CIM Concepts Incorporated

Analysis of Plant Data

Project Examples

Overview of Selected Plant Data Reporting Projects

CIM Concepts helps manufacturers visualize and analyze plant data. The following stories loosely describe two separate projects for clients that had the goal of providing high-level analysis of plant data. In both cases, the customer requirement was for the analysis of trends and patterns in the data, and not for the actual real-time running of the plant.

In all cases the project begins with an understanding of the client's requirements. In the first of the following project scenarios (Beach Buns, Inc.), the client's concern is with increasing throughput and reducing downtime (equipment availability). In the second scenario (Sunny Day Solar Panels), the focus is on improving product quality and lowering cost. The design of projects is specific to each client's unique needs because "one size does *not* fit all."

The plant data analysis techniques utilized in the following examples employ OLAP (OnLine Analytical Processing). This technique looks at snapshots of summarized data in a graphical manner to allow the user to extract meaningful insight from the analysis. The insights occur from "slicing and dicing" the data in a flexible manner, looking at progressively greater levels of details in areas of interest. Automated updates with live data create the flexibility that static reports cannot.

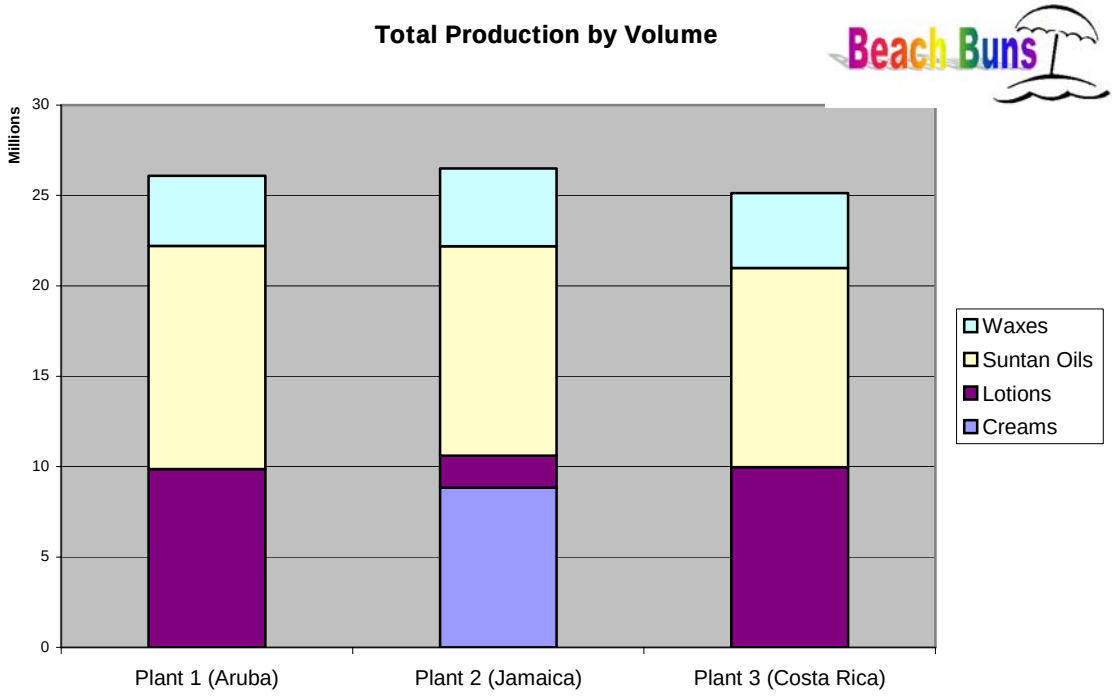
The client's familiarity with tools and their existing company standards will determine the technologies utilized in the projects. A relational database provides the foundation for aggregating the data and performing the analysis. In both example cases the relational database used is SQL Server from Microsoft. CIM Concepts database experts design and optimize the database for analysis. The clients selected Microsoft Excel for the display of data because of their high level of comfort with the tool and existing licensing for it.

Clients receive training in using the reports, and in how to make basic changes to the reports. A variety of user and support training methods are available including formal classroom training, one-on-one training, and user documentation. CIM Concepts will work with and support client projects, but CIM Concepts offers clients the flexibility of deciding when and if they desire additional help.

Beach Buns, Inc. – production analysis

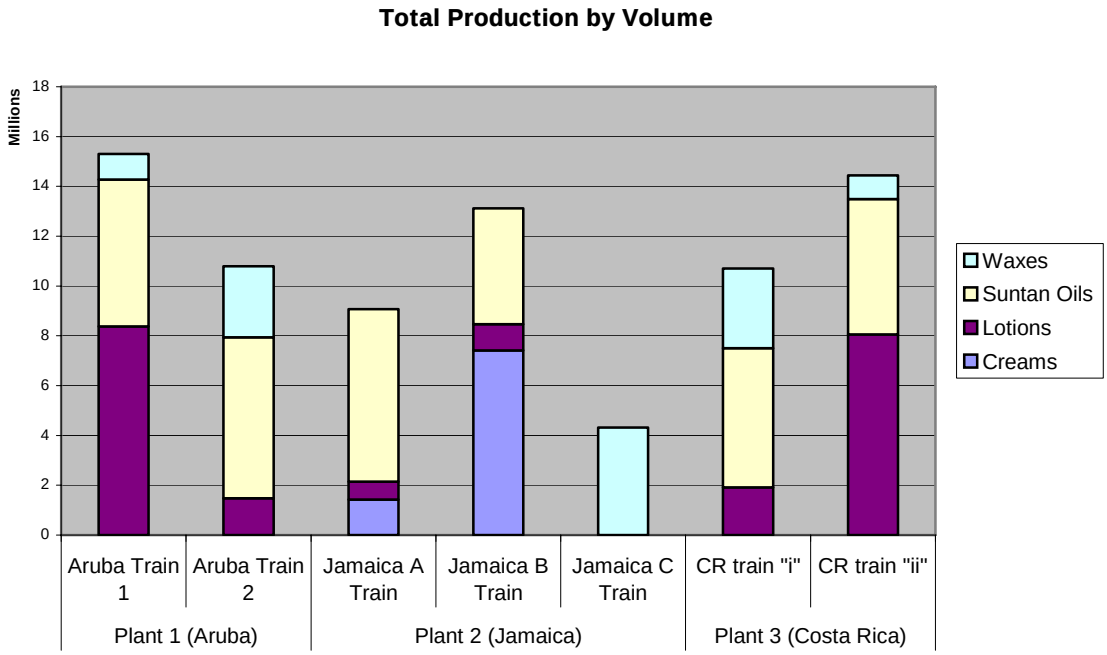
Background: Beach Buns, Inc. is a fictional maker of tanning products with three manufacturing plants located in Central America and the Western Caribbean. Production Manager Barry Bright is using his new OLAP analysis tool to look at company-wide production for the current year.

