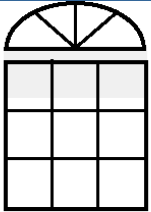


Minnesota Waste Wise

Lean in Manufacturing



LINDSAY

WINDOW & DOOR

since 1947

October 12, 2008

Lindsay Window was founded on quality and service since 1947.

- **Started by Leonard Lindsay in 1947 making single glaze wood windows in the basement/garage of his home located in Mankato, MN**
- **One of the first companies to offer “Swing and Clean” replacement systems in single and insulated glass units for self window replacement**
- **Helped pioneer the Vinyl Windows movement in the mid-1980s**
 - As popularity grew, expanded from 1 to 7 lines of vinyl windows
 - Leader in customer service and product quality
- **Expanded to Washington, MO in April, 2001 and purchased the assets of Sun Room Concepts in June 2007**

Lindsay Windows manufactures high-quality, energy efficient products.

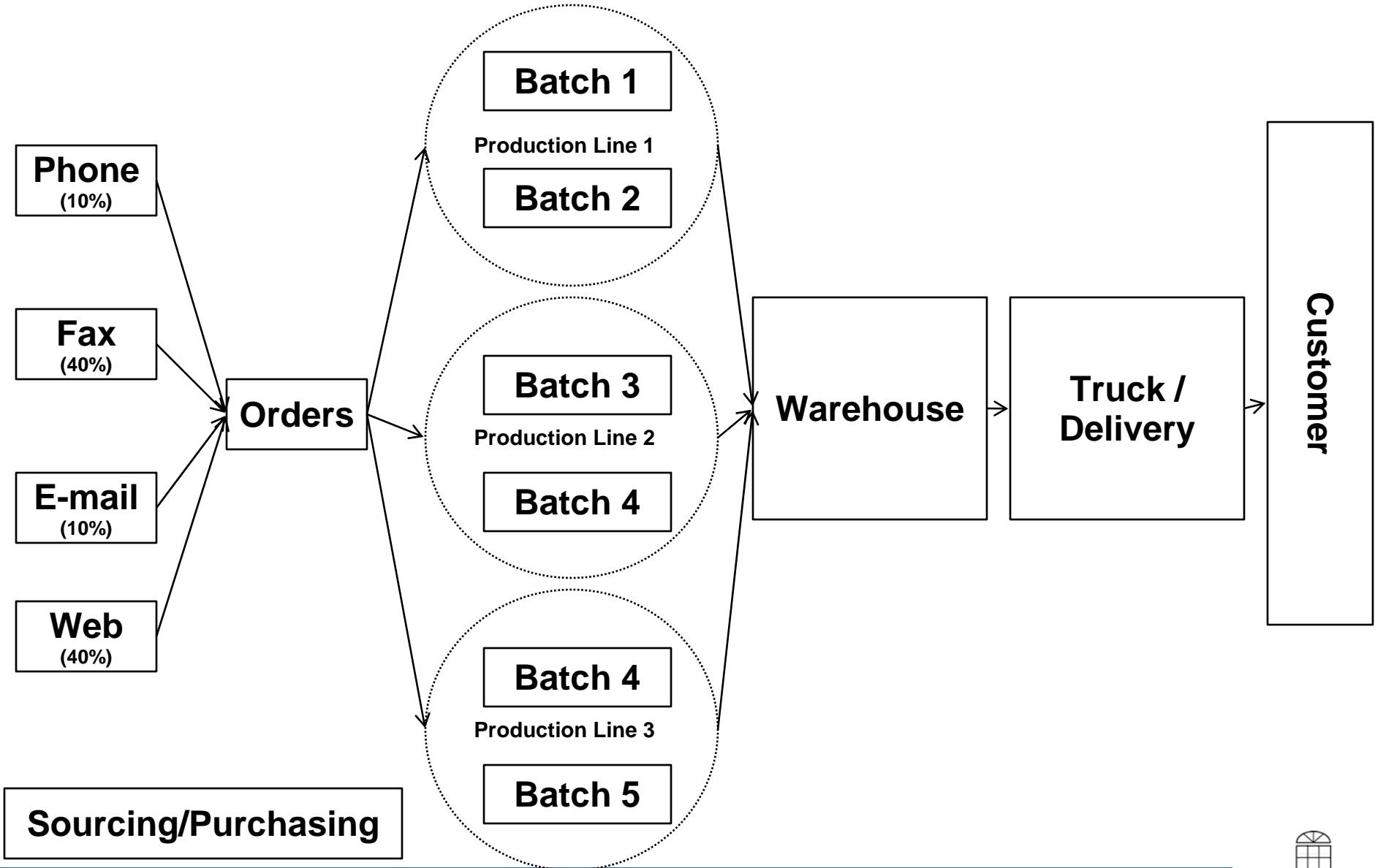
- **99% are used for residential use**
 - 80% Replacement
 - 20% New Construction
- **Everything we manufacture is Make to Order**
- **Energy Efficient Glass is used extensively**
 - 99% of the products contain Low-E
- **Glass “spacer” is the most energy efficient available**
 - Warmest Edge
 - Fewest Failures
 - Tested to last 100+ years
- **Founding member of the Earthwise Group**
 - Collection of window manufacturers across the country
- **Laminates provide wood look on the interior without staining, painting, etc.**
- **Lindsay Window was the first company to make Low-E STANDARD**

