

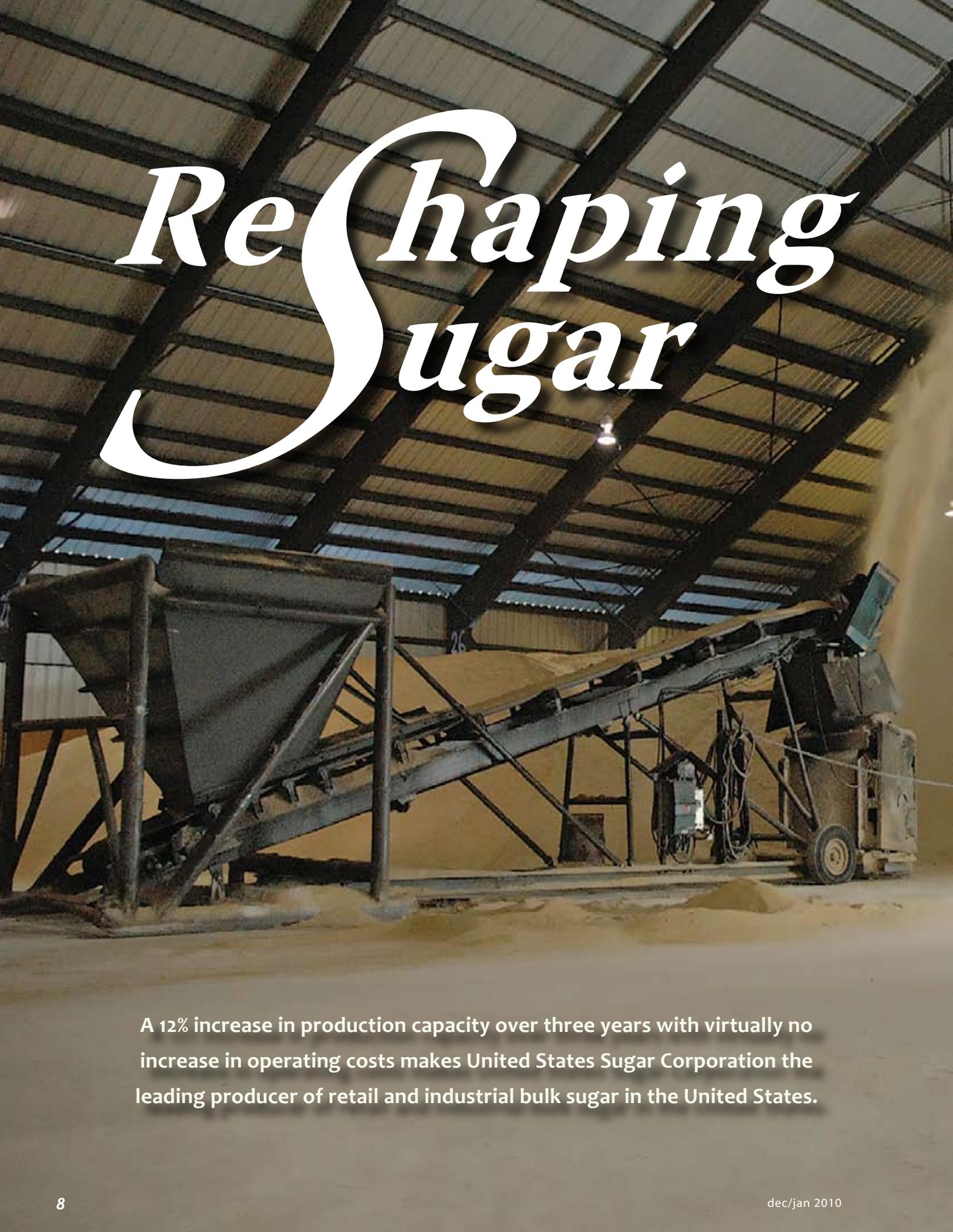
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