

Bioenergy: Opportunities and Challenges for Biological Integration on the Farm

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Steve Shaffer
Office of Agriculture and Environmental Stewardship
California Department of Food and Agriculture



Overview

- Why not Energysheds?
- Natural resources trends
 - Issues – opportunities and challenges
- Current state policies and actions
- Examples
 - Klamath; Sac Valley; Delta; Westside; Tulare; Imperial Valley
- Summary and conclusions

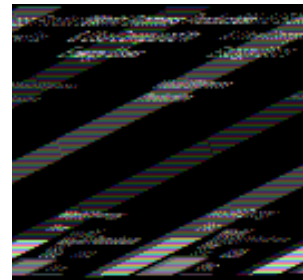


The Concept

- Watersheds; Airsheds; Foodsheds
- Energysheds!
- Interconnectedness
- Multiple Objectives
- Local self-reliance
- Collaboration



Biomass Energy Potential



Feedstock Quantity

- USDA/DOE – 1.3 billion tons/years – optimistic?
 - http://www.osti.gov/bridge/product.biblio.jsp?osti_id=885984
Biomass as Feedstock for a Bioenergy and Bioproducts Industry:
The Technical Feasibility of a Billion-Ton Annual Supply
Perlack, R.D. ORNL/TM-2005/66 ; 2005 Dec 15
- California – Biomass Collaborative
 - <http://biomass.ucdavis.edu/>
 - Over 80 million tons produced (no energy crops)
 - Potential sustainable use - 30 million tons
 - By 2050 - 48 million tons
 - Current use – 5 million tons



Biomass Energy Potential

- 1.3 billion tons of biomass =
 - 50 billion to 100 billion gallons of liquid fuel (gallons of gasoline equivalent – gge)
- Current US gasoline and diesel consumption: 180 billion gallons
- 30 million tons = 1.5 billion to 3 billion gge

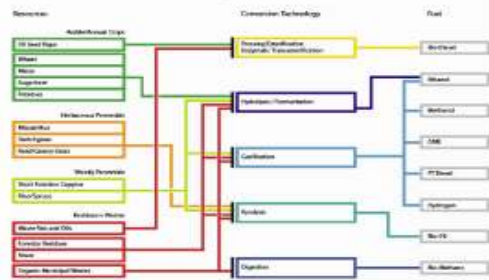


Fuels

- Alcohols – ethanol, methanol, butanol, etc.
- Ethers – MTBE, ETBE, TAME, DME
- Biodiesel – esterified plant and animal fats
- Bio-derived oils – hydrocarbons – bio-oil (algae), Fischer-Tropsch diesel.
- Biomethane – purified biogas.
- Electricity – combustion, gasification, fuel cell.
- Hydrogen – secondary product reformed from above, or primary production e.g. from algae.



Possible Advanced Biofuel Pathways



Issues – (Sustainability)

- Life cycle analyses
- Energy quality/utility
- Multiple objectives management
- Public Policy - Farm Bill
- Geopolitics – energy security
- Climate change
- (Bio) technology
- Economic

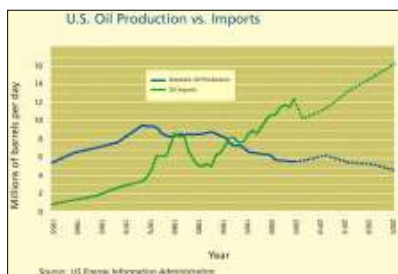


Market Drivers

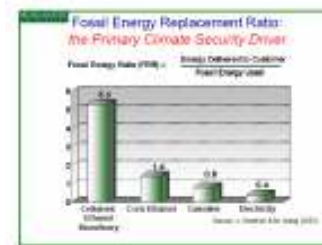
- Energy prices
- Local economic development
- Balance of trade
- Greenhouse Gas Emission Reductions (credits)
- Renewable Energy Credits
- Energy Security
- Other Environmental benefits (e.g. wildfire potential reduction)



