Future of Feed Mill Manufacturing

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Presentation Overview

- Sustainability
- Energy Conservation
  - Boiler
  - Electricity
  - Transportation
- Biosecurity
- Feed Mill Efficiency
  - Automation
  - Batching accuracy
  - Shrink

Sustainability

Sustainability is the capacity to endure in a relatively ongoing way across various domains of life. In the 21st century, it refers generally to the capacity for Earth's biosphere and human civilization to co-exist.

Wikipedia

Economic Sustainability

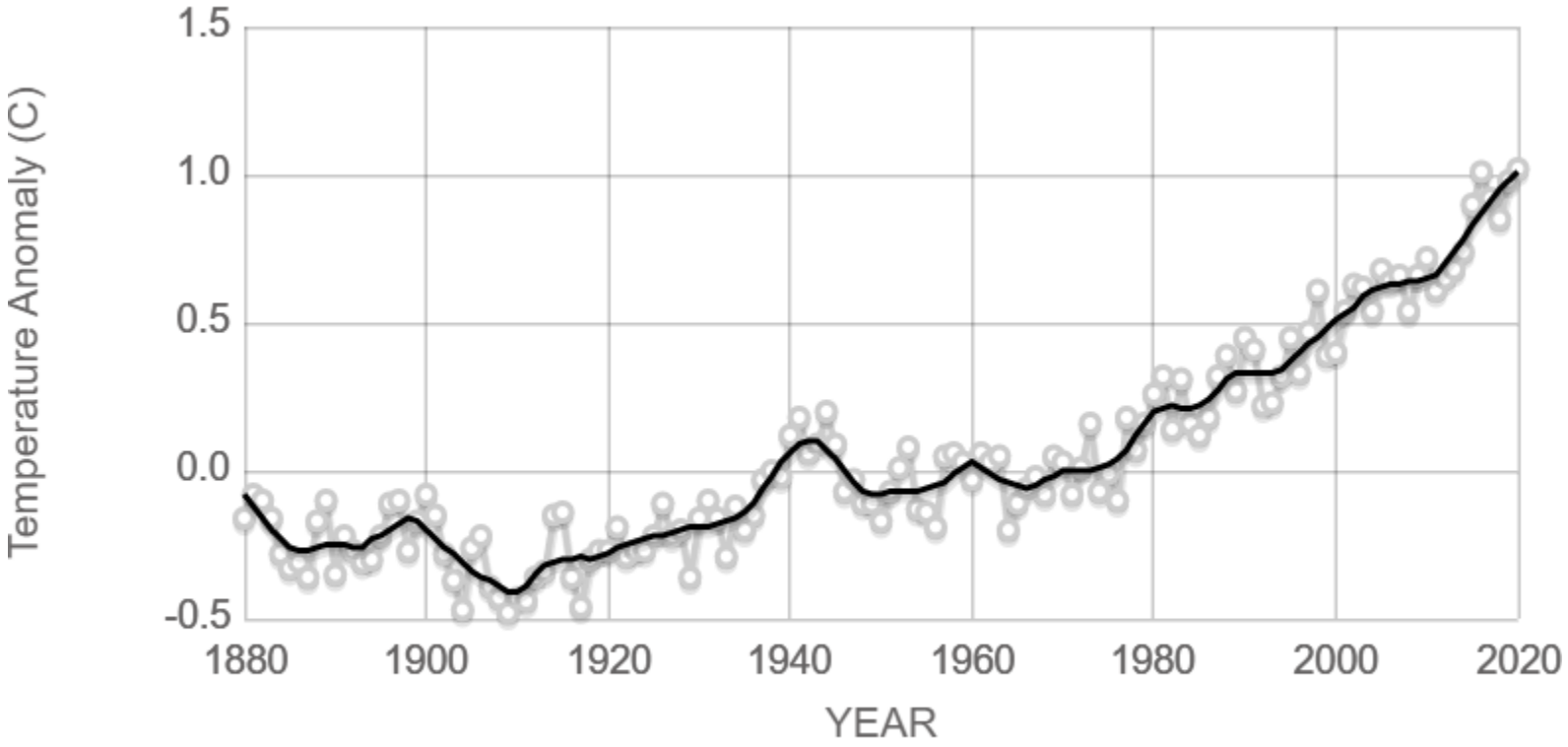
- Economic sustainability refers to **practices that support long-term economic growth without negatively impacting social, environmental, and cultural aspects of the community**.

- Feed Mill
  - Customer expectations vs Animal performance
  - Automations vs Employees
  - Environment vs Cost

Major Challenges to the Feed Industry

- Climate Change/Warming of the Earth
- Water Scarcity/Drought
- Global Population
- Global Pandemic
- Green Energy

Earth Temperature



Source: climate.nasa.gov

Effect of Weather on Animal Industry

- Availability of feed ingredients
- Cost of feed ingredients
- Use of more by-products
- Less water more droughts in certain regions
- CO_2 emissions regulations
- More natural disasters
  - Food
  - Oil
  - Human capital

ENERGY MANAGEMENT

Energy Management Resources

FMT - Online

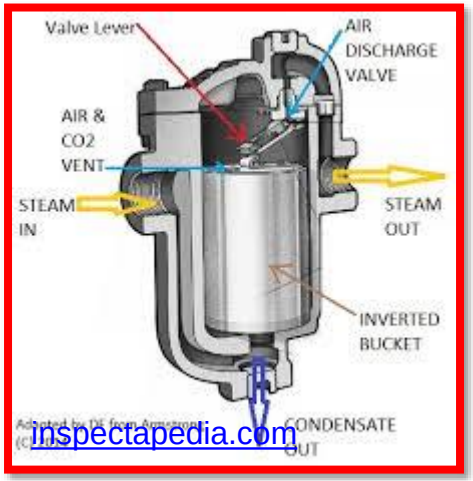
SECTION XI: ENERGY MANAGEMENT			
1	Organizing an Energy-Management Program	2020	XI-3
2	How to Calculate Energy Requirements by System	2020	XI-6
3	Energy Audit	2020	XI-12
4	Energy Calculations and Conservation Opportunities	2020	XI-16
5	Methods of Conserving Energy	2020	XI-28
6	Resources	2020	XI-32

Energy Goals/KPI

- Do you have energy Key Performance Indicators?
  - BTU/ton
  - MCF or Gal/ton
  - kWh/ton
  - $$$/ton
  - Operational efficiency
    - Motor operating at capacity
    - Throughput by process
- Energy management is good for sustainability and the environment.