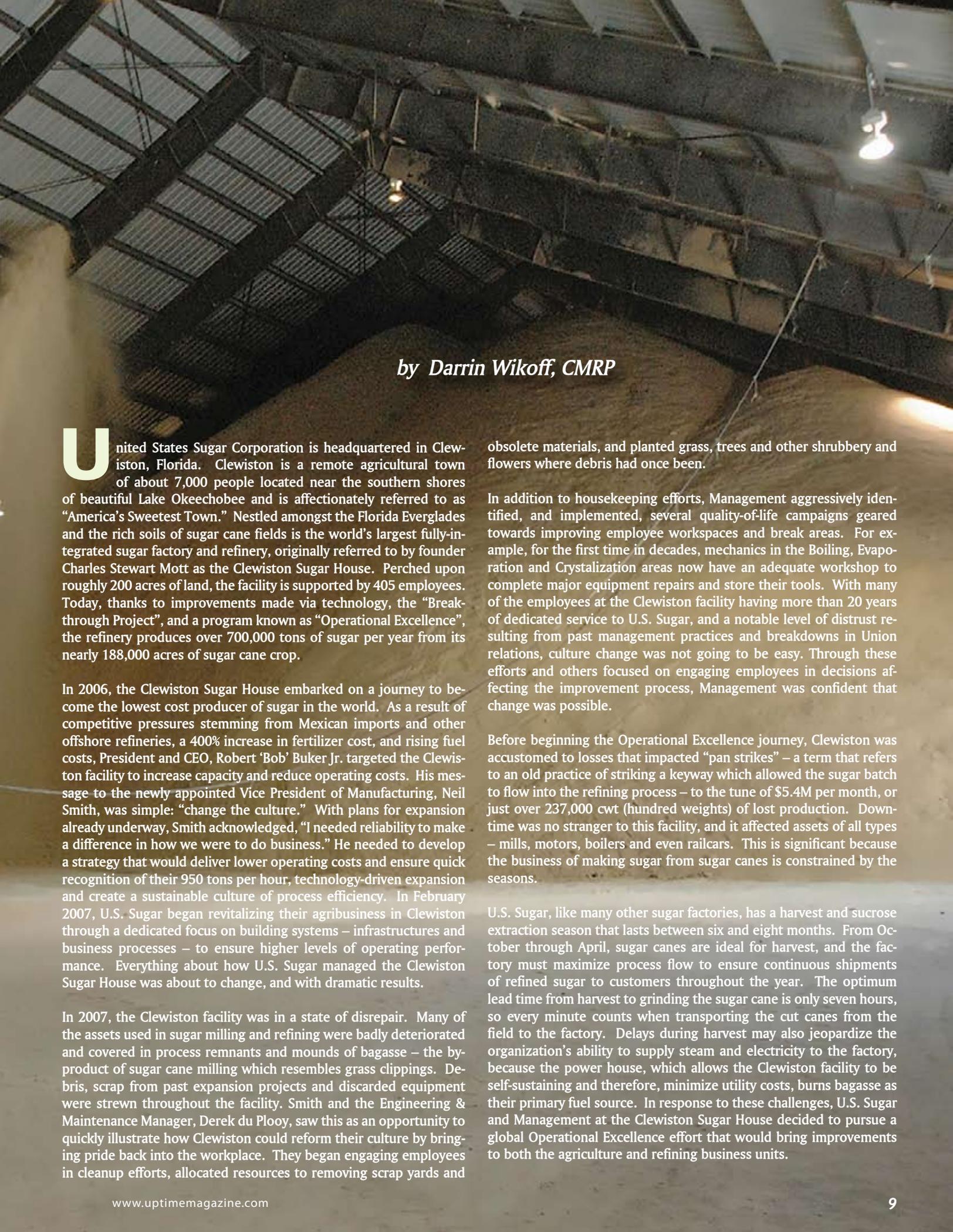


