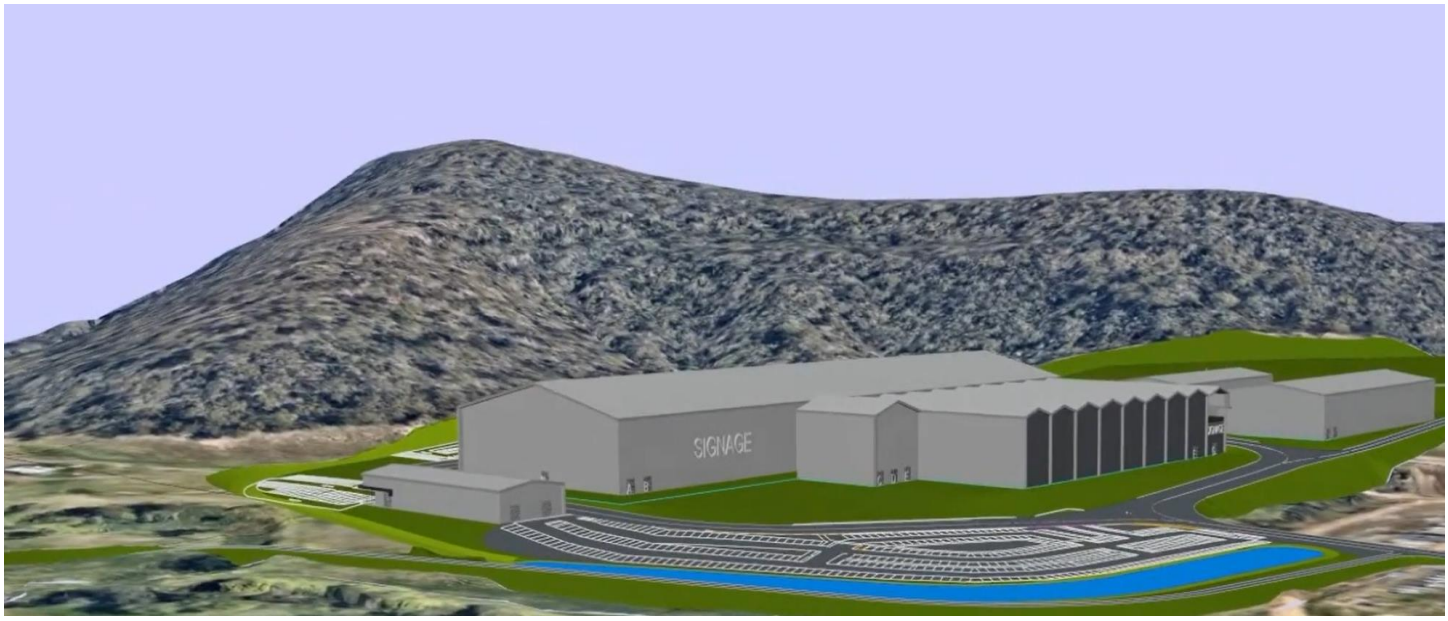
PROJECT

CONCEPTS

LOCKYER VALLEY FRUIT & VEGETABLE PROCESSING COMPANY LTD



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THE PROBLEM / THE SOLUTION

The Problem

Australia has not traditionally been internationally competitive when it comes to the current manufacturing costs for value adding its agricultural produce and has ignored the opportunity to profitably value add Australian Farm (Fruit & Vegetables) for the benefit of the whole community, consumers, and growers. It does not, particularly in Queensland, have immediate, cost effective, local access to a (value adding) processing facility, which can dramatically increase farm gate profitability, and compete with all comers.

The Solution

To design, build and operate a highly profitable, state of the art, sophisticated value adding fruit and vegetable processing facility, close to transport, farm products and national/state domestic markets.

Located in the centre of the tenth most fertile growing region in the world - focused on frozen, canned, juiced, and powdered products, which are in perpetual demand, and are currently serviced by major overseas owned identities.

1. THE AIM / TARGET AUDIENCE

- Improving operations and aiming for the best and most profitable we can be.
- Attention to details of every aspect of the project.
- to develop an approach that will ensure that Australian growers and the facility achieve competitiveness with (and displace) imported manufactured food products.
- Our target audience is the Australian buying public and all government related entities in this marketplace.

2. RESOURCES NEEDED TO ACHIEVE GOAL

- A thorough analysis of how things are currently done in Australia and how they compare internationally.

  Using this information, review current worldwide technologies, to identify suitable equipment and to design modifications to integrate the selected equipment into the ideal food processing enterprise, to suit the South-East Queensland setting.

- Design an integrated project involving the land, growers, transport and dispatch and a building and traffic flow design to optimise movement on site.
- Identify, as many opportunities as possible, which address sustainability issues, conservation of water, minimise waste, using optimum energy and efficiently producing highly nutritious, safe foods.

3. INITIAL PROJECT DESIGN CONCEPT

Integration Concept

Most projects are not designed with integration in mind.

Lockyer Valley Foods recognises the value to all the project stakeholders in integrating their various interests.

- We have identified the external stakeholders as the Growers, their land, and the transporters from farm gate to the factory and the wholesale purchasers thereafter.
- We plan to integrate crop selection with cropping schedules to ensure that the produce is of the highest quality and yields to deliver higher ROI to Growers and a steady supply of high-quality produce in a regulated and controlled delivery to match the processing capability of the factory and the volume of buffering storage on site.
- Integrated bulk handling systems will be implemented to enable fast discharge of produce at the processor into water to minimise handling damage, in under 5 minutes, as well as fast reloading of sanitised, empty bulk bins.

Lockyer Valley Foods proposes installing different receival systems for processing a range of produce.

The Growers crops contain a range of produce with varying qualities, to ensure that all produce attains its highest commercial value, various processes will be installed to process all grades of produce. These product destinations involve converting produce into frozen solids, canned solids, with the highest visual appearance and juices, pastes, and powders for the visually inferior produce.

- Electricity will be generated from natural gas and Biomethane.

Electricity generation will also be an integrated concept where gas engines are used to generate electricity, the exhaust gas from these engines will be captured and used for heat process.

Notes: The conversion of the natural gas into useful energy is around 90% as opposed to 43% for the gas use in engines without its employment in Combined Heat and Power (CHP) because of the deployment of an energy cascade on site, where the waste heat is used several times, at gradually lowering temperatures.

In the future the bio waste from the produce processing will be used in a bio methane plant, to replace the importation of bottled gas into the plant. Multiple engines running the electrical generators are brought on and offline, to match the changing electrical loads on the generators.

- Metal Can making and plastic pallets will also be manufactured on site, to minimise the volume of incoming transport because unfabricated feedstock is more compact than fabricated products.
- Manufacturing these items on site facilitates a more efficient just-in-time manufacturing profile, to closely match the crops and customers' orders.
- A print shop located on site, for cartons and labels, will enable us to integrate printing requirements with customers' orders to ensure that there is no excess unsuitably printed packaging on site.
- The receivals and processing equipment have been selected to be installed in systems where produce with similar processing needs can be installed.
- We will use the same group of machines to process different produce throughout the year to optimise the use of these systems and machines.
- A thermal energy system (TES) will be installed, to make ice slurry where two hundred tonnes of ice slurry at -50^{o}C is stored in a 200-tonne insulated silo.

This will be manufactured continuously by a 75-kilowatt freezer, to apply a consistent load on the gas engines. When large volumes of cooling are required, the TES will act like an ice battery, to enable fast draw down on the stored ice, to meet these peak loads, without imposing fluctuating demands on the gas-powered generators.

Note: This removes the requirement to have larger freezing machines to match these peak demands, which could be over 1200 kilowatts at times. This store of ice will also be used for a circulating chilled water air conditioning system because it has minimal maintenance and running costs.

- Radio shuttles, which are motorised pallet sized transporters will be employed throughout the plant to transport pallets around the site pallet storage system.

This integrated system will use the same system elements for the deep freezer store, the empty metal can store and the dry goods store. This will minimise the number of spare parts inventory as well as minimising the skill set require for multiple systems.

- The bio waste collection system will be in the under croft where all waste streams will be integrated into a single bulk transport tube conveyor, to transfer waste biomass either to transport leaving site or to the onsite future biomethane plant.

This integration will enable odour control and sanitising to take place automatically, with the employment of minimum labour in the process.

The system is inherently safe, being located in a tube, as opposed to a belt conveyor, which needs safety guards and is time consuming to clean, as well as giving off odours from the open belt.

