A Framework for Defining, Measuring and Certifying Sustainability for a Bioenergy/Transportation Energy System?

McKinley Addy

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Sustainability Topical Areas

- Definition
- Modeling, Measurement and Standards (Certification and Regulation?)
- Constraints
- Some Policy Applications – Why it is important
  - Regulatory – Low Carbon Fuels Standard
  - Funding Program Administration (i.e., AB 118)
  - EISA 2007
  - AB 32
  - Other?
- Limitations in Assessing Sustainability
- Consistency in Using Results
- Research Gaps and Future Research

AB 118 Sustainability Provisions

Section 44271(a)(2)

"Establish sustainability goals to ensure that alternative and renewable fuel and vehicle deployment projects, on a full fuel-cycle basis, will not adversely impact the state's natural resources, especially state and federal lands."

What Do We Measure?

Ecological Components		Social Components
Energy Use	Habitats and Ecosystems	Public Health
GHG Emissions	Biodiversity	Land Use Change
Water Impacts (Use, quality, waste water discharge)	State and Federal Lands	Wealth Effects
Forest Cover	Criteria Pollutants, Toxics	Environmental Justice

On What Basis? (Lifecycle)

Is everything measurable?

A Measurement Framework?

- Define a Sustainability Function
  - Account for factors/indicators of sustainability
  - Assign units or use analogous units
  - Common units lend to easy combination
  - Separate units require separate treatment and setting of performance thresholds
- System of Sustainability Equations
  - Results can be modeled
- Sustainability Index that can be modeled?
- Using units from established sectors?

DISCUSSION PANEL

- How to best assess sustainability within the framework of LCA – short- medium- and long-term research strategy

- AUDIENCE QUESIONS

Transportation Energy Context

- California uses 20 billion gallons of fuel - 95% petroleum
- State Alternative Fuels Plan Goals (AB 1007)
  - 9 percent by 2012 increasing to 26 percent by 2022
  - 20 percent at 2020 means
    - Displacing 4 billion gallons of petroleum-based fuel
    - 370 million gallons of new alternative supply annually
    - Current in-state production is 80 million gallons ethanol and 25 million gallons biodiesel
- Bioenergy Action Plan
  - 20% of biofuels used in 2010 to be produced in California
- AB 32: Reduce GHG levels to 1990 levels by 2020
  - 80% of 1990 levels by 2050
- Low Carbon Fuel Standard: Reduce carbon intensity of all transportation fuels 10% by 2020

Energy Commission Challenge for AB 118 and Sustainability

- Interpret the Sustainability Language from AB 118
- Write Regulatory Goals
- Guidance for Investment Plan Solicitations
- Screening Criteria means that:
  - Applicants must submit enough information to know if a "sustainability test" has been met
- Reasonable Constraints on Use of Public Money or Undue Burden on Emerging Technologies?

Sustainability Idea Broadly Used

- 3 Main Components
  - Environmental – Social – Economic
- Widely Used Concept in:
  - Community Development
  - Forestry
  - Fisheries
  - Agriculture
  - Transportation Planning
- Is it a Set of Standards or a Philosophy?

How Much Better? = Thresholds

- Better Than Current Practices for Non-Sustainable Industries?
- No Net Loss or Change from Status Quo?
- No Unacceptable Change?

- Biofuel Production Means More Resources:
  - Land, water, fertilizer, chemicals, labor, energy

Sustainability and Existing Regulatory Standards

- Is a Sustainable Practice different than Current Regulatory Standards?
- California has stringent standards:

CEQA	Environmental Permits
Air quality	Water quality
Toxics	Biodiversity Protection
Land Use	Labor

- Does This Equal Sustainability?

Metrics to Assess Carrying Capacity

- Carrying Capacity is the ability of an air basin, watershed, land area or ecosystem to absorb resource extraction and pollution loading until its basic functions are impaired.

Carrying Capacity Examples

- **Climate and Atmosphere**
  - How much carbon and CO2-eq can the Earth's atmosphere absorb until the climate changes?
- **Criteria Pollutants**
  - How much loading can an air basin absorb until public health, animal health or ecosystem health are impaired?
- **Water**
  - How much water can be withdrawn, or how much nutrient loading and toxics can be discharged until beneficial uses and aquatic ecosystems are impaired?
- **Forests**
  - How much timber can be harvested without impairing basic ecosystem function?
- **Wildlife**
  - How much habitat and how many individuals can be lost until a species reaches the endangerment threshold?

