Tuesday 23 November 2021

Subject: Biosecurity Australia: Outline of Bioenergy Project

Detail: Approved Arrangement Requirement – Preliminary Assessment Application

A. Introduction

Mt Alexander Bioenergy Pty Ltd h(MAB) as undertaken a comprehensive and detailed Feasibility Study and bankable Business Case. This has led to the production of a high-level design report for the proposed facility (attached).

Please note that the detailed engineering design phase has not yet commenced. MAB is in the process of conducting an EOI to be followed by an EPC tendering process in order to select the preferred engineering partner. Accordingly, whilst we will specify the broad scope of works required for the project, the actual detailed design has not yet been undertaken. Bio-security considerations and requirements will be incorporated in the tender process, however the preferred EPC partner will have as one of their responsibilities the task of ensuring the design meets the bio-security requirements, as anticipated in the "Approved Agreement" with which MAB will need to comply upon project commissioning and operation.

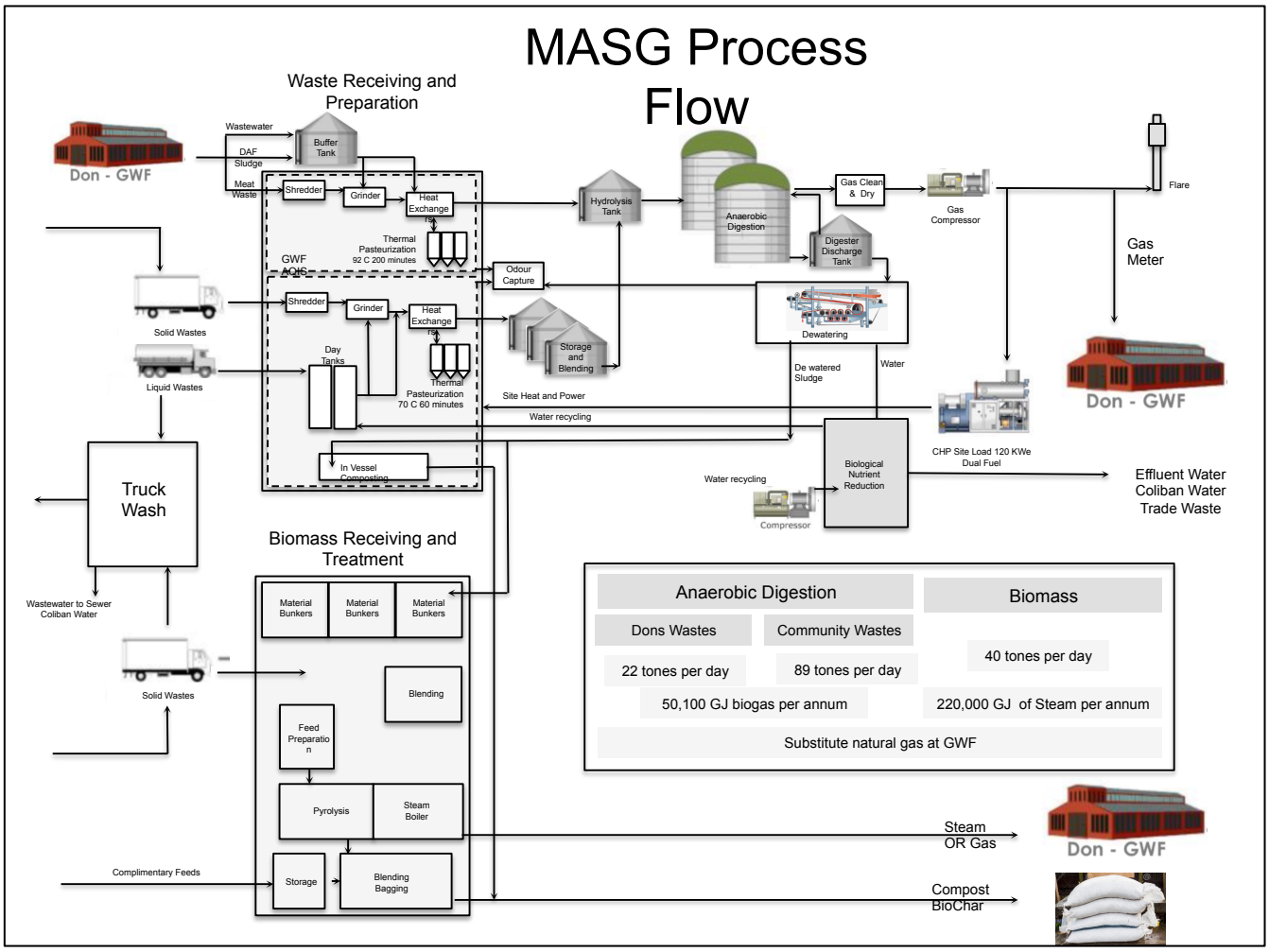
Mab is able to share with Bio-security Australia our current expectations as outlined in the attached High Level Design document and process map (refer p2 overleaf).

