



PET Container Recycling

March 21, 2013

Lori Carson

Phoenix Technologies International LLC



PET Container Recycling

- Recycling Overview
- Recycling Processes
- PET Bottle Recycling
- rPET for Food Contact Applications
- Emerging Challenges for Recycling





Recycling Overview

- Why Recycle?

- Environmental reasons

- Greenhouse gas prevention
 - rPet produces 36% less ghg's*
- Resource conservation
 - uses 42% less energy*
- Feel good factor

- Legislative requirements

- Many countries, including the US
 - Examples include: Canada, Germany, Belgium, Austria, Denmark, Sweden, Switzerland, Japan and many others!

- Economic

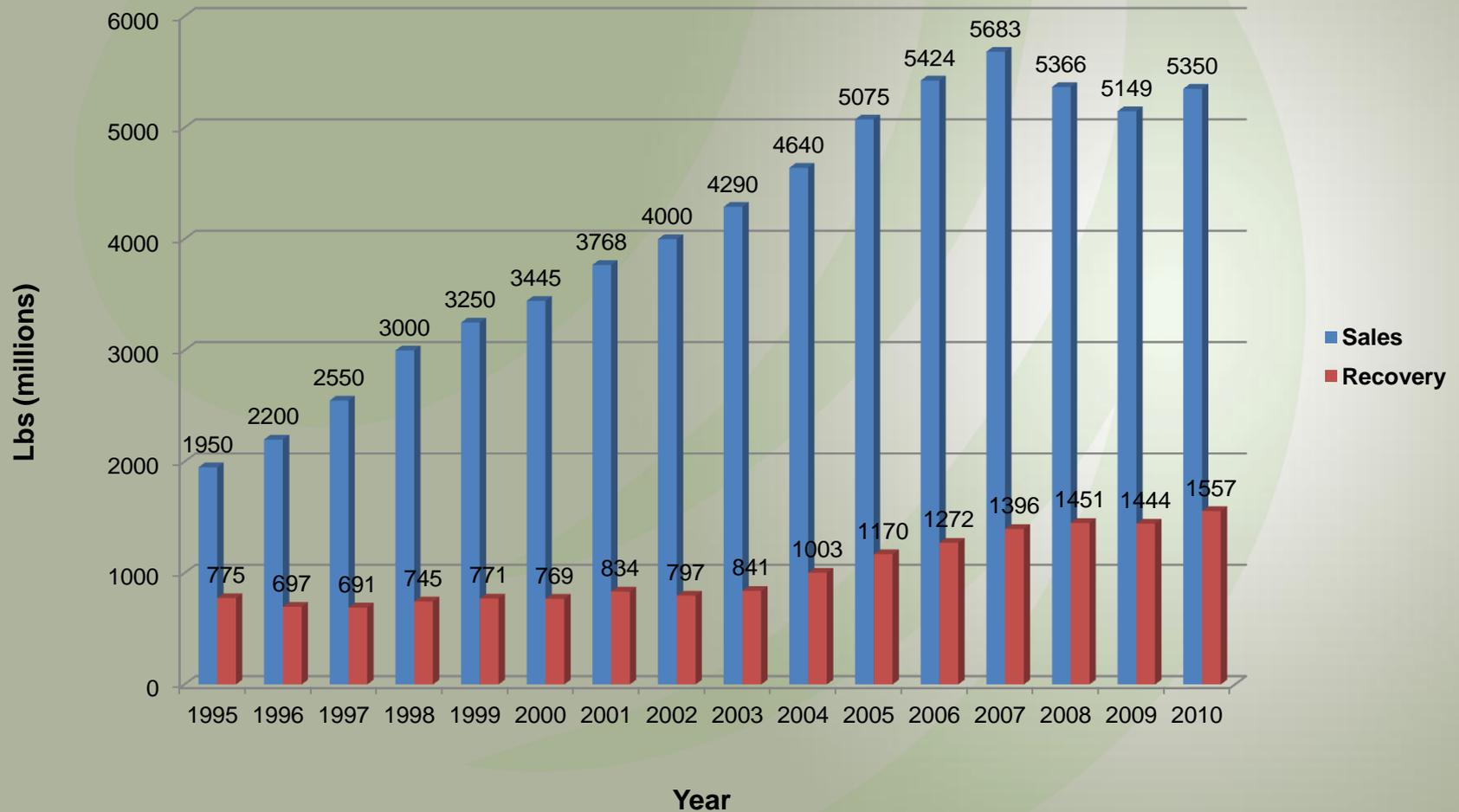
- For the recycling incentive, either curbside or retail





Recycling Overview

PET Bottles Produced vs. Bottles Recycled (lb.)