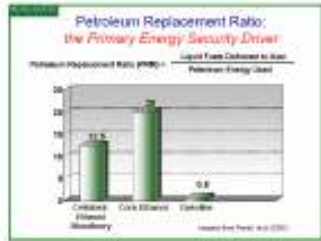
Us Oil Production and Imports



Energy Efficiency



Petroleum Replacement Efficiency



Recent CA Policy Drivers

- **Bioenergy Action Plan**
- **AB 32 Global Warming Solutions Act of 2006**
- **AB 1007 Joint ARB / CEC Alternative Fuel Report**
- **Governor's Exec. Order S-01-07 for a Low Carbon Fuel Standard**
- **Passage of AB 118 of 2007**



Bioenergy Action Plan

- Executive Order S-06-06, established the following targets to increase the production and use of bioenergy: state shall produce a minimum of 20 percent of its biofuels within California by 2010, 40 percent by 2020, and 75 percent by 2050; state shall meet a 20 percent target within the established state goals for renewable generation for 2010 and 2020.
- 64 actions by state agencies – 7 for CDFA, including regional digesters, biomass energy zones, animal material management; Farm Bill policy recommendations
- http://www.energy.ca.gov/bioenergy_action_plan/index.html



AB 32 Global Warming Solutions Act of 2006

- Mandate to achieve GHG reductions from all CA sources
- 2000 levels by 2010; **1990 levels by 2020**; 80% below 1990 levels by 2050
- 174 Mmt reductions
- Cap and trade system????
- Global Warming Advisory Committees:
 - Environmental Justice
 - Economic and Technology Advancement
 - Market
- <http://www.arb.ca.gov/cc/cc.htm>



State Alternative Fuels Plan

- Required by AB 1007 of 2005
- Draft with errata released October 19, 2007
- 9 percent in 2012;
- 11 percent in 2017;
- 26 percent in 2022.
- <http://www.energy.ca.gov/2007publications/CEC-600-2007-011/CEC-600-2007-011-CTD.PDF>



Governor's Exec. Order S-01-07 for a Low Carbon Fuel Standard

- 10% reduction in fuel carbon intensity by 2020
- Adjusted for life cycle GHG emissions
- To be adopted by ARB by end of 2008
- http://www.energy.ca.gov/low_carbon_fuel_standard/index.html



AB 118 of 2007

- Alternative and Renewable Fuel and Vehicle Technology Program
- \$10 million/yr
- Starts in July 2008; sunsets January 2016
- Funded by \$3 - \$20 increase in vehicle fees
- Grants and loans for alternative transportation fuels development



Feedstock Sources

- Residuals – Agriculture, urban, forestry
 - Manure, trees and vines, straws, food processing residuals, animal materials
 - Green, food, paper and cardboard, wood
 - Mill, pulp, slash, thinnings
- Conventional crops – corn, sorghum, sugar cane, sugar beets, oil seeds, other small grains.
- Dedicated crops – grasses, trees, other plants
- Unconventional crops – Jerusalem artichoke, Buffalo gourd, Cattails, Jatropha, Jojoba, Algae???



Energyshed Examples

- Sugar beets and sweet sorghum, vegetation management in the Klamath Basin?
- Habitat corridors and rice straw in the Sacramento Valley?
- Reinventing Delta agriculture?
- Rotational crops in high value systems?
- San Joaquin Valley opportunities with dairies and drainage impaired lands?
- Sugar cane production and processing in Imperial Valley?



On-farm Considerations

- Resource availability
- Economies of scale
- Integration into existing operation
- Ability to manage
- Regional opportunities – coops; JPAs.
- Not only biomass – PV, solar thermal,



Conclusions

- Biofuels are and will be a part of sustainable energy supplies – how much and in what form are yet to be determined.
- Several Keys –
 - Informed policy based on continuous research and development
 - Strategies that achieve multiple benefits
 - Public policies that recognize multiple benefits and internalize external disbenefits for all energy sources