View BB1: Barry creates a simple chart showing total production by product class across plants:



This simple bar chart shows at a glance that while all three plants had similar total output for the year (slightly above 25 million pounds), the product mix is different. Creams (the darker blue) are only made in Jamaica, while most of the lotions (maroon) are made at the other two sites.

View BB2: Barry decides to drill down to the production train level within each plant. In four mouse clicks, he has this chart:

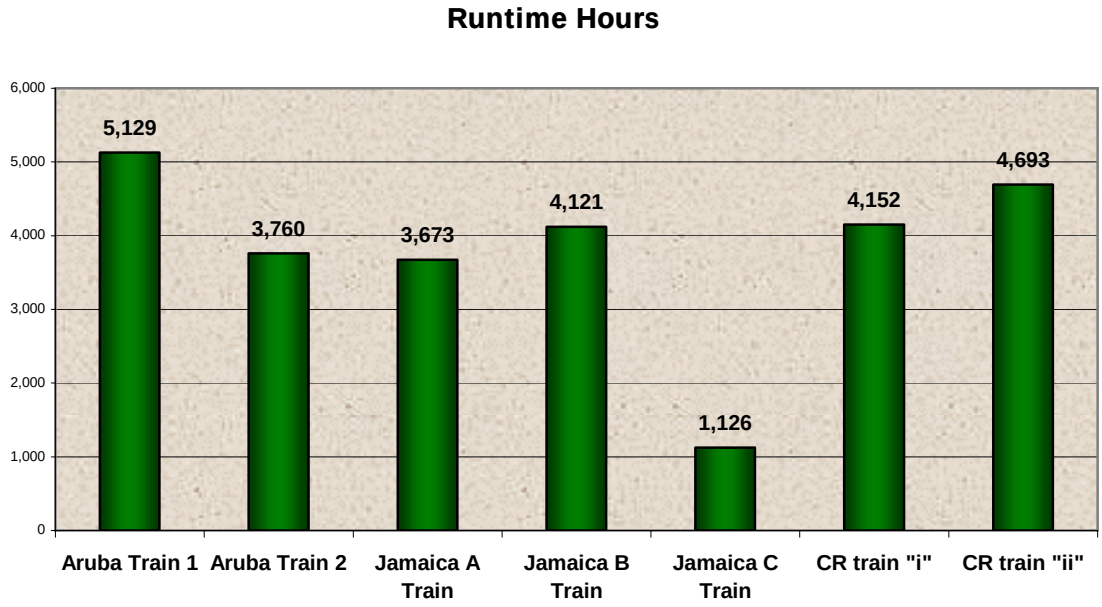


This chart shows that, although the production for each plant overall is similar, the individual trains have very different output levels. Moreover, it shows that at the Jamaica site, train C is specialized, producing only waxes. At the other two sites, waxes are produced on the main two trains along with all other products.

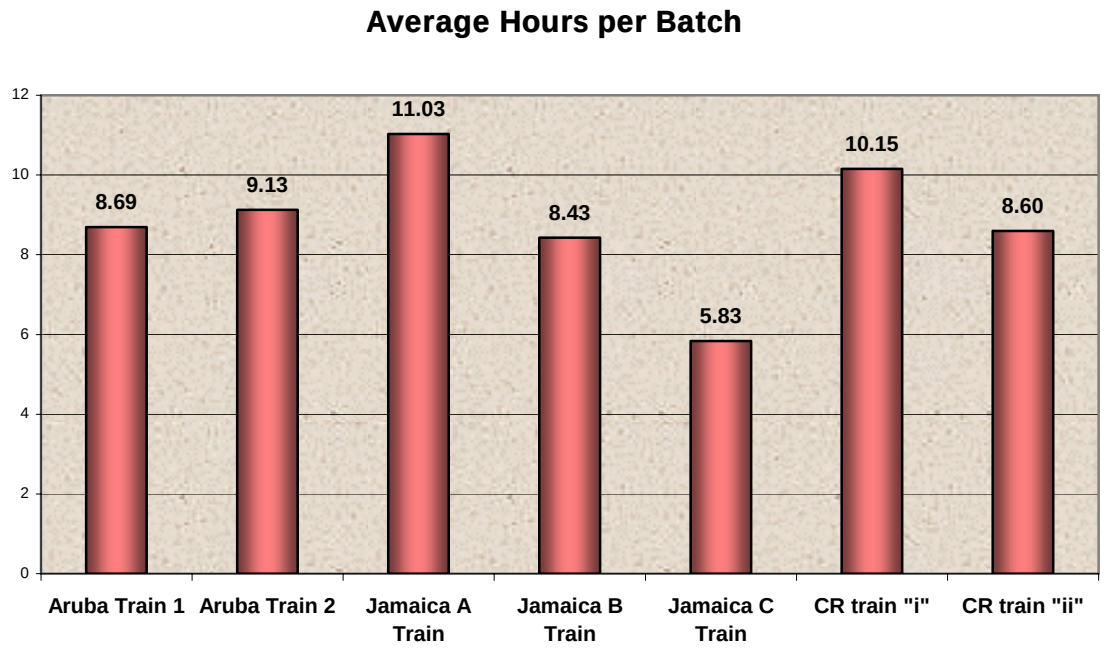
Barry is not too worried about the discrepancy in total output volume, because he suspects that waxes take longer to produce per unit volume than the other products. The chart seems to indicate that the more waxes there are in the product mix for a train, the smaller the total volume output.

