



Understanding EPR & Mitigating Risk

Case study in sustainability
& packaging design in
partnership with the AHFA

Tuesday, June 02, 2026



What We Do

EFP specializes in custom shape molding, fabricated foam products, and cold chain solutions. **We offer complete design and testing services with an ISTA certified lab in Nashville, TN.**



Custom Shape Molding

With 7 locations, EFP is a high-volume EPS/EPP custom shape molder and manufacturer of bio-based packaging, NatureKool®.

Complete Design, Sampling and Testing Services

Projects will be expertly managed from design to fulfillment, including the capability to produce precise samples with full CNC capabilities.

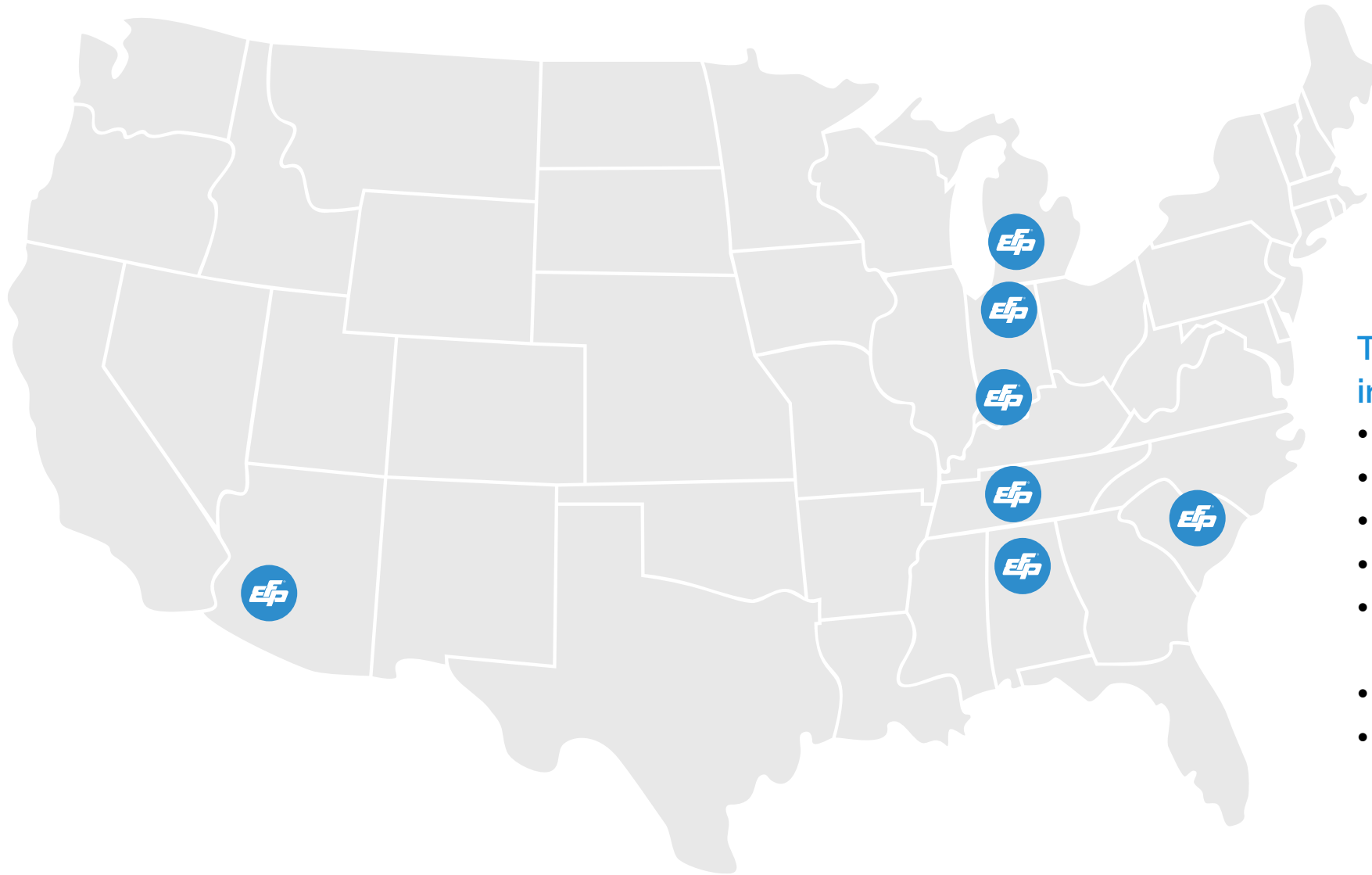
Broad Fabrication Solutions

We utilize a slicer, down cutter, die cutter, CAD cutter, and skiver.

Vertically Integrated

From concept, design, prototyping, testing, tool design, tool manufacturing, mold, and kitting we offer a one-stop-shop.





**Today: 7 state-of-the-art plants
in 6 states**

- Elkhart, IN
- Evansville, IN
- Decatur, AL
- Bishopville, SC (new 2024)
- La Vergne/Nashville, TN (new 2025)
- Casa Grande, AZ (new 2025)
- Howell, MI (new 2026)

1.4M sq. ft. of manufacturing, design, and warehousing across the U.S.



Our Story

EFP began molding expanded polystyrene (EPS) over 70 years ago, building a reputation for innovative protective packaging manufacturing.

In recent history, we have expanded into EPP and added our NatureKool® product line.



Thermal Design & Innovation Lab

The TDI Lab™ is an ISO17025 Accredited, ISTA Certified Laboratory offering simulated transit testing, LCA, Thermal Solutions, Infrared Analysis, and 3D scanning.



Sustainability

On the forefront of recycled EPS packaging, recapture, circular alliances, and infrastructure. Innovator in bio-based cold chain and protective packaging.



Advisor

A team that understands that the future of packaging is circular. An industry that learns from each other is one that flourishes.

Agenda

Extended Producer Responsibility
(EPR) Introduction

How the EPS Industry is
Responding

EPR Fees and Ways to Reduce the
Impact

Total Packaging System Cost and
the Influence of Damage Rates

Packaging Study and Findings

“Good Packaging
protects your
product;
great packaging
protects your
brand.”

