Industry Analysis:

Bioplastics

Is this a good market to go into?

- Already well established plastic companies
  - Easiest
  - Funding, capital, technology, volume, coops
- Start up businesses
  - Hardest
  - Capital, allocation of resources, volume, distribution channels

Because there is not a huge market there is potential for either a well established company or a start up to have success.
Differentiation of Inputs

- There is no real different outcome to all the different inputs. With plastic you first look at which has the properties suitable for a particular application.
- This brings you to the cost differentiation of your inputs.
  - The price of non-renewable energy resources increases significantly. Which brings about bio polymers would becoming competitive
  - This is a matter of when, not if

Shows agriculture commodity price to crude oil price ratios over 30 years for 3 key agricultural crops that can be used as feedstock for bioplastics.

Importance of Volume to Supplier

- Producers are managing to achieve utilization of capacity and improve technology.
- Only begin to make full use of resources if there is economic incentives for producers.
- 5 years ago PLA & PHB sold for $50/kg, 2003 PLA is $3.6 and PHB is $9.
- Cargill Dow is planning to reduce costs of PLA production by 70% with a three fold increase in capacity making it competitive with other low cost plastics.
Price is a dominant factor with commodity resins.
Technology change is helping the industry with price, and so is the volume being planned.
Very much a growing industry.

Table 3.1: Estimation of existing and planned capacity (main leaders)

<table>
<thead>
<tr>
<th>Resin Family</th>
<th>Company</th>
<th>Existing Capacity 2003</th>
<th>Capacity Planned 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA-4</td>
<td>Celgard</td>
<td>20,000</td>
<td>25,000</td>
</tr>
<tr>
<td>PA-4</td>
<td>Bexar</td>
<td>15,000</td>
<td>20,000</td>
</tr>
<tr>
<td>PA-4</td>
<td>Honda</td>
<td>10,000</td>
<td>13,000</td>
</tr>
<tr>
<td>PA-4</td>
<td>Mitsubishi</td>
<td>5,000</td>
<td>6,000</td>
</tr>
<tr>
<td>PA-4</td>
<td>Toyota</td>
<td>2,500</td>
<td>3,000</td>
</tr>
<tr>
<td>PA-4</td>
<td>Honda</td>
<td>10,000</td>
<td>15,000</td>
</tr>
</tbody>
</table>

Presence of Substitute Inputs

- Existing plastic supply chains are dominated by strong economics of scale and are extremely efficient in utilization that capacity to produce low cost resins
- This is why market share is so low
- Hinders growth and expansion if we can not competitively price
- Huge potential as oil prices rise and the market for plastic keeps sky-rocketing.

Volume Plans

- Price is a dominant factor with commodity resins.
- Technology change is helping the industry with price, and so is the volume being planned.
- Very much a growing industry.
Threat of Substitute Products

**Substitute Products:**
- Traditional Petroleum-based Plastics
- Other Bioplastics (i.e. PHA and PLA)

**Key Components for Industry:**
- Price Performance
- Switching Costs
- Buyer Propensity to Substitute

"It's not like there's a huge market demand for products made from bioplastics... in the area of bioplastics, the important thing is function and cost."

-- Alla Katsnelson, Nature Biotechnology
**Industry Overview of Substitute Products**

- Bioplastics are a niche product in an already well established marketplace
- Must compete with well established traditional plastic firms such as DuPont, 3M, MDE, & Milliken
- Many traditional plastics firms such as BASF, Metabolix, and Cereplast are venturing into Bioplastics

[Link](http://www.plasticsindustry.org/IndustryGroups/content.cfm?ItemNumber=1275&navItemNumber=1092)

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**Substitute Products: Price & Performance Comparisons**

**Petroleum Plastics**
- Price increasing
- High Quality and Reliable Performance in countless applications
- Highly Reliable with a variety of different species which can be personalized to consumers

**Bioplastics**
- Price decreasing
- Performances is high in specific applications but is lacking in other applications
- Is highly specific qualities which makes application highly specific, though quality is improving

[Links](http://www.eia.gov, www.european-bioplastics.org)
Substitute Products:
Switching Costs

Two options:
- Switch bioplastic providers
  - Differences in machining qualities may result in lower yields or quality during phase-in
- Switch product (bioplastic to petroleum plastic or vice versa)
  - Established product traits may prevent switching
  - Learning, machine, and marketing costs

Substitute Products:
Buyer Propensity to Substitute

- End-user awareness and affinity for eco-friendly products makes consumption likely
- Up to 41% of end users were willing to pay more to consume bioplastics rather than traditional plastics (model-projekt)
- Many competing firms compete in the larger plastics market with a traditional plastic in addition to their bioplastic product (i.e. Dupont, Metabolix)
- Most bioplastic producers are working with one formula which they have created themselves, reducing the motivation to switch from one bioplastic to another. (i.e. PHA to PLA)
- Plant location is crucial in the cost to yield ratio so feedstock can be delivered at the least cost. Therefore switching from one bioplastic to another may be difficult

BARGAINING POWER OF BUYERS

Bargaining Power of Buyers

Buyers:
- Manufacturing firms which buy the resin to manufacture into goods which are then sold to other firms or directly to the consumer.

