

Client Overview

Founded in 1916 in Chicago, Calumet is a petrochemical industry pioneer with a wealth of experience and a distinguished past. Their diverse portfolio encompasses premium lubricants for automotive and industrial use, solvents for manufacturing, and specialty oils in consumer goods. A commitment to innovation has propelled Calumet's growth, as they maintain an unwavering dedication to quality.



Problem Statement

Calumet currently mixes and packages its products in different facilities across the US. The allocation of products from sourcing to packaging then to customer delivery is not optimal, resulting in higher transportation costs and distances.

Thus, the reallocation of each product to its optimal packaging facility will result in the optimization of transportation routes, the reduction of transportation costs, and the enhancement of the delivery process, providing orders faster to their clients.

Key Assumptions

- Consider only Burnham products.
- Accommodate all products in all facilities.
- Disregard supply constraints at facilities.
- Transport products by rail, then truck.
- Measure FTL capacity in # of gallons.
- Target solely customers in the US.
- Apply constant transportation rates.
- Ignore customer delivery times.
- Disregard minimum shipment quantities.
- Neglect labor costs across facilities.

Approaches & Results

Algorithm #1: Transportation Costs Optimization Model - Burnham in Operation

- 1) Packaging Facilities Optimization Model:** Developed an optimization algorithm through Python that optimizes the total distances traveled.
- 2) Sourcing Facilities Implementations:** Incorporated each product's respective sourcing facility to the code, minimizing the total distance for each product route.
- 3) Truck and Rail Rates Implementations:** Implemented the costs of transporting the products from sourcing to the packaging facility, and then to the clients' locations.

Material Description	Quantity (GAL)	Sourcing Facility	Current Packaging Facility	Optimal Packaging Facility	Destination State	Current Cost	Optimal Cost	Cost Savings
CALUMET 420-460	5892.92	Cotton Valley	Burnham	Burnham	IN	2431.500211	2431.500211	0.000000
CALSOL 5550	5400.00	Princeton	Burnham	Shreveport	NV	8874.964447	6708.559971	2166.404476
CALUMET 600 SOLVENT	4917.42	Cotton Valley	Burnham	Shreveport	TX	5467.238947	1574.286560	3892.952387
CONOSOL® 260	4602.24	South Hampton	Burnham	Burnham	IL	1307.110969	1307.110969	0.000000
CALUMET 600 SOLVENT	4371.04	Cotton Valley	Burnham	Burnham	IL	1285.156811	1285.156811	0.000000

Algorithm #2: Transportation Costs Optimization Model - Burnham Shutdown

Currently, the Burnham packaging facility suffers from workplace hazard and safety constraints which can lead to the closure of the facility from a legal intervention.

Dilemma

Invest into the Burnham facility to enhance its safety and work environment.

Shut down the facility and redistribute its products across the other facilities.

Our team developed a second Python algorithm that redistributes the products that are optimal at Burnham across the other packaging facilities, considering the same factors as in Algorithm #1.

Material Description	Quantity (GAL)	Sourcing Facility	Current Packaging Facility	Optimal Packaging Facility	Destination State	Current Cost	Optimal Cost	Cost Savings
CALUMET 420-460	5892.92	Cotton Valley	Burnham	Shreveport	IN	2431.500211	4227.808215	-1796.308004
CALSOL 5550	5400.00	Princeton	Burnham	Shreveport	NV	8874.964447	6708.559971	2166.404476
CALUMET 600 SOLVENT	4917.42	Cotton Valley	Burnham	Shreveport	TX	5467.238947	1574.286560	3892.952387
CONOSOL® 260	4602.24	South Hampton	Burnham	Karns City	IL	1307.110969	3410.283648	-2103.172679
CALUMET 600 SOLVENT	4371.04	Cotton Valley	Burnham	Shreveport	IL	1285.156811	3413.304504	-2128.147692

