The Embedded Carbon Tax: Project Update

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Quarterly Overview

• 2 research objectives in last quarter:
  – Determine impact of carbon tax (C tax) on biobased industry
    • How is industry impacted by various C taxes?
  – Determine role of C tax in macroeconomic rebalancing policy
    • C tax as a consumption tax
    • Impact of U.S. consumption tax on global rebalancing efforts
Carbon Tax and Biobased Industry

• Ideal C tax treats industry according to strict carbon accounting
  – If C-positive, pay tax on emissions
  – If C-neutral, pay no tax
  – If C-negative, receive tax credit

• All sectors of biobased industries should be covered
  – Past policies have provided favorable treatment to select few
Research Project: Pyrolysis and Carbon Policy

- Modeled two types of pyrolysis facilities (slow & fast) under ACES scenario
  - i.e., cost advantage for C-neutral products; credits for C-negative products
- Pyrolysis yields sequestered C (biochar) and C-neutral (biogasoline) products
- Sensitivity analysis of results used to determine biggest profitability factors
Pyrolysis and Carbon Policy: Results

- **Bio-oil Yield (40; 53; 66 wt% feed)**
- **Biomass Cost ($110; $83; $55/metric ton)**
- **Fuel Yield (37; 42; 47 wt% bio-oil)**
- **Hydrogen Price ($2.00; $1.5; $1.00/GGE)**
- **Fixed Capital Cost ($223; $172; $120 MM)**
- **Gas Credit Value ($0; $5; $16.5/MMBTU)**
- **Catalyst Cost ($3.53; $1.77; $0.88 MM/yr)**
- **Char Value ($10; $20; $55/short ton)**

**Fast Pyrolysis**

**Internal Rate of Return**

- 10.00%
- 5.00%
- 0.00%
- 5.00%
- 10.00%
- 15.00%
- 20.00%
- 25.00%

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Pyrolysis and Carbon Policy: Results

• Pyrolysis profitability depends more on C tax increasing price of high-C competitors than sequestration credit value
  – 25% increase in fuel yield doubles facility IRR
  – 175% increase in offset value increases facility IRR by 20%

• Pyrolysis facilities derive greater value from C-neutral products than C-negative products
Policy Implications

• Should C tax pay more attention to carbon-neutrality than sequestration?
  – Slow pyrolysis unprofitable under scenario despite greater sequestration potential
  – Existing proposals focus more on sequestration than increasing price of C-positive competitors

• Greater tax efficiency and environmental efficacy?
Carbon Tax and Macroeconomic Policy

• Policy debate in DC has shifted from cap-and-trade to rebalancing global economy
• As world’s largest economy, U.S. policy can play a significant role in rebalancing
  – As part of rebalancing, US consumers must be encouraged to spend less over long-term (short-term is another matter)
Carbon Tax as Consumption Tax

• Could a consumption tax aid rebalancing efforts?
  – Analysis of OECD members suggests a 10% increase in use of consumption tax results in $40B change to current accounts

• Downstream C tax shares many characteristics with consumption tax
  – Ultimately discourages consumption of most products (i.e., carbon-positive) to varying degrees based on carbon footprint
Carbon Tax as Consumption Tax

• Rebalancing the global economy
  – US consumers must increase saving/investing while decreasing spending

• U.S. consumption tax could aid this process
  – Consumption tax would increase domestic and foreign investment in U.S. and reduce consumption (Grubert et al., 1995)(Hines Jr., 2007)
Next Steps

• C tax and biobased industry
  – Biochemicals industry can play large role in reducing net emissions via carbon-neutrality
    • Potential to be high-value industry
  – Analyze biochemical profitability drivers under C tax scenario

• C tax and global rebalancing
  – Explore C tax/cons. tax/restructuring linkage
  – Determine whether ideal C tax can “kill two birds with one stone”