As per Biosecurity Australia's recommendation we provide the following details describing the relevant project parameters to facilitate the commencement of *preliminary assessment of suitability*. The context for this submission is a twin technology approach, combining an aerobic digester (AD) with a biomass pyrolysis-steam boiler (BT). The AD plant (stage 1) takes high moisture organic streams (over 20% moisture) and the BT plant (stage 2) accepts low moisture (below 20% moisture) woodier waste streams.

Due to the need to phase the project for commercial and technical reasons the AD plant will be built and commissioned first, followed by the BT plant twelve months later. This application is mostly focused on stage 1. It is the view of the technical team of Mt Alexander Bioenergy (proponents) and its advisers that

the proposed technology addresses the decontamination objectives of Biosecurity Australia through high temperature pasteurisation.

The integrated bioenergy process flow diagram is shown below.



B. The specification of the AD plant (stage 1) design

This section is to be read in conjunction with the process diagram above and will include:

Design

1. The design will include three separate treatment reaction tanks. One tank will be filling while the second tank is reacting (or cooking) while the third tank is draining.
2. A heat exchanger will be used to transfer thermal energy from the draining tank to the filling tank. The reaction tank is then heated to the target temperature, as per below.
3. Successfully treated batches will be sent to the anaerobic digestion system while any unsuccessfully treated batches will be re-cycled back to the feed system and not sent to AD until they are successfully treated.
4. If there is a problem with part of the system, then it can operate as a two-tank system while maintenance is undertaken.
5. The thermal energy is supply by hot water from the combined heat and power generator. Two by 75 KW CHPs are included in the design, rather than a single 150 KW unit to provide a level of redundancy. During start up or in the case of a system problem, if insufficient biogas is available, then LPG will be used to fuel the CHPs and provide the heat and power required.
6. This thermal disinfection process is a commonly deployed commercial solution, well proven and low risk

Commissioning

1. The system will be commissioned with clean water, to confirm the functionality of the system.
2. Once the system is confirmed to be operating correctly, it will be operated using wastewater from the Dons operations.
3. Only once the operation has proven to be reliable and the whole AD system operating to specification, then AQIS wastes will be diverted from landfill to the plant. The operation of the plant will be re-confirmed with the meat wastes.

Operation

1. The Thermal disinfection process shall meet the target temperature and time every cycle, without exception.
2. A calibrated temperature sensor shall measure the coldest point in the wastes within the treatment vessel and the temperature of the processed wastes shall be measured as the wastes leave the treatment vessel measuring and recording the temperature variation and minimum temperature of each batch. The temperature sensors shall be calibrated as per the manufacture's recommendation to provide 0.5% accuracy.

