Alternative Policy Approaches to Greenhouse Gas Control

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Plan of Presentation

Why Care - brief

What is happening legislatively

What could happen
Why Care?
Is something happening
Some say recent data shows Climate change is over

Ups and downs in global atmospheric temperatures over a decade are not easy to interpret.

Climate models predict increasing emissions will cause a temp increase.
Pre industrial - 275 Counting Non CO₂
1985 - 345 this is increase almost doubles
2007 - 380+

http://www.esrl.noaa.gov/gmd/ccgg/trends/co2_data_mlo.html
## Why Adapt - Inevitability

<table>
<thead>
<tr>
<th>Stabilization level (ppm CO₂-eq)</th>
<th>Global mean temp. increase at equilibrium (°C)</th>
<th>Year CO₂ needs to peak</th>
<th>Year CO₂ emissions back at 2000 level</th>
<th>Reduction in 2050 CO₂ emissions compared to 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>490 – 535</td>
<td>2.4 – 2.8</td>
<td>2000 - 2020</td>
<td>2000- 2040</td>
<td>-60 to -30</td>
</tr>
<tr>
<td>535 – 590</td>
<td>2.8 – 3.2</td>
<td>2010 - 2030</td>
<td>2020- 2060</td>
<td>-30 to +5</td>
</tr>
<tr>
<td>590 – 710</td>
<td>3.2 – 4.0</td>
<td>2020 - 2060</td>
<td>2050- 2100</td>
<td>+10 to +60</td>
</tr>
<tr>
<td>710 – 855</td>
<td>4.0 – 4.9</td>
<td>2050 - 2080</td>
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<td>+25 to +85</td>
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<tr>
<td>855 – 1130</td>
<td>4.9 – 6.1</td>
<td>2060 - 2090</td>
<td></td>
<td>+90 to +140</td>
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</tbody>
</table>

### U.S. Greenhouse Gas Emissions by Gas

- HFCs, PFCs, & SF₆
- Methane
- Nitrous Oxide
- Carbon Dioxide

### 400 Thousand Years of Atmospheric Carbon Dioxide Concentration and Temperature Change

- CO₂ Concentration from Antarctic Ice Cores
- Temperature Change from Antarctic Ice Cores
- Current Level
- 1000 AD Level

Graphic: Michael E. Eddy, The Woods Hole Research Center
Approaches to limit GHGs - Generalities

In general, emission costs are typically not fully considered by the emitting decision maker.

Many think too much is being emitted and it is judged desirable to reduce emissions.

Three approaches have evolved to fix this in a pollution setting

1. Limit maximum allowable emissions
2. Tax emissions
3. Cap total emissions and allocate emission permits to individuals allowing them to trade.
Now Climate Change and Legislation
Forms of Greenhouse Gas Legislation

Energy Bill

Cap and trade Bills/Policies
  State and Local
  Federal
  International

Taxes

Clean Air Act
2007 Energy Act
Imposes LCA requirements on eligible fuels.

Total amount of biofuels added to gasoline is required to increase
- to 36 billion gallons by 2022, from 4.7 billion gallons in 2007.
- further specifies that 21 billion gallons of the 2022 total must be derived from non-cornstarch products (e.g. sugar or cellulose).

Bioelectricity has largely been left out of the story with some small research and development undertaken.
2007 Energy Act
Imposes LCA requirements on eligible fuels.

**Conventional Biofuels** - ethanol from corn and facilities built since bill - **20%** reduction no less than **10%**.

**Advanced Biofuels** - other than ethanol from corn starch - at least **50% LCA** minimum may be lowered to **40%**

**Cellulosic Biofuels** -- LCA emissions at least **60%** less - no lower than **50%**

**Biomass-Based Diesel** -- at least **50%** less LCA than diesel may be reduced to **40%**.

**Undifferentiated Advanced Biofuels** - Other than corn ethanol derived from corn starch, has LCA at least **50%** less than fuel replaced. Reducible to **40%**
Greenhouse Gasses and Biofuels

Feedstocks take up CO2 when they grow then CO2 is emitted when feedstocks burned or when energy derivatives burned. But starred areas also emit. In total they increase emissions but recycled on net. LCA accounts for total net offset.