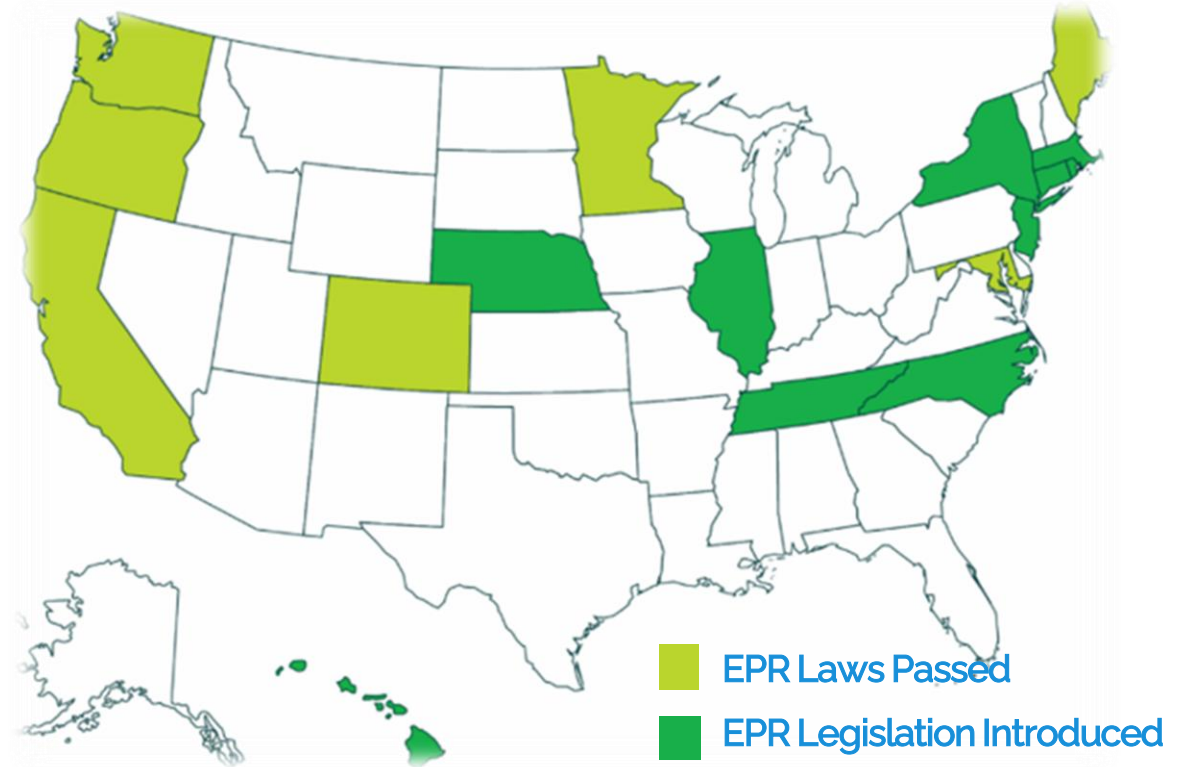
Extended Producer Responsibility Laws (EPR) for Packaging Materials

Key Goals:

- Reduce pollution from packaging especially plastic
- Make packaging more circular

Key Provisions/Mandates:

- Promote sustainable product design thru end of life
- Increase recycling: Recycling rates by specific dates
- Reduce single-use plastics
- Shift financial responsibility for end-of-life disposal of packaging materials from municipalities to producers:
 - Fees charged to producers (i.e. brand owner) based on weight of each packaging material imported into a state.



Packaging EPR

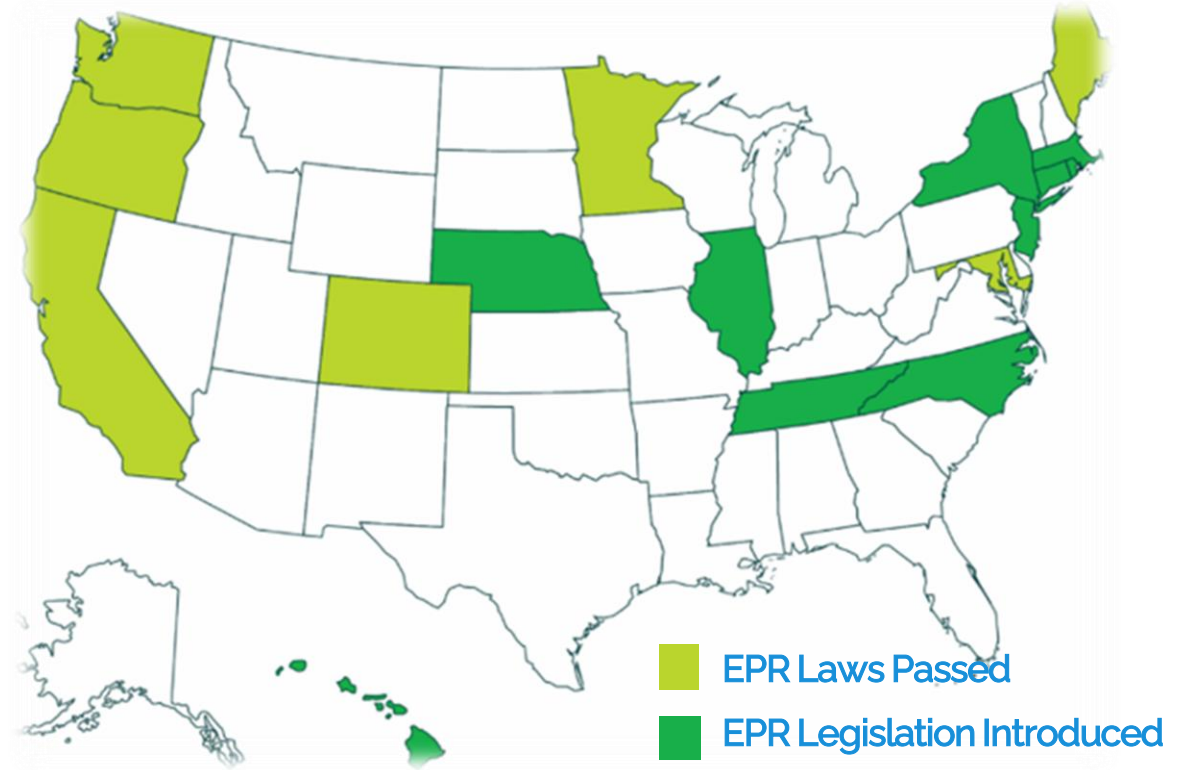
Spreading Quickly

7 States Passed Packaging EPR Laws

- Oregon
- California
- Colorado
- Maine
- Washington
- Maryland
- Minnesota

10 States Introduced Packaging EPR Legislation in 2026

- Connecticut
- Hawaii
- Illinois
- Massachusetts
- Nebraska
- New Jersey
- New York
- North Carolina
- Rhode Island
- Tennessee



**No bans on EPS
transport packaging!**

EPR Law Complexity

Vary by State

Effective Dates and Timelines:

- Producer Responsibility Organization (PRO) Selection
- Program Regulations
- Producer Registration
- Producer Baseline Reporting
- Invoices from PRO to Producers

Covered Materials Category (CMC) List:

