Food Processing Case Study #2

Dry Ice Pellet Manufacturing
Sutton-Garten Co.
ChillZilla® CO_2 Supply System

Patent no. 9,939,109 B2

Highlights:
Location — Indianapolis, IN
Scope of Project:

- Engineer & manufacture a turnkey system solution to receive warm liquefied CO_2 from transports, chill the liquid in the bulk tank, and dispense it to the dry ice pelletizer to reduce pellet production costs. Pre-chilling of the LCO_2 before dispensing to dry ice increases the dry ice yield. The production savings is tabulated once the electricity costs for chilling and added PB are accounted for.
- 50 Ton ChillZilla® CO_2 Liquid Supply System
- Chiller: 480 & 230 Volt x 23kW
- Electric side arm Pressure Builder: Thermax® #L224-18, 18 kW
- 2" NPS Python® Vacuum Insulated Pipe (CO_2 from the tank to the pelletizer & the chilled Freon® 404A from the chiller to the tank)
- Installation completed & operational August 24, 2017

Application:
Liquid Carbon Dioxide is typically stored in a pressure vessel at 250 psig saturation. The piping from the liquid feed line of the bulk tank is piped to a pelletizer machine nearby. Typical distances can range up to 60' and the piping is generally not vacuum insulated. This system typically results in a dry ice production efficiency of 2.5 to 3 lbs of liquid CO_2 to produce one lb of dry ice. Chart recommends the ChillZilla CO_2 system to reduce overall pellet production costs in applications that consume one to two trailer loads per day (22-44 tons/day).

Project Background:
Sutton-Garten Co., an independent industrial gas supplier located in Indianapolis, IN was planning to expand their dry ice pellet, spaghetti and block manufacturing. Their business had grown to support the procurement of a new pelletizer from Cold Jet. Sutton-Garten worked with Chart Inc. to analyze Chart's new ChillZilla CO_2 to improve pellet production costs. The ChillZilla system lowers the temperature of the liquid in the tank prior to dispensing to the pellet machine for improved dry ice yield. The added cost of electricity to operate the chiller and PB is calculated into the financial analysis to determine the net savings. The online calculator and literature can be found by searching: Chillzilla CO_2.

Significant Accomplishments:

- First ever installation in the world for the 50 ton ChillZilla CO_2 system.
- Chart was able to provide a full turnkey system solution with the tank system, chiller, Python® VIP and the Thermax® electric pressure builder.
- Improve the customer's dry ice yield from 3.13:1 to 1.9:1 (liquid to dry ice ratio by weight), a **39%** increase! Note: customer routinely measures yield in a range from 1.8:1 to 2.0:1 with the ChillZilla system.
- Reduce customer's overall dry ice production costs by **38%** (LCO_2 & electricity)
- Increase production from 500 to 600 lbs/hr of dry ice on machine #1 and from 600 to 725 lbs/hr of dry ice on machine #2 – a 20% increase!
- Density of dry ice top quality from extreme cold liquid.

"Chart has been a dependable partner for Sutton-Garten in building both our dry ice and CO_2 business. The ChillZilla system has helped us increase efficiencies and reduce costs for our entire dry ice production facility. It's been a great investment." Pat Garten, Sutton-Garten Co., September 20, 2017

Cost savings financial analysis:

Inputs	U/M	Old Tank & Piping	ChillZilla & Python System
Dry Ice Production Yield Ratio (Avg. measured)	XX:1 (lbs liquid to lb dry ice)	3.13	1.9
Temp of LCO_2 exiting bulk tank	Avg. measured, degrees F	-8ºF based on sat. press	-41 to -27
Dry Ice Production Yield (measured)	tons per day	18	
Liquid CO_2 purchased price (incl. delivery, hazmat, etc fees)	$/ton	U.S. Average Value	
Electrical consumption for chiller and PB system	kWH per day	(1)	400
Electrical costs	$/kWH	(1)	$0.090
Production Days	Days/month	21	
Calculations			
Amount of liquid CO_2 purchased per day based on yield ratio	tons per day	56.3	34.2
Amount of liquid CO_2 saved with ChillZilla/Python System	tons per day		22.1
Amount of liquid CO_2 saved with ChillZilla/Python System	% per day		**39.3%**
ChillZilla/Python system CO_2 savings	$/day		$1,549.80
Cost of energy per production day	$/day		$36.00
Net savings with ChillZilla/Python system	$/day		$1,513.80
Net savings with ChillZilla/Python system	$/year		$381,478
Net savings with ChillZilla/Python system	%		**38.4%**

(1) Old 14 ton system had a 3.5 HP chiller (system replaced with the ChillZilla system), 26 ton has a chiller (now used for beverage), neither chiller electrical costs measured.
(2) Productivity improvements not included in financial analysis.

Notes: Average saturation pressure of delivered liquid, 245 psig (-8ºF).
Chiller Capacity: 20 tons (one trailer load) at 250 psig (sat.) at a usage rate of not less than 16 hrs/day continuous for peak efficiency (120 psig sat.) = 1.25 tons/hr.
Chiller Case Study Capacity: 1.4 tons of LCO_2 per hr.
Chiller Power Consumption: 23kW. PB Power Consumption: 18kW.