# Lecture # 8 -- Transferable Discharge Permits

## I. Transferable Discharge Permits

- Tradable permits work by addressing the *property rights* problem. Permits give a firm a property right to emit a certain level of a pollutant, but no more. The firm needs to obtain the right to exceed the limit by purchasing more permits.
    - In addition, if the firm does not want to use all of its permits, it can sell them to someone else.
- Two types of trading programs:
    - Credit trading programs
        - Firms can sell credits generated by reducing emissions more than required
        - Offset programs are an example
    - Cap-and-trade programs
        - Government makes a centralized decision as to how much pollution is allowed, then distributes permits to all participants
- How permits work:
    - Government begins by setting the desired level of emissions (potentially considering MAC and MD).
        - Thus, like command and control policies, the government has control over the final amount of pollution.
    - Firms are issued permits to emit pollutants. Only the desired number of permits is issued. Thus, the quantity is assured. (E.g. if goal is 1000 tons of emissions, may give 100 firms permits for 10 tons each).
    - Firms can buy and sell permits.
        - Firms with higher MAC will be willing to buy permits from firms with lower MAC.
            - If the price paid is less than the MAC of the high-cost firm, it is better off.
            - Similarly, if the price is greater than the MAC of the low-cost firm, it is better off. It can take the money it gets from selling the permit, use it to reduce pollution, and still have some left over.
            - ***Such trades are possible until MAC is equal across firms.***
                - Thus, permit trading allows a given level of pollution control to be achieved for the least possible cost. Economists consider this least-cost solution to be efficient.
    - Today's class will include an exercise to illustrate permit trading. I will post the results of the exercise after class.

- Offsets
    - Offsets can be regulated or voluntary
        - *Regulated* offsets used to comply with environmental regulations
            - Clean Air Act requires firms building new facilities in non-attainment areas to offset new emissions by reducing emissions nearby
            - Purchasing credits to apply to a cap-and-trade program
        - *Voluntary* offsets purchased to reduce the environmental impact
            - Often used by firms (or other organizations) to demonstrate environmental commitments
    - Use of offsets is growing
    - To evaluate whether offsets work, a key principle is a*dditionality*
        - Would the emission reduction have occurred without the sponsored project?
            - We don't want to give others credit for something that would have happened anyway.
            - However, how do we measure this? Requires knowing the no-intervention baseline.
        - Example: Requirements for additionality from the Clean Development Mechanism (CDM)
            - *Identify alternative scenarios*: What other options are available to project participants? Do these alternatives comply with local regulations?
            - *Barrier analysis*: Are there barriers to implementing the alternative scenarios? Are there barriers to completing the proposed CDM project that the project design overcomes?
            - *Investment analysis*: Is the baseline scenario (i.e., the projection of what would have occurred in the absence of CDM investment) a better financial investment than the proposed CDM project?
            - *Common practice analysis*: Is the proposed project currently common practice in the area?
        - To test how well CDM identified additionality, Calel *et al*. (2021) compare wind turbines built under CDM in India to those not supported by CDM
            - They identify as BLIMPs (blatantly inframarginal projects) CDM projects built in the same state and the same year as an unsubsidized project that is less productive and is farther from the grid
            - Just over one-half of all projects were BLIMPS

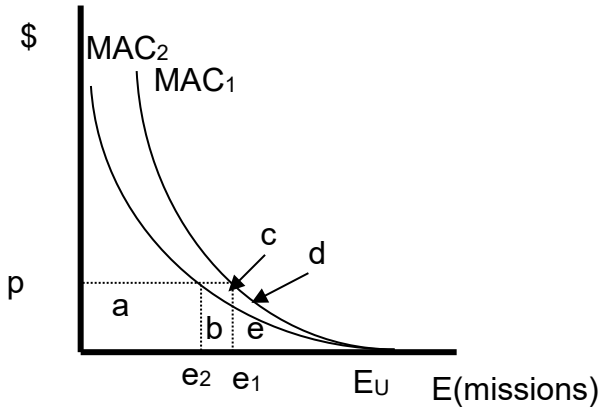
## II. Implementation Issues

*NOTE: Depending on how long the in-class exercise takes, we may not cover all of this material on Monday.*