- 60 to >100 categories – packaging materials/ applications

Excluded Applications: Medications, hazardous materials

B2B & Industrial Packaging Sometimes Excluded

Small Business Exclusions

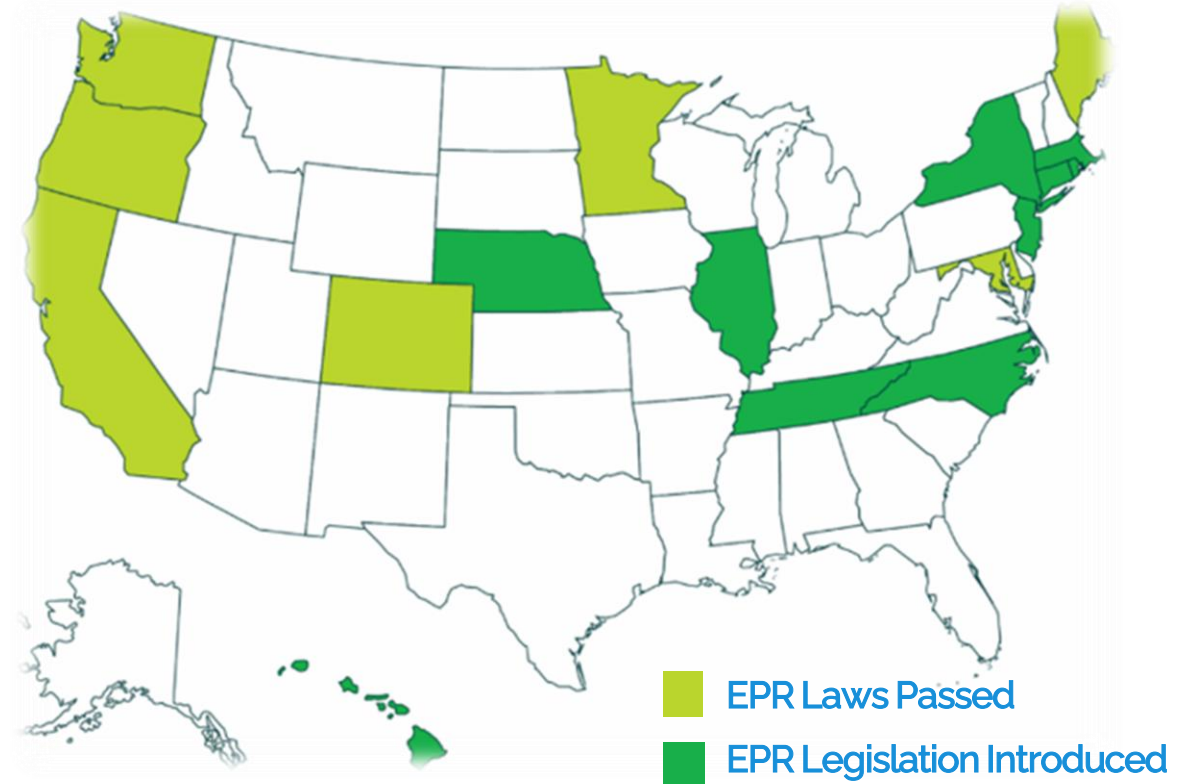
Recycling Rates and Dates:

- California Mandatory: 30% by Jan 2028, 65% by Jan 2032

Post Consumer Recycled (PCR) and Source Reduction Mandates

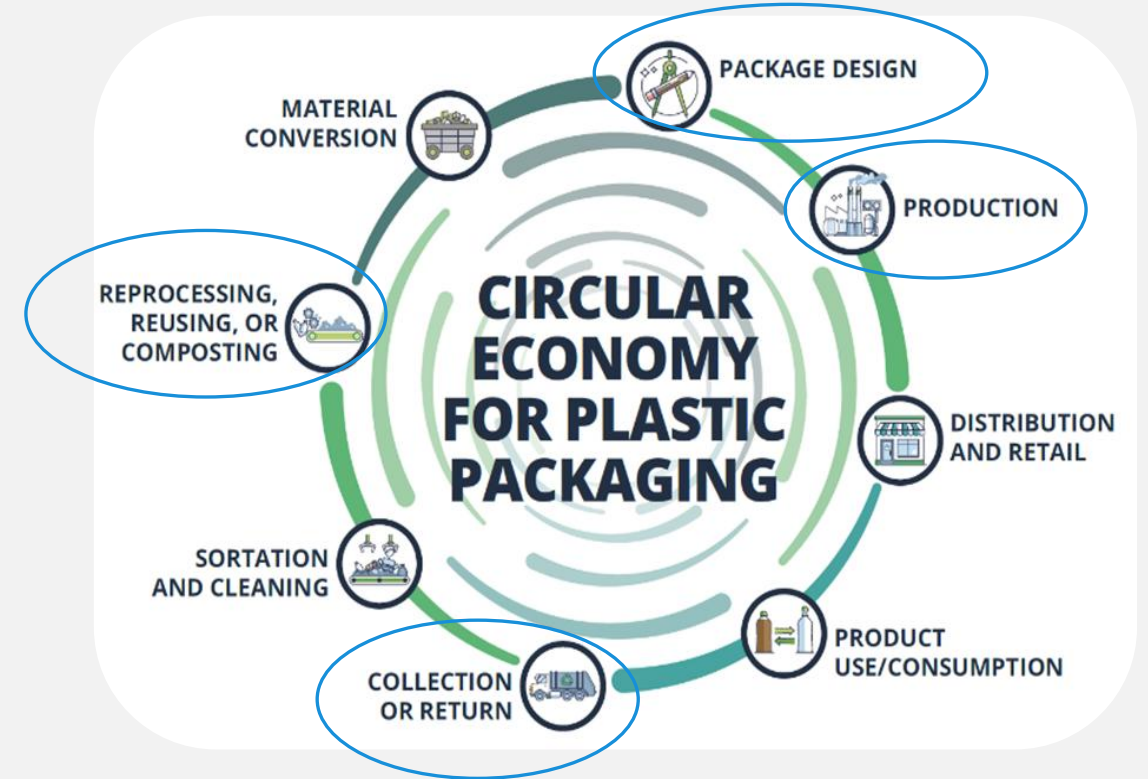
Eco-Modulation:

- Graduated fee structure (eco-modulation) based environmental impacts



EPS Industry's Sustainability Strategy: Making EPS Packaging Circular

- ✓ EPS with 30% to 50% recycled content
- ✓ Expanding collection, recycling, and reuse
- ✓ Educating and collaborating with customers, regulators, NGOs
- ✓ Monitoring & influencing EPR developments, Developing packaging strategies to reduce Total Packaging System Cost



Manufacturing with Circularity in Mind

EPS with up to 30% to 50% recycled content

- Huge opportunity for brand owners to move the sustainability needle

Ideal choice for protective packaging

- Processes like virgin bead in molding plants
- Same performance as virgin EPS parts
 - Compression, tensile strength, density
 - Drop test, shock test
 - Thermal performance