Barry does wonder why, at the Jamaica site, Train A lags so far behind Train B in output, when they have similar product mixes that do not include any waxes. Was Train A down for a significant portion of the year, or is it that much slower in producing products?

Views BB3 & 4: Barry delves into the Jamaica Train A issue. A total runtime chart will show if Train A experienced significant downtime:

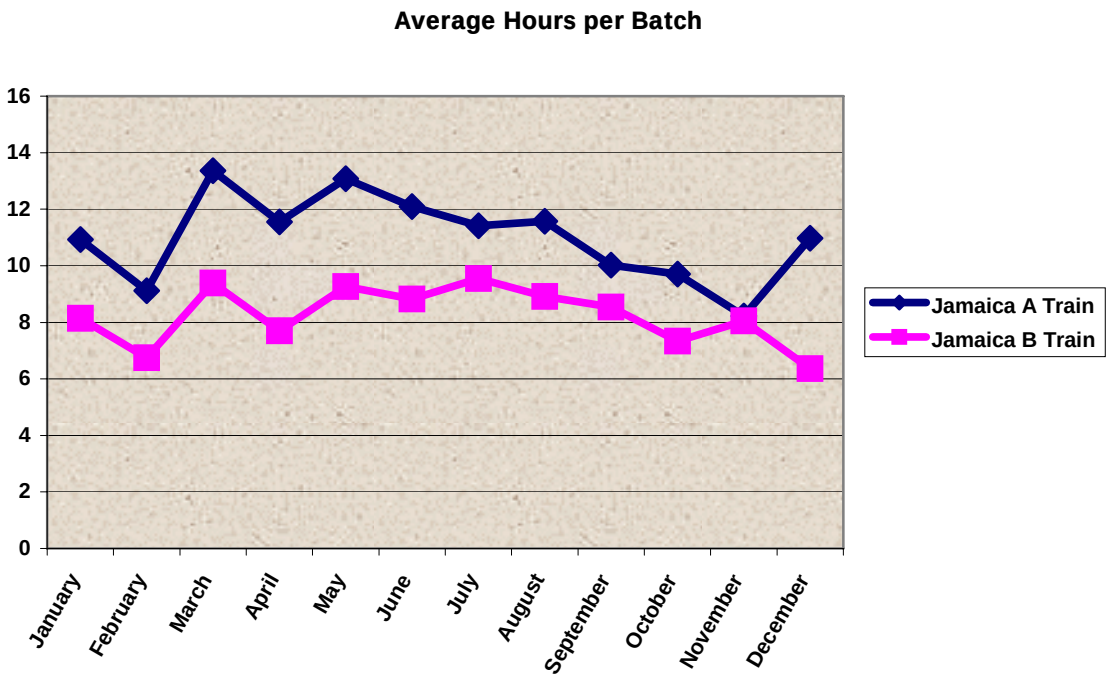


Train A does have more downtime than Train B, but is that the whole story? A chart of average runtime per batch shows that Train A is also slower even when it is operating:



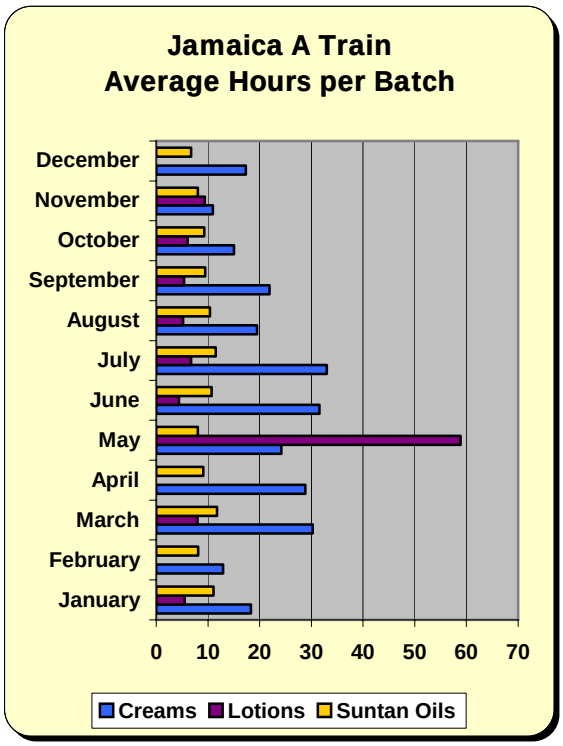
Train A is the slowest of all trains at all locations on a per-batch basis… and it doesn't even produce any waxes. Now Barry is convinced that he's got an issue that needs investigation.

