



final report

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Prototype commercial development of High Moisture Extrusion Cooked meat

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Abstract

The project P.PSH.0673 sought to demonstrate the feasibility of producing commercial volumes of ProForm Foods' High Moisture Extrusion Cooking technology (PHMC) red meat products to secure real market feedback on prototype reformed meat products in local and overseas markets. In so doing the completed technical validation and verification of the scale-up of the process has mitigated the risk when scaling up throughput for full commercial plants, which was the overall technical purpose of the exercise, which has been completed.

Table of contents

1	Background	4
2	Project Scope and Definition	13
3	Business Opportunity and Strategic Intent	13
4	Success Criteria	13
5	Conclusions	14

1 Background

- The initial requested precursive go/no-go cost benefit analysis conducted by Phil Green of Greenleaf Enterprises established commercial viability. The findings of the “Ex-ante viability of High Moisture Extrusion Cooking (HMEC) for red meat industry value-adding” study completed and tabled in May 2014 suggested the following:

Based on reviews of product quality, customer correspondence, P&L costings and capital budgets the PHMC business case is very robust. The longer term opportunity to generate new profit value for the red meat industry in Australia is well in excess of \$50 million per annum and \$140 million for the whole value chain using very conservative estimates.

It is recommended to proceed with investment in the ProForm Demonstration Plant.

- The project is beginning to realise its potential. This is reinforced by the further MDC project awarded to ProForm.
- The demonstration plant was then designed, established, and commissioned. MLA/MDC personnel have visited the site on a number of occasions.
- The second go/no-go milestone was to demonstrate a rate of at least 300kg/hr rate through the plant. This was achieved.
- The remainder of the project was to demonstrate the channels to market and process thereof – markets, intellectual property considerations, dissemination, and logistics. To this end, numerous commercial engagements have been developed. The commercial sale of beef and lamb ProForm product generated in the demonstration plant has been achieved utilizing Australian beef and lamb.
 - Contract finalisation with other customers is at the volume confirmation stage through to the packaging finalisation stage
 - Numerous visits to and from customers have been undertaken locally and overseas. Samples have been despatched locally and globally
 - The marketing plan and initial product mix has been reviewed and refined to focus on food service
 - The procurement and meat supply relationships have been reviewed.
 - A business and IP model strategy has been reviewed and refined
 - It has been resolved that a patent generation process (for 3 patents) be undertaken. To this end, ProForm has engaged the patent attorneys FrankeHyland based in Macquarie Park in Sydney
 - A review of market uptake has been undertaken as has opportunities for growth. To this end, the production of bulk-frozen product provides the greatest return on manufacturing
 - Product cost and customer reviews continue to be undertaken
 - A relationship with Wild Flavours (owned by ADM) has been established where umami style flavours have been specifically developed for the ProForm applications
 - These products have been tested in the market with favourable response. These items go to delineating project impact and outcome, market interest, and the value proposition of the overall 10-year project plan.

The initial MLA (MDC) funding was to de-risk the initial establishment of a demonstration capability and market development that is in its 4th year and ahead of schedule.

ProForm undertook an industry awareness activity via exhibiting at Fine Food Australia in 2017 during September 11-14 at the ICC Sydney. Fine Food Australia is a respected trade exhibition for the foodservice and retail industry. The event is a showcase of the latest products, an unveiling of new ideas, and a demonstration of new techniques by food industry leaders. A new website was created to enhance the marketing potential of the product portfolio.

Success in achieving milestone and recommendations

The milestone portfolio and their cumulative completion percentages (following the named milestones for reference) are shown below:

2a Determine HMEC Process & Equipment Design (100%)

2b Specification requirements including risk assessments (100%)

3 Establish infrastructure, compliances/Regs and ancillary services for pending HMEC installation (100%)

4 Procure and Implement HMEC Equipment, (mechanical, electrics & instrumentation) Installation and commissioning (incl. initial production testing) (80%)

5a Trials and capacity modelling to prescribed product development briefs (include supply chain and legal requirements, shelf life) (100%)

5b Complete commissioning production trials for bill of materials/formulations and consumer research intelligence (100%)