Sweet Success at U.S. Sugar



ReShaping Sugar

A 12% increase in production capacity over three years with virtually no increase in operating costs makes United States Sugar Corporation the leading producer of retail and industrial bulk sugar in the United States.



by Darrin Wikoff, CMRP

United States Sugar Corporation is headquartered in Clewiston, Florida. Clewiston is a remote agricultural town of about 7,000 people located near the southern shores of beautiful Lake Okeechobee and is affectionately referred to as “America’s Sweetest Town.” Nestled amongst the Florida Everglades and the rich soils of sugar cane fields is the world’s largest fully-integrated sugar factory and refinery, originally referred to by founder Charles Stewart Mott as the Clewiston Sugar House. Perched upon roughly 200 acres of land, the facility is supported by 405 employees. Today, thanks to improvements made via technology, the “Breakthrough Project”, and a program known as “Operational Excellence”, the refinery produces over 700,000 tons of sugar per year from its nearly 188,000 acres of sugar cane crop.

In 2006, the Clewiston Sugar House embarked on a journey to become the lowest cost producer of sugar in the world. As a result of competitive pressures stemming from Mexican imports and other offshore refineries, a 400% increase in fertilizer cost, and rising fuel costs, President and CEO, Robert ‘Bob’ Buker Jr. targeted the Clewiston facility to increase capacity and reduce operating costs. His message to the newly appointed Vice President of Manufacturing, Neil Smith, was simple: “change the culture.” With plans for expansion already underway, Smith acknowledged, “I needed reliability to make a difference in how we were to do business.” He needed to develop a strategy that would deliver lower operating costs and ensure quick recognition of their 950 tons per hour, technology-driven expansion and create a sustainable culture of process efficiency. In February 2007, U.S. Sugar began revitalizing their agribusiness in Clewiston through a dedicated focus on building systems – infrastructures and business processes – to ensure higher levels of operating performance. Everything about how U.S. Sugar managed the Clewiston Sugar House was about to change, and with dramatic results.

In 2007, the Clewiston facility was in a state of disrepair. Many of the assets used in sugar milling and refining were badly deteriorated and covered in process remnants and mounds of bagasse – the by-product of sugar cane milling which resembles grass clippings. Debris, scrap from past expansion projects and discarded equipment were strewn throughout the facility. Smith and the Engineering & Maintenance Manager, Derek du Plooy, saw this as an opportunity to quickly illustrate how Clewiston could reform their culture by bringing pride back into the workplace. They began engaging employees in cleanup efforts, allocated resources to removing scrap yards and

obsolete materials, and planted grass, trees and other shrubbery and flowers where debris had once been.

In addition to housekeeping efforts, Management aggressively identified, and implemented, several quality-of-life campaigns geared towards improving employee workspaces and break areas. For example, for the first time in decades, mechanics in the Boiling, Evaporation and Crystalization areas now have an adequate workshop to complete major equipment repairs and store their tools. With many of the employees at the Clewiston facility having more than 20 years of dedicated service to U.S. Sugar, and a notable level of distrust resulting from past management practices and breakdowns in Union relations, culture change was not going to be easy. Through these efforts and others focused on engaging employees in decisions affecting the improvement process, Management was confident that change was possible.

Before beginning the Operational Excellence journey, Clewiston was accustomed to losses that impacted “pan strikes” – a term that refers to an old practice of striking a keyway which allowed the sugar batch to flow into the refining process – to the tune of \$5.4M per month, or just over 237,000 cwt (hundred weights) of lost production. Downtime was no stranger to this facility, and it affected assets of all types – mills, motors, boilers and even railcars. This is significant because the business of making sugar from sugar canes is constrained by the seasons.

U.S. Sugar, like many other sugar factories, has a harvest and sucrose extraction season that lasts between six and eight months. From October through April, sugar canes are ideal for harvest, and the factory must maximize process flow to ensure continuous shipments of refined sugar to customers throughout the year. The optimum lead time from harvest to grinding the sugar cane is only seven hours, so every minute counts when transporting the cut canes from the field to the factory. Delays during harvest may also jeopardize the organization’s ability to supply steam and electricity to the factory, because the power house, which allows the Clewiston facility to be self-sustaining and therefore, minimize utility costs, burns bagasse as their primary fuel source. In response to these challenges, U.S. Sugar and Management at the Clewiston Sugar House decided to pursue a global Operational Excellence effort that would bring improvements to both the agriculture and refining business units.

Operational Excellence

The Operational Excellence mission of U.S. Sugar is clearly focused on bringing pride back into the workplace in order to be the low cost producer within the United States.

“The way you change culture is to instill pride,” says Neil Smith. Upon Smith’s desk lies a stack of laminated pocket cards entitled “The Change” which illustrate the mission of Operational Excellence. Smith uses these cards when employees enter his office as a means of continually reinforcing the company’s desire to create a more inviting workplace that enables efficiency and improvement. Even after two years of implementation, Smith and his leadership team are committed to culture change as the leading improvement objective. To say that change is part of the improvement strategy would be misleading, it’s the overall mission of Operational Excellence. Everyone within the Clewiston facility has a responsibility to instill pride. Everyone from the Maintenance and Engineering staff to the administrative staff has been recruited to assist with the transformation. As an example of inclusive thinking, administrative assistants are responsible for monitoring and managing landscaping maintenance and restoration. No one takes this mission lightly, and that’s an indication of the level of pride that Management has already instilled.