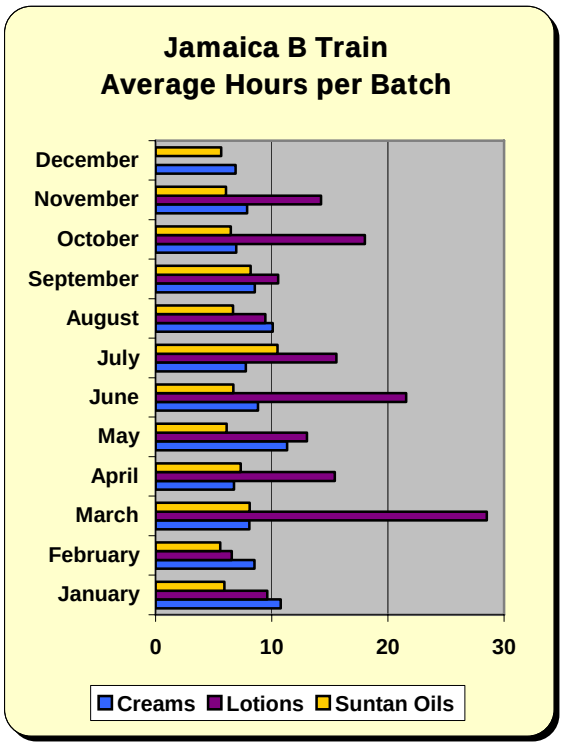
View BB5: Is the discrepancy constant over time, or an isolated occurrence? A trend chart can help:



Except for the month of November, when they were equal, Train A has consistently longer average batch times than Train B.

View BB6: Does the longer batch time correlate to particular products? Barry charts average batch time by month and product class:

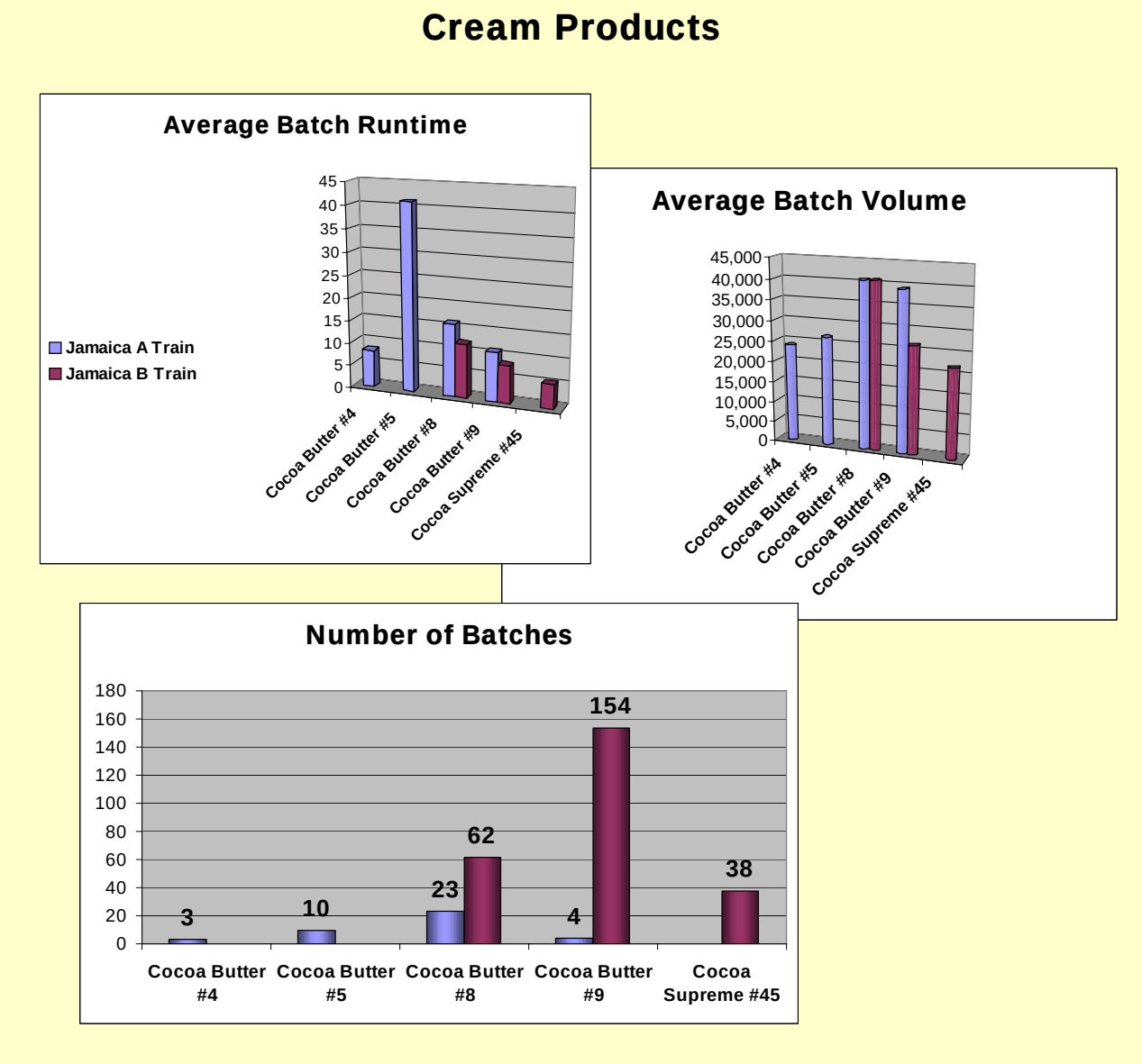




The longest average run time on Train B was almost 30 hours in March for Lotions. The longest average run time for Train A was almost 60 hours for Lotions in May (note the different hour scale on the X-axis). What really interests Barry, however, is that the average run time for creams on Train A is 20 to 30 hours for several months running, as opposed to generally 10 hours or less on Train B.

