Thermoforming Quarterly®

A JOURNAL OF THE THERMOFORMING DIVISION OF THE SOCIETY OF PLASTIC ENGINEERS

FOURTH QUARTER 2010 ■ VOLUME 29 ■ NUMBER 4

Shifting Into Drive for 2011

INSIDE . . .

UPES resin
ENABLED BY QINNEX TECHNOLOGY™

Achieve a sustainable balance of performance and cost.

Enabled by QINNEX® technology, UPES® resin as an additive to polyolefins enables **significant source reduction** while **increasing performance at no additional cost.**

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Thermoforming Quarterly®

FOURTH QUARTER 2010
VOLUME 29 ■ NUMBER 4

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Thermoforming Quarterly®

A JOURNAL PUBLISHED EACH CALENDAR QUARTER BY THE THERMOFORMING DIVISION OF THE SOCIETY OF PLASTICS ENGINEERS

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"Embrace the Challenge" = Huge Success

First of all, I want to thank all of our sponsors, exhibitors and attendees who made this year's conference a great success. Secondly, a special word of thanks is in order for Clarissa Schroeder, your conference chairperson, for her dedication and drive to deliver an informative technical program and to manage a successful conference overall. I also would like to acknowledge our scholarship winners: Adam Mix, UW of Madison; Clinton Reges, East Carolina University; and Jerome Fischer, Oakland University. On behalf of the Thermoforming Division, I wish them continued success in their academic and thermoforming careers.

As we drive forward to the close of 2010 and open the doors to a new year in 2011, I want to review some of the areas where your Thermoforming Board is taking action.

2010-2014 Strategic Plan

1. Streamline committee duties by using more on-line meetings between board meetings.
2. Restructure and refine the conference.
3. Develop a communication committee to improve the information flow from the Board to the membership.
4. Reduce costs.

Our goal here, like many other companies and trade organizations, is to create a more efficient board. We have already begun to address one of these areas: many of our technical committees are now meeting online to address items left over from our last board meeting in September. Our next board meeting in February 2011 has an aggressive meeting schedule designed so that board members become more productive during our time together. By holding these periodic meetings between formal board gatherings, we can improve the methods by which we promote our industry and be more effective in bringing to our membership an array of topics and developments in materials and processes.

We are now in the early stages of planning our next board meeting in May at Penn College (Williamsport, PA). As you may know, your board and division are extremely active in providing funding, program assistance and course development at this highly acclaimed technical college. It only makes sense for your board to visit this center of higher education, to experience their passion and develop a strong bond between industry and academia. In this sense, we are true to our mission statement: *"Our mission is to facilitate the advancement of thermoforming technologies through education, application, promotion, and research."*

Thermoforming Business Outlook

As Dr. Peter Mooney illustrates in our "Business of Thermoforming" feature this issue, some of our biggest challenges include designing new, innovative products and creating business models that deliver sufficient value for our customer so they will continue to buy. This has been made more difficult by the recession. We are also facing increasing costs from rising health insurance premiums, dealing with more government regulations and potentially a greater federal income tax. There also appears to be a shake-up coming in raw material costs. We are in a roller coaster of ups and downs these days. However, in response to this uncertainty, one of the most important acts we can do as thermoformers and manufacturers is to get out there and get involved with our clients and our markets. Push thermoforming with a PASSION! Explain all the benefits we can offer the markets over alternative closed-molding processes.

BE ACTIVE within your industry instead of sitting around waiting for the phone to ring. It starts with you! If you have any view points or comments please feel free to contact me. I would like to hear from you!

ken@pcmwi.com

New Members

Juan Jose Aguirre
Total Petrochemicals USA
Deer Park, TX

Sandeep Armin
C&K Plastics
Metuchen, NJ

Jammie Arens
Advanced Extrusion Inc.
Becker, MN

Dave Armstrong
Fabri-Kal Corp.
Kalamazoo, MI

Chris Atkinson
Flecknoe Pty. Ltd.
Cloverdale, W Australia

Clint Atkinson
Superline Plastics
Perth, W Australia

Suresh Ayyasamy
GDC Inc.
Goshen, IN

Andrew P. Bacher
Tri-Cor LLC
Cleveland, OH

Gordon Beach
Display Pack
Grand Rapids, MI

Dwayne Bixler
Tech II
Springfield, OH

Serge Blanchard
CGP Europe
Torcy

Ron Blitchok
Display Pack
Grand Rapids, MI

Christoph Bonte
Vitalo Industries NV
Meulebeke

Marshall Brekke
Mikwaukee, WI

Bill J. Burke, Jr.
Spring, TX

Cory L. Buxengard
Allied Plastics, Inc.
Twin Lakes, WI

Patrick M. Cain
General Plastics
Glendale, WI

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Springfield, OH

Jeeyoung Choi
Align Technology
San Jose, CA

Todd Chrismer
McClarin Plastics
Hanover, PA

Nathan Cline
Georg Utz
Edinburgh, IN

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Rapid Granulator Inc.
Cranberry Twp, PA

Christopher Corona
Cartier & Wilson Co.
Columbus, OH

Sandy Crapser
Advanced Extrusion Inc.
Becker, MN

Gary Crivellaro
Speck Plastic Inc.
Nazareth, PA

Don Culbertson
Omni Technologies
Greendale, IN

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University of Minho
Minho

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Placon Corp.
Madison, WI

Al Diocochea
Freetech Plastics Inc.
Fremont, CA

Goran Djekanovic
AWP
Surrey, BC

Tom Douglas
Douglas Fabrication &
Machine Inc.
Wendell, NC

Allen Dunlap
Kenson Plastics Inc.
Warrendale, PA

Kamal Eldin Eisa, Jr.
Octal Petrochemicals
Salalah

Perry Engstrom
Arlington Heights, IL

Mark Faber
CM Packaging Group
Lake Zurich, IL

Jay Ford
ASI Plastics
Port Coquitlam, BC

Brett Franklin
Tooling Now
Mentor, OH

Bill Gerard
Specialty Mfg. Inc.
San Diego, CA

Jim Grace
Profile Plastics Corp.
Lake Bluff, IL

Scott Grant
Display Pack
Grand Rapids, MI

Carl Griffin
Insul-Fab
Cornelia, GA

Shane Harris
Seeley Int'l. Pty. Ltd.
Lonsdale

Dina Hebein
Profile Plastics Corp.
Lake Bluff, IL

Cory J. Hendricks
Corvac Composites
Byron Center, MI

Dale A. Hogan
Visy Industries
Campbellfield

Daniel J. Hribar
Plastic Ingenuity
Cross Plains, WI

Rocky Jacobs
Concote Corp.
Tyler, TX

James Johnson
Midland Plastics
New Berlin, WI

Scott Johnson
Charlotte, NC

Alan Jordan
CPT
Janesville, WI

Chad Kampa
Advanced Extrusion Inc.
Becker, MN

Phillip Karig
Mathelin Bay Associates
LLC
St. Louis, MO

Chris Kirby
Granger, IN

Wesley Knotts
Thermopro Inc.
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Maini Plastics &
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Wentworth Technologies
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Precision Packaging
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Kevin Lakinski
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David Larson
Allied Plastics Inc.
Twin Lakes, WI

Erik Larson
Allied Plastics Inc.
Twin Lakes, WI

C. Y. Lee
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Point Comfort, TX

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Eberle Mfg. Co.
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Springfield, OH

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Tulsa, OK

Tim Lusk
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Technologies
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Wildwood, MO

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Brentwood Industries
Reading, PA

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Tray-Pak Corp.
Reading, PA

John D. Manos
Rochester, NY

Mike Matthews
Tech II
Springfield, OH

Jason Mendofik
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Reading, PA

Dan Mitchell
Solo Cup Co.
Chicago, IL

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Coppell, TX

Robert Mozian
SencorpWhite
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Andy Pavlick
Genpak LLC
Hope Hull, AL

Doug Payne
Proform Plastics Ltd.
Frankton, Hamilto

Kevin Pedersen
Persona Inc.
Watertown, SD

William Person
Bloomfield Hills, MI

(continued on next page)

New Members *(continued)*

Randy Pinsch
General Plastics
Milwaukee, WI

Michael Pugh
Seeley International
Lonsdale

Robert Rehmel
Barger Packaging
Elkhart, IN

Tim Riegling
Display Pack
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Brandon Roberts
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Russell Romocean
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Alliance, OH

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Tray-Pak Corp.
Reading, PA

Brent Shannon
Specialty Manufacturing
San Diego, CA

Kent Shepherd
Plastics Unlimited Inc.
Preston, IA

Fred Simonson
Multisource Mfg. LLC/
Victory Tool
Anoka, MN

Keith D. Smith
Flight Plastics
Wellington

Kelly South
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Chris Spellman
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Prabhushanker
Srinivasan
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Asheboro, NC

Frank Stones
ASI Plastics
Port Coquitlam, BC

Cameron Streidl
Formed Solutions Inc.
Holland, MI

Masaaki Sueoka
Kyoraku Co. Ltd.
Chuo-ku Osaka-Shi,
Osaka

Li Sun
Becton Dickinson
Franklin Laakes, NJ

Varawong Tangitvet
vandapac
Chonburi

Indarjit Teelucksingh
Metal Industries Co. Ltd.
Tunapuna

Robert Tennyson
Multi-Plastics Extrusion
Lewis Center, OH

James Michael Thomson
Boltaron Performance
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Ricardo Vallejos
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Anne Walker
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Phillip Whetstone
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Sue Williams
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Costa Mesa, CA

Dan Williams
Placon Corp.
Madison, WI

Stefan Wilson
Metal Industries Co. Ltd.
San Juan

Terrence Woldorf
CMT Materials Inc.
Attleboro, MA

Tracy C. Wolf
Innovative Plastech Inc.
Batavia, IL

Frank Wolfinger
Placon Corp.
Madison, WI

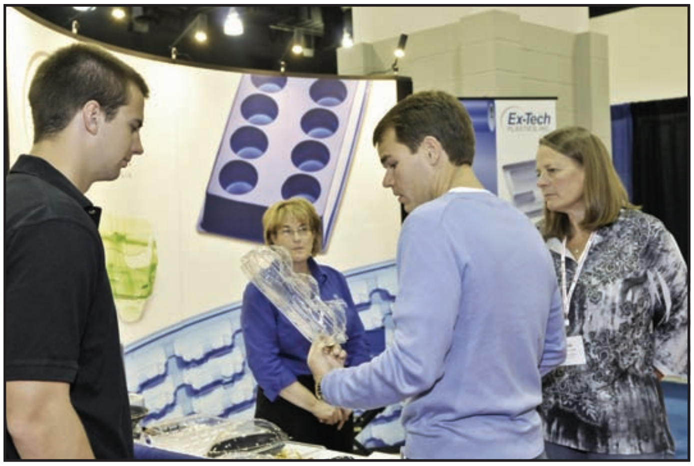
Sam Woodford
Placon Corp.
Madison, WI

2010 Thermoforming Conference
Milwaukee, Wisconsin

Attendees enter the Exhibit Hall as "Embrace the Challenge" gets underway.

Future thermoforming experts learn about the latest technology on display.

Thermoformer of the Year Roger Kipp and family.



Attendees examine some product samples at the Ex-Tech Plastics booth.

