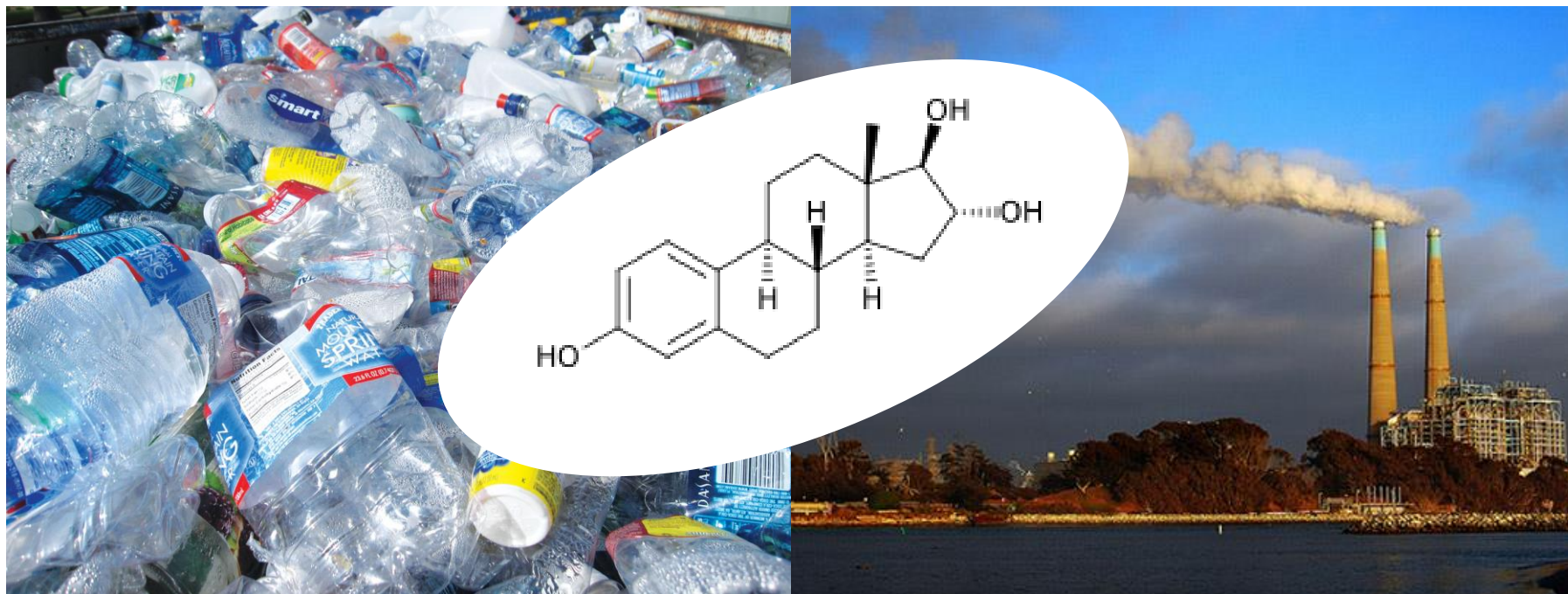




Expanding materials to improve performance, lower cost,
and reduce environmental impact

The Problem...



Customer Pain – Compostable Items are Expensive and Poor Performing, Corporations Want Lower CO2 Emissions

Delivering On Value...

