

# Multilayer Polyethylene Films For Food Service Packaging Applications

## FlexPackCon 2017

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NOVA Chemicals

# Multilayer Polyethylene Films for Food Service Packaging

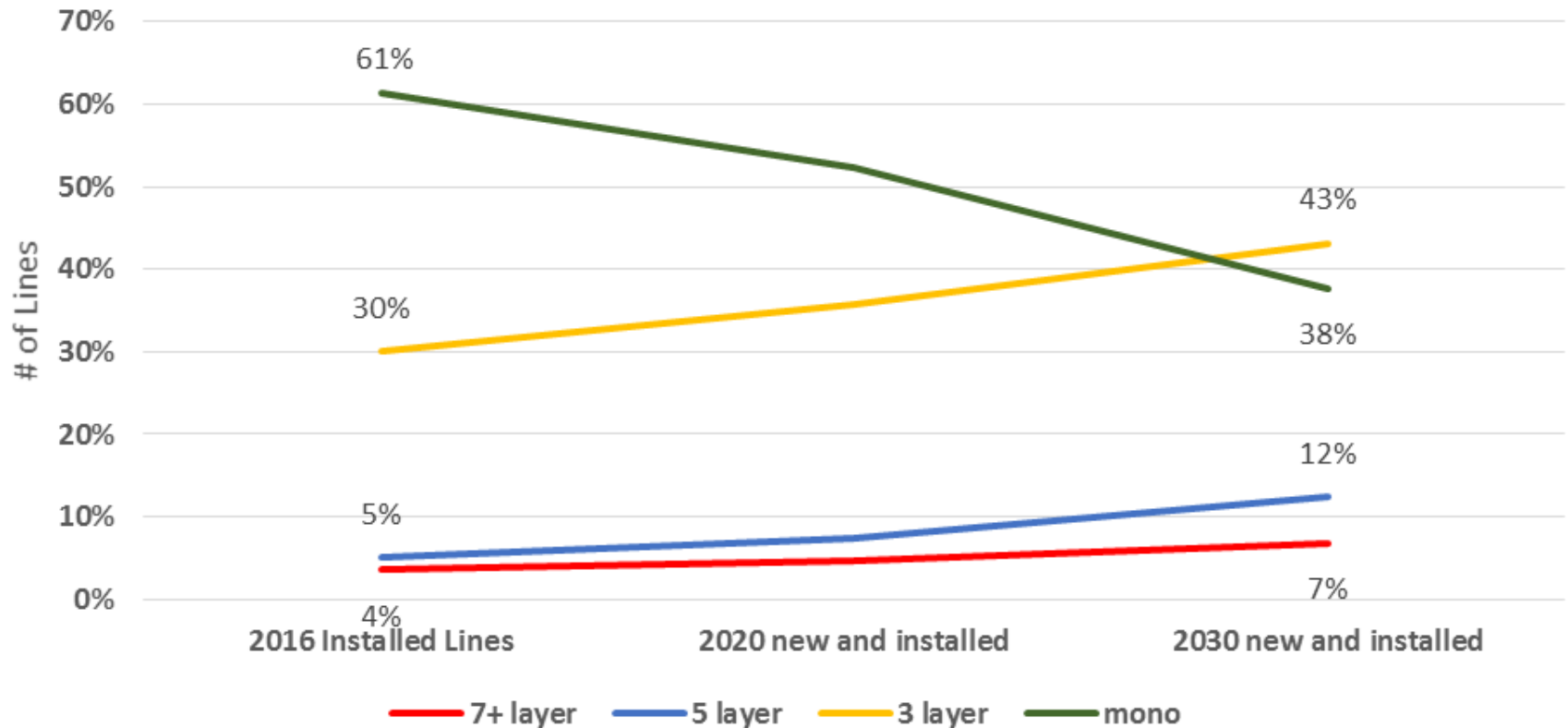
The advent of more complex multilayer blown film co-extrusion lines and the development of a high barrier high density polyethylene resin (B.HDPE) has facilitated many new options in food packaging.

In this presentation, we will discuss:

- Trends in extrusion equipment
- The protein food market segment
- Changes in food service poultry packaging
- BONFIRE<sup>SM</sup> Multilayer Property Predictor for packaging film design

