Imposition of a Load-Based GHG Emissions Cap & Trade System on California's Electricity Market: Can This System Work with MRTU?

Analysis by Southern California Edison

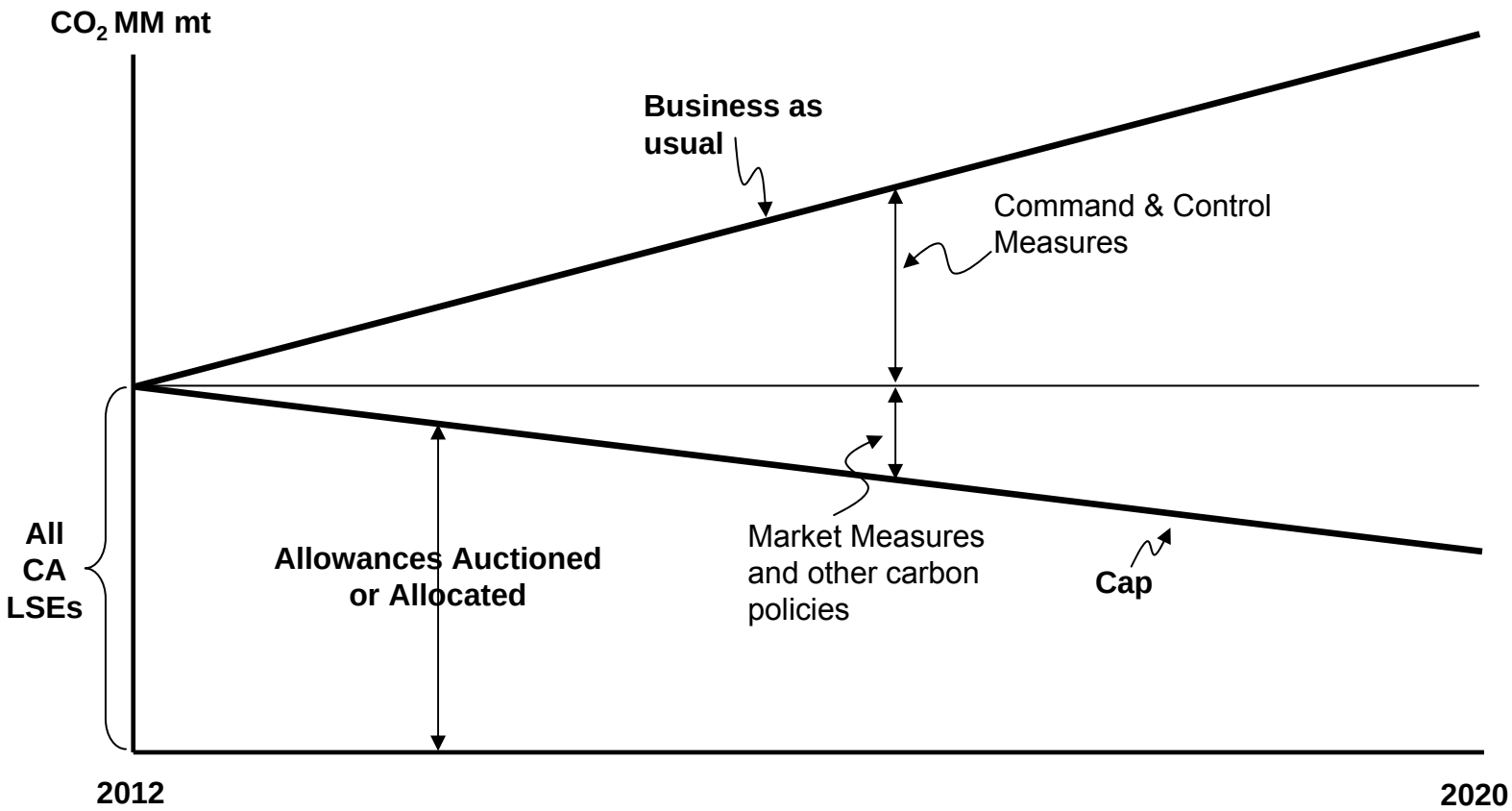
MSC Meeting
June 8, 2007

California Assembly Bill AB-32 States

- "…require the state board to adopt a statewide greenhouse gas emissions limit equivalent to the statewide greenhouse gas emissions levels in 1990 to be achieved by 2020…"

- "…action taken by California to reduce emissions of greenhouse gases will have far-reaching effects by encouraging other states, the federal government, and other countries to act."

