Making Markets for Biomass

You don’t make markets - you serve them

USDA’s Agricultural Outlook Forum 2012

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Bioformix®

Bio-Product First Movers

Lessons Learned

- Focused on huge commodity consumer plastics and fuels applications
- Low prices, huge investment and time to scale
- Bio-based molecules - no distinct advantages, no value based differentiation
- Direct substitutes, and new to world plastics - vastly underestimated technical and market hurdles
- If not for a green label, difficult market adoption and investment
- Petrol offers hundreds to thousands of plastics & chemical options
- Like any product, what's the compelling argument?

Green Chemistry

What actually makes sense? Whatever makes business sense

- Focus on enabling, low volume, high value specialty applications
- Support young biomass with initial higher value markets to support the learning curve - like all previous chemicals!
- High prices, low investment and short time to scale
- Pick new molecules that enable something dramatic - a step function change
- Pick molecules that can be substituted at a lower relative cost
- Green or not, would everyone would have invested?
- Any new platform, biomass or not, should exhibit a compelling case across a broad range of hundreds to thousands of plastics & chemical options
- Like any product, what’s the compelling argument?

Drop in Plastics Commodities?

Customers switch on half pennies, need perfection

- Very low prices coupled with huge existing capital investments
- 30 to 50 years of know-how to get this far - 99.99% purity - or the wrong ones
- Need huge plant volumes to get cost competitive
- Why price lower?
- Why deep six existing investments?
- **Business model upside down -- almost nothing has ever gone from commodity to specialty**
- Strong global growth – double digit demand for early movers with economies of scale

Investors are learning... Government should too

Cash efficiency, fast path to sustainable profits

- More and more VC's are focused on biomass where costs can be made very low for very basic building blocks from multiple sources
- Must lead to a true platform - looks like a barrel of petroleum
- Focus on specialties first at low volumes and high margins and prices
- A focus thus on enabling technologies across the board - applications
- C3 and below versus biomass C4 and above - Methane, CO_2 is a feedstock
- A focus on the path to cash flow fast - validate the demand
- The dream product - a draw so powerful the incumbent is worthless

Amyris, Inc.

- Cosmetics, flavors & fragrances early on
- Neossance™ squalene replacement
- Lower cost, lower price - but high margins
- Low volumes - fast launch, lower investment
- Replaces controversial shark based products

- Performance waxes and oils
- Specialty coatings, adhesives and plastics resins
- Initially lower volumes for specialties at high margins
- Low volumes - fast launch, lower investment
- Provides a step-wise path for the successes to larger volumes and lower prices for big markets

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- Zero energy, high speed curing monomer platform
- Specialty coatings, adhesives, inks & composites
- Initially lower volumes for specialties at high margins
- First products - $100’s to $1000’s per pound
- Low volumes - fast launch, lower investment
- Provides a step-wise path for the successes to larger volumes and lower prices for big markets

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Our First Products?
High Performance, Energy Efficient Adhesive and Coatings

- Combines super glue's ambient, ultra-fast cure with epoxy performance
- Cures in seconds to a minute - dial it in
- Infinite pot life, no mixing, no heating, no odor, & biologically friendly
- Industrial Assembly Adhesives - Ultra-fast cure and high performance is new
  - *Light Assembly - Faster cure, low or no energy, high performance*
  - *Wood Panel Products - Energy savings, faster curing, biodegradable, biofriendly*
  - *Flexible Packaging - Instant curing, low or no energy, biodegradable, biofriendly*
- Consumer, DIY & Professional Adhesives
  - *Retail Adhesive Customer - Fast curing with high performance*
- Coatings - Ultra-fast, solvent free, ambient cure with high performance is new
  - *Can Coatings - Faster curing, low or no energy, solvent free, BPA free*
  - *Industrial Coatings - Faster curing, low or no energy, biodegradable, biofriendly*

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A Great Example!

Plywood & Composites
made with no energy!

No ovens, no heating, biologically safe, biodegradable
No formaldehyde release, no styrene
10% to 20% less costly

Forest Products Lab interested

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A Great Example!

High speed, solvent free, no bake coatings!

75% Faster, much less expensive

& environmentally friendly

Low/No heat enables suite of new advanced materials, high performance thermo plastics; further drives down costs, drives up performance, and achieves fuel efficiency targets with light weight materials.

Encompasses EPA Green Chemistry Principles of designing from molecular level to full systems approach; reduces pollution, unleashes innovation, creates jobs, achieves sustainable manufacturing.

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The Results?
Jobs & Economic Growth for Ohio

- Over $200 million in revenue within 5 years
- Real jobs that are market supported, not government funded
- High value - products sell whether green or not
- Better than GDP growth potential
- 100+ professional jobs ($90K avg) for Ohio within 5 years
  - +6 2011
  - +14 2012
  - +15 2013
  - +20 2014

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The Results?
Sustainable Manufacturing, Global Competiveness

- Jobs, jobs, jobs – stem staggering jobs loss in petrochemicals (create over 200,000 new jobs 5 years)
- Reverse trade deficit back to surplus in polymers/chemicals (plummeted from $20B surplus in mid 1990s to $10B deficit)
- Grow the bio-economy
- Revitalize manufacturing consistent with President's Council on Science and Technology, Advanced Manufacturing Initiative
  - Systems approach, less energy, less capex and opex
  - Sustainable economics
  - Arbitrage with renewable feedstocks and cleantech
  - Advanced materials
- Win the future with global competitiveness

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High Performance Sustainable Polymers

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