# Film Extrusion Equipment Trends

## \*North America Blown Film – New and Current Equipment 2016-2030

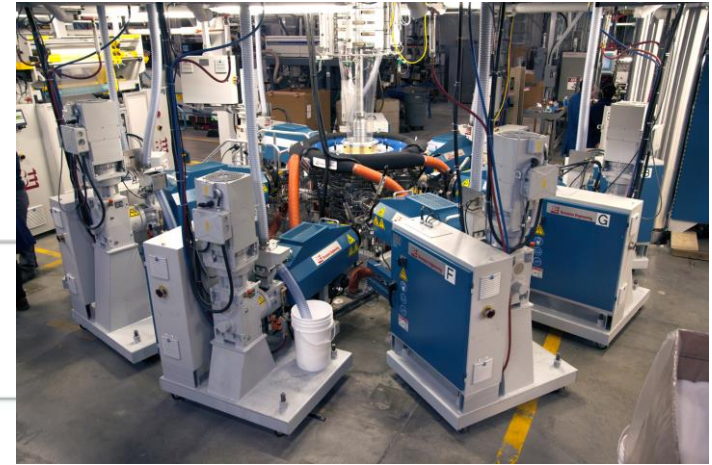
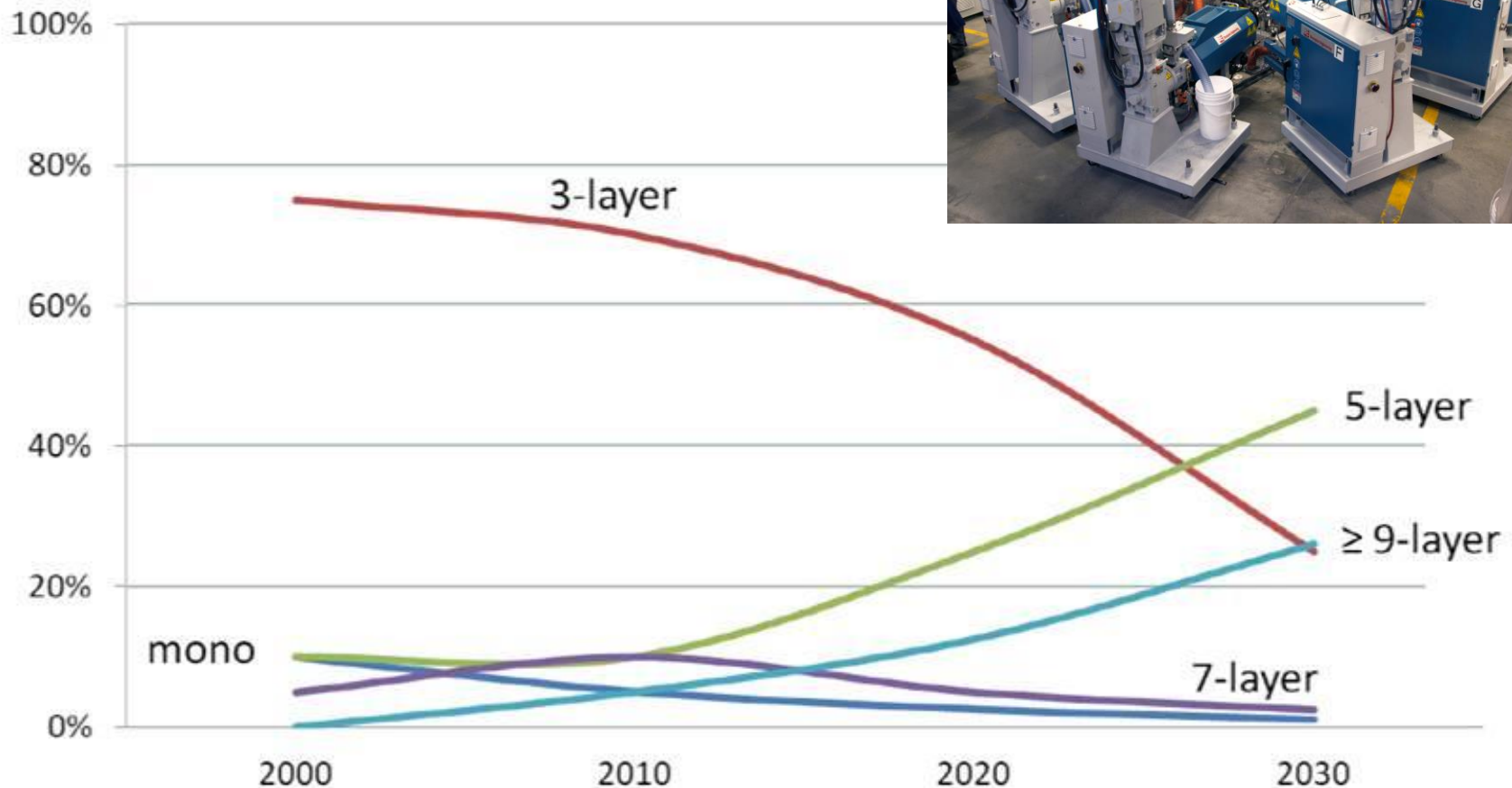


\*Based on 5,000- 6,000 blown film lines in existence in 2016.

Source: internal / external

# Film Extrusion Equipment Sales / Trends

## Multilayer Blown Film Lines Trend Long-term Outlook



Source: internal / external

## Data Sources and Analysis Process

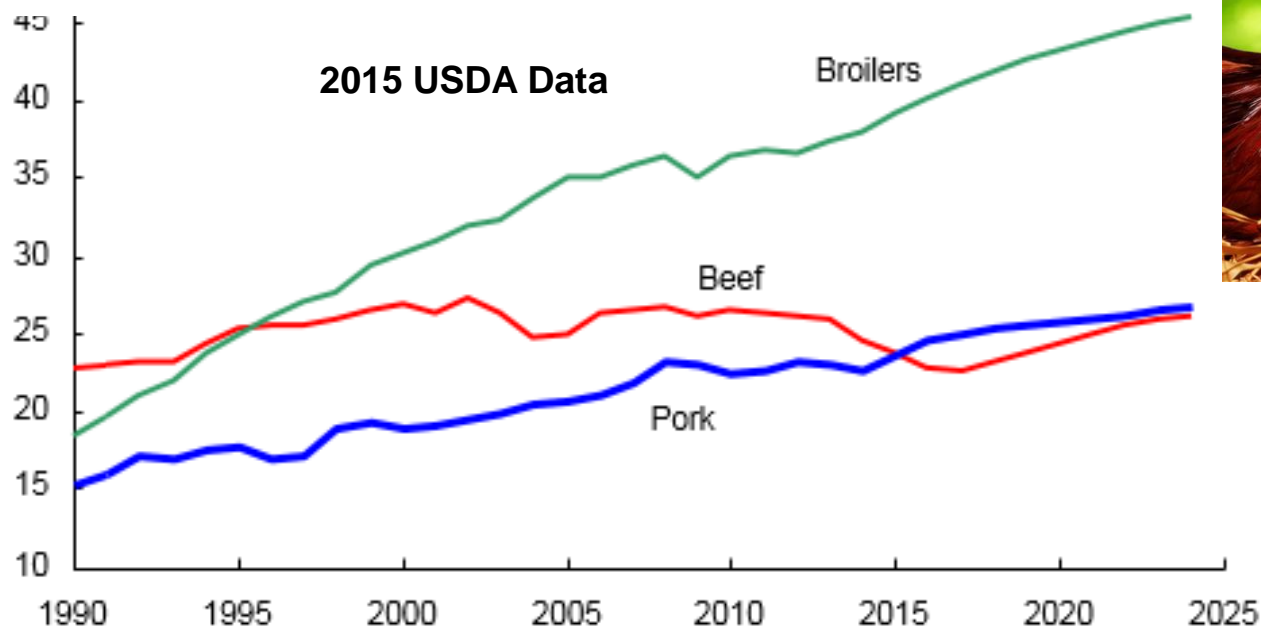
- External Market Research
  - Market studies, conferences, tradeshow, and publications
- Internal research
- Primary Market Research
  - Industry expert interviews
- Analysis and focus area identification

