NEW ENERGY CORPORATION PTY LTD
ABN: 16 139 310 053
Suite 1, 12 Parliament Place, West Perth, WA 6005
PO Box 1036, West Perth, WA 6872
T +61 8 9226 0722 F +61 8 9481 8023
www.newenergycorp.com.au

5th November 2012

Chairman
Environmental Protection Authority
Level 8, The Atrium
168 St Georges Tce
Perth, WA, 6000.

Attention: Mr Richard Sutherland

Boodarie Waste to Energy and Materials Recovery Facility – New Energy Corporation Pty Ltd – Public Environmental Review (Assessment Number 1911).

Dear Sir,

New Energy is writing in response to advice received from the Department of Environment and Conservation (DEC) dated 24th September 2012.

The DEC letter provides a detailed assessment of the PER referenced above. New Energy would like to thank the DEC for its review of the PER and this letter and attached information is to provide our response to the recommendations received.

The attached information focuses on the two main considerations from the DEC regarding the project, which were:

1. Gasification is a relatively new technology and is less proven for large scale processing of mixed wastes.
2. The cumulative impact of clearing 10 hectares on the Priority 1 flora species Tephrosia rosea var venulosa.

The attached information also individually addresses the 32 recommendations raised by the various branches with in the DEC.

In regards to the scale of the technology and its ability to process mixed waste, New Energy through our consultants, Aurora Environmental have made a request to meet with the EPA. We would like to introduce Entech the technology provider so they can directly answer questions surrounding their technology and project experience.

New Energy understands that this is the last outstanding correspondence resulting from submissions received from the Boodarie Waste to Energy and materials Recovery Facility PER process.

We look forward to meeting with the EPA as the final stage prior to a report being prepared for the Minister for the Environment.

Yours sincerely,

Jason Pugh
General Manager

Responses to the DEC Recommendation of 24th September 2012

Recommendation 1: Flora

The flora and vegetation information presented in the PER prepared for the Waste to Energy project was compiled in accordance with the EPA's requirements as outlined in the Environmental Scoping Document (ESD).

The ESD required the proponent to provide information on flora and fauna expected on the site from other appropriate surveys. A review of available literature revealed that there had been numerous biological studies conducted on the site or in the general vicinity of the site. Only those that covered the entire site, a portion of the site or in close proximity were reviewed and summarised in the PER. These included:

- Mattiske (1994) – flora and vegetation survey of the Boodarie Strategic Industrial Estate comprising two site visits, with no Priority flora identified during the survey.
- Biota (2004) – flora and vegetation survey covering 345km of FMG's Stage A rail corridor. A portion of the survey area overlapped the New Energy site. One Priority 3 taxon (*Gymnanthera cunninghamii*) was recorded approximately 2km north of the site and adjacent to South-West Creek.
- ENV (2009a) – flora and vegetation assessment of BHP Billiton Iron Ore's Outer Harbour project area. The survey included a portion of the New Energy site. No priority taxa were recorded on the portion of the New Energy site in the survey area. However, one Priority 3 taxa (*Gymnanthera cunninghamii*) was recorded approximately 1.3km east of the site and adjacent to South-West Creek by ENV (2009a) and a Priority 1 taxa (*Tephrosia rosea* var. *venulosa*) was recorded approximately 2.2km south-east and 2.5 km south-south-east of the site.

- ENV (2009b) conducted a targeted priority flora survey in the Port Hedland area for BHP Billiton Iron Ore's growth projects. No Threatened Flora under the *Wildlife Conservation Act 1950* were recorded during the survey. However, four Priority taxa, *Heliotropium muticum* (Priority 1*), Tephrosia rosea* var. *venulosa* (Priority 1), *Pterocaulon* sp. A Kimberley Flora (B.J. Carter 599) (Priority 2) and *Goodenia nuda* (Priority 3) were recorded within the Port Hedland area during the targeted survey. None of these species were recorded on the site. The report did identify a record of *Gymnanthera cunninghamii* (Priority 3) approximately 1.1km east of the site in an area adjacent to South-West Creek.

