Air Pollution Control: Economic Approach

Class EE375

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Reference: **[TL]** – Tietenberg, T. and Lewis, L. Environmental Natural Resource Economics, 2015 (10th edition), Pearson, Chapter 15.

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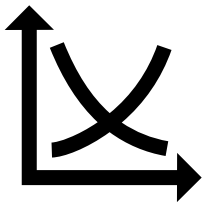
Two main economic approaches to control air pollutions

Command-and-Control (CAC)

- **Primary Standard**
- **Secondary Standard**

Market-based approach



- **Emission charge**
- **Cap-and-Trade**

Command-and-control (CAC) Policy Approach

- A historical approach to air pollution control – primarily using **emissions standards.**
- Under this approach, the **National Ambient Air Quality Standards** (NAAQS) is established to **set legal ceiling** on the allowable concentration of the pollutant in the outdoor air averaged over a specified time period.
- **Two types of standards**

Primary Standard

- ✓ designed to **protect human health**
- ✓ had the earliest deadlines for compliance and required a sufficient level to be set to protect the most sensitive groups of population without considering the costs to do so.

Secondary Standard

- ✓ designed to protect other aspects of **human welfare** such as houses, monuments, vegetation, etc.

CAC Policy Approach – Is it efficient?

The ambient standards will be efficient if the marginal benefit equals to the marginal cost, depending on five aspects of the standard-setting process:

The threshold concept	• Heath threshold is set as a margin of safety sufficiently high that no adverse health effects would be suffered. **Is the threshold valid?**
The level of the ambient standard	• Considering efficiency, standard would be set to maximize the net benefit, which includes a consideration of costs as well as benefits. The current policy **explicitly excludes costs** when considering the ambient standard setting.
Uniformity	• Standards **apply to all parts of the country**, not considering the number of people exposed, the sensitivity of the local ecology, or the costs of compliances in various areas
Timing of emissions flows:	• The **timing of emission control** is important. The reliance on a constant degree of control raise compliance costs, in particular when it requires a high degree of control. Less control would be applied under normal circumstances.
Concentration versus exposure:	• However, **human exposure to health effects** is not only determined by the level of outdoor air pollutant's concentration but also the number of people exposed, and the amount of time spent in each place

CAC Policy Approach – Is it cost-effective?

If the ambient standards are being met in the least costly manner possible?

- The cost-effectiveness of CAC **depends on local circumstances** such as prevailing meteorology, the spatial configuration of sources, stack heights and the degree to which costs vary with the amount controlled.
  - This **requires complex modelling** to compare the costs of the CAC allocation costs to the lowest cost of meeting the same objective.
  - The allocation of responsibility among emitters for reducing pollution has led to **high control costs t**han necessary to achieve the air-quality objective.
  - Stringent controls usually result in **excessive control costs** when the policy is lack of temporal flexibility. Traditional approach was not able to identify enough appropriate technologies to produce sufficiently stringent reductions.

Market-based approach

Emission Charge

- **An efficiency charge** – designed to force the polluter to compensate completely for all damage caused.
- **A cost-effective charge** – designed to achieve a predefined ambient standard at the lowest possible control costs.

Experience from Japan

The emission charge on sulfur dioxides (SO_2)

- ✓ Based on **damages to human health** implemented through the Law for the Compensation of Pollution-Related Health Injury.
- ✓ Determined by the administrative process and based on the **revenue needs for funding compensations to victims** of air pollution.
- ✓ Unexpectedly high charge rates are necessary to raise sufficient revenue for the compensation and provide quite an incentive effect on emissions reduction.

Experience from France

Air pollution charge

- ✓ designed to **encourage the early adoption of pollution control equipment**.
- ✓ Levied on all industrial firms having a power-generating capacity of 20 MW or more or industrial firms discharging over 150 metric tons of taxable pollutants.
- ✓ The revenue from the charges are used to subsidize installations of pollution control equipment.

Is Emission Charge cost-effective?

Emission Charge

Evidence suggest that emission charge is **more cost-effective in reducing SO_2 emissions**, resulting in **more equalized marginal costs** which is a condition for cost-effectiveness

- Although the emission charge is cost-effective, **it may not be popular**, particularly in heavily polluting power plants as
  - Emission charge would require the company to also pay for uncontrolled emissions such as acid rain.
  - The additional expense of paying emissions charges may outweigh the savings from lower equipment and operating costs achieved because of emission charge.
  - This dilemma is resolved by adopting **an emissions trading system** (e.g., sulfur allowance trading program) designed to complement, not replace, the traditional CAC.

Market-based approach

Cap-and-trade markets

The allowance prices respond automatically to changing market conditions.

Example is "**California's Regional Clean Air Incentives Market or RECLAIM**" Almost 400 industrial polluters participating with annual allocation of pollution limit for nitrogen oxides and sulfur dioxide.

- Polluters are allowed great *flexibility in meeting these limits*, including buying credits from other firms that have controlled more than their legal requirement.
- The burden of identifying the appropriate control strategies has *shifted from the control authority to the polluter*
- However, problems could occur when the level of the cap is politically influenced (initial allocations were inflated) or when unanticipated changes raise the allowance price to very high level.
  - A **'safety valve' mechanism** – if allowance prices were higher then some threshold, the program would be temporarily suspended, and a fee per ton would be imposed instead until the normal operation was back.

What about approach to control regional pollutants?

- While local pollutants damage the environment near the source of emissions, regional pollutants can cause damage some distance away.
- Regional pollutants **can impose external costs** to impose proper incentives to implement efficient control measures, when the influence of pollutant zones extends beyond local boundaries.
- Example of this case is **acid rain**. It is difficult to find the solutions to acid rain problems when those bearing the costs of further control are not those who will benefit from the control.
    - In the U.S., the **acid rain legistration** was delayed due to opposition of some states due to its potential effects on increased electricity price, employment loss in high-sulfur, coal-mining industry. These barriers were overcome by the **sulfur allowance program** instituted through the 1990 Clean Air Act Amendments.