



# Abengoa Bioenergy Hybrid Biorefinery Concept



**Sustainable  
Growth**



**Biomass 2009: Fueling Our Future  
March 17, 2009  
National Harbor, Maryland**



# Abengoa Overview

Abengoa is a technology company that applies innovative solutions for sustainable development in infrastructure, environmental and energy sectors. It is present in over 70 countries where it operates through its five Business Units: Solar, Bioenergy, Environmental Services, Information Technology, and Industrial Engineering and Construction.

## Industrial Engineering & Construction

With engineering... we build and operate conventional and renewable energy power plants, power transmission systems, and industrial infrastructures



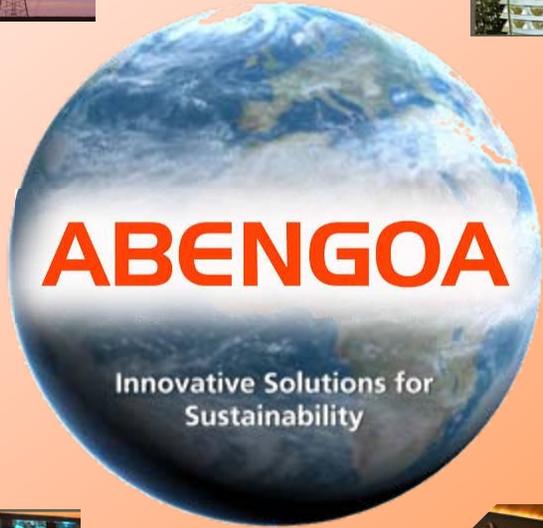
## Environmental Services



With waste ... we produce new materials through recycling, and we treat and desalinate water

## Bioenergy

With biomass ... we produce ecological biofuels and animal feed



## Solar



With the sun ... we produce thermoelectric and photovoltaic electric energy

## Information Technology



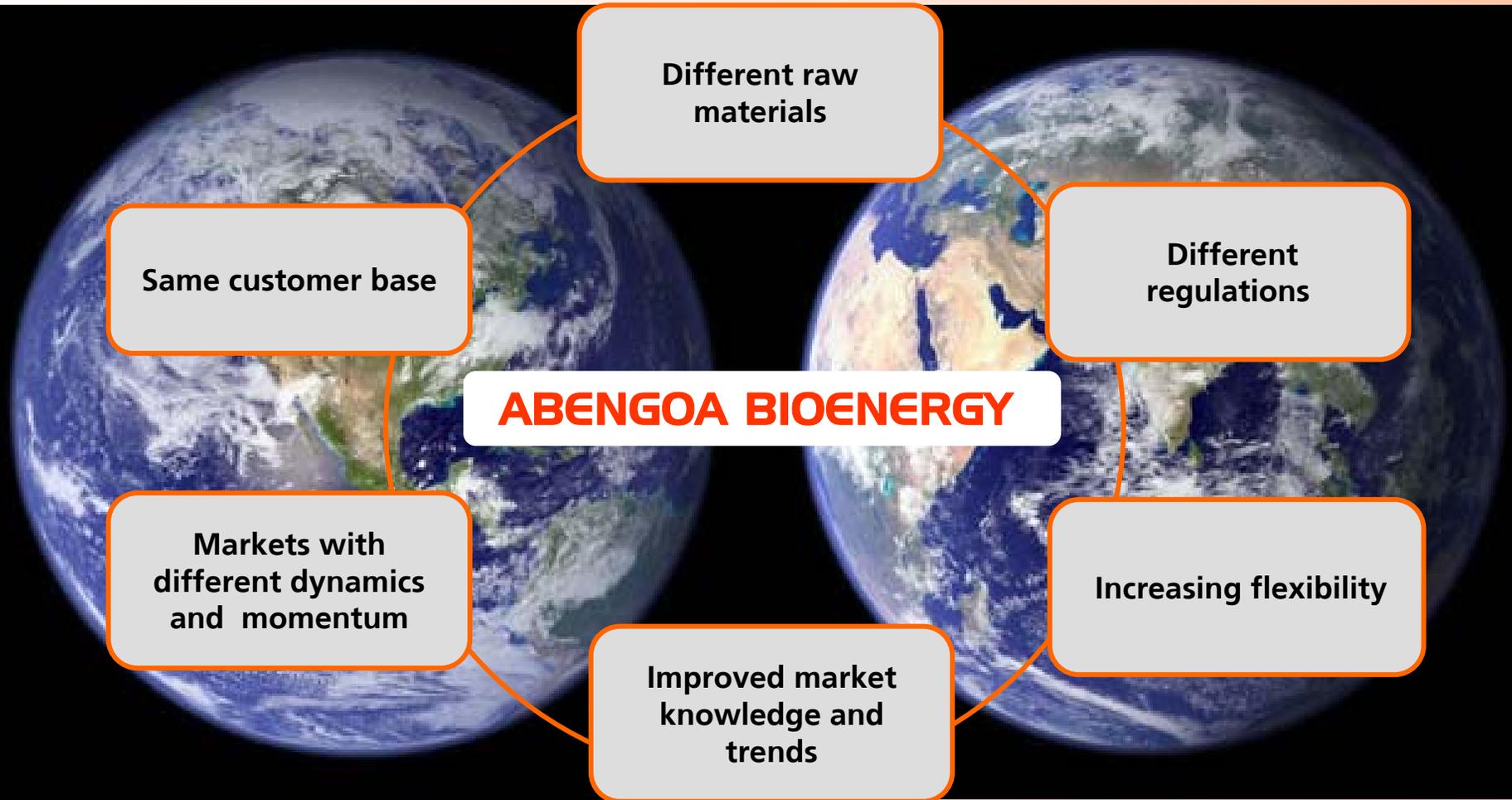
## Focus Abengoa



With social and cultural policies ... we contribute to economic progress and the conservation of the environment in communities where Abengoa is present