- ENV (2011a) was commissioned by BHP Billiton Iron Ore to undertake a Level 2 Regional Flora and Vegetation Assessment of the Port Hedland region. The study area was 808.7km^2. The assessment consisted of database searches, a literature review of more than 30 flora and vegetation assessment reports conducted in the Port Hedland region (dating from 1994 until 2011). A field survey by ENV staff was conducted from 30 April 2011 to 6 May 2011 and from 20 June 2011 to 1 July 2011. In total 70 person days were invested in the survey. No Priority flora was recorded on the New Energy site.

Based on the review of the available information Aurora Environmental concluded that there is potential for priority taxa to be present on the site.

Determining the cumulative impacts on a single species such as *Tephrosia rosea* var. *venulosa* is, in Aurora Environmental's view, difficult for the following reasons:

- The identification of *Tephrosia rosea* specimens to variety level is complicated as this species has not been formally described and more than half the collections of *Tephrosia rosea* lodged at the Western Australian Herbarium have been on loan since 1998 (Dillon 2010).
- Due to the need for revision of *Tephrosia rosea* as a species, no definitive conclusion can be made regarding the regional distribution of *Tephrosia rosea* var. *venulosa* until the taxonomy of the species is further clarified (ENV 2011a).
- The total number *Tephrosia rosea* var. *venulosa* plants present in the Port Hedland region is not well defined.
- The presence/absence of the species at the New Energy site has not been confirmed via a recent site specific study which was not a requirement of the EPA's ESD.
- The total number of *Tephrosia rosea* var. *venulosa* plants that have been authorised to be cleared via EPA approvals and DEC native vegetation clearing permits in the Port Hedland region is not easily accessible.

Notwithstanding the above complications, ENV (2011a) reported that more than 4,600 individuals of *Tephrosia rosea* var. *venulosa* (or similarly described variants) were recorded from 304 locations in their Port Hedland study area across a range of habitat types. This suggests that the species (or similar variant) may be somewhat more widespread in the Port Hedland region. Therefore, if it was present on the New Energy site and having regard to the total area proposed to be cleared (10ha), it is highly unlikely that the conservation significance of the Priority 1 taxon would be impacted.

In response to the DEC's recommendation, New Energy has commissioned a targeted flora survey to confirm the presence/absence of *Tephrosia rosea* var. *venulosa*. The survey is scheduled in early November with the results being available in late November. The results of the survey can be provided to the DEC and the EPA when these are available.

Recommendation 1: Technology

Pyrolysis V Gasification Question

The Entech gasification process can be correctly described as "low temperature gasification". The Entech technical information though refers to the "Pyrolytic Gasification Chamber or PGC". The PGC receives the waste after it is charged and heats to the required ignition temperature in an oxygen depleted, sub-stiochiometric environment. The thermal degradation process is commonly referred to as pyrolytic gasification because it approaches semi-pyrolysis with condensable gases and some vapours produced. In other words, the organic material within the solid feed is converted into a volatile and energy rich methane gas that is referred to as "syngas". The volatile constituents of the syngas are primarily CO, CH_4 and C_nO_n hydrocarbons.

In contrast to true pyrolysis, which is an endothermic process requiring an external heat source to sustain it and conducted in the absence of oxygen, the gasification process occurring in the PGC is

exothermic once the chamber reaches normal operating temperatures and operates with sub-stiochiometric oxygen levels as previously described.

