An Opportunity To Revolutionize Transportation Fuel Production Domestically Using Existing Biomass

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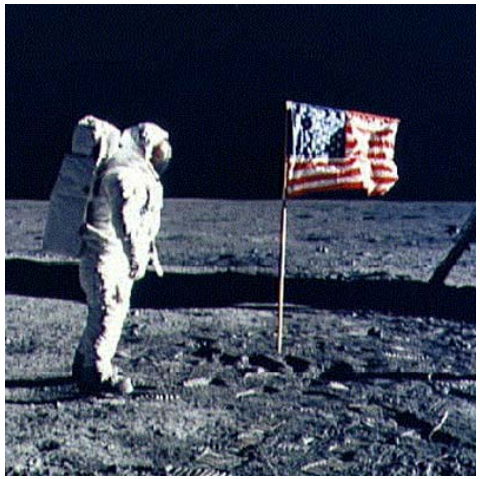
BlueFire Ethanol

The Bomb ♦ The Moon ♦ Biofuels

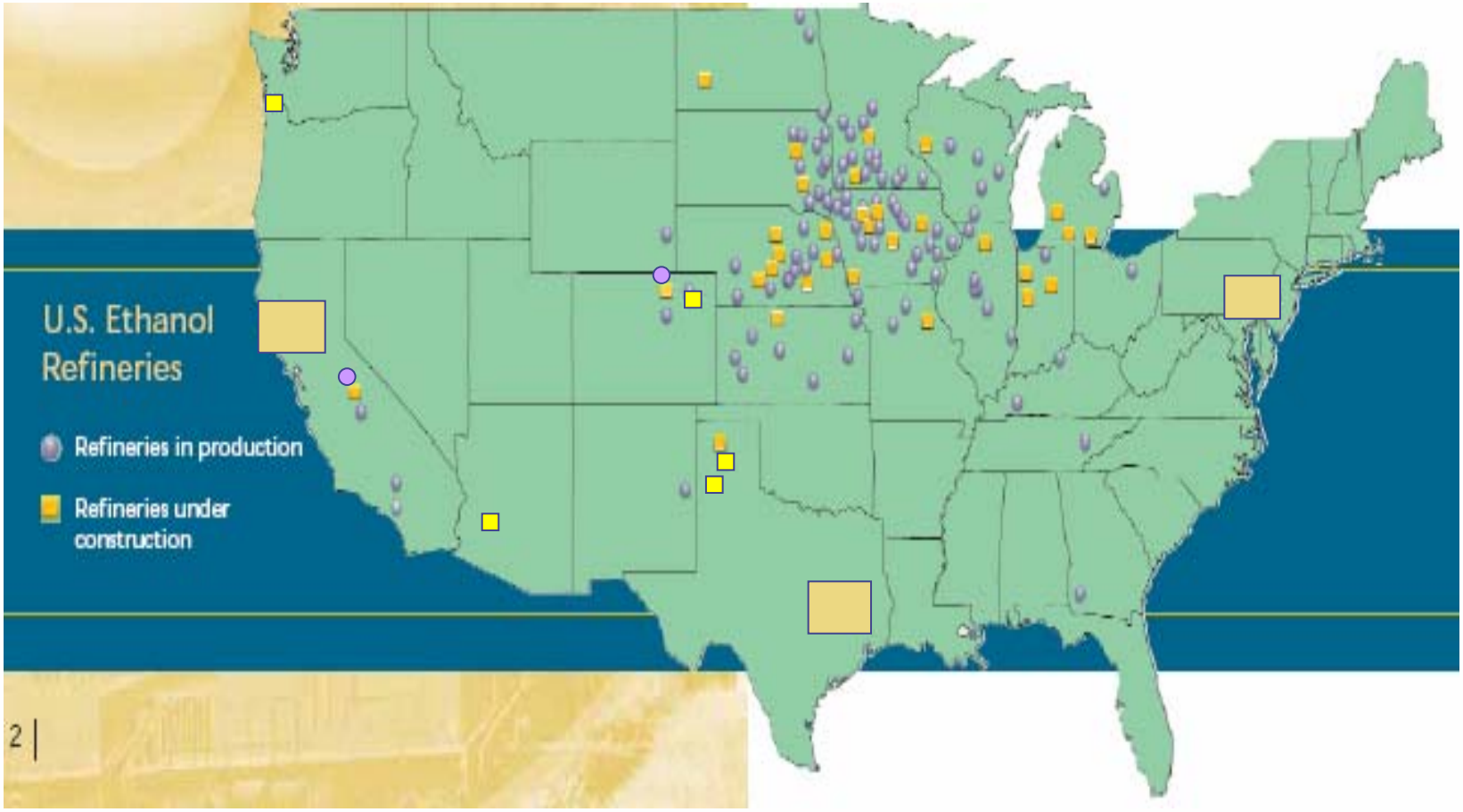
- Developing mass produced biofuels will be the great achievement of the 21st Century



