

uponor Lean Green Project

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Advisor: Jane Paulson

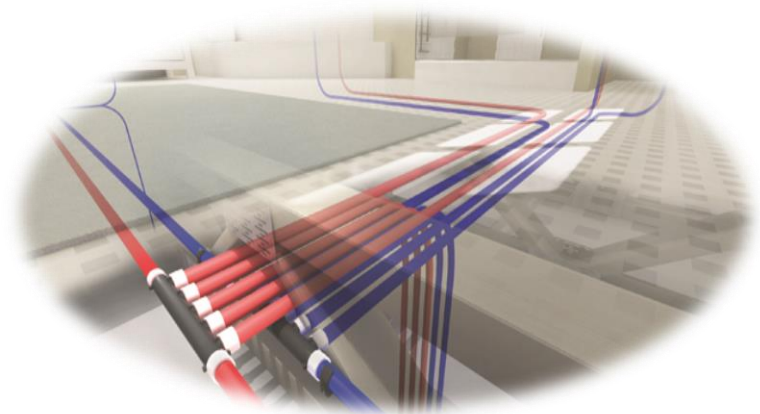
Minnesota Technical Assistance Program

UNIVERSITY OF MINNESOTA

Overview

Overview: The Company, Uponor

- 4p-σ-ηωα
- Cross-linked Polyethylene pipe (PEX) extrusion
- Plumbing, radiant heating/cooling, fire safety
 - Residential
 - Commercial



Overview: The Project

- New extruder system
 - Faster production
 - Higher operation cost
 - Same proportion as production gain
 - No net gain for Uponor
- Goal: Minimize operational costs through reduction of energy, water, and other inputs, using Lean tools and philosophies

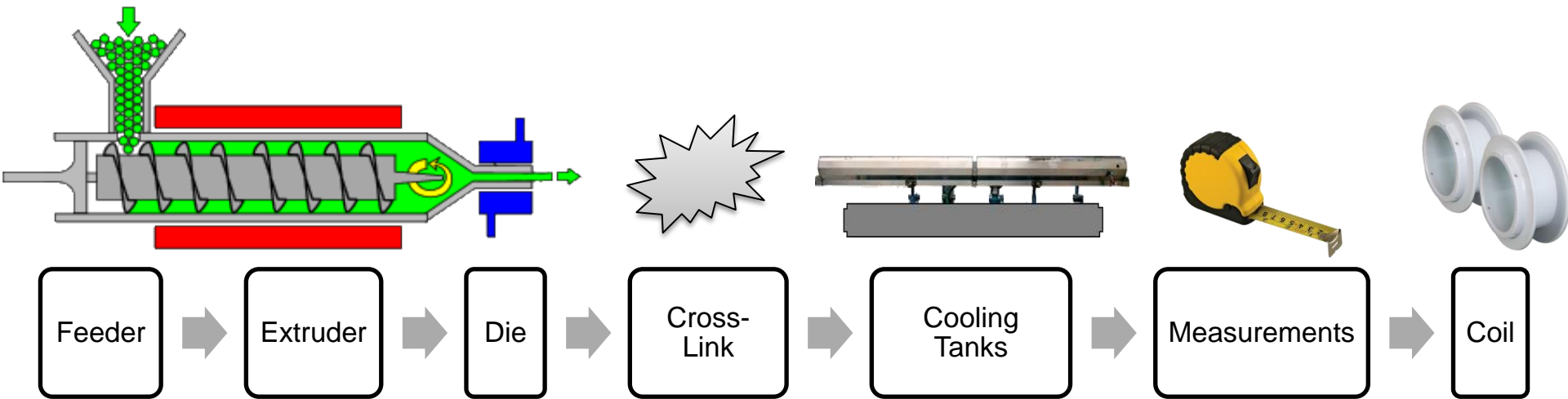
Approach: Lean Manufacturing

- Philosophy based on continuous improvement
 - Minimize waste
 - Defective product
 - Overproduction
 - Waiting
 - Non-/Under-utilized talent
 - Transportation
 - Inventory
 - Motion
 - Excessive processing

