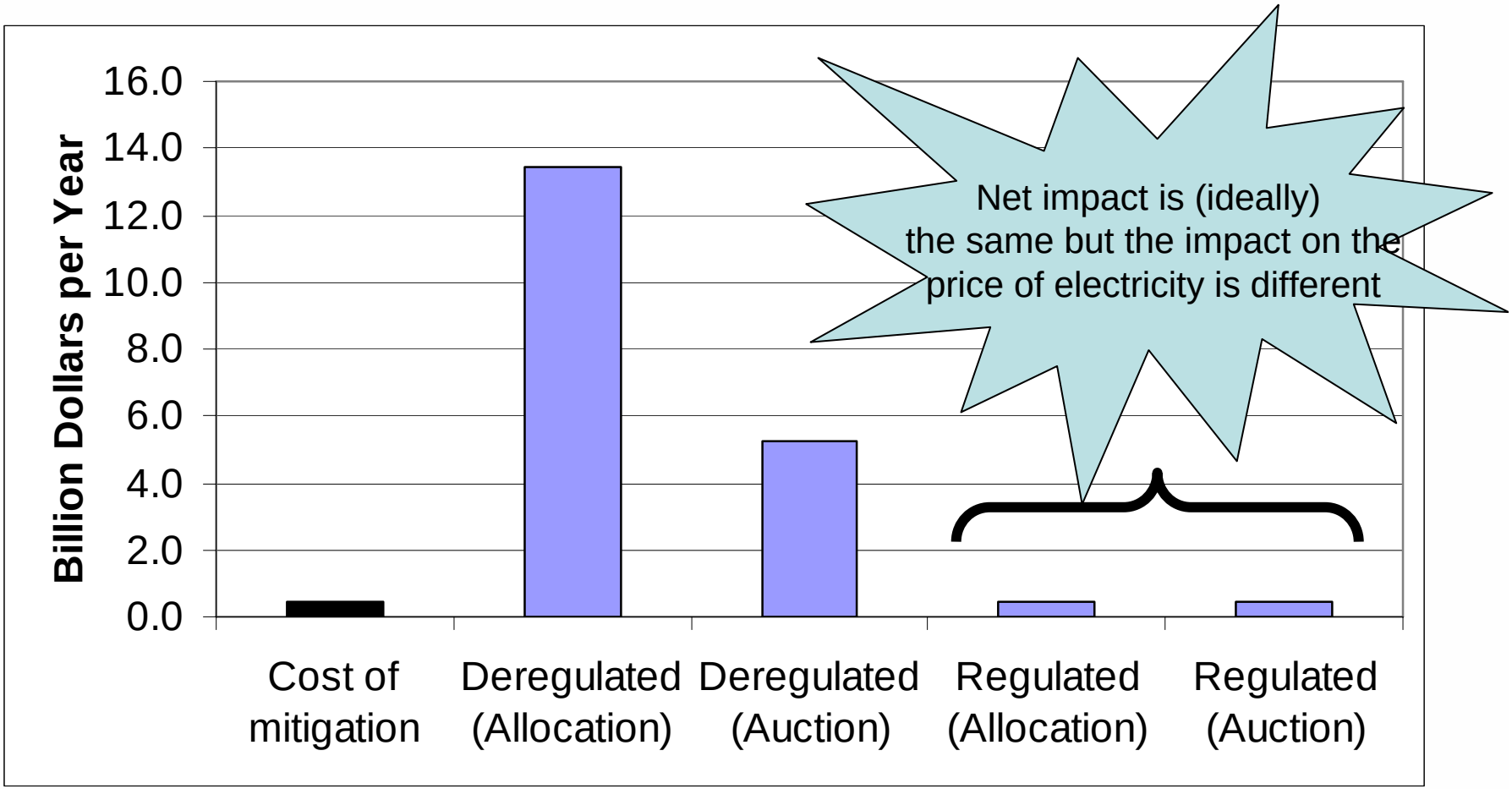
# Balance Sheet #4: Cap-and-trade in a deregulated market with auction of allowances to benefit consumers

| | Coal | Oil | Gas | Nuclear | Solid Waste | Hydro | Wind | Consumers |
|---|---|---|---|---|---|---|---|---|
| **Million Ton Allowances Allocated** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ***408*** |
| **Value of allowances @$20/ton** | $ - | $ - | $ - | $ - | $ - | $ - | $ - | ***$ 8,169*** |
| **Cost of 10% abatement @ $10/ton average cost** | $ (416) | $ (3) | $ (35) | $ - | $ - | $ - | $ - | |
| **Cost of allowances for remaining 90%** | $ (7,491) | $ (54) | $ (625) | $ - | $ - | $ - | $ - | |
| ***Sum of allowance and abatement costs*** | *$ (7,907)* | *$ (57)* | *$ (659)* | *$ -* | *$ -* | *$ -* | *$ -* | ***$ 8,169*** |
| ***Price impact*** | *$ 7,422* | *$ 66* | *$ 1,031* | *$ 4,549* | *$ 87* | *$ 233* | *$ 24* | ***$ (13,413)*** |
| **Net Gain (Loss)** | **$ (882)** | **$ 6** | **$ 317** | **$ 4,305** | **$ 83** | **$ 221** | **$ 23** | **$ (5,244)** |

