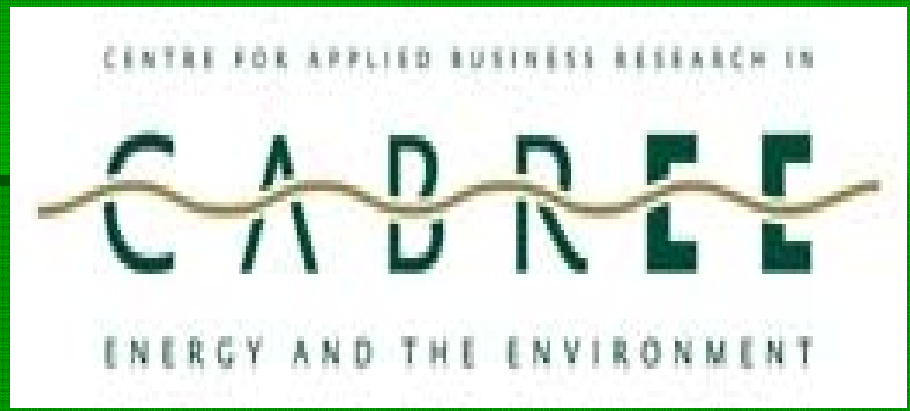
Economists Are *SO* Cheap...
A Primer on Emissions Trading

André Plourde
Professor and Chair
Department of Economics, University of Alberta

Prepared for presentation at the 17th Annual Environmental Lawyers in Government Conference, 12-14 September 2005


CBEEDAC
C A N A D I A N
Building Energy End-Use
DATA AND ANALYSIS CENTRE
commercial • residential • institutional


CENTRE FOR APPLIED BUSINESS RESEARCH IN
CABREE
ENERGY AND THE ENVIRONMENT

Roadmap

- **Context**
  - In what sense are economists cheap?
- **Meeting Environmental Policy Objectives**
  - Forms of policy intervention – “policy instruments”
  - Costs associated with these instruments
- **Does It Always Work?**
  - Some limitations…
- **Summary**

Context [1]

- **Starting point…**
  - Human activities generate flows of waste discharged into “environment”
    - “polluting emissions”
  - These emissions can create damage to ecosystems and / or human health

Context [2]

- **Fundamental issue…**
  - Unfortunately…some economics jargon
- *Polluting emissions are negative externalities*
  - Not all "costs" of activity borne by those directly involved – producers & consumers
  - Some of the costs borne directly by "innocent bystanders" – the rest of us…"society as a whole"

Context [3]

- ***SO…***
  - In absence of any government intervention, letting consumers & producers do what they want to do yields a situation where, from point of view of society as a whole…
    - ***TOO MUCH POLLUTING EMISSIONS ARE GENERATED***
- **IMPLICATION…**
  - There is an economic case for government intervention

Context [4]

- **IDEA…**
  - Possible to increase the overall "well-being" of society by reducing polluting emissions
  - ***Assume a GIVEN environmental policy objective…***
    - "reduce total emissions of a given pollutant by a set amount"
    - [aside: how is this "set amount" determined?]

Context [5]

- **Remember…**
  - NEED some form of government intervention to achieve this environmental policy objective…
- **BUT…**
  - Not all forms of government intervention are equally effective – some more costly than others

Context [6]

- **Economists are cheap?**
  - Because they think that the form of government intervention used should minimize cost of achieving a given environmental policy objective
- **Why should we care?**
  - Because “resources” used to reduce pollution cannot be used to do something else…

Context [7]

- If “more” resources than necessary used to achieve a given environmental policy objective…
- Then **these additional resources are “wasted”** in the sense that…
  - A different form of government intervention could have achieved given environmental policy objective at lower cost
  - AND…these additional resources would then have been available to address other priorities of individuals / society…
    - Health care
    - Education
    - Welfare
    - …

Punchline…

- **Economists ARE cheap…**
  - ***And it is all about reducing waste…***
  - Government intervention NECESSARY to meet given environmental policy objectives
  - Since ***not all forms of government intervention are created alike***…
    - Adopt “least-cost” approaches to achieving given environmental policy objectives
    - Doing so means that “more” is available to address other priorities