3. The target temperature will be set as the target minimums target temperature plus 6 times the standard deviation of the temperature variation of the outflowing waste temperatures plus an agreed safety margin.
4. The process time shall commence from the time that the reaction vessel is full and the minimum process temperature at the coldest point reached. The minimum process time shall be not changeable in the PLC, however, it can be extended if required. Timers in PLCs are accurate and calibration is not expected to be required.
5. The reaction vessel discharge system shall include two discharge valves. The first is normally open and this diverts treated wastes back to the incoming tanks while the second is normally closed and this allows the process wastes to be sent to the AD process. The normally closed valve can only be opened by the PLC when the minimum process time and temperate has been met . The normally closed valve does not have a manual over ride function, the operators cannot force the valve to open. The normally closed valve has a set of contacts that confirm the position of the valve. If the normally closed valve does not return to the normally closed position between cycles, then the reactor will not be allowed to accept wastes and one of the three reactor tanks will be locked out until the fault is repaired.
6. The PLC will record the operation of the disinfection system with any fault not being operator re-settable. Any fault must be cleared by the site manager and justification for the fault recorded for review as a KPI.

Maintenance

1. The heat exchangers expect to be cleaned once per 3 – 6 months. A stand-alone system will flush the heat exchangers with detergent, caustic, acid and detergent and the CIP wastes generated will be collected in a tank and sent to the site wastewater treatment system.
2. Temperature sensors shall be calibrated according to manufactures specifications

C. **Five key biosecurity determinants are listed below**, supported by an explanatory paragraph.

Types of biosecurity waste (waste profile) to be used in the proposed treatment process.

Dons Smallgoods (division of GWF) operates a large meat processing facility in Castlemaine, VIC. Much of their 'raw' material is imported pork product from Europe and Canada. The treatment of the respective waste streams associated with this imported raw material are currently covered by their existing BioSecurity Australia *'Approved Arrangements' For 3.2 – Imported pig meat processing Requirements – V4.0*. These are currently disposed of by Cleanaway through deep burial at the Truganina landfill, near Melton. The types and volumes are shown below:

- Cardboard packaging & Plastic wrapping (approx. 2,000 tonnes per annum to deep burial landfill)
- Meat waste (approx. 4,117 tonnes per annum)
    - Treated (to normal landfill)
    - Un-treated (to deep burial landfill)

It is proposed that these waste streams can become valuable feedstocks for the bioenergy plant. The meat waste would be a valuable feedstock for the Anaerobic Digester and the packaging waste via the thermal pyrolysis plant which runs at over 700 degC to produce heat (steam) for Don's factory and biochar for local agriculture. In both bioenergy technologies there is a treatment phase for pasteurisation and/or high temperature thermal treatment. See schematic on previous page and below for technical details.

How and where the waste will be transported to and received at and stored at the facility prior to processing.

Meat waste handling and transport will be done in accordance with *Approved Arrangements: 3.2 – Imported pig meat processing* Table 2 clause 2.1; this same approach would apply for transporting this waste an additional 100m to the proposed Mt Alexander Bioenergy anaerobic digester.

- The meat waste is currently collected in clearly marked and tracked bins which are then transported within the Dons Smallgoods premises via truck to the waste heat treatment plant which lies circa 200m west of the main facility.
- The contaminated cardboard and HDPE plastic packaging waste is compacted and disposed of via sealed and enclosed Cleanaway trucks at a deep burial site two hours away.
- The proposed bioenergy plant will accept both of these streams in the existing bins and trucked several hundred metres north to the bioenergy plant (adopting the same handling procedures), to a different destination from the current arrangement, and delivered into the sealed receivals hall.
- Due to the nature of the waste streams the material will be immediately processed; no external storage is intended. It will be a just-in-time process (refer to schematic on page 2).

Description of the processing stages, including details of the type of process, the technologies used and the process parameters (e.g. time, temperature, pressure) for each stage.

