Using Production Incentives to Combat Leakage

Dallas Burtraw
Resources for the Future

LIFE DICET Carbon Market Policy Dialogue #1:

Session 3:

Carbon leakage prevention: free allocation and other measures

15 October 2020

Three Topics

1. Production incentives through output-adjusted allocation
2. Interpreting empirical evidence
3. Leakage in offset markets

1. Production Incentives under a Cap

- Conceptually, updating output-based allocation (OBA) of capped allowances is almost identical to a tradable performance (emissions intensity) standard
- The allocation reduces variable costs
  - *Production-adjusted allocation* would be a more descriptive term
- Case study: Vintage differentiated regulation under Obama's Clean Power Plan
  - The potential for leakage in the electricity sector is especially high where market and political boundaries are not aligned, and where regulations differ by fuel source or vintage
  - The Clean Power Plan regulated only *existing* emitting sources under a cap, due to legal constraints of the Clean Air Act
  - Leakage to new sources was an expected result
- Modeling found OBA could reduce leakage to new sources by up to 75%
  - The production subsidy becomes increasingly effective at reducing leakage when the policy becomes increasingly stringent

RFF

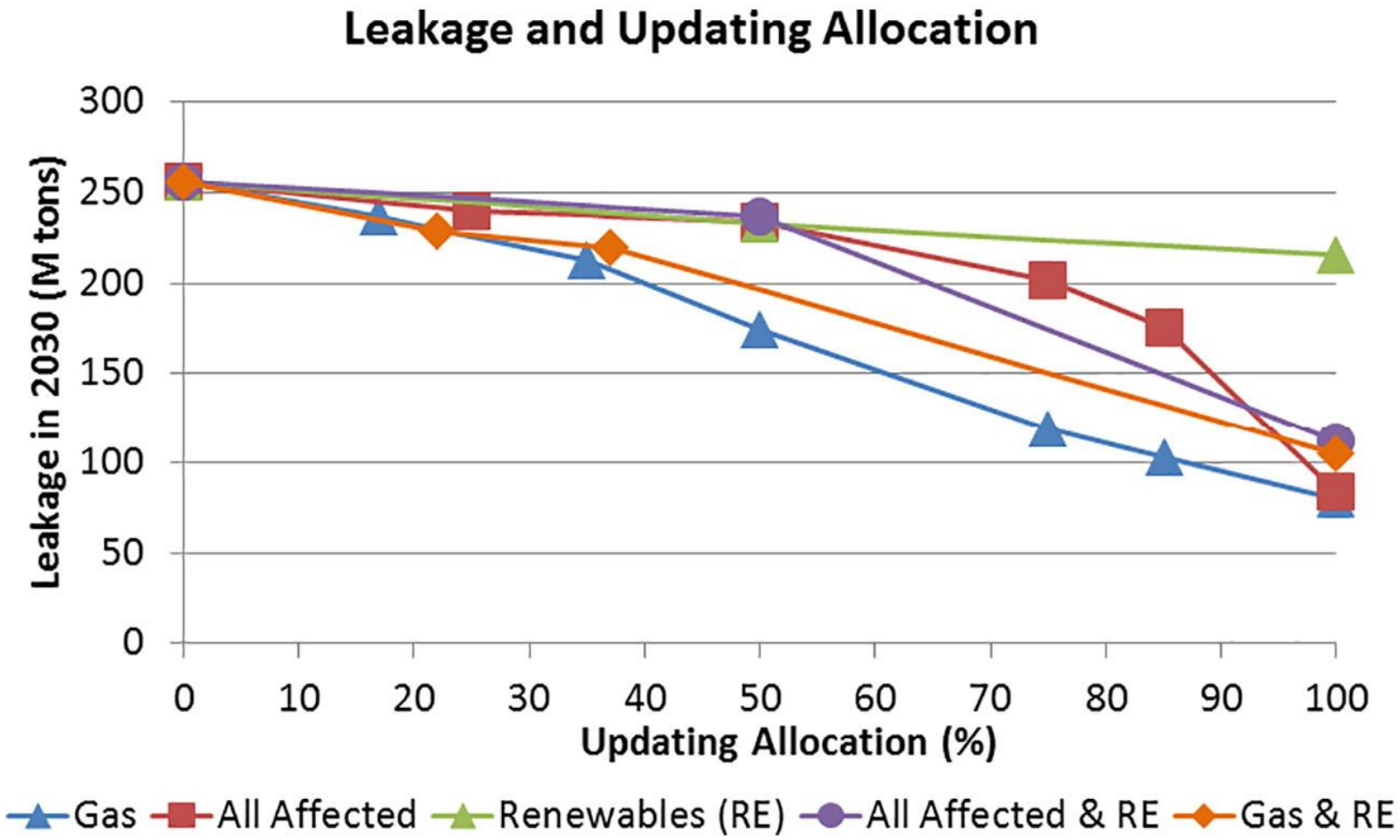
Additional Findings