- The future biomethane plant is also highly integrated. Lockyer Valley Foods consultants envisage two types of biowaste conversion technologies. One to employ plasma to convert black plastic, plastic coated cardboard, demolition wood and woody biowaste such as corn stalks into Syngas which is carbon monoxide and hydrogen. (This to power the process steam boilers) and is the common town gas or coal gas which is used to power our cities.

Note: The boilers will be equipped with burner technology to enable fast adjustment to burn Syngas, Methane, Propane, and Diesel Fuels to meet any supply issues.

A Grower initiative to be provided by Lockyer Valley Foods

Plasma technology integrates very well with the Growers ongoing points of rancour where they currently take their plastic sheeting used as mulch, as well as poison drums and old trickle tape, to the dump at their cost.
The conversion of this waste into gas only results in molten glass containing heavy metals as residue. When cooled it is used for road base.
The biomethane plant will receive biowaste from the processor, including out of date supermarket products and restaurant waste.
The packaging left over after extracting the waste supermarket products is fed straight into the plasma gasifier which is integrated with the biomethane plant, eliminating the usual plastics and cardboard packaging waste stream.
The bioreactors' waste stream is high in phosphates and nitrogen because the restaurant waste contains oils, fats, and proteins. These two elements are required to be removed from the wastewater stream as part of the water treatment regulations.
To achieve this our process will add magnesium hydroxide, in one third proportions of each element, to form Struvite. When dried and milled it will be sold back into the farming sector as a slow-release fertiliser.

- Lockyer Valley Foods will install a modern laundry system to launder the uniforms required by the factory staff. There will also be a large canteen. As a point of difference in attracting and maintaining staff, we will

integrate a number of social programs for their staff centered around the assistance that the laundry and canteen capability could offer.

[Historically these types of food processing plants have employed a majority of women. They often have a difficulty in maintaining their family, as well as working a long shift at the processor. We envision using the laundry/canteen and offering these services to employees as part of our superior employer practices.

We will capitalise on the existing great reputation of the Lockyer Valley and Southeast Queensland

Lockyer Valley Foods will address community desire to capitalise on their "sustainability" marketing narratives. All systems and equipment are designed to be developed with an emphasis on delivering sustainability dividends. This will assist the marketing team in presenting our points of difference - by not only implementing sustainable systems, but also our ability to demonstrate them to customers and the wider buying public and, by extension, explain the origin of the increased profitability to Lockyer Valley Foods' investors.

The Lockyer Valley and Southeast Queensland has a long-established reputation as the "Salad Bowl of Australia," (a name owned by Lockyer Valley Foods) consequently, it is in the ideal location to establish a modern state of the art food processing facility. Its longer hours of sunlight, fertile land and reliable water supplies makes it the most logical location to place the processing facility in Australia.

- ✓ Multiple crop species able to be grown year-round, to enable the same processing equipment to be fully employed throughout the year.
- ✓ The selected Withcott Processing Centre is ideally located to a modern transport network and close to customer distribution centres.
- ✓ We are close to the Port of Brisbane, (145 kilometres - two lane Warrego Highway - 1-hour 40 minutes travel time - no traffic lights).
- ✓ 40 minutes travel time - no traffic lights to Brisbane West International Airport (including freight dispatch) in Toowoomba.

Using available modern processing lines

Our processing lines and equipment are currently available from suppliers around the world. There is a wide body of critical assessment available on these machines from experienced industry operators. These machines are installed in the leading food processing companies.

Lockyer Valley Foods have evaluated these recommended leading brands as practicable and have re-arranged these lines to improve efficiencies and have selected machine concepts that have reduced cleaning times.

Where we have identified site specific adaptations required, to be applied to lines, asking manufacturers to incorporate into machine offerings.

4. LOCKYER VALLEY FOOD INITIATIVES

Where Lockyer Valley Foods have made novel improvements has been in materials handling, particularly around efficient storage, and retrieval systems.

Efficient storage and retrieval systems are not common in existing food processing lines. Materials handling conveyors, storage bins and transfer cars are low technology, when compared to the sophisticated equipment being offered by the manufacturers of processing machinery. Queensland engineers are highly capable of designing the materials handling systems required. Materials handling is found in all industries in Queensland. There is a deep pool of experienced practitioners available to us through our consultant Engineers at RMA Ltd in Toowoomba.

Modern industrial management concepts

We have embraced the following modern management concepts and selected machines and procedures to implement them. *Note:* It is not the cost of production that is the issue, but rather the cost of not producing.

We have reviewed systems, industry practices, farming equipment, transport systems, factory equipment and management procedures, to identify where optimum production run times are being wasted, due to inefficient, legacy operating procedures. These initiatives ae incorporated into every step of our plans.

Year-round cropping optimises utilisation of processing equipment

Queensland and the Lockyer Valley are able to grow crops all year round. This enables the same processing equipment to be fully employed all year round when compared to other locations with only one growing season.

This is particularly important in regard to tomato processing. The plant is only one third of the size of a single season tomato processor. This point is particularly important for tomato processing because of the intense international competition.

OEE85 - Our critical tool!

We have embraced the management concept of and overall equipment effectiveness of 85 (OEE85), which will deliver our capacity to operate for 90% of the available time, at 95% design speed, with 99.9% accuracy. The product of these three numbers is 85.

The OEE85 concept has been employed to select the manufacturing equipment lines that deliver this metric. Lockyer Valley Foods is selecting on the speed and efficiency that a line can be recalibrated to its next processing application.

Cleaning time plays a leading role in achieving the OEE85 targets. Typically, in the wider processing industry, cleaning time is not regarded as a profit constraint but rather something that has always been done and is inherent in the industry and as such has not been reviewed for its potential to capture the efficiency dividend.

We are selecting equipment and maintenance procedures that require less than 10% of the available time per production run to conduct these nonproductive activities.

Integration of Horticultural activities with Lockyer Valley Foods for mutual benefit

We have chosen to locate the enterprise in the Lockyer Valley because of its proven history of growing high quality fresh produce. Extensive discussions were held with key stakeholders in the Southeast Queensland horticultural industry and more generally Australia wide. From these discussions, a clear understanding was obtained of the issues which local producers would like to see implemented and a cooperative relationship formed to ensure optimised returns for all stakeholders.

Horticultural developments in plant nutrition have been embraced to deliver enhanced yields to assist in the grower's region of interest and to deliver lower costs of fresh produce to the factory. The processor will allocate (5x5 year) crop supply contracts to various growers in Southeast Queensland to ensure long term reliable supply and also to disperse the growing locations to minimise the risk of damage from hail rain and other natural events.

The processor will integrate planting times and locations to ensure an orderly daily delivery of produce to the processor, at harvest time.

Plant varieties and plant nutrition specifications will be directed and monitored by the processors in-house agronomists.

Bulk Handling Technologies

We have embraced bulk handling technologies to improve efficiencies in transporting produce from the farms to the factory. Current produce handling is geared to the fresh produce market which involves small bins and forklifts and is not optimised for the manufacturing industry. We have designed our bulk handling equipment and procedures at the farms and factory, to efficiently receive the produce from the farms.

Responding to customer demands retailers and manufacturers

Retailers have been encouraging us to respond to their requests for Australian grown and Australian processed frozen and canned goods. They in turn are being pressurised by their customers demanding more Australian sourced foods.

The retailers have supplied volumes and price points for their frozen and canned products requirements. The prices offered are within our level of expectations. These prices have been used to build the financial spreadsheet for the business model.

The retailers and manufacturers have defined the product mix that they are looking for and these figures have been used to provide a broad-brush approach to the equipment capability required and the correct selection of equipment.

The retailers have asked Lockyer Valley Foods to start the project by concentrating on IQF (Individual Quick Freeze) deep frozen products, although recently they are becoming anxious about the cost-of-living increases and the rise in demand for canned produce because of the cheaper cost per kilogram over fresh produce. We have selected the IQF option as stage one, and plan to develop the project in stages (unless funds raised can expedite this process).

5. STAGED DEVELOPMENT FOR THE PROJECT

Subject to the above comment (Pg-12) Lockyer Valley Foods have planned to develop the project in stages to minimise initial capital outlay and to enable the enterprise to attract and train suitable staff without unnecessary pressure.

By demonstrating sound profitability in stage one it is anticipated that this result will assist in attracting investors, debt finance and government grants.

