

## PROFESSIONAL CONSTRUCTION MANAGEMENT – A CASE STUDY

Project Owners benefit greatly by having a skilled Construction Professional on their team, providing valuable guidance and services needed in today's sophisticated construction arena. Industrial Projects Construction (IPC) was the Construction Manager on a greenfield Medium Density Fiberboard project in Willows, CA.

We will discuss some challenges that came with designing and installing a serial number one process industry plant. We all know it takes a great team, and we had one. But what did that team of engineers and contractors specifically do that was compelling? Let's dig into that a bit. But first some background.

## CALPLANT'S GENESIS (BRANDED AS EUREKA MDF) .....

California's Sacramento Valley is the second-largest rice-growing region in the US, planting over 500,000 acres annually. In 1991 the California Air Resources Board passed legislation phasing out field burning of rice fields. Current practices require the straw to be tilled under followed by an additional field flooding to facilitate straw decomposition. This greatly increases machinery, labor, water demand, fuel costs and greenhouse gases without an increase in crop yields.

CalAg, LLC ("CalPlant") was founded in 1996 to address issues resulting from the burn ban. Years of experimentation, product trials, and committed efforts confirmed that Medium Density Fiberboard ("MDF") was an excellent use for the straw.



## PROJECT DETAILS

The CalPlant project is the first MDF plant in the world utilizing rice straw as the furnish material. The plant was designed to produce more than 150 million square feet of MDF annually ( $\frac{3}{4}$ " basis) using 280,000 tons of rice straw.

The process design was developed in Germany by Siempelkamp Maschinen- und Anlagenbau GmbH ("Siempelkamp"). The Siempelkamp ContiRoll® Generation 9 continuous press employs a product mat 10-feet wide and 117 feet long. The mill produces MDF thicknesses of 2.0 mm to 32 mm (0.080" to 1.25"). The state-of-the-art press is currently the only one of its type in the United States.

**Industrial Projects Consulting, LLC ("IPC")** was the Project/Construction Manager. All major contracts for engineering, vendor supply and construction were solicited, procured, and managed by IPC. IPC oversaw all the design professionals, their scopes of work, schedules, quality, and contracts. We managed site safety, with the added Covid-19 global pandemic as an unexpected challenge.

The Balance of Plant engineering design was prepared in Eugene, OR by Evergreen Engineering, Inc.

The project site is 273 acres, with 25 acres for the plant itself. The balance of land is designed to store 330,000 tons of baled rice straw feedstock which is harvested in a six-week period in the fall of the year.

Detail design began in the Fall 2017, and ground was broken for the site and civil packages in the Spring of 2018. Detailed design for structural, mechanical, electrical, controls, and specialty packages was prepared in parallel to site construction. Commercial operation began in Spring 2021.

Eureka™ MDF meets or exceeds the American National Standards Institute (“ANSI”) performance standards for traditional wood based MDF with excellent machinability, paintability, and consistency. Its annually renewable fiber source ensures a steady, homogenous supply of Eureka™ MDF.



## CHALLENGES, SOLUTIONS, AND BENEFITS

Our team faced all the normal design and construction issues for a complex, heavy industry plant design, but these expanded to a never-ending compilation of obstacles.

### Serial Number One Plant Design

**Rice straw is an emergent furnish material:** Many parts of this MDF plant were of conventional design, but the handling and processing of rice straw presented new challenges. Rice straw is like wood, but different. Bale breaking/chopping, and refining are two areas where customized equipment designs are evident. The straw must be cleaned, sized, refined, and resin impregnated to provide a furnish that meets the exacting standards of a very competitive industry.