Scale of the Technology

Although the overall scale of the proposed waste to energy plant is substantially larger than any plant previously delivered by Entech, the technology risk is being managed by a conservative approach to the overall plant design. The scale issue as raised by the DEC is only relevant to the gasification reactors themselves not the "air quality control system" (AQCS) and the "power generation" (PG) aspects of the plant design as indicated by the following:

- Both the AQCS and the PG components of the design do not form part of Entech's intellectual property. These plant features will be delivered by expert vendors who have experience in delivering BAT solutions for treating the off gases from combustion processes.
- The AQCS and PG are not of a scale that poses any substantial technology risk. The AQCS are vendor items have been installed in numerous facilities internationally and at a scale far bigger than New Energy is proposing for Boodarie. The PG equipment is relatively small compared to other projects and steam turbine energy generation has been utilised for many decades.
- The gasification produces significantly cleaner off gas when compared to incineration. This is true in terms of volume of off gas and the concentration of contaminants and particulates contained in the exhaust gases exiting the Syngas burner for heat recovery treatment in the AQCS. As a result the AQCS system will operate at significantly lower contaminate loads than the typical incinerator facilities they are designed to operate in.
- New Energy will shortly be embarking on the detailed engineering for the project including detailing the specification for both the AQCS and PG and propose that a detail design review of these systems is more appropriately conducted by DEC during the Part V approval process. New Energy is confident that it will be able to demonstrate compliance with BAT commitments at this detailed design stage when more specific vendors and equipment can be discussed.

As previously acknowledged the Boodarie plant is a scale up over plants previously installed by Entech. However, Enetch's deliberately conservative design philosophy will manage the technology risk associated with the scale up. These design aspects include:

- Modular nature of scale up: in order to reach the design capacity of 72 MW thermal as specified for the Boodarie project, Entech has incorporated a modular design for the pyrolytic gasification chamber or PGC. Four (4) PGC's with an individual capacity of 18 MWt will be installed with a fifth PCG also installed to allow planned maintenance of the system whilst maintaining full plant availability. This conservative design feature is to ensure that process conditions and design constraints are not compromised. These design constraints are further detailed below.
- Conservative Design: The Entech gasifier design has evolved through project experience and a commitment to a conservative design basis. Some key design features that support this statement are:

- The first is the maximum thermal capacity of the individual PGC units. The largest installed gasification unit currently in operation is 14 MWt so the Boodarie PCG is a scale up of 28%. In engineering terms this is not a significant scale up. In terms of Entech's past experience they have managed technology scale up on a far larger scale than this with success.
- The second design feature is residence time for the waste in the PCG. A waste residence time of between 16 hours and 24 hours is a non negotiable design feature. This is to ensure that all waste is fully gasified and ensuring any resultant ash produced is suitably inert. This slow "cooking" of the waste also ensures that the waste stays on the bed of the hearth and that associated ash from the process is not entrained in the syngas. It also allows process conditions to be monitored and changes affected when required. Combusting waste in 1 – 2 hours (like conventional incineration) makes it more difficult to materially alter process conditions.
- The third design feature is the agitation of waste without using excess air. This is achieved by having a mechanical stoker that enters the PGC under the waste to agitate the waste without creating significant fly ash. The stepped hearth is also key to achieving significant agitation as waste tumbles from one step to the next thus exposing any uncombusted materials,

Invariably gasification projects that have failed internationally have either tried to gasify too much waste in a single reactor or have attempted to gasify the waste too quickly.

- Reference Projects: New Energy has only presented reference plant information pertaining to Entech projects that were able to send us qualitative emissions data to form part of our submission. This however does not accurately illustrate the size or number of projects successfully installed and commissioned by Entech. On the issue of scale the largest recent plant undertaken by Entech has been the Malaysian Clinical waste gasification plant owned and operated by Malaysian company FMS. The plant in Kamunting processes all the medical waste for the northern part of the Malaysian Peninsular. The size of this facility is 14 MWt and was installed in 2008. New Energy undertook a site visit of the facility in 2011 and was impressed with the plant operations. Steam from the facility was being used to operate an adjacent industrial laundry also owned and operated by FMS. The plant has met all local licence conditions and is equipped with a continuous emissions monitoring system. The client subsequently sent New Energy 5 years of CEMS data for our reference. After thorough review of the information we decided not to rely upon it for our submission. This was not because the operating parameters were out of specification by rather the data sets appeared "too good" and we were concerned that the instrumentation may not have been kept in calibration by the operator. As a result, we were not prepared to submit this information to the EPA.