The SPE PlastiVan educates local Milwaukee-area students about the wonders of plastics.

A packed session at the conference center is testament to another successful event.

All Conference Photos Courtesy of Dallager Photos, Columbus, OH

Thermoforming in the News

InterTrade Industries buys California packaging thermoformer

By Bill Bregar, Plastics News Staff
Posted: October 22nd, 2010

HUNTINGTON BEACH, CA – InterTrade Industries Ltd. has purchased Plastic Concept Inc. in a deal involving two thermoformers in Huntington Beach.

The deal expands InterTrade's thin-gauge thermoforming capacity, doubles manufacturing space and quadruples its tooling capability. A company spokeswoman said InterTrade will continue to run Plastic Concept's factory and retain its employees. Workforce numbers were not available.

Plastic Concept adds to InterTrade's blister and clamshell operations. InterTrade specializes in vacuum and pressure forming of heavy-gauge products for markets including aerospace, military, automotive, electronics, medical and consumer products. It also does in-line forming.

Terms were not disclosed for the purchase announced on October 21st.

Plastic Concept has nine thermoforming machines that specialize in thin-gauge plastics, for retail packaging and other markets. The company employs 22 and generated 2009 sales of $4.2 million, according to *Plastics News'* most recent thermoformers ranking. InterTrade said it will retain all Plastic Concepts employees.

InterTrade is ISO 9001:2008-certified with more than 35 years of experience. The company does in-house computer-aided design and five-axis computer numerically controlled routing. It is a subsidiary of American Innotek Inc. in Escondido, CA.

Creative Plastics International Acquires Thermoforming Assets of SeaGate Plastics

Released: 11/11/2010

JACKSON CENTER, OH – Creative Plastics International, Inc. (New Washington, OH) announced today that it has acquired the thermoforming division assets of SeaGate Plastics in Tecumseh, Michigan. This production will be transferred to Creative Plastics facilities, located along the I-75 corridor near Jackson Center, Ohio.

Kevin Fink, President of SeaGate Plastics, stressed that "While SeaGate has spun off its thermoform operation, we will continue to operate the extrusion facilities in both Ohio and Michigan."

Gerald Wurm, President of Creative Plastics, stated that the SeaGate customers "can continue to expect high-quality products with uninterrupted supply and top notch service. This transfer will be advantageous to SeaGate customers who will now have access to other types of vac-grade materials, larger part sizes of up to 8 x 10 feet, pressure forming, higher volume rotary forming and roll fed inline product offerings."

Correction

Due to a formatting error on page 19 of our last edition of *Thermoforming Quarterly* (TQ 3, Vol 29, No. 3), we inadvertently printed a table from "The Business of Thermoforming" article with some missing data. The corrected table is printed below.

	Contact M/c	Radiant M/c	Units
SPECIFIC WEIGHT	1.35	1.35	g/cm^3
SHEET PRICE	1.63	1.63	$/Kg
SCRAP PRICE	0.38	0.38	$/Kg
% SKELETAL WASTE AND SCRAP	11	25	%
ENERGY CONSUMPTION (GN)	6.8	70	KW/machine
NUMBER OF CAVITIES PER TOOL	10	10	N/A
ORDER SIZE	2000000	20000000	N/A
COST OF LABOR	19.20	19.20	%/Hr
ELECTRICITY	0.128	0.128	$/KwHr

Table 2. Variables Common to All Materials.

Report from Dusseldorf

A Review of Thin-Gauge Thermoforming Technology from the 2010 K-Show

by Mark Strachan
Global Thermoforming Technologies, Inc.

On the first day of "K" 2010, I was one of the first at the gate and when the show opened, I was like a kid in a candy store eager to verify the claims made by so many thermoforming OEMs. There were a lot of press releases in the many plastics publications leading up to the show and I needed to see for myself the state of technology on display.

In this report, I list the details of machinery (in no particular order), tooling and I have added my comments on the actual demonstrations and special features that, in my opinion, should be well-noted by those interested in purchasing new thermoforming machinery. In some cases I have added diagrams that will better explain the usefulness of some of those features. Unfortunately, we do not have enough space in one article to discuss all the thermoforming machinery configurations available today, so I will only be making mention of those showcased at "K" this year.

Configuration # 1

Form then **Trim** then **Stack** – all operations are performed in separate stations while material is still captive in the chain rails.

An example of such a configuration was showcased by **Kiefel Technologies, Inc.** of Freilassing, Germany. Their new KMD80 steel rule machine, with separate forming and trimming stations and an up-stacker system ran at a remarkable 45 cycles per minute producing a plug-assisted fruit clamshell on an 8-cavity tool manufactured by Techno Trading A/S.

The majority of the machinery showcased at the show this year featured trim-in-place technology, so before proceeding any further, we'll take a closer look at this technology.

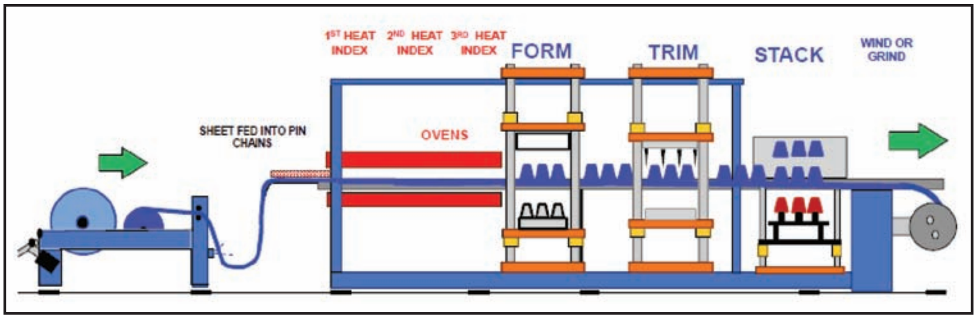


Illustration 1: Form/Trim/Stack.

Configuration #2

Trim-In-Place Thermoformers – the part is formed and trimmed in the form station.

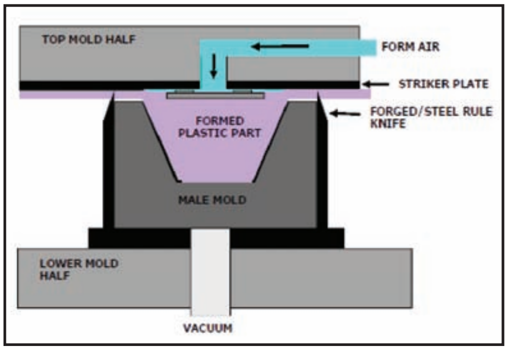


Illustration 2: Trim-in-Place Tooling.

The sharp edge of the knife only partially penetrates the sheet, creating a sealed chamber between the heated sheet and the mold cavity. Once the forming air pressure and/or the forming vacuum is turned off, the knife is driven through the sheet cutting the formed part from the web.

The trim-in-place feature is available in various thermoforming machinery formats. The type of format chosen depends on the geometry of the final plastic part and how the processor would like the finished parts presented to the packer or the downstream automation equipment. The illustrations on page 8 show a few of those formats.

(continued on next page)

Configuration # 3:

Form and **Trim-in-place** then **Stack –** The form and trim operations are performed in one station and then the parts are moved to another station for the stacking operation.

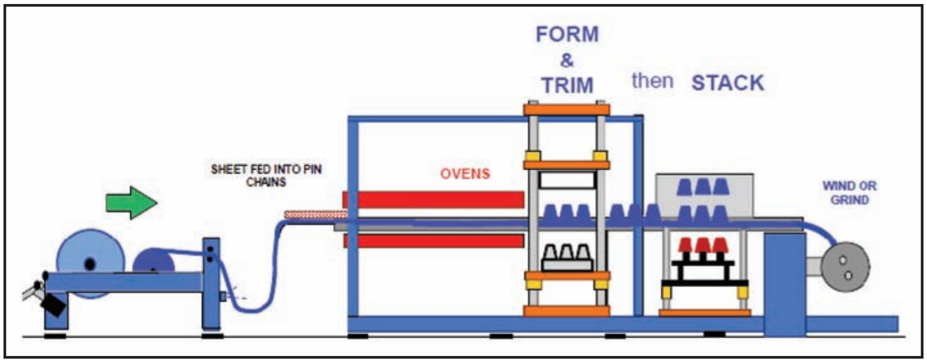


Illustration 3: Form & Trim-in-place then stack.

ILLIG Maschinenbau GmbH Co. of Heilbronn, Germany's RDK90 thermoformer is a perfect example of such a single station trim-in-place machine and I was very impressed to see this machine running at an incredible 55 cycles per minute producing 6"x 5"x 4" APET trays on an 18-cavity steel rule-type trim-in-place tool. The steel rule trim-in-place tooling offers reduced tooling costs while still being capable of accommodating the required 50+ psi of form air pressure. The trick is in the mounting of the steel rule knives and the precision welding of the join. This is now made much easier by new, extremely high precision CNC benders and welders available in the market today.

GN Thermoforming Equipment of Nova Scotia, Canada exhibited their new GN760 with third-motion plug which ran a 10-cavity tool with a center web of only 7 mm between cavities. The trays were run using 600 micron (0.023") thick sheet from Octal's D-PET range of materials. The trim-in-place tooling was manufactured by GN.

Paddle Type Retrieval System

Often in when using the single station trim–in-place configuration, parts can be retrieved via a paddle that enters the form station and picks up the trim parts before the next cycle. At the OMV stand, the paddle was used to place the preformed labels in the mold cavities and at the same time to pick out the formed labeled parts and place them on a conveyor.

TIML: Thermoforming In-Mold Labeling

Even more impressive is the fact that this same machine configuration can be configured to allow for a pre-printed label to be automatically placed into the mold (by the same parts removal paddle) prior to the platens closing. This is known as TIML (Thermoforming In-mold labeling) and although I first saw this done commercially in the early 1980's at the company my father was running (Nampak, Mono Containers) in South Africa. The advent of new label materials and faster automation equipment is rapidly making this a very viable option for parts decorating and will, in my opinion, take a large chunk of business from the IML (Injection In-Mold Labeling) industry.

Such a TIML machine was showcased by **OMV Machinery S.R.L of Verona, Italy** where seven labels were simultaneously picked from label magazines then pre-formed and placed in a 7-cavity euro tub mold (single row) and were running consistently at 14cpm. OMV did a great job in simplifying the process to take full advantage of their patented in-mold placement and retrieval system.

Trim-in-Place & Tilt

Staying with the trim-in-place technique, a very popular European thermoforming configuration is the tilt-mold system for stacking. This technique is becoming more popular in the USA for the manufacture of tubs, lids and smaller trays.

I am personally very excited about this technology as I cut my thermoforming teeth when I was only 16 years old when I ran four such thermoformers, first built by Habomat in 1967 (model T100).