Expanding EPS: Collection, Densification, and Recycling

EPS is one of the easiest plastics to recycle

- Key challenge is collection and transportation

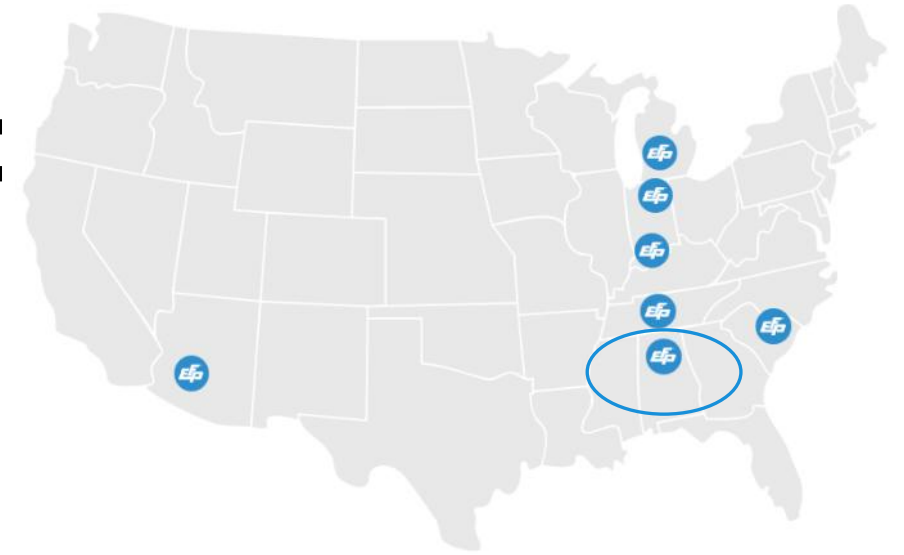
Industry, customers and associations taking action

- Big box stores and other retailers
 - Expanding collection and recycle after appliance delivery
- Industry organizations
 - Polystyrene Recycling Alliance
 - EPS Industry Alliance
- EPS producers like EFP
 - Densifiers, community off points

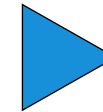
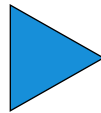


Expanding EPS Recycling:

EFP Collaboration with Customers

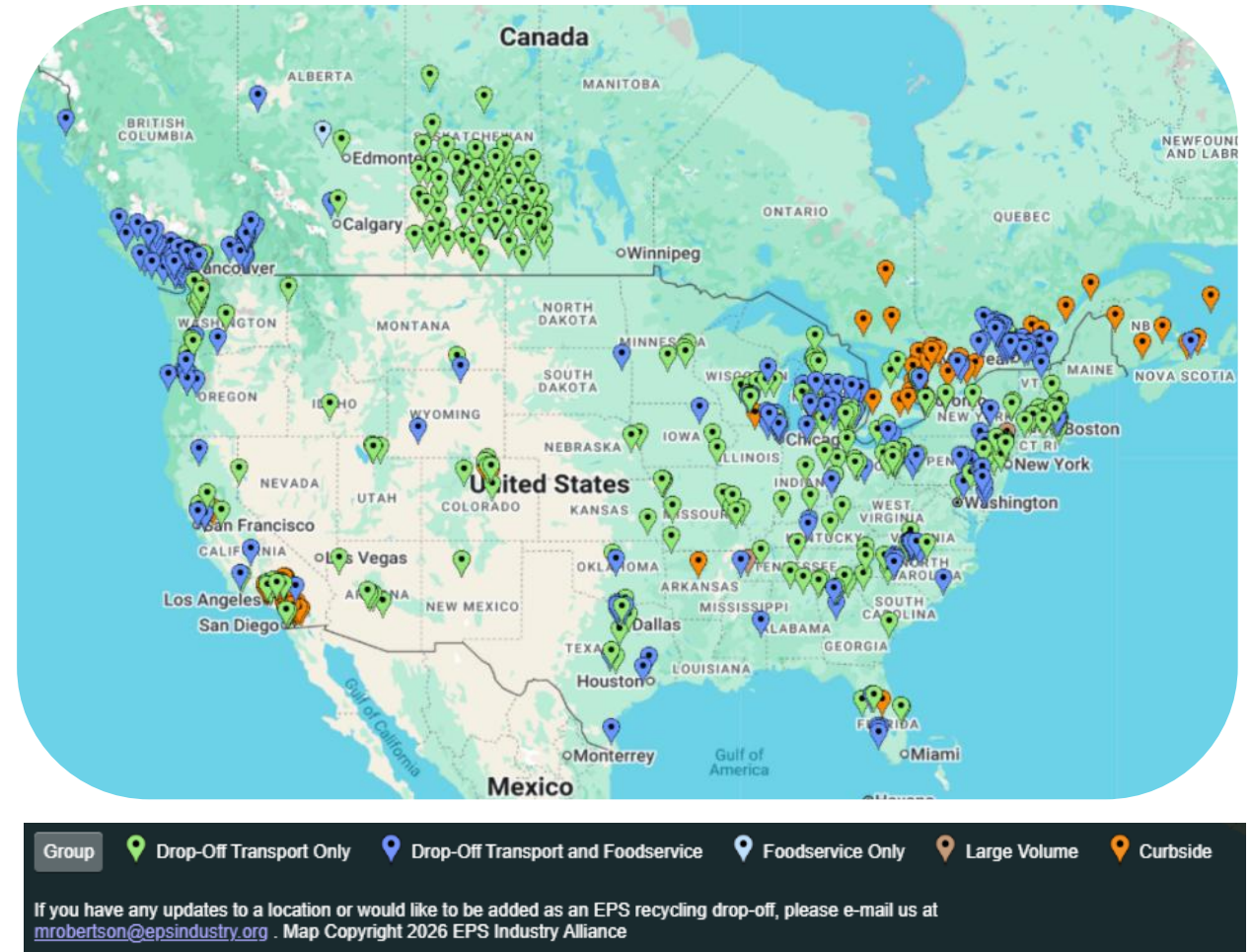
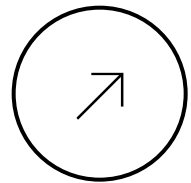