Problem Statements

- Need to reduce foreign oil imports oil dependency
  - 65% of U.S. oil consumption is imported (of 21 million barrels per day consumption in 2005)
  - About 2.3 million barrels a day of US imports (a 17 percent share) came from the Persian Gulf in 2005, or about 11 percent of total US consumption
  - Oil imports is the largest single element of U.S. trade deficit.
  - California imports 40% of its oil supplies from foreign sources, 20% from Alaska and only 37% produced in the state
  - California relies on petroleum-based fuels for an overwhelming 96 percent of our transportation needs.
- Need to have solid waste management strategy
  - For growing urban areas
  - Alternatives to open-field burning
  - Improve forest health
- Must address Global Climate Concerns and preservation of natural resources
  - Transportation accounts for 40 percent of California's annual greenhouse gas emissions

Bring ethanol production closer to ethanol demand
Create geographic diversity in ethanol production



RFG areas

Cellulose Ethanol is The Future Of Ethanol

- Gain significant progress in meeting energy security goals
- Most promising near term solution to GHG reduction goals - Cellulose ethanol provides nearly 90% reduction.
  - Location within landfills create even greater GHG benefits from use of landfill gas and diversion of waste from decomposition avoiding methane production
- Create geographic diversity in ethanol production.
  - Bring ethanol closer to transportation fuel markets
- Contribute to waste management goals
  - Diversion of cellulosic wastes from landfills extends landfill space
  - More beneficial use of agricultural and forest residues
- New industry for California's urban and rural communities

Landfills are Our New Energy Source

- **Extended life – build air space**
  - **beneficial use of waste materials**
- **Co-location of ethanol biorefinery provides closer access to urban transportation fuel markets**
- **Economic source of landfill gas to generate power and steam for ethanol biorefinery**
- **Existing landfill regulatory oversight might simplify permitting process for ethanol biorefinery**
- **Generate GHG credits from ethanol production, use of landfill gas and diversion of waste from decomposition**

California can turn the tide towards a meaningful shift to a new fuels paradigm built on biomass resources

- California has a reputation to set trends
- Large transportation fuel market
- Significant biomass resources

  "*Each year California generates over 20 million tons of organic materials, of which about 6 to 8 million tons are composted and mulched. Out of this, about 1.5 million tons are used as feedstock for the traditional biomass-to-energy industry. But what about the almost 15 million tons now landfilled each year? "*

  Produce 1 Billion gallons of ethanol annually.

- Technology available for sustainable conversion of biomass to renewable fuels

Means of Producing Ethanol from Biomass & other Wastes

Thermochemical			Hydrolysis		
Technology	Pros	Cons	Technology	Pros	Cons
Gasification – Catalytic	Lower capital cost, feedstock flexibility, high yield per ton of feed	Tar production, requires gas cleanup, catalyst poisoning, catalyst disposal, production of mixture of low alcohols (I.e., impure product)	Dilute Acid Hydrolysis	Low capital cost, low acid consumption, public domain technology	Lower conversion efficiency, co-factor/toxin production
Gasification – Bioreactor	Lower capital cost, feedstock flexibility, high yield per ton of feed	Tar production, requires gas cleanup - bioreactor poisoning with real feedstocks.	Strong Acid Hydrolysis	Medium-high capital cost, low acid consumption	Low conversion efficiency, co-factor production
Fractionization - Mechanical	Recovery of pure components	Moderate capital cost, high energy cost	Concentrated Acid Hydrolysis	95% recycling of acid, high conversion efficiency, near zero liquid discharge	Moderately-high capital cost
Fractionization – Solvents	Recovery of pure components	Moderate capital cost, high energy cost	Enzymatic Hydrolysis	Enzyme cost reduced recently	NOT Suitable for MSW and Greenwastes
			Hybrid – Dilute Acid/Enzymatic Hydrolysis	Enzyme cost reduced recently	Co-factor production