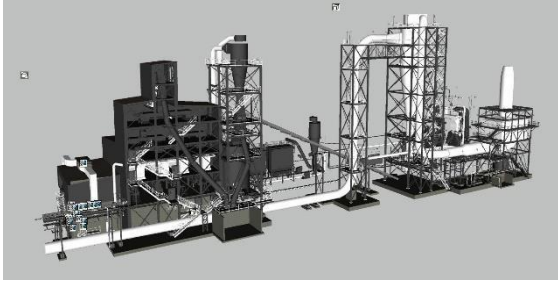
CalPlant hired an expert in the manufactured board industry, Siempelkamp from Krefeld Germany. Siempelkamp (SKR) designs and installs about 50% of all new continuous fiberboard machines in the world. SKR took contractual responsibility for all process design, material handling and fabrication, and resin/wax system design. They installed their latest ContiRoll® Generation 9 continuous press as their signature process equipment. We won't delve into any proprietary process details in their solutions.

The benefit to CalPlant of working with an industry expert, who had considerable experience with different furnish materials, is that Siempelkamp adapted their experiences to the demands of rice straw.

**Design Coordination across two continents:** The process designers were in Germany, the Balance of Plant engineer was in Eugene Oregon, and specialty designers were scattered about the Western USA. Integrated design coordination was key to success.

IPC provided experienced engineers to reside with the Prime Consultant for the duration of the design effort. Considerable trips to the specialty design firms further ensured close coordination between stakeholders.

Procore, a construction management software, was successfully used by all parties to ensure timely document control and distribution. IPC maintained this system. It was continually updated and could be trusted to be accurate for design and construction needs. Project teams could reliably access latest design information and documents, receive and respond to bid requests, and provide regular reporting to the project leadership.



BIM Building Information Modeling: The project gained considerable efficiencies using Building Information Modeling (BIM) software. Siempelkamp modeled the entire project using BIM software, including equipment, to very high levels of accuracy.

- All structural steel, piping, cable tray, lighting, ducting, conveyors, buildings, and fire suppression was modeled. That model, functionally our general arrangement, was used as a basis of design by Evergreen Engineers who created individual REVIT discipline models and drawings.
- The REVIT models were used for both internal and external cross discipline checking and for coordination with specialty systems suppliers.
- The REVIT models were converted to fabrication models using TEKLA, CADWORX, and other industry software for use by CNC fabrication machinery and pipe spooling.
- The Siempelkamp 3D model was updated at select intervals to aggregate Evergreen's evolving detail discipline models.
- The extensive modeling allowed the project to achieve a high level of integration between designs, installation contractors, and field coordination.
- Models were also used for training by the incoming plant operations and maintenance personnel.

The benefit to CalPlant was increased input during the detail design phases, increased quality from the design professionals, and a greatly improved coordination and reduced field changes between the building trades.

**The plant has a well-based water supply:** Many plants use wells for process and firefighting water. CalPlant had the need for instantaneous firewater flows over long distances and up tall towers. Instantaneous water pressures of 10-12 bar (145 to 160 psi) was needed to service fast acting spark detect and quench nozzles. Waiting for a pump to respond and increase pressure was too slow to service these nozzles.

Consistent high pressure was provided using a pressure accumulator and pump/tank arrangement integrated into the firefighting systems. The accumulator tanks were pressurized to 160 PSI and could sustain that pressure for sufficient time to allow a pump to start up and take over pressurizing the system. The system was sized to provide simultaneous fire flow for several discrete systems at our tallest towers.

The benefit to CalPlant was a reliable self-acting firefighting system used to knock down sparks from tramp metal in the ducting and fans. Asset protection to reduce risk saves on insurance costs and reduces downtime.



## EPC Contract Modifications

**Major EPC Contractor changes:** At the behest of the investors, this project began as an engineering, procurement, and construction (“EPC”) contract. IPC was initially involved solely as the Construction Monitor representing the interests of the bondholders (debt providers). About 6 months into the project it became apparent the EPC contractor's budget was inadequate to build the project. After a series of negotiations, it was decided to replace this contractor, and to pursue the balance of the project with CalPlant as the Owner/Builder represented by IPC as their project/construction manager.