Better



Improved Strength
and Thermal
Performance

Bio-Based

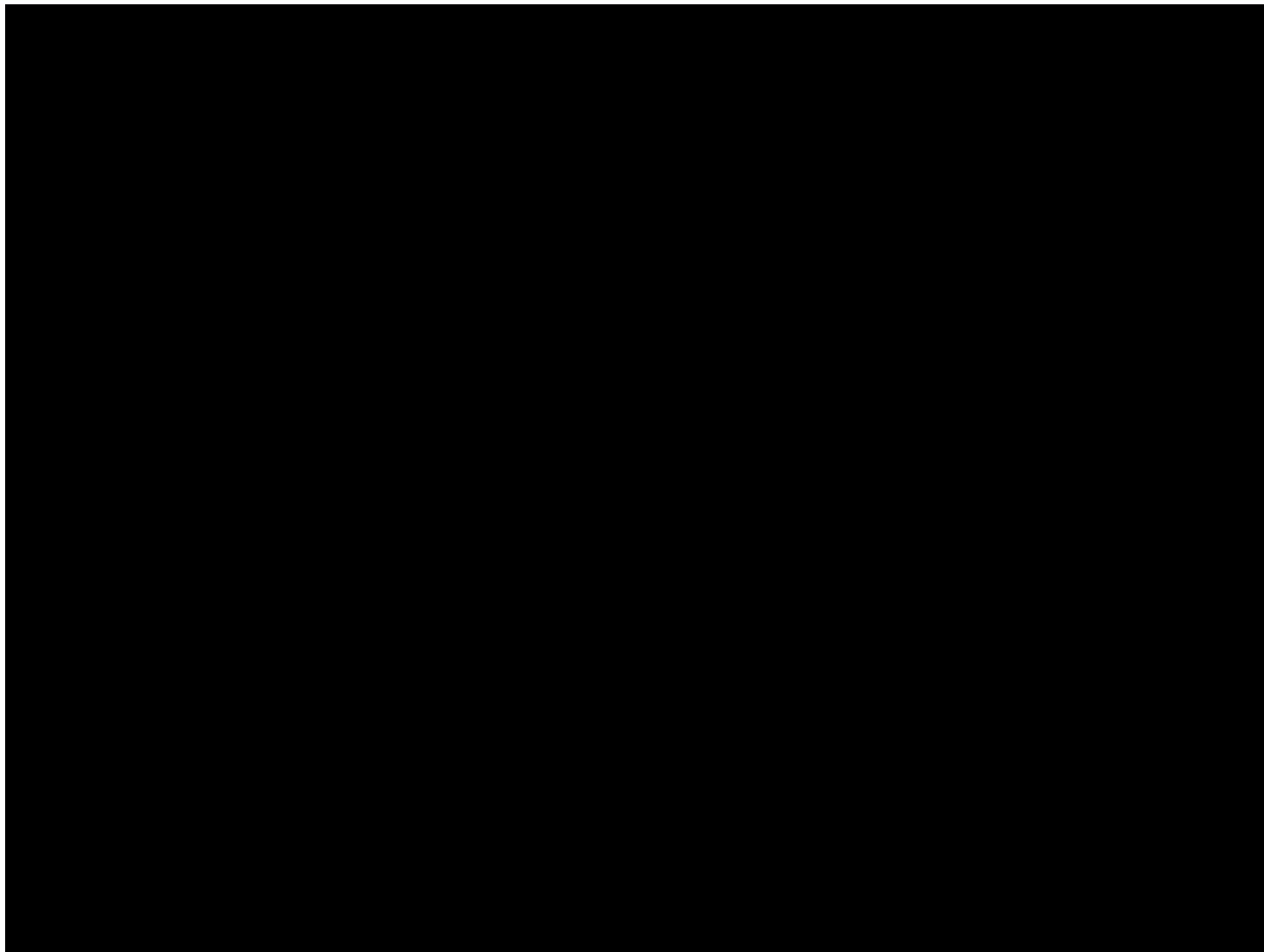


65-90% Reduction in
CO2 from Material
Sourcing

Lower Cost



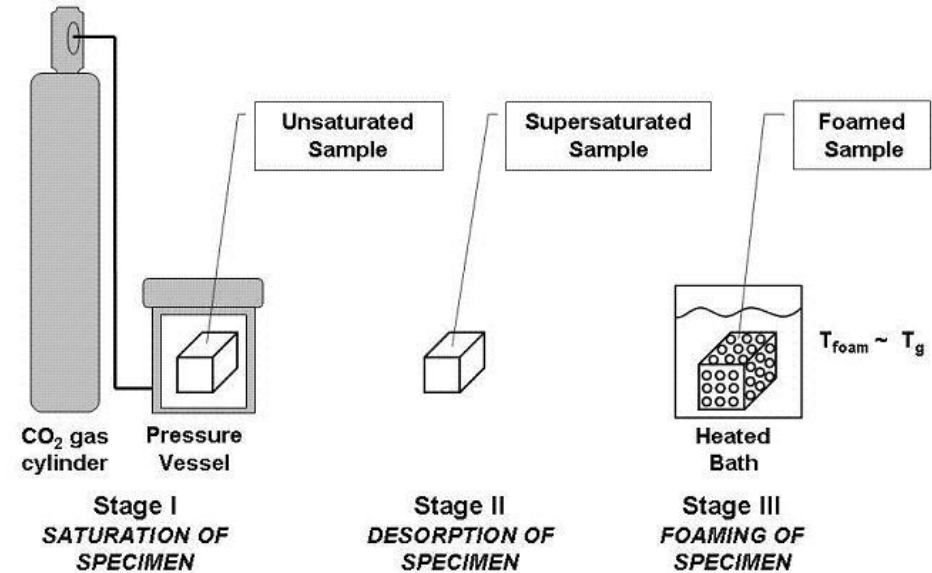
Less Material = Less
Money



Solid State Foaming

- Traditionally took 2 to 40 hours
- Batch Process
- Unique in generating layered structures

Solid-State Microcellular Process



Benefits of Solid State Foaming

- Compatible with wide range of additives
- Decouples crystallization behavior and foaming behavior
- Foam polymers that have not been expandable in past
- Can be done inexpensively in lab

The Process...

