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## Ad-air™ in Application: QSR Food Tray Case Study

### **Problem Statement:**

A global food packaging and thermoforming converter was seeking to minimize the amount of PET material used in their multi-compartment, Quick Service Restaurant (QSR) food tray, while maintaining the necessary mechanical properties of the application.

### **Solution:**

MicroGREEN Polymers, Inc., partnered with the company under a Joint Development Agreement (JDA) to explore expanding PET using Ad-air™ gas impregnated thermoforming technology to minimize the material costs while maintaining the quality of the application. The JDA included:

- Specifying the scope of work
- Engineering the microcellular structure to achieve desired results
- Quantifying capital expenditures and ultimate unit cost savings
- An exclusive option to protect the customer in their field of use during the JDA.

### **Results of Joint Development:**

#### **Scope of Work:**

The customer supplied the PET roll material and thermoformer tooling mold to MGP. All the equipment necessary to carry out the development project (such as pressure vessels, ovens, thermoformer and Instron testing machine) was readily available at MicroGREEN Polymers' R&D facility in Arlington, WA.

An MGP staff scientist along with an R&D technician completed the project within the 1 month project timeline. The customer was updated on a regular basis during the course of the JDA.

A formal written report that outlined the feasibility of creating stiff PET thermoformed QSR trays with good surface quality and shape detail at a significantly reduced relative density to solid PET, as well as, a Unit Cost Analysis based on the results achieved, was presented to the customer at the end of the project. Currently, a license agreement is under consideration.

#### **Engineered Results:**

- Using Ad-air™ technology, a stiff, expanded PET thermoformed QSR tray with 20% relative density to the original solid was produced.
- The expanded tray achieved the required shiny surface quality and detailed shape features.
- Depending on the test load used, the expanded trays had comparable or even higher stiffness to their counterpart solid trays at only 45% of the weight of the original solid tray!



## Unit Cost Savings:

As the model below demonstrates, the customer would achieve a 39% cost savings per unit and a return on their investment in approximately 1.5 years!

## Unit Cost Analysis of QSR Food Tray



Foaming Parameters			
Polymer type to foam	PET	\$ 0.80	\$/lb.
Polymer type that remains solid	PET	\$ 0.80	\$/lb.
# of rolls/chamber		5	
Saturation Chamber OD		48	in
Solid Sheet thickness (inches)		0.025	
% Solids of foamed roll		20%	
Times Expansion		5.0	
Foamed Sheet Thickness Expansion		2	times
Finished Roll Width (in)		46	
Finished Roll Index (in)		46	
Thermoformers		3	
Indexes/min/t'former		6	
Indexes per minute/total		18.0	
Units / sheet	46 X 46 in	48	

Capital Assumptions (\$ in oos):		
	7	chambers
Saturation Time (Hrs)	24	
	Per Unit	Incremental Installation
Chamber Cost (installed)	\$139	\$970
Interleaver - slitter		\$250
Roll Handling & Support Equip.		\$300
Foaming Tunnel (installed)		\$738
Other		\$1,500
Total		\$3,757

Comparison to Conventional		
	Ad-air	Solid
Sheet Thickness on roll (in)	0.050	0.025
Units / 8 hr shift (1000s)	415	415
Unit Cost (\$/unit)		
Raw Material	\$0.011	\$0.027
Processing	\$0.004	
Royalty	\$0.001	
Total (\$/unit)	<b>\$0.01623</b>	<b>\$0.027</b>
	<b>39% Savings</b>	
Rolls/operating day	29	
Foaming Tunnel Utilization	23%	
Savings/operating day	\$12,980	
Payout (calendar days)	405	

Metrics Summary*		
*Assumes Operating 24/5	Ad-air	Solid
Process Cost per lb	\$ 0.21	
Net cost \$/msi (w/o regrind)	\$ 0.49	\$ 0.97
Rolls/operating day	29	29
Rolls/operating year	7,144	
Wt/roll	929	2,322
Capacity/day (lbs)	26,540	66,349
Capacity/day (kg)	12,064	30,159
Capacity/year (lbs)	6,634,930	16,587,324
Capacity/year (kg)	3,015,877	7,539,693
ft/yr	25,833,600	25,833,600
Index/yr	6,739,200	6,739,200
Units/yr	323,481,600	323,481,600