- The potency of OBA depends on who receives the allocation
  - The most potent policy provided a strategic subsidy only to *existing* natural gas units
    - This forestalled new investment in natural gas and expedited retirement of coal
  - However, OBA to **all covered sources** (existing gas and coal) is almost as effective
    - Although unintuitive, more generation chases the same allowances, driving up the allowance price
  - The ***net relative production incentive*** is what matters
    - The net incentive when allocating to all sources is almost identical as under allocation only to gas
    - Allocation to all sources also reduces power market distortions by equalizing the subsidy per MWh
    - In contrast, allocation to renewables leads to more renewables, but lowers the allowance price, reducing the penalty for coal (green and brown are friends) and reducing the subsidy to existing gas causing more leakage to new gas
    - Nonetheless allocation to renewables is cost effective but achieves fewer emissions reductions

➢ General finding: To reduce leakage, the production incentive should be directed in a way to maximize production from among the set of emitting sources that are covered by the emissions cap

RFF

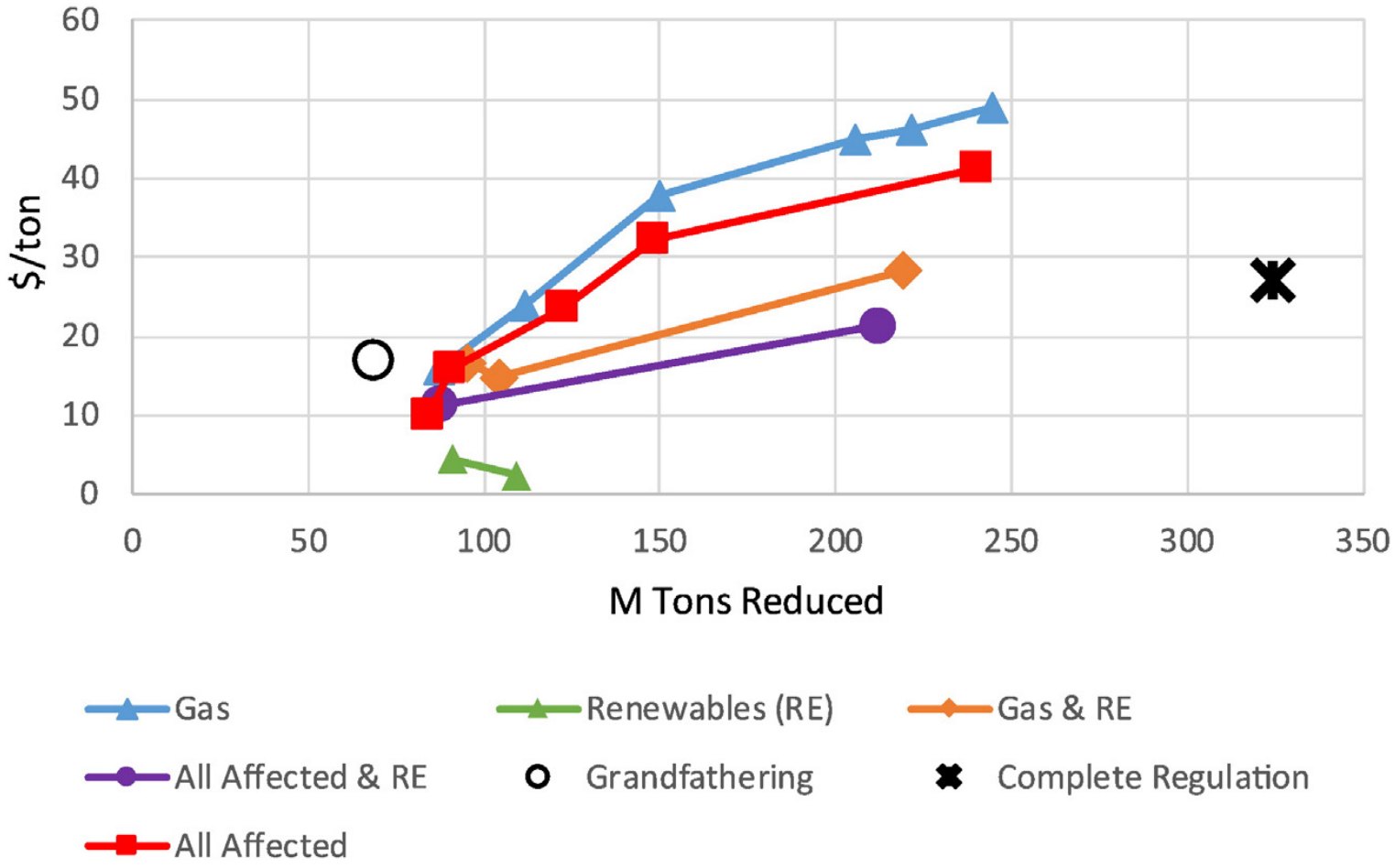
Strategic allocation to reduce in the US Clean Power Plan (electricity)