# Protein Food Market

## Protein Market Segment Assessment

### U.S. red meat and poultry production

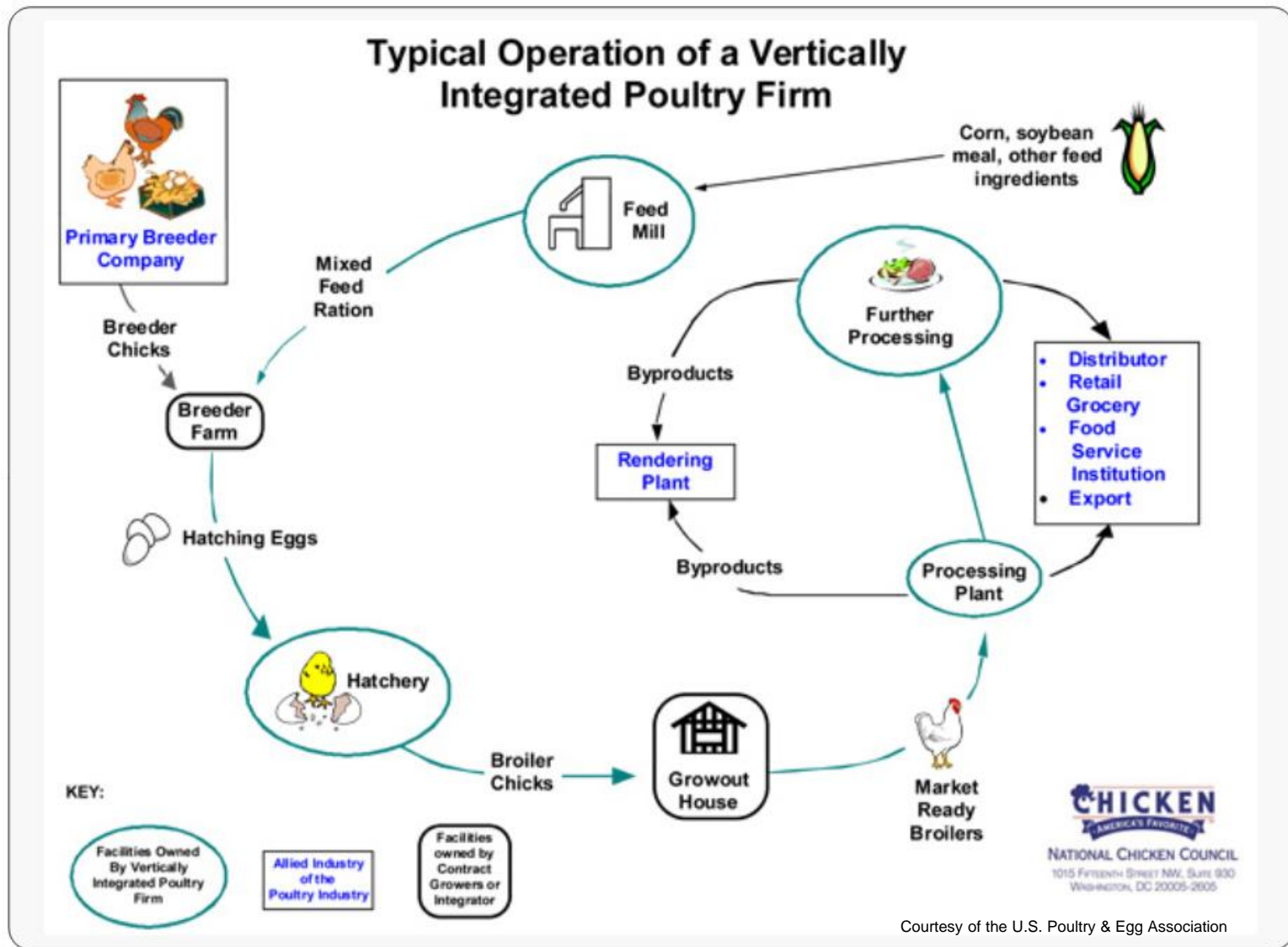
Billion pounds



did you  
know?

- Chickens grown for eating (rather than laying eggs) are called broilers.
- Contrary to some myths, growth-enhancing additives such as hormones or steroids are not used in chicken.