Extrusion Overview



Extrusion Overview

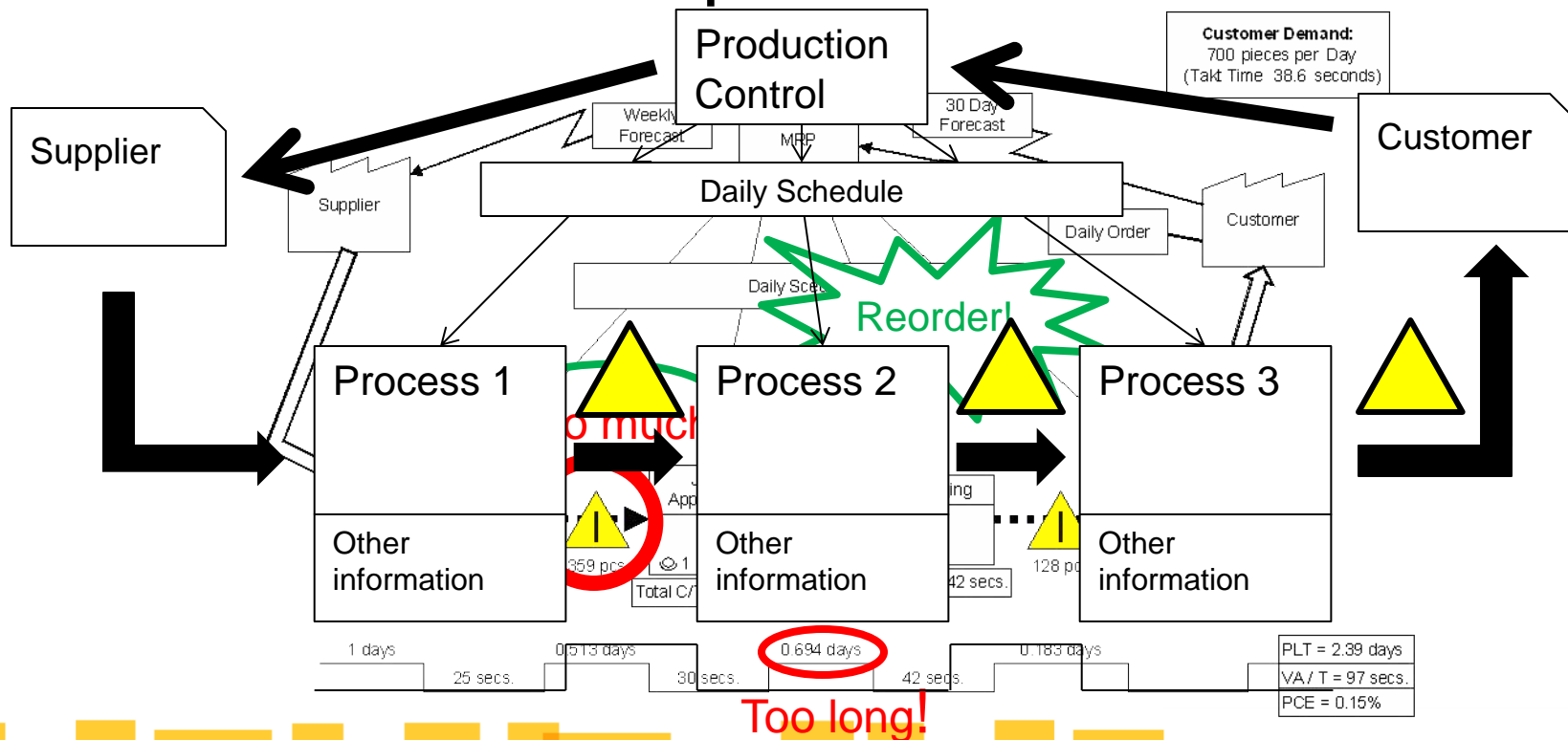


Prioritizing Efforts

Tools