Our goal is to build sustainable products that not only reduce energy consumption, but last for generations.

Lean manufacturing at Lindsay Window is an ever evolving process

- **For years, we have failed...**
 - High turnover
 - Wrong leadership
 - Lots of cost, very little result
 - Difficult to measure and compare in the industry
- **Lots of projects started....but never finished**
 - Consultants
 - Internal projects
- **We are now beginning to succeed....**
 - Right People
 - Right Projects
 - Right Motivation

Here is the order process for Lindsay Window



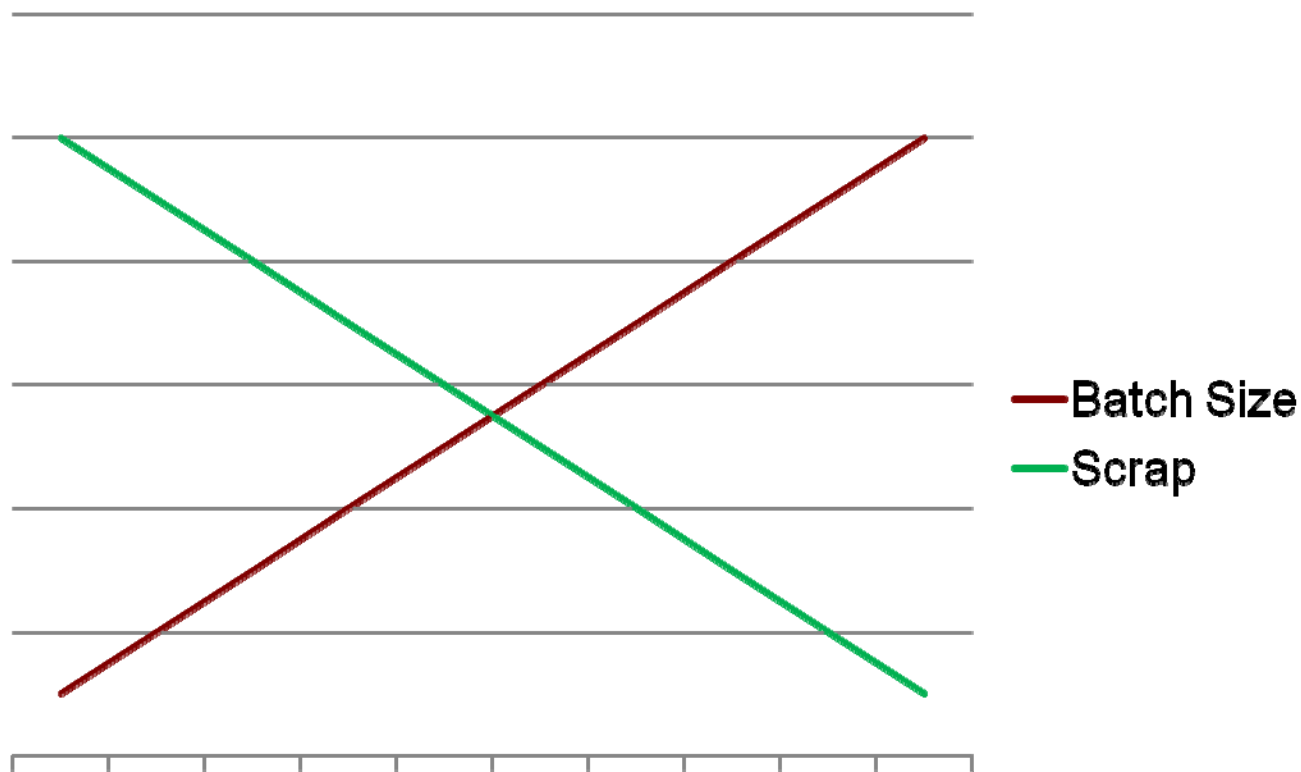
Within our office, we are incorporating a few items to help us be “lean” and encourage recycling/reduced use.