Biofuels are big today address GHGs
Offset Rates Computed Through Lifecycle Analysis

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Crop Ethanol</th>
<th>Cellulosic Ethanol</th>
<th>Biodiesel</th>
<th>Electricity Co-Fire 5%</th>
<th>Electricity fire 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorghum</td>
<td>39</td>
<td></td>
<td></td>
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<tr>
<td>Sugarcane</td>
<td>65</td>
<td></td>
<td></td>
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<tr>
<td>Corn Residue</td>
<td>73</td>
<td>93</td>
<td>86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat Residue</td>
<td>73</td>
<td>95</td>
<td>91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switch Grass</td>
<td>69</td>
<td>94</td>
<td>90</td>
<td></td>
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<tr>
<td>Energy Sorghum</td>
<td>79</td>
<td>98</td>
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<tr>
<td>Sweet Sorghum</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet Sorghum Ratoon</td>
<td>63</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soybean Oil</td>
<td></td>
<td>71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn Oil</td>
<td></td>
<td>55</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bagasse</td>
<td>90</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lignin</td>
<td></td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Net Carbon Emission Reduction (%)

Crop ethanol < cellulosic < biodiesel < Electricity

Opportunities have different potentials

Ethanol offsets are in comparison to gasoline. Power plants offsets are in comparison to coal.
STATE AND REGIONAL INITIATIVES

From Lydia Olander RECENT EFFORTS IN US CLIMATE POLICY: IMPLICATIONS FOR FORESTRY AND AGRICULTURE, presented at 5th Forest and Agriculture Greenhouse Gas Modeling Forum April 2009
Tax characteristics

First the tax

- Levied against emissions
- Money to the government can redistribute but transactions costs
- Reduce pollution if reduction cost < than tax
- Keep emitting if reduction cost > tax but incentive to reduce
- Will not stimulate sequestration in absence of credit
- If cost of emissions reduction < tax may do nothing but could get a tax credit if defined
- May need emissions grandfathering and tax above that
- Magnitude of emissions reduction is uncertain
Cap and Trade Market characteristics

Now cap and trade

- Total cap on emissions
- Would need development of a credit for sequestration
- Firms with expensive emission reduction costs could buy from firms with cheap cost and have incentive to reduce
- Would create least cost reductions for emission cap level
- Money stays in private hands
- Incentive to reduce if cost < market price and firm gains a valuable salable commodity
- Emission reduction is certain cost/unit is uncertain
- Place of emission reductions uncertain
- SO2 example – power plants
- Chosen Kyoto mechanism
Markets versus taxes – Some Cases

Manure lagoon that could be covered with methane recovery system

– Carbon/GHGs arises
  • Methane emissions that are destroyed (revenue source)
  • Carbon emissions when methane burned, capital cost (cost source)
  • A possible offset of fossil fuel (revenue source)

– Under tax
  • Without grandfathering methane emissions would be taxed.
  • Reduce if covering is cheaper than tax.
  • Money to government
  • If covering cost < tax might reduce too much but only gain tax
  • Could increase operation size but would have to pay for emissions

– Under cap and trade
  • Would have rights to emit
  • Could do nothing and have business as usual
  • Could cover lagoon reducing emissions and sell permits if cost of covering was cheaper than cap and trade market price
  • If covering a lot less might reduce too much but only gain tax savings
  • Could increase operation size but would have to buy permits
Markets versus taxes – Some Cases

Farmer producing switchgrass as a biofuel feedstock

–Carbon/GHG arises
  • As sequestration in soil (revenue source)
  • As emissions from N application (N2O), equipment (cost source)
  • As offset of fossil fuel (revenue source)

–Under tax
  • Without grandfathering pay for fuel and N emissions when buying
    Might experience reductions from prior land use and this is a savings
  • Sequestration revenue would require a credit provision
  • Money to government
  • Biofuels not a credit but added revenue through higher switchgrass price if
    switchgrass combustion/fuel emissions are exempted from tax

–Under cap and trade
  • Would probably pay for permits when buying diesel and fertilizer
    Might experience reductions from prior land use and this may be a savings
  • Sequestration would be salable if rules allow
  • Money to permit seller or from buyer
  • Not saleable as credits, higher switchgrass price if use exempted from cap
Markets versus taxes – Some Cases

Farmer changing tillage to less intensive

- Carbon/GHG arises
  - As sequestration in soil (revenue source)
  - As emissions from equipment and N use (cost source)
  - As reduced emissions from equipment (revenue source)