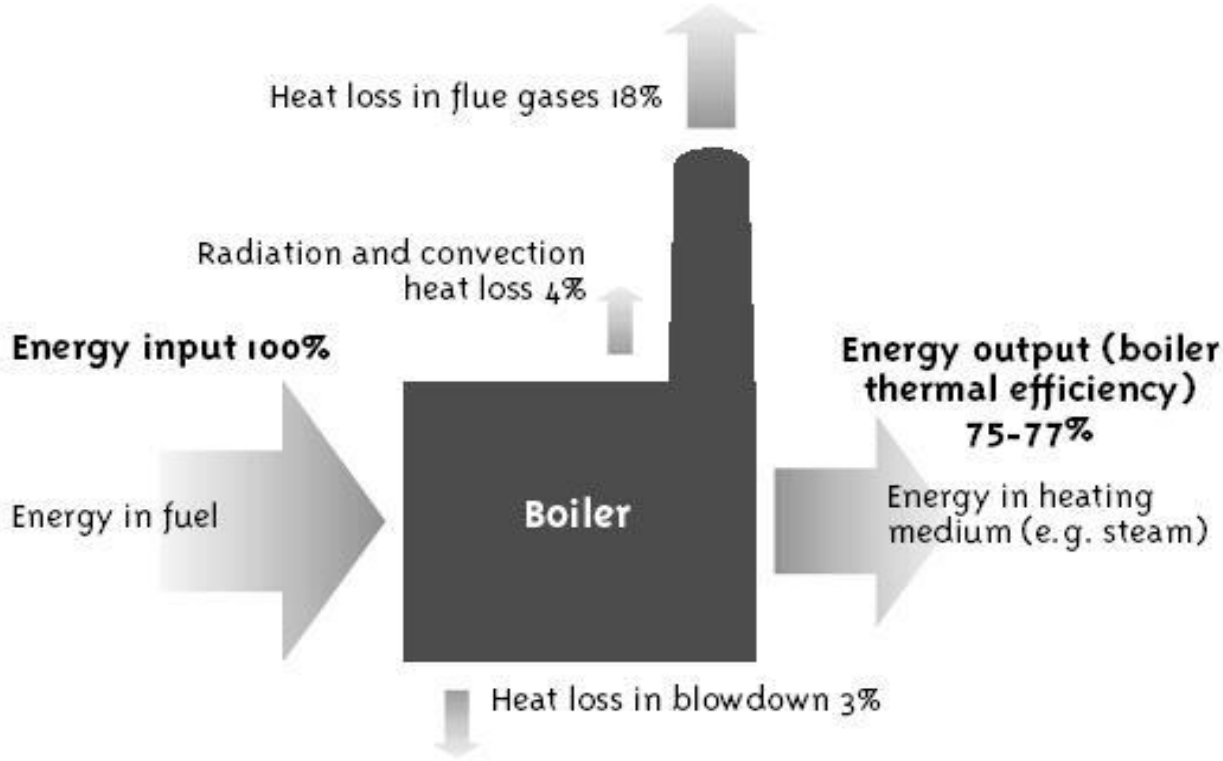
Energy Audits

Steam



Electricity

Boiler



http://www.energysolutionscenter.org 3/9/08

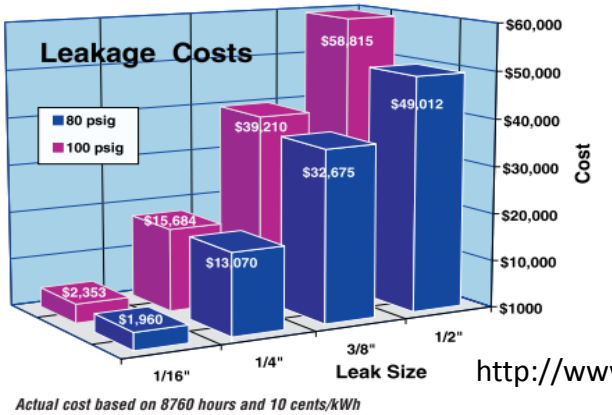
Motors and Lights

- Record watts of lights used, but not necessary.
  - Watts per hr./day _____ / 1000 = kW/hr._____

- List equipment systems and number of hours running day, but not being used.
  - Motor ____ HP ___ **Running System Not Used Hr./Day ____**

Air Compressor

- Record pressure at compressor with no air users operating.
  - 15 min_____
  - 30 min_____
  - 45 min_____
  - 60 min_____



http://www.kaeser.ca/

- If more than a 10 lb. drop in 1 hour, identify all air leaks.

  Number _____

- Does air compressor draw air from outside?
- Yes ___ No___

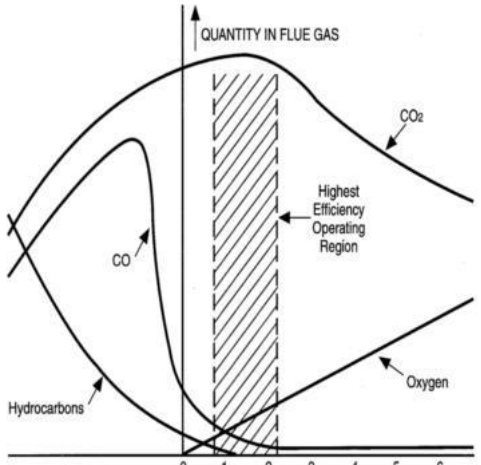
ENERGY CONSERVATION

Boiler Efficiency Analysis

Efficiency Check

CleaverBrooks

1. O2 & CO
2. 70 – 80%
3. Tune-up
4. Air/fuel drives
5. O2 Trim
6. Updating BMS
7. New burner

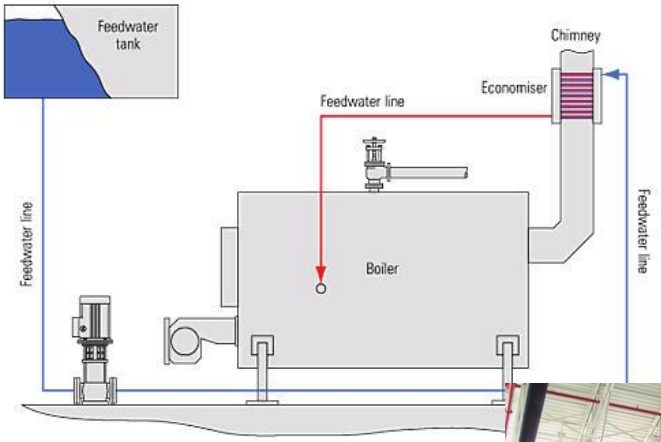


www.natcomonline.com

http://www.energysolutionscenter.org 3/9/08

Source: Steve Connor, 2010

Energy Savings - Economizer



- Example – 500 hp Boiler
  - 20,000,000 BTU
  - 5% recovered with economizer
  - 1,000,000 BTU's
  - Water returned to boiler

