PIPE INSULATION MANUFACTURING PROCESS

Background

A large ***construction materials company*** that produces ***pipe insulation*** has ***hundreds of different products*** that need to be ***produced on a daily, weekly, or monthly basis.*** Each ***product is described*** by the type of material, the ***internal pipe diameter and the thickness of the insulation,*** and is manufactured on one or more of several available ***production lines.*** The production facility ***works on 365x24 schedule.***

Highlights:

- ***500+*** SKUs
- ***Multiple*** production lines
- Inventory constraints ***(minimum WIP, maximum storage)***

The challenge

The company was dealing with:

- Many "emergency", ***last-minute small orders***
- ***Limited number of production capacity*** thru' shared "mandrels" (3 for all lines)
- They were ***operating at then-current capacity*** but could sell more, therefore needed to ***maximize production***

Objective:

- ***Increase throughput,*** without adding any manufacturing capacity, and ***reduce overtime costs.***

Current scheduling limitation

Following is a ***simplification for example;*** The company must ***produce five products*** for which ***demand can fluctuate greatly from one day to the next.*** There is a ***minimum level of finished goods*** that should be ***on-hand*** at the end of each day ***to avoid stock-outs the following day.*** At the same time, there is ***limited storage capacity*** in the plant, so maximum ***levels of inventory must also be enforced.*** The ***production requirements***, and ***machine assignment constraints,*** are shown as follows:

(A) Product ID	(B) Processing Rate (lbs/minute)	(C) Day's Demand (lbs)	(D) Inventory On-hand (lbs)	(E) Minimum Inventory (lbs)	(F) Maximum Inventory (lbs)	(G) Machine Assignments
1	150	66,000	25,000	33,000	50,000	1, 2
2	150	27,000	20,000	20,000	35,000	1, 2
3	75	90,000	35,000	45,000	50,000	1, 2, 3
4	75	48,000	35,000	30,000	50,000	1, 2, 3
5	75	60,000	40,000	40,000	45,000	2, 3

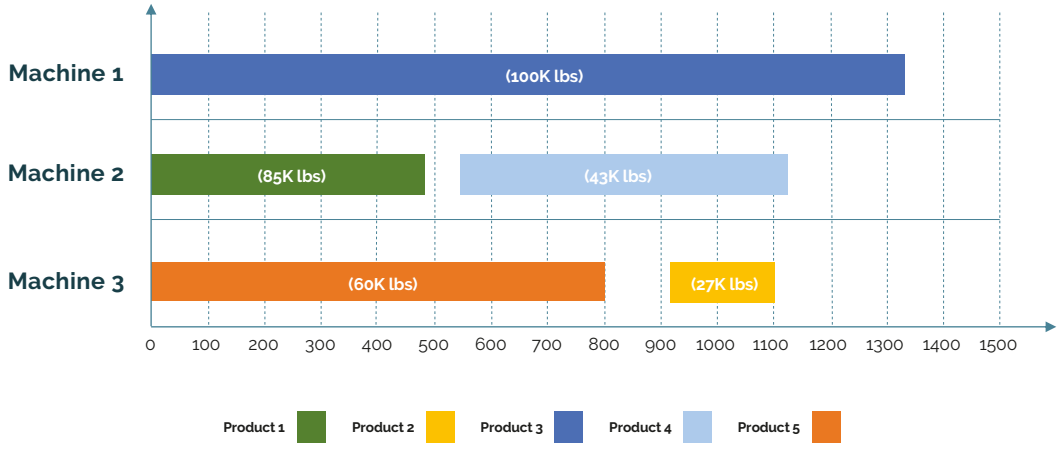
· *Note that the inventory on-hand for Products 1 and 3 is lower than the minimum allowed, presumably due to disruptions in the previous day's production, so this difference needs to be addressed.*

There are also ***sequence-dependent changeover times*** incurred when ***changing a machine from production*** of one product to another, as shown ***(in minutes)*** in Table 2.

Table 2: changeover times

Product	1	2	3	4	5
1		0	60	60	60
2	120		60	120	180
3	180	120		60	120
4	180	180	120		120
5	60	180	120	120	

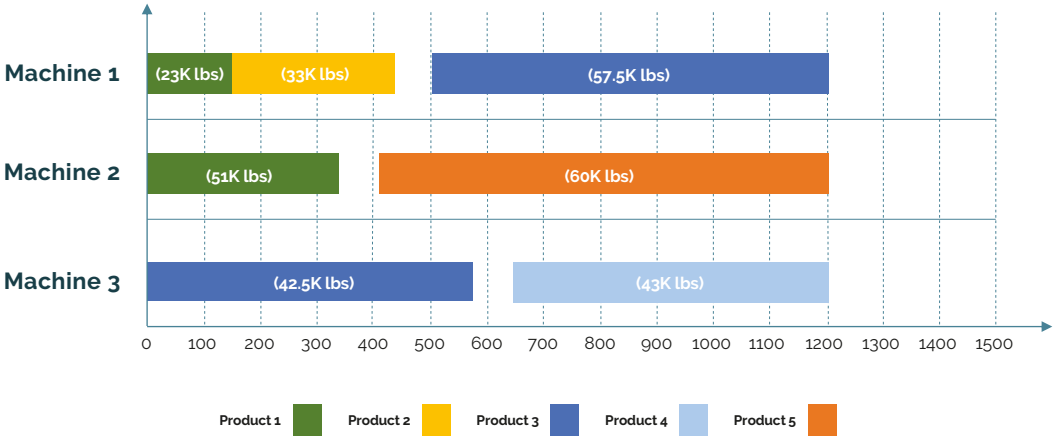
The company's ***current scheduling approach*** was an entirely ***manual process,*** carried out on a series of ***complex spreadsheets.*** Taking all the above into account, the existing ***manual scheduling*** would produce a schedule as shown below, which incurs ***133 minutes of overtime costs*** on Machine 1.



OptPro Solution

OptPro combines ***mathematical optimization technology*** with a digital twin representation of the actual process.

In the **OptPro-driven** schedule, as can be seen, ***all machines finish their production at exactly 20 hours*** (1200 minutes). To achieve this, ***both Products 1 and 3 are split into two batches,*** to be ***produced on different machines.*** Even so, the total changeover cost incurred in this plan is the same as in the current schedule ***(so no worse)*** with 180 minutes; however, ***the total cost is much less,*** because the ***company avoids paying its operators*** for more than 133 minutes of overtime.



Results

This simple example illustrates ***the benefits*** of the **OptPro** approach in ***terms of maximizing throughput and minimizing costs,*** including changeover costs and ***operational expenses*** related to ***overtime.***

Actual **OptPro** results at the company indicated a ***9% increase in throughput and elimination of required overtime,*** all with existing manufacturing capacity and ***no additional Capex required.***

OptTek Systems, Inc.

2241 17th Street
Boulder, CO 80302

303.447.3255

www.OptTek.com