The stages are as follows: -

Stage 1

- Construct the frozen fresh produce line along with its supporting systems to receive, buffer storage, cleaning and grading, peeling, slicing, and dicing, blanching and optically scanning for reject material.
- Build the first nineteen bays of building 4, sufficient to enclose the frozen line and its supporting systems.
- Complete earthworks for the entire site to minimise disruptions to plant operations in the future if earthworks were performed in stages. (Currently operationally approved).
- Install stormwater interception system and retention ponds. (Currently operationally approved).
- Construct access roads to eliminate future access road issues.
- Build part of the staff car park, sufficient for Stage 1 staff loading.
- Install temporary portable buildings for offices, staff amenities and lunchroom.
- Build Powerhouse, building 2, which includes the site engineering workshop and minimum number of electricity generators and one boiler only.

Stage 2

- Build the balance of building 4 bays, (Bays 20 to 32] to accommodate the can filling line from bay 19 division wall to the autoclaves, autoclaves, Can storage, and high-speed truck loading system and dry goods dispatch, laboratories, printing room and long-term fresh beetroot storage, in the western skillion of building four.
- Install the metal can fill line and ancillary equipment.
- Build, building 1, to eventually house the full metal can building lines.
- Install one of three metal can body making lines.

- Build building 3 to house the plastic pallet making line.
- Install plastic pallet building line.
- Install carton printing equipment in Building four.

Stage 3

- Build offices, canteens, staff amenities, top Floor of Building 4's northern side.
- Install powder making lines in Building four under offices and canteen.
- Produce receivals for produce destined for juices, paste and powders on the northern end of Building four.
- Powder, paste and powders packaging equipment in Bay 20 to Bay 24 area.
- Add balance of electric generators and second steam boiler.
- Add additional autoclaves.
- Construct and trial run seedling nursery.
- Construct tomato processing building five.
- Add the final two, can making lines and can lid making equipment in building one.

Stage 4

- Install tomato processing Lines in Building 5.
- Construct French Fries building, Building 6.
- Construct stage 1 Potato Suberizer for fresh long term potato storage.
- Install bulk stainless steel storage vessels, for pasteurised tomato pieces.

Stage 5

- Install French Fries line.
- Install drinks Line in building 4.

Building design concepts

- The main processing building - building 4 consists of a main gallery formed by thirty-two portal frames with a clear span of seventy metres. The length is 235 metres with a North South alignment. There is a 35-metre-wide skillion roof along the western side housing the printing and cartons stores, laboratory, syruping/ brining room and long-term beetroot storage.
- This building will allow the unimpeded layout design of the production lines, without having to consider intermediate columns. This will also be beneficial in designing future layouts and alterations.
- This production floor is installed 5.0 metres above an undercroft. The building is built on benches cut into a steep hill. This enables the main production floor to be at ground level on the Western side of the building and the under croft opening at ground level on the Eastern side. This facilitates heavy lifts to each level.

- The raised undercroft enables all of the production services to be located in this spacious area, away from the aseptic environment required to be maintained in the processing areas. Services and their maintenance can be conducted without the maintenances staff and fitters installing new equipment, from having to gown-up to meet sanitary requirements as in the main processing areas. This is time-consuming and leads to repairs and maintenance being postponed and avoided, hoping that someone else has to do the job.

The raised floor also allows for adequate room to install the control equipment in duplicate. This ensures that if a breakdown occurs the functioning twin can take over very quickly with minimum production disruption. Repairs can be performed in a less stressful environment, according to a planned schedule and not an emergency response. Because the control equipment involves steam it will be hot and will require several hours for the equipment to be depressurised and cooled down before repairs can be conducted. Duplication removes these prolonged delays.

The entire building is insulated and positively pressurised to minimise ingress of dust and pathogens. Humidity will also be controlled to minimise the spread of pathogens from one person to another. Dry air desiccates droplets of saliva and allows them to travel further on the air current.

Because forklifts will not be employed in the processing areas, the wear and tear to the polyurethane sanitary floor finishes caused by the forklifts will be eliminated. Coatings are much thinner and have much longer intervals between reapplication of floor finishes, this saves significant sums in maintenance and minimises time taken.

Operational design essential differences

- Receiving produce from the field in purpose made field bins that have 20-foot shipping container specifications, to allow them to be loaded on a wide range of available transport.
- The bins are unloaded at the processor using overhead gantry cranes, which quickly lower the bins into a deep-water sump, where buoyant produce instantly floats out of the bins. This gently unloads the bins in seconds, as opposed to up to 45 minutes using conventional current truck unloading procedures.
- Produce that sinks will be directed straight to the washers and destoners. Produce will be optically scanned sized and pumped into size graded buffer stores.
- The water can be chilled to remove field heat to arrest ripening and soften mud on the produce. The water is unipolar water which sanitises the incoming produce. Rocks and heavy objects fall to the bottom of the water sumps. The water from the deep sumps flows out of the sumps and into larger ponds, which functions as gentle buffer storage during plant interruptions and buffer storage from 9:00pm - 6:00am.

We have identified that cleaning and the end of a production run can typically take eight hours to perform.

While cleaning the plant is not productive and if taking eight hours to achieve would not meet OEE85 concepts - In order to meet the OEE85 goals we have carefully researched equipment and procedures required to meet these targets.

The most significant development in achieving these goals is the application of tube conveyors extensively throughout the plant to enable these goals to be met.

Tube Conveyors

- We have embraced OEE85 and have set about identifying manufacturers who have developed processing equipment that is faster to clean and quicker to recalibrate and maintain.
- Of particular interest is the application of tube conveyors, used in the transport of products in the production process. Tube conveyors have been employed in several industries for many years, most commonly in the dry produce areas such as nuts, seeds, coffee beans, grains, and flour. In recent years, the tube conveyors have been upgraded to allow them to be cleaned in place (CIP), without the intervention of labour. This cleaning innovation enables the tube conveyors to be cleaned in around 15 minutes, according to the manufacturers video presentation. This means that the tube conveyors can be cleaned and back in operation in under one hour, as opposed to the usual belt and Z type elevators which can be offline for more than 5 - 8 hours.
- Tube conveyors have been identified as being exceptionally efficient in transporting frozen produce into the safety of the -20^{o}C deep freezer store. They are the cornerstone technology for achieving our production efficiency goals.
  Note: Usually, in the current production procedures staff collect the frozen produce into bins as it leaves the IQF freezers on the production floor. From this point forklifts collect the filled containers and transport them a distance, into the deep freezer store.
- The deep-frozen produce is transported by the tube conveyors, at the point of discharge from the IQF freezers and conveyed directly into bins, located *INSIDE* the deep freezer store.
  Note: As the bins are filled, they are moved to form a row of up to six filled bins waiting for collection, like a railway siding. From this point a rail mounted, transfer car, LOCATED INSIDE THE DEEP FREEZER STORE, equipped with 4 radio shuttles, simultaneously picks up 4 bins at the siding, filled with frozen produce and transfers them to the deep isle freezer store, where the 4 radio shuttles simultaneously transfer their bins from the deck of the transfer car, into the deep isle storage.

The section of the freezing process starting at the cooling position, just after the blanchers, hot blanched produce at 80^{o}C, produce is cooled to 2^{o}C, on through the IQF freezer and the tube conveyors into the freezer

store are all conducted in an aseptic environment. As staff are not involved, aseptic staff protocols are not required. The ionized air in the tube conveyors is micro filtered to 0.3 microns and can be dried to minimise the transfer of water vapour into the deep freezer store to minimise the need for defrosting the freezer evaporator coils.

This is not possible in the usual processing lines unless the entire processing room is built to be aseptic and aseptic protocols for staff implemented.

The advantages of this development following: -

- No bin filling staff required.
- No forklift drivers required.
- Only one operator is required to operate the frozen bin storage working from a control room.
- The produce is not exposed to thawing if the processing line is interrupted before the bins are filled because this takes place inside the deep freezer store.
- The produce is transferred within seconds into the frozen safety of the -20^{o}C deep freezer store.
- The tube conveyor is naturally aseptic and filled with dehumidified, ionised frozen air, to maintain the aseptic environment and minimise frost build up on the evaporator coils.
- The tube conveyor equipped, deep freezer store, only require 60 kw of freezer capacity to maintain the frozen environment.
- The transfer car can remotely recover four bins at one time, for loading into the positions, where individual frozen species, are assembled for discharge from the deep isle store for further processing.
- To retrieve the produce from the deep freezer store, four tube conveyors are each loaded with a single species, which will be used to make up to a four species product mix, for transporting to its aseptic mixing position, on top of one of six multi-head weighers in the product assembly area.
- The multi-head weighers measure out the weight of each frozen species which make up the product mix.
- Operators can quickly seal off the discharge valves on the tube conveyors to prepare them for clean in place procedure (CIP).
- Clean in place is automatic and only takes 15 minutes or so.
- In the event of a process disruption downstream in the packaging and palletising areas the unpackaged frozen produce is automatically returned to the dispatch bins in the deep freezer store to prevent thawing.
- All produce records are continuously stored on the factories' Manufacturing Execution System (MES) for produce tracking and inventory control.
- The many disadvantages (avoided by Lockyer Valley Foods) of the traditional freezer store operations include (and deliver significant cost savings):
- Multiple bin filling and handling staff required.