The mission of Operational Excellence continues with a focus on processes, or systems, as Smith and his team commonly call them. These systems are the means by which business leaders hope to institutionalize new behaviors in support of reliability, maintenance, materials management and operating best practices. “Operational Excellence put in systems and steps that allow the culture to evolve,” says Jack Webb, the Powerhouse Maintenance Planner. Evolution of culture, instead of forcing people to change their behaviors, is a very unique approach to change management – one that, if you stop and think about it, makes sense. Like many other competitive companies, U.S. Sugar has undergone numerous improvement initiatives in the past which claimed to have a culture change component. In the past, they’ve focused on “managing” the change, meaning they used tactics aimed at requiring people to adopt changes. In the past, resistance to changes merely shifted from active to passive, leaving Management with a perception of success. When the focus moved to the next “flavor of the month” employees went back to doing things the same old way, producing the same old results. The approach to Operational Excellence is different because the primary focus is on culture change, therefore requiring solutions that would deliver change.



Figure 1 - Scrap from past projects next to Mill.



Figure 2 - Beautification efforts outside raw sugar warehouses.

In February 2007, Smith engaged Life Cycle Engineering (LCE), a Charleston, SC-based reliability consulting firm, to guide and mentor U.S. Sugar through their journey towards Operational Excellence. Leveraging LCE’s Reliability Excellence methodology, from March to May 2007, the Clewiston Sugar House partnered with industry experts and representatives from the agricultural business to develop formal business processes. The system design focused on four main areas of Operational Excellence:

Work Management – Those processes which govern how U.S. Sugar would manage maintenance resources and coordinate activities with operations in order to more efficiently execute repairs and preventive maintenance routines.

Materials Management – Those processes which would ultimately enable U.S. Sugar to consolidate inventory warehouses and optimize on-hand quantities to reduce holding costs while ensuring a just-in-time delivery of materials to operations and maintenance.

Reliability Engineering – The focus within these business processes was failure prevention and asset care. Redefining how U.S. Sugar develops and executes preventive maintenance programs, or how they

capture and analyze failure data, has added a level of predictable performance that’s been lacking since the first pound of sugar cane was ground in 1929.

“In meetings now we talk about the consistency of Milling operations (from hour to hour) instead of focusing on overall tons per day,” says Sean Miller, Reliability Engineer.

Operational Efficiency – Operations focused on developing systems to 1) identify the source of losses which impact sugar production; 2) report losses on an hourly basis to determine corrective actions; and 3) quantify the impact of the cumulative losses. As a philosophy, Overall Equipment Effectiveness (OEE) was the model that led to the current methodology in place. However, unlike most OEE first-timers, the Clewiston leadership team focused on eliminating repetitive losses per day instead of focusing on the number or percentage of OEE. This leading-indicator application of OEE has helped to change the culture within the operating ranks.

The Reliability Excellence Model, shown in Figure 3, outlines the areas of improvement that helped U.S. Sugar drive culture change within the Clewiston facility. Beginning with a solid foundation of management commitment, strengthened by cross-functional partnerships between Maintenance Planning, Engineering and Maintenance Supervision, the facility was able to engage employees in defining the problem statement and gaps which were preventing the Sugar House from achieving the desired levels of operational efficiency. Through a business process re-engineering approach, focus teams were able to define the systems needed to transform their business. These focus teams included members from all levels of the organization, from the Refinery, Factory, Powerhouse and Agriculture. Although the teams were facilitated by LCE coaches, it was U.S. Sugar employees, the stockholders, who ultimately deployed solutions within every aspect of the operation which delivered results and seeded the culture change initiative.

The initial implementation of newly designed business processes began in June of 2007. The implementation began in the boiling operation, where sucrose extracted from the sugar cane enters a series of centrifuges and boilers in order to separate the raw sugar crystal from the molasses, then quickly spread to the Powerhouse, Factory and finally the Refinery itself. Throughout the implementation in 2007 and 2008, employees and management worked to refine the systems put in place as their understanding matured and results were recognized. Since 2007, the processes have been simplified, no longer needing the