- Under tax
  - Without grandfathering would pay for equipment and N application emissions probably when buying diesel and fertilizer
    - Might experience reductions from prior land use - a savings
  - Sequestration revenue would require a credit provision
  - Money to government but savings to farmer

- Under cap and trade
  - Would probably pay for permits when buying diesel and fertilizer
    - Might experience reductions from prior tillage - a savings
  - Sequestration credits would be salable if rules allow
  - Money to farmer as permit seller
Tax and Cap and Trade
US CAP-AND-TRADE POLICY

Current champ Waxman – Markey

Probably wont become law this year

http://www.nicholas.duke.edu/institute/cleanenergyact/index.html
Comparison of Legislative Climate Change Targets in the 110th Congress, 1990-2050
As of December 8, 2008

For a full discussion of underlying methodology, assumptions and references, please see http://www.wri.org/usclimatetargets. WRI does not endorse any of these bills. This analysis is intended to fairly and accurately compare explicit carbon caps in Congressional climate proposals and uses underlying data that may differ from other analyses. Price caps, circuit breakers and other cost-containment mechanisms contained in some bills may allow emissions to deviate from the pathways depicted in this analysis.
U.S. CAP-AND-TRADE

– Inside the cap
  • Emissions: power plants, factories, oil refineries (gasoline)

– Outside the cap
  – Domestic
    » Land management emissions and sinks: forestry, agriculture, landfills
    » Emissions: fugitive emissions, industrial N2O
  – International
    » Industry and energy in developing countries
    » Deforestation in developing countries

Offsets

From Lydia Olander RECENT EFFORTS IN US CLIMATE POLICY: IMPLICATIONS FOR FORESTRY AND AGRICULTURE, presented at 5th Forest and Agriculture Greenhouse Gas Modeling Forum April 2009
Offsets

- Forests
  - Afforestation/reforestation
  - Forest management
  - Avoided deforestation
- Landfills
- Livestock
- Urban Forests
- Co-digestion (anaerobic digestion of manure and waste)
- Natural gas transport fugitive emissions
- Coal mine methane

From Lydia Olander RECENT EFFORTS IN US CLIMATE POLICY: IMPLICATIONS FOR FORESTRY AND AGRICULTURE, presented at 5th Forest and Agriculture Greenhouse Gas Modeling Forum April 2009
FROM EPA (2005) GREENHOUSE GAS MITIGATION POTENTIAL IN U.S. FORESTRY AND AGRICULTURE

National Mitigation Cost Curve for Agriculture, Forestry, and Biofuel Offsets

- Agricultural soil carbon sequestration
- Forest management
- Fossil fuel mitigation from crop production
- Agricultural CH4 and N2O mitigation
- Afforestation
- Biofuel offsets
Why politically have Offsets

1. Achieve more mitigation without increasing costs
2. Bring in important constituencies
3. Provide a bridge to low carbon technologies (provide rapid results)
   – Land use critical for this

From Lydia Olander RECENT EFFORTS IN US CLIMATE POLICY: IMPLICATIONS FOR FORESTRY AND AGRICULTURE, presented at 5th Forest and Agriculture Greenhouse Gas Modeling Forum April 2009
ALTERNATIVE OFFSET SCENARIOS
EPA ANALYSIS OF THE CLIMATE SECURITY ACT OF 2008: S. 2191 (MARCH 2008)

Graph showing the comparison of different offset scenarios from 2005 to 2050:
- **No offsets**
- **15/15**
- **Unlimited offsets**

Legend:
- Scenario 5 - S. 2191 - No Offsets
- No International Offsets
- Scenario 2 - S. 2191
- Scenario 10 - S. 2191 - Alt. Ref.
- Unlimited Domestic Offsets
- Scenario 4 - S. 2191 - Unlimited Offsets

Y-axis: 2005 $ / MCO2e
X-axis: Years (2015 to 2050)
CONCERNS ABOUT OFFSETS

1. Will work too well
   – Diverts effort away from capped sector, reduces investment in technology
   – *Question of the cap not a problem with offsets.*

2. Won’t work
   – Projects too complicated or too costly, or too discounted to bring in sufficient participation

3. Not real reductions
WAXMAN DRAFT BILL _ OFFSETS

1. Allows maximum 2 billion tons, split evenly between domestic and international offsets
2. Credits 4 tons for every 5 submitted
3. Domestic program
   • Integrity Advisory Board & Administrator
   • Additionality: legal, 2009, common practice
   • Performance Std Baselines
   • Impermanence coverage (buffers or insurance)
   • Adjustments for uncertainty (discounts)
   • Adjustments for leakage (discounts)
   • Early credits _ State programs (CCAR/RGGI)