	Lean Benefit	Recycling Benefit
New Copier/Printer/Fax	E-mail instead of fax	2 Fewer machines in use Less Paper useage
Web Order Entry	Customer Enters Orders	Fewer faxes Less Paper back and Forth
Pay by Credit Card	Fewer Checks	Fewer checks
Duplex Printing	None	Less Paper
Separate paper and garbage	None	Less Garbage
Installed Fax Server	Less time	Less paper (don't have to print)

Within manufacturing, sometimes the “drivers” for lean have an inverse effect on Recycling

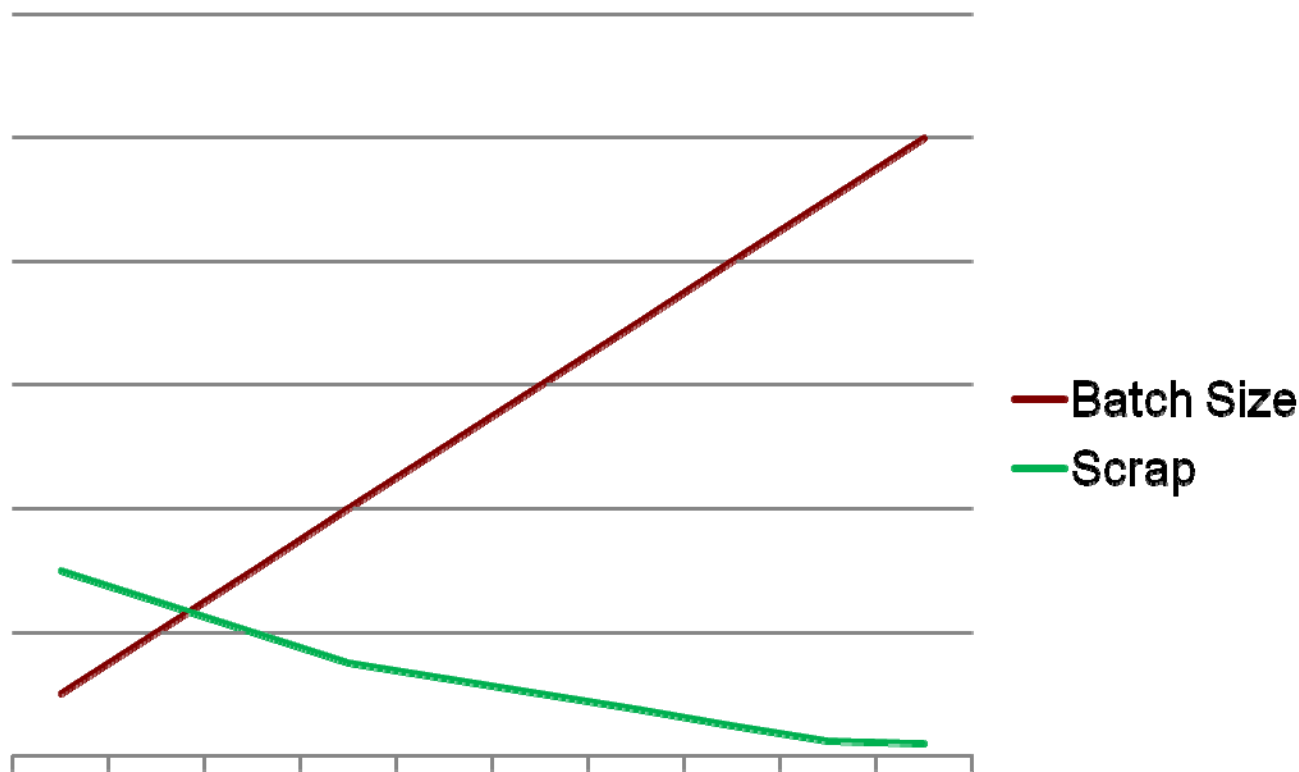
	Lean Driver	Potential Impact
Labor	Increased productivity	More Waste
Small Batch Sizes “Batch of One”	Increased productivity, shorter lead time	Increased scrap

Here is a simplistic effect batch size can have on parts that are cut on saws



In reality the effect is more curved and depends on the data being cut.

The goal is to get as close to the ideals in both scenarios....



In reality the effect is more curved and depends on the data being cut.

The relationship between cutting labor and material costs varies, depending on the saw and material.

Saw Area	Material Cost	Labor Cost	Labor:Material Ratio	100% Labor Yield
Frame	\$3,200	\$104	1:31	3.25%
Sash	\$2,200	\$104	1:21	4.72%
Bead	\$400	\$104	1:4	26%
Screen	\$500	\$104	1:5	21%
Other Parts	\$480	\$104	1:5	22%

The improvement in yield can pay for the all of the labor to cut it.