Major Appliance Manufacturer | Decatur, AL

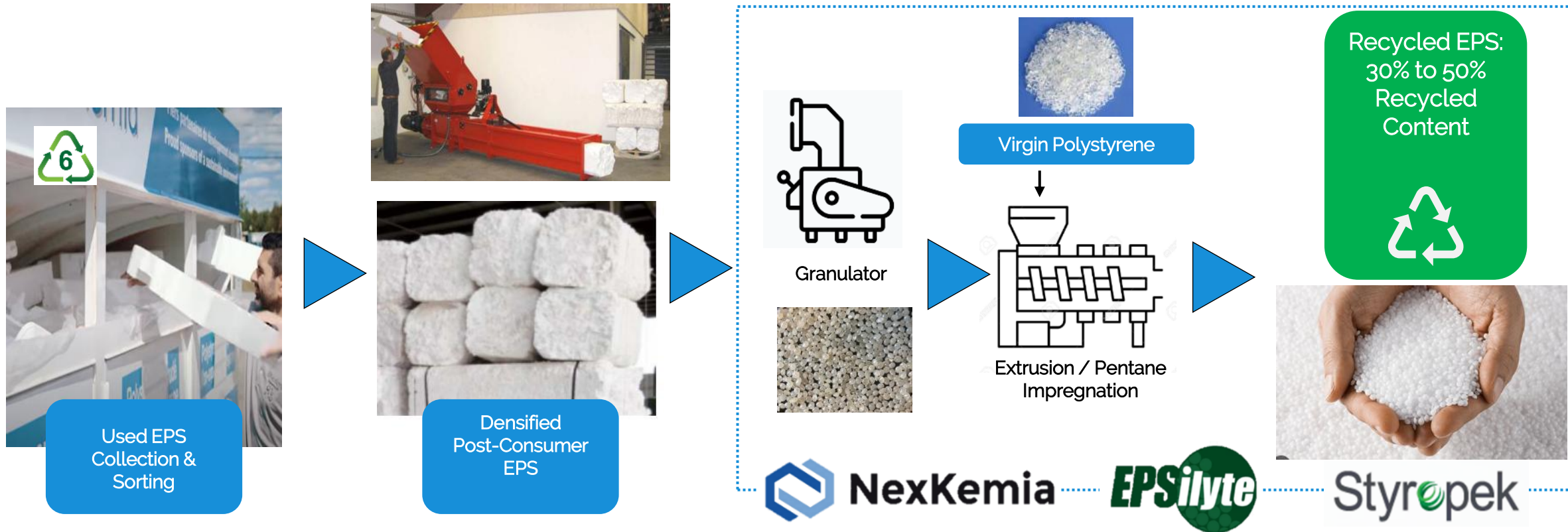


Landfill Avoidance: 1 to 2 Trailer Loads per Week !!

730 EPS Recyclers and Drop Off Locations in the US and Canada



Environmentally Friendly Mechanical Recycling



Paper and Corrugate: Significant Environmental Impact of Their Own

6th Largest US Industrial Polluter Paper

Recycling vs Virgin (EPA data):

- 65% of the water pollution
- 25% of the air pollution

Air Pollution:

- CO₂, acid rain chemicals, cadmium, lead, mercury

Water Pollution:

- Solids, nutrients, lead, dioxin, manganese

Water Use:

- 2.6 gallons used to manufacture one sheet of paper



EPS Recycling: A Proven and Expanding Solution

North America Recycling Survey
and
Report (EPS-IA, 2022)

- EPS transport packaging recycling rate of 31%

California Recycling Study
(EPS-IA, 2024)

- Transport packaging rate 26% to 32%
- Optimistic about meeting the California 30% recycling mandate for January 2028



Alliances, Associations, Regulators and NGOs: Engagement to Drive Change



Alliances, Associations, Regulators and NGOs: Engagement to Drive Change



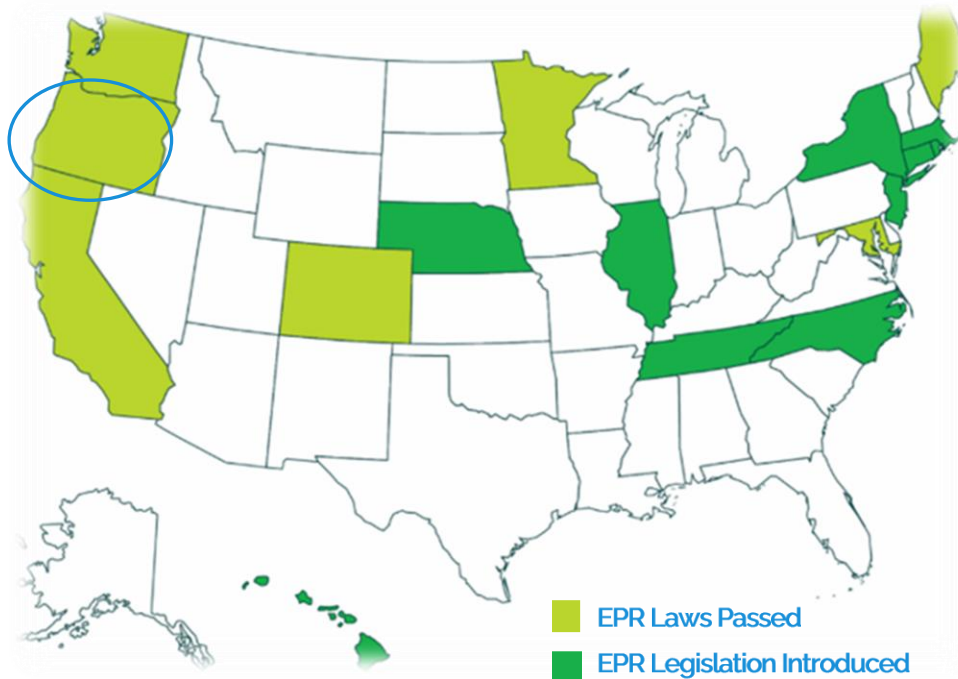
California SB54

Advisory Board Meeting

March 20, 2026

EPR Fees are Here:

Oregon First to Send Out EPR Invoices



Material Class	Covered Material Type	Fee Rate (\$\$/lb)
Paper/Fiber	Corrugated Cardboard	\$ 0.03
Paper/Fiber	Polycoated Paperboard	\$ 0.32
Paper/Fiber	Other Paper Laminates	\$ 0.31
Wood	Wood and Other Organic Materials	\$ 1.57
Plastic - Rigid	PS (#6) White Expanded/Foamed Cushioning and Void Fill	\$ 1.08

Item	Retail Sale Price	EPS Packaging (lbs)	Oregon EPR Fee (\$\$/lb)	Total Fee Per Item (\$)	Percentage of Sale Price (%)
Television, 65"	\$600	3.19	\$1.08	\$3.45	0.57%
Washing Machine	\$700	1.78	\$1.08	\$1.92	0.27%
3-Drawer Dresser	\$300	0.88	\$1.08	\$0.95	0.32%

Well worth the cost:

- Light weight
- Low cost
- Reduced product damage

Reducing EPR Fees: The Power of B2B Recycling and Recycled Material Content

Oregon:

Oregon's law directs eco-modulated fees to consider factors including life cycle analyses, product-to-package ratios, and material choices.

Others:

Colorado, Minnesota, California,
Maine



Reducing EPR Fees: The Power of Life Cycle Assessments (LCA)

Oregon Example:

Oregon's law directs eco-modulated fees to consider factors including life cycle analyses, product-to-package ratios, and material choices.

Ways an LCA Can Reduce EPR Fees

1. Demonstrating Lower Carbon Footprint

Many EPR programs reward packaging with lower greenhouse gas emissions.

- Requires less energy to manufacture
- Has lower transportation emissions
- Contains recycled content

2. Supporting Recyclability Claims

- End-of-life recovery benefits
- Closed-loop recycling potential
- Avoided virgin material production

3. Quantifying Source Reduction

Many EPR programs incentivize lightweighting.

