

Processing and Conversion

Carbon and Green House Gases

Indirect Land Use Change

- Long discussion on a “production topic” that could overwhelm any GHG reductions arising from many proposed process improvements (removing incentive for making process improvements)
- As currently proposed, incorporation of indirect land use change (ILUC) in life cycle GHG calculations could exclude all manner of renewable energy technologies that are land deployed (not just grain ethanol).
- ILUC was inserted into EISA 2007 during informal reconciling of Senate and House versions of the bill, with few legislatures or stakeholders aware that it had been included. Example of big impact legislation that had no public discussion or input.
- The potential impact of ILUC on the future growth of biofuels cannot be overlooked.

Attributes of Processing Technologies that will Reduce GHG impacts

- Do not use fossil fuels
- Avoid distillation and drying of products (energy intensive)
- Utilize carbon dioxide or other carbon-rich byproducts (such as biochar) as products or carbon sequestration agents
- Employ non-biomass sources of hydrogen (solar or wind) to enhance yield of biofuels and reducing CO₂ emissions

First Things First...

- We need to make available to the biofuels community techno-economic analyses (TEA) and life-cycle analyses (LCA) on proposed technologies before investing in their development.
- The federal government should not try to pick winners and losers among the many technology options (let the markets do that)
- Federally supported basic research will help keep new discoveries in the public domain and thus contribute to more rapid advancement of new technologies

Some Other Points Raised

- GHG emissions are not the only thing we should economize upon
 - Primary energy use
 - Water use
 - Land use
- Processing efficiencies and hence GHG emissions will be strongly impacted by decisions across the value chain
 - For example, distributed vs. centralized processing

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Sustainability

What Does Sustainability Encompass?*

- Greenhouse gas emissions
- Economic prosperity
- Land Use
- Social Well-Being
- Biodiversity
- Air Quality
- Water Use

“Goal is to increase food, fuel, and energy security while safeguarding soil, water, and biodiversity.”

*Proposed by Stan Bull and his colleagues at NREL and MRI

Are Some Processes Superior in Terms of Sustainability?

- Soon to be released NREL study comparing ethanol production from biochemical and thermochemical processing shows few major differences in sustainability
- Microalgae (lipids) and bio-oil (lignocellulose) have some theoretical advantages (but we tend to get most excited about what we least understand)
- The important thing is to establish the metrics for a sustainable system and then design the system to deliver

Feedstocks will Drive Selection of Processes (not vice-versa)

- Biomass monocultures not necessarily superior to mixed cultures
 - Long experience with monocultures in agriculture
 - More uniform feedstock
 - Sustainability will depend upon agricultural practices whether monoculture or mixed culture
- No favorite feedstocks
 - Need to be prepared to use whatever is *regionally appropriate*
 - Hybrid poplar, switchgrass, cobs and stover, etc.

Some Additional Observations

- Large-scale, centralized processing is possible if biomass is densified before transport (see Bruce Dales presentation on Regional Feedstock Processing Depots)
- Nutrient recycling will be essential for sustainability of biofuels agriculture
- Keep in mind that fuels, not processes are permitted (impacts efforts to achieve fuel flexibility)
- Can biofuels compete with biopower in terms of sustainability (but how else do we reduce dependence on imported petroleum if not biofuels?)

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Food vs. Fuel

Biofuels Vision*

- Produce fuels that are truly “drop –in” instead of merely being fuel additives
- Leverage existing refining/transportation infrastructure to lower capital costs, minimize value chain disruptions, and reduce investment risk
- Focus on path toward second generation feedstocks, which can get you to 40% petroleum replacement

*Offered by Jennifer Holmgren of UOP

Food vs. Fuel: Preaching to the Choir

- Tremendous public misunderstanding about relationship between food and fuel agriculture
- Huge opportunity to integrate bioenergy production with food production
- Ecological intensification of land use could provide food and fuel on fewer acres
- Evolution of the cell phone as an analogy of future possibilities in biofuels: What was unimaginable twenty years ago has become a reality today.
- But dismissing the concerns of the skeptical “with a few facts” will not convert them to your side.

What Should We Do?

- Need to be careful about overhyping the opportunities (damaging may already be done)
- Picking the winners early can have huge costs and leave stranded assets
- Deployed infrastructure of Air Force presents development opportunities for developing countries - may even lead to enhanced food security in those countries
- Recognize that leaving behind the petroleum age means that we will have to learn to harness energy in the biosphere for both food and fuel and anything else we want for society – let's make these biosphere impacts positive.

What Should We Do (Continued)?

- “Age of over abundance” will eventually come to an end and we will have to be more efficient in both food and fuel production than is currently practiced (we waste what is cheap and abundant).
- The biofuels community needs to come together with other stakeholders to define the metrics of performance and the industry to them.