5c Complete setup for validation of the plant to achieve quality at a rate of 300 kg/hr (100%)

5d Complete validation of the plant to achieve quality at a rate of 300 kg/hr (100%)

6 Develop the quality system and training program to support pending HMEC new product / market development (100%)

7a Cost Benefit Analysis - Marketing plan / mix and supply chain targets (100%)

7b Cost Benefit Analysis - Evaluation Portfolio and Market Industry Roll-Out (100%)

8 Market and Industry Roll-Out Optimisation (100%)

Additionally, it is acknowledged and agreed that ProForm Gourmet will make available production data to enable analysis for a period of five years from the completion of the project. To this end, ProForm Gourmet seeks to collaborate with MLA (MDC) to provide data, as appropriate, to 2020 and forecasts to 2025 for establishment of the value return case for the project. This will provide valuable project review information for all parties.

The production capacity of the demonstration plant is 1,600 tpa that is based on the demonstrated 300kg/hr rate. Designs for a high capacity lamination die are completed and as the requirement for further capacity increases demands, the capacity can be increased to 1,935 tpa.

Below are 2 examples of some products developed using the technology with Beef that were showcased at Fine Foods Australian in 2017:

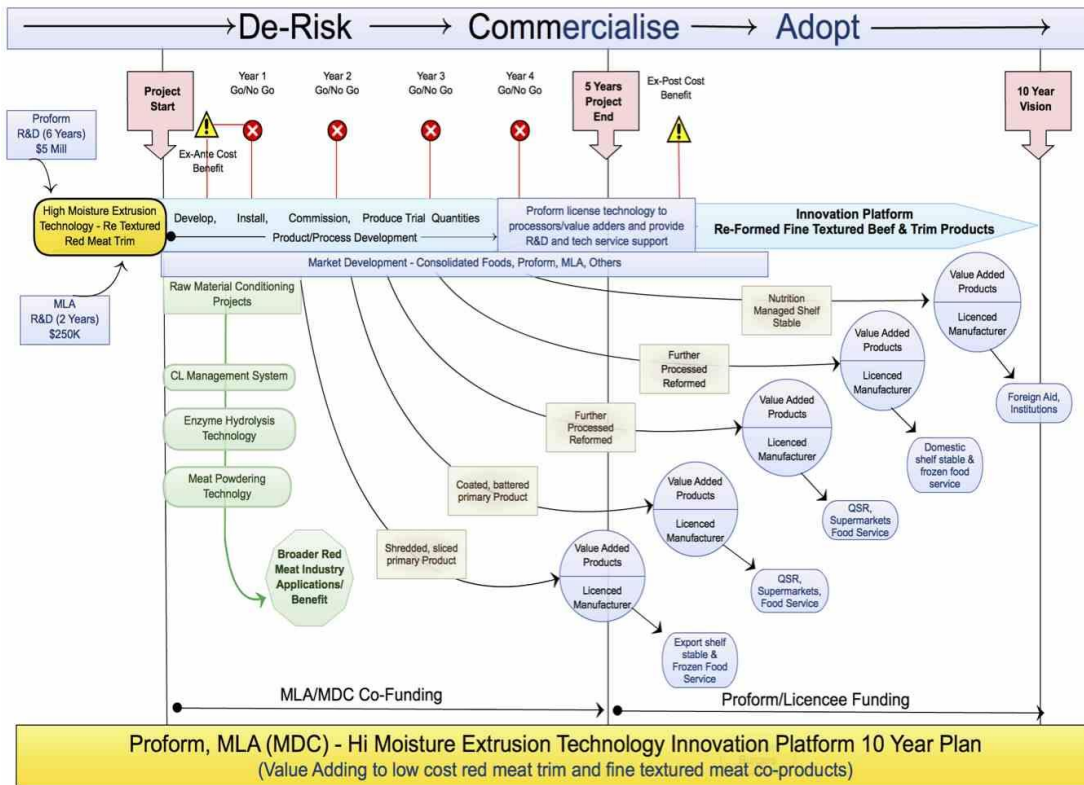






The demonstration plant will in the future serve as the innovation hub for the technology platform focussing on niche high value formats enabling continuous ongoing development for the product suite developed for commercial volumes at sites locally and internationally. The progress of this activity is being realised with the follow up MDC project between ProForm and MLA, MDC through project P.PSH.1013 “Development of high value, structured, cooked meat shreds and snacks using red meat and HMEC (ProForm)”

The business model, shown below, has its foundations on that agreed over many meetings and discussions at the outset of the project and is still the basis for sound development for the technology platform to add value to low cost red meat trim and fine textured meat products.