*All dollar values are in US $Million*

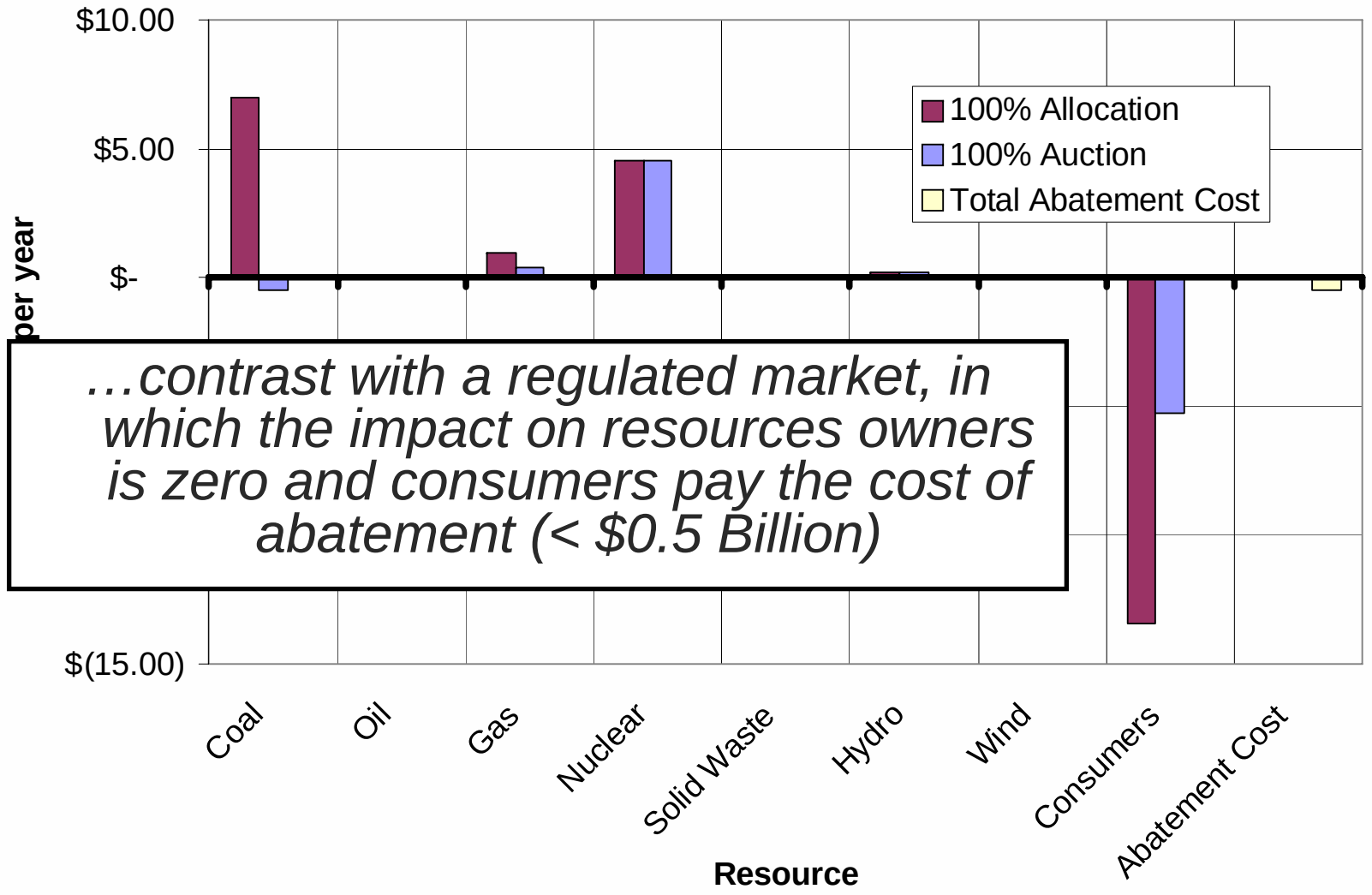
  

# Cost to consumers depends on market structure and allocation scheme



# Winners and Losers in deregulated market




*…contrast with a regulated market, in which the impact on resources owners is zero and consumers pay the cost of abatement (< $0.5 Billion)*

# Take-home messages for DEREGULATED markets

- Cap and Trade + deregulated electricity markets =
  - HIGH COST
  - MINIMAL BENEFITS
  - WINDFALL PROFITS FOR EXISTING RESOURCES
- Worse with allowance allocation, ***but still pretty bad with auction***
- Existing, amortized nuclear resources make out best, multiplying consumer cost without producing any benefits

# Take-home messages for REGULATED markets

- Net cost impact of cap & trade equals mitigation cost, ASSUMING:
  - …if allowances are ***allocated***, prudent, cost-based regulation so that the value of allowances is counted towards the utilities' revenue
  - …if allowances are ***auctioned***, proceeds are used wisely for consumer benefit and are not raided for other purposes
- *AUCTIONING of allowances raises the price per kW-hour, which increases the incentive for energy efficiency*