http://www.energysolutionscenter.org 3-5-08

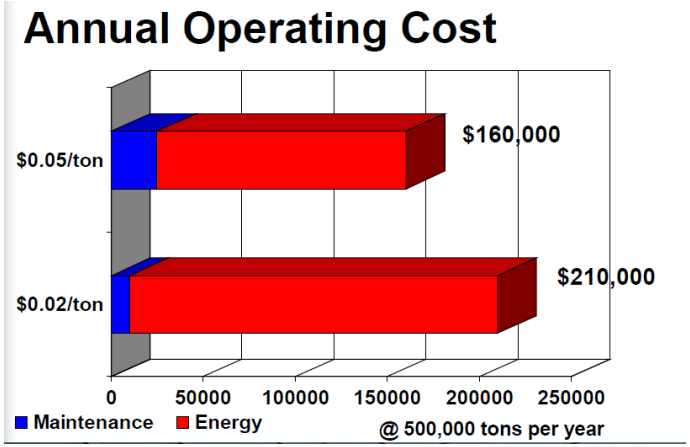
Hammermill Efficiency

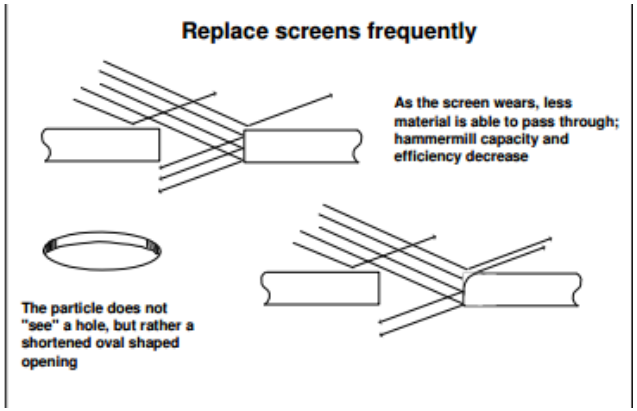
Maintenance cost

- $0.02 – 0.05 per ton grinding corn for a complete feed

Energy cost

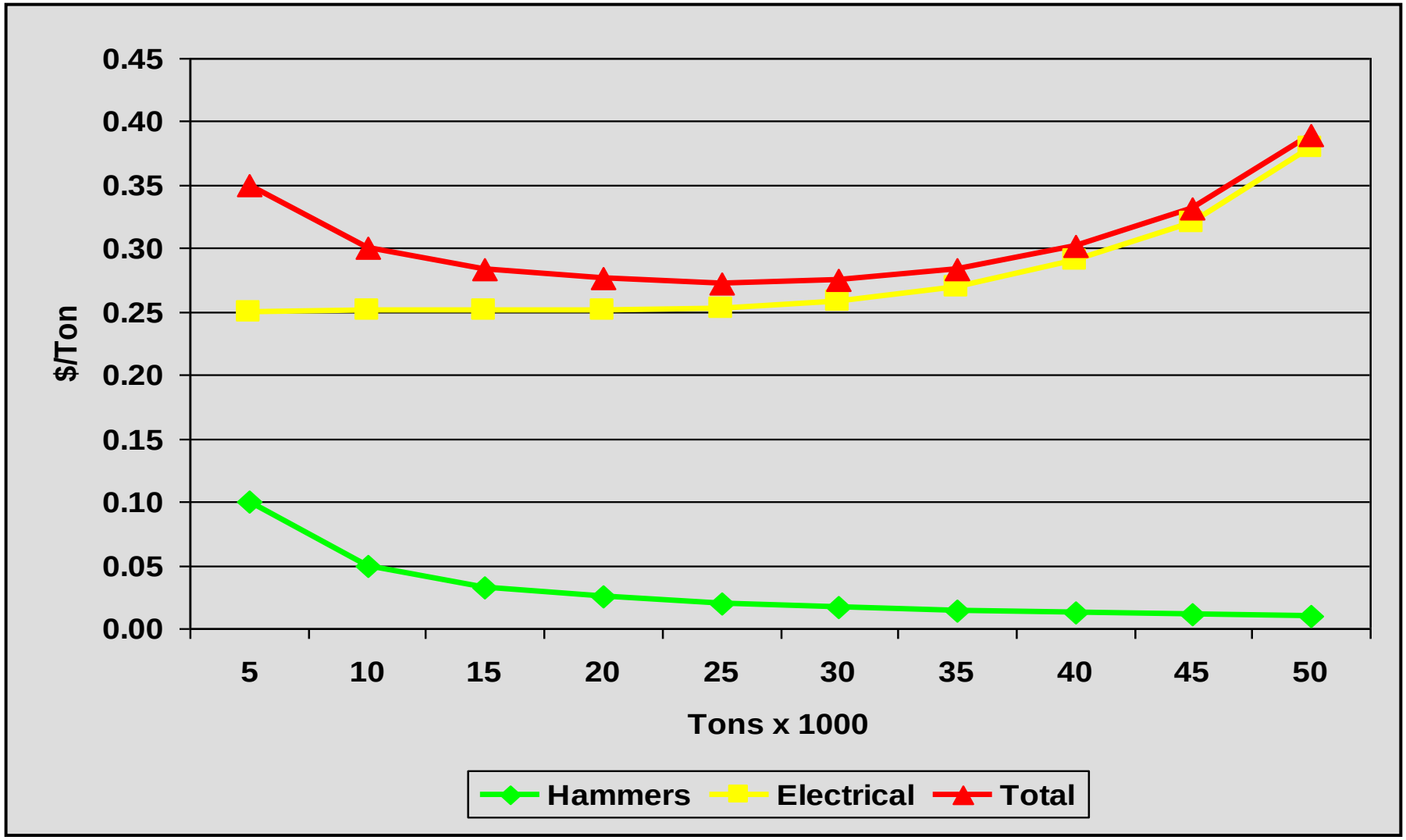
- $0.15 - $0.35 per ton





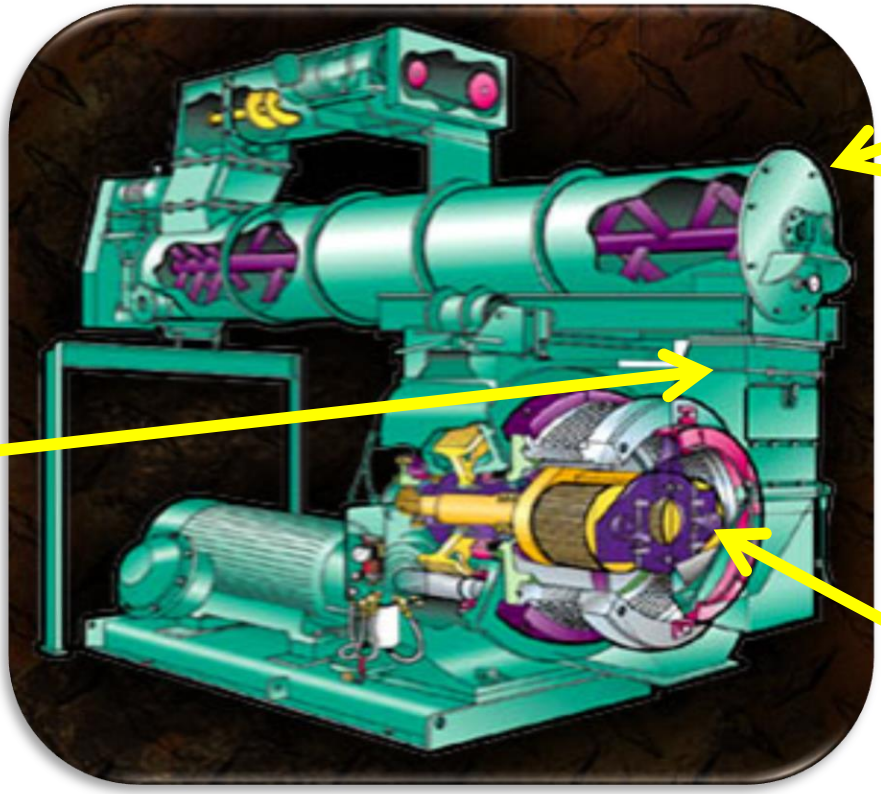
Anderson, 2010

Optimization of Grinding



Pellet Mill Efficiency

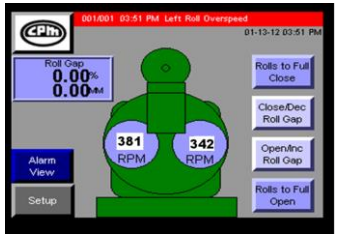
Temperature
Moisture



Conditioner

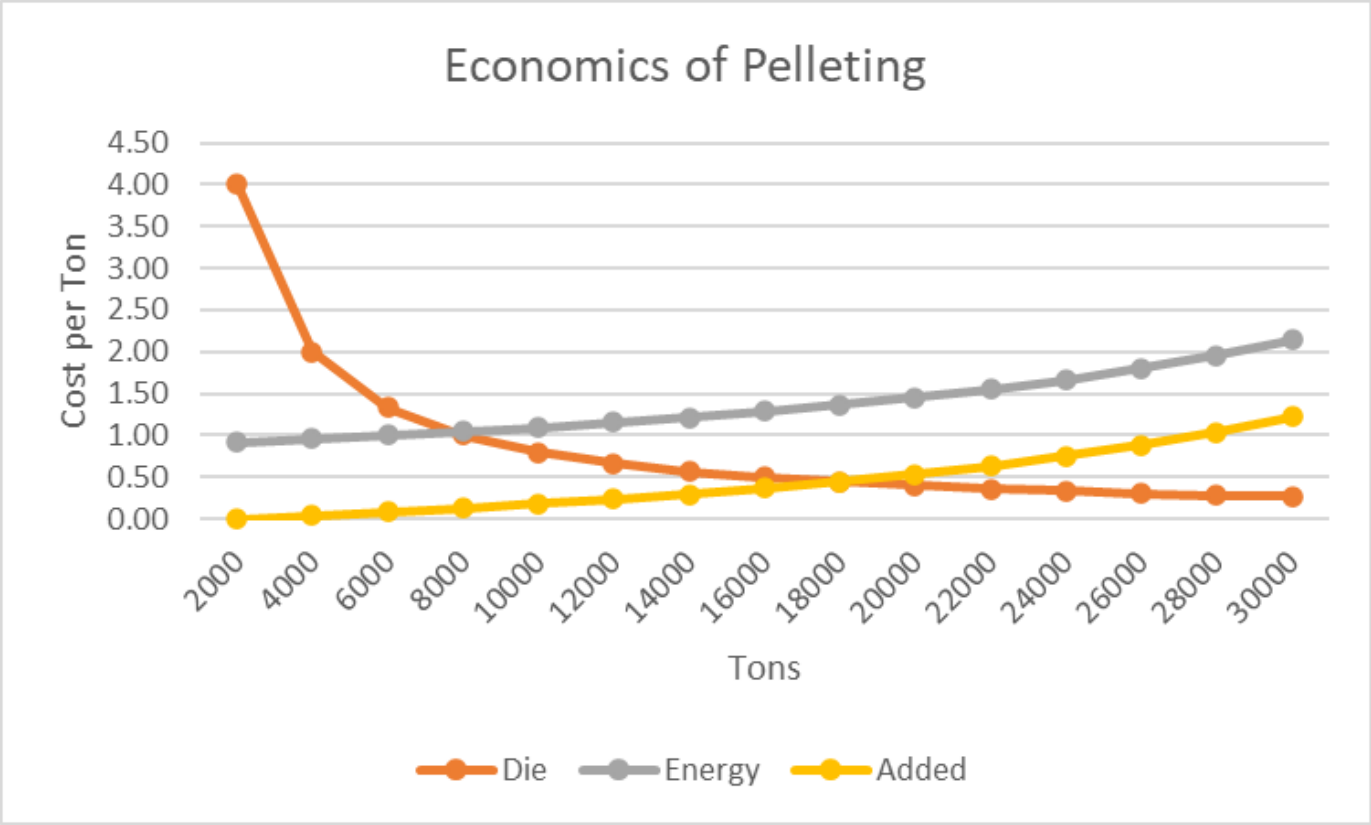
VFD

Die & Rolls



http://www.cpmroskamp.com/pelletmill/products/pelletmills/

Optimization of Pelleting



Laser Align V-Belts

V Belt Alignment Tool - Pulley Pro Green

Get more out of your belt driven equipment with proper belt alignment using PULLEY PRO belt alignment tool.

Patented Reflected Laser Beam Technology