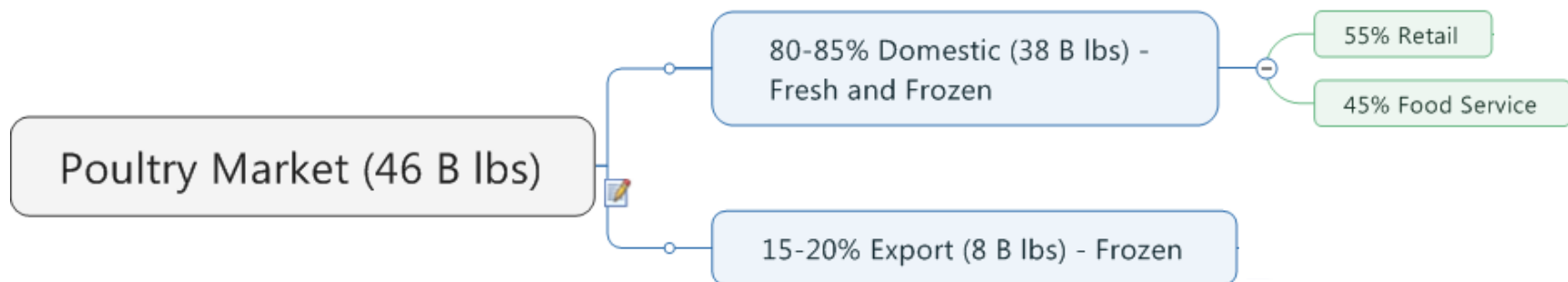
# Value Chain



# Market Overview

## Poultry

- 83% Chicken
- 15% Turkey
- 2% Other
- Main focus is on domestic market

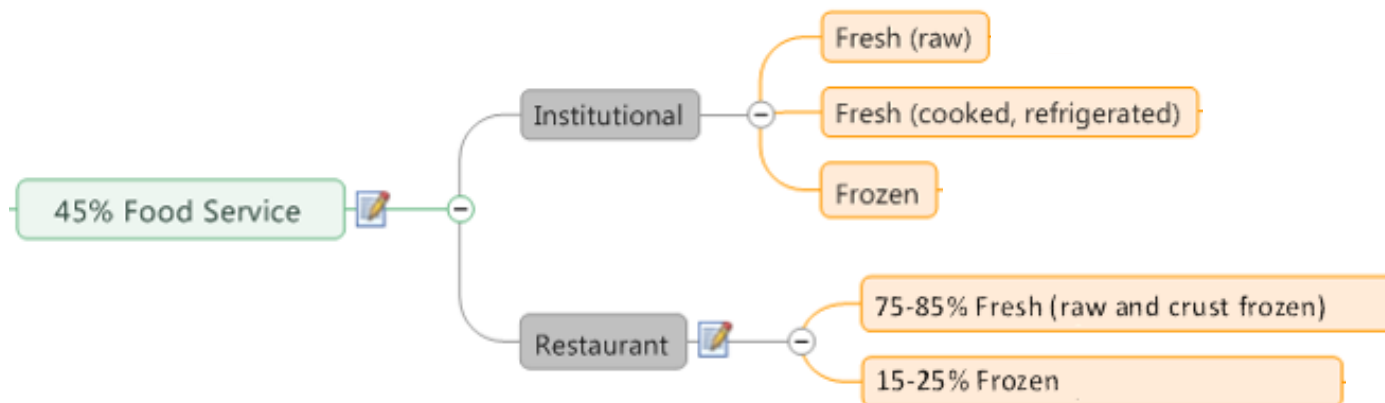


did you  
know?

- About 8.5 billion broilers are produced in the US each year; the average broiler weighs about 6 pounds.
- If we went back to raising chickens the way we did in 1925, chickens' mortality rate would increase 490%, and the poultry industry's environmental footprint would be increased three-fold.

# Market Overview

## Retail and Foodservice



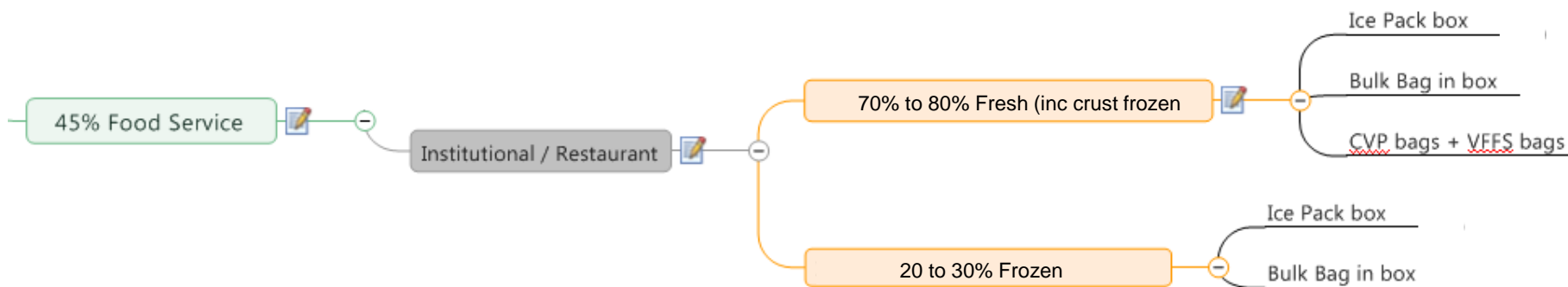
did you  
know?

- About 25,000 family farmers have production contracts. Approximately 95% of chickens are produced on these farms.
- More than 40 billion pounds of chicken product was marketed, measured on a ready-to-cook basis.

# Market Overview

## Foodservice Packaging

- Ice Pack box
- Bulk Bag in box
- Gas Flushed CVP bags
- VFFS bags

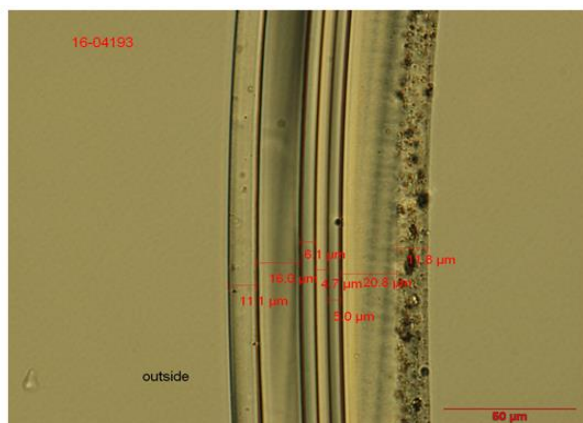


did you  
know?

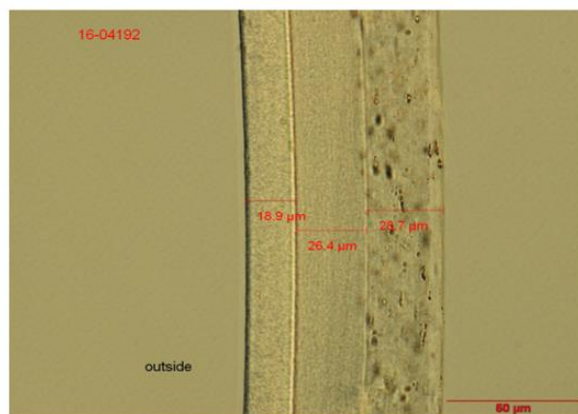
- The United States has the largest broiler chicken industry in the world, and about 19 percent of production was exported to other countries in 2015.
- Americans consume more chicken than anyone else in the world – more than 90 pounds per capita in 2015.

