

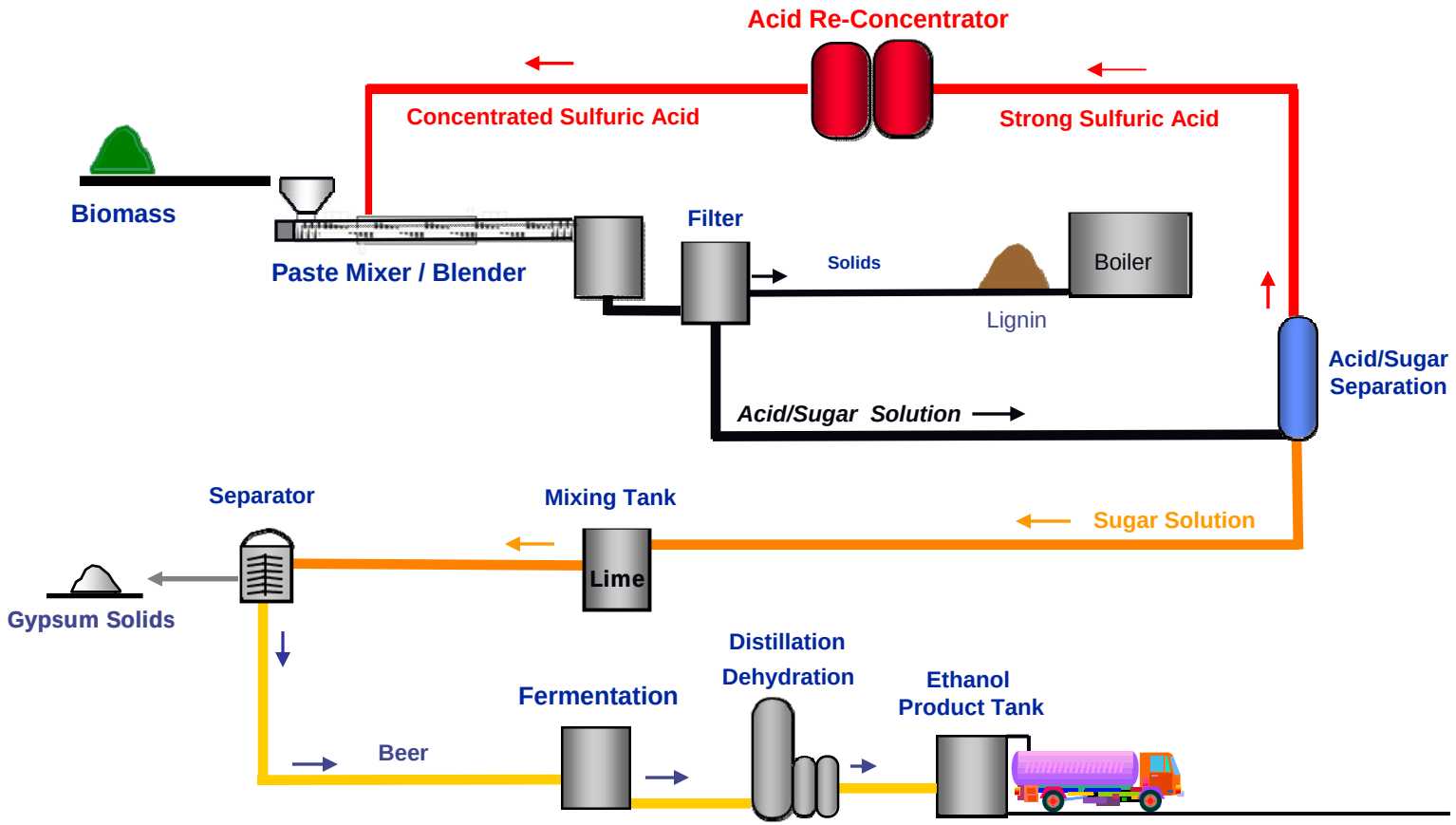

BlueFire Ethanol, Inc.

California Biomass Collaborative Forum

BlueFire Ethanol, Inc.