Recycling Overview

Current Recycling Rate of PET Containers



Source data: NAPCOR 2011



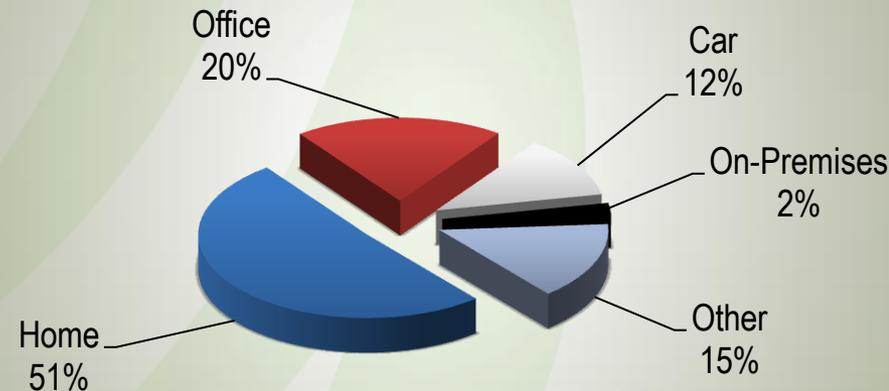
Recycling Overview

- Why did the recycling rate decrease until recently?
 - Years ago, the predominate PET bottles were 2L CSD and 64 oz Juice bottles consumed at home and more likely to be recycled
 - The predominant bottle became single serve bottles (CSD, water, sports <24 oz) consumed outside the home with fewer recycling opportunities.
 - Growth in “new age” beverages not covered by many deposit laws

Why is the rate increasing now?

- More education/public awareness
- More venue recycling opportunities
- More incentive based recycling
- More states with deposits covering more bottles
- Less total resin into packaging (more bottles, less weight)

PET Beverage Bottle Consumption Location



Source data: Beverage Packaging Environment Council (BPEC)



Recycling Overview:

Domestic vs. World Markets: 2008

- So where does all of the 1557mm lbs of post consumer recycled PET bottles go?
 - 776 mm lbs were purchased by reclaimers
 - 781 mm lbs were purchased by export markets or 50.2% of all collections (most to China),





Recycling Overview

- How can we increase the amount of PET bottle available to the recycling industry?
 - Increase the importance of recycling to the general public through education (recycling codes less confusing, etc)
 - Increase availability of curbside collection
 - Increase availability of out of home collection
 - Legislative methods (banning containers to landfills, deposit laws, etc)
 - Establish programs that offer monetary incentives for recycling (Recycle Bank, deposit systems, etc)





PET Bottle Recycling

What Happens in the Recycling Process?

- The process begins by delivering the collected bottles to a Materials Recycling Facility (MRF)
 - In 2007, there were 567 MRFs operating in the US
 - MRFs accept both source separated and commingled recyclables
 - After sortation, the separated materials are sold.
 - Single stream curbside collection programs are growing
 - 160 in 2007 vs. 90 in 2003
 - Homeowner puts it all in one bin (single stream)
 - This increases recycling participation (13% improvement)
 - Usually impacts the yield quality
 - All sortation is done at the MRF
 - Places greater emphasis on the use of autosortation equipment
 - Aluminum cans, glass and plastic bottles are separated
- MRFs typically recycle only PET (#1) and HDPE (#2)
 - But a growing number now accepting other plastics
 - Numbers 3-7 plastics when accepted usually sold unsorted