# Commercial Food Service Packaging Analysis

Poultry Category	Secondary Package Format	Primary Package Format	Packaging Film Structure
Chicken Parts	-	3 layer coex Pouch	HDPE/PE/LLDPE-Talc
Chicken Parts	-	7 layer coex Pouch	PA/EVA/Nylon/EVOH/Nylon/PE/PE-Si
Chicken Parts	3 layer coex Outer Bag	-	C8-LLDPE/LDPE/c8-LLDPE
	-	9 layer barrier coex Inner Pouch	PA/EVA/EVA/PA/EVOH/PA/PE-tie/PE/LDPE-Si



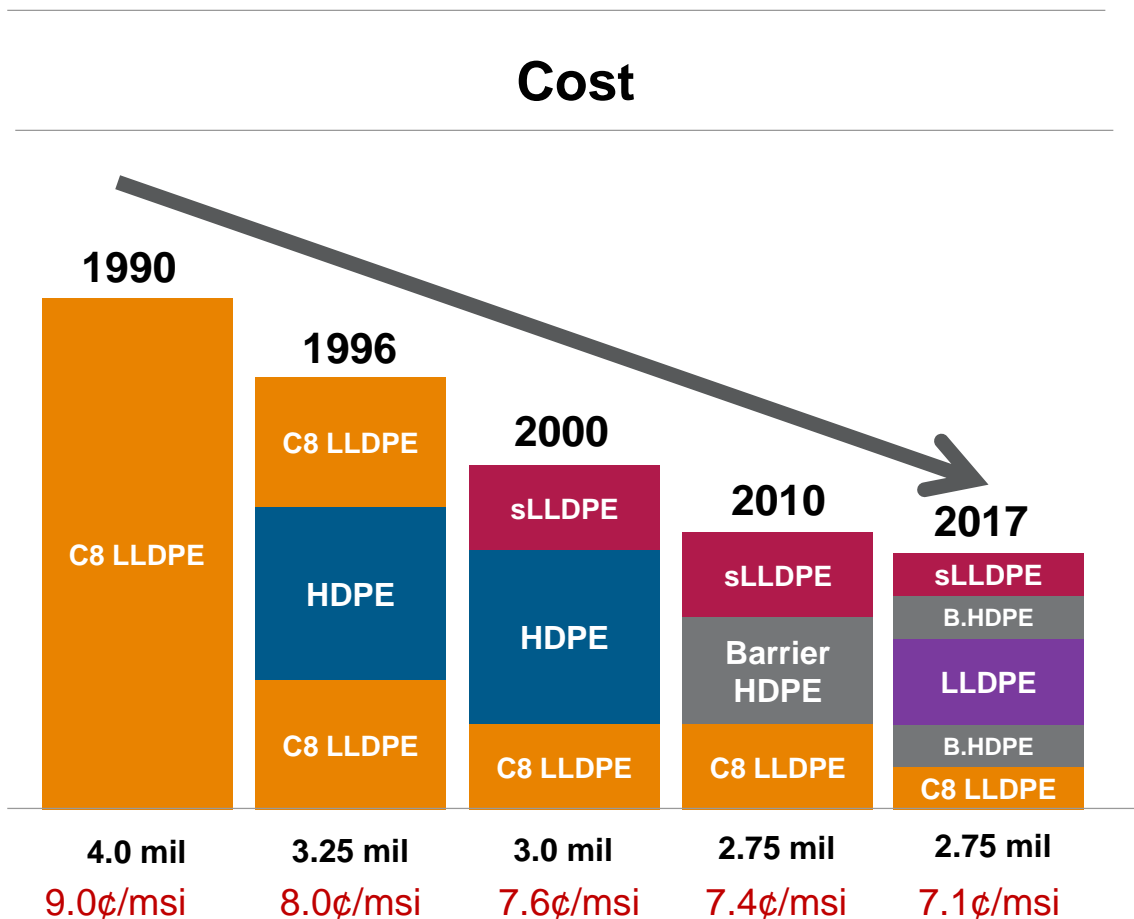
Nylon / EVA / Nylon / EVOH / Nylon / PE-tie / PE-silicone



HDPE / PE / LLDPE-Talc

- Barrier Food Service Bag
- Non- Barrier Food Service Bag

# Cost Savings from Downgauging: Poultry Bag



## Desired Properties

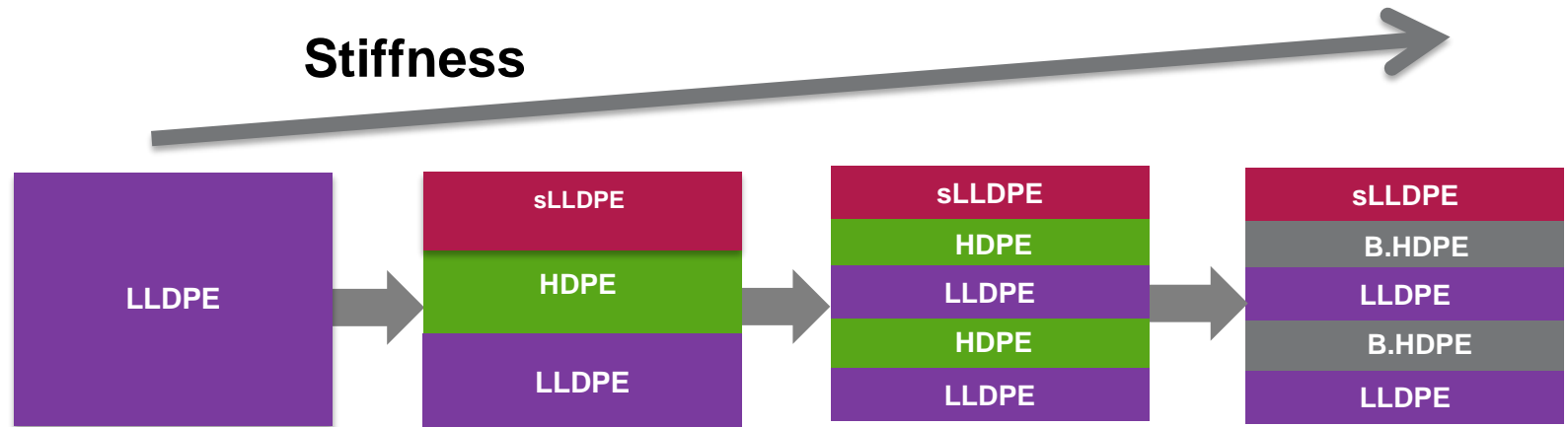
- Medium oxygen barrier
- Seal-through contamination
- Dart and puncture resistance
- Burn-through resistance
- VFFS capability

# Resin Grades

The following resins are referred to in the next slides:

Name	Grade	Melt Index g/10 min	Density g/cc
C8 LLDPE	SCLAIR® FP120-C	1.0	0.920
HDPE	SCLAIR 19C	1.0	0.958
sLLDPE	SURPASS® FPs016-C	0.7	0.916
B.HDPE	SURPASS® HPs167-AB	1.2	0.967