The Pulley PRO® Green Belt Alignment Tool is light-weight, compact and durable. The unit magnetically attaches to the inside or outside face of any pulley or sprocket and has no small parts or targets that can get lost. We use our proven reflected laser beam technology for maximum angular resolution, thus providing you with the most reliable and accurate readings that no other method or belt alignment tool can match.

Using the latest in Green laser diode technology makes our green laser line 10x's brighter to the operator than a red laser line for better belt alignment.

Category: Laser Pulley & Belt Alignment Tools

INSTALLATION & MAINTENANCE TOOLBOX

Carry everything you need to install and align a new drive belt in one case!

View Toolbox »

CONTACT US FOR DETAILS!

NAME *
Name (Required)

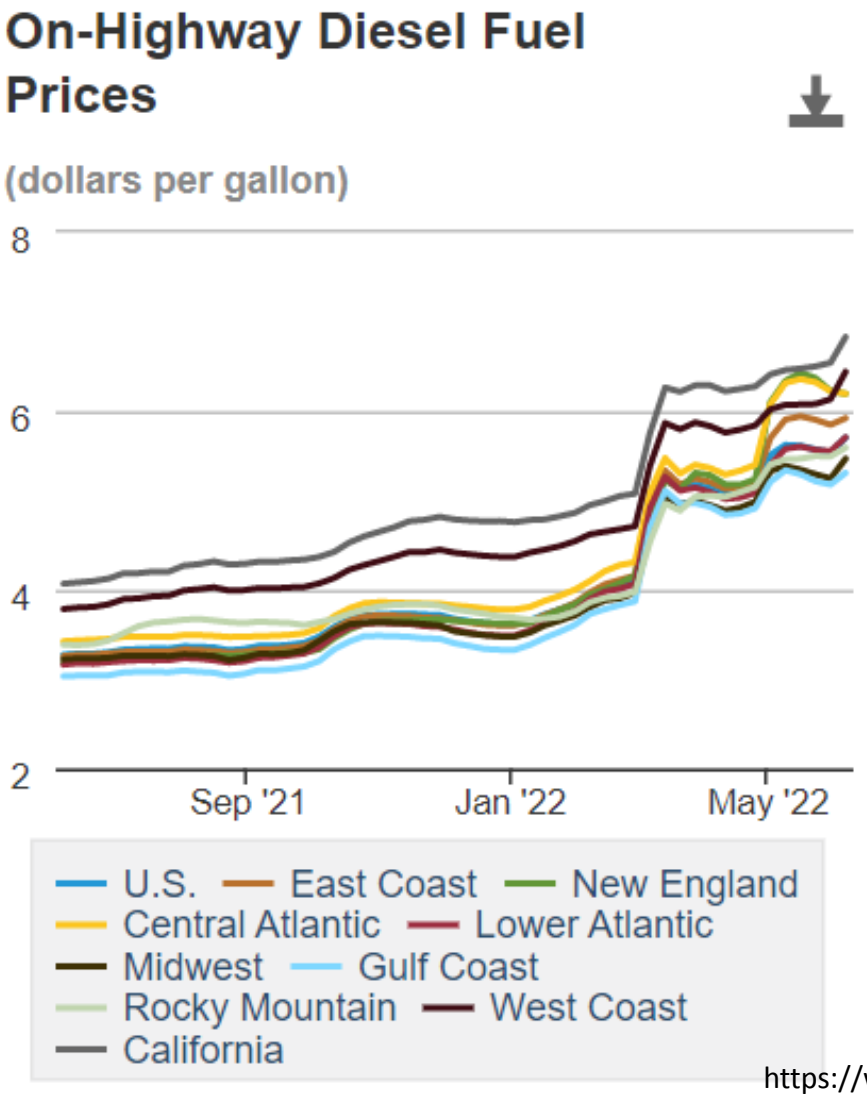
EMAIL *
Email (Required)

PHONE
Phone

Direct Drive Gearboxes

- Eliminates belt slippage and power transfer problems.