Objectives & Instruments [1]

- **Why do economists like emissions trading?**
  - In many situations, emissions trading is a "least-cost" approach to achieving given environmental policy objectives
    - "in theory"
    - ***BUT…***a growing body of empirical evidence in support

Objectives & Instruments [2]

- Let's look at the "costs" of meeting a given environmental policy objective in a simple example
  - 2 firms – total emissions of pollutant: 22 units
    - Firm #1: 14 units
    - Firm #2: 8 units
  - *Environmental policy objective:*
    - Reduce TOTAL emissions of pollutant by 10 units

Objectives & Instruments [3]

- *BUT…*firms are different in terms of their abatement costs…
  - Costs of reducing polluting emissions DIFFER across firms…
  - Costs of reducing each additional unit of polluting emissions
    - "marginal abatement cost" - MAC
    - Pattern differs across firms…

Objectives & Instruments [4]

MAC ($) Firm #1	Units of Pollution Reduced	MAC ($) Firm #2
0	0	0
3	1	1
5	2	2
7	3	3
9	4	4
11	5	5
13	6	6
15	7	7
17	8	8

Marginal abatement cost (MAC) higher for firm #1 than for firm #2

POLICY OBJECTIVE: reduce TOTAL polluting emissions by 10 units

WHICH instrument??

Objectives & Instruments [5]

- Let's look at two instruments…
- **"Emissions Standard"**
  - Government tells each firm to reduce emissions by 5 units
    - TOTAL emissions reduction = 10 units
    - TOTAL emissions now allowed = 12 units
    - Environmental policy objective met
  - "command-and-control"

Objectives & Instruments [6]

- **"Emissions Trading"**
  - Government prints & distributes 12 emissions permits
    - Each permit allows firm to emit 1 unit of pollutant
    - Very large penalty if emit without permit
    - Each firm gets 6 permits from government (change later)
    - ***Firms can trade permits with each other***
  - TOTAL emissions now allowed = 12 units
    - TOTAL emissions reduction = 10 units
    - Environmental policy objective met
  - "market mechanism"

Emissions *Standard*

MAC ($) Firm #1	Units of Pollution Reduced	MAC ($) Firm #2
0	0	0
3	1	1
5	2	2
7	3	3
9	4	4
11	5	5
13	6	6
15	7	7
17	8	8

Each firm reduces emissions by 5 units

What is TOTAL COST of abatement?

Firm #1: 3+5+7+9+11=$35

Firm #2: 1+2+3+4+5 = $15

TOTAL COST = $50

"not available to do anything else"

Emissions *Trading* [1]

MAC ($) Firm #1	Units of Pollution Reduced	MAC ($) Firm #2
0	0	0
3	1	1
5	2	2
7	3	3
9	4	4
11	5	5
13	6	6
15	7	7
17	8	8

In the beginning…each firm has 6 permits

How many units of emissions does each firm need to cut?

Firm #1: 14 – 6 = 8 units
Firm #2: 8 – 6 = 2 units

WHAT HAPPENS NOW?

Emissions *Trading* [2]

MAC ($) Firm #1	Units of Pollution Reduced	MAC ($) Firm #2
0	0	0
3	1	1
5	2	2
7	3	3
9	4	4
11	5	5
13	6	6
15	7	7
17	8	8

What if firm #2 were to "trade" one permit to firm #1?

Firm #2 would need some payment since its total abatement costs would RISE by $3

BUT…total abatement costs of firm #1 would FALL by $17

So there is a positive permit price at which this deal makes sense

Emissions *Trading* [3]

MAC ($) Firm #1	Units of Pollution Reduced	MAC ($) Firm #2
0	0	0
3	1	1
5	2	2
7	3	3
9	4	4
11	5	5
13	6	6
15	7	7
17	8	8

What if firm #2 were to trade ANOTHER permit to firm #1?

Firm #2 would need some additional payment since its total abatement costs would RISE by another $4

BUT…total abatement costs of firm #1 would FALL by another $15

Again, there is a positive permit price at which this deal makes sense

Emissions *Trading* [4]

MAC ($) Firm #1	Units of Pollution Reduced	MAC ($) Firm #2
0	0	0
3	1	1
5	2	2
7	3	3
9	4	4
11	5	5
13	6	6
15	7	7
17	8	8

HOW LONG DOES THIS TRADING GO ON?