Cap & Trade System



Note: Total allowances may be increased or decreased through interaction with other markets

Market Impacts of a Cap & Trade System

- Definition of terms
  - K = LSEs total variable cost of serving its load
  - L = LSE's load
  - g_i = generation from unit i
  - $C_i(g_i)$ = variable cost of generation from unit i
  - $E_i(g_i)$ = GHG emissions from generation unit i
  - P = market price of power
  - P_E = market price of GHG emissions
  - C' = marginal cost
  - E'_M = marginal emissions cost of market purchases

Cost under a Source-Based Cap

Total LSE Cost =

(Operating cost of all generation) +

(Emissions of all generation x price of emissions) +

(Net Short position x Market Price of power)

$$K = \sum_{i} C_i(g_i) + \sum_{i} E_i(g_i) \cdot P_E + (L - \sum_{i} g_i) \cdot P$$

Competitive Market Outcome Under a Source-Based Cap

Minimizing the Total LSE Cost and solving shows that:

LSE's generation bid = marginal operating cost plus marginal emissions cost

for each unit

$$\frac{\partial K}{\partial g_i} = C'_i + E'_i \cdot P_E - P = 0 \qquad \text{which yields}$$

$$P = C'_i + E'_i \cdot P_E \qquad \text{for all i}$$

Cost under a Load-Based Cap

Total LSE Cost =

(Operating cost of all generation) +

(Emissions cost of all generation) +

(Net Short position cost) +

(Emissions cost of Net Short position)

$$K = \sum_{i} C_i(g_i) + \sum_{i} E_i(g_i) \cdot P_E + \left(L - \sum_{i} g_i\right) \cdot P + \left(L - \sum_{i} g_i\right) \cdot E'_M \cdot P_E$$

Competitive Market Outcome Under a Load-Based Cap

Minimizing the Total LSE Cost and solving shows that:

LSE's generation bid = marginal operating cost plus the ***difference*** in marginal emissions cost between the portfolio and the market

for each unit

$$\frac{\partial K}{\partial g_i} = C'_i + E'_i \cdot P_E - P - E'_M \cdot P_E = 0 \qquad \text{which yields}$$

$$P = C'_i + (E'_i - E'_M) \cdot P_E \qquad \text{for all i}$$

Total Cost to the LSE Under Source–Based or Load-Based Cap

For either a source-based or a load-based cap, we find:

Total LSE Cost =

(Operating cost of all generation) +

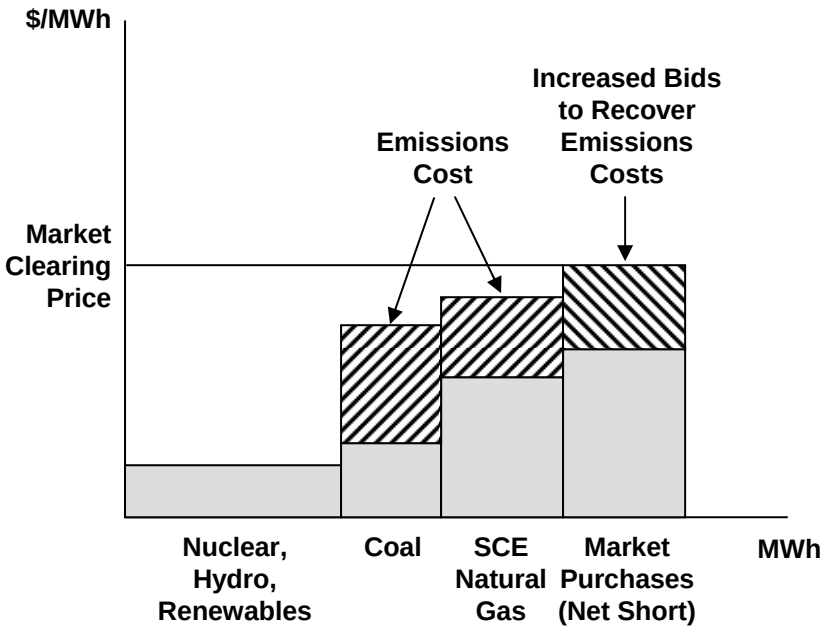
(Emissions cost of all generation) +

(Net Short position cost) x (marginal operating cost + marginal emissions cost)

