Cellulosic Fuels – The Path to Commercialization

Policy Considerations

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Three Key Uncertainties in Cellulosic Biofuel Route Forward

1) Policy Uncertainty (size, duration, form/target of incentives)
2) Technological Uncertainty (throughout supply chain)
3) Demand Uncertainty (if we price it, will they come?)

Broad questions on policy role
• Can policy address these uncertainties?
• To what extent should it?
• How?

Broad potential guidelines for policy
• bake learning/flexibility into policy design
• aim to bridge gap separating “policy push” and “demand pull”
• don’t stray too far from market realities

Presentation
• Policy landscape and market response (so far)
Current Policy Snapshot

- **Alternative Fuel Policies Using Carbon Accounting** (market-based, “technology-forcing”)

- **Blending Mandates (US RFS)**

- **Low Carbon Fuel Standards (CA, OR, BC)**

- **Carbon Pricing (CA, BC)**

- **...+ targeted incentives**
  - (biofuels to “biobased”, fueling infrastructure)
Which ‘Biofuel Route(s)’ Favored by Current Policy?

**Policy incentive**
- modest, limited
- market-based competition to meet targets at lowest cost

**Three Uncertainties?**
- policy incentive size, longevity, form (courts, politics)
- technological (not fully identified/understood)
- demand (less emphasized)

Not so technology-forcing (so far)
“Incrementalism” On Display in California under LCFS

- More alternative fuels (ethanol dominates, biomass-based diesel use surges)
- Big new fuel is technologically most understood & ‘drop-in’ (renewable diesel)
- For cellulosics, biogas dominates liquid fuel

RFS trends are qualitatively similar

Source: ARB data

**Fuel Gallons**

**Ethanol**
- Bolt-on corn fiber activity
- Problems at larger facilities

**Drop-in**
- Renewable diesel
- Jet fuel partnerships

**Other**
- DME
- (No) algae

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**Total gallons**

<table>
<thead>
<tr>
<th>Year</th>
<th>Gallons</th>
</tr>
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<tbody>
<tr>
<td>E2 2017</td>
<td>689</td>
</tr>
<tr>
<td>UCD 2017</td>
<td>522</td>
</tr>
<tr>
<td>UCD 2018</td>
<td>936</td>
</tr>
</tbody>
</table>

- co-location & retrofits
- multiple (or nonfuel) target markets
- delayed projects & commissioning

*Source: UCD Biofuel Tracker (Witcover and Williams 2017)*
Limits to Incrementalism for Lower Carbon Intensity?

ARB Scoping Plan modeling: Proposed 18% carbon intensity reduction by 2030

Volumes

- Hydrogen
- Renewable Diesel
- Renewable Gasoline
- Ethanol (conventional)
- Electricity
- Biodiesel (FAME)
- Cellulosic Ethanol
- Biomethane

Credits

- Hydrogen
- Renewable Diesel
- Biodiesel (FAME)
- Renewable Gasoline
- Cellulosic Ethanol
- Ethanol (conventional)
- Biomethane

Source: ARB presentation, 3/17/17 workshop

- Not a projection !!
  - least-cost optimization..within scenario modeling constraints (E3), current CI ratings & costs
  - CA only; competing demand not modeled (yet)
  - Current technologies dominate
    - Little ethanol of any kind
Impact of “More Of The Same”? Multiple “LCFS” Jurisdictions

- Expand demand (& competition) for low CI-rated fuels
- Hard to navigate for producer (different timing, CI ratings)
- Sustainability safeguards critical

CA: 18% (proposed)
BC: 15% (announced)
More “LCFS” ahead…beyond transport in Canada, 2019

Energy under CI Standards

- Clean Fuels Program: 10%, 2015-2025
- RLCF: 10%, 2010-2020
- LCFS: 10%, 2010-2020
- Clean Fuel Standard: 30 MT reductions, 2030
- Regulation in development
- Key design issues pending, impact on transport fuels uncertain

Sources: OR DEQ, BC Energy/Mines, CA ARB, StatCan
Current Policy Issues

- **Policy uncertainty** (RFS annual volume-setting, LCFS court cases and scoping plan)
- **Price “collars”**
  - cost containment ("soft" credit price ceilings)
  - price floor (for financing)
    - mechanisms under discussion for dairy biogas-to-LCFS in California
    - limited support for specific projects identified through reverse auction process
      (‘contract for difference’* or ‘put options’)
- **Supplemental incentives?**
  - if so, how big, for how long?
  - where along distribution chain? ("point of obligation")
  - fosters competition?
- **Environmental outcomes** (assessing, safeguarding, encouraging)

Still needed
- Clear idea of size, duration of required policy role (or gameplan for this)
- Implications of policy patchwork

*adapted from Pavlenko et al. 2016*
Thank you!

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References