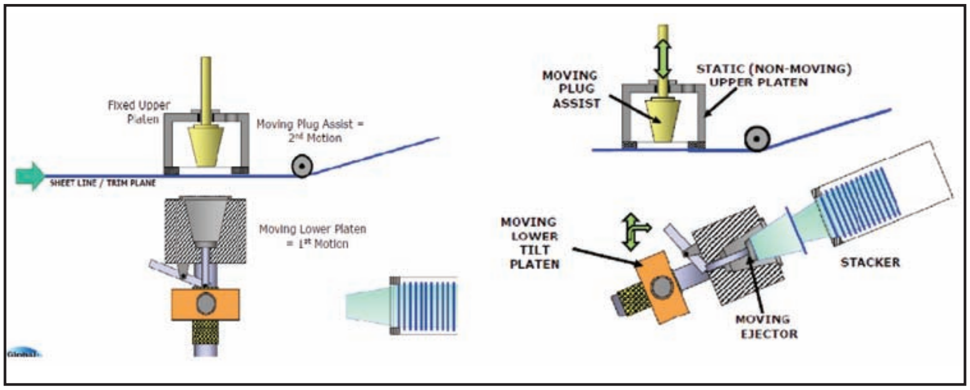


Illustration 4: Below sheet line former with trim-in-place and tilt-to-stack feature.

When I saw this old machine on display at the Wikon stand, I could not help reminiscing over the countless hours I spent toiling over the mechanical cams, micro switches and mechanical gears that were required to dial in a product.

With these small but remarkable machines, I was able to secure a contract for airline juice cups for the outgoing flights from Cape Town.

Mark Strachan at Wikon booth in Dusseldorf.

Thomas Piesik of **Wikon Thermoform Ltd. & Co. KG of Luebeck, Germany** has taken these old machines and rebuilt a newer version for use in today's market. While they would be considered a miniature thermoformer in the predominantly large-bed thermoforming industry in the US, I believe it still has a place in the industry where a small filling or printing house would like to easily manufacture their own cups, tubs and lids.

Further advancements have been made to the trim/tilt/stack technology so that taller, thinner walled parts that would normally crush easily when stacked can now be stacked in nested fashion while promoting much faster forming cycles.

A – The formed cup is picked up by the stacker mandrel.

B – The formed cup is turned 180 degrees.

C – The formed cup is placed into the stacker magazine, tapered end first.

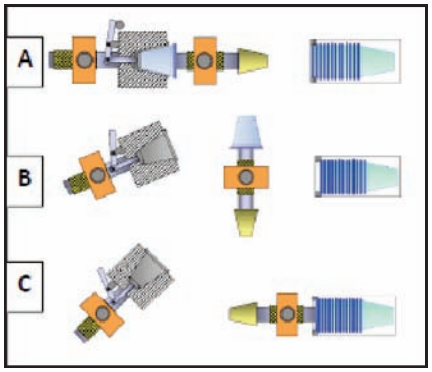


Illustration 5: Below sheet line former with trim-in-place, tilt-to-stack feature with 180 degree swing.

The only disadvantage of these machines is that one is not able to form above the sheet line to include features such as high "U" flanges. Some OEMs have included features which allow the chain rails to pivot down and away from the form station after each form cycle.

Other companies that showcased the form/trim and tilt-to-stack configurations were:

ILLIG Maschinenbau GmbH Co. demonstrated a model RDM 70K with a 27-cavity APET drink cup at 45cpm. This model also included many energy saving features.

Kiefel Technologies, Inc. demonstrated a model **KTR4** trim-in-place and tilt machine with their "BEST 75/39" vertical stacker. This machine was producing APET drinking cups with the following dimensions: 80mm diameter, 100.5mm deep, 6.1g, 1mm thick on an 18-cavity tool manufactured by BoschSprang at a rate of 45cpm using form air saving technology.

Gabler Maschinenbau GmbH showcased a new M60 trim and tilt former with a 24-cavity drinking cup tool for APET at 38cpm. The up and down movement of the form platen is driven via servo cam drive while the tilt is achieved via a separate servo motor. The tooling was manufactured by **BoschSprang BV of The Netherlands** and because I was intrigued with the superb clarity of the parts, I went to the BoschSprang stand where they were running a Gabler M90 trim and tilt machine for PP cups (60 cavities at 38cpm). The PP cups were so clear that I thought they looked like APET cups. I discovered that the high clarity sheet was supplied by Sabic and Martijn Haex of BoschSprang also attributed the high clarity of the cups to a new plug material from CMT Materials, Inc. known as Hytac-FLXR5.

Meaf Machines B.V of The Netherlands showcased their new trim and tilt technology which abandons the cam-driven motions of former models and is now replaced with multiple servo drives. The tooling was built by Mold and Matic of Austria.

MEICO (TFT) of Monza, Italy showcased their new trim in place and tilt former built at their WM Wrapping Machinery SA, plant in Switzerland. The new thermoforming machine model FT 500 ran a 15-cavity mold for 95mm diameter PET/PP cups at 45cpm. A patent-pending pivot system uses a combination of servomotor driven cams and levers, based on an innovative double desmodromic system which I was told permits absolute precision of movement, repeatability, and a controlled distribution of forces during the platen movement and cutting phases of the cycle.

TSL – Thermoforming Systems LLC of Union Gap, WA showcased their latest machine, the FT3500 featuring TSL Tilt

(continued on next page)

Technology, which was developed to accommodate the growing mid-sized trim-in-place machine market primarily for PP processing. The machine forms and trims parts up to 5.91" (150mm) deep in a single station and has a forming area of 30.51" (775mm) x 17.72" (450mm).

The TSL patent-pending tilt technology is a synchronized dual servo toggle-driven design which provides a rugged, high speed forming platform for a reliable and repeatable thermoforming process. This is the only trim-in-place and tilt machine currently being built in the USA. Moreover, this machine is only a small part of a very large TIML automation line currently being produced by **Hekuma GmbH of Eching, Germany**. What might prove to be an important development in US thermoforming is the news that Tech II, an Ohio-based injection molding company, will be the first U.S. company to produce TIML-labeled parts using this TSL-Hekuma system.

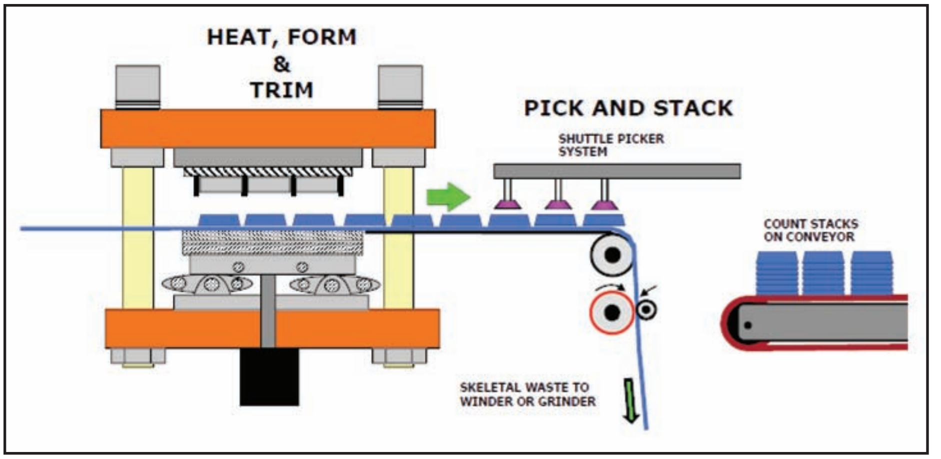


Illustration 6: Heat, form & trim-in-place.

Configuration #4:

Heat, Form & Trim-in-place (aka contact-heat method) – the plastic sheet is heated, formed and trimmed in the same station and then the trimmed parts are moved to a separate stacker. The upper platen is static while the lower platen moves up and down.

The heating is made possible by a hotplate mounted on the lower moving platen which consists of many tiny vent holes and a baffle plate sandwiched in-between to block off the areas where heat should not be applied. When the lower platen moves up and pins the sheet against the knives, air is blown down on the sheet, pinning it against the hot plate for a preset time. The air is then turned around and blown up through the hot plate causing the heated sheet to move into the female mold cavities. After a sufficient cooling time, the knives are driven through the sheet and the parts are trimmed.

The disadvantage of this forming configuration is that until recently one could only form “above sheet line” parts. This is due to the fact that the lower plate is an extremely hard and flat plate against which the forged or steel rule knives trim. New tooling techniques allow for limited “below sheet line” forming.

GN Thermoforming Equipment exhibited their new GN3021DX with robotic stacker, forming a reverse lip tray on a standard contact-heat cut-in-place machine by profiling the lower heater plate. The 8-up common edge tool (no skeletal web in-between the trays) was manufactured by GN and was running at 16-19cpm. D-PET sheet supplied by Octal was 380 microns (0.015") thick.

In conclusion, I was very impressed by the outcome of my findings at the 2010 K-Show as the majority of the pre-show hype proved to be true. I am especially excited about thermoforming in-mold labeling and the impact it is going to have in the very near future on markets worldwide. It also became very clear to me that there has been a dramatic upswing in the economy and that thermoforming companies are purchasing new machines again. I look forward to “K 2013” as I believe we will see many more thermoforming machinery and tooling OEMs offering new, advanced technologies allowing for larger volume production of in-mold decorated parts such as pre-printed sheet, TIML and more.

2010 Thermoforming Conference Milwaukee, Wisconsin

Ribbon Cutting by International President Ken Braney and members of Thermoforming Board of Directors.

Need help with your technical school or college expenses?

If you or someone you know is working towards a career in the plastic industry, let the SPE Thermoforming Division help support those education goals.

Within this past year alone, our organization has awarded multiple scholarships! Get involved and take advantage of available support from your plastic industry!

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- UMASS Lowell
- San Jose State
- Pittsburg State
- Penn State Erie
- University of Wisconsin
- Michigan State
- Ferris State
- Madison Technical College
- Clemson University
- Illinois State
- Penn College

Start by completing the application forms at www.thermoformingdivision.com or at www.4spe.com.

Thermo Forming Division

Process Cooling for Compounding

Michael Mueller, Technical Sales Manager, AEC, Inc.

You wouldn't want to slow down your extruder capacity with a feeder that is undersized, but every day we see plants that limit capacity due to undersized or inefficient cooling systems and pumping capacity that is short of what is required. Today, having an adequate and energy-efficient cooling system is crucial to be competitive.

Cooling requirements have not changed much for extrusion processes; however confusion still exists as to how much cooling is required, what type of system to choose, and the benefits of each.

In extrusion processes, there are two types of cooling requirements: material cooling and machine cooling. We will also explore elements of process cooling in thermoforming.

Material Cooling

The type and throughput rate of the material processed determines the heat load requirement while the heat transfer device determines the flow rate required. Polyolefins and PVC usually require cooler water, 45-55˚F, while resins such as nylons, styrene, polycarbonates and PET process well with higher temperatures, some over 80˚F. The formula for material cooling is expressed as follows:

Mass x Delta T x Specific Heat /12,000 = cooling load in chiller tons (15,000 for cooling tower applications)

Usually a safety factor of 20 percent is included by auxiliary companies to guarantee sizing. This calculation has been used to create easy guidelines for extrusion processes as follows:

40 lbs/ton/hr for LDPE	(coating)
50 lbs/ton/hr for HDPE	(pipe/profile/sheet)
55 lbs/ton/hr for LDPE/PP	(sheet)
75-80 lbs/ton/hr for PS/ABS	(sheet/pipe/profile)
80-90 lbs/ton/hr for PVC	(sheet/pipe/profile)

Required flow rates for these cooling applications are:

- water baths and under water pelletizers - 2.4 gpm (or less)
- pipe/profile – 4.8 gpm per ton
- sheet extrusion – 8 gpm per ton and extrusion coating – 12 gpm per ton

Thermoforming

In thermoforming, most cooling requirements are for tempered water in the 80-110˚F with some high speed applications in the 50˚F range. Tower water or chiller systems are typically used.