Transportation Fuel Cost



https://www.eia.gov/petroleum/gasdiesel/

Feed Delivery – Transportation Cost

Feed Delivery	Tons Delivered			
	21	23	25	**27**
Cost/Load, $	100	100	100	**100**
Delivery Cost, $/ton	4.76	4.35	4.00	**3.70**
Additional Cost, $/ton	1.06	0.64	0.30	**0**

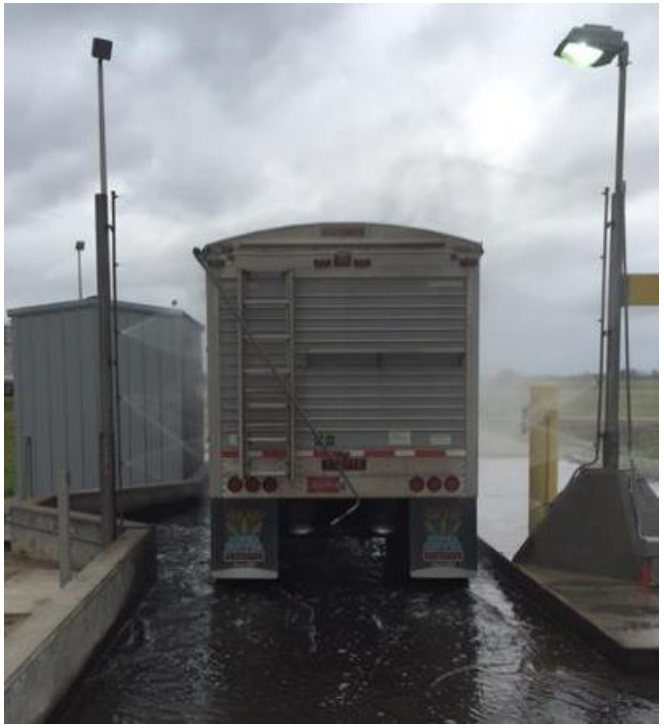
Feed Delivery	Round Trip Miles to Farm			
	20	30	40	50
Cost/Load, $ ($5/ton@24ton/Load)	120	120	120	120
Cost Per Mile	6.0	4.0	3.0	2.4

BIOSECURITY

Biosecurity Policy

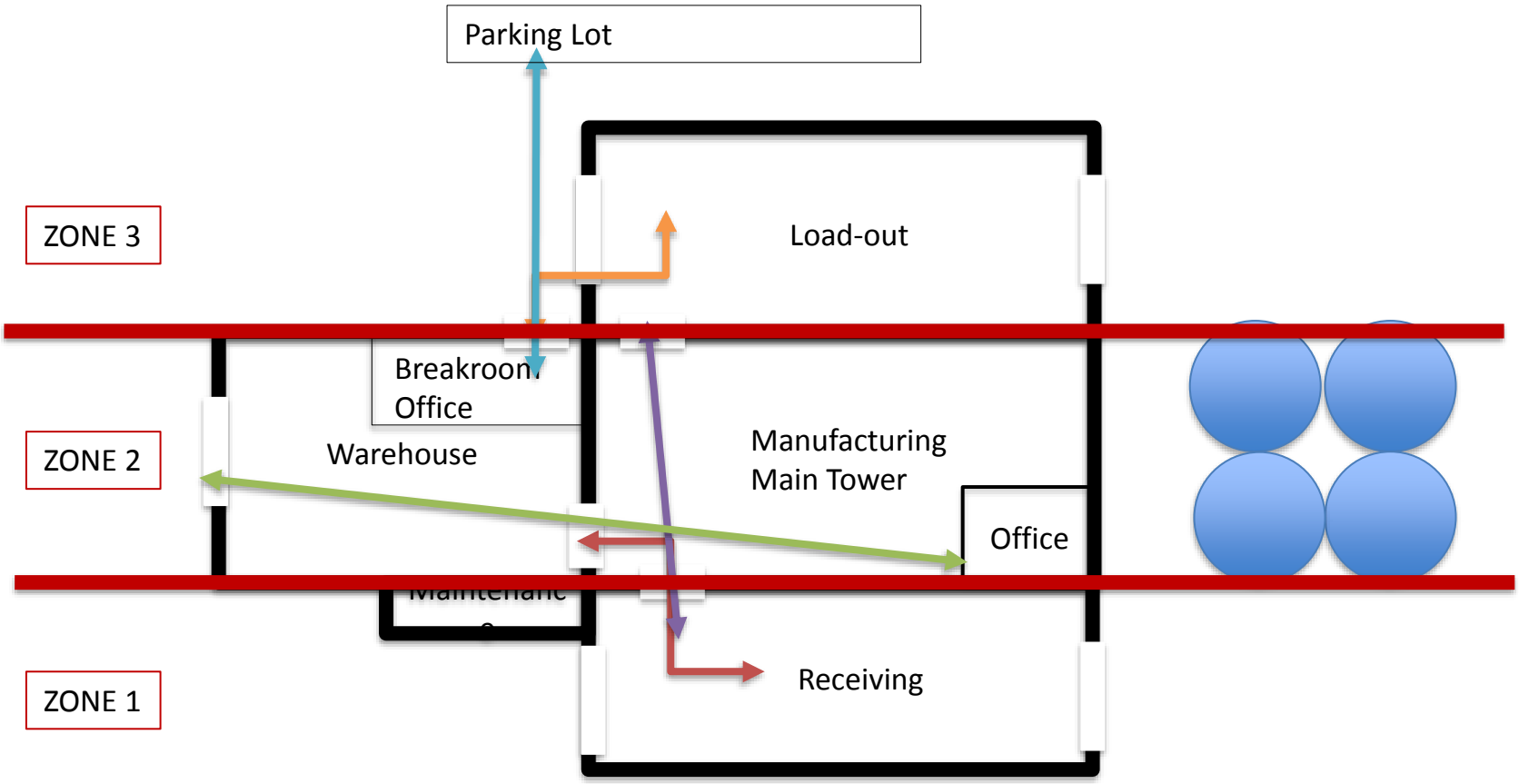
- Visitors Policy
  - Days since last contact with animals
  - Clothing while at the plant (boots, coveralls, gloves)
- Ingredient purchasing
  - Verified suppliers
  - Purchasing specifications (quarantine days)
- Employee Policy
  - Animals at home
  - Hygiene
  - In-plant movement