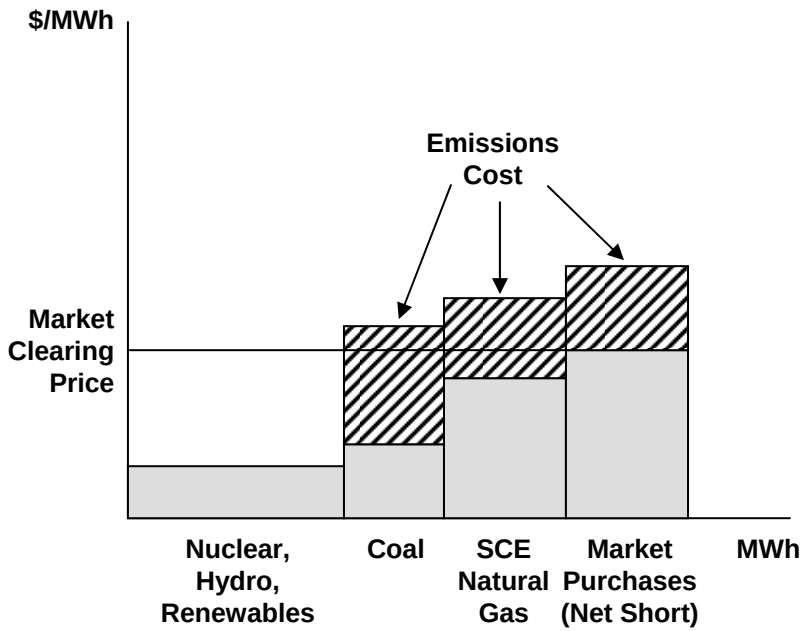
$$K = \sum_{i} C_i(g_i) + \sum_{i} E_i(g_i) \cdot P_E + \left(L - \sum_{i} g_i\right) \cdot \left(C'_i + E'_i \cdot P_E\right)$$

Total LSE Costs Under a Source-Based Cap and a Load-Based Cap

Source-Based Cap



Load-Based Cap



Transactions Implications of Source-Based Cap and Load-Based Cap

- Under a source-based cap, a seller bidding into the CAISO market will earn a market price that reflects the emissions cost of the marginal unit. That seller would demand the same price to sell bilaterally to an LSE.
- Under a load-based cap, a seller bidding into the CAISO market would not expect to receive a market price reflecting emissions costs. However, if that seller sells directly to an LSE, the LSE would be impacted by the emissions from the seller's generation.
- The LSE should be willing to pay a premium for power that is cleaner than the market. The LSE should require a discount for power that is dirtier than the market.
- As a result, clean power should sell to LSEs and dirty power should sell to the market.

Cost Effectiveness of Clean Resources

- Under a source-based cap, displacing marginal purchases from the market, or marginal generation from one's own portfolio with a clean resource (e.g. energy efficiency) saves the operating cost and the emissions cost reflected in the market price of power, or avoided from the portfolio – this is true for an IOU, muni, or ESP

- Under a load-based cap, displacing marginal purchases from the market or marginal generation from one's own portfolio with a clean resource saves the operating cost reflected in the market price of power, or avoided from the portfolio, and saves the emissions cost associated with the avoided market purchase, or avoided from the portfolio – this is true for an IOU, muni, or ESP

- The avoided cost is the same under either case – the incentive to pursue clean resources is the same in either case – this is true for an IOU, muni, or ESP

Summary and Conclusions

- Total Costs to LSEs should be the same under a source-based cap and a load-based cap
- Cost effectiveness of adding clean resources, including energy efficiency and renewables is the same under either approach
- Transactions economics by sellers is changed under a load-based cap, potentially affecting CAISO reliability and efficiency
- A Source-Based cap is preferred, and SCE believes that under a First Seller point of regulation structure, California can and should adopt this approach to a Cap & Trade Market for GHG