One major development we use is optimization called “MAXCUTS”, which improves our cutting yield by 6-8%!

- **Cutting variable pieces out of fixed lengths**
- **The “leftover” portions are usually thrown away or recycled**
- **Historically, that “optimization” has had a distinct start and end**
- **I wrote a patent pending application to change the way optimization is done**

How does you view optimization? Like this.....



Or like this?



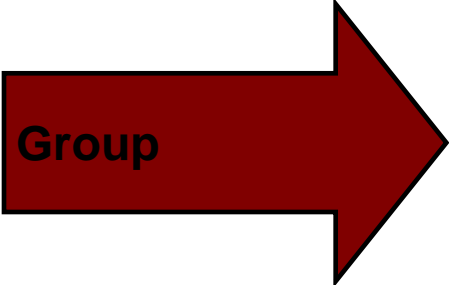
And like this?



How does MaxCuts work?

- Step 1: Look for common sizes and group (assuming maximum of 8)

Qty	Size	Qty	Size	Qty	Size
2	31	2	27.25	8	19.25
2	31	2	27.25	8	19.25
2	31	2	23.25	8	24.25
2	37	2	23.25	8	24.25
2	31	2	19.25	8	24.25
2	24.25	2	19.25	8	26
2	24.25	2	19.25	8	27.25
2	24.25	2	19.25	8	31
2	24.25	2	27.25	8	32.25
2	24.25	2	15.25	8	31
2	24.25	2	27.25	8	32.25
2	20.25	2	27.25	4	15.25
2	20.25	1	15.25	4	19.25
2	32.25	2	19.25	4	20.25
2	20.25	2	19.25	4	21.45
2	32.25	2	19.25	4	23.25
2	24.25	2	19.25	4	24.25
2	24.25	2	19.25	4	28.25
2	24.25	2	19.25	2	26
2	24.25	2	26	2	28.2
2	28.25	2	32	2	31
2	28.25	2	26	2	31.875
2	32.25	2	26	2	32
2	32.25	2	26	2	36.875
2	21.45	2	26	2	36.875
2	21.45	1	26	2	37
2	21.45	2	31.875		
1	28.2	2	36.875		
1	15.25	2	31		
1	26				
1	28.2				



Step 2: Optimize at the highest quantity first...

Optimize these....

Qty	Size
8	19.25
8	19.25
8	24.25
8	24.25
8	26
8	27.25
8	31
8	32.25

Into these layouts

Layout 1

- 19.25
- 24.25
- 24.25
- 26
- 27.25
- 31
- 32.25

Layout 2

- 19.25

But look for Layouts that have too much leftover scrap...

Qty	Layout 2
8	19.25

And split those into the next lowest quantity

Qty	Size
4	19.25
4	19.25

Step 3: And include them into the next lower level of quantities...

