ERS Polyol Opportunity Overview
October 2012

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Company Overview

WHAT WE DO
Elevance Renewable Sciences Inc. is the leader in the chemical conversion of renewable feedstock into a wide range of both ‘drop in’ and novel specialty chemicals.

TECHNOLOGY
Elevance produces a wide range of specialty chemicals from renewable oils using proprietary, Nobel prize winning metathesis technology developed by Dr. Robert Grubbs at Caltech.

COMMERCIAL PRODUCTION
Already commercialized, marketed and generated gross profits from first suite of commercial products
Asian JV 180,000mt biorefinery with Wilmar commences production in 2012.

KEY STATS
Employees: 140
Founded: 2007
Headquarters: Woodridge, IL
High Performance Specialty and Intermediate Chemicals from Natural Oils

- Variety of Natural Oils
- Widely Available
- Commercial Today
- Low Capital Requirements
- Low Operating Costs
- High Value Product Mix
- Addresses Critical Shortages
- Meets Customer Performance Needs

Soy

Canola

Palm

Specialty Chemicals

Olefins

Oleochemicals
**Elevance Advantage**: An Elegant Conversion Process

### Petroleum Route to Decene
- Crude Oil
- Naphtha
- Light Naphtha
- Olefins
- Ethylene
- LAO
- Decene

### Elevance Route to Decene
- Natural Oil
- Olefins and Modified Triglycerides
- Intermediate Olefins
- Decene

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**Less than ¼ of the Capital and Operating Costs of Traditional Processes**

**Fewer steps and with lower capital and operating costs**

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Elevance Advantage: Proprietary Metathesis Technology

Refining natural oils to specialty chemicals and intermediate chemicals using metathesis technology

Traditional Catalyst

Our Proprietary Catalyst
Elevance Advantage: Leveraging the Inherent Complexity of Plant Oils

- Traditional processes use small molecules to build more complex molecules
- The Elevance process reduces costs by leveraging natural plant oil complexity

Natural Oils

Metathesis Reaction

Specialty Chemicals

C9 ESTER/ACID FRAGMENTS
C9 OLEFIN FRAGMENTS
C6 OLEFIN FRAGMENTS
C1 OLEFIN FRAGMENTS

Oleic C:18:1
Linoleic C:18:2
Linolenic C:18:3

Oleic
Linoleic
Linolenic
Palmitic C:16:0
Stearic C:18:0

Olefins

Saturated Chains

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2012, Elevance Renewable Sciences.
Elevance Advantage: Superior Process

- Low capital intensity and low cost of production
- High value product mix
- Technology process proven and _scalable_

Feedstock Options:
- Soy oil
- Palm oil
- Canola oil
- Corn oil
- Jatropha
- Algae
- Tallow
- Mustard oil

Nobel Prize-Winning Technology:
- Metathesis
- Distillation
- Transesterification
- Derivatization
- Separations
- Alcohol
- Glycerol
- Hydrolysis/Hydrogenation
- Co-Reactants

Standard Chemical Unit Operations:
- Olefins
- Oleochemicals

Proprietary biorefinery process
Near-Term Large-Scale Commercialization
One million metric tonnes from three biorefineries by 2015

Plant #1: Gresik, Indonesia
Expected Commissioning: 2012
Capacity: 180,000 MT expandable to 360,000 MT

Plant #2: Natchez, MS
Expected Commissioning: 2014
Capacity: 310,000 MT

Plant #3: South America / SE Asia
Status: In discussions with petrochemical and agricultural processors to evaluate biorefinery JV and offtake opportunities
### Accelerated Market Entry through Leading Commercial Partners

<table>
<thead>
<tr>
<th>Partner</th>
<th>Product</th>
<th>Addressable Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkema</td>
<td>Specialty Polymers</td>
<td>Engineered Polymers &amp; Coatings</td>
</tr>
<tr>
<td>Clariant</td>
<td>Polymer Additives</td>
<td>Engineered Polymers &amp; Coatings</td>
</tr>
<tr>
<td>Hutchinson</td>
<td>Rubber Processing Oils</td>
<td>Lubricants &amp; Additives</td>
</tr>
<tr>
<td>NL</td>
<td>Greases</td>
<td>Lubricants &amp; Additives</td>
</tr>
<tr>
<td>Stepan</td>
<td>Surfactants and Antimicrobials</td>
<td>Consumer Ingredients &amp; Intermediates</td>
</tr>
<tr>
<td>Dow Corning</td>
<td>Personal Care</td>
<td>Consumer Ingredients &amp; Intermediates</td>
</tr>
</tbody>
</table>
Polyol Opportunity
Specialty Chemicals Based on Novel Di-functional Molecules