Our Suppliers



PLA
Pellets



Patented
Process



Forming

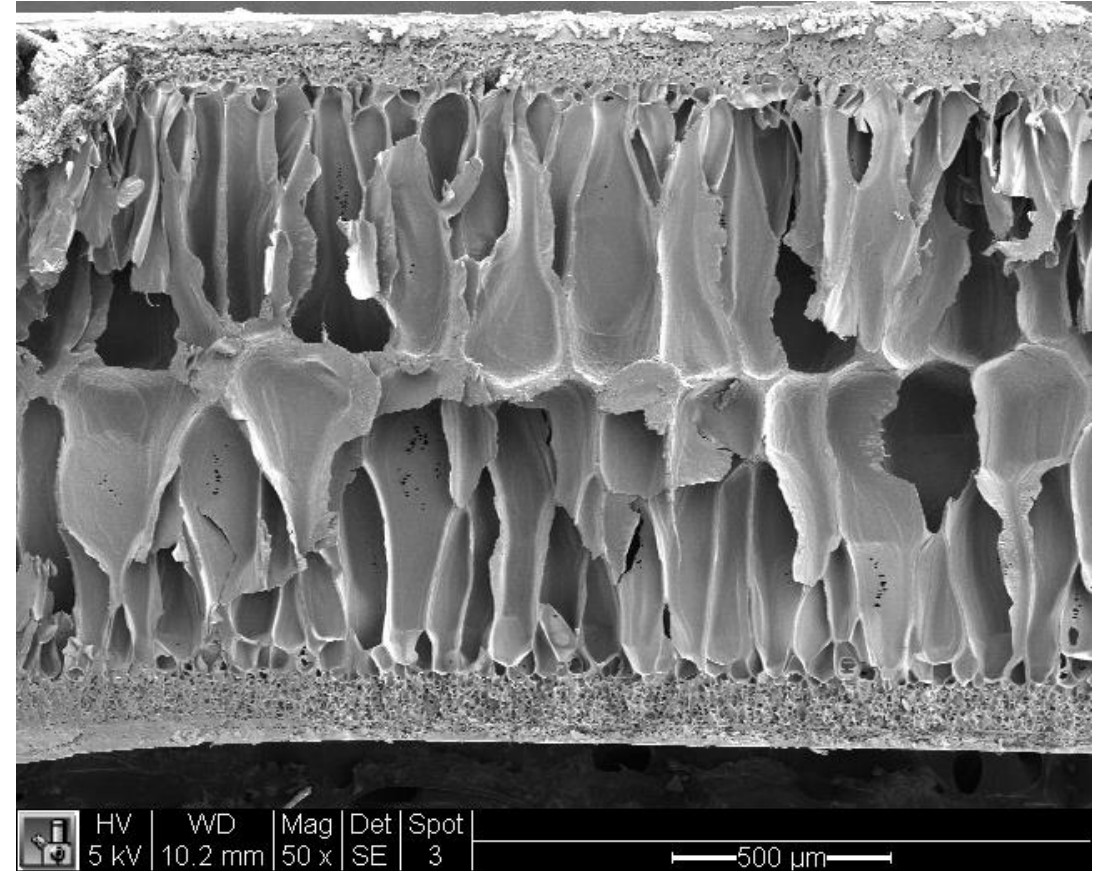


Compostable,
Strong, Low
Cost Products



Layered Structures

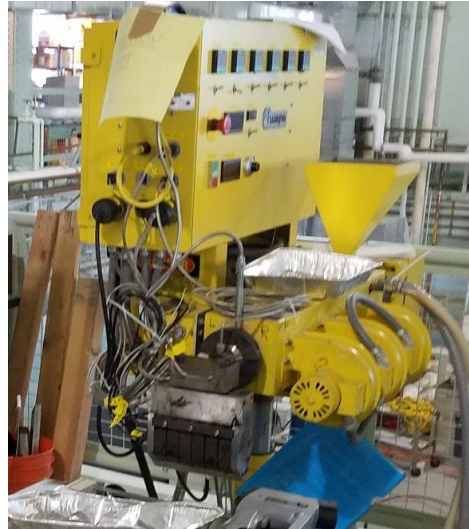
- Higher density skins have superior aesthetics, strength to traditional foams
- Large cells at center provide low density overall
- Can incorporate fillers to give papery feel, increase strength
- Follow rule of mixtures



Grow Plastics Status - Equipment

- 2 inch device developed, tested
- 8 inch saturator developed, tested to point of making 50 foot rolls
 - Currently installed at USDA Albany, CA
 - Beginning shake down and diligent repeatability testing
- Machinery partner developed with experience in high pressure gas equipment and roll handling, open to others
 - Possibility of small business voucher program with LBL
 - NSF Manufacturing Equipment Grants

