Policy Design for Biofuel Markets: Fueling Change and Changing Fuels

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Outline

- Background
- Summary of existing State policy
- Comparison basic policy options
- A preliminary policy proposal for motor fuel markets

Biofuel markets today

- Midwest Corn ethanol & soybean-based biodiesel
- Volatile emerging markets
- Battles on the public opinion and science front
  - Energy balance is not great
  - Carbon emissions reductions are currently not fantastic
  - Compete for land; food v.s. fuel?
- Western U.S. at disadvantage in current markets
- Promising developments for the future? Yes.
  - Cellulosic ethanol has potential for:
    - Carbon emissions reduction and energy balance
    - Western states will likely compete better
  - Myriad other biofuels on the horizon:
    - Cellulosic bio-gasoline; bio-oil and its derivatives; butanol, methanol, etc.

WSU biofuel economics & policy research

- State Legislature directed WSU to recommend market incentives and public R&D programs to promote in-state biofuel and feedstock markets.
- Basic goals of the legislation:
  - Promote economically viable and sustainable instate production of biofuel and feedstocks;
  - Deliver the greatest net reductions of carbon emissions;
  - Reduce petroleum dependence.

State policy

Policy	*States* *[Federal programs not included]*
Consumption incentives – grants for converting vehicles to operate on biofuels, credits for consuming biofuels	**32 states** AK, AZ, AR, CO, DE, HI, IL, IN, IO, KA, KY, LA, MN, MO, MT, NE, NM, NJ, NY, NC, OH, OK, OR, RI, SC, SD, TN, UT, VT, VA, WA, WI
Production incentives – grants, subsidies (tax credits), low interest loans	**27 states** AR, FL, HI, IL, IN, IA, KS, KY, LA, ME, MD, MI, MN, MO, MS, MT, NE, NM, NC, ND, OK, OR, SC, SD, VA, WA, WY
Feedstock production incentives – tax credits, tax exemptions	**8 states** AR, LA, MO, MT, NM, OR, WA, WY
Distribution incentives – grants, subsidies, low interest loans	**29 states** AR, CO, FL, ID, HI, IL, IN, IA, KS, LA, ME, MI, MN, MO, NE, NJ, NM, NY, NC, ND, OH, OR, RI, SC, SD, TN, TX, UT, WA
Research incentives – grants, mostly	**8 states** CA, DE, FL, HI, MT, TX, VT, WA
Content standards – based on volume	**11 states** CA, HA, IO, LA, MN, MO, MT, NM, OR, PA, WA

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Pacific States

- **Washington:**
  - Aggregate standard; 2% biofuel by Dec. 2008, increases later.
  - Minor tax exemptions for biofuel production and retail inputs.
  - Energy Freedom Program: low-interest loans for selected projects.
- **Oregon:**
  - Tax credits for facilities, production, OR feedstocks, and consumption.
  - Standard: 10% ethanol by volume (each gal. contains 10% ethanol). Implement when OR production capacity ≥ 40 mgy. 2% for biodiesel.
- **California:**
  - Reduce C emissions to 1990 levels by 2020 (-10%).
  - Fuel standard based on net carbon emissions, not volume.
  - Standard imposed on licensees: producers, blenders, importers.
  - Credit trading and banking among licensees to reduce compliance costs.
- **[Federal programs:**
  - 51cents /gallon ethanol tax credit
  - $1/gallon biodiesel tax credit
  - Other]

Policy Design for an emerging biofuel market

- Target market failures.
- Target policy directly to goals.
- Provide incentives that promote and direct, not restrict, technology development.
- Address networking issues for distribution and consumption.
- Promote competitive rather than concentrated markets if economically viable.

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Policy focus for today

- Content standards
- Taxes, subsidies
- Performance-based policy
- Comparisons & tradeoffs

Content standards (quantity instrument)

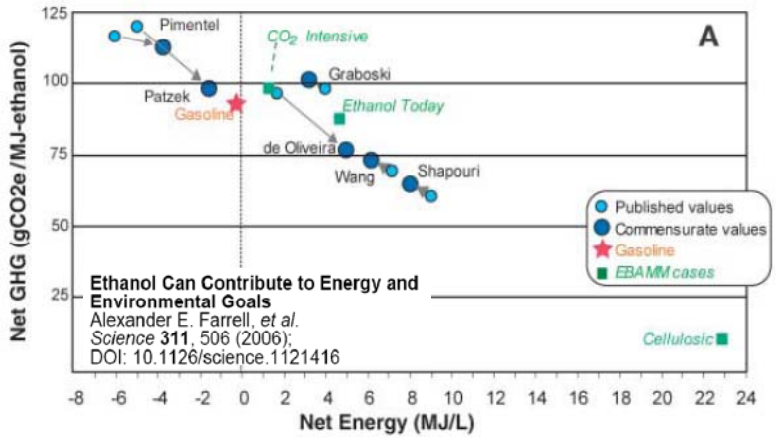
- **Per unit standard (OR). Each gallon must contain x%.**
  - **Fuel production and distribution licensees are responsible for satisfying the standard.**
- **Aggregate standard (WA).**
  - **Aggregate will be *x*% biofuel; content per gallon may vary.**
  - **Who's responsible for satisfying Washington standard? No one in particular!**
- **Advantages of standards:**
  - **Policy is tied directly to a fixed goal.**
  - **No direct tax revenue support necessary.**
  - **Consumers of blended fuel bear the costs; may reduce total fuel consumption.**