- Miller Plastic Products, Inc.
- Solo Cup Company
- Raven Industries, Inc.
- Meyers Industries, Inc.
- A.I.A. Plastics, Inc.
- Polyfab
- Brown Machine
- ILLIG
- Kortec
- Winfa
- Dupont

Bargaining Power of Buyers

- **Bargaining Leverage**
  Key Components for Industry:
  - Buyer vs. Producer Concentration
  - Switching Costs
  - Backward Integration

- **Price Sensitivity**
  Key Components for Industry:
  - Product Differences
  - Brand Identity
  - Decision Maker Incentives

Bargaining Leverage: **Buyer vs. Producer Concentration**

- Hundreds of small manufacturing firms which manufacture small quantities of plastic into highly specialized products

- A few mega-firms which buy large quantities (i.e. Solo and Winfa)

- Only a few big bioplastic producers in the US, though there are many smaller local firms
  - Natureworks’ world production market share: 40% of total production
  - Bigger companies are likely to hold the larger market shares.

- Overall: leverage is given to the producers
Bargaining Leverage: 
**Switching Costs**

Costs Associated with Switching:

- Learning curve for materials
  - Staff
  - Material
  - Quality
- Machining Specification
  - Cleaning to prevent contamination
  - Heat and moisture differences
- New Relationship
- Transportation Costs?

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Bargaining Leverage:
**Backward Integration**

- Many traditional plastic manufacturing firms are already backward integrated
- Less likely for manufacturers to become bioplastic producers:
  - Specific copyrighted recipes for high quality products
  - High R&D costs
  - High manufacturing costs
  - Different equipment than traditional plastics

Price Sensitivity:

Product Differences

- Quality and Cost differences between traditional plastics and bioplastics make large buyers more picky.
  - Example: Solo Cup Company

- Specialty product producers are more willing to pay more for bioplastic resins

- End-user market is willing to pay more for a bioplastic product, reducing price sensitivity of buyers

Price Sensitivity:

Brand Identity

- End Users feel more comfortable with a brand that they’re familiar with
  - True for both traditional plastics and bioplastics

- New firms will struggle to establish a name for their products on the market

- New firms will likely have to offer their product at a lower price than other producers even if their product is higher quality in order to establish the validity of their product.
**Price Sensitivity:**

**Decision Maker Incentives**

- End-user desire for ecofriendly products is creating a marketplace for bioplastics.
- If end-users are willing to pay more for the product, producers are willing to pay more for the resin and are likely to buy more of it to fill demand.
- So long as this end-user demand is in place, there will be an incentive for manufacturers to use bioplastics because it will likely bolster sales.

**ENTRY BARRIERS**
Cost Advantages/Disadvantages

- Petroleum plastics currently cheaper
  - Petroleum costs $513 per ton @ $70 per barrel

Carbon Based Polymers
- Starch costs $400 per ton
- Sugar costs $300 per ton
- High dev. costs and lack of economies of scale keep petroleum cheaper.

Economies of Scale

Average Companies- 5,000-10,000 tons/year
CDP Natureworks plant- 140,000 ton capacity of PLA
Hycaill plant- 50,000 ton capacity of PLA
ADM + Metabolix plant – 50,000 ton capacity of PHA (biobased polyester)

http://www.biodeg.net/fichiers/highlights%20in%20bioplastics%20(Eng).pdf
http://www.icrinc.com/web/assignments.php
www.turkusciencepark.com
Government Policies

- **US**
  - No current national policies
  - City of San Francisco banned the use of petroleum plastic bags.
  - NY may soon follow suit.

- **Europe**
  - France- “Biobag Law” 2005, all plastic bags must be biodegradable by 2010.
  - Germany- strong policy support.
    - Incentive- The new German Packaging Ordinance
  - Netherlands- Biobin system for certified biodegradable products.
    - Government support

Access to Inputs

- Agricultural feedstocks such as corn, potatoes, and wheat are needed for starch based bioplastics.
- Issue of Food vs. Feedstock.

Global plastics consumption is expected to increase by 15 billion lbs. per year. Bioplastics are growing at a faster rate, currently accounting for 10 to 15% of the total plastics market and projected to reach 25 to 30% by 2020. For more information, visit http://www.hkc22.com/bioplastics.html.
**Concentration**

- Currently there are over 500 bioplastic processing companies available.
- Potential for over 5000 companies by 2020.
- Largest producing companies may grab good portion of market share with economies of scale.

http://www.hkc22.com/bioplastics.html

**Product Differences**

- Bioplastic polymers do not differentiate much from each other.
- Bioplastics look the same as petroleum plastics and have fairly comparable usage properties.
- Bioplastics enjoy the advantage of biodegradability compared to petroleum plastics.