- We convert cellulose in wastes to sugars for the production of fuels and chemicals such as ethanol
- Through proven technology now commercially available
  - Concentrated acid hydrolysis demonstrated in early 1900s
  - 5+ years of Arkenol pilot plant experience
  - 5 years of operations in Izumi Japan by JGC (Third party validation of efficacy of technology)
  - Commercial vendor testing on actual feedstock
- By a team experienced in energy project development
  - Experienced staff with experience as developers of energy projects, since 1989, as ARK Energy and Arkenol, Inc.
  - Developed, financed and built energy projects in excess of $1Billion in value as ARK Energy.
- Embarking on project opportunities that optimize our competitive advantages
  - Locate close to markets of products
  - Minimum feedstock standards for process
  - Regulatory climate and surrounding landuses support biofuels development
- Supported by national and environmental drivers to create a cellulosic biofuel industry
  - National Renewable Fuel Standards
  - Climate Change
  - Energy Independence

BlueFire Simplified Production Flow Diagram



BlueFire is developing commercial-scale cellulosic ethanol production facilities

Facility	Status
3.9MM Gallon Lancaster, CA	• 10 acre site secured by BlueFire • Received permits to begin construction • Estimated build time – 14 months • "shovel-ready"
17MM Gallon DOE Project	• Receiving funds from U.S. DOE • Development activities commenced
55MM Gallon (In Planning)	• Expected standard size for widespread deployment • Site selection in process

BlueFire Lancaster Facility – a case for urban wastes to ethanol

- Project site located at or adjacent to landfill
- Utilize existing transportation infrastructure
- Landuse/zoning consistency
- Relatively undeveloped area

BlueFire Facility

1) Convert about 200 tpd of urban waste (greenwaste and other cellulosic wastes
2) Utilize tertiary treated water
3) Produce 3.9 million gpy ethanol to serve California's 1 Billion gpy ethanol market
4) Use lignin as fuel to produce required thermal needs
5) Designated as "Minor Source" for criteria pollutants under CAA permitting
6) Well over 2 years in permitting and still going

Siting and Permitting Challenges

- After nearly 3 years of development and permitting – the potential for losing all work and approval of Use Permit jeopardized with 1 letter
- Challenge to product market - ethanol GHG benefits questioned, redefining ethanol's role as a renewable fuel
  - LCFS (CARB)
  - RFS (EPA)
- Policy directives to encourage/mandate clean energy lost in the permitting process focused on identifying the potential negative impacts of a project

Potential Role of Cellulosic MSW in Sustainable Biofuel Production

- Volumes are sustainable – will always be there
- Uses local and existing resources and economics
  - Optimize use of existing infrastructure – locate production facilities at or close to landfills
  - Allows for renewable fuel supplies closer to markets for the products
- Results in GHG reduction
  - Diversion of biodegradable components of MSW from decomposition avoids methane emissions – 20+ times more potent GHG than carbon dioxide.
- Extends landfill space
  - Siting and expansion of landfills are becoming more difficult
- Captures significant energy value in waste
  - transition from crop based production of renewable fuels

California Biomass Resource Potential for Sustainable Ethanol Production

- Urban waste streams
  - 2005 – 42 MM tons of MSW
    - 4.7 MM tons of ADC buried in California
      - Of which 3 MM tons was green waste (@70 gallons/ton) -- 210 MM GPY Ethanol
    - Of the other material landfilled, over 50% is biomass (paper, cardboard, C&D, leaves, grasses, prunings, branches, stumps.
      - Estimate of 18 million dry tons – **1.2 billion gpy ethanol**
- Agricultural
  - 20 MM dry tons of agricultural residues from orchard/vineyard prunings & removal, field and seed crops residues, vegetable crop residues, food processing wastes –
  - Assume 50% is usable – 10MM tpy --- **700 MM gpy ethanol**
- Forest Materials
  - 26 MM tons per year from mill residues, forest thinnings, logging slash)
  - Assume 50% is usable 13 MM tpy --- – **910 million gpy ethanol**
- Dedicated crops
  - Marine/freshwater (kelp, algae)
  - Energy crops (switchgrass and other grasses)

(Ref: Biofuels from Municipal Wastes – Background Discussion Paper, March 28, 2007, California Biomass Collaborative/Integrated Waste Management Board.