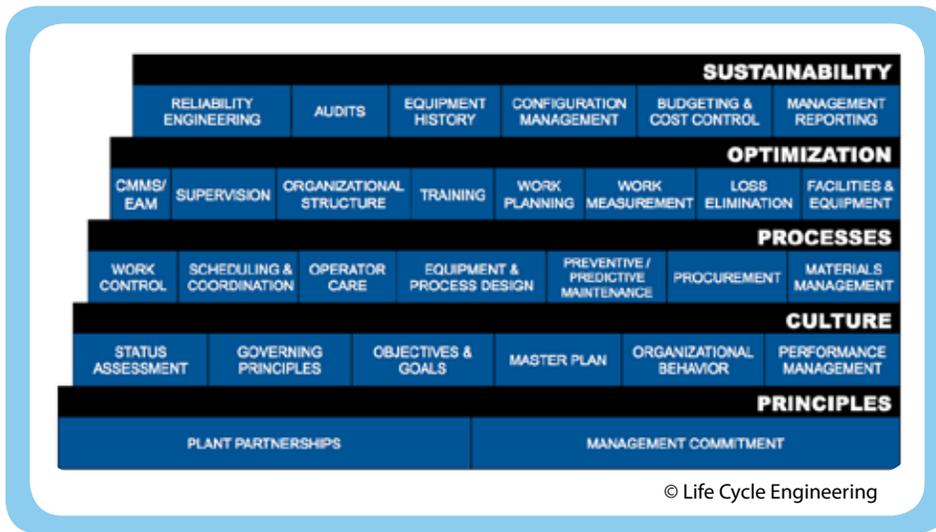


Figure 3 - Reliability Excellence Model

original degree of detail, and today serve as a method of auditing one another, as partners, against agreed upon standards of practice. For example, during the 2009 summer repair – a planned outage within the factory that allows the organization to recondition assets in preparation for the grueling harvest season – management revoked overtime as a means of completing the planned work. Instead, management and supervision within maintenance and operations held each other accountable to follow the business processes and work within the framework of the system. This was a real proving ground for Operational Excellence. By mid-September, two weeks before the outage period was scheduled to conclude, 99% of the scheduled work was completed as planned, and no additional overtime, beyond scheduled overtime resulting from natural shift rotations, was necessary. The system worked! Everyone from the controller to factory operators were impressed with the results; never before had a summer repair gone so smoothly. Just one year prior, maintenance had expensed a considerable amount of overtime in an effort to rush the scheduled work to completion within the last 2-3 weeks of the outage.

Today, efforts continue in materials management, job planning and the development of preventive and predictive maintenance routines. There's a new level of confidence in the system that's helping to accelerate improvements in these areas. A heightened level of trust within the materials management system has created an increase in demand for kitted materials – prepared packages of spares, consumable materials and special tools for repairs and preventive maintenance. Operators are being engaged more and more in preventive maintenance routines throughout the factory, performing duties such as cleaning, lubrication and recording system parameters for engineering analysis. Reliability engineering

resources are continuing to help minimize downtime through the application of predictive technologies like vibration analysis, oil analysis and thermography. The level of skepticism is diminishing. One Operations Supervisor, Billy Dyess, shared "I wasn't a believer in vibration analysis...I didn't have time to stop packaging." Dyess explained that his perception of the value that predictive technologies can bring to his organization has changed: "The first couple of 'predicted failures' made me a believer."

The Clewiston Sugar House is not out of the weeds yet; there's still a long road ahead. Failures still plague the factory and other areas of the facility, but operations continues to monitor losses and the number of days of good production without a failure, in order to help maintenance and engineering improve the system. More and more data is being compiled within the newly implemented SAP enterprise asset management system that engineering will be able to use to further eliminate those repetitive problems that are still preventing the operation from reaching the new performance targets established by upper management. Maintenance is working to continually strengthen their ability to reduce turnaround times when critical equipment repairs are necessary. The collaborative efforts of these partners will continue the focus on culture change, and within a couple of years you'll be reading about U.S. Sugar achieving Operational Excellence.

Operational Excellence Delivers Results

If you participated in the U.S. Sugar tour at the International Maintenance Conference (IMC) in December of 2008, then you were able to see firsthand the improvements that were be-

ing made at the Clewiston factory. But, I'll bet you didn't know of their success. Operational Excellence has already delivered some pretty amazing results for the Clewiston Sugar House. Although pan strike losses and energy losses still occur, there's been significant progress towards reducing operating costs per unit of production. Here are some of the measurable results from U.S. Sugar's journey to Operational Excellence:

- Within two years, grinding operations in the factory have increased 16% from 27,000 tons per day to over 32,000 tons. In fact, in the first 19 days of the 2009-2010 harvest, the Factory set a record production of 500,000 tons of processed sugar cane, which equates to 92,000 tons over projections and nearly three days of additional sugar processing capacity. Much of these gains can be attributed to more effective maintenance being performed during the off season, as evident by a 35% decrease in "emergency work."
- In turn, the refinery has had record production runs for the past two years with an overall increase in production capacity of just over 12%. The additional sales of 1.7M cwt is a direct result of those efforts focused on the elimination of failures, more efficient execution of maintenance during service days and mini-outages, and operators taking ownership for the day-to-day condition and care of their assets. Mechanics and operators working together reduced elevator failures from one per month in 2007 to a total of two in 2009, an 83% reduction in downtime.
- Operational Excellence has also significantly impacted maintenance costs. For example, during the last repair season, contract labor costs were reduced by 33% as a result of increasing internal labor utilization by 12.4 FTE's throughout the entire factory – both a direct result of improvements made in work and materials management.
- The materials management focus quickly resulted in the elimination or sale of \$2.9M of obsolete or damaged inventories that were continuing to accrue carrying costs. Indirectly, by removing the poor quality maintenance spares, downtime to operations has been reduced, resulting in the already mentioned improvements in capacity. Most notably, Clewiston has consolidated inventories from the refinery and agriculture, reduced the number of warehouses being occupied and maintained by the facility from 11 to 3, and reduced warehousing labor by 8 FTE's.

- We can't forget the customer focus of Operational Excellence. As of October 2009, customer complaints, at 0.05 per 1000cwt, are down 84% from 2006, and 54% from 2008, an impressive testament to the overall impact that culture change can have on an organization's ability to increase customer value.

So, what about the culture change? Are we there yet? The Warehouse Manager, Randy Hall, had this to say, "There are holes in the wall now; before it was a solid brick wall." Pride is evident in every aspect of the U.S. Sugar operation in Clewiston. Leadership continues to reinforce the expectation that employees need to take ownership of their facility and the work they do day-to-day. Business systems that were in place prior to the implementation of Operational Excellence are constantly being challenged to ensure that they meet the overall mission of the facility. Darrel Collier, the Factory Manager, said "The first year was pretty tough...but once we understood the system, it got easier and easier." Culture change is not a quick win in any improvement strategy. Change takes time, but this facility, and leadership, is willing and committed to making it happen. As a consultant with more than eight years of experience helping organizations like U.S. Sugar implement transformational change, I can't remember when I saw so much dedication to change. I believe that their success, and what holds leadership accountable for the change, is the routinely communicated mission of Operational Excellence, "The Change." Organizations that declare victory once they see evidence of the solution driving the desired result ultimately fail to recognize the full potential of Operational Excellence. In my mind, this factory is different. Leadership in Clewiston won't sound the trumpets of victory until they see evidence of a new, institutionalized culture. This implementation has not been a technical solution with a cultural component; it's a cultural solution with technical enablers.

Sustaining the Gains

Sustaining the Operational Excellence journey requires you to first align your organization based on the long-term vision of how your organization is to do business. As Neil Smith expresses it, "If we're not going to be reactive, then we don't need the redundancy in management to support the reactive." This refers to Smith's focus on aligning his leadership and supervisory structure within the factory to support a proactive and more efficient manufacturing operation. Consolidating supervisory positions that were in place due to former reactionary habits afforded Clewiston the opportunity to reallocate qualified resources



Figure 4 - Photos of MRO material storage in Central warehouse before the project and properly stored materials after the project implementation.

to new roles such as Maintenance Planner, Material Coordinator and Reliability Engineer. These roles help support the implementation and long-term sustainability of newly defined business processes.

Most people within the factory believe that they are achieving a level of stability that affords them the opportunity to really optimize performance of the operation. The organization is now in a transition from a maintenance-led, although manufacturing sponsored, improvement campaign to one that's led by operations. Supervisors aid the sustainability efforts by frequently communicating how the system is designed to work and how it will affect operators, in order to further build awareness. Employees within operations have not been as engaged as the maintenance and engineering departments, beyond the housekeeping efforts originally deployed by Smith and his leadership team, so sustainability means getting these people involved in decisions affecting improvements in their areas. There are a number of pockets of excellence where operators are taking a more aggressive role in operational efficiency. For example, in the refinery, operators in the packaging area are

competing with one another to see who can maximize production while working within the guidelines of the system. It's this type of healthy focus on efficiency that will enable the Sugar House to sustain improvements over the next couple of years.