BlueFire Basic Technology Description

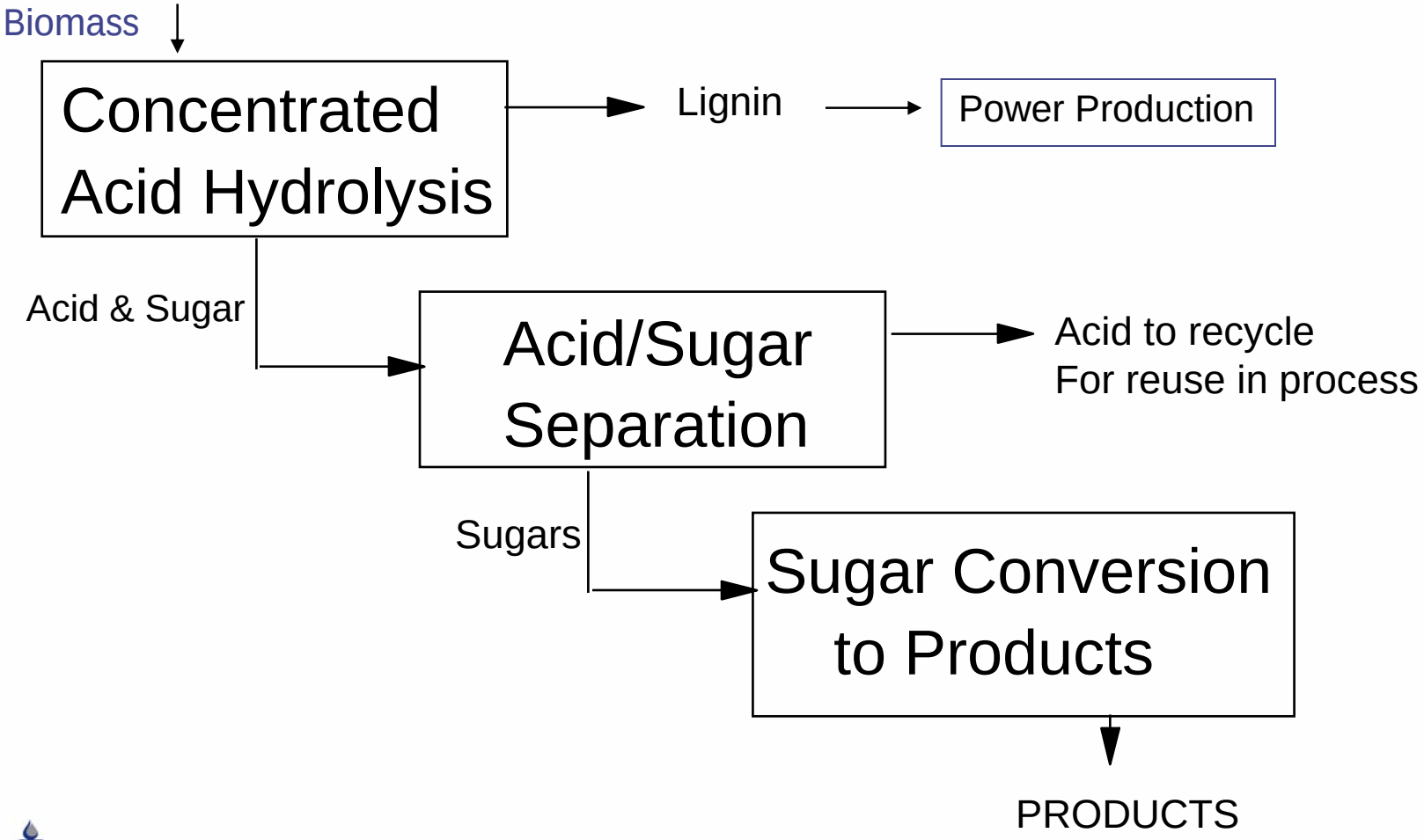
- Technology Category
  - Concentrated Acid Hydrolysis
    - No pretreatment required
    - Does not use enzymes
    - Proven concept in mid 1900s
- Feedstocks
  - Any cellulosic material – from agricultural residues to post-sorted urban waste.
    - Flexibility in using mixed waste streams.
- Products
  - Ethanol
  - Lignin
  - Gypsum

BlueFire Ethanol, Inc.