- Forklifts require the deep freezer store doors to be opened, which allows frozen air to escape heat from the forklifts to be released and water vapour to enter.
- Forklift operators invariably damage door frames and doors and frozen produce packaging.
- Customers impose penalties and reject damaged goods deliveries.
- Difficulty in attracting and keeping forklift operators to work in -20ºC conditions.
- A deep freezer store with 32,000 pallet positions would normally require at least 600 kw of freezing capacity to maintain the -20ºC freezer environment.
- Several forklifts are usually required, because the usual practice is for a forklift to place the bin of frozen product on a radio shuttle, then they would pick up the radio shuttle and transport the bin and radio shuttle, to the designated isle, where the forklift orders the radio shuttle to leave the forklift and travel into the deep isles. The forklift waits for the radio shuttle to return to the forklift, where it picks up the empty radio shuttle and returns the empty radio shuttle to the loading area to pick up another filled bin for storage.
- No efficiency dividend from transferring single bins to each individual deep isle.
- Retrieving the products from the deep freezer store for transport to the product mixing area requires the same level of inefficient activity in reverse to loading.
- The bins of frozen produce are held in ambient air awaiting bin filling and transport into the freezer store and subject to thawing.
- The bins are placed on bin tippers which load Z elevators to the multi-head weighers.
- Z elevators take 8 hours to clean.
- The Z elevators feed shaker conveyors which require five times more floor area than tube conveyors.
- Shaker conveyor installation are over eight times more expensive than tube conveyor solution.
- Additional extremely expensive conveyor systems required to return frozen product to the freezer storage, due to its inability to be packaged, in the event of downstream breakdowns.
- To achieve aseptic environment the whole processing area needs to be rendered aseptic.
- Time consuming aseptic protocols for operators.

Other concepts we have identified and will install are in reducing cleaning times and unscheduled stoppages in slot drains.

Slot Drains

Floor drains in processing areas are very time consuming and labour intensive to clean. Usually, two cleaners are required to lift the drain covers off the trough drains and every element in the drain cover requires detailed cleaning. The trough drains are usually formed in the concrete slab and do not have sanitary surfaces, to deliver this level of sanitation requires additional diligence to ensure the crevices in the drains are properly sanitised.

Slot drains are tear drop shaped drains, which are cast into the concrete floor. They are made of stainless steel, which once installed, the only visible component is a 20 mm wide slot in the concrete floor.

These drains are fast and efficient to clean by one cleaner and enable aseptic cleaning to be confidently achieved, due to their polished surface and cavity free construction. Special tools are employed to fit down into the body of the drains and then turned 90^{o}C to engage the tools which push any objects in the slot drain, down to the end of the slot drains where strainer catch baskets are located.

The main processing floor will be raised 5.0 metres, to expose the round stainless-steel pipes mounted on the soffit of the slab, below the slot drains, connected to the strainer baskets, installed between the slot drains above.

Automatic, computer-controlled control valves will be installed in the pipe drains, under the slot drains, which when shut, will contain the sanitising liquids in the slot drains for the required sanitising time and when sanitising is completed, enable the fluid to be screened and reused for other sanitising procedures.

The aseptic cleaning fluid inside the stainless-steel drains will remain in the drainage system for sufficient time to achieve Log 5 pathogen destruction, sanitation.

Unipolar water is the sanitizing medium and very inexpensive because it is made continuously on site by electrically ionising potable water used in the sanitising system, requiring only one kilowatt of electricity to make one thousand litres.

There are no carcinogenic residues from Unipolar Water as is associated with the more usual calcium chloride sanitation. The retailers are looking for ways to eliminate calcium chloride because it leaves a residue and is carcinogenic.

Ice Slurry "Pigs" to Clean Food Pastes from Production Pipework

Another Lockyer Valley Foods efficiency aid is the employment of Ice Pig's for cleaning paste conveying pipes to force paste in the pipes ahead of the ice pig, using compressed air.

Pastes produced from various juices are pumped around the plant for inclusion in various paste products, or alternatively further dried to produce high value powders.

Removing paste residues in pipework is tedious and time consuming. *A new innovation adopted by us has become available where "Pigs" consisting of approximately twenty litres of food grade ice slurry, fired through the pipework, with the aid of food grade compressed air.*

This process takes less than a minute to clean the paste from the conveying pipes as compared with 45 minutes and 4500 litres of flushing water for the current pipe cleaning procedures. These 4500 litres of wash down water then add to the water treatment loading and are essentially inefficient, and wasteful of water and time.

Ice slurry which is only around twenty kilograms stays in the paste without further treatment, because the volume in the paste will not significantly alter the water content of the at least one thousand litres of paste in the vessel.

Truck Load Plate Technology

Another area requiring significantly improved by us is the employment of automatic truck loading and load plate technology.

Loading trucks at the loading docks is usually a time-consuming exercise and requires many loading docks. It also exposes the palletised loads to damage from the forklifts loading the trucks. Additionally, as in the case of the freezer store loading area, the operating environment is -20^{o}C which increases the difficulty of recruiting experienced, proficient forklift drivers for this job.

The adopted concept is to minimise the inefficiencies experienced by the usual truck loading operations, We have designed their pallet marshalling and continuous load assembly activity solutions, around load plate technologies. Load plate truck loading technology enables fast freezer truck loading and eliminate product damage caused by forklifts.

Truck load plate technologies is a mature technology, having been developed and offered by at least twelve international companies.

The technology enables loading a freezer truck in 5 minutes, with the aid of only one operator in a remote-control room. Loading docks required are reduced to 20% of the usual loading dock numbers required.

Combined with well-known materials handling technologies, involving roller conveyors, and indexing chain conveyors, we have identified suppliers of these systems enabling them to install automatic load assembling systems, within the -20^{o}C environment. Preassembling the pallets forming the next loads will complement the efficiencies of the load plates. The remotely operated automatic system will enable the retrieval of palletised packaged frozen products in the -20^{o}C environment, while protecting the products from thawing. Preventing thawing is a critical requirement in maintaining aseptic conditions in fresh frozen produce, by assembling the loads in -20^{o}C conditions minimises the risks of sanitary recalls.

The truck loading technology will be employed at loading points around the factory for ambient temperature dispatch points as well, because of its inherent efficiencies and application in protecting the products from forklift damage.

Integrating The Efficient Equipment Discoveries into a Working Model

Lockyer Valley Foods have identified the suite of processing machines required to meet the OEE85 requirements at this IQF freezer processing line.

The main components on the critical production path are the two (IQF) Individual Quick Freezers, the tube conveyors leading in and out of the 32,000-pallet position, deep freezer store and the truck loading equipment.

Supporting equipment feeding the two IQF freezers are:

- ✓ *Produce receivals.*
- ✓ *Produce Washers.*
- ✓ *Produce peeling.*
- ✓ *Produce slicing and dicing.*
- ✓ *Produce blanching.*
- ✓ *Produce grading.*
- ✓ *Products weighing.*
- ✓ *Products Xray screening.*
- ✓ *Products bagging.*
- ✓ *Products cartoning.*
- ✓ *Products palletising.*

The above machines are in multiples, so if one is offline, the factory operators have multiple choices to cover the loss of a machine.

These include quickly changing over to an alternative species of produce that use a specific set of processing machines. **Example**, if a steam blancher is offline, then onions, capsicum, mangoes, or berries could be processed, which don't require blanching.

The above machines also have a higher manufacturing capacity to enable the remaining machines to run a little faster to make up for lost production.

To overcome the potential for the IQF, tube conveyors and the truck loading equipment being inoperative, these machines are also in duplicate, to provide flexibility and manufacturing options to keep a viable level of production going and are also oversized to enable catching up with production targets, when the offline equipment is restarted.

In the event that a major disruption event takes place when both lines are disrupted, then we have identified options involving processing baked beans, chickpeas or pasta as stop gap measures.

Note: These options can be operating in one hour, with the selection of innovative fast rehydrating equipment, available on the market and using the metal can filling line.

Other technologies not fully embraced by industry involve open volute food pumps to flexibly pump produce around the plant to the processing points. These choices enable elegant transport routes to be installed without the use of forklifts and belt conveyors and their attendant shortcomings. They are quickly and efficiently cleaned with minimal application of labour.