- Refer to section 5.2 of the attached High Level Design document for details of the thermal pasteurisation and heat treatment proposed
- See table below with summary information
- See table on following page (extract from Mass Balance)

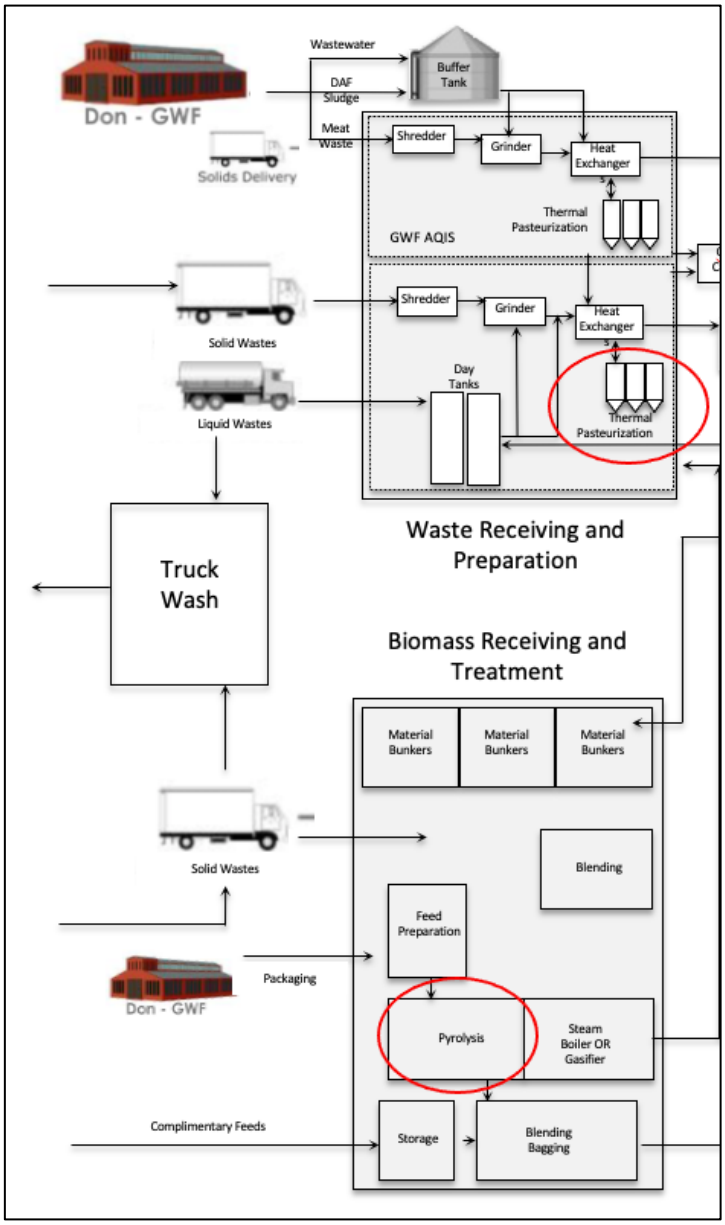
The thermal treatments for the respective waste streams will be isolated from each other and treated at the temperature required by Biosecurity Australia (Approved arrangements for Imported Pork Table 4, clause 4.2. They occur during the pre-treatment phase whereby the inbound meat waste is reduced to a specified size and blended with the DAF sludge and associated waste water before being exposed to the high temperature decontamination. Similarly for the externally sourced general community waste. Both streams meet in the hydrolysis tank from where it is passed through for anaerobic digestion.

Process	Description	Temp (°C)	Time	Pressure
Anaerobic Digestion (GWF/Don's pig meat waste)	Thermal pasteurisation via heat exchangers	92	200mins	STP
Anaerobic Digestion (general community waste)	Thermal pasteurisation via heat exchangers	70	60mins	STP
Biomass Thermal	Pyrolysis thermal oxidiser	725-925	2.5 secs	TBA

Approved arrangements for Imported Pork Table 4, clause 4.2. ('Imported pig meat waste must be disposed of by one of several methods' such as point 3 shown below)

- heat treatment to one of the following approved minimum core temperatures and times:
  - 100°C for 30 minutes
  - 99°C for 40 minutes
  - 98°C for 50 minutes
  - 97°C for 60 minutes
  - 96°C for 80 minutes
  - 95°C for 100 minutes
  - 94°C for 120 minutes
  - 93°C for 150 minutes
  - 92°C for 200 minutes

Red circled areas indicate where and how the heat treatment will occur for effectively treating potential meat waste pathogens.