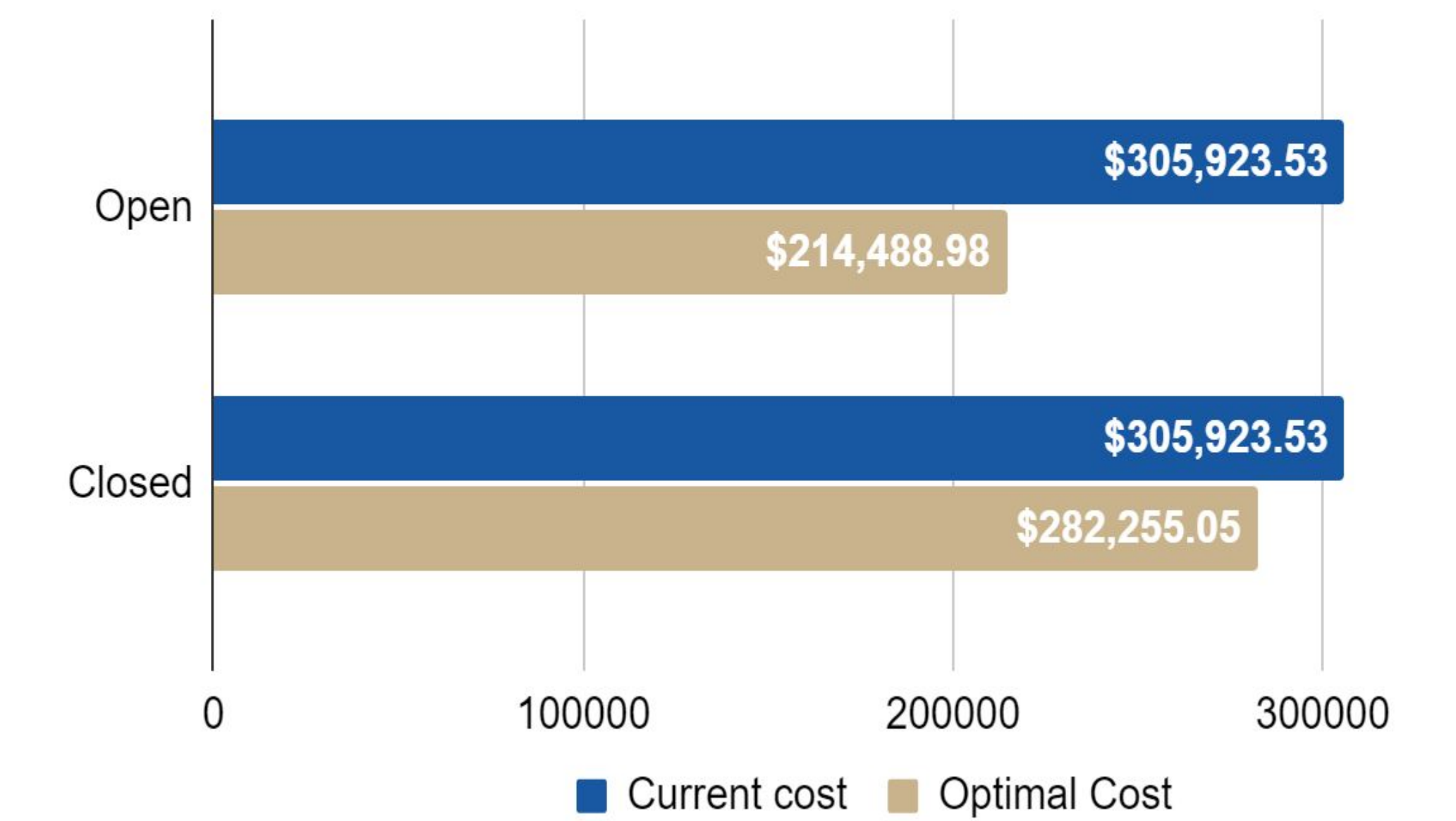
Algorithm #3: Instant Allocation Algorithm

Today, Calumet has no standardized process for picking a packaging facility once they receive an order. Thus, we created an alternate version of our algorithm, where the user inputs information on the ordered products, and the algorithm will output where the product should be packaged to minimize the transportation costs.

```
Enter the item name: CALPAR 100
Enter the sourcing facility: Burnham
Enter the customer destination state: CA
Enter the quantity in gallons (GAL): 8000
The optimal packaging facility for CALPAR 100 shipping from Burnham to CA is Shreveport with a cost of $11807.00
```