Sizing for mold cooling in thermoforming depends on the amount of material being cooled and is as follows:

240 lbs/hr PVC = 1 cooling ton
250 lbs/hr HIPS = 1 cooling ton
180 lbs/hr PE = 1 cooling ton

The cooling rates are lower for thermoforming as the air used in the molding process helps to cool the material in the mold. Recommended cooling water flow rates for thermoforming are approximately 4.8 gpm per ton and like most applications, achieving turbulent flow in the tool is as important as the temperature of the cooling water. The higher flow rate causes lower temperature differential across the tool and more leads to consistent cooling of the parts.

At 4.8 gpm per ton a rise in temperature of 5˚F will occur from the process water inlet to the tool to the outlet. At 2.4 gpm, the temperature rise of process water will be 10˚F. You can determine the exact heat load of a tool by using the following formula: *GPM x Delta T / 24 = chiller tons*.

Machine Cooling

Some extruder gearboxes and barrels may be air-cooled so the following information pertains to those water-cooled components that have heat exchangers provided on the extruders. The machine cooling requirements are usually for 85˚F water. Some manufacturers may request lower temperatures.

One ton per 100 hp on gearboxes
Feed throats: up to 3½" - 1 ton each; 4" and up = 2 tons per extruder
Barrel cooling: 1 ton per inch diameter
Screw cooling: ½ ton per inch diameter
Vacuum pumps: 0.2 tons per pump HP

Add up all material cooling (45-50˚F or 85˚F, material dependent) and machine cooling requirements (at 85˚F) for the number of extruders, and begin the process of selecting the most efficient cooling system. It is also important to consider other plant cooling requirements including air compressors, dryer after-coolers and HVAC requirements.

Different Applications

An interesting difference between injection molding applications and the extrusion processes is that injection molding loads are usually 70-75% hydraulics, with air compressors and other equipment requiring 85˚F water and 25-30% material cooling requiring 50˚F water. Extrusion processes are almost the opposite, with 70-80% material cooling and 20-30% machine cooling. This has led extrusion companies to lean towards air-cooled chiller systems and to bypass tower systems that require more water treatment, dual sets of process water piping and indoor space. Recent trends show compounders with both higher and lower water temperature requirements are considering tower water systems (possibly with smaller water cooled chillers) as an energy efficient alternative.

Cooling Systems

Considering that a 100 ton cooling tower utilizes a 5-10 hp fan and the same size chiller requires 100+ hp for compressors and condenser fans, even the most efficient chilled water systems cost $9.00-12.00 more per hour for electricity (at $.06 per kW/hr). Costs for a basic 100 ton chilled water system will start at about $95,000 while a 100 ton tower system starts at about $45,000. Costs for a closed-loop tower system will start at about $55,000. Water and water treatment chemicals only slightly reduce the advantage of cooling tower cost savings.

Current chiller design utilizes rotary compressor technology in both screw and scroll compressors. Scroll compressors combined with new refrigerants including R410a which operates at a higher pressure than other refrigerants can provide more cooling tonnage per hp and should be considered for upgrading any chilled water system 10 years old and any reciprocating compressor design. Screw compressors generally utilize R-134a and come in larger sizes starting at 60 tons.

Closed Loop Tower System with Heat Exchanger (left) filters (center) tower water treatment unit (right).

Cooling towers use evaporative cooling to achieve energy efficient cooling at higher water temperatures but have been improved in recent years with "closed loop" designs that provide clean, clear water to process via heat exchangers, coils or fluid cooler designs. In northern and arid climates cooling towers may provide cooling water temperatures easily in the low 70˚F range for most of the year. Cooling towers are air-to-water heat exchangers that are based on wet bulb conditions (a temperature and humidity index) and may achieve upper 60˚F water temperatures in 100˚F weather due to low humidity.

Energy Efficiency

In addition to updating chiller designs, other energy saving devices have become extremely popular. High efficiency motors, variable frequency drives and free cooling system designs are often used for energy savings and gaining rebates from power companies and utilities.

Winter-Koolers, also known as free-cooling fluid coolers, use low ambient conditions in northern climates to cool process water via fan coils.

Winter-Kooler Unit on a roof.

A 100 ton fluid cooler uses eight 1.5 hp fans and 28 amps at 460v to cool the load. An air-cooled chiller at 220-300 amps will achieve the same result, depending on the type of chiller. This represents a savings of $7.80-$10.00 per hour of operation when air temperatures are 15 degrees lower than process water requirements. Thermostatic switching systems will activate the system automatically at night and during cold weather while the chiller shuts down as the water temperature lowers. These systems require freeze protection and usually provide a payback of 1.5 winters.

Variable frequency drives have become a standard option on cooling towers, chilled water pumping systems and tower fans. They offer excellent energy savings in the range of 30% for most motors, more as systems are operated at partial load, i.e. when fewer process machines

(continued on next page)

running. Variable speed drives have come down in price in recent years and provide many benefits in addition to energy savings. Benefits of variable frequency drives include:

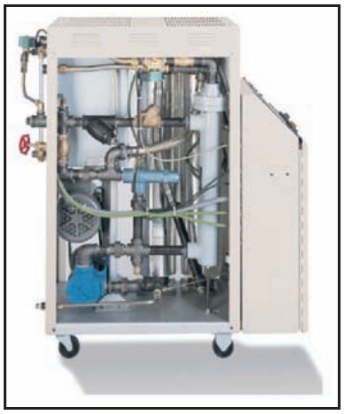
- Improved process control (based on temperature or pressure)
- Reduced energy/operating costs
- Built-in soft start
- Reduces water hammer
- Control shut down with loss of power
- Motor performance
- Extends pump life/Reduces maintenance
- Less pump noise

Variable frequency drives may be retro-fitted to existing systems as long as inverter duty motors are being used, making an upgrade a very good choice for reducing energy costs immediately.

Variable Frequency Drive Pump Control. The smaller pump is the chiller pump.

Temperature Control

Some heating and cooling applications such as barrels, dies, heating and chill rolls require close temperature control above the temperatures where chillers and towers can safely operate. Temperature control units can isolate these requirements and provide a process circulating loop up to 300˚F with water and 550˚F with oil. A wide variety of these units are available for particular applications.



Oil Temperature Controller – 550˚F.

Water Treatment

Water treatment is required by all process cooling systems. Some chiller companies will not start up a chiller without filtration equipment located (and operating) upstream of the chiller. Chillers operating at 45˚F or lower require freeze protection as the evaporator may see temperatures at the freezing point.

Chilled water and closed loop systems require industrial corrosion inhibitors as the recirculating fluids become corrosive over time. Chilled water systems require: filtration, corrosion inhibitor (possibly a biocide to prevent biological growth (slime)) and occasional system water tests.

Tower systems require more attention for water treatment. As a tower system evaporates water the mineral content and dissolved solids remain in the system, super-charging it with the undesirable effects of the local water supply. Four components are required for tower water treatment systems: water meter chemical feeder to monitor incoming water and add the appropriate chemical; filtration; biocide feeder; and a bleed-off (conductivity) controller which purges water when dissolved solids become too high.

As the winter falls upon us, it is a very good time to review process cooling systems and get a head start on summer. Items to review can include overall system sizing and easy energy efficiency upgrades such as a new, energy efficient chiller or variable frequency drive controls. |

2010 Thermoforming Conference Milwaukee, Wisconsin

Conference Chair Clarissa Schroeder enjoys a packed show floor in Milwaukee.

PROSPECTIVE AUTHORS

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A Market Overview and Outlook for the Thermoforming Industry

by Dr. Peter J. Mooney, President
Plastics Custom Research Services
Advance, NC

[Editor's Note: The following article is taken from a formal presentation delivered by Dr. Mooney at the September Thermoforming Conference in Milwaukee, WI. It appears in Thermoforming Quarterly *with the express permission of Dr. Mooney and PCRS. We invite readers to send us their comments on this piece and other articles. If you would like to contribute a business or technical article, please write to cpcarlin@gmail.com.)*

The State of U.S. Manufacturing

Let's take a brief look at trends in U.S. manufacturing on which we all depend for the growth of our companies.

We observe in this graphic the trend of the percentage share of manufacturing value-added in U.S. GDP from 1947 to 2004.

The overall trend-line is obviously downward. Yet the implications for manufacturing employment are even more disturbing. Employment in U.S. manufacturing industries has been declining at an average annual rate of 0.1% for the past 60 years whereas factory output has been growing at an average annual rate of 3.4%.

The one bit of good news is that the recovery of manufacturing output here in 2010 has been quite impressive. The value of U.S. manufacturing output has grown every month since January, driven largely by the automotive and electronic equipment industries.

The State of U.S. Thermoforming

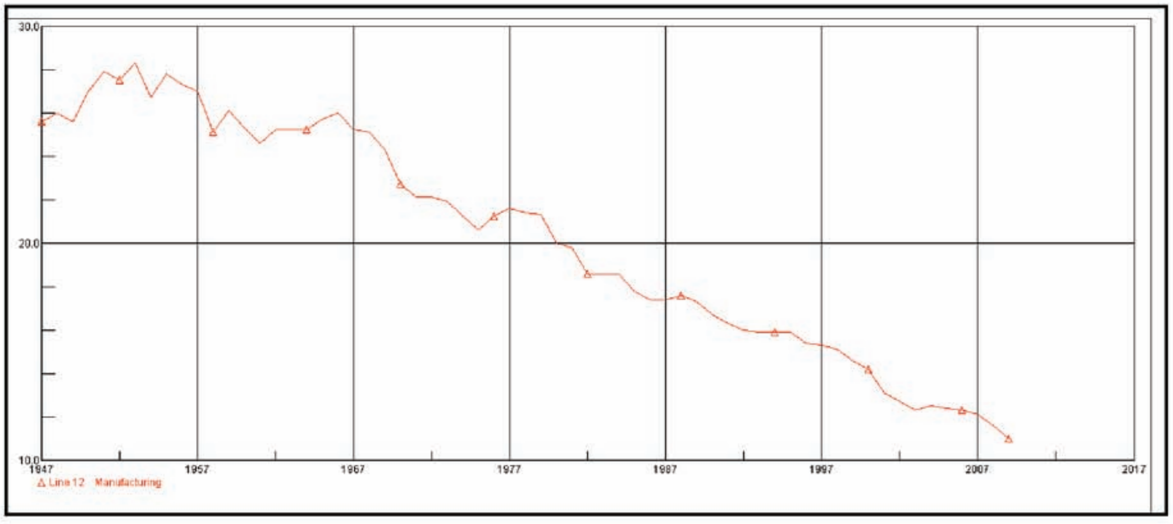
This then is the economic environment in which thermoformers and the companies on your material and machinery supply chain operate. Let me turn now to what I see evolving in the two branches of thermoforming – that is, light-gauge film forming (primarily packaging) and heavy-gauge sheet forming (primarily industrial products).

Hopefully most of you know that since 1995 I have been researching and publishing – roughly every 3 years – reports covering both the packaging and industrial thermoforming businesses. I'd like to share with you today some of the data and insights from my two latest reports covering those businesses.