The following set of questions and their replies forms the foundation of the technology dissemination:

(1) How much meat is added to these products?

- In general, the meat can range from 0 to 75% depending on the CL value of the animal protein
- The added meat is a function of the intended function and use and the economics of the cost of formulation

(2) What is the NFP on the base products?

- The Nutritional Food Profile of the Base product is
 - Beef (Lamb), soy, water, gluten, fibre, herbs and spices

COMPARISON OF PROFORM FOODS WITH RED AND WHITE MEATS

PRODUCT	WATER (%)	PROTEIN (%)	FAT, TOTAL (%)
PROFORM GOURMET	60.6	29.6	6.4
BEEF, ROUND STEAK, Grilled, Lean Only	63.3	30.0	6.2
BEEF, BLADE STEAK, Grilled, Lean Only	64.5	28.7	6.8
BEEF, RUMP STEAK, Grilled, Lean Only	61.2	32.7	6.7
BEEF, SIRLOIN STEAK, Grilled, Lean Only	60.6	28.4	8.8
HAMBURGER MINCE, Simmered, Drained	60.2	26.7	12.1
LAMB, MIDLOIN CHOP, Grilled, Lean Only	64.2	27.8	7.2
PORK, BUTTERFLY STEAK, Grilled, Lean Only	65.6	29.6	4.7
PORK, MIDLOIN CHOP, Grilled, Lean Only	62.9	31.5	5.3
TURKEY, BREAST, Baked, Lean Only	64.6	29.4	4.5
CHICKEN, BREAST, Baked, Lean Only	65.7	28.4	4.8

(3) How do you label the product?

- In Australia it is classed as a **processed meat product**
 - (A cooked meat product)

Processed meat

Processed meat as a category is a continuum of products ranging from meat products with a minimum of 30% meat to products that are all meat flesh.

Products containing less than 300 g/kg meat are regarded as mixed foods and must comply with the general food standards and any food product standards that apply to components of the food.

- Based on the final paragraph in the code, it is appropriate to refer to the product as follows:
 - Beef Pattie shreds
 - Beef Pattie cubes
 - Beef Meatloaf shreds
 - Beef Meatloaf cubes

(4) Shelf life and how distributed?

- For product ex-cooker which is vacuum sealed in 5kg (11 lb) bags
 - **Deep chill** should be about **20 weeks**
 - **Frozen** should be **3 years**

(5) How is the product built?

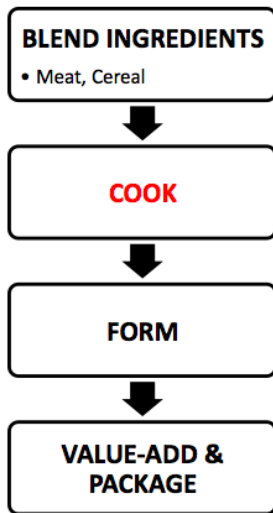
(Shows the basic premise of the continuous cooking process)

- The process is similar in principle to mozzarella – heat and stretch protein to get a stringy, fibrous texture
- Basic premise is similar to a meatball process
 - However, the fundamental difference is that instead of forming and then cooking as done in the meatball process our proprietary process cooks and THEN forms the protein,