The technical specifications for the raw material waste stream from Dons Smallgoods is shown below. Prepared by Biogass Renewables Pty Ltd as part of the Feasibility Study 2018, it was based on their successfully operating Richgro AD plant at RichGro, Jandakot, W.A.

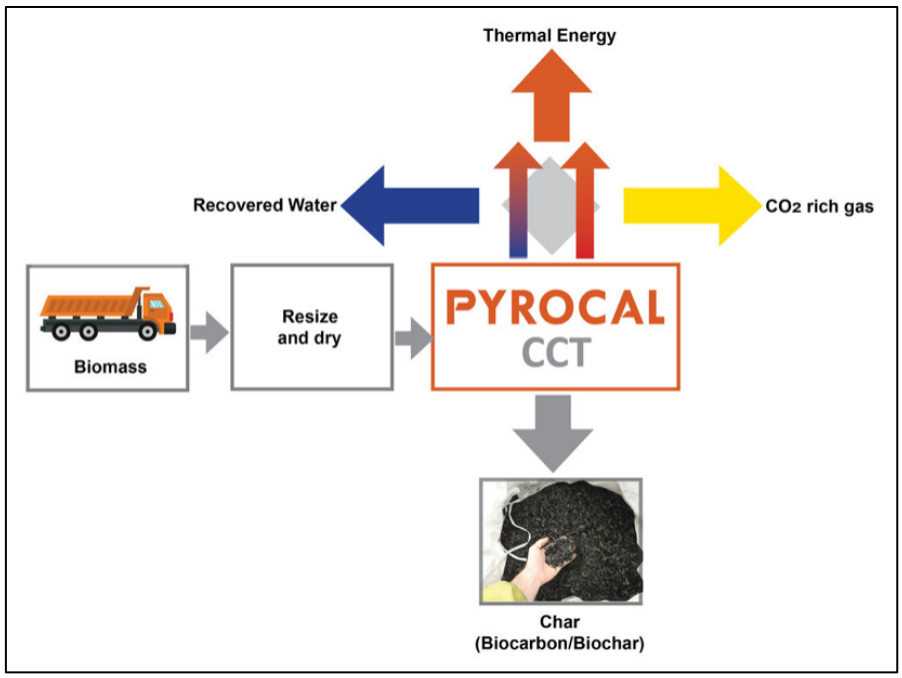
Waste Streams	Units	DAF Sludge	Meat Waste
Annual Throughput	TPA	2,800	900
Weekly Throughput	TPW	53.85	17.31
Daily Throughput	TPD	8	2
8 Hours /Day Input	TPHr	0.96	0.31
DM%	%	8%	32%
VM%	%	89%	92%
Density	Kg/m3	1,000	680
COD	Kg/m3	26.0	TBC
Biogas Yield	m3/ tonne	50	185
Methane Content	%	60%	60%
Volitile solids	vskg/T	71.20	294.40
Biogas Production /yr	m3 / year	140000.00	166500.00
Biogas Production /hr	m3 / hour	15.98	19.01

Measures and methods that will provide verifiable assurance that the process parameters have been attained. (e.g. measuring equipment, technologies, calibration methods)

- Contaminated (prescribed) waste will arrive at the bioenergy plant clearly labelled as per current "*Approved Arrangements for 3.2*" with Dons Smallgoods
- Stage 1- Anaerobic Digestion: PLC based computer control and monitoring systems will capture, log, monitor and report the following information (refer image below for PyroCal technology):
    - Subject to the EPC detailed engineering design
- Stage 2- Biomass Thermal Pyrolysis: PLC based computer control and monitoring systems will capture, log, monitor and report the following information, based on the desired specifications:
    - Subject to the EPC detailed engineering design

Note that Stage 1 (AD) will precede the Biomass stage (2) as there is additional complexity to this overall technology, however from a Biosecurity perspective the pyrolysis process is extremely effective at dealing with any meat waste contaminated material such as cardboard and plastic packaging due to the very high temperatures of the pyrolysis process (over 700°C for 2.5 seconds) – to be checked with Biosecurity Australia.