Single outliers (bad data collection, or a batch with serious problems) can skew the average for a single bar on a chart, but several months in a row with high values may indicate a true systemic problem. Barry decides to concentrate his efforts on Cream production on Train A.

View BB7: Barry produces a series of charts showing individual cream products produced for the year:



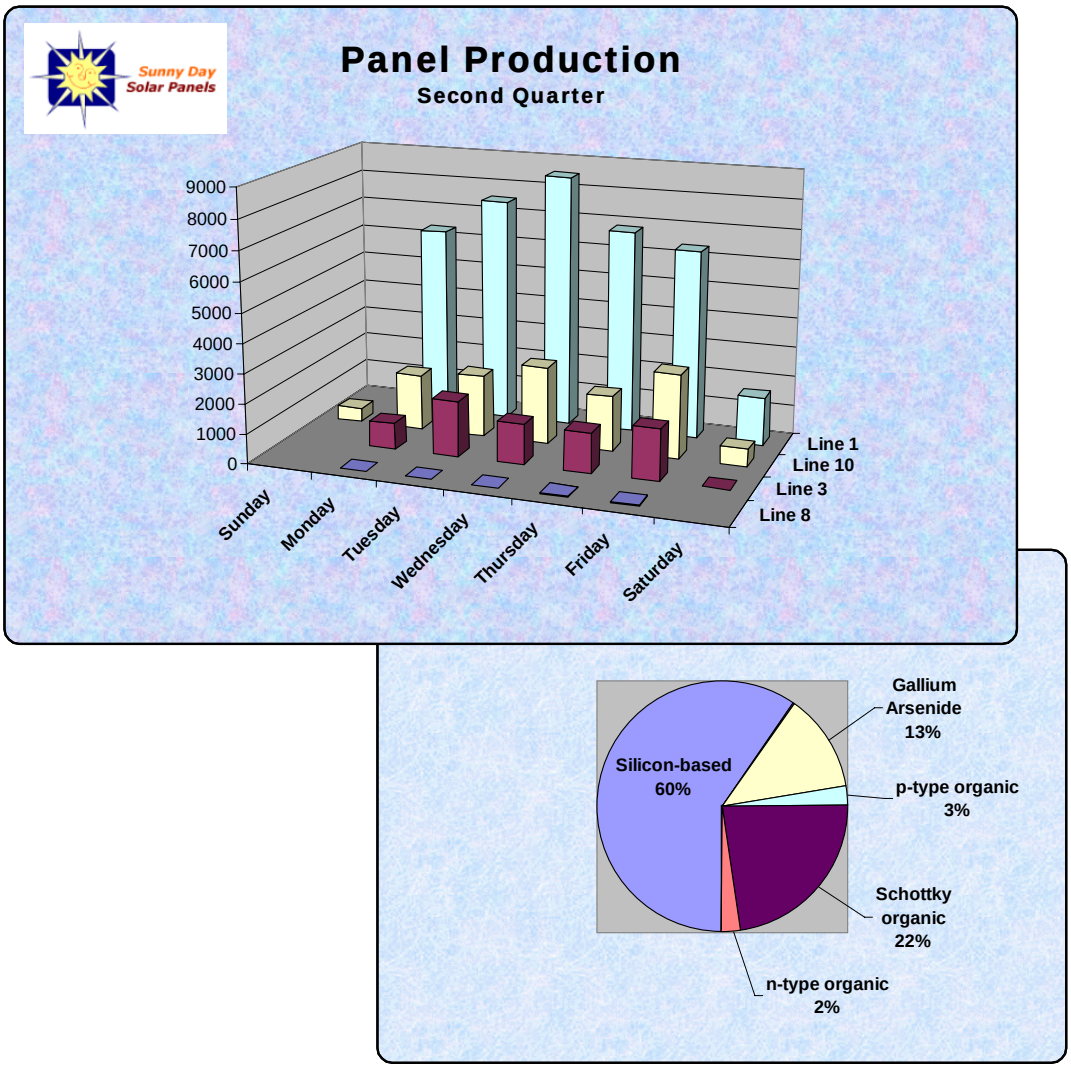
Barry sees that one product, Cocoa Butter #5, is made only on Train A, has a very long average run time, does NOT have a large average batch size, and makes up only a small portion of his product mix.

Based on this information, Barry asks the engineering manager at the Jamaica plant to investigate the product recipe for Cocoa Butter #5, to determine why it takes so much longer to make than the other cream products. He also schedules a meeting with the corporate marketing team to investigate the impact of reformulating or dropping Cocoa Butter #5 from the company's product line.

Sunny Day Solar Panels – defect analysis

Sonia Savvy is a data analyst for Sunny Day Solar Panels, another fictional company. Sonia has been tasked with reducing the cost to the company of defective panels rejected during the manufacturing process. Sunny Day began collecting data just a few months ago. Sonia now has one complete quarter's worth of data to analyze, April through June of the current year.