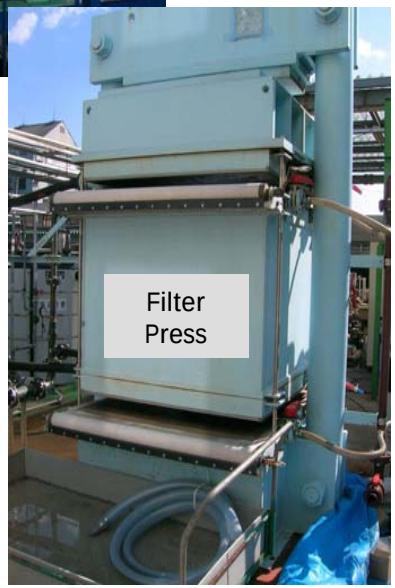
- Publicly traded on OTCC: Pinksheets – BFRE
- Exclusive licensee of Arkenol's concentrated acid hydrolysis process for North America
- Headquartered in California – Staff and majority shareholders have been involved in technology development since 1992 as Arkenol
- Experienced developer of energy projects as ARK Energy and Arkenol, Inc.
- Cellulose to ethanol pilot facility operated in California in late 1990s
- Process reviewed by federal, state and local agencies resulting in permits issued
- Technology demonstrated by JGC Corporation (major Japanese engineering and construction company)
- Strategic alliances with qualified parties for deployment of production facilities
- Initial Production facilities will be fully integrated in existing landfills across North America

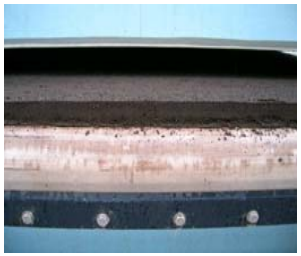
Proven Technology

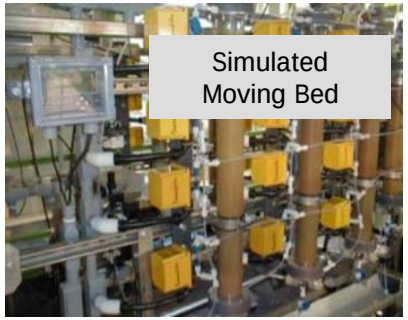
- Patents are improvements to proven concentrated acid hydrolysis technology
- Technology has been successfully licensed & used by third party – JGC Corporation of Japan
- Testing on a vast array of potential feedstock in Arkenol pilot plant in CA and JGC in Japan



Concentrated Acid Hydrolysis for Cellulose to Ethanol Production







IZUMI, JAPAN FACILITY

Operated by JGC Corp for NEDO

Project Maturity Schedule

- Research – DONE
- Pilot Plant - DONE
  - City of Orange, California
    - Used to test various equipment
    - Test feedstock from U.S. and overseas – ag, MRF residual, wood, greenwaste, RDF
    - Financed by Arkenol and ARK Energy, Inc.
    - Operated for 5 years
  - Izumi, Japan
    - Operated by JGC Corporation
    - Located adjacent to existing ethanol plant
    - Funded by JGC and NEDO (New Energy Development Organization)
    - Integrated system operated since 2002
    - Third party validation of Arkenol Technology
- Commercial Facility

Cellulose to Ethanol
Commercial Constraints to Commercialization

- Financing structure for first commercial plant
  - Outside capital is required
  - Private capital markets in line for 2nd plant
  - Risk profile of private capital makes financing of 1st plant difficult

Provider of Feedstock

•Credit Worthy

•Specified Term (matching project loan term)

•Quality Specification

•Quantity Specification

•"Put or pay" requirement

•Damages for nonperformance

Project Execution Team

•Credit Worthy

•Mechanical Guarantees

•Schedule Guarantees

•Process Guarantees

•Fixed Price

•Liquidated Damages (damages for nonperformance)