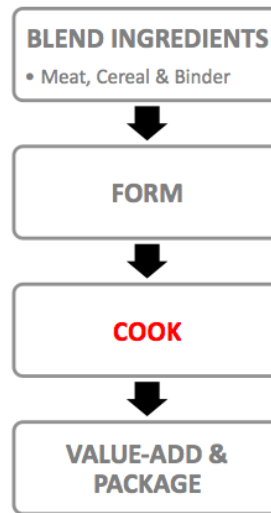
PROFORM GOURMET PROCESS COMPARISON



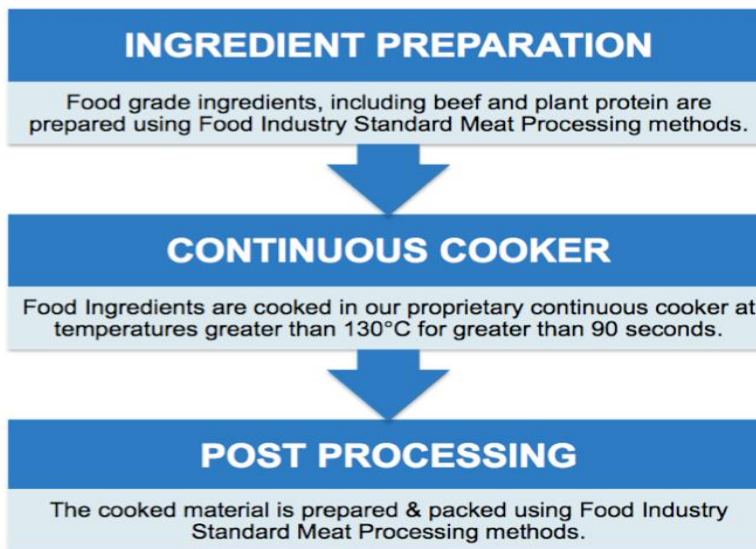
**ProForm Gourmet
Process Flow**



**Standard Commercial Meat
Pattie or Ball Process Flow**



PROFORM FOODS PROCESS



(7) Ingredient options (non-allergen, gluten free, etc.)

- Proteins with totally different conformation and solubility characteristics, such as soy globulins and gluten, can be texturised either separately or together, via induced phase separation in biopolymer mixtures to generate anisotropic structure formation. This is provided appropriate cooking conditions are selected (water and protein concentrations, temperature, residence time). Myofibrillar proteins are easily texturised in association with soy proteins or gluten.
- Beef and Lamb for animal protein sources
 - High or low fat, mechanically or centrifugally separated meat
- Require some non-highly hydrolysed protein for plant protein source
 - Soy, wheat, rice, oilseeds, legume, potato, pea
 - Gluten free, allergen free (soy free) is in development
- Other ingredients
 - Dairy proteins
 - Egg proteins
 - Fibres
 - Citrus, Wheat, Potato, Pea, Soy
 - Hydrocolloids, Thickeners, Gums, Stabilisers

(8) Claims

- ProForm Gourmet's offering to the marketplace is the proprietary ProForm High Moisture Cooking (PHMC) food processing technology that facilitates the fibrous restructuring of proteinaceous material.
 - The technology enables the production of a wholesome range of tasty protein based foods with a meaty texture.
 - The delivery of a quality muscle meat eating experience at a lower price-point is achieved by incorporating more cost effective protein sources into the meat matrix.
 - A key benefit of the technology is the consistency in product quality, shape, weight, flavour and texture.
 - Lower in saturated fat, cholesterol, high in protein, price competitive
 - The product is a ready meal component that is ready to heat-and-eat. Additionally, it can be flavoured with additional sauces, rubs, and seasonings during the heat-and-eat preparation

(9) How ingredients and process parameters could create different products depending on the market / customer

- Different formulations and process parameters impact on texture and flavour
- Three steps are essential for texturisation:
 - 'Melting' of the protein constituents inside the cooker as a result of high shear and temperature
 - Steady pumping of the food 'melt' from the cooker into the texturising die
 - Development of a laminar flow in the cooling die to initiate fibre formation
 - By adjusting the formulation, moisture, temperature, flow, and pressure, a wide range of textures can be formed
 - Mass temperature, pressure, residence time and shear rate are the main system parameters influencing the process outcome, and depend on cooker geometry, process parameters and feed composition.
 - The molecular transformations and associations during texturisation can be described as a sequence comprising stretching, aligning, and crosslinking under the effect of heat, moisture, and shear

The above represents the initial item of the communication plan for the technology. Having lowered the threshold for investment via the ProForm Gourmet/MLA (MDC) model established, the development of facilities of 3 to 10 times the capacity of the demonstration plant via binding license agreements with parties in an orderly manner so as not to dissipate the technology but disseminate and implement for structured growth.