Management is also working on sustaining the gains. Metrics are now in place that help business leaders monitor the operation against the system. For example, SAP notifications are tracked to ensure operators and operations supervisors are entering maintenance needs in the work order system to be prioritized, planned and scheduled. Supervisors are also tracking the number of notifications that identify a potential failure before it impacts production. These monitoring practices will ensure the integrity of the system while continuing to reinforce cultural expectations. Although some people still operate outside the system, it's getting harder and harder to hide.

While this story has focused on the manufacturing side of the business, the agriculture side of the business has been involved since the global design of the system and has implemented many of the same improvements. An-



Figure 5 - Aerial plant photo after cleanup efforts.

other aspect of sustainability worth noting is the impact of Operational Excellence on the agricultural business. Because of the record production levels achieved during this year's opening harvest, with the factory being three days ahead of projections, agriculture will benefit from operating cost reductions, theoretically having to harvest three days less this year than in previous years. This effectively reduces the demand in agriculture on labor and fuel, resulting in a \$2.5M savings. This supply chain effect is a great catalyst for sustainability and the enterprise partners will achieve a lower overall cost per unit and ensure future collaboration with regards to improvements.

Learning from the Clewiston Sugar House

What can we learn from U.S. Sugar's journey to Operational Excellence? Here are a number of key observations that you should keep in mind before beginning your improvement process:

1. The mission is culture change, and capital enhancements and technical improvements are best deployed as enablers.
2. Employee engagement is critical to success, it's all about the people and your first step is to instill pride in the work place.
3. Never overlook the opportunity to communicate the mission of your improvement strategy or the intent of the solution. Building awareness builds desire in your employees to get engaged.
4. Design your "system" with the beginning and end in mind. When beginning your improvement process, employees need more detail to fully understand the system and how they are integrated into the system. Once implemented, refine the system as a method of auditing and maintaining personal accountability to uphold the principles of your strategy.
5. While starting slowly within a specific area of your facility, embrace the eagerness of leaders who take the design to new levels of enthusiasm, commitment and results.
6. Continually reinforce the successes that your improvement process brings to the organization. Once again, never overlook an opportunity to initiate a conversation that reinforces the mission and how the organization is working towards that mission.
7. Keep the focus on the long haul. Put people in positions where they can be

successful in executing the new system. Remember that the overall goal is culture change, and position your business leaders where they can effectively sponsor the change.

8. Recognize when certain groups or departments have not been involved as a result of the initial design. Take steps to reshape your strategy in order to increase engagement and further drive performance results.
9. Education is the first, second and third step in your implementation process. Employees who don't understand the system or how they must change their behaviors in order to work within the system will inevitably develop work arounds. Work arounds restrict your organization's ability to achieve the full

potential of your solution.

10. Build partnerships within your supply chain in order to share lessons learned and leverage improvements that impact customer value.

Darrin Wikoff, CMRP, specializes in organizational change management, business process re-engineering, reliability engineering, and work management. As a Principal Consultant and adult education facilitator at Life Cycle Engineering (www.LCE.com) Darrin empowers his clients and students with the skills and knowledge necessary to implement business transformation initiatives like Lean Manufacturing, Total Productive Maintenance and Reliability Excellence. Darrin can be reached at dwikoff@LCE.com

An Interview with Robert Buker, Jr., President of U.S. Sugar

Robert Buker, Jr. is a welcoming, gracious and personable man. His pride for U.S. Sugar's accomplishments in Clewiston is abundantly obvious, and he clearly believes that Operational Excellence has averted the closure of the Clewiston Sugar House.

Buker described the Clewiston facility as "out of control on so many levels" prior to the Operational Excellence implementation. "We didn't know what we were making, buying or even paying our employees." Buker explained that U.S. Sugar didn't have the systems in place that allowed them to understand how much sugar they were making, or measure performance of any part of the operation, and they didn't understand how much of an impact the agricultural side of the business was having on manufacturing. With market prices flat since 1980, "we were getting squeezed and had to make a change."

"You don't lay out a battle plan you can't explain in a few words," he said when I asked why his primary expectation of leadership was to change the culture. He went on to say that "if you make it too complicated, people will lose interest." Buker's patience and understanding of the improvement process is unusual for a man of his position. Most executives want improvements immediately, and no doubt he did too, but his fortitude to stay the course and hold his leadership accountable to deliver has been a critical success factor. "If you attack further behind enemy lines, you don't always feel the impact, but a more significant im-

pact you make." This was the analogy he used to explain his decision to go with an improvement strategy like Operational Excellence, which would take three to five years to deliver significant results. I should mention that many of Buker's analogies were military references which stemmed from his upbringing and passion for military history. Buker admitted he was not always patient. He didn't wait for the culture change to be "fully staged", in his words, but instead pressured the organization to implement the breakthrough project and both technical and change-oriented improvements of Operational Excellence at once. If he'd had it to do again, he would have waited.