We would like to highlight five (5) Entech installations that illustrate both scale and flexibility to treat different feed stocks. Of note is the fact that these plants have an identical configuration to each

other and still successfully treat vastly different waste streams. **Appendix 1** provides some details on these projects but in summary:

- Malaysia (Project Ref 1162): processing high CV (35 MJ/KG) biohazardous waste. This project has a 14 MWt Entech gasifier.
- Singapore (Project Ref 1123): processing low CV (7 MJ/KG) abattoir sludge by-products. Also incorporates two gasification units into a singles air quality control system.
- Taiwan (Project Ref 1072): processing CV (10 MJ/KG) MSW and dried sewage sludge.
- Taiwan (Project Ref 1142): processing CV (20 MJ/KG) liquid waste which is a by-product of pharmaceutical manufacturing. This project utilises the "Liquifire™" liquid waste injection system. Further details of this process are discussed in Recommendation 10 below.
- Polish Gorzow: (Project Ref 1164): processing CV (35 MJ/KG) biohazardous waste. This plant was recently commissioned in September 2012.

Heterogeneous Waste Streams at Large Scale

New Energy has considered the risk of large scale heterogeneous waste stream management and we would make the following comments regarding this. Firstly, the need for waste to energy solutions as part of the range of waste management services was identified by our foundation shareholders, Instant Waste Management (IWM). The importance of the association with IWM cannot be overstated. IWM is the largest privately owned waste management company in Western Australia and has been a market leader for over 15 years. IWM is a leading recycler of C & D waste and is moving into C & I waste management. The company has recently completed a $10 million Materials Recovery Facility (MRF) in Bayswater that will be the template for the MRF planned for Port Hedland. The relevance of this is:

- The new Bayswater MRF is sized to process 280,000 tonnes of mixed waste per annum.
- MRF is designed to create clean segregated streams for sale, including:
    - Sand
    - Metals (ferrous and non-ferrous)
    - Aggregate
    - Timber
- The recycled products being produced are both uniform and of a high quality

We acknowledge that the streams to be processed at Boodarie are highly variable but the MRF will enable New Energy to create waste bales that are of a homogeneous nature. It also reduces the risk that incompatible items (such as plaster board as referenced by the DEC) will be fed into the gasifier.

Figure 1: Mixed waste from IWM is dropped onto the apron feeder for sorting at the Bayswater MRF

Figure 2: a network of conveyors, screeds and inspection points allows the mixed waste to be separated into individual streams.

Figure 3: all waste passes through inspection points.

In regards to differing waste compositions contained in streams such as MSW, New Energy does not believe this will pose a significant issue for the Entech gasifier.

Entech has vast experience in treating medical and clinical waste streams. These streams are by nature highly heterogeneous. The waste streams are characterised by the following:

- Medical waste can have extremely high calorific values, particularly from waste medicines and plastics.
- Medical waste can have extremely low calorific values, such as kitchen waste, blood products and surgical waste.
- Unlike the heterogeneous streams we will encounter in the Pilbara, the medical waste received does not get inspected. It arrives in sealed bags that are not opened and fed directly into the gasifier. The change in process conditions within the gasifier are monitored and altered automatically.