See photo images below of what is envisaged for the biomass thermal pyrolysis-based plant, excluding the back-end heat exchanger (not relevant for this application).





Descriptions of the products, by-products and waste products, including a description of their physical attributes/parameters, that will be produced at each stage of the proposed treatment process.

- AD: Two products are produced from this plant:
    1. Biogas – this product is well understood; it will be scrubbed of H2S (H2O + SO4) before being piped as biogas (~64% CH4) to Don's
    2. Digestate – this arises from the sludge at the bottom of the AD tanks and is rich in minerals N, P, K, C, S and physically consists of:
        - Solids fraction (~3,000 tonne p.a.) at 30% D.S.
        - Liquid fraction (~15,500 kL p.a.) at 1% D.S. liquor

- Biomass Thermal: Two co-products are produced from this plant:
    1. Heat (steam) - composition can be provided on request
    2. Biochar – comment

The proposed treatment and/or disposal methods and paths of each waste product.

One of the core design principles (circular economy) underpinning the Mt Alexander Bioenergy project is a goal of zero waste. We do not intend to have any waste that will need to be disposed.

- AD: Assuming the digestate co-product can be effectively processed and used as a valuable resource, there is no need for the treatment and disposal:
    - Digestate – still to be finalised during the detailed design stage however we envisage one of the following treatments will be applied:
        - Sent directly to the biomass thermal plant (Stage2) as a material resource (NOT a waste) to extract the energy through the pyrolysis process, OR
        - Converted into compost using an onsite aerobic composting technology (below) such as Hot Rot, the parameters for which are:
            - 10-12 days in vessel time
            - Moisture level 55%
            - Harmful pathogen treatment by holding digestate at 55-60°C for 3-4 days a
            - Scale of Hot Rot matched to suit the 8 tonnes per day (assuming Complete Mix AD enables delivery of digestate in continuous flow mode)



        - Only if the previous two options are not possible would consideration be given to sending the digestate directly to Coliban WWTP via Don's dedicated trade-waste pipe



- Biomass Thermal: There are possibly two additional 'resources' produced from this plant which will have some commercial value but are subject to final detailed engineering design:
    - Wood vinegar - comment (possibly to be provided to farmers for soil conditioning purposes)
    - Biochar Ash – comment (possibly to be included in compost or direct to farm land)

Proposed end uses for each product or by-product (e.g. stockfeed, cattle therapeutics, compost, soil conditioner/fertiliser).

- This is dependent on the detailed engineering design, however the longer term goal is to have the AD digestate used as a feedstock in the biomass thermal plant, whereby the parameters of pyrolysis process (temperature and time) far exceed what is believed to be a minimum threshold for effective pathogenic heat treatment
- Biochar has many well-known uses without the need for blending or modification, including but not limited to:
    - Soil additive for helping building soil carbon,
    - Industrial purposes ('activated carbon') for filtering of chemicals and residues
    - Stockfeed supplement (balances the rumen microbiome and helps reduce enteric methane production)

The following five topics are not considered relevant for the proposed Mt Alexander Bioenergy facility but are listed for completeness purposes.

- Type of feedstock, if any (e.g. domestic waste product, woodchip) will be blended with the biosecurity waste prior to processing?
    - N/A

- The proposed ratio of feedstock to biosecurity waste?
    - N/A
- How and where will blending of feedstock occur?
    - N/A

- Is there an optimal moisture content that the feedstock needs to be in order to be processed using the proposed technology?
    - N/A

- If there is an optimal moisture content that the feedstock needs to be, how is this achieved and what waste (liquid?) is produced as this point?
    - N/A