Vehicle Sanitation

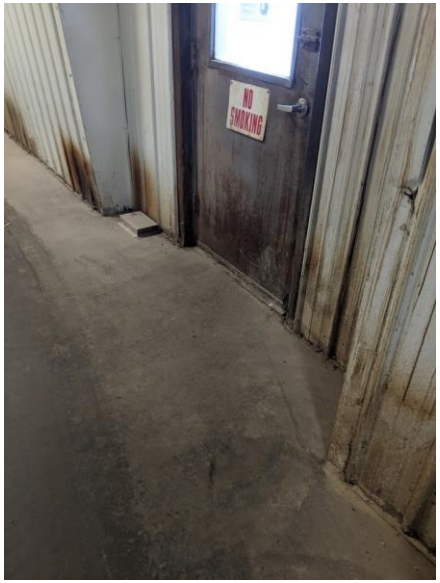


Photos: Frank Garczynski

People Preventive Control



Biosecurity at Feed Mill Doors



No Biosecurity

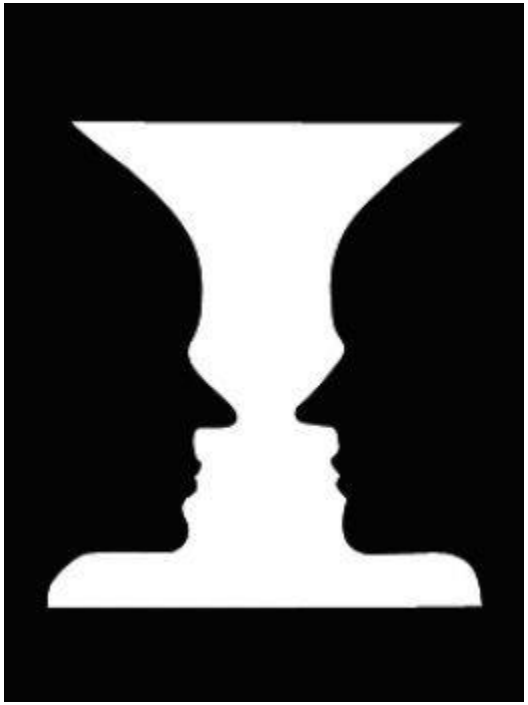
Boot Pad - Dry

Boot Pad - Wet

FEED MILL EFFICIENCY

Manufacturing Challenges

- Manufacturing challenges can be viewed as problems or an opportunity for improvement.



What do you see in the picture?

Production Cost *vs* Formulation *vs* Quality

Least Cost Formulation

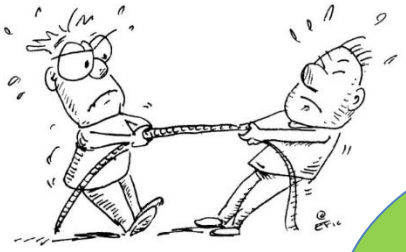
Throughput

Maximizing Feed Mill Performance

Cost

Feed Safety

Pellet Quality



Maximizing Animal Performance

Nutrient Quality

Customer Perception of Quality

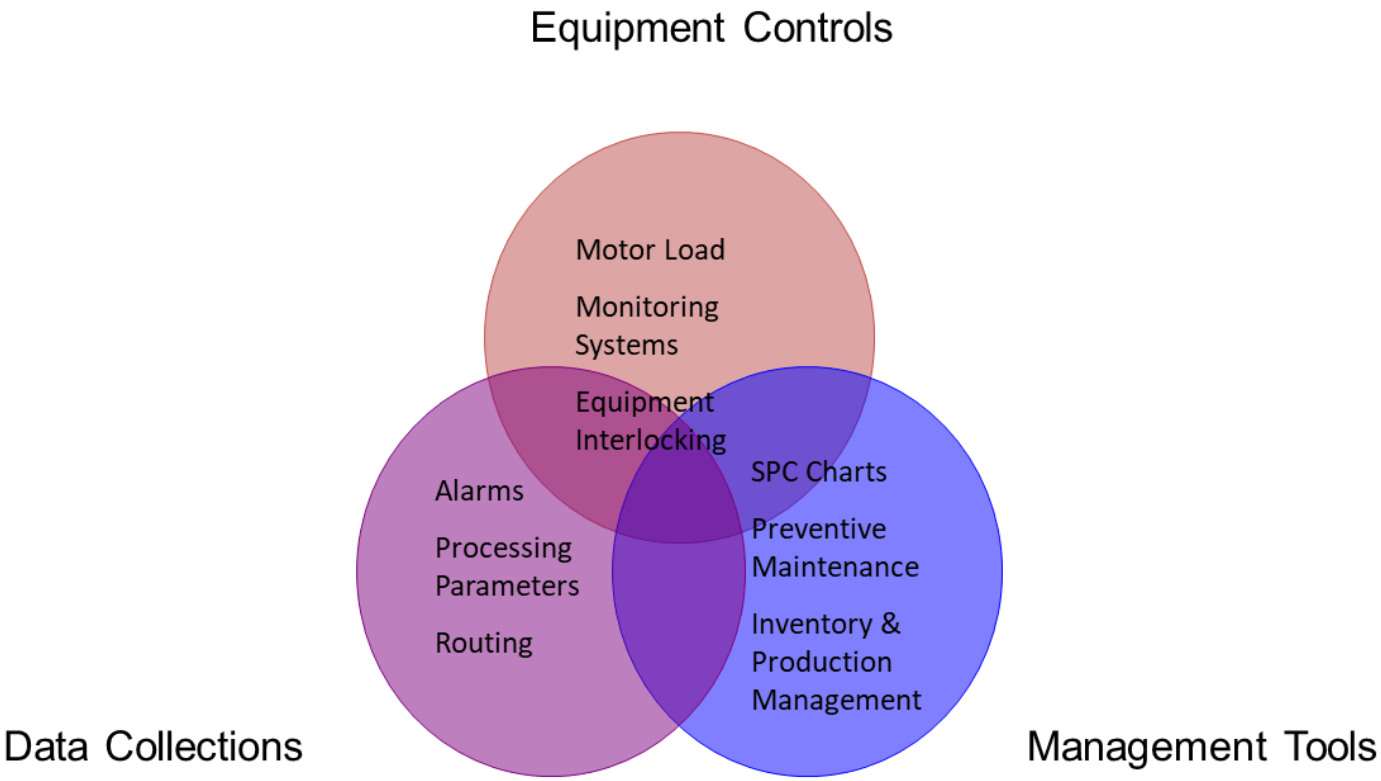
Business/Customer Objectives

- Lowest live production cost
- Lowest feed cost
- Lowest manufacturing cost
- Lowest delivery cost
- Production of a premium product
- Customer feed specifications
  - Nutrient requirements
  - Particle size
  - Pellet quality and pellet fines