- Transportation emissions that are reduced because of lower package weight

EFP Real-World Investigation: Washing Machine Protective Packaging



Washer 1

- Almost all corrugate
- Total weight = 7256 gm



Washer 2

- Corrugate top box
- Heavy duty EPS base
- Total weight = 5902 gm



Washer 3

- Almost all EPS
- Light corrugate top and bottom
- Plastic shrink wrap
- Total weight = 2231 gm



70% LESS Packaging Weight

EFP Real-World Investigation: Washing Machine Protective Packaging Life Cycle Analysis (LCA)

LCA Completed by Andrew Klasek, TDI Lab Director
EFP Thermal Design & Innovation Lab | La Vergne, TN

Global Warming Potential (kg of CO2 equivalent) Per Package

Washer 1

- Packaging weight = 7256 gm

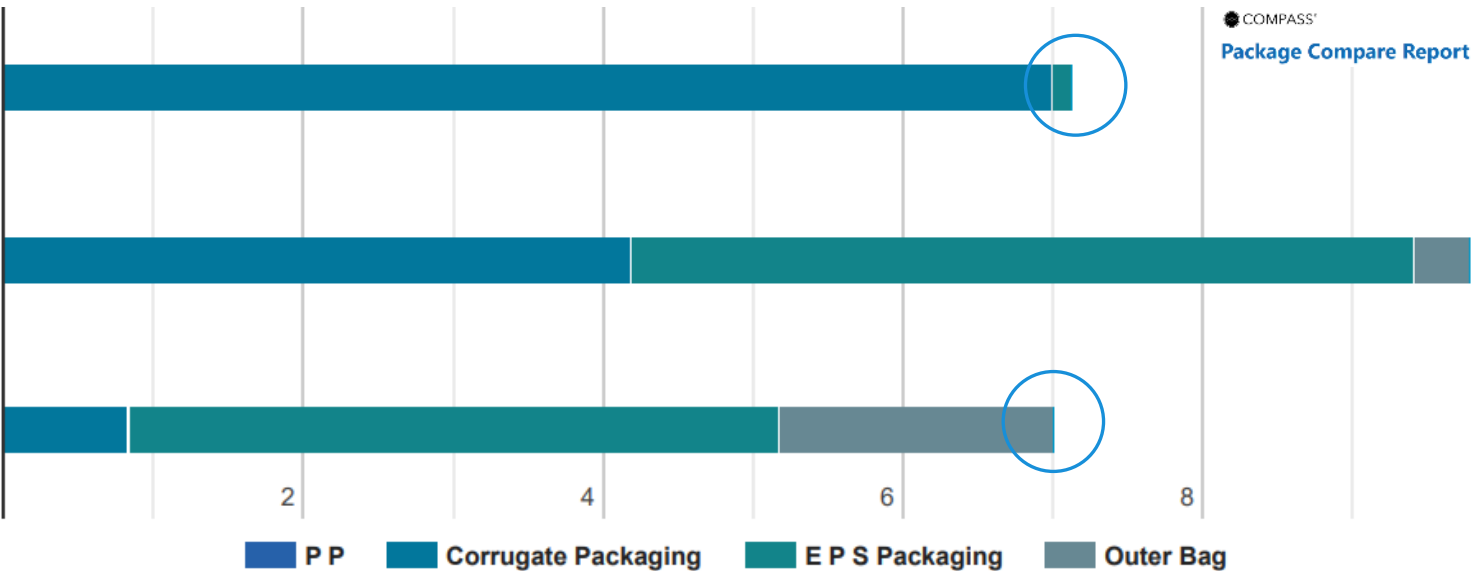
Washer 2

- Packaging weight = 5902 gm

Washer 3

- Packaging weight = 2231 gm

70% less packaging material
by weight vs corrugate



Reducing EPR Fees: The Power of Smart Material Choices

What is NatureKool®?

- ✓ Plant-based cold chain solution crafted from sustainable hemp and cotton material
- ✓ Greatly reducing carbon footprint providing a low ecological footprint
- ✓ Unmatched carbon sequestration, improving air quality
- ✓ Rapidly renewable hemp fibers with lower water requirements
- ✓ A simple solution to make your life easier while meeting your customers' increasing ESG goals
- ✓ Customized solutions available to meet your protective packaging needs



Reducing Total Packaging Costs: The Power Designing with Packaging Experts



- ✓ Packaging Materials Cost
- ✓ Product Damage Cost
- ✓ Transportation Cost
- ✓ EPR Fees
- ✓ Eco-Modulation Fees and Credits

But EPR Fees are Only Part of the Story

Total Packaging System Cost is Key

Total Packaging System Cost (TPSC) Formula

Cost Component	Formula	EPS Cost	Alternative Cost
EPR Fees	Weight x Fee Rate	$1.00 \times 0.85 = \$0.85$	$1.35 \times 0.45 = \$0.54$
Material Cost	Weight x Material Price	$1.00 \times 1.00 = \$1.00$	$1.35 \times 1.30 = \$1.75$
Damage Cost	Product Value x Damage Rate	$500 \times 0.5\% = \$2.50$	$500 \times 1.5\% = \$7.50$
Transportation Cost	Weight x Freight	$1.00 \times 0.12 = \$0.12$	$1.35 \times 0.12 = \$0.16$
Ecomodulation **	EPR Fee x Bonus/Malus %	$0.85 \times (-10\%) = (\$0.85)$	$0.54 \times 10\% = \$0.54$
Total Per Unit	Sum of Formula Outcomes	\$4.39	\$10.49
Total w/o Ecomodulation		\$3.54	\$9.95

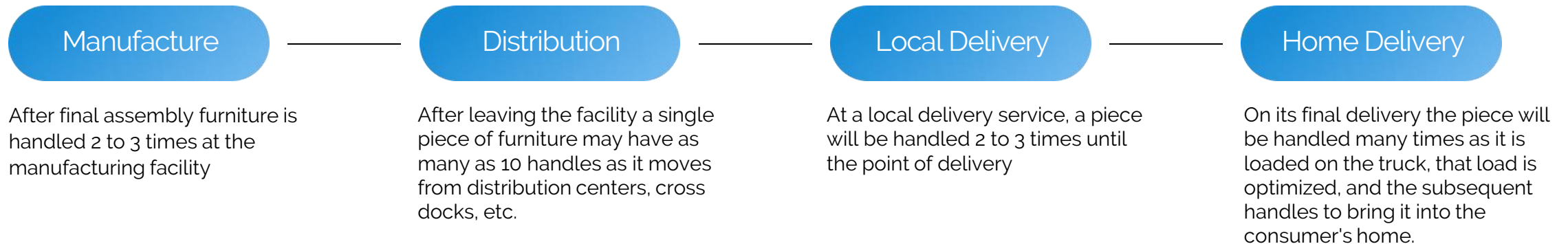
Assumptions:

EPR Fees	64% Higher for EPS
Material Weight	27% Higher for Alternative
Material Cost	23% Higher for Alternative
Damage Rate	1% Higher for Alternative

Conceptual Only; Pending Further Evaluation

Working with your packaging suppliers (like EFP) to minimize total cost.

Packaging Lifecycle



Across a variety of customers, it is estimated that a piece of furniture will be handled 25 times or more.