Buker describes today's Clewiston operation much differently. "We're measuring each stage from cut to deliver to grind to refine". He's proud of the fact that their ability to deliver cut sugar canes to the Factory in seven hours or less is the best in the world, and ultimately helped them avoid nearly \$5M in sucrose losses this year, which certainly translated into increased revenues. Buker speaks fondly of the fact that Clewiston is more deliberate in their activities, "more precise in everything we do." Buker summed it all up by saying that the implementation methodology, facilitated by Life Cycle Engineering, was "an ignition source for culture change" and helped the Clewiston Sugar House transform their business from "terrible, to world-norm, (and soon) to world-class."



Using a proven business reengineering process, LCE's Reliability Consulting Group (RCG) has led many clients through a total organization transformation designed to raise operational performance to a sustainable world-class level. Reliability Excellence creates reliability-centric standard practices for business processes, operational and maintenance work execution and organizational effectiveness as well as asset reliability.

RCG provides a unique combination of strategic, tactical, technical and educational services to help you achieve your short- and long-term business objectives.

STRATEGIC SERVICES: World-class performance begins with a strategy and comprehensive business plan that integrates all critical business functions. RCG's unique boardroom-to-shop floor approach to business process reengineering enables you to transform your organization and achieve operational excellence.

Our strategic consulting teams facilitate the development and implementation of standard processes that assure a sustainable business strategy and standardized work practices. These standard processes help you effectively use your installed capacity and improve operating profitability.

Transforming an organization into a world-class performer is a long-term effort that requires a heavy front-end investment to achieve sustainable benefits. Our proven Reliability Excellence transformation process includes services designed to generate short-term improvements that can fund the business reengineering process. These services include:

- **Loss elimination:** RCG reliability engineers identify and resolve issues that impact your cost of goods sold and operating profit. While not sustainable without the reengineering initiative, these loss elimination activities have the potential to generate short-term, "quick win" improvements that off-set reengineering cost.
- **Infrastructure preparation:** RCG engineers and technicians establish asset hierarchies, asset criticalities and asset management plans that support a reliability-centric transformation.

TACTICAL SERVICES: When organizations have specific, short-term needs for experienced subject matter experts (SMEs), our team can provide capabilities that can be hard to come by on a short-term basis. RCG can provide:

- **Reliability engineers** to resolve chronic waste or loss problems or provide on-going reliability engineering support
- **Planners and Schedulers** to create a planning and scheduling function or augment existing staff
- **Materials Management SMEs** to set up storerooms, materials handling or materials management programs or augment existing staff
- **Enterprise Asset Management (EAM) SMEs** to optimize the use of Computerized Maintenance Management Systems (CMMS) or other EAMs
- **Lean Six Sigma SMEs** to facilitate implementation of a Lean Six Sigma program or augment existing staff

ASSET MANAGEMENT: Life Cycle Engineering's Asset Management Services (AMS) team helps our customers jump-start their asset management programs. Whether you are re-implementing an old system or migrating to a new Computerized Maintenance Management System (CMMS), Enterprise Asset Management (EAM) or an Enterprise Resource Planning (ERP) system, it's an enormous undertaking that demands the right people with the right knowledge and skill set to ensure the proper installation of the critical elements of your asset management system. Our AMS team can assist with EAM implementation and optimization, risk-based asset management programs and life cycle asset management.



HIGH IMPACT LEARNING – CUSTOMIZED TRAINING SOLUTIONS: High Impact Learning is learning that changes behavior to achieve desired results and is a process, not just a single event like "taking a class." The Life Cycle Institute helps organizations determine if learning/training is the answer to a performance shortfall and can design a High Impact Learning solution. This involves:

- Defining competencies and skills
- Assessing gaps
- Learning Impact Maps
- Creating High Impact Learning interventions that produce results
- Documenting application of new abilities

When retention strategies and support beyond the classroom experience are included in the learning initiative, the application of new knowledge and skills can increase by up to 80%.

To learn more about the Life Cycle Institute, contact: 800-556-9589 or education@LCE.com