View SD1: Sonia looks at an overview of panel production during that time period:

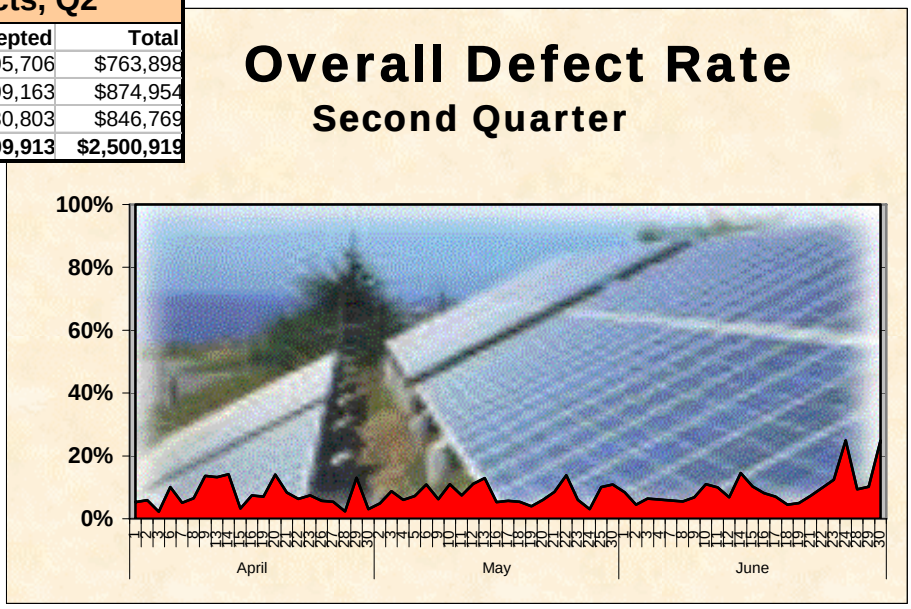


The panel production chart shows that the busiest production line at Sunny Day, by far, is Line 1. Production usually shuts down on the weekends, but there have been a few Saturday runs, and Line 10 operated on a Sunday at least once during the third quarter.

The pie chart on the previous page shows that most panels produced by Sunny Day are Silicon-based (60%), followed by Schottky organic type (22%), and Gallium Arsenide panels (13%).

View SD2: Sonia looks at the overall defect rate, and total cost of defective panels produced, during the quarter:

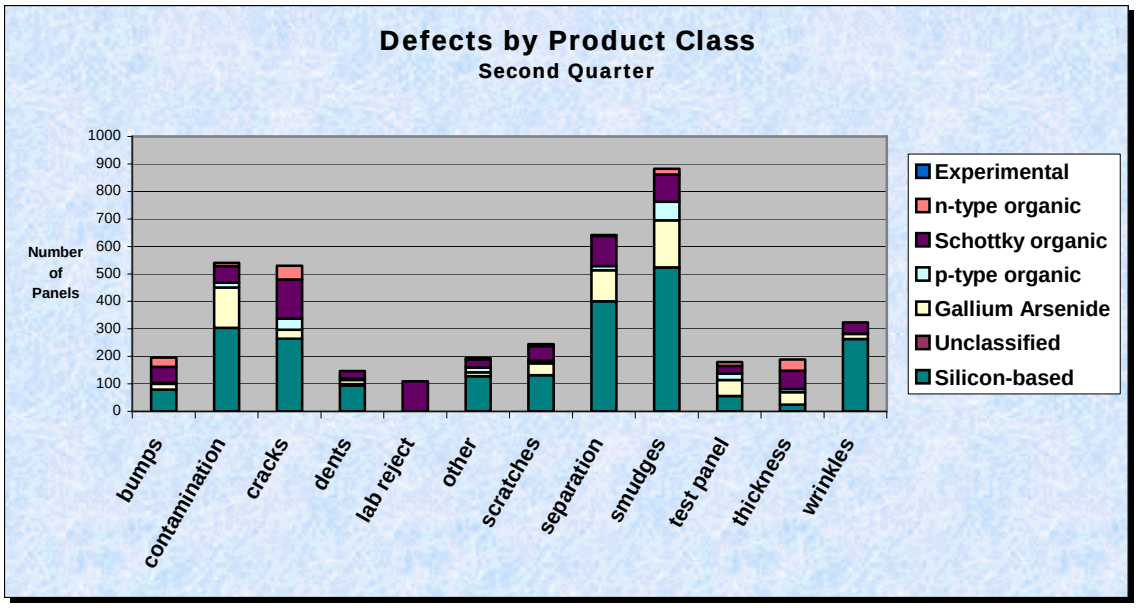
Cost of Defects, Q2			
	Defective	Accepted	Total
April	$58,192	$705,706	$763,898
May	$65,772	$809,163	$874,954
June	$65,966	$780,803	$846,769
Total	**$190,988**	**$2,309,913**	**$2,500,919**