Feed Mill Key Performance Indicators

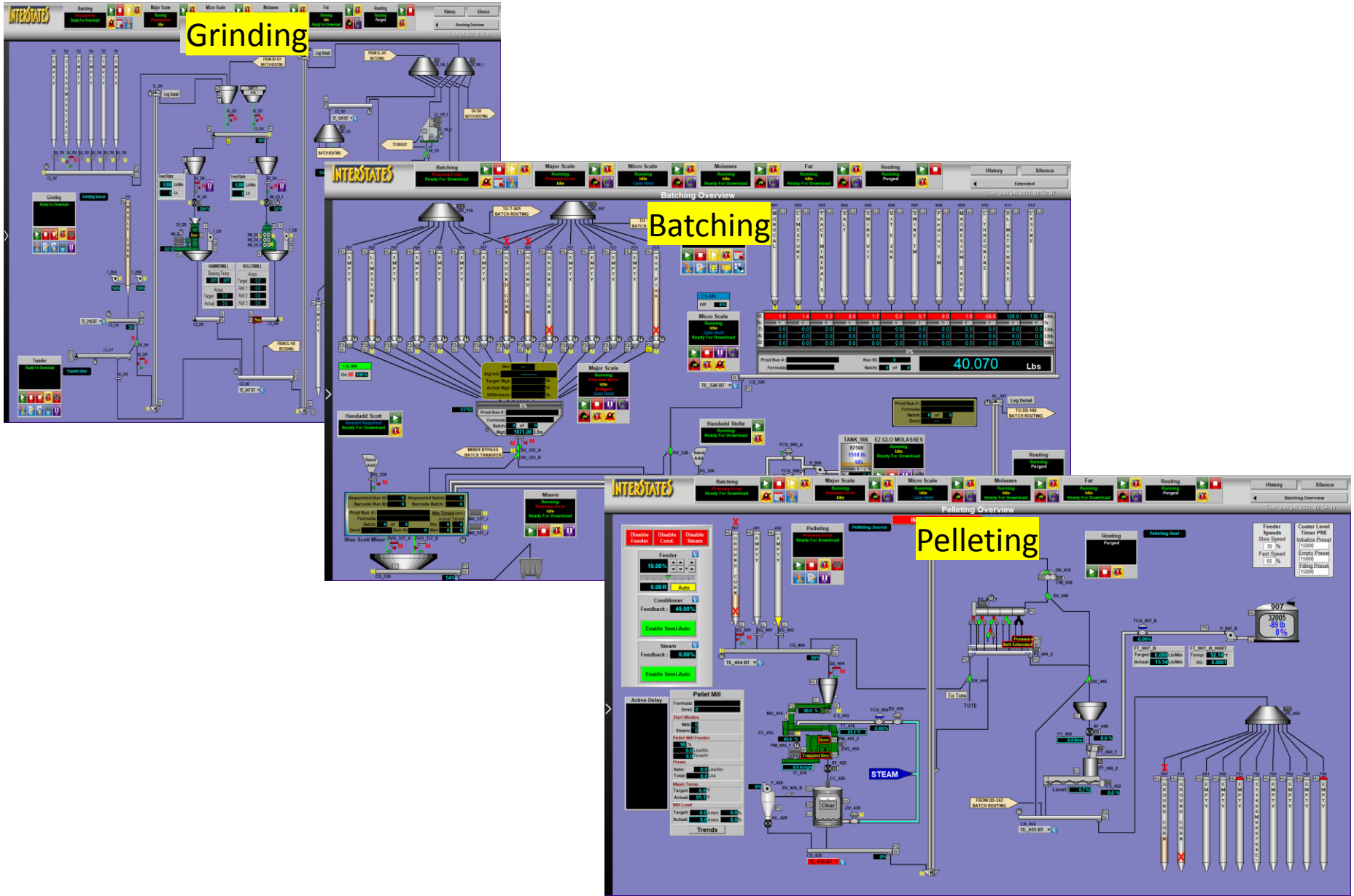
- Productivity
  - Tons/man hr
  - Changeovers
  - Tons per run
  - Energy per ton
    - Electrical
    - Fuel
  - Actual vs. scheduled hrs
  - Bagged tons per day
  - Downtime
    - Unplanned vs. planned
  - Transportation efficiency
  - Load-out waiting time
  - Shrink
  - Pellet quality

Integrated Computer Systems



Integrated computer systems manage the process and collect data simultaneously. Collected data can be analyzed or reported to multiple users and managers on site or in remote locations.

Process Automation



Smart Moisture Sensor Technology

REAL-TIME
IN-LINE

Microwave Analyzer

Digital Capacitance

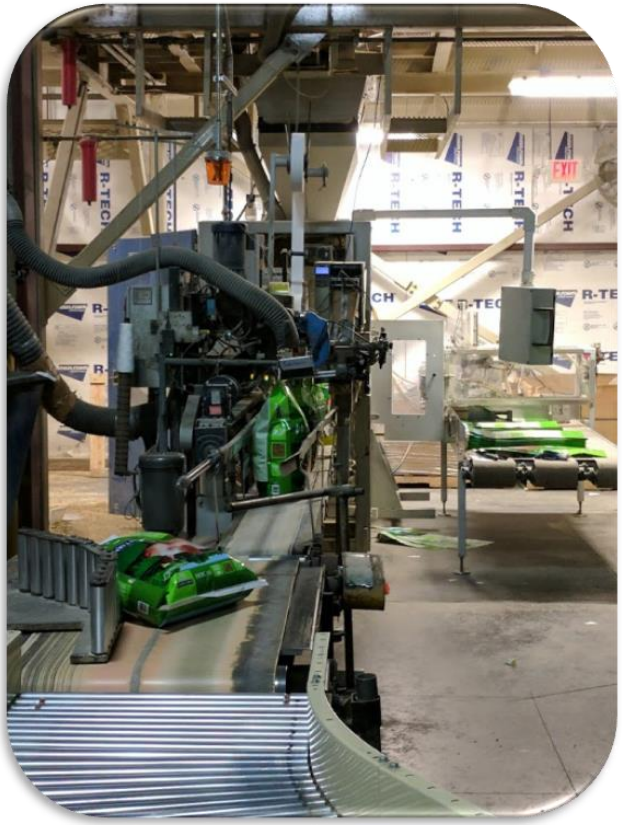
NIR Moisture Analyzer

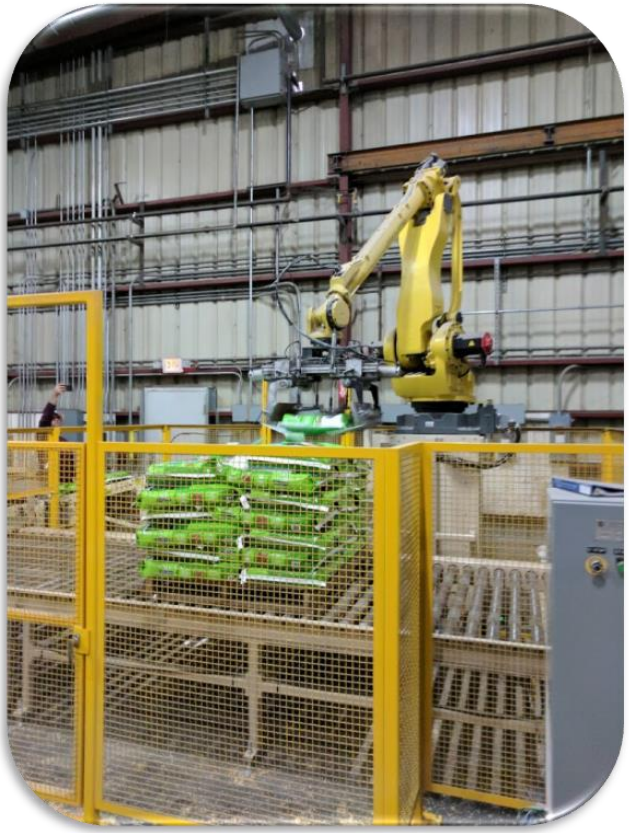
(1) Real-time
(2) Accurate and repeatable
(3) Big data; analyzed and transferred instantly
(4) Relies less on human intervention

BUT it is critical to understand and manage moisture for achieving meaningful long lasting results

Source: Agentis Innovations Limited

Automated Packaging Lines





Microswitches and electric eyes are used to determine the position of bag during filing and location of pallets for robotic stacker.

Statistical Process Control

- SPC is the method of using specialized statistical probability methods to monitor and detect external influences on a systems performance.
- SPC should first be used to stabilize out-of-control processes, but it can also be used to monitor the consistency of products and services.