6. PROCESSING QLD GROWN PRODUCE

PROCESSING QLD GROWN PRODUCE - Into Frozen Packaging

Lockyer Valley Foods have been approached to supply frozen products to retailers and manufacturers. Approaches to food service customers have not been made, however assumptions of a demand of half retails demand would not be unreasonable based on available grocery retail statistics.

Major retailers have indicated an interest in 70,000 tonnes per annum, manufacturing 25,000 tonnes and the balance attributed to the service sector and future growth of 35,000 tonnes per annum for a combined design size of 130,000 tonnes per annum.

It is anticipated that this target will be achieved over a three-year escalation schedule, although output could be stepped up more quickly, if trained staff are available. The enterprise projected budget estimates are based on a fully operational level of 120,000 tonnes per annum.

The equipment to be used is Individual Quick Freeze (IQF) and has been sized on the freezing capacity to process 9000kg per hour for each IQF frozen line, based on broccoli. Sweet corn, peas, strawberries, and other small sized produce will have a greater production capacity per hour for potentially another 13,000 tonnes per annum capacity.

We have used the annual indicated tonnages from the retailers and manufacturers and extrapolated the service industry potential opportunity from those figures, as the basis for the equipment design. There are multiple manufacturers of IQF freezers in the frozen produce equipment manufacturing space.

Lockyer Valley Foods have been in close consultation with key players in order to validate their equipment selection and IQF frozen line design.

This approach has enabled us to obtain the following design parameters for the IQF frozen line to achieve the output goals defined by their potential customers.

- Estimate the area of crops required for each species in the product mix
- identify the produce specifications required to meet the customers' quality standards
- Planting equipment size
- Harvesting equipment size
- Agricultural produce production costs
- Transport inbound logistics selection and costs
- Fresh produce reception equipment and operational constraints minimisation strategies

- Buffering storage requirements
- Staff numbers and specialisation
- Electrical demand
- Steam demand
- Refrigeration plant capacity and dimensions
- Identify the types of produce preparation required to match the proposed produce mix
- Identify the types of slicing and dicing equipment required to deliver the product size specifications
- Identify which produce requires blanching
- Design the layouts and pipe sizes for fresh produce hydraulic transport (water pumps), to move produce in various stages of preparation along the processing line
- Using the volume of food to be processed, design the tube diameter size, driving power and route for the tube conveyor based, waste produce collection system
- Dimensions of the two 9000kg per hour IQF freezers
- Position the two IQF freezers in the main processing room to optimise the process layout efficiencies
- Select the super critical CO^2 and Ammonia cascade freezing system required for the IQF freezer duty, plus a growth contingency
- Select the tube conveyor transport system route and dimensions for the frozen product to be transported from the IQF freezers into the deep isle freezer storage
- Determine the number of pallet positions required for the deep frozen, deep isle storage building and the optimum building height and footprint to minimise the external surface area
- Design the transfer car and lift system to transfer the filled storage bins to the deep isle racking store
- Design the single species bin receivals and discharge station, to feed the four frozen produce distribution tube conveyors, supplying each multi-head weigher
- Select the correct number and capacity of the multi-head weighers to process the product range as outlined by our customers.
- Select the correct raised multi-head Weigher platform size
- Select the correct number and capacity of the vertical baggers to deliver the planned production target
- Select the correct X-Ray and optical scanners to ensure the product is not contaminated by metal or plastics
- Select the most suitable carton erectors to match the product mix and bag volume
- Select the most suitable carton filling equipment
- Select the most appropriate shrink wrappers and palletisers

- Design delivery system for retail bags, packaging, pallets and shrink wrapping from the packaging store and print room, to service the vertical baggers, carton filling and palletising area
- Select appropriate empty pallet discharge storage magazines to match the design number of cartons throughput
- Processing equipment required for the line
- Printing and labelling requirements
- Pallet handling and refreezing station prior to entering the deep freezer store, sized to manage the selected design pallet throughput
- Storage racking position number requirements, for cartoned and palletised products waiting in the deep freezer store to be dispatched
- Pallet retrieval systems from storage and truck loading system sizes and number
- Determine the number of loading docks
- Transport fleet operations design

Lockyer Valley Foods have been in detailed discussions with key manufacturers of equipment that will be used on this IQF freezing line. These companies are very experienced in designing their offerings to meet their clients' operational requirements. The equipment is common and mature technology.

We plan to implement B2C (Business to Customer) business model, at a suitable time in the future to capture the efficiency dividends generated by the freezer lines enabling them to supply these customers at competitive prices.

Designs have been developed to achieve the assembly of 12 -16 kg insulated packaging, containing mixtures of multiple choices of .500 gram to 1.0 kg bags of frozen products for delivering to customers doors. The designs have been developed in order to ensure that sufficient space has been reserved in the deep freezer dispatch area where service industry orders will be assembled.

Lockyer Valley Foods' points of difference for the deep freezer line revolve around the adoption of OEE85 and the reduced cleaning times to achieve these goals.

Also, the adoption of clean in place tube conveyors in association with transporting frozen produce into the deep isle freezer store is novel and has led to other industry changing outcomes employed at this plant. *All achieved by repurposing equipment that is already used in other sectors!*

PROCESSING QLD GROWN PRODUCE - Into metal cans

National grocery retailers have identified an appetite among their customers for Australian grown and Australian processed food products and have encouraged us to design their processing facility to meet this demand. *The retailers have identified canned and frozen products where they see the most growing demand*. We have adopted this initiating strategy and designed the staged development process to match their clients' requests.

As the cost of groceries increases, the retail prices of canned and frozen products are significantly less than fresh products and are most often manufactured from produce processed at its optimum nutrition and quality.

This fact is being more frequently pointed out in the media, this endorsement can only lead to an increased demand, as the cost-of-living pressures increase.

We plan to install three metal can manufacturing lines, with the goal of producing metal cans on site to contain the canned products required by their customers. These three lines have a design capacity to manufacture 914 million, 425-gram metal cans.

However, the range of metal cans required by their customers requires them to reserve one of the lines for smaller runs, of less in demand cans, such as 200-gram cans and 3000-gram cans.

Note: It requires one shift to change the can size being manufactured by the line, so in order to achieve OEE85 goals, the can manufacturing line must run for 9 shifts, manufacturing the one can size (9 shifts equals 90% to match OEE85). A cheaper rebuilt line will be acquired and left calibrated to meet these intermittent demands.

We are encouraged to install their own can manufacturing line because the cost to manufacture themselves has been shown to be around 33% of the prices offered by external metal can manufacturers.

Manufacturing our own cans is extremely important in producing products at internationally competitive prices. In-house manufacturing prices are cheaper and also eliminate the high transport costs of transporting unfilled metal cans, where the transport loads consist of (predominantly) air!

Queensland had a thriving food processing industry in former times. 15 years ago, when the last major cannery in Queensland moved its operations to New Zealand leaving established Southeast Queensland Growers without options to supply the food processor, or as a destination for sub retail quality produce.

We reached out to major retailers for their views on the establishment of a Queensland-based food processing facility. The major retailers have been supportive and gave us their produce requirement targets and an indicative buy price. They were very keen to cooperate because of the significant customer demand for Australian grown and processed products. *Overseas importers are also very keen to import competitively priced Australian exports, because of the customers perception of its inherent food safety and quality.*

We used this information to determine the scale of the required facility to deliver these target requirements for canned foods. Prior to moving to New Zealand over 30,000 tonnes of beetroot was processed annually into cans in Brisbane. *This translates to a 425g can number of around one hundred million metal cans.*

Pineapple canning in Brisbane was a similar number.

Other products required by the retailers are baked beans, spaghetti, peas, beans sweet corn, cocktail potatoes, carrots, mango, and mushrooms.

There is also a significant demand from the service industry sector for similar product, processed into larger containers, with Australian annual sales, of around $86 billion p.a. or about half that of retail food sales.

The long-term target of five hundred million metal cans as 425-gram equivalent has been determined to take place in yearly increments, of one third of this combined output, planned to be achieved by 2032.

By producing at this scale, the metal canned produce output from the facility, as shown in the cost estimates have indicated that the Facility can produce canned tomato produce at internationally competitive prices.

The manufacturing costs and methodology were provided to us by an international metal can making company. They have an Australian facility from which these data in the budget spreadsheets were prepared.

In 2016, canned, imported tomato products were found to have been dumped in Australia, where wholesale prices here, were less than wholesale prices in Italy. As the result of these findings, tariffs were imposed on these dumped tomato products, of up to 8.5%, which further assists the project in maintaining international competitiveness with imported tomato products.