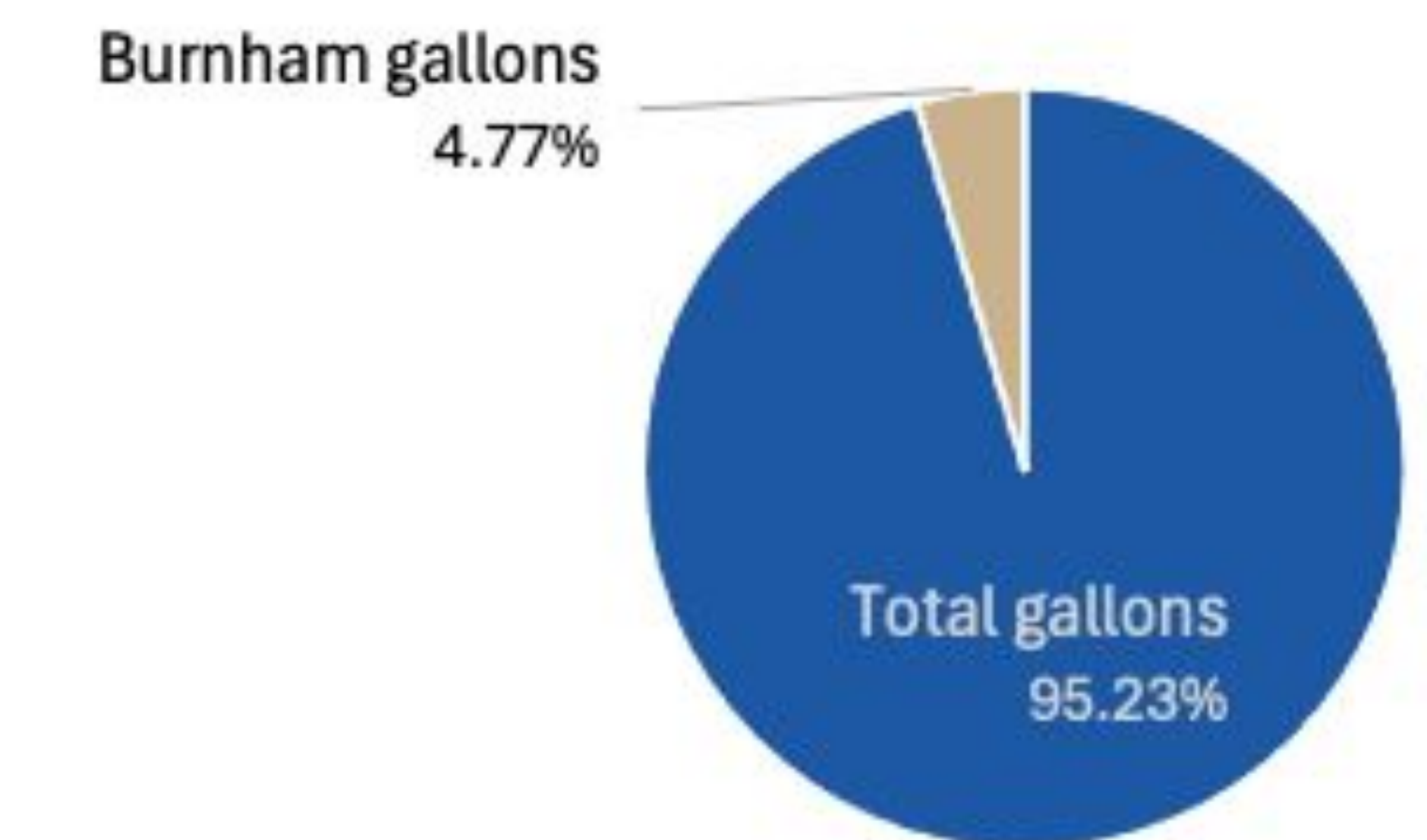
Quantitative Impact

Current cost and Optimal Cost for Packaging Burnham Products in 1 Year



- Cost savings if kept open: \$91,434 yearly
- Losses from shutting down: \$67,765 yearly

Total Cost Savings Opportunity for Packaging Burnham Products in One Year



By applying our cost optimization algorithm, Calumet could save a total of **\$1.9M** per year.

Next Steps

- Add facility-specific constraints.
- Break down into drums and totes.
- Analyze the cost to invest in Burnham.
- Expand to customers outside of the US.
- Apply to products in all packaging facilities.

