Coskata’s Thermal Bio-Syngas to Biofuels Platform

ABIC, September 2010
Loula Merkel, Director, Government Affairs
Coskata envisions being a leader in syngas conversion

**Coskata Vision:**
To be the global leader for **synthesis gas-to-biofuels and chemicals**, beginning with ethanol

We will achieve this through technology development, licensing as well as owning and operating facilities, and providing onsite products and services
Coskata is a leader in next generation biofuels

**Company**
- Formed in 2006 and based in Warrenville, IL
- Strong management team and >50 employees

**Technology**
- Benefits
  - Industry leading yields and cost targets
  - Feedstock and geographic flexibility enables energy security
  - Environmentally sustainable
- Scale-up
  - Pilot facility operating at headquarters in Warrenville, IL
  - Demonstration facility in Madison, PA operating since 2009
  - Commercial Flagship facility to begin production in 2013

**Backing**
- The Blackstone Group®
- GM
- Advanced Technology Ventures
- Coghill Capital Management
- Total
- Globespan Capital Partners
- Khosla Ventures
- Sumitomo
- Great Point Ventures
- Arancia Industrial
Coskata’s technology can fuel solutions

**Environmental Sustainability**
- Up to 96% reduction in greenhouse gasses
- Lowest water use per gallon of ethanol
- Feedstock flexibility – can use any sustainable biomass

**Energy Security**
- Geographic flexibility – local production from local feedstocks
- Scalability allows significant early contribution to RFS

**Economic Growth**
- Cost competitive with gasoline, unsubsidized
- Can create millions of “green jobs” in rural areas

**Ready Today**
- Strong team and financial backers for execution
- Pilot facility operating at headquarters in Warrenville, IL
- Demonstration facility operating in Madison, PA
- Commercial Flagship facility under development
- Commercial licensing in process
Cellulosic biofuels will involve several technologies

DOE is targeting 2 major pathways for cellulosic biofuels

- **Biochemical Conversion**
  - Enzymatic hydrolysis
  - Fermentation

- **Thermochemical Conversion**
  - Gasification
  - Catalysis

**Products**
- Fuels
- Power
- Bio-products

Coskata’s Hybrid Gasification + Fermentation (thermo-biological) technology combines the best of both routes

Source: DOE Biomass program presentation to Governor’s Ethanol Coalition, Aug. 20, 2008
The Coskata Process produces low-cost cellulosic ethanol

- Feedstock and geographic flexibility with gasification
- Highest proven conversion efficiency of ~100 gal/ton
- Cost competitive with gasoline at oil prices today
The best and highest use of biomass becomes critical

<table>
<thead>
<tr>
<th>Feedstock Flexibility</th>
<th>Enzymatic</th>
<th>Catalytic</th>
<th>Gasification +</th>
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<tbody>
<tr>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<th>Ethanol Specificity</th>
<th>Yes</th>
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| Yield* (gal/dry ton)  | ~55-85    | 76-89**   | ~100           |

* Best estimates from publicly available data
** Chemical catalysis yield estimate from 2012 NREL targets (76 for ethanol, 89 for all alcohols)

Source: Press; DOE; Company reports
A “Feedstock Flexible” process will help the industry to realize full potential

Projected biomass sources

- Energy crops (28%)
- Crop residues (31%)
- Forest resources (27%)
- Corn (6%)
- Other (8%)

100% = 1.3 billion dry tons

Cellulosic ethanol:

- READY TODAY
- Able to be made from any carbon source
- Billion ton report estimates over 1/3rd of gasoline can be replaced
- Use of locally grown resources enhances energy security

Coskata is commercializing rapidly

**Horizon (2008)**
*Integrated Processing*
Warrenville, IL
- Integrated processing system with methane thermal reformer, multiple bioreactor designs, and distillation

**Lighthouse (2009)**
*Semi-Commercial*
Madison, Pennsylvania
- Minimum engineering scale (linear scale-up to commercial production)
- Front-end biomass gasifier
- Testing multiple commercial-scale bioreactor and separations designs