As long as it is a "good deal" for both buyer & seller of permits!

As long as RISE in total abatement cost for permit seller is less than or equal to FALL in total abatement cost for permit buyer…

Emissions *Trading* [5]

MAC ($) Firm #1	Units of Pollution Reduced	MAC ($) Firm #2
0	0	0
3	1	1
5	2	2
7	3	3
9	4	4
11	5	5
13	6	6
15	7	**7**
17	8	8

This occurs when MAC of firm #1 = MAC of firm #2 = permit price

Firm #1 reduces emissions by 3 units
Firm #2 reduces emissions by 7 units

What is TOTAL COST of abatement?

Firm #1: 3+5+7 = $15
Firm #2: 1+2+3+4+5+6+7=$28

TOTAL COST = $43

Standard vs Trading [1]

- Environmental policy objective attained in both cases…*but at a lower cost with emissions trading*
  - TOTAL abatement cost with standard = $50
  - TOTAL abatement cost with trading = $43
  - "not available to do anything else"
- 5 permits are traded from firm #2 to firm #1 – TRANSFER of $35 = 5 permits @ $7
- ***NOTE…available to firm #1 to "do something else"***

Standard vs Trading [2]

- ***A few important benefits of trading…***
  - **COST EFFECTIVENESS** through flexibility
  - Provides ***ongoing incentive*** for firms to reduce emissions
    - Encourages technological developments
  - ***Low information need*** on part of government
    - Firms need to know their abatement cost structure, but the government does not
  - Hard to make case that monitoring / enforcement costs higher than for standard

Standard vs Trading [3]

- *Conditions / situations where trading likely to work well…*
  - **"uniformly mixed pollutants"**
    - Don't need to worry about localized areas of high pollution concentration – "hot spots"
    - Think of SO_2 and CO_2 - for example
  - **Abatement costs differ across firms**
    - Reasons for firms to trade
  - **Lots of buyers & sellers in market for permits**
    - High degree of "liquidity"

Standard vs Trading [4]

- *By extension, conditions / situations where trading **NOT** likely to work well…*
  - **"non-uniformly mixed pollutants"**
    - Need to worry about localized areas of high pollution concentration – "hot spots"
  - **Abatement costs the same across firms**
  - **Very few buyers & sellers in permit market**
    - Exercise of market power – permit price manipulation

Standard vs Trading [5]

- **A few issues with trading…**
  - **How do transactions costs compare to "gain" in cost effectiveness?**
  - **How to do "initial allocation" of permits?**
    - Here: government ***gives all*** permits to firms
      - **"gratis allocation"**
      - Does this "discriminate" in favour of existing firms & against potential entrants?
      - Does it "reward" the worst polluters?

Standard vs Trading [6]

- **How to do "initial allocation" of permits?**
  - Another polar alternative
  - government ***sells all*** permits
    - **Initial allocation through an "auction"**
      - ***ALL*** revenues from permit sales go to government
        - ***Good bits:*** use these revenues to lower taxes; no discrimination – anyone can buy at market price
        - ***Less good bits:*** distributional concerns; competitiveness issues for some emissions-intensive firms

Standard vs Trading [7]

- **QUESTION…**
  - *Is it possible to use standard to "replicate" pattern of emissions induced by permits?*
    - In theory – Yes…
    - But, in practice – very, very unlikely
    - Basically, would need a different standard for every set of abatement cost conditions – every firm
      - HUGE informational requirements for government !!!

Summary [1]

- **Economists *ARE* cheap…**
  - It is all about reducing waste
  - Seek to meet given environmental policy objectives by lowest-cost means
  - Emissions trading allows this to happen
    - Flexibility of responses by firms – emit, abate, use permit
    - Once environmental policy objective set, relatively low information need for government

Summary [2]

- **Emissions trading will *NOT* provide desirable results in all situations**
  - "Hot spots"
  - Liquidity concerns / price manipulation
- ***BUT…***
  - an important instrument in the policy arsenal