- Initial allocation of permits
    - To begin a permit trading system, firms need to have permits to trade. The initial distribution can be done in several ways.
        - The government can auction permits to highest bidder.
            - At least initially, additional trading shouldn't be needed, as permits go to firms willing to pay the most.
            - Raises revenue for the government.
        - Equal distribution among firms.
            - May seem fairer, but what if firms are of different sizes.
        - Historical emissions rates (more permits to bigger polluters).
            - For example, if want to reduce pollution by 10%, give each firm permits equal to 90% of their current emissions.
            - However, this penalizes early actors. Should firms that have already reduced get fewer permits?
        - Also, combined systems are possible (e.g. hold back some permits for auction).
    - Note that firms will prefer getting the permits for free, as it gives them an additional asset. Auctioning permits makes the plan more like a tax. Thus, free distribution is more politically palatable.
    - Also, note that if the market is competitive, the market should yield an efficient solution no matter what the initial allocation. However, the effects on individual firms (e.g. who benefits by selling permits, versus needing to buy them), will be different.
- Establishing trading rules
    - For a market to work, transactions costs must be low.
    - However, at the same time, monitoring and enforcement will be necessary.
        - Need to track both emissions and the number of permits each firm has.
    - Are offsets allowed?
        - Usually have higher transaction costs
        - Should offsets with other geographic jurisdictions be allowed?
    - Who should be able to participate?
        - Should environmental groups or private individuals be able to buy permits and then not use them?
        - Which firms participate?
            - The EU-ETS, discussed below, illustrates the importance of these decisions

- Interaction with other policies
    - Because there is a hard cap, other policies that affect emissions may lower permit prices
        - E.g. in the EU-ETS, if an individual country adds additional regulations (e.g. UK carbon tax), demand for permits falls
        - Because supply is fixed, the price falls, but emissions do not change
    - This is known as the “waterbed” effect
    - Can address the waterbed effect by adding a price floor
        - If prices cannot fall below the price floor, so emissions fall instead. Some permits go unused.
- Geographic considerations:
    - For some types of pollution (e.g. $CO_2$), where it is emitted doesn’t matter.
    - For others, (e.g. carbon monoxide in a city), location does matter.
    - A tax system would deal with this by charging higher fees in areas where pollution is a bigger concern.
    - Ways for permit system to deal with geographic concerns:
        - Ambient-based permit system: permits needed for pollution as measured at each receptor.
            - E.g. a firm downwind might need to buy two permits from a firm upwind to be able to emit one unit of pollution.
        - Limit trading to within regions
            - Limits trades to areas where the emissions have the same effect.
                - For example, New York State has tried to prohibit NY power plants from selling $SO_2$ permits to plants in neighboring states.
                - The EPA divides the country into two regions (East and West) for $NO_X$ trading
            - However, such rules may prohibit some beneficial trades.
            - Also, this limits competition, which might keep the market from working correctly.

- Incentives for innovation
  - The incentives for innovation are the same as with an emissions fee
  - Here, the opportunity cost of polluting is using a permit, which sells for price p.




  - Consider two cases:
    - A firm has enough permits to cover its pollution.
      - The opportunity cost of polluting is that it cannot sell a permit.
      - Thus, innovation not only lowers marginal abatement costs, but allows the firm to sell more permits.
    - A firm does not have enough permits to cover its pollution.
      - The opportunity cost of polluting is that the firm must buy a permit
      - Thus, innovation not only lowers marginal abatement costs, but saves the firm from the need to buy additional permits.
  - In either case, the opportunity cost includes the value of permits either purchased or used instead of being sold:
    - With $MAC_1$, $e_1$ is the level of emissions.
      - Abatement costs = d + e
      - Cost of permits = a + b + c
        - Total cost to firm: a + b + c + d + e
    - With $MAC_2$, $e_2$ is the level of emissions
      - Abatement costs = b + e
      - Cost of permits: a
    - Savings: c + d
    - This the is the same result we had with emission fees