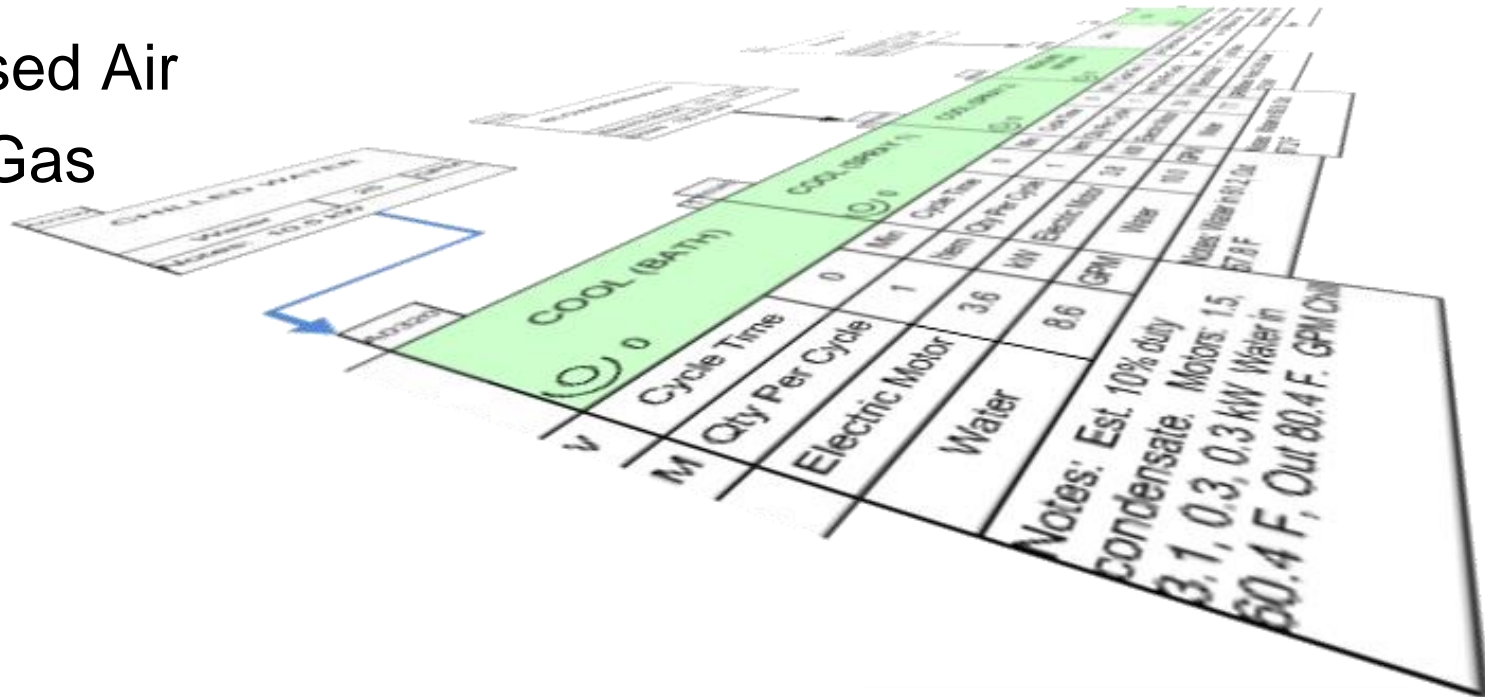
Value Stream Maps

- Lean visual tool to help analyze a process' current state and plan a future state