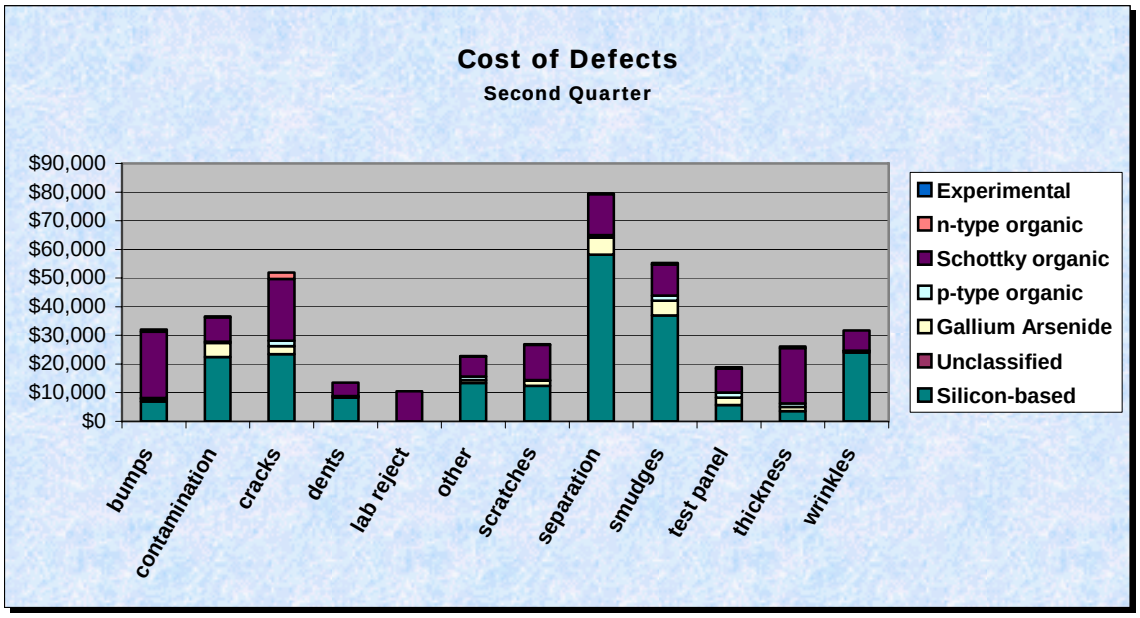


The overall defect rate during second quarter hovered mostly below 10%, with a couple of spikes above 20%. The overall trend seems to be neither increasing nor decreasing (although the end of June seems to have been a particularly problematic period).

The total production cost of the defective panels was $190,988, which is about 7.5% of the cost of production overall ($2,500,919).

View SD3: Sonia looks at defect rate by product class, first by number of panels, then by cost:

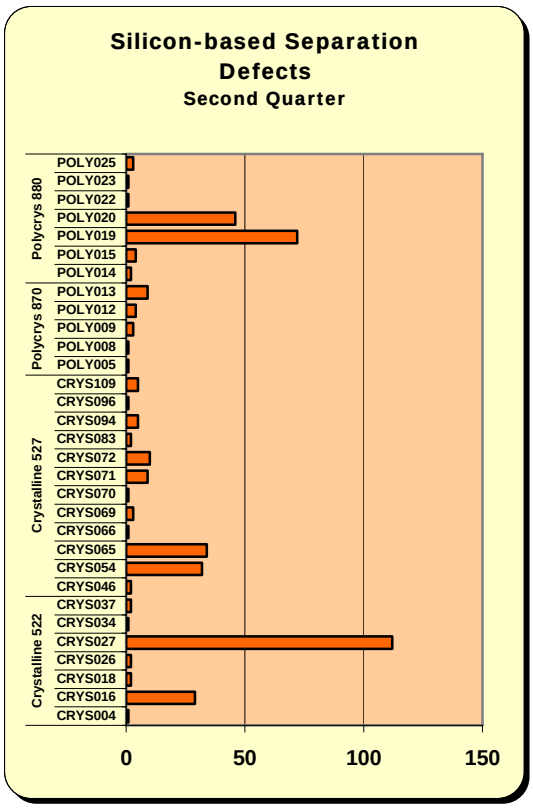


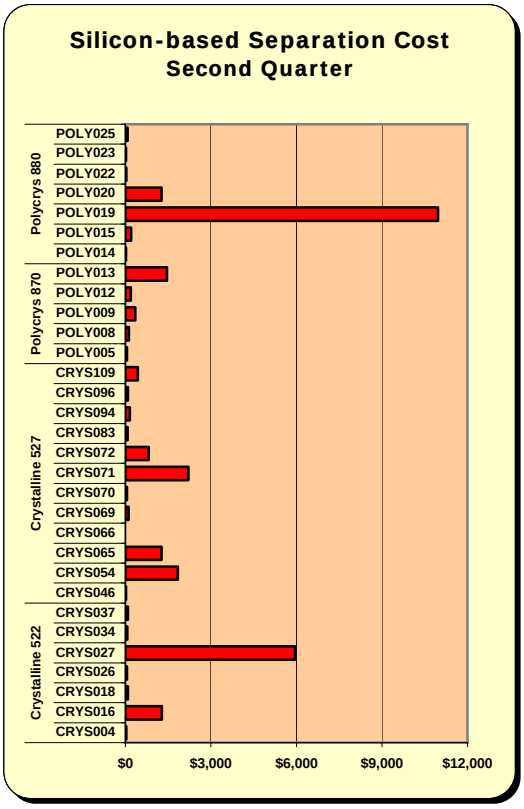


Sonia notices that the most common defects at Sunny Day were smudges (almost 900 panels). However, the ***costliest*** defect was not smudges, but separation defects ($80,000). In fact, separation defects in silicon-based products alone were costlier than the next highest defect for all product classes combined.

Based on this information, Sonia decides to concentrate her initial investigative efforts on separation defects for silicon-based products.