I'll start by providing the graphic shown on page 13 portraying the share of thermoforming in North American plastics processing.

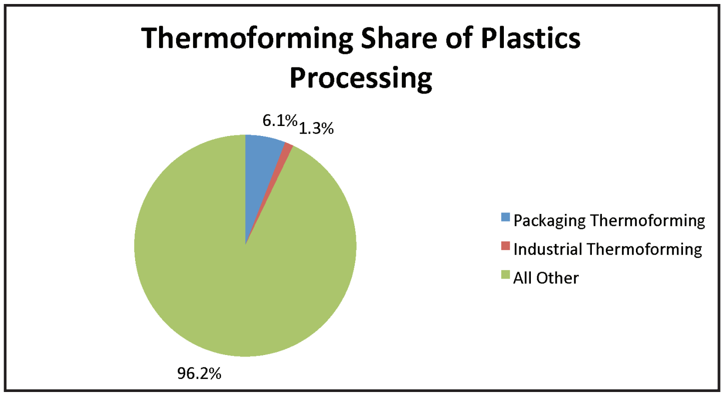
Packaging thermoforming is obviously the larger segment with 2009 sales of $11.3 billion, based on the consumption of

Share of Manufacturing Value-Added in U.S. GDP (1947-2009)



(Source: U.S. Bureau of Economic Analysis)

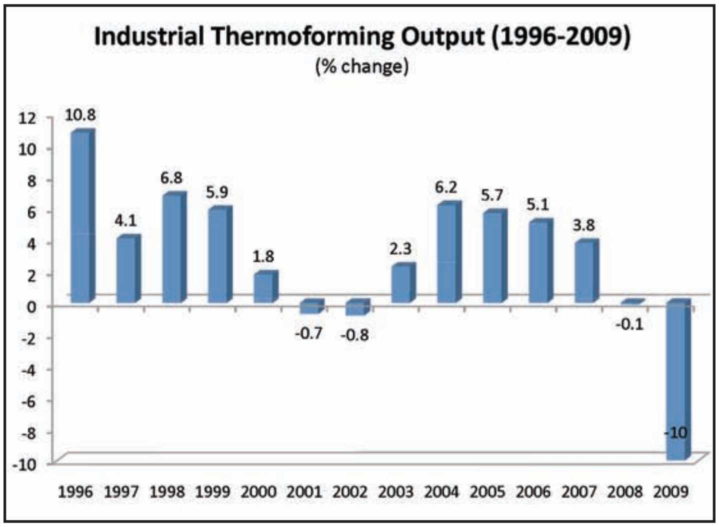
Metric	Industrial Thermoforming	Packaging Thermoforming
Sales 2009 ($mil)	2.55	11.3
Vol. of output 2009 (bn lbs)	1.275	6.11



6.1 billion lbs. of plastic material. Industrial thermoforming is the smaller segment with 2009 sales of $2.6 billion, based on the consumption of 1.3 billion lbs. of plastic material.

Industrial Thermoforming

I'll address first the industrial thermoforming business. In the slide shown below, I portray the annual changes in the value of North American industrial thermoformed output going back to 1996. We observe that this business boomed in the mid-1990s. It tapered off in the late 1990s and then suffered lost sales in the moderate 2001-2002 recession. It recovered, like the rest of the North American economy, in 2004. Since then its growth dynamic has weakened, culminating in a severe slump in 2009. This estimate of a 10% drop in industrial thermoformed product sales is based on data from the most



recent Plastics News survey of thermoformers, published earlier this year. The actual drop may have been worse than 10%. I'll return to this point momentarily.

Another way to get an assessment of the recent trend of industrial thermoformed output is to examine the trend of key markets in which these processors participate. They are as follows:

Leading Industrial Thermoforming Markets

- agricultural equipment
- aircraft/aerospace
- appliances
- automotive/transportation
- building and construction
- electrical/electronic devices
- signs and displays
- lawn and garden
- marine products
- medical devices
- office products
- recreational/ sporting goods

I regard the following table as critical to an understanding of the extent of the setback in industrial thermoforming in recent years and the extent of the challenge recovering from this setback in future years. I gathered data on unit shipments in 10 of these end-use markets from 2004 to 2009, drawn from several industry associations tracking these markets. Here are the sources of these data.

Sources

Appliances:	2004-2009, major home appliance shipments from the Association of Home Appliance Manufacturers; 2010-2014, PCRS projections
Automotive:	2004-2009, car and light truck production from Wards Auto; 2010-2014, PCRS projections
Building:	2004-2011, single- and multi-family housing starts from The National Association of Home Builders; 2012-2014, PCRS projections
Furniture:	2004-2010, sales of office furniture from the Business & Institutional Furniture Manufacturer's Association International; 2011-2014, PCRS projections
Heavy Trucks:	2004-2009 actual data and 2010-2014 projections from ACT Research
Marine:	2004-2009, new boat sales from the National Marine Manufacturers Association; 2010-2014, PCRS projections
Medical:	2004-2009, PCRS estimates of medical device production; 2010-2014, PCRS projection
RV:	2004-2011, Recreational Vehicle Industry Association; 2012-2014, PCRS projections
Signs:	2004-2009, sales of profile extruders specializing in the production of signs and displays; 2010-2014, PCRS projections

(continued on next page)

Other: 2004-2009, real GDP growth; 2010-2014, PCRS assumes 3% real GDP growth in 2010 followed by 2.5% 2011-2014

In some cases these associations have put forward predictions for the likely volume of production in 2010 and 2011; in one case (heavy trucks) their forecasts go out to 2014. In all other cases I have made what I believe are conservative projections from 2010 out to 2014.

Here then is the table.

Trends in the Volume of Production in Major Markets Served by Industrial Thermoformers, 2004-2014 (2004 = 100)

Market	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Appliances	100	100	101	95	86	75	80	87	95	100	105
Automotive	100	101	98	95	80	54	62	71	80	89	100
Building	100	106	92	69	46	28	37	45	55	65	75
Furniture	100	113	121	128	125	88	83	80	90	100	105
Heavy Trucks	100	117	129	83	72	43	50	76	91	97	94
Marine	100	99	105	97	81	75	60	65	70	75	80
Medical	100	102	104	106	108	110	112	114	116	118	120
RV	100	104	106	95	64	45	62	67	75	80	90
Signs	100	102	111	103	98	95	98	100	103	106	109
Other	100	103	106	108	109	106	109	112	115	118	121
Average	100	105	107	98	87	72	75	82	89	95	100

Notes: 1) The annual averages are unweighted averages.
2) Data are in volume terms except for those for furniture and signs which are in value (sales) terms.

I have taken the data on volume of production from the various associations and converted them into indices starting in 2004. Therefore, all markets have a common starting point of 100. By 2006 most of these markets had index numbers greater than 100. However, by 2007 the volume of production in most markets began dropping back to 100 and below. This downward trend continued into 2009 when only two markets – medical equipment and all other – had volume of production indices greater than 100. Fortunately most of these markets have been rebounding here in 2010. By 2014 this analysis suggests the average volume of production in these 10 markets will be 100 – the same as in 2004, 10 years ago.

I mentioned a minute ago that based on the most recent Plastics News survey of thermoformers the sales decline experienced in 2009 by industrial thermoformers was 10%. That was in value or sales terms. Based on the data in this table, relating to the volume of production, the decline was even greater – that is, 17% from an average index level of 87 in 2008 to 72 in 2009. Even this may be an understatement.

Nevertheless, the scenario portrayed in this table demonstrates clearly what you already know – namely, many key durable goods markets took tremendous hits during the "Great Recession." Building and construction was particularly badly hit, and 10% of U.S. manufactured goods are consumed directly or indirectly in the building and construction sector. The good news is that as the economy recovers there should be huge pent-up demand. Appliances, cars, computers, and other durable goods either wear out or require upgrading. So there will be strong demand for these durable goods. However, economists differentiate between demand and effective demand. The difference is money – that is, will consumers have the money and will banks lend them the money to purchase these worn-out products?

On the supply side the glut of capacity created over the period 2004-2008 won't be eliminated quickly. Thus, as this table suggests, whereas some markets are likely to rebound back to and beyond the 100 index level by 2014, others will take longer to regain that level.

I made assumptions underlying each of my market projections for 2010-2014. They are as follows:

Appliance

In theory the rebound in appliance manufacturing should correlate positively with new housing starts, however the recent trend of new housing starts has been woeful. A Whirlpool official was quoted recently saying that future appliance sales will be driven largely by households replacing old and worn-out machines, not installing new machines in new houses. I would add that Mexican, not American, thermoformers will derive the benefit from the eventual rebound in large appliance production.

Automotive

By 2014 annual car and light truck production will hopefully return to 16-17 million units, the level common in the first half of the decade.

Building

New housing starts last year were 554,000, the lowest total recorded since records began in 1959. New housing starts exceeded 2 million units in 2004 at the height of the housing bubble. It is totally implausible that we will regain the 2 million level of new housing starts by 2014 – nor, from an economist's perspective, should we.

Overspending on housing constitutes a gross misallocation of national resources that should go instead to raising productivity and national income.

Furniture
The commercial real estate market will continue to slump in 2010 and 2011, and then rebound out to 2014. Office furniture will follow that trend-line.

Heavy Trucks
Heavy truck production won't recover to the 2004 level until after 2014.

Marine
Boat sales were down 20% in the first quarter of 2010. That level will hold for the remainder of the year, and then boat production and sales should rebound out to 2014.

Medical
The medical product industry is truly recession-resistant. It grows every year, and it will continue to grow to 2014.

Signs
The production of signs and displays wasn't impacted that much in 2008-2009, and it should continue to grow to 2014.

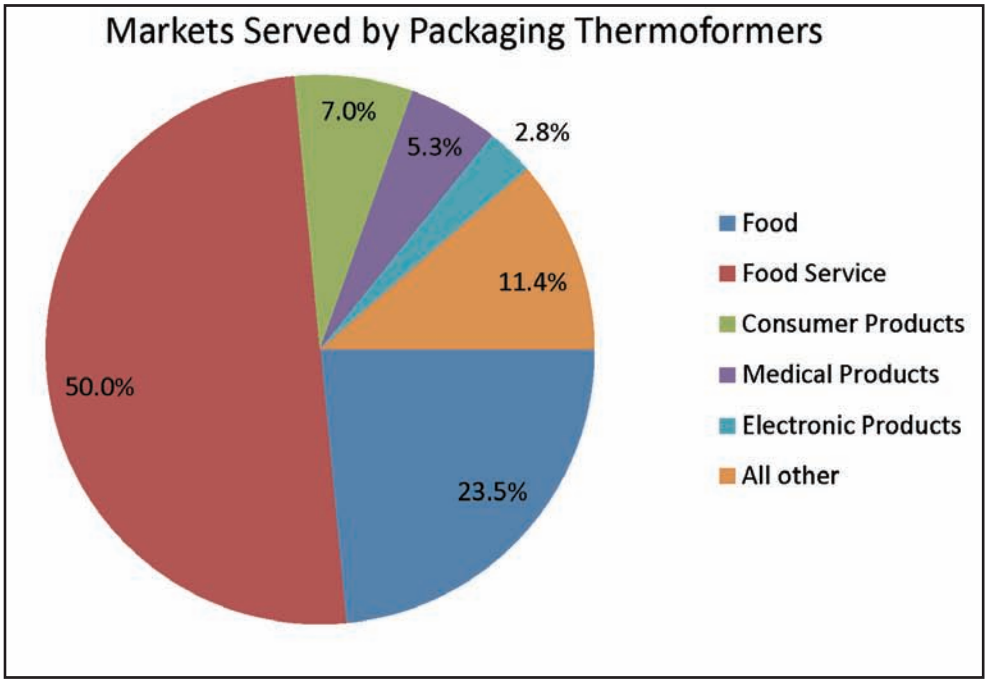
Other
The "all other" category is based on the trend of real U.S. GDP. I assume 3% GDP growth here in 2010 and then 2.5% GDP growth out to 2014. This is much slower future growth than the government's February Budget Statement.