PET Bottle Recycling

Bottles are Compacted for easy Shipping



Bottles Conveyed to Compactor



Bottle Baler



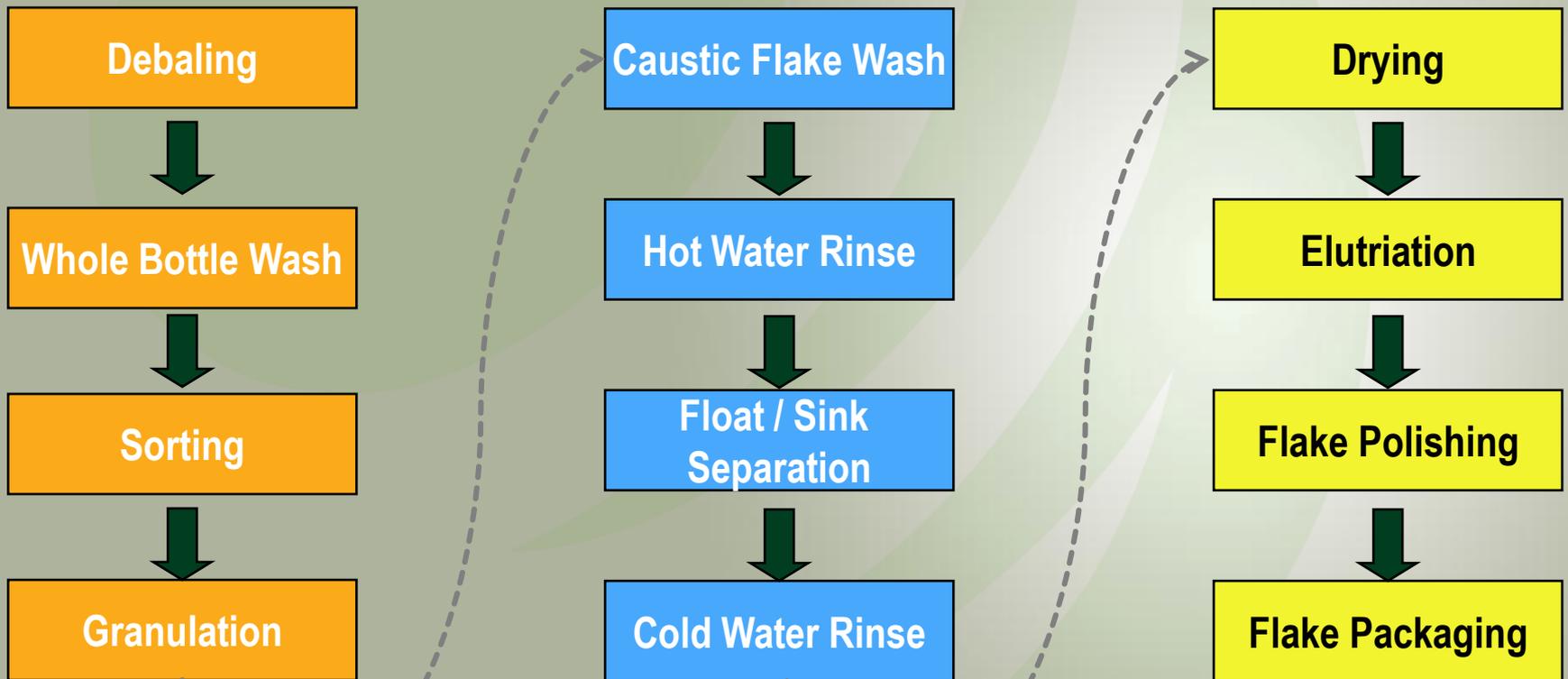
Baled Bottles



PET Bottle Recycling

How Do PET Bottles Get Cleaned?

What do the Reclaimers do?



Converters then purchase this clean flake to use it directly as flake in their processes or to extrude and pelletize it.



PET Bottle Recycling:

What Gets Removed During the Washing Process?