Taxes and subsidies (price instruments)

- **Substitution and income effects**
  - **Substitution effects: Taxes on fossil fuels alter relative fuel prices in favor of alternatives. Subsidies on renewables => inverse.**
  - **Income effect opposite: aggregate fuel consumption will decrease with taxation and increase with subsidies**
- **Tax revenues for motor fuels are often used for transportation infrastructure.**
- **Subsidies are paid for by taxpayers. Who is the taxpayer?**
  - **General population.**
    - **Relative price to consumers of biofuel ↓**
    - **More biofuel, perhaps more total fuel consumption.**
  - **Motor fuel consumers.**
    - **Petrol and biofuel sales support subsidy proportional to their use.**
    - **Cost of subsidy borne by fuel users**
  - **Nonrenewable fuel producers (Oil companies, refineries).**
    - **Relative prices change further in favor of biofuel.**
    - **More biofuel, less petroleum fuel.**
    - **This approach taken off a US Senate energy bill this year.**

Carbon standard or tax/subsidy program

- Environmental characteristics of biofuels vary.
- Cellulosic ethanol: smaller carbon footprint than corn ethanol as produced today.
- Volume based policies do not address this difference; carbon based standard could.
- Current Life Cycle Analysis (LCA) Research is developing to assess the carbon life-cycle of fuels.
- LCA could support a carbon index to implement a carbon standard, carbon tax, and/or subsidy



- Implementation:
  - requires careful balance between complexity (precision) and ease of use.
  - CA: a coarse carbon categorization, burden on producer to show lower carbon emissions.

Pros & Cons of a carbon performance criterion

- **Advantages:**
  - Can be tailored to specific goals: e.g. greenhouse gas mitigation.
  - Better directs market outcomes toward these ultimate goals.
  - Directs market R&D toward the low carbon goal rather than other goals (e.g. low cost biofuels regardless of C content).
- **Disadvantages**
  - Costly implementation: requires measuring net carbon emissions.
  - Imperfect implementation: Difficult to capture carbon footprint exactly.
  - Does not necessarily target other nonmarket fuel characteristics

Price versus quantity instruments under uncertainty

- Uncertainty is a defining characteristic of these rapidly evolving biofuel markets (especially supply uncertainty) in the long run.
- Weitzman and others (1978, etc.): price & quantity instruments perform differently under market uncertainty depending on supply and demand elasticities.
- Based on theory and simulations, Nordhaus (1994), Newell and Pizer (2001), and others find that for climate change mitigation, price instruments tend to perform better in terms of expected policy benefits.

Combination performance-based Standard/subsidy

- **Integrating standard and subsidy can alleviate weaknesses of each.**
  - **Tax/subsidy program to direct markets in the short & long run.**
  - **A (binding) standard as a lower bound if market development is more costly than expected.**
  - **Both could be based on the same performance standard.**
- **Pulls markets forward but reduces risk of imposing unexpectedly high regulatory costs.**

A preliminary proposal: Revenue-neutral carbon tax and subsidy program

- Standards and subsidies are in vogue, but each has drawbacks.
- Carbon taxes alone appear politically infeasible at the moment.
- **Proposal:** tax high-carbon fuels to fund a subsidy for low-carbon fuels (marginal and/or for investment in R&D).
- In principle can be designed to be revenue neutral.
- A growing literature suggest that this type of "revenue recycling" can provide lower total costs for reaching environmental goals than standards.
- Can be used to support a "lower" (minimal) performance standard
- If/when carbon markets are implemented in the U.S., subsidies and other support should be reconsidered in favor of biofuel integration into carbon markets.

Conclusion

- Climate concerns are an increasingly central part of energy policy today (e.g. The Western Climate Initiative).
- Many of the objectives (energy independence, rural economic development) will tend to follow under an umbrella target of carbon emissions reduction, but the reverse is not necessarily true.
- Carbon-based standards and price instruments will be more difficult to implement, but are becoming increasingly more feasible.