Leakage in the continental US with updating allocation (2030)

Palmer et al. 2017, *Energy Economics*

Strategic allocation to reduce in the US Clean Power Plan (electricity)



Average Cost and Tons Reduced (2030)

Palmer et al. 2017, *Energy Economics*

Another Example – Geographic Leakage

Modeling allocation by states within regional power markets

- Severe leakage is possible from states with emissions caps to unregulated states or states with intensity standards
- However targeted output-based allocation can protect against leakage
  - Negative leakage is possible
  - Targeted allocation can impose costs on neighbors
  - In brief, this moves away from equal allocation to all emitting sources and toward strategic allocation providing a production subsidy

Burtraw et al. 2015 *Environ Resource Econ*

RFF

2. Empirical Evidence

Two places to look:

- Existing emissions pricing programs
- Variation in energy costs

Conceptual Challenge for Empirical Evidence

Distinguish between short run shifts in activity associated primarily with variable costs and long run shifts associated primarily with capital costs.

- Hurdle rate makes investment decisions unresponsive at low prices

Level and *stability* of the carbon price is relevant to shifts in capital investment

RFF

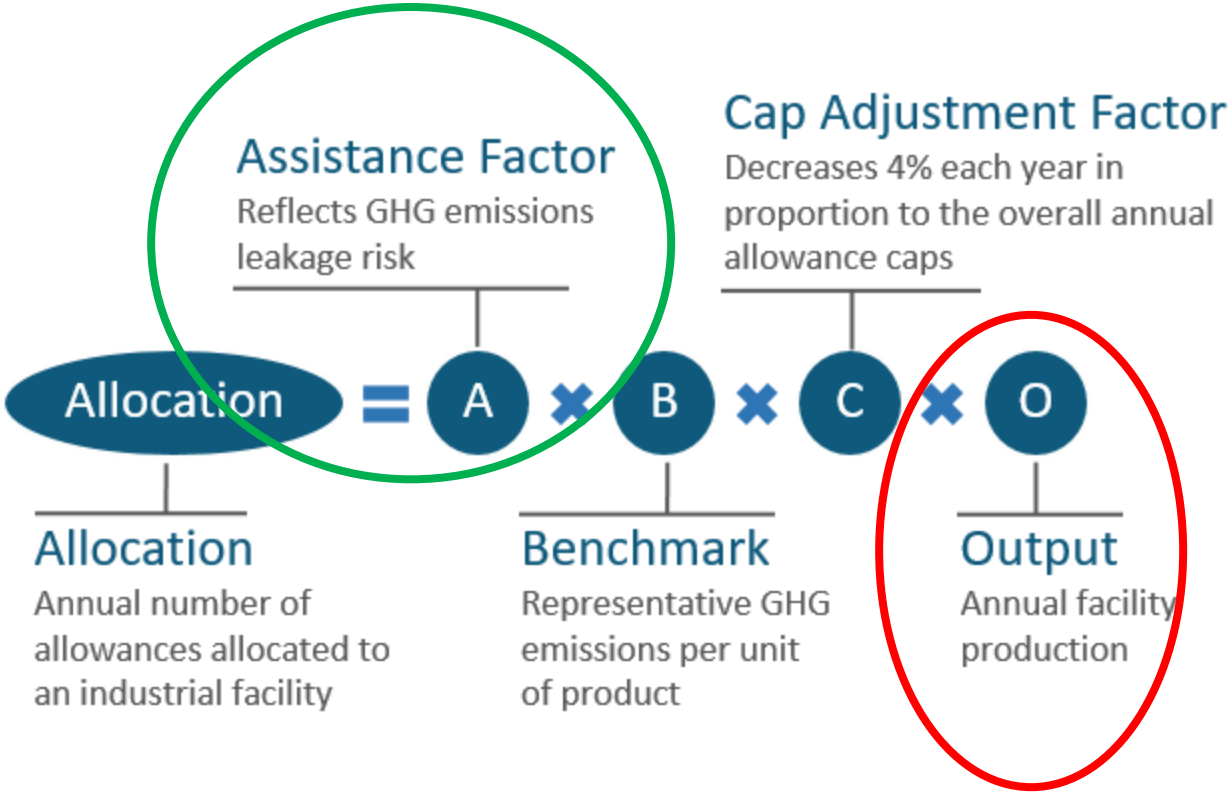
Usefulness of Empirical Evidence from Carbon Pricing Programs