Reducing Total Packaging Costs:

Damage Matters



\$1,710.00 markdown



Reducing Total Packaging Costs: Damage Matters



\$1,499.00 markdown



Reducing Total Packaging Costs: Damage Matters



\$599.00 markdown



Three piece total: \$3,808.00 markdown



Reducing Total Packaging Costs: Damage Matters

A single return often costs 2X to 3X
the value of the original item

The Hidden Cost Breakdown

- **Reverse Logistics:** Return shipping costs can be exorbitant
- **Labor & Processing:** Returned goods must be received, unpacked, inspected for damage, and repackaged.
- **Inventory Depreciation:** By the time an item is inspected, seasonal trends may shift, forcing deep discounts.
- **Damaged Goods Write-Offs:** Items that are broken, worn, often yield \$0 and require disposal.
- **Lost Acquisition Spend:** The marketing dollars spent to acquire that customer are gone.

Environmental & Customer Impact

- **Wasted Resources:** Damaged shipments carry a disproportionate environmental footprint, sometimes responsible for nearly half of a supply chain's total environmental impact.
- **Friction & Churn:** Up to 73% of shoppers hesitate to repurchase from a brand after receiving a damaged order, resulting in a severe drop in Customer Lifetime Value (CLV).

Packaging Case Study

A lab tested packaging solution
based on industry feedback.



AHFA Sponsored Visits with Distributors and Manufacturers: A First-Hand Eye Opener for EFP

Date	Place
Tuesday	High Point/Greensboro, NC
January 20th	Samson Marketing Warehouse
January 20th	Metropolitan Warehouse & Delivery
January 21st	Hooker Furniture- Cloverleaf Warehouse
January 21st	Bassett Furniture

Furniture Manufacturers & Distributors

- Shared their packaging process
- Similar pack out as import furniture.
- Common Materials:
 - Corrugated cartons and edge protectors,
 - Foam sheeting,
 - Stretch wrap,
 - Molded and fabricated EPS
 - Molded urethane blocks.
- Corrugated carton for base support rather than wood.
- Adhesive backed foam for blocking and bracing.

EPS Recycling Demonstration

Details being Developed

Metropolitan Warehousing and Delivery appears to be an excellent potential partner for an EPS and Flexible film recycling demonstration.

Metropolitan Warehouse & Delivery

48 States. 40+ Distribution Hubs.

4 Cross Docks

EFP conducted an initial (2 day) study of the EPS generation at Metropolitan.

Metropolitan Warehouse & Delivery leases 402,010 SF



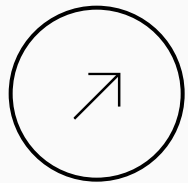
Day Average Total Volume (ft ³)	89.38
Day Average Total Volume (yds ³)	3.31
Day Average Weight of EPS (lbs)	56.69



Polystyrene Recycling
ALLIANCE



Notable Findings



Weight

Non- EPP/EPS solutions contributed to a significant amount of overall shipping weight. Several packaging solutions were in excess of 50 lbs.

Multiple impacts

Many components used were sacrificial and after the first impact or drop, lost their protective qualities and no longer provided the high level of protection needed.

Unnecessary packaging

Several large air gaps were exaggerated to accommodate thickened or redundant packaging. These accommodations are not practical and drive shipping and EPR costs.

Poor design

Some packaging elements were a combination of materials. These cannot be recycled and show the inefficiency of one or more of the materials. Several materials provided little to no contact to the surface which reduced their effectiveness.

ANALYSIS

Areas for Improvement

Mixed materials in packaging

- Usually not recyclable and drives up EPR costs.
- It is also an indication of a less-than-optimal design.

Packaging components should not need their own packaging.



ANALYSIS

Areas for Improvement

Foam in place products:

- Harmful if inhaled
- May not handle multiple impacts
- Polyurethane has limited recyclability
- Inconsistent in shape molding



ANALYSIS

Areas for Improvement

Wood or wood substitute structural base

- Non-continuous contact across the bases and tops.
- Provide little to no support except for when in direct contact with the product.
- High EPR cost
- High transit weight



Expanded Polystyrene (EPS) & Expanded Polypropylene (EPP): Superior Performance for Transport Packaging



EPS Protective Packaging
Excellent shock absorption for drops/impacts
Lightweight
Very Low Cost
Moldable; Design freedom
Non-abrasive, won't scratch product finishes
Reduces damage-rate

EPP Protective Packaging
Excellent shock absorption Durable. Multiple Impacts.
Lightweight. Greater Strength.
Low Cost, Reusable
Moldable; Design freedom
Non-abrasive, won't scratch product finishes
Reduces damage-rate



Seeking the Right Packaging for Heavy Furniture

We sought to design a packaging system that could address everything we observed:

- Lightweight
- Multiple impact resistant
- Recyclable
- Modular/universal system
- Form fitting
- Standalone performance
- Reduce transit size
- Non-marring
- Non-hazardous
- Reusable
- Multiple densities



Avoid Single Impact Crush



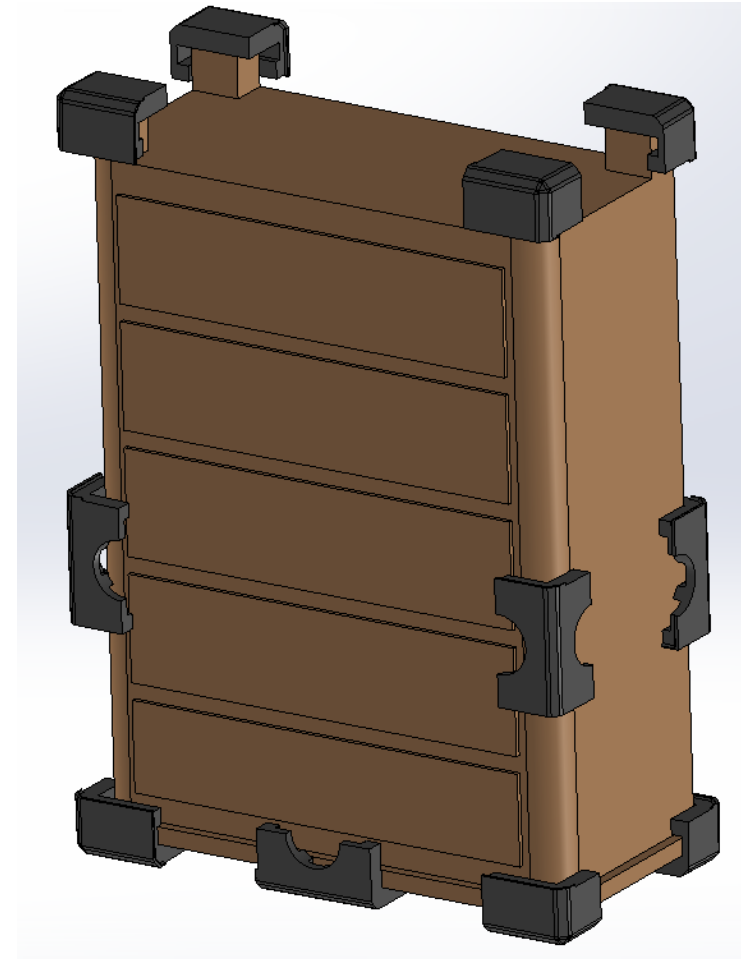
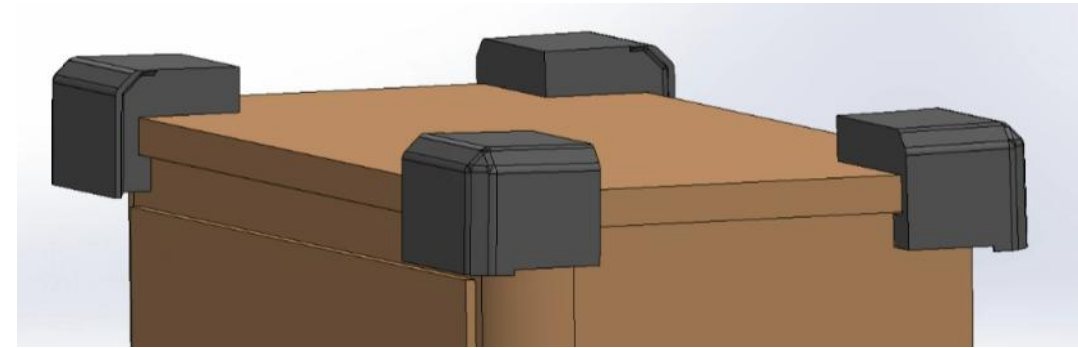
Our Proposed Solution: Molded EPP