# Engineered Structure: I-Beam Effect (3 mil film)

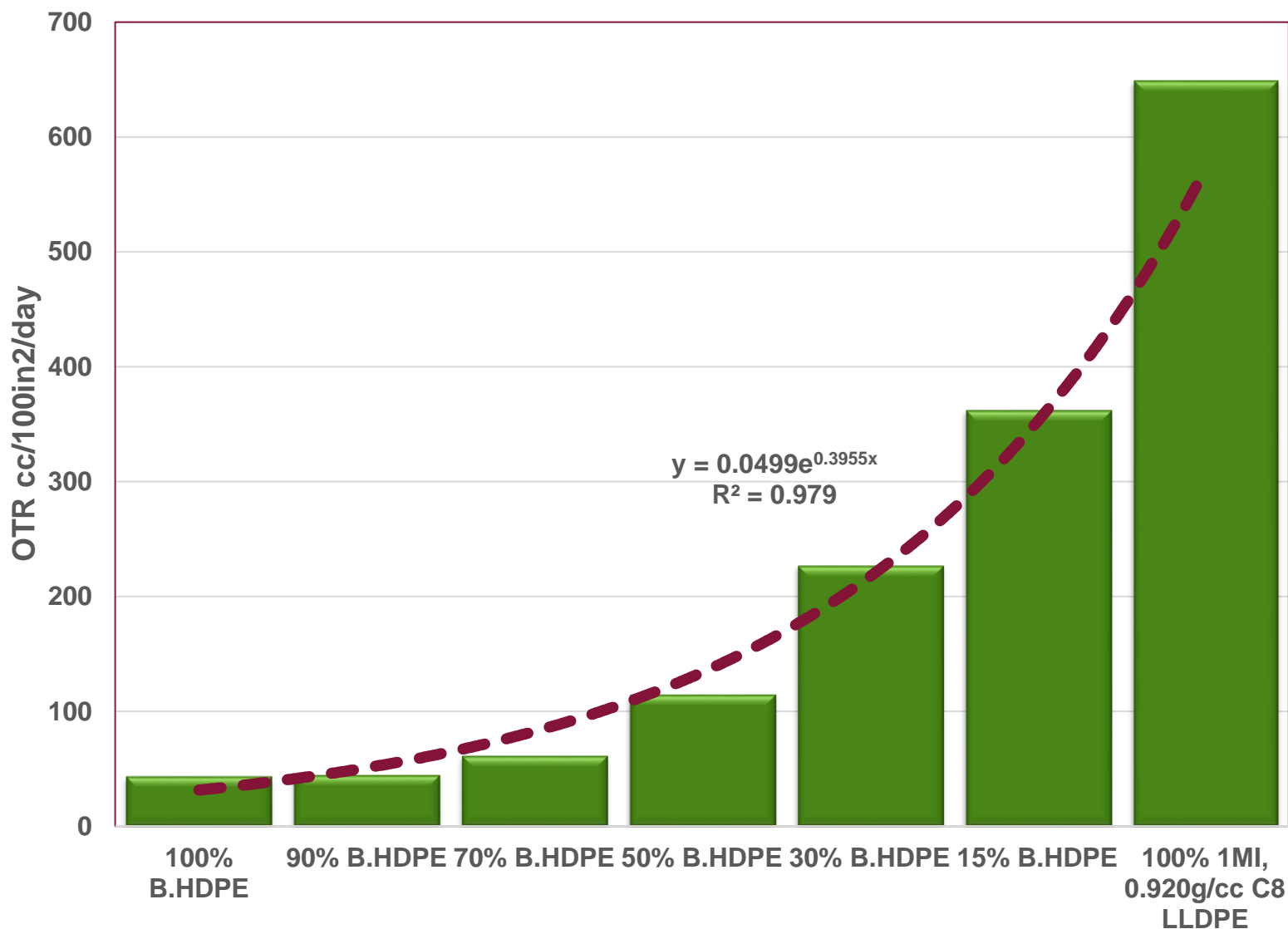


OTR	184 cc/100in <sup>2</sup> /day	68 cc/100in <sup>2</sup> /day	67 cc/100in <sup>2</sup> /day	23 cc/100in <sup>2</sup> /day
WVTR	0.43 g/100in <sup>2</sup> /day	0.16 g/100in <sup>2</sup> /day	0.16 g/100in <sup>2</sup> /day	0.06 g/100in <sup>2</sup> /day
1% Secant	175 Mpa	568 Mpa	567 Mpa	723 Mpa
MD Tear	1260g	241g	171g	140g
Bending Stiffness	6.5N·um	11.0N·um	13.6 N·um	15.9 N·um