## Global player ethanol advantages

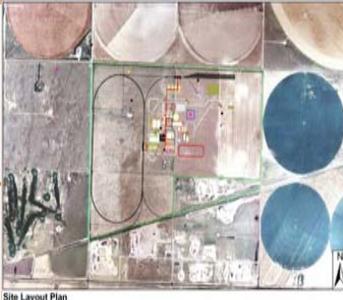




# Hybrid Refinery



## Commercial Hybrid Biomass Plant Hugoton (KS, US)



- ▶ Capacity : 12 MG and 40MWe per production year
- ▶ Raw material : Corn stover
- ▶ Technology : Enzymatic Hydrolysis & Gasification Technology
- ▶ Objective : Demonstrate biomass conversion commercial viability
- ▶ Start-up Operations : 2011 estimated



## Biomass Demonstration Plant in BCL (Salamanca, Spain)



- ▶ Capacity : 1.3 MGPY
- ▶ Raw material : Wheat and Barley Straw
- ▶ Technology : Enzymatic Hydrolysis (glucose)
- ▶ Objective : Demonstrate biomass-to-ethanol process technology at commercial scale
- ▶ Start-up Operations : 2009



## Biomass Pilot Plant in York (NE, US)

- ▶ Capacity : 0.02 MGPY
- ▶ Raw material : Corn stover
- ▶ Technology : Enzymatic Hydrolysis (glucose & xylose)
- ▶ Objective : Competitive process with grain ethanol
- ▶ Start-up : 2007



## 2.1 Project Description

Biorefinery

- Cellulosic feedstocks, 1100\* dry metric tons per day total
- Enzymatic Hydrolysis, 400 dry metric tons per day  
Ethanol, 12 million gallons per year, qualified as Cellulosic Biofuel  
Co-products
- Gasification Process, 300 dry metric tons per day  
Synthetic gas (syngas), 157 MMBtu to high-pressure water-tube boilers
- Cogeneration, 400 dry metric tons per day feedstock, 200 tons per day stillage wet cake  
44-MW steam turbine
- Starch Ethanol, 88 million gallons per year ethanol, 750 thousand tons per year WDGS  
On hold due to market conditions

### Biomass Procurement

- Procure, store, haul, and process all Biorefinery feedstocks



### Co-gen Plant, co-located

- Biomass feedstocks, 600 dry metric tons per day

First of its kind combined Advanced Biofuels and Cellulosic Biofuels facility to seek financing.



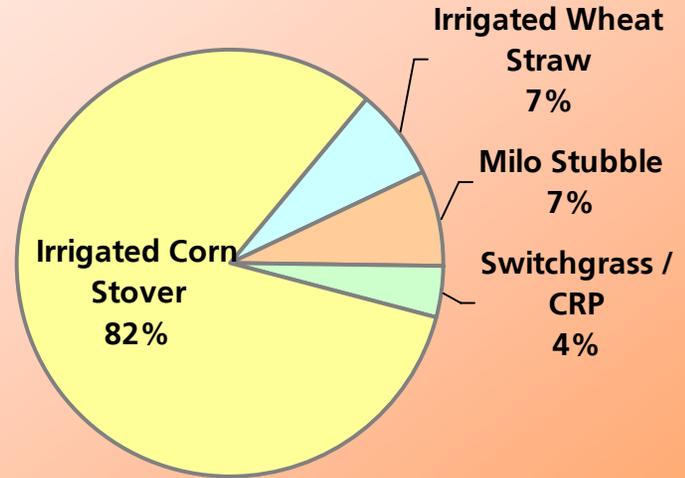
## Abengoa Bioenergy Hybrid of Kansas

- **First commercial facility of Abengoa Bioenergy's Cellulosic Ethanol technology**
- **A \$500 million plus project, supported by a \$76 million grant from the Department of Energy plus an equity commitment from Abengoa Bioenergy. Project start of construction, 2nd Half of 2009, operation in 2011**
- **Located in South West Kansas**
- **Opportunity to leverage infrastructure at many plant operations**
- **Key first project in the successful growth of Abengoa's Cellulosic Ethanol Business and the Nation's Cellulosic Ethanol Industry**



## ABHK Biomass Input Today

- ▶ Estimated 300,000 – 550,000 acres of land
- ▶ 1750 "as is " tons of biomass per day
- ▶ 750,000 "as is " tons of biomass per year



Irrigated Wheat Straw



Milo Stubble



Switchgrass



Irrigated Corn Stover



CRP Grassland

## Up To 100% Switchgrass

### Reasons

- Little to no fertilizer required
- Lower input costs
- Can be grown on poor soils
- Tolerant of flooding and drought
- Large potential from CRP and underutilized acres

### Challenges

- Establishment cost for producer
- No immediate revenue for producer
- Availability
- Harvest and Collection methods



**CRP Grassland**



### Financing

- Equity (competition for cash)
- Loan Guarantees
- Credit Rating
- Credit Subsidy Risk

## **Challenges/barriers**

- Blend Wall**
- Indirect Land Used**
- NEPA**
- Timing (financial situation)**
- Technology Risk**
- Raw Material risk**
- Market Risk**



## Policies

- **Loan Guarantees**
- **Biomass Crop Assistance Program (BCAP)**
- **Indirect land Used**
- **GHG cap and trade**
- **Renewable Portfolio Standard**



# BCyL Biomass Ethanol Plant