I'll summarize, therefore, my sense of the past and likely future growth dynamic in regional industrial thermoforming.

Over the period 2004 to 2009 the average annual growth of sales by industrial thermoformers was only 0.5%, mainly due to the difficult economic conditions experienced the past two years. If I assume an average annual price increase of 2.5%, then the average annual change in the volume of output of industrial thermoformed products over the past 5 years was -2.0%. In view of the pent-up demand for durable goods as we emerge from the recession, it is entirely possible that average annual volume growth in industrial thermoformed output could be 5% or more out to 2014. And 5% could be too conservative. For example, if my projections for the various durable goods markets

Recent and Likely Future Growth in the Value and Volume of Industrial Thermoforming, 2004-2014 (% change)

Period	Volume of Production	Inflation	Value of Production
2004-2009	-2.0	2.5	0.5
2010-2014	5.0	2.0	7.0



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in the foregoing table are reasonably accurate, the average annual growth rate for these 10 key markets from 2009 to 2014 will be 6.8%. If inflation remains subdued at 2%, then the average annual increase in the value of industrial thermoformed products could be in the range of 9-10%.

Packaging Thermoforming

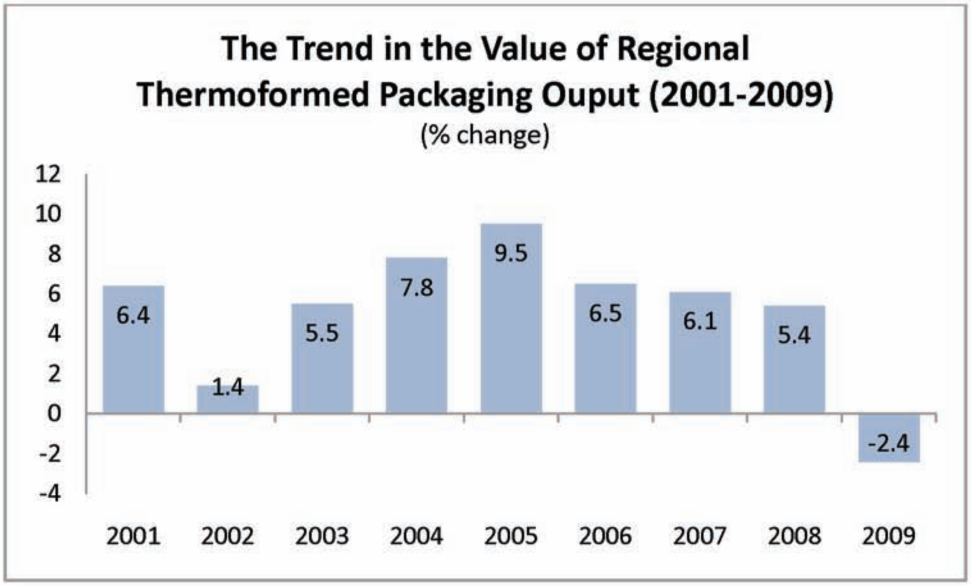
I'll turn now to address the packaging thermoforming business.

The distribution of markets in packaging thermoforming is very different from that of industrial thermoforming. Food service and food processing constitute roughly three-quarters of the total business. Conventional wisdom suggests these markets are relatively recession-resistant, as is the medical product packaging business.

Nevertheless, as a result of the recession, the value of thermoformed packaging output in 2009 experienced a rare decline of 2.4%.

The setback to average household incomes was such that austerity ruled the day. Families changed their shopping patterns, heading to Wal-Mart, Family Dollar, Goodwill, and other discount outlets for lower-priced items. Producers were forced to lower costs, and this impacted packaging decision-making as well.

What lies ahead for the packaging thermoforming business? I've made 3 key assumptions. First, I assume the average annual growth in the volume of production in food-related markets will be 2% – that is, twice the rate of the growth of the U.S. population. Second, I assume average annual growth in the volume of non-food-related markets will be 6.8%, the rate I referred to a minute ago. Third, I assume the market weights of 75% and 25% for food- and non-food-related markets will continue to apply.



Bringing these assumptions together, I arrive at a 3.2% average annual growth rate in the volume of thermoformed packaging out to 2014. I assume an average annual inflation rate of 2.0%, slightly higher than the 1.8% rate that prevailed over the past 5 years. So the average annual increase in the value of production of thermoformed packaging out to 2014 works out at 5.2%.

What are some of the trends evident in packaging thermoforming?

Trends in Packaging Thermoforming

- inline thermoforming
- inmold labeling and printing
- light-weighting
- sustainability
- the new austerity

Recent and Likely Future Growth in the Value and Volume of Packaging Thermoforming, 2004-2014 (% change)

Period	Volume of Production	Inflation	Value of Production
2004-2009	3.0	1.8	4.8
2010-2014	3.2	2.0	5.2

Inline Forming

In all the plastics processing businesses I cover, I see a trend to faster speed and greater control over the process. In packaging thermoforming this means converting from two-step processing – taking extruded sheet to the former – to one-step processing by means of inline sheet extrusion and forming. This may be difficult for custom packaging thermoformers to justify. It makes eminently good sense for high-volume proprietary and captive thermoformers.

Inmold Labeling and Printing

In the same way injection molders have reduced secondary operations by introducing inmold labeling to their operations, thermoformers are taking that route to improved cost-effectiveness. This is also true of distortion printing. This is not an easy capability to take on; getting the registration right is tricky. However, some packaging thermoformers have mastered this technology, and I believe others will follow in their wake.

Light-Weighting of Thermoformed Packaging

Clearly there is a continual drive to lightweight formed cups, lids and other formed packaging to compete against injection molders. However, inevitably we will reach the end of this technological change. We may already be there. Plastic packages are getting thinner and thinner, which compromises the functionality of the package. Ultimately we'll reach the stage where the packaging is so thin you can't see it or feel it. I don't think we want to go there.

Sustainability

I have to confess I've always been a sustainability skeptic. I was making a presentation about "Innovations in Plastics" at a conference in Dublin, Ireland, in 2008. At the end of the presentation a guy asked me what I thought about carbon footprint. I told him I think about it as little as I possibly can. However, the reality that we all face, whether we agree with the concept or not, is that sustainability sells. So you simply have to keep up to speed on biopolymers, biodegradable plastics, PCR and all the other plastic materials that will ultimately appeal to the end-use consumer.

The New Austerity

In the wake of the Great Recession, some economists are referring to "the new austerity." The recession will eventually end. However, it is likely to leave huge scars on the psyche of consumers. Confronted with high unemployment, stagnant real income, limitations on bank lending, higher taxes, higher healthcare costs, the uncertainty created by Congress and the administration – confronted with all this consumers will be far more cautious in their spending patterns. Many products packaged in blister packs, clamshells and trays may encounter slower growth in demand from households determined to live within their means.

Conclusion and Recommendation

Economists, despite all their faults and failings, are clear as to how we can restore the virtuous economic cycle where growth leads to hiring, which leads to higher disposable income, which leads to increased effective demand, which in turn drives growth. We have to become more productive. We put too much emphasis on restoring consumer demand. We need to boost the supply side as well. We simply have to become more productive. GDP growth derives from two macro variables - 1) labor force growth and 2) productivity improvements. That's it – that's what GDP growth is all about. Without productivity improvements we will only grow in line with the population. Unemployment will stay elevated, and per capita income will continue to stagnate.

Thermoformers have many options for raising their productivity – namely,

- If you haven't done so already you need to apply <u>lean manufacturing</u> throughout your whole organization.
- Maximize <u>energy efficiency</u> in every aspect of your plants
- <u>Automate</u> to minimize your total labor force burden. I presume you've all done that to some degree already.
- <u>Differentiate</u> your company and your services for a marketing advantage. You wouldn't be around if you haven't followed that principle over the recent past.
- <u>Diversify</u> your processing capabilities. If someone comes to you with a part design that really should be injection molded or blow molded or extruded, you should have the in-house capability or the partner to take on that job.
- Be an <u>integrator</u>. You won't survive simply being a shoot-and-ship thermoformer – even if you're a very good one. Be a total solutions provider to your customer with value-adding upstream and downstream capabilities.
- <u>Innovate</u> – In a recovering economy your customers are looking to differentiate their products and services, to rise above the rest. They are wide open to any new innovative component or assembly that can draw attention to their brand. You have to assist them in that process.
- Be <u>forward-thinking</u> – You're obviously concerned with surviving day-to-day. You've been forced to lay off some of your staff, many of them with valuable skill

(continued on next page)

sets. Now you're at the irreducible minimum. So it's more important that ever to look ahead to what some call the "reset economy" of the future.

It is axiomatic that industries rise or fall based on their ability to attract, retain and productively use talent across all aptitudes and skill levels – from brilliant design engineers to plant floor operatives.

As the beneficiary of a great education and as a former teacher of economics, I have a passion for education. I suggest the most important challenge we confront as an industry is our inability to invest in our educational system to get young people interested in a career in plastics.

For years the SPE Thermoforming Division has been way ahead of the curve, awarding scholarships to young men and women to pursue an education in plastics. Now you need to redouble that effort. Moreover, you need to convince every other SPE division to do likewise and to coordinate those efforts. If we could pool the funds and human capital resources from the various divisions, we could truly make a difference attracting young people into our profession. We simply don't have the option of sitting on the sidelines.

2010 Thermoforming Conference Milwaukee, Wisconsin

Ed Probst, Profile Plastics, inspecting part in competition.