**Flagship (2013)**
*Commercial Production*
Southeast, U.S.
- 55 MM gallons / yr
- Multiple gasifiers that process ~1500 dry tons/day of biomass
- Cost competitive with gasoline
Coskata has unsurpassed anaerobic research and development capabilities

Lab and Horizon Pilot

• Complete anaerobic bacteria strain management facility capable of advancing native strains through guided mutation and selection

• New native strains have been isolated and advanced, and patent applications filed

• Platform technology

![2 liter fermenter](image1.png) ![14 liter fermenter](image2.png)
Coskata’s proprietary technology drives efficiency

Microorganisms utilize the chemical energy of the syngas to selectively produce ethanol.

Coskata’s **anaerobic bacteria** consume both CO and H2, allowing efficient conversion across the range of H2:CO ratios:

\[
\begin{align*}
6 \text{ CO} + 3 \text{ H}_2\text{O} & \rightarrow 2\text{C}_2\text{H}_5\text{OH} + 4 \text{ CO}_2 \\
6 \text{ H}_2 + 2 \text{ CO}_2 & \rightarrow 2\text{C}_2\text{H}_5\text{OH} + 3 \text{ H}_2\text{O}
\end{align*}
\]

Innovative **bioreactor designs** drive maximum productivity.
Lighthouse is a critical milestone on the path to commercialization

Project Lighthouse

• Demonstrates technology at significant scale, allowing direct scale-up to commercial

• Operating results prove Coskata ethanol yield at 100 gallons/dry ton

• Completes design details for commercial facilities

• Proves commercial viability on multiple feedstocks, enabling multiple commercial licenses
Flagship represents Coskata’s first commercial facility

Project Flagship will:

- Produce 55 million gallons of fuel-grade ethanol
- Be located in the Southeast United States
- Utilize 1.1 million green tons of wood biomass*
- Create over 700 direct and indirect green jobs
- Represent the world’s first commercially viable, feedstock flexible ethanol plant
- Enable acceleration of licensed facilities

* Green tons refer to total tonnage of biomass including moisture. For wood biomass moisture typically makes up ~50% of the total mass.
Coskata is building facilities and licensing technology

Coskata is demonstrating the technology at scale

Coskata’s licensing model can enable fast capacity build-out

Coskata has the resources to deliver commercial projects
Coskata has well developed licensing protocols

Developing “Project Partnerships” with:
- Parties looking to profitably expand
  - Chemical companies
  - Feedstock companies
  - Project developers
- Existing operations to compliment core business
  - Corn ethanol producers
  - Sugar mills
  - Pulp and paper companies
- Parties obligated to blend
  - Oil companies

<table>
<thead>
<tr>
<th>Project Definition</th>
<th>Engineering</th>
<th>EPC</th>
<th>Startup &amp; Operation</th>
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<tr>
<td>1-3 months</td>
<td>5-9 months</td>
<td>~24 months</td>
<td>20+ years</td>
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Coskata deliverables:
- Works with licensee to develop and finalize project scope and estimate project economics
- Provides full appropriation ready front-end engineering design
- Work with EPC to perform detailed engineering, procurement and construction
- Evaluate installation and oversee start-up to guarantee operations
- Ongoing on-site and general technical support services
- Access to ongoing technology improvements
Co-location can result in substantial financial synergies

Raw Materials Procurement
- Corn stover
- Corn fiber
- Wood biomass
- Municipal waste

Shared Infrastructure
- Wastewater Handling & Treatment
- Chemicals Storage
- Utilities
- Road, Rail, etc.
Coskata is ready for full-scale facilities today

Coskata has **successfully scaled** cellulosic ethanol technology in 2009 and is ready to build commercially

Coskata’s FlexEthanol process is **cost-competitive with gasoline** at oil prices today

The Coskata process with wood biomass uses **half the water** required to produce a gallon of gasoline and **reduces lifecycle greenhouse gas emissions** by as much as 96%

Can use any non-grain based carbon source (ag waste, trash, energy crops, etc.) allowing **ultimate feedstock flexibility** and **geographic flexibility**

**IT’S TIME TO START BUILDING!**