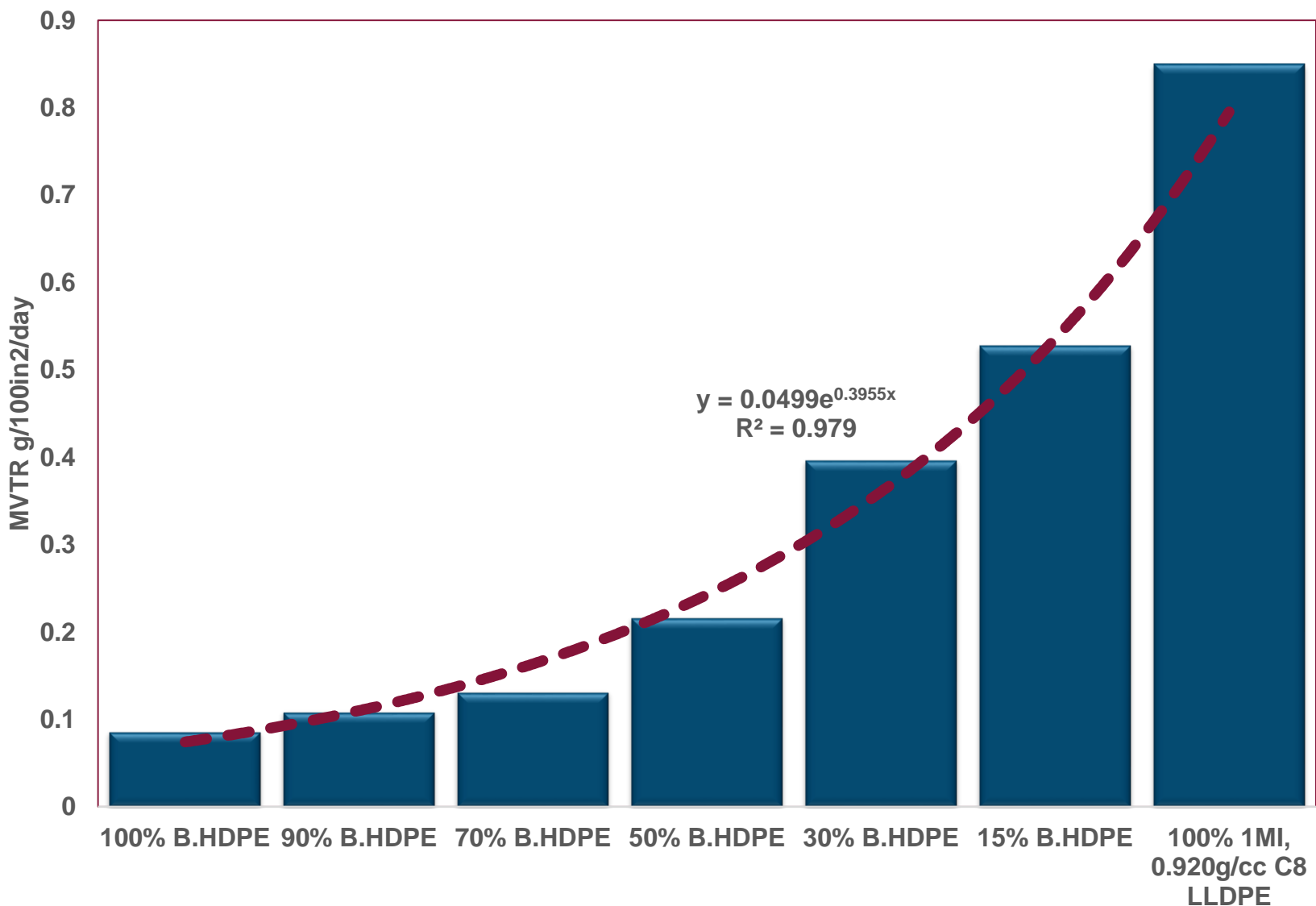
**did you  
know?**

Stiffer films feel thicker than softer films. Also, downgauging of films can be limited by film stiffness due to packing systems. Separation of HDPE will result in higher film stiffness: I-Beam Effect.


# Oxygen Transmission Rate SURPASS HPs167-AB Barrier HDPE Blends



# Moisture Barrier Transmission Rate SURPASS HPs167-AB Barrier HDPE Blends



# BONFIRE<sup>sm</sup> Multilayer Property Predictor











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Target Thickness (Mils)  Run







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### 3 Layer FPs016/19C/FP120

Layer	Materials	Ratio	Thickness	
A	FPs016 - 100%	20%	0.60	  
B	19C - 100%	60%	1.80	  
C	FP120 - 100%	20%	0.60	  
				

### 5 Layer 13.3 FPs016/HPs167/FP120/HPs167/FP120

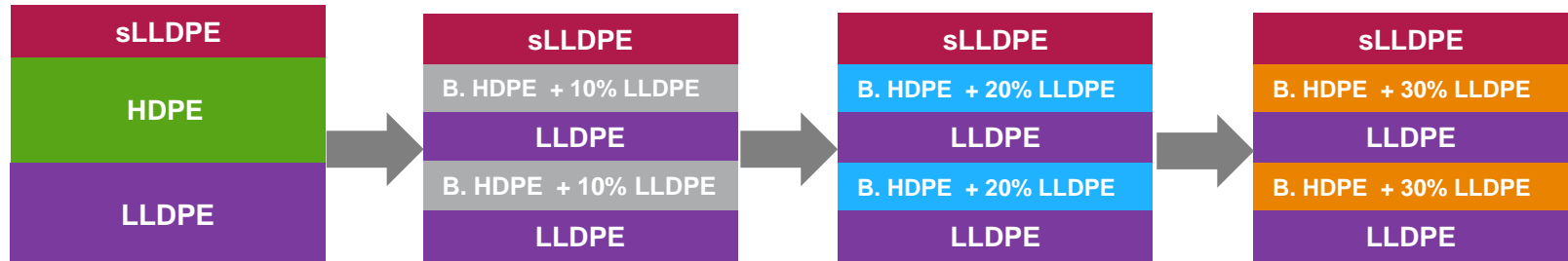
Layer	Materials	Ratio	Thickness	
A	FPs016 - 100%	13.3%	0.40	  
B	HPs167 - 100%	30%	0.90	  
C	FP120 - 100%	13.3%	0.40	  
D	HPs167 - 100%	30%	0.90	  
E	FP120 - 100%	13.4%	0.40	  

 New  
 Save  
 Structures  
 Compare  
 Materials  
 Profile

# BONFIRE<sup>sm</sup> Multilayer Property Predictor

 New	Property Comparisons 			
 Save				
 Structures	5 Layer Poultry Film with sHDPE	3 Layer Poultry Film 	Delta	Units
 Compare	23.25 OTR	67.81 OTR	-66%	cc/100in <sup>2</sup> -day-atm 
 Materials	0.06 WVTR	0.16 WVTR	-63%	g/100in <sup>2</sup> -day 
 Profile	723.5 1% MD Sec Modulus	564.2 1% MD Sec Modulus	28%	MPa 
 Logout	0.5 Penetration Energy	1.2 Penetration Energy	-59%	Joules 
	139.7 MD Tear	241.2 MD Tear	-42%	Grams 
	19.3 Bending Stiffness	11 Bending Stiffness	75%	N-μm 