To deliver the design volume of metal canned products, two six hundred can per minute, can filling lines are proposed. This size of metal can-filling line is a common size in the canning industry.

There are can-filling lines that run over 2,000 cans per minute. Several can filling line manufacturers have submitted can filling line proposals. It is from these proposals that we have gained reassurance that their concepts layouts are valid. The operating environment on which the Can numbers have been calculated is to run the canning lines for 21.6 hours a day, 7 days per week for 48 weeks of the year, as required, to achieve OEE85.

Note: In order to maintain OEE85, it will be necessary to select a dual head seamer, which is the machine which attaches the lid to the filled can, where one seamer head is set at one can diameter and the second head at another diameter. If not possible then a second seamer will be required to be installed in the line because the changeover in settings requires 3 to 4 hours which will exceed the 10% of running time allowed under OEE85 conditions.

The metal cans are conveyed across from Building 1, where the lids and can bodies are manufactured, via an aseptic environment sky bridge. The metal cans are stored on pallets in an aseptic, controlled atmosphere mezzanine room, above the can filling lines. *Only one operator is required to store and retrieve the metal cans using radio shuttle technology, as used in the deep isle deep freezer store.*

The cans are depalletized and conveyed directly into the can filling lines, on magnetic conveyors, from this mezzanine store.

This procedure eliminates the use of forklifts which are a common factor in denting and damaging cans and other equipment. Retailers will return whole shipments if only one pallet on opening a container is found to have forklift damage.

Can storage and distribution area only require two operators, per shift.

Once canned, the filled cans are branded, using readily available ink jet printing machines, to record the audit trail.

The metal cans pass out of the manufacturing area and enter the autoclave sterilising area where packaging labelling and palletising occur.

There are multiple international autoclave manufacturers from whom we have obtained supply quotations. *The autoclaves are required to be calibrated to ensure that the equipment delivers the sterilising time required by the government regulators to achieve the level of pathogen destruction required.*

Once sterilised, the metal cans are labelled, put into trays or cartons, and shrink-wrapped. This equipment is offered by manufacturers around the world. They design their lines to deliver the outcome that they perceive their customers need to achieve their objectives. After shrink wrapping, they are cartoned and palletised. The pallets are transferred to the loading station where a transfer car carrying four radio shuttles picks up the pallets of filled cans and transfers them to the deep isle storage racks, where individual radio shuttles transport the pallets into their storage positions.

Note: The radio shuttles have sensors on them to bring the radio shuttle to a halt 50mm from the face of the last pallet stored on that line of racking. This development eliminates filled cans from being damaged and

dented in the transfer process and storage from forklift tynes or by being crashed into other pallets of filled cans.

Transfer shuttles on the discharge side of the racking retrieve the pallets of packaged cans using radio shuttles and delivers them to the truck load plate assembly conveyor system. The truck loading system is the same as the frozen line load plate automatic truck loading system. There are two load plate loading docks and one part load forklift loaded loading docks on the eastern side of Building 4 and two loading docks for forklift loading part load curtain sided trailer trucks on the western side of Building 4.

Using the data gained from determining the weight of solid products required by our customers to be canned, we have been able to determine the following metrics, for the canned produce lines:

- Estimate the extent of the cropping area required to meet these objectives
- Identify the produce specifications required to meet the customers' quality standards.
- Planting equipment size
- Harvesting equipment size
- Agricultural produce production costs
- Transport inbound logistics and costs
- Reception equipment and constraint minimisation strategies
- Buffering storage requirements
- Staff numbers and specialisation
- Electrical demand
- Steam demand
- Metal can making equipment selection and manufacturing costs
- Packaging requirements: labels, trays, shrink wrap, cartons, and their costs
- Palletising, number requirements and shrink wrap
- Processing equipment required for the canning line
- Printing and labelling and the number of printers and layout of the print room
- Syrup and brine requirement for the cans and the layout of the brine room
- Autoclave numbers and basket assembly and handling equipment
- Cartoners for the autoclaved products
- Palletisers for the cartons of autoclaved products
- Pallet handling and deep isle storage racking systems and sizes and pallet position number requirements
- Pallet retrieval systems from storage and truck loading system sizes and number
- Transport fleet operational design

- Select the number of can body making equipment lines to manufacture the planned number of empty cans and lids
- Determine the can body making line building requirement
- Transport and logistics to receive metal plate for can making
- Determine transfer of empty cans from the manufacturing lines to the mezzanine can body store above the can filling lines.
- Further opportunity to offer empty cans and lids to external customers.

Lockyer Valley Foods points of difference include :-

- *In house can body costs are about 33% of external manufacturers quoted prices*
- *Fully implement OEE85 in the can body making building where a can body size is run for nine shifts without size change because it requires one shift to effect the change. The company who provided budgetary assistance was not aware of the negative effect of more frequent can size changes*
- *Recognition that a single seamer set up time is too long for OEE85*
- *Magnetic can supply from mezzanine above filling lines*
- *No forklifts*
- *Deep isle racking using radio shuttles to eliminate forklifts and forklift damage*
- *Fast truck loading load plate technology*
- *Only three loading docks required instead of ten*
- *Much reduced labour requirement*

7. POWDER MAKING LINE

Lockyer Valley Foods have designed the enterprise business model to assist the company's marketing team in projecting the enterprise's sustainability credentials that the retail customers are seeking.

Of particular concern to the buying public is the perception that sound produce is being wasted or rejected unnecessarily.

The current broader industry model revolves around the fresh produce industry.

This industry has to grade very stringently, to satisfy the "grudge buying" behaviour of the retail customers, where they think they are paying too much for the produce and only select the perfect pieces of produce while decrying the predatorial behaviour of the retailers.

The result of this situation is that a large volume of inherently sound, though only minimally visually unattractive produce, is left in the paddock or graded out at the packing sheds and assigned to waste or stock feed.

In our case our business model involves buying the whole crop from the growers or leasing land and planting our own crops. In order to economically use the whole crop, we plan to grade the whole crop into descending order of fruit appearance. We have selected a suite of readily available machines to process the whole crop into descending visual grades.

In the course of preparing the produce for processing, a minor proportion of the produce is unsuitable for further packaging. For example, the small "round back" outer segments of a beetroot are rejected once the slices, which meet specification, have been graded out for packing. The remnants and broken pieces can then be redirected to be further broken down to facilitate juice extraction. This will result in a lower maximum price for the premium produce but a higher overall return to the grower because the whole crop has been purchased and used.

This juice can either be packaged and sold as a juice or concentrated to a paste by the evaporation of excess water. The pastes can also be sold in that form as a single species or blended for further manufacturing applications. From the paste stage of the process if selected, the paste will be subjected to further water evaporation to produce a powder with less than 2% moisture content.

At this stage of the project, we only intend to produce pastes and powders in bulk. Juice on the other hand will be offered in retail ready container sizes as well as bulk containers.

Note: All of the above equipment to deliver these product outcomes are mature technologies and available from several equipment manufacturers around the world.

The juice in retail ready containers will be processed using aseptic monobulk, bottling lines, where the sterilised juices are pumped into the aseptic processing machine, where PET bottle preformers are fed into the machine, to be expanded into the final PET bottle size, in an aseptic environment.

This machine has a footprint of only 12 m x 17 m and is able to process over six hundred bottles per minute and only requires one operator.

When not bottling juice other liquids such as spring water can also be bottled to optimise the run time of the aseptic filling line.

Juice can be stored in refrigerated vessels for further processing at a later date.

Lockyer Valley Foods' points of difference include: -

- *Taking the whole crop to minimise waste*
- *Higher return to growers*
- *Cascading use of visually inferior products*
- *Manufacturing pastes and powders*
- *Designing plant to be photogenic to demonstrate on social media that they not only talk about sustainability, but they actually can also demonstrate that they practice sustainability*

  This last point assists the marketing team with verifiable sustainability facts.

8. PLASTIC PALLET MAKING LINE

Lockyer Valley Foods plan to install a pallet making line which will produce plastic pallets with a load capacity of 6000 kg and only weigh 8 kg. These pallets have been selected because of their strength, light weight (wooden pallets weigh 32 kg), economical manufacturing cost and are less expensive than plastic laminated, polystyrene composite pallets making lines.

After the recent bush fires the pine plantations, from which the bulk of Australian pallets timber was sourced, were severely impacted. If you were not an established customer, then pallet manufacturers were declining to process orders from new potential customers. Wooden pallets also present export problems with phytosanitary requirements and also, they cannot be used from which direct retail sales take place. Another disadvantage is that they are not always made to a uniform dimension, and they drop saw dust around the processing lines.