Proposed Solution:

EPP

Utilize structure of furniture to reduce need for wood or corrugated base. Rotate unit 180°

- Lowers packaging and EPR costs.
- Molded EPP blocks that will take multiple impacts.
- One material for ease in recycling
- Design blocks for edge alignment and top protection
- Slot in block to fit around top edge.
- Transfers impact to a larger area.
- If packaging components work together lower strength corrugated carton will be an option.
- Chamfer block edges allowing carton to take the initial impact.

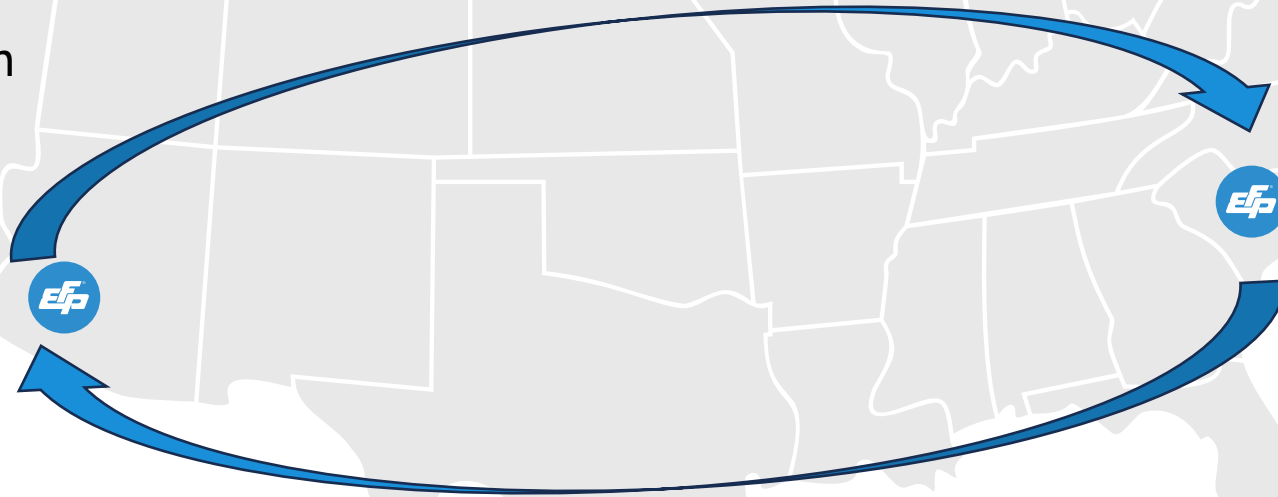


Next Step:

Torture Test

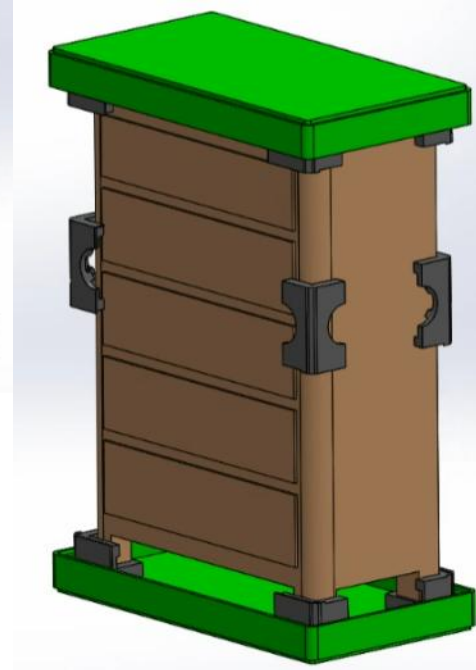
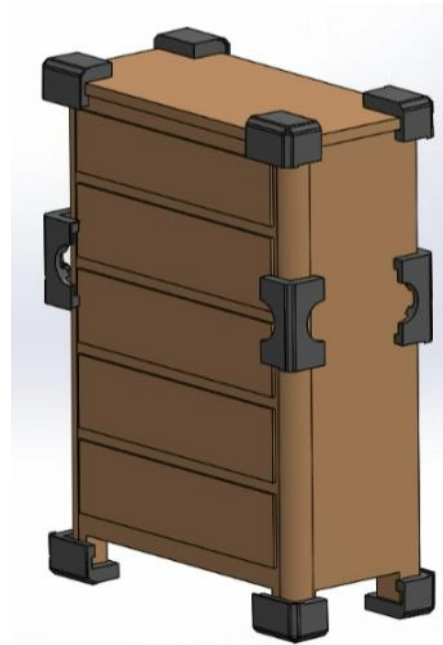
Ship Product from Bishopville, SC
to Casa Grande, AZ and back

- 80 Hours
- 4,100 Miles
- XX% Weight Reduction
- 100% Recyclable
- Goal: Zero Damage



Possible Future?

1. With EPR compliance necessary and growing, is it time to think of returnable options?
2. Do many manufacturers have a closed loop distribution network?
3. If that is the current method for most, reusable trays, dunnage, and sleeves may be a viable option.
4. Stackable trays and collapsible sleeves.
5. So many product offerings may make this a difficult task.



Reducing Total Packaging Costs: The Power Designing with Packaging Experts



EFP Seeking Partners for
Additional Packaging
Demonstrations and
Collaborations!



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Thanks!