Source: *Six Sigma for Dummies, 2012*

Value of SPC

- Opens communication between departments
- Removes subjectivity of results
- Summarizes large amounts of data
- Converts numbers to visual charts
- Identifies changes in the system
- Identifies problems in the process
- Monitors the outcome of changes

Least Cost Formula vs. Batching Errors

			Feed Mill Scales	
	%	3 ton Mix	Major +/-2 lbs	Minor +/- 1 lbs
Corn	63.91	1917.3	1916-1918	
SBM	19.82	594.6	594-596	
DDGS	10.0	300.0	300	
Phosphate	1.38	41.4		41-42
Salt	0.43	12.9		12-13
Lysine	0.21	6.3		6-7

Batch Production Report Data

- Determine the difference between the theoretical and actual amount of ingredient added.
  - Enter the “+” or “–” number into the excel spreadsheet.
  - Enter a minimum of 25 data points for each ingredient
  - Data points must be in sequential time order.
- Calculate the specification limits.
  - Determine the average amount/call for each ingredient.
  - **Multiple the average amount by 1% (> 5 lbs /batch).**
  - **Multiple the average amount by 2% (< 3 lbs /batch).**

Batching Data

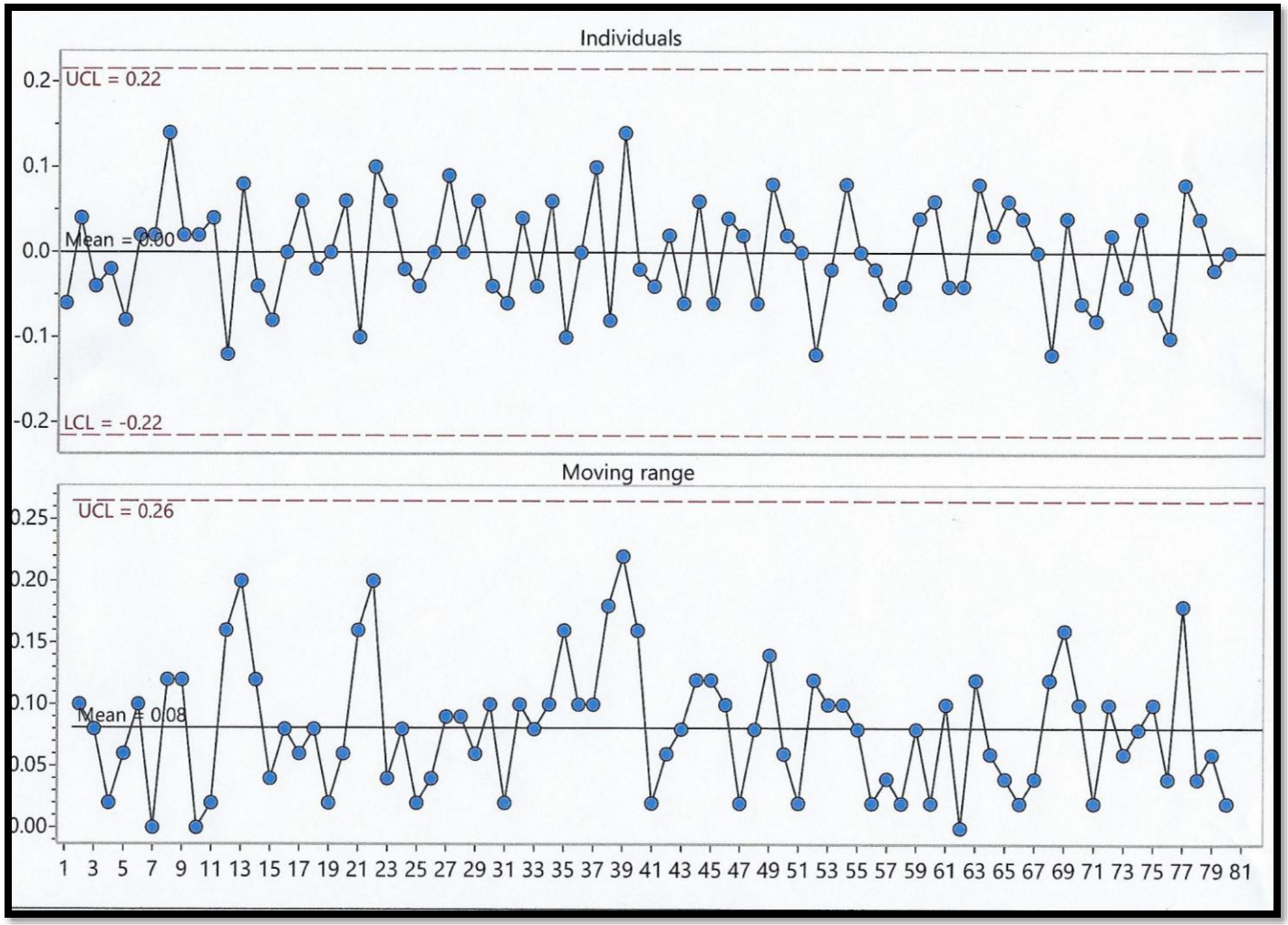
BATCH RUN SUMMARY REPORT

System: BATCHING Run ID: 9362

20140421001219MM **Formula:** 311453P000300P ~ PHASE 3 NURSERY **Work Order #:** 9412
Destination: 402 **Oper:** McAtee
Start Time: 4/21/14 11:00 **End Time:** 4/21/14 10:43 **Number of Batches:** 1 **Batch Size:** 2000 lb

Item Code	Description	Lot Code	Source Equip	Target Quantity	UOM	Actual Quantity	UOM	Dev. %	Comments
HANDADD SCALE									
23210	DL-METHIONINE		WAREH(	2.30	lb	2.30	lb	0.00	
23310	L-THREONINE		WAREH(	2.30	lb	2.30	lb	0.00	
88009	HIPHOS 2700		WAREH(	0.30	lb	0.30	lb	0.00	
		Total for HANDADD SCALE:		**4.90**	**lb**	**4.90**	**lb**	**0.00**	
MAJOR SCALE									
11102	GROUND CORN		311	1,275.38	lb	1,277.00	lb	0.13	
21100	SOYBEAN MEAL (DEHULI		304	657.20	lb	658.00	lb	0.12	
		Total for MAJOR SCALE:		**1,932.58**	**lb**	**1,935.00**	**lb**	**0.13**	
MICRO SCALE									
23100	L-LYSINE 78.8%		012	6.00	lb	6.00	lb	-0.03	
52120	LIMESTONE		002	19.51	lb	19.50	lb	-0.03	
52225	MONO CALCIUM PHOSPH		001	22.01	lb	21.97	lb	-0.17	
52310	SALT		004	7.00	lb	7.17	lb	2.40	
71000	SWINE TRACE MINERAL		007	3.00	lb	2.88	lb	-4.03	
71100	SWINE VITAMIN KSU		005	5.00	lb	4.95	lb	-1.03	
		Total for MICRO SCALE:		**62.52**	**lb**	**62.47**	**lb**	**-0.08**	
		Total for 20140421001219MM:		**2,000.00**	**lb**	**2,002.37**	**lb**	**0.12**	

SPC Control Chart Example



Target addition = 4 lbs (1.8 kg)

Take Home Points

- Sustainability is an on-going process that must be evaluated in the animal and feed industry to help improve the current environmental conditions.
- Biosecurity requirements will continue to increase in feed mills and feed delivery.
- Automation of feed mills will continue to reduce operating costs and improve the accuracy of operations.
- **Business Objectives** and **Key Performance Indicators** must be part of the **Business/Operations Culture**.

Thank You

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