Scaling Issues

- What is the boundary of the physical, geographic or social system about which we are concerned?
- What is the timeline for the system we are considering: one year, 50 years, or 1,000 years?
- Issues
  - GHG emissions are global pollutants
  - Water use is regional
  - Wastewater discharge may be a localized issue
  - Indirect land use changes are global, regional and localized

Information Requirements

- How much of what information is needed to determine if an alternative fuel or vehicle technology is “sustainable?”
- Who provides the information and analysis?
- Are some LCA models more robust and suitable than others? Do information claims on sustainable products and processes need to be certified by third parties?
- Are all metrics and parameters given equal weight, or are some more important than others?
- Remember: Information costs money to compile

Sample Frameworks to Assess Sustainability

Sample Frameworks to Assess Sustainability

3 general approaches to assess sustainability:

1. Science and Standard-Based Assessments like CEQA and Environmental Performance Reporting
2. Documented adherence to applicable laws and regulations
3. Adoption of Best Management Practices

Sustainability Screening Based on CEQA and Major Environmental Permitting

CEQA Hierarchy

Avoid, Minimize, Mitigate Impacts

CEQA Information and Process

1. Clear, quantified descriptions of ecological and social systems of concern – The Baseline
   - Energy, GHGs, Water, Forest Cover, Habitats, Environmental Justice, etc
2. Project Description
   - Enough information to assess project impacts
3. Analysis of how project affects physical and social environment
   - Significance Criteria and Thresholds
4. Mitigation Measures to reduce impacts to Non-Significance

Roundtable for Sustainable Palm Oil

8 Principles and 40 Criteria for Sustainability Certification

1. Transparency
2. Compliance with Applicable Laws and Regulations
3. Long-Term Economic Viability
4. Best Practices for Growers and Millers
5. Environmental Responsibility, Conservation of Natural Resources and Biodiversity
6. Consideration of Employees, Individuals & Communities Affected by Growers and Mills
7. Responsible Development of New Planting
8. Continuous Improvement

Key Question: Can It Guarantee Sustainable Production?

Brazilian Ethanol Sustainability Factors

Ecological Areas of Concern	Socio-Economic Areas of Concern
Water Use	Competition with Food Production
Water Pollution	Employment
Biodiversity	Income Distribution
Soil Erosion	Land Tenure
Fertilizer Use	Wages
Genetically Modified Organisms	Working Conditions and Worker Rights
Sugarcane Burning	Child Labor
Greenhouse Gas Emissions and Energy Balance	Social Responsibility and Benefits
	Competitiveness

Smeets et al developed comprehensive, science-based metrics to assess sustainability of sugarcane ethanol production in Brazil.

- Emphasize compliance with existing laws.
- Concluded that sustainability cannot be assured at present time.

Sustainability from Other Sectors

- Forestry and Wood Products
  - Forest Stewardship Council
- Agriculture
- Fisheries
- Transportation
- Social and Environmental Justice
  - Corporate Responsibility Programs
- BMPs and Chain of Custody

Some Examples: Sustainability and AB 118

Potential Projects and Fuel Pathways

Alternative Fuel Types	Feedstocks	Source	Processing and Distribution Infrastructure
Biodiesel	Domestic and foreign energy crops (algae, soy, palm oil), waste grease and oils,	Row crops, aquaculture, Waste collection	Industrial processing, distribution, fueling stations
Biomethane	Landfill gases, feedlots, biomass	Landfills, feedlots	Gas processing, distribution, fueling stations
Biomass to Diesel (Fischer-Tropsch)	Wood wastes, ag wastes, energy crops		Industrial processing
Butane	Petroleum refining and natural gas	Refineries	
Electricity	Cal. grid – renewable and fossil, National and International grids	Natural gas, nuclear, hydro and coal powerplants. Renewables	Transmission and distribution lines, residential and commercial charging stations
Ethanol	Bioenergy crops (corn, sugar cane, sorghum), farm & feedlot waste streams, fiber and woody materials (cellulosic materials)	Row crops, woodlots, farms, feedlots	Industrial processing, distribution, fueling stations
Dimethyl Ether	Propane / natural gas derivative		
Hydrogen	Natural gas and electricity derivatives, industrial byproducts (nuclear), water cracking (energy intensive)	Refineries	Distribution, fueling stations
Renewable Diesel	Domestic and foreign energy crops, waste grease and oils, algae	Row crops, aquaculture, Waste collection	Industrial processing, distribution, fueling stations
Natural Gas	Domestic and Canadian wells, LNG imports	Natural gas and petroleum wells	Transmission and distribution pipelines, residential, commercial, institutional charging stations