# Winning strategies…

- *Energy efficiency*

- Re-regulate electricity markets before implementing cap & trade
- Windfall profits tax on existing resources (esp. nuclear)

- *Energy efficiency*

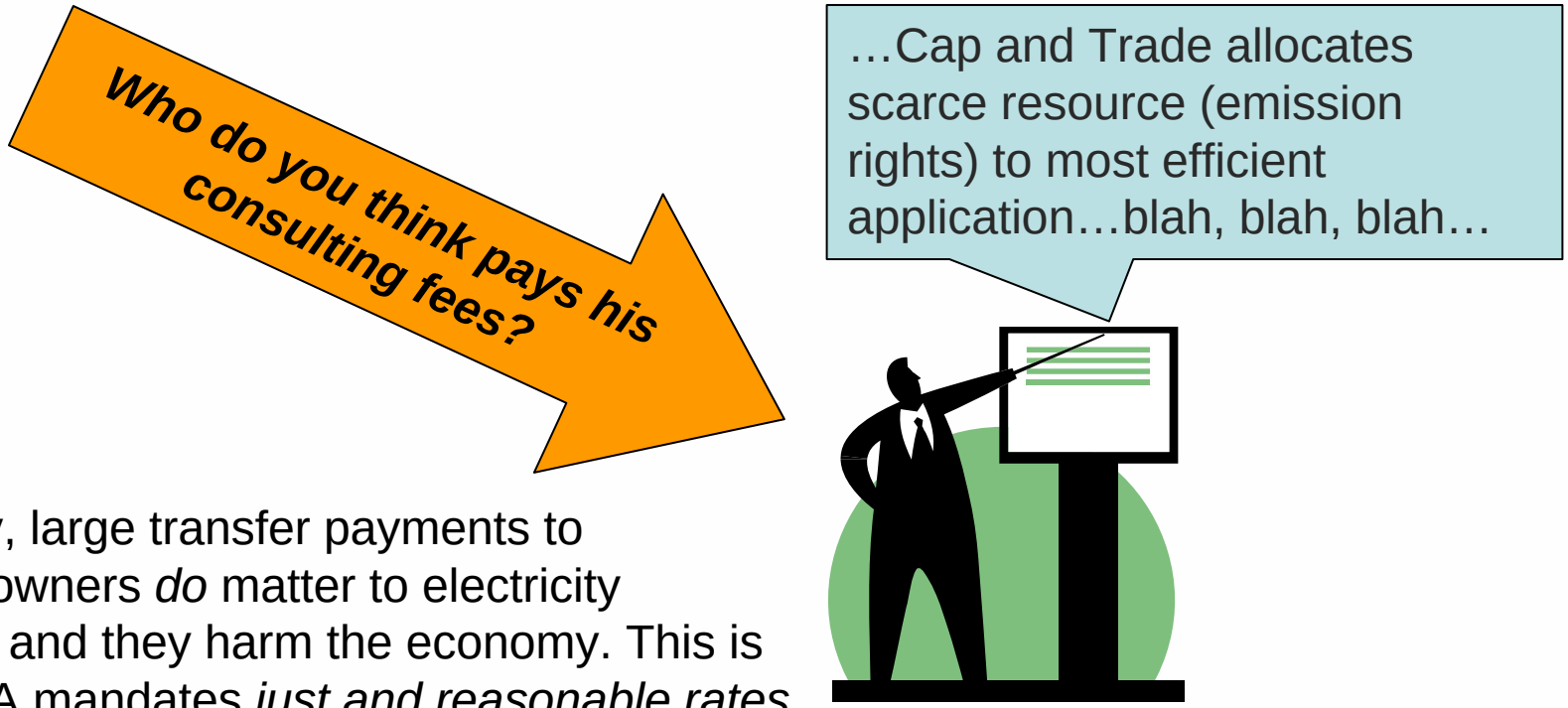
- Spend a large chunk of allowance auction proceeds on energy efficiency
- **Large users:** reduce demand or build your own zero-carbon resources, whichever is cheaper

- *Energy efficiency*

# Winning strategies

- Direct development of renewable energy and DSM is a MUCH MORE EFFICIENT approach to reducing carbon emissions




**Shockingly**, large transfer payments to generation owners *do* matter to electricity consumers, and they harm the economy. This is why the FPA mandates *just and reasonable rates.*

# Conclusions

- Cap and trade *in deregulated markets* can raise the price of electricity, with an economic impact that is orders of magnitude larger than the actual cost of mitigation
- Big transfer payments to existing, amortized resources who will benefit from higher prices but see no cost impact
- If allowances are allocated in deregulated markets, even coal (most GHG-intensive fuel) makes a windfall
- In regulated markets, consumers pay only the cost of mitigation whether allowances are allocated or auctioned—ASSUMING wise and prudent cost-based regulation
- Program design MUST allow for compliance through efficiency and renewables, and states MUST seize these opportunities!

# Discussion Questions

- What are you doing to prepare for GHG regulations? How are you analyzing economics? What assumptions are you using?
- Do you participate in PSC filings? How? How about legislation/ rulemaking?