# Engineered Poultry Film Using BONFIRE<sup>SM</sup> Multilayer Property Predictor (3 mil film)

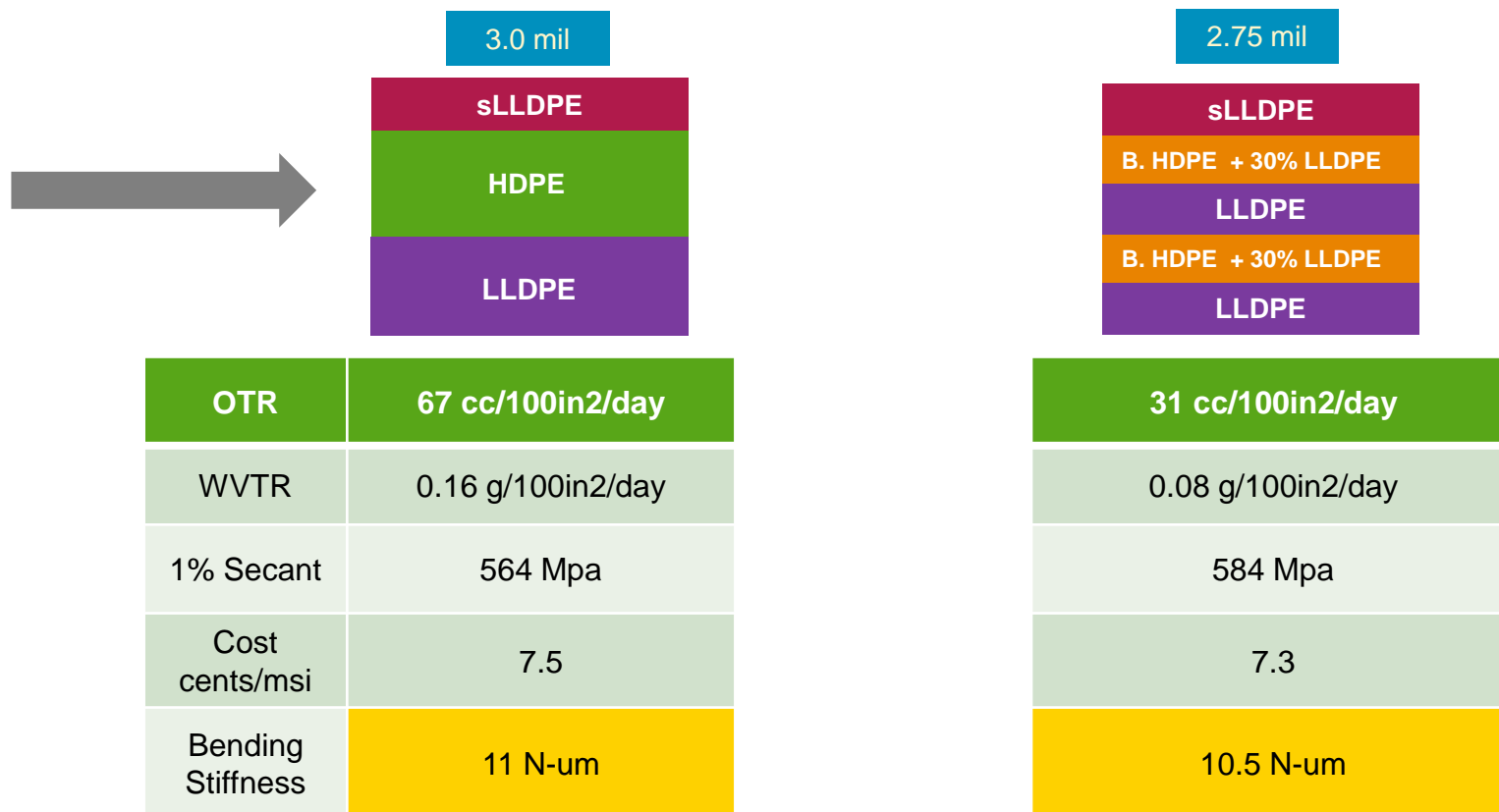


OTR	67 cc/100in <sup>2</sup> /day	23.8 cc/100in <sup>2</sup> /day	26.4 cc/100in <sup>2</sup> /day	28.8 cc/100in <sup>2</sup> /day
WVTR	0.16 g/100in <sup>2</sup> /day	0.06 g/100in <sup>2</sup> /day	0.06 g/100in <sup>2</sup> /day	0.07 g/100in <sup>2</sup> /day
1% Secant	564 Mpa	668 Mpa	612 Mpa	584 Mpa
Cost cents/msi	7.5	8.1	8.0	7.9
Bending Stiffness	11 N·um	15.1 N·um	13.6 N·um	13.2 N·um

did you  
know?

The above values are from the BONFIRE<sup>SM</sup> Multilayer Property Predictor tool, the first in a series of planned calculators and models in support of application development in the food packaging and other flexible film markets.

# Engineered Poultry Film Using BONFIRE<sup>sm</sup> Multilayer Property Predictor Tool



did you  
know?

The above values show how you can adjust the desired film properties / thickness and cost using the BONFIRE Multilayer Property Predictor tool.

# Designed Film for VFFS Poultry package

2.75 mil

sLLDPE

B. HDPE + 30% LLDPE

LLDPE

B. HDPE + 30% LLDPE

LLDPE

<b>OTR</b>	<b>31 cc/100in<sup>2</sup>/day</b>
WVTR	0.08 g/100in <sup>2</sup> /day
1% Secant	584 Mpa
Cost cents/msi	7.3
Bending Stiffness	10.5 N·um

## Desired Properties

Medium oxygen barrier	Maximum Shelf life
Seal-through contamination	Reduced Leakers
Dart and puncture resistance	Package Integrity
Burn-through resistance	Packaging speed
Bending Stiffness	VFFS speed

# Conclusions

- Poultry is the fastest growing segment of the protein market
- Distribution is roughly split between food service and retail
- Food service segment is seeing increased use of Vertical Form Fill and Seal to package parts
- Engineered films using a Barrier HDPE are ideal for a stiffer, downgauged film while maintaining shelf life requirements.
- The BONFIRE<sup>sm</sup> Multilayer Property Predictor allows customers to quickly simulate the properties of potential multilayer films.

# Come work with us!



**Shrink Tunnel**



**Horizontal FFS**



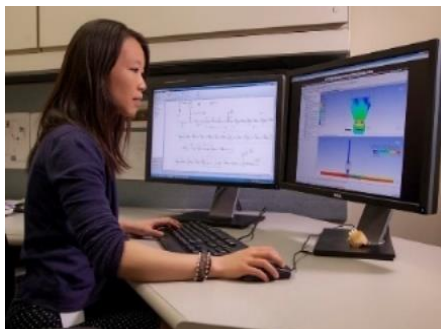
**Vertical FFS**



**9 Layer Blown Film Line**



**Testing Labs**



**Virtual Design Tools**



**Adhesive Laminator**



**Thermoformer**



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