GHG Regulation
3 Approaches

• Direct Regulation
• Cap and Trade
• Fee
Economy Wide Model

• Find the effect on the total CA economy of these three types of measures
• Use EDRAM, a general equilibrium model of CA
• What is EDRAM?
Model History

• California State Senate Bill 1837 in 1994
• Evaluate Tax Bills Over $10 million
• Adopted by CAL EPA/ARB
  – SIP (2000 report)
  – Petroleum Reduction Strategies (joint with CEC)
  – Current SIP
• Continuous use for last 8 years
DRAM

• Captures all the fundamental economic relationships among consumers, producers and government.

• Computable
  – done numerically
  – over 1100 equations

• General Equilibrium
  – Prices adjust to clear markets
    • in factors, labor and capital
    • in goods and services
  – Conserves Money
  – Conserves goods, services, and factors
Industrial Sectors

• Group like industries together
  – e.g. Agriculture sector represents all agricultural firms in CA.
    • output value = value of all crops in CA
    • labor demand = total value of labor used in ag.

• Data
  – national data Bureau of Economic Analysis
  – state employment data
Households & Gov’t

• 7 categories of HH
  – one for each marginal tax rate
  – traces income and expenditure for each

• Gov’t
  – 7 federal, 27 state, and 11 local sectors
  – keeps program areas and tax types separate
Where is Petroleum?

- Refining
- Crude Production
- Import and Export
  - Crude
  - Refined
- Intermediate good purchased by
  - Transportation
  - Other sectors

- Purchased by consumers
- Significant direct tax revenue
- Engines are needed to use petroleum
many different goods and services and many types of firms

Two Factors: Capital and Labor
Production

• Output is made from
  – Value added
    • which is made from capital and labor
  – and Intermediate Goods

• Producers Maximize Profits
Consumers

- Maximize their happiness by buying
  - goods and services
- Their income comes from
  - labor
  - capital
  - transfers (e.g. social security)
- They pay taxes
Gov’t and Trade

• Government has taxes as income
• Gov’t buys goods and services
• Gov’t makes transfer payments
Trade

• When domestic prices increase relative to world prices, imports go up and exports go down.
State Level Model

• (1) Regional CGE models do not require that regional savings equal regional investment.
• (2) Regional economies trade a larger share of their output.
• (3) Regional economies face larger and more volatile migration flows than nations.
• (4) Regional economies have no control over monetary policy.
• (5) In regional models, local, state and federal taxes are interdependent through deductibility.
• (6) There is less state specific data than there is national data.
• (7) the California CGE differs from a national CGE in that California faces a long run balanced-budget requirement.
Investment and Migration

• Immigration and emigration respond to economic conditions.
• Investment and disinvestment respond to the rate of return.
• Model is equilibrium—takes 3-5 years to fully adjust to policy changes.
Back to 3 Types of Measures
Carbon Tracking

• Track C02e at the level of primary energy within CA.

• Calculate the carbon intensity (MMTCO2e per billion dollars of purchases) for
  – Refineries, the natural gas, and in-State electricity.
  – Imported natural gas, refinery products, and electricity.
Direct Regulation

• Develop a “conservation supply curve”
  – List of regulations
  – Ordered by cost by ton CO2e saved
  – Go down the list until you get the savings you need.
Economy Wide Effects

• Example: Fuel
  – Now: Fuel is made with oil (and other things)
  – Alternative: Use less oil but more agricultural outputs (e.g. corn) and more processing (e.g. services of the chemical industry)
  – Made Up Example
    • 10 billion less in oil purchased
    • 5 billion more chemical industry services
    • 5 billion more agricultural outputs
Technological Change

- The changes from the conservation supply curve are applied as changes in technology.
- Every barrel is fuel is now made with less crude and more agriculture and chem industry.
- Therefore price of fuel must change. Uneconomic techniques raise the price.
- Model follows through consequences of raised prices. Consumers demand less, less exported, more imported and so on.
Model

- EDRAM takes the change in technology to make gas and finds the changes in relevant variables
  - Incomes (including income of low earners)
  - Employment
  - Population
  - And so on.
  - Carbon (changes in prices give further effects than just the technologies themselves)
Fee

- We track carbon.
- We charge a fee on the “carbon purchases” by the prime sectors (oilref, gas and elect distributors and importers)
- For any fee level…
...for any fee level

- Find the measures from our conservation supply curve that would pay for themselves and apply them.
- Run model and tabulate carbon.
- Choose the fee level that achieves the desired reduction.
Where does the fee go?

• Used to reduce other tax (double dividend)
  – PIT, Sales, Bank and Corp are big ones
  – Remitted lump sum
  – Could easily be targeted to certain income groups
    • E.g. a tax credit for those earning below $10K

• Used for increased expenditures
  – Across the board
  – For specific carbon reduction measures
Cap and Trade

• Nearly same as a fee!
  – Choose a cap.
  – Raise the fee until the cap is met.
• But Who Gets the Money?
• Examples
  – Auction. It could go to the general or a special fund. Just like a fee.
  – Grandfathered. It goes to the firms.
Consequences

• If the value of the quotas is transferred to the firms, there is no reason to believe that anything like all of it will be spent in CA
  – Is much like a federal excise tax on CO2e
  – In general, quota rents transferred outside CA are quite deleterious to CA income.
Conclusion

• Cap and Trade, Fee, and Direct all make use of technologies from the conservation supply curve.
  – Cap and Trade and Fee only use those measures below the carbon value.

• Cap and Trade and Fee require a “sink” for the value created by the carbon cap or by the tax
  – “sinks” outside CA are costly