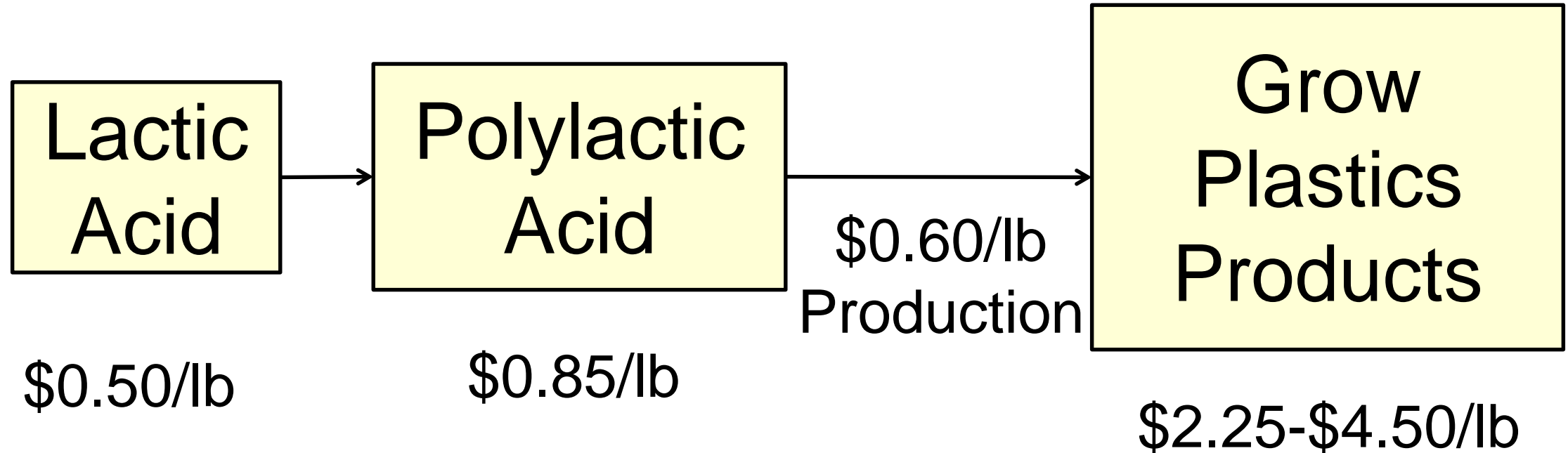
USDA Pilot Plant and People are Amazing



- Pellets to End Product
- Full Analytical Lab
- Credibility

- Support of Experts in Field
- Help sourcing Materials
- Visitors

Economics – Producing End Products



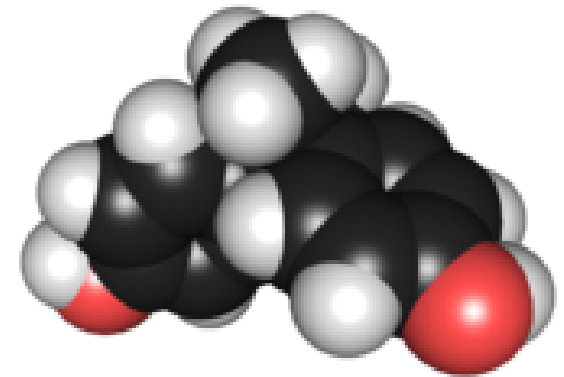
Why go to End Products?



Everyone Understands
a Meat Tray that Doesn't
Have Carcinogens and
is Compostable



Vertical Integration is
Where the Money is



Most of the industry solves
problems with nasty additives
– EG BPA and Plasticizers

Grow Plastics Interests

- Barrier – Both understanding customer requirements for specific applications, barrier coatings available
- Structural Applications – Composite Cores
- Ocean and backyard degradation while retaining properties
- Alternate feedstocks, processes for generating PLA

Ocean Degradation

- Barry, Carolyn. "**Plastic breaks down in ocean, after all—and fast.**" *National Geographic* 20 (2009).
- **"SM, SD, and ST1 are widely distributed in the North-West Pacific oceanic coast determined through this study."**
 - Saido, Katsuhiko, et al. "New analytical method for the determination of styrene oligomers formed from polystyrene decomposition and its application at the coastlines of the North-West Pacific Ocean." *Science of the Total Environment* 473 (2014): 490-495.
- Pelegrini, Kauê, et al. "Degradation of PLA and PLA in composites with triacetin and buriti fiber after 600 days in a simulated marine environment." *Journal of Applied Polymer Science* 133.15 (2016).