Now do the 4's

Qty	Size
4	19.25
4	19.25



Pieces from last optimization

Qty	Size
4	15.25
4	19.25
4	20.25
4	21.45
4	23.25
4	24.25
4	28.25

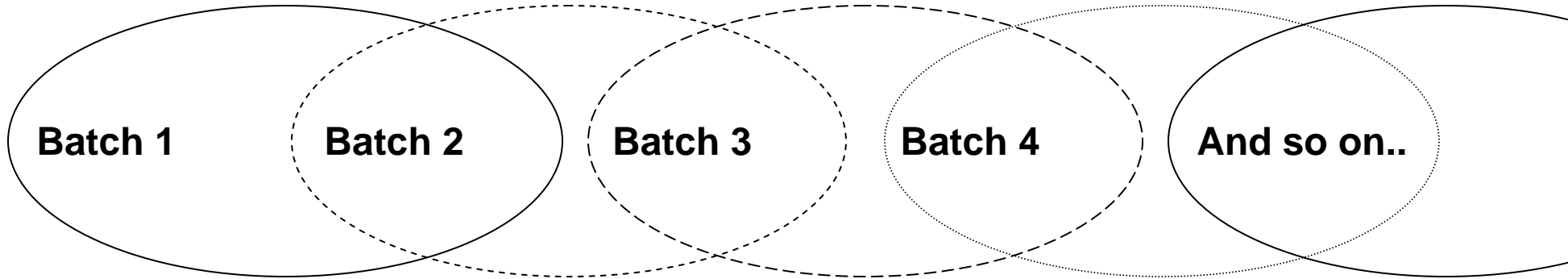


Quantities that could only be matched up to 4

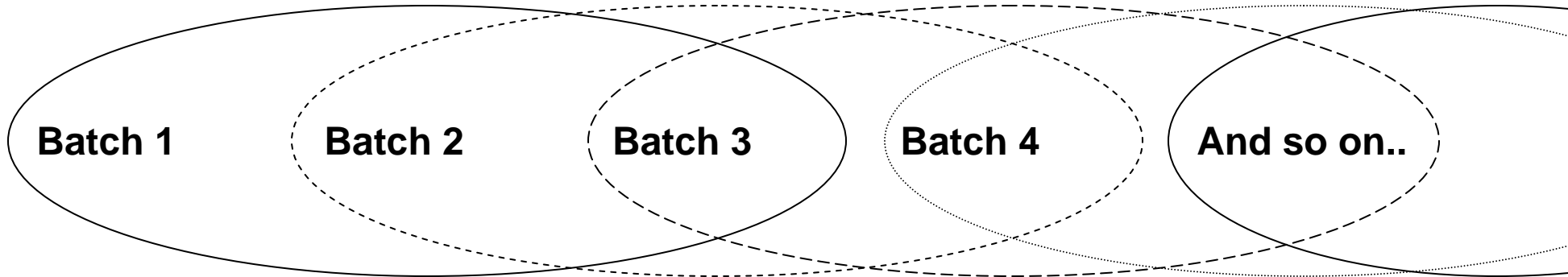
And repeats until it reaches the lowest setting (usually 1).

MaxCuts also provides the ability for “continuous optimization”.

Like this...



Or Like This...



With this, there isn't a stop as long as the part is within "MaxLook"

For frame and sash (where you want the best yield), the results are impressive

Batch Size	Current Yield	Max-Look using 1 Batch Ahead	Max-Look using 2 Batches Ahead	Savings/Window
10	71%	+16%	+17%	\$4.55
20	81%	+9%	+11%	\$2.29
30	84%	+7%	+8%	\$1.69
40	86%	+5%	+6%	\$1.33
50	88%	+4%	+5%	\$1.04
100	92%	+2%	+2%	\$0.43

Your batch size is the number of windows that are the same color AND use the same frame and sash.

For frame accessories, notice the savings in labor AND the improvement in yield.

Batch Size	Current Yield/ Loads	Yield Improvement with Max-Opt	Load DECREASE with Max-Opt	Savings/Window
10	72%	+16%	-130	\$0.26
20	84%	+8%	-99	\$0.14
30	88%	+6%	-96	\$0.12
40	90%	+4%	-88	\$0.10
50	92%	+3%	-98	\$0.10
100	94%	+3%	-90	\$0.09

Remember, this is only for one saw. Similar results are found with glazing bead, reinforcement, and screen.

In addition to reducing scrap, we have expanded the materials we recycle.

- **Cans, Plastic Bottles, Glass Containers**
 - Now have several comingled bins for employees
- **Paper, Cardboard**
 - Much better effort and coordination with bins located throughout the facility
- **Vinyl Dust**
 - Worked with supplier to recycle the “dust” created when cutting vinyl
- **Wood**
 - Some is sent to a preschool for projects (done since 1990)
 - Other wood is now recycled for animal bedding
- **Stretch Wrap**
 - Now sent to choice plastics
- **Screen Mesh**
 - Sent for making puppets
- **Supplier “reels”**
 - Worked with supplier to reuse (sent back to supplier)

We estimate our savings is approximately \$700-\$1000 per month!

Everyone here can help improve the recycling efforts of their organization and industry

■ **SHARE with your competitors**

- Everything we have done has been shared with other members of the Earthwise group
- We are promoting “Earth Week” that encompasses Earth Day and Arbor Day (April)
- Led to several companies increasing their level of recycling and waste reduction

■ **LEAD, but look for examples to follow**

■ **CHALLENGE your organization to do more, look for opportunities to create a win-win**

■ **REWARD employees for milestones and achievements**

- We have employee meetings once a month and if everyone does a good job recycling, we pay for pizza

During these challenging economic times, it is more important than ever to know where supplies are coming from.

- **Buy American**
- **Buy Midwest**
- **Here is where our materials come from**
 - Vinyl: Dayton, OH and Winnebago, IL
 - Glass: Northfield, MN and Spring Green, WI
 - Hardware: Owatonna, MN
 - Extruded parts: Ohio
 - Balances: Sioux Falls, SD
 - Glass Spacer: Ohio



Your actions help support American jobs.

We also advertise our returns, mistakes, etc. on a web site

www.ExtraWindows.com

- Trying to get connected with Habitat for Humanity
- Working with other manufacturers to add inventory
- Avoids us throwing away windows that can be used somewhere