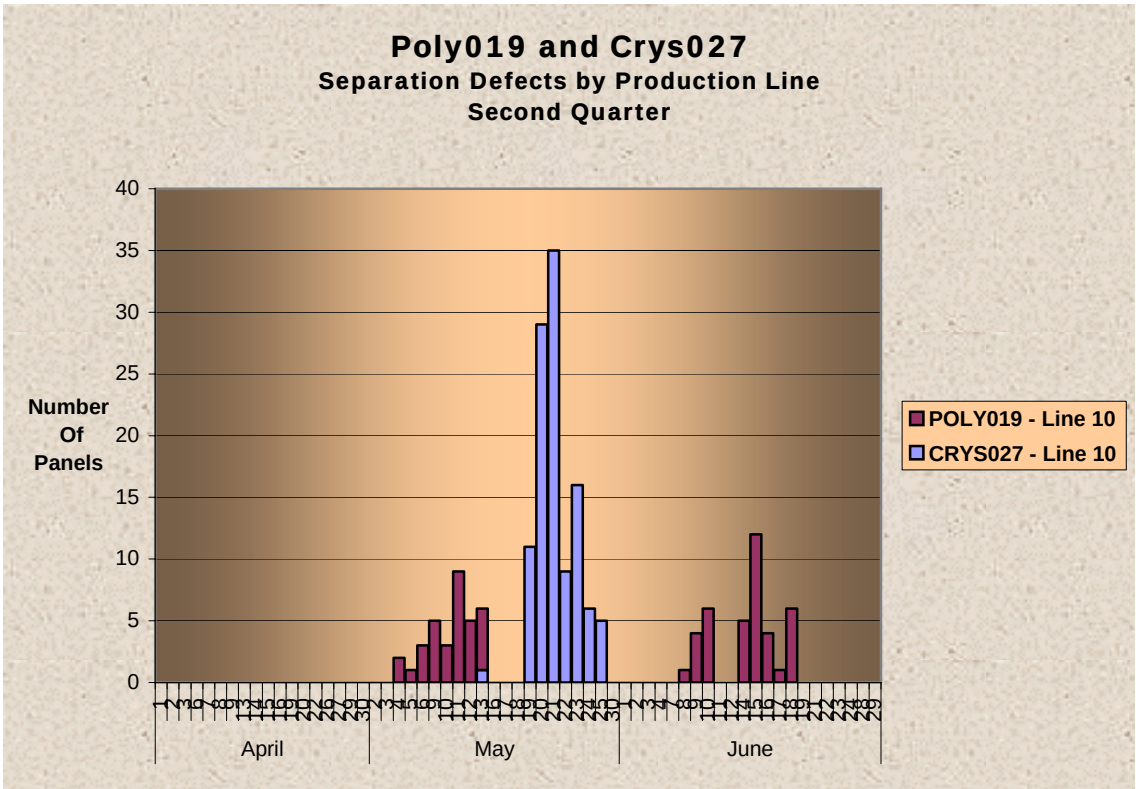
View SD4: Sonia creates a chart showing separation defects for individual silicon-based products:





Two products appear to be of particular interest. Polycrystalline silicon product POLY019 is by far the costliest in terms of separation defects. Crystalline silicon product CRYS027 has the highest number of defective panels, and is the second most costly.

View SD5: Sonia charts these two particular products by date and production line:



Interestingly enough, all separation defects for these two products during the data collection time period occurred on line 10. The separation defects occurred in spurts, between May 4-6, May 9-13, May 19-25, June 8-10, and June 14-18.

Sonia's next step will be to interview the Line 10 operators and review the operations logs for these time periods. In doing so, she hopes to be able to trace the root cause of the incidents… which may have been equipment malfunction, inadequate operator training, or bad raw materials, for example.

Once the root cause is identified, Sonia may be in a position to recommend steps to avoid similar product separation incidents in the future.

Summary

Use of OLAP technology applied to the plant data allows users to find patterns in the data, and answers to questions they hadn't previously considered. The key to effective reporting analysis is the upfront design and structuring of data objects. A good design allows users to creatively manipulate and drill into the data in ways that canned reports do not permit.

In the case of Beach Buns, Inc., Barry was able to view production by product class across multiple locations, answering numerous questions including: What was the runtime for a given production line? How long did it take to make each product? Are deviations constant or isolated?

Barry had the actual plant data to back up his analysis, and did not have to rely on "gut feelings" or a "shotgun approach." Furthermore, he was able to email the analysis to his peers to solicit their input since they too used Excel. With this production issue resolved, throughput improved and they operated more efficiently. The plant data is not static; Barry will keep up his efforts to continuously improve production by doing further analysis and focusing his attention where there will be the greatest return.

A different set of issues faced Sunny Day Solar. Sonia knew that defects in the product were hitting them on the bottom line. Drilling down into the data showed that the most frequently occurring defect was not the costliest.

Analyzing this information from manual batch sheets used to take Sonia an incredibly long period of time just to sift through and tally the data. Using OLAP technology enabled her to quickly focus her efforts away from data collection and to information analysis. The analysis helped her know when and where the quality issues were most severe. The result of the analysis was that quality improved by identifying and solving the issues creating the defects. This, in turn, drove down operational costs.

In the real life scenarios, CIM Concepts special value to the clients was in analyzing their unique needs and designing a relational database to aggregate the plant data in a manner effective for analysis. CIM Concepts created the structures and relationships within the data and designed preliminary report templates. Clients were educated on using the analysis tool and on maintaining the environment so that they are free to further develop unique new reports on their own.

CIM Concepts enabled clients to flexibly analyze their data in new ways, providing the catalyst for positive operational change.

CIM Concepts Incorporated

Why CIM Concepts?

Expertise CIM Concepts' staff of highly trained professionals has the experience to help clients be successful. The CIM Concepts team is comprised of individuals with real-world experience who have been in the client's situation, faced tough challenges – and succeeded! With a client's vision and CIM Concepts' know-how, CIM Concepts can make it happen!

Integrity CIM Concepts is proud of its reputation as a partner who can be counted on to do what they say they will do – on time and on budget. CIM Concepts is frank in their assessments. With every engagement, CIM Concepts believes their reputation is on the line. That's one reason CIM Concepts has a loyal client base with repeat engagements.

Support Unique client needs and requirements are handled with flexible, personalized service. This is fundamental to CIM Concepts business principles. CIM Concepts anticipates client needs and is prepared to go the extra mile to satisfy their clients.

Value Quality work at a reasonable price brings value to CIM Concepts' clients.

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