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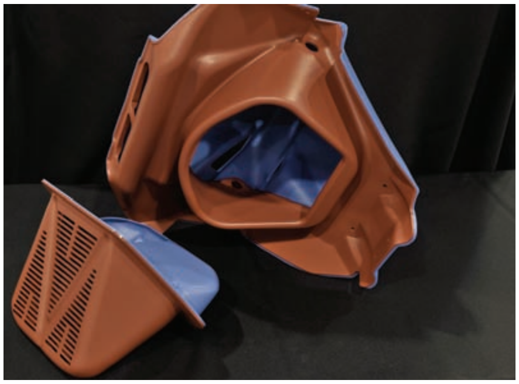
Heavy-Gauge – Pressure
1st Place: Specialty Manufacturing Inc.
Enclosure Assembly

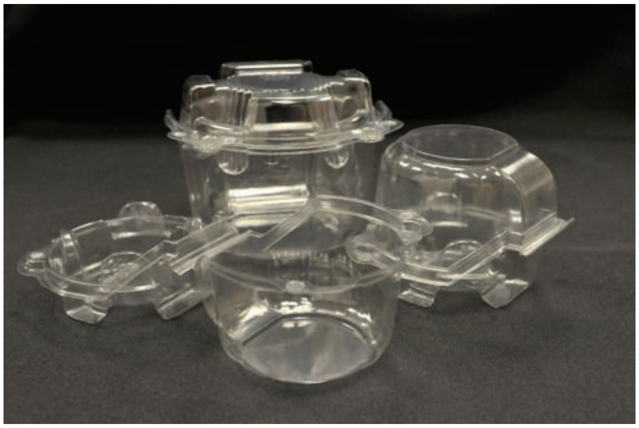
Heavy-Gauge – Vacuum
1st Place: Brentwood Industries
Chrome Bumper Cladding

Heavy-Gauge – Pressure
2nd Place: Profile Plastics
Progeny Machine Cover

Heavy-Gauge – Vacuum
2nd Place: Plastilab Technologies
The Vorttice: Competition Cycling Helmet



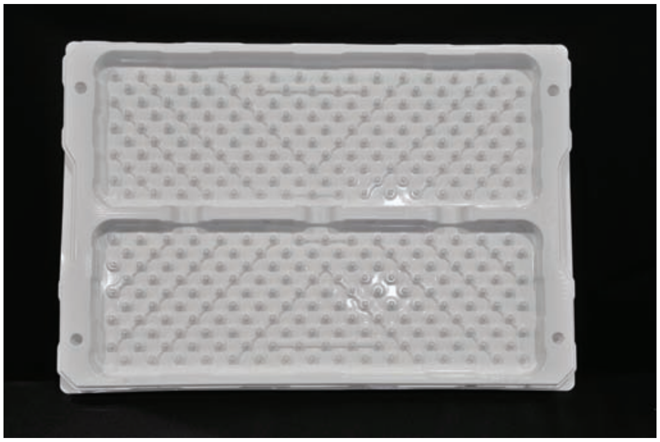
Heavy-Gauge – Twin-Sheet
Winner: Allied Plastics
Front Bumper with Air Silencer Intake



Roll-Fed – Food
1st Place: Lindar Corporation
Single Cupcake and Muffin Package

Roll-Fed – Food
2nd Place: EverEdge IP
CrushPak – A Crushable Yogurt Container

Roll-Fed – Medical
1st Place: Perfecseal
Surgical Device Package



Roll-Fed – Industrial
1st Place: Vitalo Industries
Automated Medical Tray

Roll-Fed – Medical
2nd Place: Tegrant Corporation
Thermo Scientific Pipette Sleeve and Lid for RD Packaging

Roll-Fed – Industrial
2nd Place: Tegrant Corporation
Motorola FUJI OEM Bluetooth Headset Package

People's Choice Winner: Grimm Brothers
Plastics BreezeDry Cabinet

Adventures in PLA

Clare Goldsberry, PlasticsToday.com (Canon Communications), October 19th, 2010. Reprinted with permission.

It seems that last month's SPE Thermoforming conference drew more than one person skeptical of the many claims surrounding the "green" revolution. Common sense, scientific data, and more reliable information could help processors sort fact from fiction.

When Fabri-Kal Co., one of the largest thermoforming businesses in North America specializing in food service and custom food packaging for the likes of General Mills and Kellogg, began looking at sustainable materials it seemed to be a good fit. David McIntosh, senior engineer Materials & Development, noted that Fabri-Kal supports the technology to reduce U.S. dependence on imported oil and "it was a good fit with Fabri-Kal's ownership and management philosophy."

In 2002, as Fabri-Kal began working with the plant starch-based plastic PLA (polylactic acid), Dow was a material supplier to Fabri-Kal, and PLA's properties were well-suited to the cold-drink cups that Fabri-Kal produced. "PLA had similar shrink to PET and we were already making a line of PET cups, and we had the tooling for PET," explained McIntosh. "It looked like a drop-in technology. However, that's not the way it worked."

Some of the early lessons Fabri-Kal realized was the importance of temperature control and the difficulties of PET-to-PLA conversion for products. Other lessons included:

- The older equipment Fabri-Kal had made it difficult to clean out the material to run PLA
- PET doesn't melt at the same temperature as PLA
- Equipment had poorer control at lower operating temperatures.

"There are so many ways in which PLA is different from PET, you have to be really careful," cautioned McIntosh. "There can be cross-contamination problems if there's a lack of communication between shifts, so plant-wide education is needed to train people in how to handle PLA in a PET plant. PLA requires more control and precision."

Today, Fabri-Kal processes PLA on a large scale, using high levels of regrind. McIntosh goes so far as to say that he believes the company has the "highest through-put PLA conversion line in the world."

"Green washing" a plague

That is all good. What McIntosh doesn't like is the amount of "green washing" going on as competitors and others strive to clam their products are sustainable. "At Fabri-Kal, we try to take the high road with respect to 'green' claims," he said. "There's a growing recognition of need for clear, meaningful and validated claims. The truth is gaining, partly driven by the FTC (U.S. Federal Trade Commission) and skeptical consumers, but there's no one single definition of sustainability."

Fabri-Kal focuses on the use of Life Cycle Inventory, published hard data that's available to all of its customers. "It's a tool that allows you to make objective comparisons between options," said McIntosh. "Data can be used (or abused) in different ways and there's no single metric for sustainability."

Greenware is Fabri-Kal's brand name for its line of drink cups and lids, crystal clear and made from Natureworks' Ingeo brand of PLA. Fabri-Kal's marketing approach for its products is based on hard data with "minimal spin," noted McIntosh. Greenware is marketed for its premium quality and appearance, its homegrown roots ("Made in the USA") from corn grown in Nebraska, and that it is made of a renewable resource that helps reduce the use of fossil fuel.

There are also disposal options for the cups and lids. "We push our 'green virtues' very hard," McIntosh added, and noted that, "Marketing is a dangerous mix of fact and fiction. Carrying a paper cup versus a foam cup makes you feel better, but it's fiction that paper is better. We believe in selling the sizzle without trashing the truth."

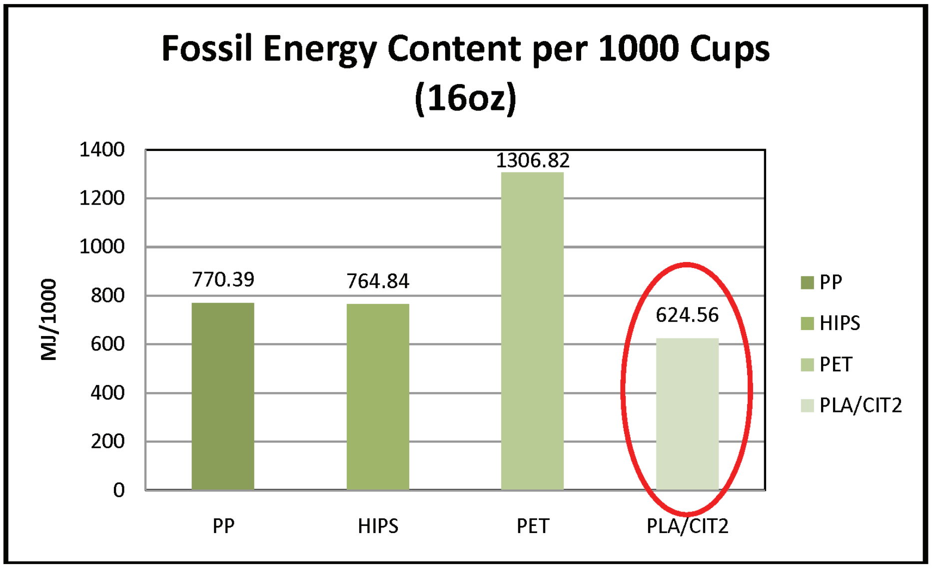
McIntosh said that before requiring a product to be made from biopolymers, companies need to assess the options and define the needs and performance requirements. "Compare the options," he said. "Some customers just want 'fluff' so they can say they're green, and others want to see true sustainability."

Next, focus on direct, quantifiable benefits, costs and performance. Third, look at the end-of-life claims. "There are too many assumptions to make broad claims, and not all provide the solutions," said McIntosh. "Do a case-by-case assessment. There's no one material suited for all applications, so we must look at applications that use other materials."

McIntosh believes that recycling is a viable answer; however, per capita the amount of waste is going down, even with population growth, and plastics recycling is "woefully low," he noted. He also noted that the fossil energy content (the amount of fossil fuel required to make 1,000 cups) in PP and HIPS is almost comparable to PLA. *[See graph below.]*

So how does the industry dispel the myths and misconceptions that drive poor decision making and regulations? First, recognize the fact that there is no significant biodegradation or decomposition in landfills, and "it is not beneficial in any way," he stated. "Biodegradable is not an effective way to address the plastics issues. Biodegradability is stupid. There, I've said it! Biodegradability is not the Holy Grail of sustainable packaging."

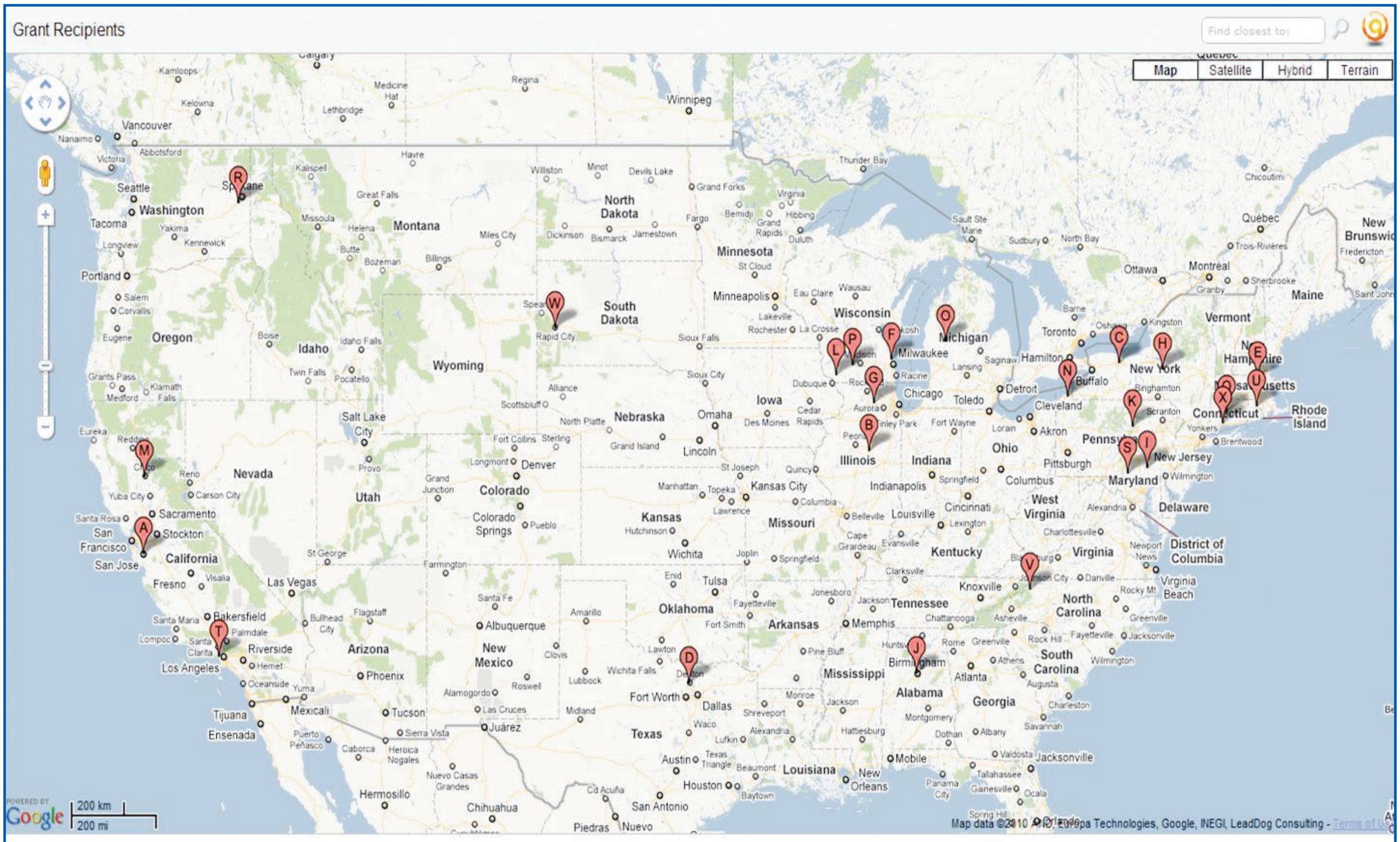
Biodegradability is a "biological process" and "not compatible with an industrial process," said McIntosh. "Manmade plastics don't perform like plants in nature. Plastics won't degrade like leaves in a forest, which is a biological process. Plastics are created through an industrial process, which means there needs to be an industrial process to deal with the disposal." |