Skilled builders know it’s hard to replace a contractor mid-project (we were 20% complete at this point).

- We began our efforts by retaining the engineering company, Evergreen Engineering Inc, which the original EPC Contractor had under contract. This continuity was very important.
- After discussions with prospective replacement contractors, we secured viable contracts with major industrial contractors who were willing to step in and lead their efforts to complete the project.
- Going forward, CalPlant held all the contracts in a multiple prime contractor arrangement.
- IPC was tasked with the detailed oversight of ongoing engineering designs, while coordinating all site contractors, offsite fabrication, material deliveries both foreign and domestic, and site safety.

The benefit to CalPlant by retaining the initial Prime Consultant provided continuity and continued progress towards design deliverables. IPC provided engineers resident at the Prime’s office, skilled in the process industries, to act as liaison between the new constructors and OEM suppliers.

With the goal of keeping site contractors engaged, the Owner / IPC / Prime Engineer elected to secure building permits for each design as it was finalized. This resulted in securing 108 separate building permits, each managed as a separate entity, while being seamlessly integrated into the project’s master permit strategy. The IPC Team, along with Evergreen Engineers, organized and managed this effort, which successfully kept the contractors engaged while minimizing delays and work stoppages.

IPC provided CalPlant the services of a skilled Construction Manager to act as CalPlant’s advocate and manager of the balance of construction. Construction continued unabated during the transition from an EPC to a Multiple Prime Contracts approach.

IPC managed overall site safety and oversaw 1.09 MM safe work hours with a lost time incident rate of 0.

## Government Agency Issues

**Unforeseen changes to permitting requirements:** Emergent land use criteria necessitated undertaking a complete re-design of a major portion of the project at about the 40% completion point. The re-design was a key challenge for the Siempelkamp engineers in Germany, and the Evergreen team preparing detailed designs in Oregon. This took three months and required a simultaneous reschedule of all remaining engineering and construction activities.

While sustaining ongoing contractor workforces, IPC redirected the design and construction priorities of major suppliers to continue advancing construction while the re-design was underway.

Additional engineering companies were hired to expedite designs, sustain design completion schedules, and keep the site contractors effectively engaged.

The risk of continuing construction during this re-design phase was very high, and the Owner did not want to lose the valuable team of mobilized contractors. The diligent efforts of all major participants made it possible to forge ahead even when we were unsure of when and how the redesign would conclude.

## COVID-19 Global Pandemic

**All projects in the USA suffered the effects of the COVID-19 pandemic.** When the Covid virus arrived in the US, our project was completing the specialty systems, and was in startup and commissioning of process equipment. Our process startup phase required more than 30 specialists from Europe to be on site. Each was an expert on their various piece of equipment. When the Covid travel restrictions between the US and Europe began, these specialists went home and were absent for five months.

The project was able to advance, but at a reduced pace. The typical European startup protocols differ in that there are fewer written commissioning narratives, and it is impossible to perform these tasks without the specialists on hand to direct the site workers.

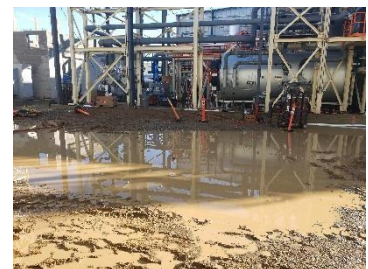
The State of California classified construction workers as essential. We developed and followed rigid Covid-19 prevention protocols and maintained an effective commissioning effort on the balance of plant systems. We had these completed and awaiting the return of the process specialists. Some schedule slippage occurred, but we retained consistency and quality from the BOP contractors.

Obtaining governmental permission for return of the European specialists required the local US congressman and the Chief of Staff in Washington, D.C. to get special dispensation for travel to the site.