- PET is isolated from other plastics (HDPE, PP, PVC)
- Labels and residual glue and adhesives
- Metals
 - Ferrous (magnetic)
 - Non-ferrous (Aluminum: cans and closures)
- Product residues, dirt and assorted debris
- Coatings
- Non-adhering barrier layers such as EVOH & nylon





Bale Sort, Grind and Wash Operations

- Basic Markets served
 - Fiber
 - Strapping
 - Sheet extrusion
 - Bottle to bottle
- Flake quality requirements increase as you transition from fiber through to bottle to bottle applications
 - Focus is on PVC, Low melt and hard contaminant (glass, rock and metal) removal
- Sort grind and wash operations are optimized to meet their intended markets
- Output from these operations is the infeed to the pellet manufacturer and the converter



Phoenix Technologies



Established - 1992
Facility – 90,000 ft²
Capacity – 85MM lbs/yr
Quality - ISO 9001:2008

- Services
 - Pelletizing
 - Crystallizing
 - Solid Stating
 - Pulverization
 - Compaction
 - Decontamination
- Products - Recycled PET
 - NLP™ non-food grade
 - LNO™ food grade
 - Approved for deposit and curbside collection operations



rPET for Food Contact Applications



U.S. Food and Drug Administration



- rPET for Food Applications

- Food contact approval for rPET is granted by the FDA for a “Process” based upon satisfactory demonstration of acceptability

- LNO’s granted by the FDA list use qualifications:

- Source material (deposit or curbside)

- Limits of use (low level to 100%)

- Conditions of Use (currently A through I)

- Approval can be granted for limited specific conditions of use or for broad coverage

- Examples: retort, cold fill, hot fill, cooked in container etc.



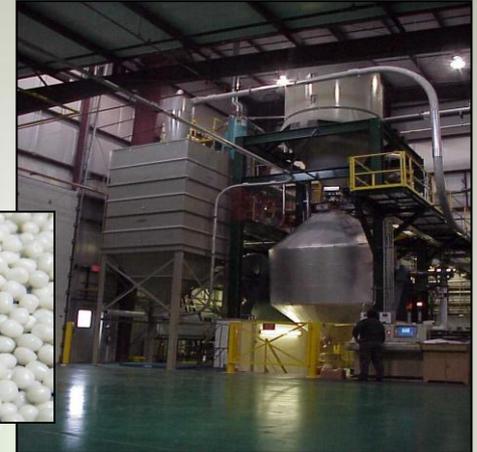


rPET for Food Contact Phoenix LNO™ Brand

LNO™ P/PT First Food Grade Line started in 2000 – 2 Lines. Process is a batch system using a chamber that is a solid stating unit. Decontamination cycle increases the IV and, because of the reduced flake size, the IV build rate is improved.

LNO™ w built on the same patent platform, introduced in 2013. Best color for a melt pellet, lower IV to match water resins. Limited to FDA E-G.

LNO™ c, technology built on the same patent platform, started in 2009 - 1.5 Lines. Non Melt technology improves the color and decreases the acetaldehyde levels to less than 1ppm, maintains IV.





Every Day Containers with rPET

Many products you see on store shelves everyday contain Phoenix rPET resins

- Colgate – Soft Soap, Palmolive, Murphy’s Oil Soap
- Coca Cola – Coke, Diet Coke, Sprite
- Estee Lauder/Aveda – hair care products
- Sherwin Williams – gallon paint cans
- S C Johnson – Windex, Scrubbing Bubbles
- Clorox
- Solo Company – Bare™ line of cups and plates



Challenges for Recycling

- Recycling Challenges of today

- New Packaging Applications

- More Single serve
- Beer and specialty alcohol
- Colored PET bottles

- New Barrier Technologies

- Multi-layer materials
- Coatings
- Active scavengers
- New comonomers

- Proliferation of PET non bottle packaging without a good recovery system in place

- Lightweighting





Emerging Challenges for Recycling

- Recycling Challenges of the future

New Packaging Designs, Materials, Labels etc

- Bioplastic materials/blends
- Biodegradable and oxo-degradable additives
- The yield of PET bottles from a bale has decreased to under ~70%

and

- More brands are considering the use of rPET to impact their environmental message so the recycle rate needs to increase if exports continue to demand 50% or more of the rPET, or it will be difficult to keep the supply and cost at a competitive level to fill demand.



How will the recycling infrastructure identify and deal with all of these challenges?



UP for the CHALLENGE!

Recycling technologies will need to continue to evolve to properly address the challenges of today and the future but the industry and all stakeholders have proven UP FOR THE CHALLENGE!



Thank you

Lori Carson

Phoenix Technologies International LLC

L.Carson@phoenixtechnologies.net

www.phoenixtechnologies.net