- Prior emissions pricing programs
  - OBA approach implies that changes in economic activity are proportional to changes in relative prices
  - Empirically we have observed low prices that are unlikely to overcome the hurdle rate and trigger immediate capital investments
  - However, new capital investments may be influenced, especially by expectations of increasing program stringency over time
  - ➢ Empirical estimates may provide a lower bound estimate of potential leakage at existing facilities from more ambitious prices that overcome hurdle rates

RFF

Assistance Factor assumes constant leakage risk

Allocation in California is product based



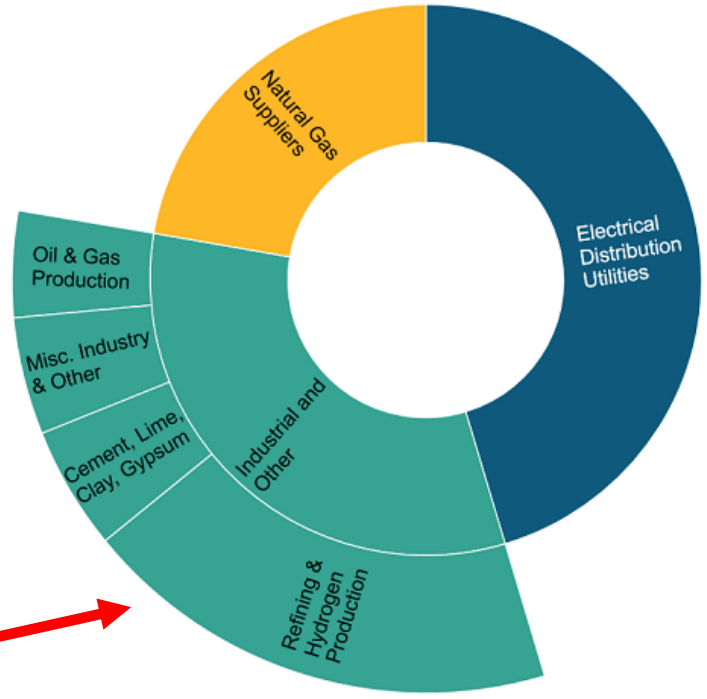
https://ww2.arb.ca.gov/our-work/programs/cap-and-trade-program/allowance-allocation/allowance-allocation-industrial

Leakage is not proportional to carbon prices

Free allocation (illustrated here) represents about half of total allowance value

Industry share (green) is to mitigate leakage

- Example: Free allocation to refineries
  - 2010 EAAC report identified potential leakage at allowance prices of $25-50/ton (today $30-$60/ton)
  - Concern fuels might be refined out of state
  - Allowance prices around $17/ton
  - Annual allocation tops $500 million in value
    - Windfall?



Usefulness of Empirical Evidence about Energy Costs

- Variation in energy costs
  - Variation in costs is relatively transient, noisy
  - Modest changes in energy costs trigger operational changes but not investments
  - Real option theory suggests hurdle rate is greater due to uncertainty in energy markets
    - Observed recently in gasoline price elasticity estimates that distinguish between changes in energy prices and state fuel prices
  - ➢ Like modest carbon prices, these estimates may provide a lower bound estimate of potential leakage at existing facilities from more ambitious prices that overcome hurdle rates

RFF

Take-Home Guidance from Empirical Evidence

- Carbon price and energy costs studies are both likely to capture operational changes that are possible with minimal investment
- Low prices are unlikely to trigger closing of existing facilities, but they could influence new investments
- Leakage rates may be an increasing function of the carbon price as disinvestment at existing facilities accelerates and hurdle rates for new investments are overcome
- But,… real option theory suggests hurdle rates for incumbent technologies and new technologies are similarly affected
  - Expectations play an important role shaping investments

RFF

3. Offset Leakage

- CARB describes:
  - Activity-Shifting Leakage: displacement of activities
  - Market-Shifting Leakage: price-driven leakage

The ongoing CA committee finds little evidence of either type of leakage, because for example…

  - Displacement of activities incurs capital costs similar to leakage-driven relocation of emitting activities
  - Investments on natural lands can boost their productivity

- A production incentive does not seem to apply to offset leakage.

RFF

Thank you.

burtraw@rff.org

RESOURCES FOR THE FUTURE