The Opportunities

- Multiple cellulosic MSW resources (greenwaste, woodwaste, construction & demolition debris, unmarketable paper)
  - U.S. MSW 2007 – 254 million tons per year (4.6 lbs/person/day)
    - Over 60% organics (waste paper, paperboard, yard trimmings, wood waste)
- Relatively fewer traditional hurdles than other biomass resources (eg. seasonality, infrastructure, indirect land use impacts)
- Infrastructure to collect already exists;
- Urban regions likely to be closer to markets for products; and
- Current disposal options are limited and becoming increasingly expensive.

The Challenges

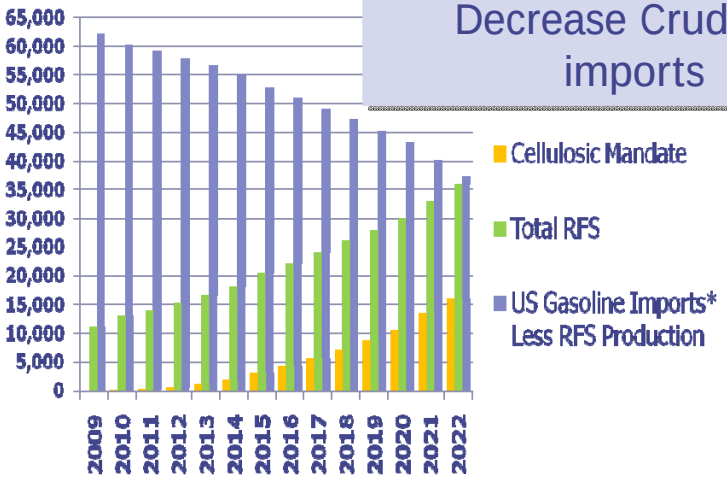
- Requires investment in conversion technologies that aren't yet widely commercially available - Need for technology demonstration at scale
- Dissemination of information to municipalities and solid waste industry to enable thinking outside the hole
- More complex feedstock and more difficult to convert to biofuels than grain crops
- Sorting of materials required for processes that convert only the cellulosic portions of wastes
- Need for local government to address solid waste management in terms of real costs, social, economic and environmental
- Potentially changing value (i.e. feedstock suppliers speculation of increasing value of their products over time)

How could we encourage use of cellulosic MSW to renewable fuels?

- Encourage diversion of organics from our landfills
- Promote increase in sorting of urban waste stream
  - Sorting at curbside residential
  - Encourage Municipal Recycling Facilities
  - Promote recycling
- Encourage diversion of organics to conversion technology use for production of fuels and chemicals
- Understand benefits and impacts and tradeoffs inherent to waste management options
- Need for lifecycle thinking, lifecycle accounting, or systems approach to waste management policy and decision making
- Sustainability standards should not impose significant additional costs and hurdles to delay commercialization of promising technologies
  - Should be consistent with current regulatory regime - (balanced approach)
  - Establish level playing field for comparison of renewable technology with traditional technology (same cradle to grave analysis)
  - Standardized approach

Ethanol based on Cellulosic MSW delivers Significant Benefits

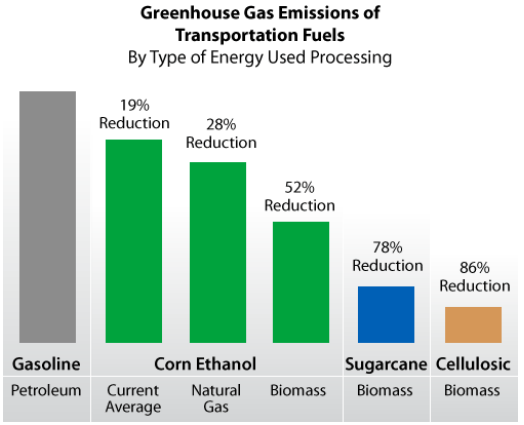
Decrease Crude Oil imports



Source Energy Independence and Security Act of 2007 and *Energy Information Administration. Total Imports of "Finished Motor Gasoline, 2007" and Total Imports of "Crude Oil, 2007" with the assumption of 20 gallons of gasoline produced per barrel. Chart assumes no increase in gasoline demand from 2009 to 2022 and is for simple illustration purposes only.

GHG Emissions Reduction

Cellulosic ethanol provides as much as 85% reduction in GHG when compared to gasoline. (Argonne National Labs)



Economic Development

- New industry for urban or rural areas
- Increase recycling
- Reduced waste disposal costs

Alternative Solid Waste Management Options