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WAXMAN DRAFT BILL _ OFFSETS

International programs

• Bilateral/multilateral
• Sectoral offsets
• UNFCCC (CDM) offsets
• Reduced Deforestation offsets
• Reduced Deforestation supplemental

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Big Income sources

- Biofuels – though commodity markets
- Afforestation
- In niches Manure
- Conservation

Less so

- Tillage
- Enteric
- Fertilizer
Big Income sources

Biofuels – though commodity markets
Afforestation
In niches Manure
Conservation

Less so

Tillage
Enteric
Fertilizer
Will a tax or market mean money for producers

Cost sources
Fossil fuel use, fertilizer use, enteric fermentation, rice, manure, deforest, break out land

Revenue sources
Sequestration, biofuel offsets

Results show for moderate tax offset revenue exceeds cost given grandfathering
Arguments from Advocates
For an incentive
Whether it be a tax or Cap/trade

– Need price to provide a strong incentive for emission reduction

– Voluntary does not get us there

– Stabilization takes 20 times Kyoto volume – time to get on with it

– Irreversibilities
For a tax

(from Mankiew, New York Times – Harvard and former CEA chair)

– Government needs tax revenue can do good with it by redistributing to reduce tax burden
– Car standards too expensive, efficient cars stimulates driving
– Cap and trade depends on how permits allocated, would mainly go to energy/power companies
– Energy cost would rise, no revenue to compensate
– Tax could be better internationally as China et al could be included, not exempted (Kyoto failure), easier to negotiate
– May be politically acceptable and implementable
For cap and trade plus market

(from House committee on Energy and Commerce)

– Point of regulation can be set where appropriate (refiners, power plants), may allow coverage of small sectors
– Certainty in level of emission reductions
– Produces emissions at lowest cost
– Rewards innovation
– Comprehensive, avoids leakage
– Can be complemented with R&D and other programs
– Ag too small with too many emitters to include
– Money stays in private hands, more efficient (added)
What might hit or miss

Sequestration
  Measurement and monitoring takes effort
  Unlikely under tax
  ?? Under cap and trade
Manure lagoons and enteric (“too small?”)
  Per head tax?
  Need rules for Cap and trade
Biofuels
  Need exemption under both
  Value passed through
Fertilizer (“too small?”)
  N2O is uncertain
  Emission rating per unit N acquired
Fossil fuel
  Tax at pump
  Emissions cap at refiner/distributor – cost passed through
Concerns as Market/Tax Evolves

Will tax policy or market have provisions for sequestration or manure lagoon covering?

Will biofuels use have emissions or use exempted?

If a tax is defined will there be a given level of deduction or a compensation scheme for historic energy use?

Should N2O from fertilizer be included? Enteric fermentation? Rice?

Is ag too small to be a player?

If ag is too small will it still face elevated energy prices?

If permits are upstream will ag get credits or grandfathering?

If we sell sequestration what happens to property rights, long run land use options and ability to cut down trees or breakout land?
International Policy

1. Annex 1 targets
2. Developing country participation
3. REDD
4. CDM
5. US Critical

CONFERENCE OF THE PARTIES-
December

From Lydia Olander RECENT EFFORTS IN US CLIMATE POLICY: IMPLICATIONS FOR FORESTRY AND AGRICULTURE, presented at 5th Forest and Agriculture Greenhouse Gas Modeling Forum April 2009
Meaningful participation needed by developing countries

Clean Air Act and Policy

Two years after a Supreme Court decision ordering the EPA to decide how to approach greenhouse gas emissions under the Clean Air Act, the Agency issued proposed findings that the gasses endanger public health, and that emissions from automobiles contribute to this form of pollution on April 17.

EPA identifies six key greenhouse gasses: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

It lists a host of environmental and health impacts, such as rising sea levels, changes in precipitation patterns and associated water shortages, extensive tree die-offs and forest fires, extended heatwaves, and intense precipitation events. For anyone who doesn't buy the scientific community's general agreement that greenhouse gasses can force the climate, the document mentions the ocean acidification caused by increases in atmospheric carbon dioxide.

The EPA is soliciting public feedback for the next 60 days, and will hold two public hearings before finalizing the decision.

http://epa.gov/climatechange/endangerment.html