Climate Action Team

Inputs to Macroeconomic Analysis of Climate Change Strategies

Preliminary Inputs

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Overview

- E-DRAM input requirements
- Total costs and savings
- Data sources
- Energy prices and savings factors
- Cost calculation example
- Savings calculation example
- Conclusion

E-DRAM Inputs

- ARB uses E-DRAM to calculate economic impacts
- Inputs consist of adjustments to sectors:
  - Costs of implementation of strategies
  - Savings due to reduced use of fossil-fuel energy

Total Costs and Savings of Strategies

- Total costs
  - $1.4 billion in 2010
  - $8.1 billion in 2020
- Total savings
  - $3.0 billion in 2010
  - $17.3 billion in 2020
- Net savings
  - $1.6 billion in 2010
  - $9.2 billion in 2020

Cost Distribution by Sector

- Costs in 2020
  - $2.5 billion for consumer transportation
  - $1.4 billion for residential construction
  - $1.4 billion for electrical devices
  - $0.7 billion for petroleum
  - $0.6 billion for forestry
  - $1.5 billion for nine other sectors

Savings Distribution by Sector

- Savings in 2020:
  - $6.5 billion for electricity
  - $2.1 billion for natural gas
  - $8.7 billion for petroleum
    - $7.1 billion from consumer transportation
    - $1.6 billion from industry

Data Sources

- State agencies
- Tellus Institute
- UC Berkeley, Department of Agricultural and Resource Economics

Energy Prices and Savings Factors

- CEC provided energy prices
- ARB calculated "savings factors" based on the prices

Energy Prices from CEC
(2005 dollars)

- Gasoline
  - 2010: $2.12 per gallon
  - 2020: $2.19 per gallon
- Natural Gas
  - 2010: $6.14 per million cubic feet
  - 2020: $8.62 per million cubic feet
- Electricity
  - 2010: ~$117 per Megawatt-hour
  - 2020: ~$117 per Megawatt-hour

Electricity Savings Factor

- If a strategy reduces electricity consumption such that CO_2 emissions decrease by 1 metric ton,
- Then electricity consumption decreases by 1.92 MWh (@ 0.521 Mt per MWh),
- And end users save $211 (@ $110 per MWh, in 2003 dollars)
- Therefore, electricity savings factor is $211 per metric ton CO_2 equivalent

Natural Gas Savings Factors

- Combustion – If a strategy results in less combustion of natural gas, the savings factor is $142 per metric ton CO_2

- Capture – If a strategy captures methane that would have escaped to the atmosphere, the savings factor is $19 per metric ton CO_2 equivalent
  - Methane global warming potential = 21
  - Assumes replacement of fossil-fuel gas

Gasoline Savings Factor

- For every metric ton of CO_2 emissions reduced from gasoline-powered vehicles,
  - Consumers reduce consumption of gasoline by 358 gallons.
  - Savings rate is
    - $234 per metric ton CO_2 in 2010
    - $243 per metric ton CO_2 in 2020

Cost Calculation Example

- Semi Conductor Industry Targets

Quantity	Value	Units	Source/ Comments
Cost-effectiveness	34.66	Dollars per MtCO2e	UCB
Emission reductions	2	MMtCO2e	Table 5-2
Cost	69.32	Million dollars	Multiply cost-effectiveness * emission reduction

Types of Cost Calculations

- Simply cost-effectiveness * emission reduction
- Net cost-effectiveness
  - Calculate net cost
  - Calculate savings
  - From that, calculate implementation cost
- Capital cost
  - Add capital costs to get cumulative cost
  - Multiply by capital recovery factor to get annualized cost

Savings Calculation Example

- **Manure Management**

Quantity	Value	Units	Source/Comments
Emission reductions	1.0	MMtCO2e	Table 5-2
Natural gas savings factor	18.59	Dollars per MtCO2e	Takes into account GWP of escaped methane
Recovery factor	50%		Not all captured gas is good enough to use as fuel
Savings	9.29	Million dollars	Multiply factors * emission reduction

Conclusion

- ARB derived costs for the strategies
- Many strategies have savings due to reduced or displaced energy use
- The savings are larger in magnitude than the costs
- The calculations are preliminary
- We plan to work with the agencies and other stakeholders to refine the assumptions and calculations