## Weather and Environmental

**All projects suffer weather and environmental challenges,** but our project was particularly affected.

**Plant Site Flooding:** 2019 was extraordinarily wet with flood events in northern California resulting from severe rainstorms causing site-wide flooding. The runoff resulted in a breach of a nearby canal thus flooding our site. Equipment was unable to move and materials were occasionally lost in the mud.



**The project years of 2018 and 2020 were the worst fire seasons on record.** The northern Sacramento valley was often smoke filled, with low smoke ceilings, at times obscuring the tops of cranes. This caused severe health and safety issues with the construction staff, necessitating close monitoring and implementation of safety-related work stoppages and slowdowns. CalPlant was directly impacted by several fires:

- Camp Fire, November 2018: This fire was 30 miles away, was in the top 25 of largest California fires, and burned the entire town of Paradise, consumed 153,300 acres, with a loss of 18,800 structures and 85 deaths. Several CalPlant personnel lost their homes. Available local rental property for craft workers all but vanished because of the number of refugees from the fire zone.

- The LNU Lightning storm of August 2020 started the largest fire on record in California, ultimately burning over 1.10MM acres, and was 10 miles from our site. This storm was responsible for igniting one of our straw stacks, which measure approximately 600 ft long, 60 ft wide, by 33 ft tall. By the end of this on-site fire, CalPlant had lost 18 straw stacks, 15% of their inventory, and was left to deal with the aftermath throughout the remainder of the project. Many CalPlant staff were fully engaged in remediation of damage and cleanup from the fire for several weeks afterwards and unavailable for ongoing startup and commissioning activities.



IPC worked diligently to ensure all firefighting systems were fully operational and capable of preventing the spread of this fire into our plant equipment and buildings. Close coordination with plant maintenance teams resulted in continued fire water flows for several weeks from the start of the straw pile fires.

## Shipping and Material Logistics

**Our logistical challenges were unique.** All process equipment was delivered from overseas in 800 shipping containers and 250 breakbulk shipments. The IPC/CalPlant team was responsible for unloading the containers and delivering materials and equipment to trade contractors at the appropriate time and place. We did not want to open any shipping container until the contents were to be installed. There were two reasons for this: lack of clean and dry laydown area, and a fear of losing track of the many specialized parts.

For contractual reasons, the site project team was not able to control the delivery schedule for this equipment.

In addition to the equipment, Siempelkamp supplied much of the commodity materials for the project including electrical cable and cable tray, pneumatic ductwork, instrumentation and control devices, and motor control centers. All of this required a high degree of coordination between the US engineers and contractors and the European designers and suppliers of these items.

IPC supervised the receipt and inventory of site shipments, based on shipping manifests, and staged the containers sequentially based on need. We developed a specialized database to track and schedule the transfer of custody to contractors and supervised a location for just in time deliveries.



## Location and Resource Limitations

The project began design and broke ground at a time when demand for engineering and construction resources were at an all-time high. Willows, CA is a small farming community 80 miles north of Sacramento. Skilled craft workers needed to come from distant metro areas, each of which had sufficient projects to employ their local craftspeople. Adequate accommodations in Willows were compromised by the number of people displaced by local fires, thus reducing available housing to critically low levels.

**IPC has a long history in the construction arena** and has good relations with both engineering and construction firms in the Pacific Northwest. IPC was successful in securing supplemental resources for engineering and construction. IPC kept the Prime Engineering and Construction teams focused on mission critical tasks, and reallocated other tasks to newly hired firms. This proved to be essential in mitigating schedule slippage, even as portions of the project experienced significant re-design.

## AND IN THE END.....

The story of this project is one of perseverance. The project founders stuck with the project twenty-five years from inception to completion. The technical challenges attendant with the design and construction of a project of this size, complexity, and location were compelling.

Every one of these problems were faced and overcome because of the determination of the project leadership, and the dedicated efforts of a group of stakeholders on two continents who believed in this project and refused to accept anything but total success.

Industrial Projects Consulting thanks them and are proud to have worked beside them.