THERMOFORMING DIVISION MATCHING GRANT PROGRAM

Dr. Peter Mooney and many industry leaders have stated that "the most important challenge we confront as an industry is our inability to invest in our educational system to get young people interested in a career in plastics." The Thermoforming Division is playing a key role in rising to this challenge. By equipping today's students with machinery and technology required for success in plastics processing, the Division is helping to bridge the gap between theory and practice.

The Thermoforming Division matching grant program provides funds to purchase thermoforming equipment for accredited schools. The Division has paid $229,617 in grants to date. If you are an educator, student or professional who would like to advance the thermoforming curriculum at your local school, please visit our website for more details: http://www.thermoformingdivision.com/aarcgrantprograms/index.htm.



Location of all schools who have received matching equipment grant funds from the SPE Thermoforming Division.

	School	City	State
A	San Jose State University	San Jose	CA
B	Illinois State University	Normal	IL
C	Rochester Institute of Technology	Rochester	NY
D	University of North Texas	Denton	TX
E	U Mass Lowell	Lowell	MA
F	Brown Deer Middle School	Milwaukee	WI
G	Northern Illinois University	Dekalb	IL
H	Morrisville State College	Morrisville	NY
I	Millersville University	Millersville	PA
J	Univ. of Alabama at Birmingham	Birmingham	AL
K	Penn. College of Technology	Williamsport	PA
L	University of Wisconsin - Platteville	Platteville	WI

	School	City	State
M	California State University - Chico	Chico	CA
N	Penn State Erie	Erie	PA
O	Ferris State University	Big Rapids	MI
P	Mount Horeb Middle School	Mount Horeb	WI
Q	Central Connecticut State University	New Britain	CT
R	Eastern Washington University	Cheney	WA
S	Gettysburg Area School District	Gettysburg	PA
T	UCLA	Los Angeles	CA
U	Rhode Island School of Design	Providence	RI
V	Appalachian State University	Boone	NC
W	South Dakota School of Mines & Tech.	Rapid City	SD
X	Yale School of Architecture	New Haven	CT

Thermoformer of the Year 2011

The Awards Committee is now accepting nominations for the **2011 THERMOFORMER OF THE YEAR**. Please help us by identifying worthy candidates. This prestigious honor will be awarded to a member of our industry who has made a significant contribution to the thermoforming industry in a technical, educational, or managerial aspect of thermoforming. Nominees will be evaluated and voted on by the Thermoforming Board of Directors at the Winter 2011 meeting. The deadline for submitting nominations is **January 15th, 2011**. Please complete the form below and include all biographical information.

Person Nominated: ____________________________________ Title: ___________________

Firm or Institution____

Street Address: ____________________________ City, State, Zip: ______________________

Telephone: _______________ Fax: _________________ E-mail: ________________________

Biographical Information:

- Nominee's Experience in the Thermoforming Industry.
- Nominee's Education (include degrees, year granted, name and location of university)
- Prior corporate or academic affiliations (include company and/or institutions, title, and approximate dates of affiliations)
- Professional society affiliations
- Professional honors and awards.
- Publications and patents (please attach list).
- Evaluation of the effect of this individual's achievement on technology and progress of the plastics industry. (To support nomination, attach substantial documentation of these achievements.)
- Other significant accomplishments in the field of plastics.

Individual Submitting Nomination: _______________________ Title: _____________________

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Street Address: ____________________________ City, State, Zip: ______________________

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Signature: ____ Date: ____________________

(ALL NOMINATIONS MUST BE SIGNED)

Please submit all nominations to: Juliet Goff,
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Vernon, CA 90058-2022
Phone 323.581.6194, ext. 223 or email at: Juliet@kal-plastics.com

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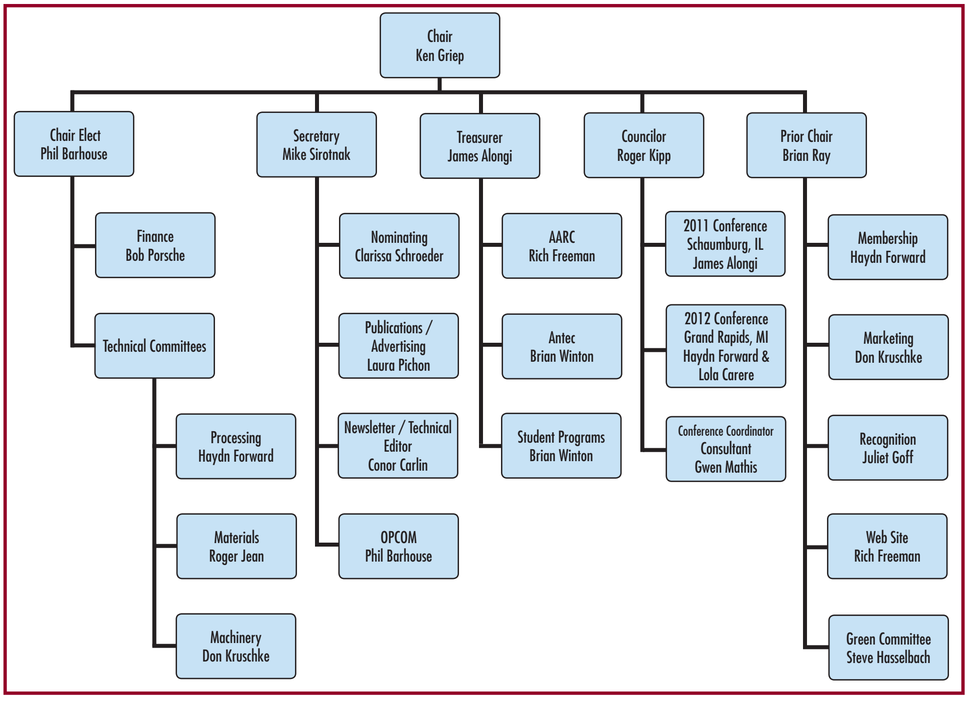
2010 - 2012 THERMOFORMING DIVISION ORGANIZATIONAL CHART



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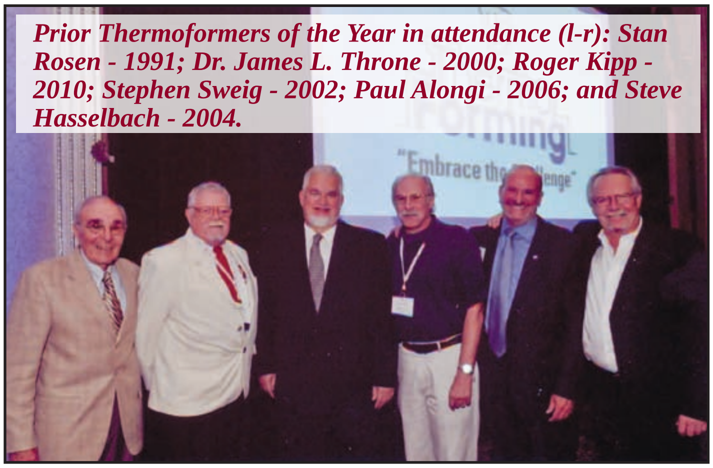
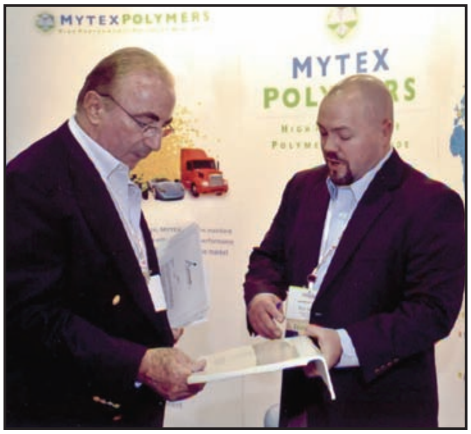
Milwaukee, Wisconsin



Prior Thermoformers of the Year in attendance (l-r): Stan Rosen - 1991; Dr. James L. Throne - 2000; Roger Kipp - 2010; Stephen Sweig - 2002; Paul Alongi - 2006; and Steve Hasselbach - 2004.

Plastics Pioneers: Frank Nissel, CEO, Welex, and Ian Strachan, Global Thermoforming Technologies.



Mytex Polymers - Exhibitor

Zed Industries - Exhibitor

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*Check out the March 2011 issue of **Plastics Engineering** to review the ANTEC® 2011 Advance Conference Program, and the full schedule of events and presentations!*

PLENARY SPEAKERS

Polymers and Plastics for the Electronics Industry
Monday, May 2
Dr. Young Kim
Samsung Advanced Institute of Technology, Samsung Elec. Co. , Ltd.

Innovations in Engineering - SABIC Approach to New Materials and New Applications
Tuesday, May 3
Tom Stanley
Vice President, Technology, SABIC Innovative Plastics

Industry Dynamics Impacting the Resin Supply Chain
Wednesday, May 4
Howard Rappaport
Global Business Director, Plastics, Chemical Market Associates, Inc.

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From the Editor

If you are an educator, student or advisor in a college or university with a plastics program, we want to hear from you! The SPE Thermoforming Division has a long and rich tradition of working with academic partners. From scholarships and grants to workforce development programs, the division seeks to promote a stronger bond between industry and academia. **Thermoforming Quarterly** is proud to publish news and stories related to the science and business of thermoforming:

- New materials development
- New applications
- Innovative technologies
- Industry partnerships
- New or expanding laboratory facilities
- Endowments

We are also interested in hearing from our members and colleagues around the world. If your school or institution has an international partner, please invite them to submit relevant content. We publish press releases, student essays, photos and technical papers. If you would like to arrange an interview, please contact Ken Griep, Academic Programs, at: ken@pcmwi.com or 608.742.7137

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