A strategic format for interaction with the supply chain, which has been evolved in developmental use to support marketing, is shown below:

2 Project Scope and Definition

The project is generally defined in two phases

- (1) Phase 1: Apply PHMC processed meat products in existing products in shredded, diced, or strip meat format
- (2) Phase 2: Develop a new line of Ready-to-eat healthy and affordable meals in frozen packs or in cans

3 Business Opportunity and Strategic Intent

The products identified for potential application of PHMC processed meat products are critical to increasing a company's total sales and revenue

- (1) In a market where affordability is a key driver for purchase, the increasing cost of meat materials, specifically beef, cannot be passed on to the consumers. To address low product margins, mechanically deboned meat or MDM is partially used to replace beef. There are, however, limitations on MDM sourcing and quality considerations as well. The PHMC processed meat products are considered as the next best option to leverage on product costs while maintaining product quality with a sustainable supply of raw materials.
- (2) As a company committed to deliver quality products, we continue to explore healthy options and plans to develop a nutritious line of products with low fat, low calorie and/or high protein.

4 Success Criteria

The final products using PHMC processed meat product will be evaluated vis-à-vis control formulation and should achieve

- (1) Acceptability ratings at par or better than control based on consumer sensory tests (analysed statistically)
- (2) Better or at par keeping quality and shelf life vs. control or running formulation

Final product costs will be evaluated upon successful completion of all tests. It shall meet the targets as defined under project deliverables.

The licensing of the demonstration plant IP technology and support services has been outlined and presented to MLA. Interested parties are invited to contact MLA and ProForm Foods for commercial discussions.

5 Conclusions

The independent pre-commencement cost benefit analysis that was undertaken by Phil Green of Greenleaf Enterprises considered the viability of the PHMC business case to determine if initial capital investment was justified and how that investment will benefit Australian processors and producers. Based on commencement of sales, reviews of product quality, customer correspondence the opportunities elucidated in the project initiating cost benefit analysis have continued to be solid indicators and manifestation of opportunities.

The project sought to develop the commercial opportunity for the red-meat industry of value adding using the ProForm Foods' Cooking technology (PHMC). This has been established. The plan to execute the growth strategy is the development of key collaborative relationships for value adding that facilitate trim recovery opportunities throughout the red meat industry. The predominant impact of the project is that it provides an innovation injection into the red meat industry to challenge existing value adding paradigms to provide substantial dollar returns. A number of outcomes emanating from the project are listed below:

- Provision of an additional value-adding channel for red meat locally and globally by enhanced utilisation of total carcass
- Generation of yield efficiencies and value effectiveness by harvesting premium value from usable protein
- Demonstration of an innovation pathway project that commercialises innovative technology to grow demand
- Opportunity for further stakeholder investment

At present, the return for the overall project investment of \$10 million (with MDC only represent a portion of this) is gathering traction and anticipated realisable by a factor of over eight times. The demonstration PHMC plant (designed and built as part of the project) has capability for developing a range of products and optimising process yields. The plant run by ProForm Gourmet using the ProForm Foods' technology is producing commercial volumes of PHMC red meat products to secure market feedback on fully cooked meat products in Australia and other markets.

Market intelligence from target overseas markets is, has, and will continue to be key to the identification of new products and for developing the adoption of the technology by the Australian Processing Sector.

ProForm Foods will license the technology for full-scale installations, which are to be supported by a technical support package to implement the technology. Full-scale production plants to process over 100 tonnes per week would be financed by commercial investment to meet initial market potential.

Overall, the work has enabled the building of an understanding for the requirements for scaled up production via the implementation of the demonstration plant. Further collaborative activities with MLA have been put forward and accepted to bridge the gap between market understanding and requirements and the capability to deliver to those specific target market opportunities.