Note: By making the pallets on site the logistics lines are noticeably short. The only logistics issue is the supply of flat plastic sheets of the correct specification in 20-foot containers. We will adjust their production levels to match the near-term pallet demand at the site. The flat sheet is a very compact storage benefit.

The manufacture of the pallets on site generates a significant income stream and also contributes to higher processor operational efficiencies.

Pallets are transferred using ceiling mounted delivery conveyors to eliminate forklifts from the delivery system. While also reducing labour and storage areas. (The conveyors are the storage system)

Lockyer Valley Foods' points of difference include: -

- *Pallets move from a cost centre to a profit centre. (Even though the spreadsheets have the pallet hire in as a cost)*
- *Supply reliability and ongoing availability*
- *No saw dust dropping into products, packaging and around the factory that has to be cleaned up*
- *Conveyor storage and hidden delivery system in the ceiling space*
- *Elimination of forklifts in the delivery system*
- *Reduced labour*

9. ONSITE POWER GENERATION AS COMBINED HEAT AND POWER

ONSITE POWER GENERATION as combined heat and power

Lockyer Valley Foods are planning to generate their own electricity on site initially using bottled propane gas and later using biomethane, generated on site, using biowaste, in two membrane, anaerobic, thermophilic, methane bioreactors.

The gas will be used to power six 1500-kilowatt capacity reciprocating engines, electric generators and three 750 kw gas powered generators, for fractional power demand balancing.

There will also be three - 750 kw diesel generators for black starts and interruptions to the gas supply.

The calculated cost of electricity generated on site is significantly less than current grid supplied power and potentially more dependable in the future with the introduction of unreliable, government sponsored, renewable power schemes.

Four main engines will supply the running load and one, on contingency standby. The sixth engine will be offline for maintenance or rebuilds. Gas powered engines, electric generators, are manufactured by several large engine manufacturers around the world. It is a mature technology with significant application in the oil and gas industry and in renewable power generation.

Waste heat will be captured from all of the engine's exhaust, using thermal oil heat exchangers, at 280^{o}C. and hot water heat exchangers to capture waste heat at lower temperatures to increase waste energy capture efficiency. This oil will be used to provide the heat to operate a steam generator, to generate steam at the same pressure as the two gas fired boilers.

Theoretical thermal energy recovered from the gas engine's exhaust is 3450 kw. The theoretical waste energy from the gas consumed in the engines is around 90% by employing CHP technologies, as opposed to around 43% efficiency for power generation and waste heat to atmosphere only. Heat exchangers will capture the heat from the exhaust gasses and transfer the heat to the thermal oil. This is a mature technology and used extensively in combined heat and power (CHP) applications.

There are multiple manufacturers of this type of heat exchanger.

Carbon dioxide will also be produced in the bio reactors, this will be cleaned, dried, and purified for use in carbonated drinks and the manufacture of dry ice, for rapid cleaning of cooking vessels and PET preformers blow Molds, Dies.

Another byproduct of bio methane production is the production of Struvite, by the addition of magnesium hydroxide to combine with ammonia and phosphates, found in the wastewater discharge from the bio methane plant. Struvite is a valuable slow-release fertiliser, its recovery is part of the water treatment plant. It will be sold as a profit centre, the income from the Struvite sales has not been included in the income analysis.

Two fifteen tonne per hour gas fired steam boilers capable of producing fifteen tonnes per hour of steam each can be run on multiple gas species, will also be installed in the plant room, to produce process steam. These boilers can run on bio methane or syngas, produced by the plasma conversion of waste plastics, demolition timber and woody agricultural residues, to further enhance our renewable energy credentials and to gain favour with the growers by taking their black plastic mulch and plastic poison drums to be used as fuel in the plasma induced gasifiers, which they currently have to dispose of to landfill, at a cost to them.

These activities demonstrating the breadth of the LOCKYER VALLEY FOODS application of renewable energy production, from bio waste and farm residues is of benefit to the marketing team in demonstrating their points of difference to the wider Australian audience.

Note: The powerhouse is located in the centre of the project to minimise the power drop of electricity in the power lines and make it easier to install a duplicate power supply grid to provide grid resilience.

10. FRESH TOMATO CONVERSION & FRENCH FRIES

Fresh Tomato conversion into juices, canned, diced and paste

Research reviewed revealed that there is a growing worldwide demand for tomato products, with specific emphasis on tomato paste.

Growing trials for processing tomatoes in Queensland, of the Roma tomato variety, showed that they possess superior flavour attributes than the Roma tomatoes grown in Southern Europe.

Trial yields of over 160 tonnes per hectare of marketable tomatoes is extraordinary, when compared to Australian statistics of 106 tonnes per hectare.

Other statistics are 59.5 tonnes per hectare world average and Italy 78 tonnes per hectare and the 5-year Italian average of 73.1 tonnes per hectare. *With this information we have investigated the potential for tomato growing and processing superior tomato products in Queensland.*

The world demand for tomato products is expected to grow, as the world population grows from the estimated 8.3 billion in 2023 and increasing to 9.7 billion by 2050. The size of the world tomato industry in 2022 was USD 106.6 billion and expected to rise to USD 139.9 billion by 2028.

In 2023, 82.54 million tonnes of tomatoes went into processing, or about 20% of the total crop. CAGR is expected to be 3.8% growing to 115.46 million tonnes by 2032. The world average per capita consumption of processed tomatoes in 2022 was 5.6 kg per year. In the USA, the average consumption per capita was 37.4 kg per year. India's consumption was 0.1kg per capita per year, as was China's.

Market drivers for increased consumption per head in developing countries are:

- Increasing numbers of Indians and East Asians are experiencing increased education and prosperity and moving into cities from the country. Bigger demand for canned goods in the near future to feed these people, as opposed to fresh and refrigerated products, as the adoption of domestic refrigeration is beyond the capacity of the emerging masses in these regions to afford them.
- Increased disposable income especially in developing countries as in India and East Asia leading to a growing consumption of processed foods.
- Consumers are becoming aware of the health benefits and longer shelf life of canned goods.
- Canned and frozen products are cheaper per kilogram than fresh produce.

- Increased prosperity leads to greater consumption of sauces which is the largest destination sector for processed tomatoes.

From this research we have selected a tomato processing plant with an hourly capacity of ninety tonnes per hour, running for 7 days per week and 21.6 hours per day.

This capacity captures the manufacturing plant scale dividend, as well as not being overly ambitious in the size of the land on which to grow the crop, about 507 hectares in total in this case, per crop. We plan two summer crops in Southeast Queensland per year and at least one winter crop in the Burdekin Valley, Bowen area.

This crop size matches the efficient hourly capacity of two mechanised 80 to 90 tonne per hour harvesting machines to harvest the crop in the available daylight hours, which is over 13.5 hours per day.

These machines only have two operators on each of them.

A further 7 to 10 operators would be required to drive the out-haul tractors and trailers from the fields and conduct loading the long-haul highway trucks.

Adopting mechanisation of this dimension goes a long way to minimising the cost of labour difference between Australia and other world producers, to deliver the Lockyer Valley Foods world competitiveness.

The Lockyer Valley location offers the potential to grow two crops in the summer months a benefit not available in the southern Australian tomato growing states, where only one crop season is available.

We will employ the most advanced tomato planting and harvesting equipment to minimise agricultural labour.

Bayer Seeds has provided budget data for processing tomato growing. From this data it is shown that the savings in the cost of seedlings by growing their own is an economical contribution to meeting their international competitiveness goals.

A person manually harvesting tomatoes is expected to pick about 57 kg per hour, for an effective 6.8 hours per 8-hour day, or 388 kilograms per picker.

In this case to meet the required 1944 tonnes per day, to supply the plant, 767 manual pickers would be required to meet this target in an 8-hour day. With an average hourly rate of $31.41 or $251.28 per day. 767 pickers would cost $192,732 per day.

Clearly this figure points to the employment of mechanical harvesting.

Mechanical harvesting in Australia is calculated to cost $12,173 per day. (See Excel Spreadsheet)

If we divide $12,173 the mechanical harvesting cost, by the number of manual pickers to do the job, 767, and an 8-hour day, the hourly rate would only be $1.98 per hour. The average farm worker in California is AUD $32.10/ hour. *Manual and mechanical picking is employed there.*

Tomato industry statistics for the tomato industry.

Ex farm gate prices paid in California in 2023 were USD $138/short ton or USD$125.16/metric tonne. At an exchange rate of 0.65 this equates to an AUD price per tonne of AUD $192.55/tonne farm gate price.