Value Stream Maps

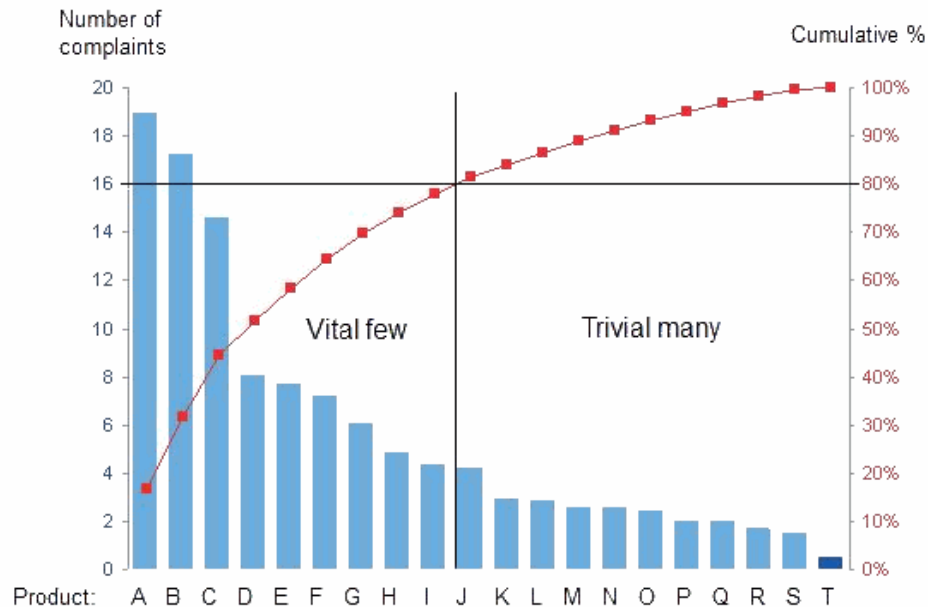
- Enterprise MN
- Energy (Electricity)
- Water
- Compressed Air
- Nitrogen Gas



Pareto Charts

- Highlights high-impact factors
 - Histogram + Cumulative Percentages

Example Pareto Chart of Client Complaints per Product



A3 Project Management

- Story of a project
 - Background/Problem
 - Root Cause Analysis
 - Goals
 - Action Items
 - Follow Up/Verification

Title: Lean Green Optimization
Owner: Chris Lanari **Idea Report Out Date:** 6/18/12
Date: 6/17/2014 **Initial Report Out Date:** 6/17/2014 **Final Report Out Date:** 8/27/2014 **Target KPI:** Safety Quality Delivery Cost Assessment
End Date: 8/27/2014 **Original End Date:** 8/26/2014 **Final Report Out Date:** 8/27/2014

Problem Statement: (What is unacceptable with the current situation?)
 Energy (Natural Gas) consumption of the new processor is over 20% higher than equivalent number of current processor.

Current Condition: (Display your thinking in this box) - (Use WSM, SIPOC, Checksheet Analysis)
 From an electricity consumption standpoint, new center #3.1 is 100% to operate, while production #7.1 is 100%.

Scope: (What is included and what is not included in the project?)
 New extrusion processor, from raw material to initial cooling operation.

Future Condition: (What would you like things to look like in the future?) - should be measurable
 Future state should cost at least 10% less to operate per year than current (6/18/2014) new processor.

Root Cause Analysis: (Potential Tools: 5 Whys, Fishbone Diagram)

Implement:

Item #	Detail	6/18	6/25	7/2	7/9	7/16	7/23	7/30	8/6	8/13	8/20	8/27	Responsibility	Cost
1	Reduce / Evaluate UV Light Intensity						(X)				(X)		Chris L, Andrew O, Jan E	
2	1a) Look for 60% Intensity						(X)						Chris L, Andrew O, Jan E	
3	1b) Test proportion										(X)		Brad G (Andrew)	
4	1c) Decide on final intensity											(X)	Chris L, Andrew O, Jan E	
5	2) Verify final intensity after test												Brad G (Andrew)	
6	3) Investigate Nitrogen Use						(X)	(X)					Chris L, Andrew O, Jan E	
7	3a) Equalize with compressed air						(X)						Brad G (Andrew)	
8	3b) Shut off heat source												Brad G (Andrew)	
9	3c) Follow up with long term plant air testing												Brad G (Andrew)	
10	3d) Reduce Drying Time, Station												Chris L	
11	3e) Implement reduction												Andrew	
12	4) Optimize Cooling Tank (the command)												Andrew	
13	4a) Investigate flow rate reduction for Cost Sav												Chris	
14	4b) Determine most appropriate on cost saving												Andrew	
15	4c) Investigate Extruder Barrel												Chris	
16	4d) Research insulation relationship												Chris, Andrew, Jan, Matt	\$150
17	4e) Find prototype insulation												Chris	
18	4f) Decide on final insulation												Chris	
19	5) Improve final string												Chris L, Andrew O	
20	5a) Equalize dry weight and impact (cost saving)												Chris	
21	5b) Implement OR for common electric												Chris	
22	5c) Investigate Preheater Efficiency												Chris L, ENGR, MARI	
23	5d) Follow up on preheater efficiency												Chris L, ENGR, MARI	

Actual Results to be Reported on: (What date?)

Measure	Current Result	Target Result	Actual Result
1			
2			
3			
4			

Lesson Learned

ROI:
 Labor Savings:
 Material Savings:
 Space Savings:
 WVA Reduction:

Team Members & Role: Chris Lanari: Project Leader, Andrew Ortuquist + Josh Meeker: Apollo specialists, Matthew Pap: Engineering Technician

Functional **End Process Owner:** Andrew Ortuquist

Action Item: Optimize Curing

- Initial State
 - All settings at 100%
 - Product within specifications
- Final State
 - All settings at 70%
 - Product still within specifications
 - \$55,300 annual savings

Action Item: Insulate Extruder

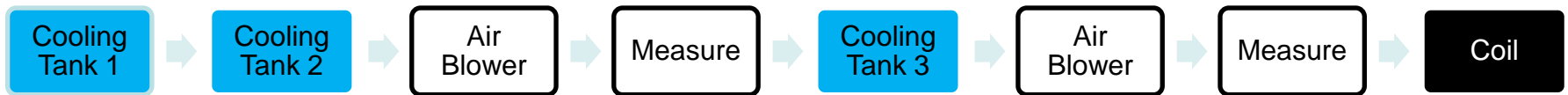
- Reduce heat loss to reduce consumed electricity
 - Heating elements
- 200 – 250 °C
 - Reduce to 43 °C
- Energy reduction
 - \$2,600 annual savings
- More safe workplace

Action Item: Switch To Comp. Air

- Initial State
 - Nitrogen
- Final State
 - Compressed Air
 - \$1,300 annual savings
 - No 100% N₂ fumes released

Action Item: Redundant Blower

- Initial State



- Final State



– \$650 annual savings

Action Items

Recommendation	Initial State	Future State	Reduction	Annual Savings	Status
Optimize Curing Process	115.2 kW	38.4 kW	76.8 kW	\$55,300	In Progress (95%)
Insulate Extruder Barrel	3.7 kW	0.1 kW	3.6 kW	\$2,600	In Progress (75%)
Switch from Nitrogen to Compressed Air	12 ft ³ /hr N ₂	12 ft ³ /hr Air	12 ft ³ /hr N ₂	\$1,300	In Progress (95%)
Remove Redundant Blower	0.9 kW	0 kW	0.9 kW	\$650	In Progress (50%)
TOTAL	119.8 kW, 12 ft³/hr N₂	38.5 kW, 12 ft³/hr Air	81.3 kW, 12 ft³/hr N₂	\$59,800	

Internship Benefits

- Project Management
- Models
 - Cost Analysis
 - Energy Flow
- Lean Manufacturing Principles

Q & A