Typical oleochemicals:
Monofunctional esters/acids

Typical olefins:
Monofunctional olefins

Di-Functional Molecules

Chemicals from the Elevance process combine functional attributes of olefins and oleochemicals in a previously unachievable single molecule
## Products Address Critical Customer Needs

<table>
<thead>
<tr>
<th>Category</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Detergents &amp; Cleaners</strong></td>
<td>✓ Improved cold water performance</td>
</tr>
<tr>
<td></td>
<td>✓ Alternative feedstock with pricing/supply dynamics</td>
</tr>
<tr>
<td><strong>Personal Care Products</strong></td>
<td>✓ Anti-frizz and shine for leave-in hair care</td>
</tr>
<tr>
<td></td>
<td>✓ Moisturizing benefits and smoother feel for skin care products</td>
</tr>
<tr>
<td><strong>Performance Waxes</strong></td>
<td>✓ Thermal stability</td>
</tr>
<tr>
<td></td>
<td>✓ Increased fragrance loading</td>
</tr>
<tr>
<td><strong>Lubricant Base Oils</strong></td>
<td>✓ Reduction in formulation costs</td>
</tr>
<tr>
<td></td>
<td>✓ Improved fuel economy</td>
</tr>
<tr>
<td><strong>Lubricant &amp; Fuel Additives</strong></td>
<td>✓ Improved lubricity</td>
</tr>
<tr>
<td></td>
<td>✓ Enhanced cold flow properties</td>
</tr>
<tr>
<td><strong>Engineered Polymers &amp; Coatings</strong></td>
<td>✓ Enhanced corrosion, chemical and heat resistance</td>
</tr>
<tr>
<td></td>
<td>✓ Light weight replacement for metal alternatives</td>
</tr>
</tbody>
</table>

*Products specifically target customer desired functional attributes*
Engineered Polymers & Coatings: Di-functional Monomers

*High performance polymers rapidly replacing metal & other materials:*

- Lower weight
- Easier to process
- Better performance in difficult environments

ERS is Partnered with Arkema in Engineered Polymers
Market Landscape: Thermoplastic Polyurethanes (TPU’s)

Global TPU Consumption by End Use,

- Engineering: 27%
- Footwear: 13%
- Automotive: 11%
- Hose/Tubing: 9%
- Construction: 9%
- Wire & Cable: 3%
- Medical: 3%

2007 TPU Demand by End-use

<table>
<thead>
<tr>
<th>End-use market, kMT</th>
<th>EMEA</th>
<th>Americas</th>
<th>Asia-Pacific</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injection</td>
<td>53</td>
<td>30</td>
<td>85</td>
<td>169</td>
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<tr>
<td>Extrusion</td>
<td>41</td>
<td>45</td>
<td>46</td>
<td>132</td>
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<tr>
<td>Adhesives</td>
<td>14</td>
<td>8</td>
<td>23</td>
<td>46</td>
</tr>
<tr>
<td>Coatings</td>
<td>4</td>
<td>3</td>
<td>17</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>112</td>
<td>86</td>
<td>172</td>
<td>370</td>
</tr>
</tbody>
</table>

Sources: IAL, several PU articles

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2012, Elevance Renewable Sciences.
Polyurethane Chemistry
PU chemistry uses 3 key ingredients: isocyanates, chain extender (diol), and polyol

- Polyurethanes are synthesized by a poly-addition reaction between polyols & isocyanates
- TPU are segmented linear polymers made from alternating hard (urethane) & soft segments
- A thermoplastic polyurethane (TPU) uses a specific combination of 3 classes of raw materials:
  - Isocyanate (NCO)
    - Difunctional
  - Chain extender (CE),
    - Low molecular weight diols difunctional monomers
  - Polyol,
    - Difunctional oligomeric material, OH terminated
Example: Olefin Metathesis for Polyol Precursor Production

- We can utilize the metathesis reaction to convert natural oils into di-functional esters

Oleate C18:1

\[
\text{MeO} \quad \text{C9 ester fragment} \quad \text{C9 olefin fragment}
\]

Plus: 3-hexene

Resulting Molecules

\[
\text{MeO} \quad \text{C12 ester} \quad \text{C12 olefin}
\]
Example: Olefin Metathesis for Polyol Precursor Production

- We can then utilize self-metathesis to convert methyl 9-dodecenoate into a diester

Resulting Molecules

C18 Di-ester

- We can subsequently deploy standard organic chemistry techniques to form mid-chain diacids and diols, which can be used as a chain extender or polyester polyol raw materials
Thank You