China farm gate price for raw produce was 650 yuan or about AUD $138.45 per tonne. This material is grown in the far east of China and has to be shipped 3,000 km to the processors. Their market is bulk or canned paste for export. They are trying to introduce more tomato paste into local consumption per medium of fast foods. As previously stated, current per capita consumption is 0.1kg world average is 5.6kg per capita, so there is a lot of scope there.

Discussions have been held with leading equipment manufacturers of tomato processing machinery around the world. A number have submitted detailed design for the plant layouts.

These layouts were used to determine the building envelopes required to house the suggested plants. These derived building envelopes were used as the basis for the Development Approval application, for the Withcott site. Logistics and transport movement was derived from these plans, to assist in the overall plant design.

The initial processing of tomatoes involves slicing and dicing followed by pasteurisation.

We plan to store excess pasteurised tomato pieces in 25, 1000 tonne stainless steel bulk containers, to be retrieved for further processing when convenient.

It is proposed to use the stored tomato as a buffer store, to provide continuity to the canning and paste lines, when other smaller throughput produce is not available for canning.

The pasteurised tomato will be pumped to either the canning lines in building four, or into the paste producing equipment in building five. Minimum labour is involved, turning the pumps on and off and starting the CIP (clean in place) procedure which is automatic.

In other plants this product is stored in thousands of IBC's and is moved around using numerous forklifts and drivers. The IBC's have a high attrition rate due to drivers damaging the IBC's. They also require to be cleaned and sanitised after every use. This is a tedious time-consuming process involving significant manual labour. The IBCs are either purchased or hired all at considerable cost.

Tomato paste will also be retrieved from long term storage, to add to canned products involving tomato paste, such as baked beans and spaghetti. Chickpea and other dried legumes, stored in silos on site, will also be used to ensure operational continuity of the canning line.

The project can grow within the capability of Lockyer Valley Foods to deal with increasing complexity, as more tomato-based products are introduced.

Initially we plan to produce tomato paste only and sell it in bulk in two hundred litre drums. Tomato paste is an international commodity for which there is a ready and growing market.

We have noticed that processing tomatoes in other locations around the world are trucked to the processor in large bulk tipper bins on semi-trailers. These bins are carefully emptied using large water monitors (water canon) which wash the produce from the semi-trailer, bulk bins, into water flumes for water transport into the processor. This is a fairly slow process which can take up to 45 minutes to complete.

Another observation is that the tomato harvesters discharge straight into the semi-trailer mounted, bulk tipper bins. We believe that this procedure will expose the Queensland harvest to interruptions caused by these highway trucks bogging in the fields, as the result of common summer, rain events.

In Italy, the harvesters discharge directly into smaller tractor drawn mobile bins, of around twenty m3 capacity. A feature of the mobile bins is that the trailer tyres have been replaced with rubber tracks, like the rubber tracks on a Bobcat excavator. *This arrangement will be employed in Queensland because the rubber track result in extremely low ground pressure being exerted by the tracks. This low ground pressure will help mitigate the effects of summer wet weather and prevent ground compaction in the fields.*

To improve the field to factory efficiency and increase the daily delivery capacity of the transport fleet, we plan to design their field bins with 20-foot container dimensions and mounting points, to enable them to be loaded onto standard semi-trailers, with 20-foot container mounting points.

This will expand the potential trailer availability numbers to be employed as well as facilitating quick loading and unloading of the bins.

Once at the factory twenty-five tonne gantry cranes will lift the bins straight off the trucks and onto roller conveyors which can receive up to six bins, to be held as buffering until required to be emptied.

Once emptied, the bulk bins are sanitized and stored on roller conveyors as buffering, waiting to be loaded onto trucks going back to the fields. Once the truck is loaded with sterilised dried bulk bins by the gantry crane operator, the truck is free to leave. This turn around should be achieved in less than 5 minutes instead of the current 45 minutes. The bulk bins filled with tomatoes will then be retrieved from buffering and emptied at the operator's convenience, by lowering them quickly into a deep, water filled sump, able to easily receive the entire, bulk bin full of tomato, or any other produce. Because tomatoes float, the tomatoes exit the bulk bins in a matter of seconds, flow over trash removing rollers and into a large receivals pond, where they remain, as an additional storage buffer before progressing to the bulk elevator, which elevates the tomatoes from the water, into the processing room. Stones and other heavy object fall to the bottom of the sump and are periodically removed by an inbuild trash removal system.

The aim of this concept is to achieve much faster truck turnarounds, which will contain transport costs, as well as being a more attractive contract destination for contract truck drivers, because they can deliver more loads in a day. In a competitive environment we expect that this approach will deliver them priority service.

The procedure also is very gentle on the fruit, as well as offering the capacity to offload several trucks in quick succession if they happen to get delayed and go off delivery schedule and arrive at a similar time.

The receiving water is sanitizing Unipolar Water, which gives Log 5 pathogen destruction, to prevent pathogens entering the processing line as well as being able to be chilled to cool the produce to arrest the over ripening effects of field heat.

French Fries

Lockyer Valley Foods have identified a potential opportunity to grow potatoes suitable for French Fries and manufacture French Fries at the Withcott site.

The Lockyer Valley was once the potato growing capital of Australia with it accounting for 90% of the Australian market.

Potatoes for French Fries require friable sandy loam soil to allow the larger potatoes to grow unrestrained into large tubers, the Lockyer Valley containing heavy clay soils is not as suitable for this variety. There exists in Southeast Queensland portions of suitable land for growing large potato tubers for French Fries outside the Lockyer Valley, within a three-hour transport radius.

We have been offered exclusive growing rights for several potato varieties suitable for French Fries.

The concept is to grow 150,000 tonnes per annum of specialised large tuber potatoes to manufacture around 104,400 tonnes of French Fries and six thousand tonnes of value-added fried potato products.

All of Queensland's French Fries originate from either Tasmania or South Australia.

Considering the Queensland consumes around 20% of Australia's French Fries production, it presents a sensible opportunity to grow and process the potatoes locally.

In 2024 the forward projections are for 1.1 million tonnes of potato to be harvested for processing rising to 1.2 million tonnes per annum by 2028.

Twenty percent of annual production equates to around 168,000 tonnes of French Fries and value-added potato products required for Queensland.

The potato seed suppliers have suggested that Lockyer Valley Foods grow their own certified seed potato. This is achieved by buying a 1000 kg consignment of certified seed potatoes, planting them then harvesting them when they are still small to be planted again for the next crop where the exercise is repeated until sufficient

seed stock has been bred up, to plant a target acreage crop. The idea is that the smaller tubers will be graded off for next year's crop seeds and the larger tubers graded to processing. This approach will minimise seed potato costs, ensure seed is available for the next crop while 100% of the sound potatoes will find an application in all processing categories. Such as French Fries, Hash Browns, cocktail potatoes for freezing and canning and potato starch and powders.

To ensure a year-round supply of processing potatoes, the potatoes will be stored in controlled atmosphere structures called Suberizer's. These Suberizer's maintain a controlled atmosphere to minimise moisture losses, maintain optimal storage temperature and minimise the production of and exhaust respiration gasses.

These structures will be installed on the farm, to meet the development codes. They are simple storage structures, with double skinned insulated outer domed walls and roofs and ventilated underfloor air systems, to remove carbon dioxide produced during respiration and water vapour. Potato will be transported daily from the remote Subarizer's and delivered direct to site, where the bins will be discharged into interim controlled atmosphere buffering bins where 720 tonnes of potato will be stored sufficient for 24 hours of operation.

The French Fries line will run for 19 days without stopping, followed by two days of cleaning and maintenance, for a combined production cycle of twenty-one days. This is a standard industry procedure and delivers the target OEE85.

The produce will be bagged in retail ready bags and service industry sized bags. The products will be cartoned, palletised and stored on site in -20^{o}C conditions.

The potato products building is two levels high, with hot production, cooling and freezing, taking place on the top floor. Frozen products will descend by gravity to the bagging, cartoning and palletising lines.

Deep isle racking in a freezer store set at -20^{o}C, will be loaded with palletised products using a transfer car and radio shuttle system, as in the main frozen vegetable installation. Pallets will be retrieved and loaded onto fast truck loading, load plate technology for fast turnaround of freezer trucks. Options for smaller deliveries to the service industry customers and door-to-door sales will also be included.

At the end of its useful life the frying oil will be pumped to the proposed bio methane plant on site for its use in producing bio methane, to run the sites gas engines and gas-powered trucks.

- Wastewater and fine solids will be pumped to the powder line in building four for conversion into starch, potato powder and pastes. This will conserve water and minimise the waste stream.