Buyer of Feedstock

•Credit Worthy

•Specified Term (matching project loan term)

•Quality Specification

•Quantity Specification

•"Take or pay" requirement

•Damages for nonperformance

Cellulose to Ethanol
Regulatory Constraints to Commercialization

- "Does it count?"
  - Municipalities faced with compliance with landfill diversion goals in California under AB939
  - Limited credit allowed for *conversion facilities*
- Redundant permitting process
  - Existing regulatory framework can be used to review potential environmental and public health and safety issues of ethanol biorefineries
  - Should avoid redundancy

Federal and California Policies Forming to Create Renewable Fuels Market

- Federal
  - Renewable Fuel Standard calls for 7.5BGPY by 2012 – Credit for cellulose is 2.5:1 compared to other raw materials.
  - President Bush calls for Increasing RFS to require 35 billion gallons of renewable and alternative fuels by 2017 – nearly five times the 2012 target now in law. In 2017, this would displace 15 percent of projected annual gasoline use.
  - White House calls for reduction in foreign imports – 75% reduction by 2025
  - Cellulose to Ethanol deployment is necessary
- California
  - Governor Executive Order call for 20% renewable fuels production by 2010 and 40% by 2020
  - California's Low Carbon Fuel Standard is the first greenhouse gas emissions standard for transportation fuels in the world
    - Transportation accounts for 40% of CA GHG emissions
    - LCFS requires 10% GHG reduction in transportation fuels by 2020

BlueFire Deployment Plan for Future Projects

- Access reliable sources of input raw materials
  - These "biorefineries" will convert widely available, inexpensive, organic materials such as agricultural residues, high-content biomass crops, wood residues, and cellulose in municipal solid wastes into ethanol.
- Locate facilities to optimize synergies with strategic partners, reduce costs, maximize environmental benefits
  - Landfill locations
  - Landfill diversion facilities (MRFs) – residuals now going to landfills rich in cellulose
  - Biomass power plant
  - Anchor for eco-industrial parks
- Embark on projects with expansion or replication potential
- Rapid deployment of multiple facilities through strategic partnerships

BFRE Milestones Completed: July 2006 to date

- July — Began trading on the pink sheets as BFRE
- July — Completed Heads of Agreement with **JGC Corporation** for Process Design for North America Projects
- August — Identified Southern California Landfill for development under DOE Grant Application in cooperation with **Waste Management Inc. (WMI)**
- August — Announced LOI with **Petro-Diamond, a Mitsubishi Subsidiary**
- Sept — Congressional Briefing on Status of Cellulosic Ethanol Commercialization with Other Industry Leaders
- Nov — So California Landfill Project Short-listed for DOE Grant
- Dec — Selected **MECS (formerly Monsanto)** as lead EPC Contractor
- Dec — Filed Form 10 SB to Become Fully Reporting Company
- Jan — Identified Co-location of biorefinery with biomass power plant under DOE loan guarantee application
- Feb — Won **U.S. Department Of Energy** Grant for So Cal Landfill Project
- March — Selected for **California Energy Commission** Funding
- April — Commence Permitting, development and engineering for first plant

DOE Grant for Development of Southern California Biorefinery

Amount -	$40 million (40% cost share of total project costs)
Location -	Southern California Landfill
Output -	Approx 18.6 million gpy ethanol
Feedstock -	700 dry tpd green and wood waste
Co-location advantages-	Landfill gas, electricity, infrastructure
Timing -	Engineering and permitting efforts started
Construction -	Q1/2 2008 subject to regulatory process
Operation -	Q4 2009
Participants -	Waste Management, Inc., Petro-Diamond (Mistubishi subsidiary), JGC Corporation, MECS (formerly Monsanto), Colmac Energy

Summary

- Ethanol is a viable and immediate Renewable Fuel Solution
- Cellulose ethanol is the future of ethanol
- As a Nation we must make commercialization of cellulose to ethanol an imperative strategy
  - Increase Production of Cellulosic Ethanol
  - Increase flexibility to blend higher levels of ethanol in reformulated gasoline
  - Expand E85 refueling infrastructure
  - Mandates for increasing flexible fuel vehicles production
- The Reward
  - Consumers gain fuel flexibility
  - Pricing related to demand
  - Break addiction to oil without being dependent on ethanol interests