To further emphasise the ability of the Entech gasifier to cope with different waste streams successfully, please find below a list of waste streams that have been treated by the Entech gasifier:

Project Number	YEAR	WDF FEED-STOCK	Project Number	YEAR	WDF FEED-STOCK
1016	1990	MSW	1109	1996	MSW
1024	1990	MSW	1115	1997	Biohazardous
1032	1990	Biohazardous	1117	1997	MSW
1033	1990	Biohazardous	1123	1997	Biomass
1035	1990	Rubber Tyres	1127	1999	MSW
1036	1990	Industrial (Textile)	1132	2000	Petrochemical (Slop Oil + Cont. Water)
1037	1991	Industrial (Textile)	1134	1998	MSW + C&I
1045	1991	Biohazardous	1138	2001	Industrial (Nuclear Reactor)

1062	1992	Industrial (Textile)	1139	2002	Biohazardous
1065	1992	VOC's	1142	2002	Industrial (Pharmaceutical By-
1067	1992	MSW + Dried Sludge	1146	2003	MSW
1070	1992	Biohazardous	1148	2003	MSW + C&I
1071	1992	Biohazardous	1150	2004	Biohazardous
1072	1991	MSW	1151	2004	Biohazardous
1073	1993	Industrial	1152	2004	Quarantine
1079	1993	Biomass	1153	2005	Biohazardous
1084	1994	MSW	1154	2005	Industrial (Industrial Estate)
1086	1994	Petrochemical (By-	1157	2006	Quarantine
1092	1995	Industrial (Nylon By-	1158	2007	Quarantine
1096	1995	Industrial (Printed	1159	2007	Biohazardous
1098	1996	Industrial (Industrial	1160	2008	Industrial (C&I)
1101	1996	MSW	1162	2008	Biohazardous
1106	1996	Industrial (LG	1164	2012	Biohazardous

It also needs to be recognised that apart from the green bin waste from Port Hedland, the majority of wastes that will be directed to the Boodarie facility will come from known sources and often will have been pre-sorted thus providing a high degree of knowledge over what is coming to the facility and also providing the ability for plant operators to mix or blend waste streams to achieve a more uniform feedstock for the MRF and gasifiers.

Finally it will be a requirement imposed by New Energy that any unusual or non-standard wastes received at the facility will need to be accompanied by detailed chemical analyses of representative samples of the material so that New Energy can ensure that the loads of heavy metals and sulfur, chlorine and fluorine compounds in feed stocks are controlled to within design limits.

The DEC comments gasification is less proven on mixed waste streams and that the PER provides no comparison with alternative treatment technologies. Section 2.4 of the PER provides alternative waste treatment options and states reasons why these techniques have not been chosen over low temperature gasification. In addition to that information we submit **Appendix 2** for your review. This information provides further comparative information regarding four different thermal waste treatment technologies, being;

- Mass burn incineration
- Fluid bed gasification
- Static hearth gasification, and
- Entech stepped hearth gasification.

Appendix 2 above also provides additional detail to the DEC regarding the process conditions that ensures mixed waste can be effectively treated by the Entech gasification process. In addition to this information, we are also submitting **Appendix 3** "Preliminary Piping and instrumentation Diagram". We submit this preliminary design information to show how process conditions are monitored throughout the process and how the PLC will take preventative action should the process conditions

fall outside set parameters. We do stress that this information is preliminary and that a more detailed process control philosophy will be prepared as part of the detailed design process.

Recommendation 2

New Energy acknowledges that conventional wisdom 'places energy from waste' only one step up from landfill in the waste hierarchy. The reality in the Pilbara, (due to its remoteness from markets, high transport costs and vast open spaces which mean that illegal dumping is an ongoing issue when waste disposal prices increase), is that access to the higher levels on the hierarchy (recycling and re-use) is to a large extent a commercial and practical impossibility. In addition, in many cases it does not make environmental sense because of the large energy cost involved in transporting relatively low value, low density materials such as paper and plastic to distant markets.

As a result, there is currently little or no recycling currently occurring in the Pilbara and these materials such as paper, cardboard, timber and plastic currently go to landfill. New Energy has discussed the issue of mixed plastics recycling with Amcor in Perth and they have advised us that they would not be prepared to receive this recycled waste stream from the plant. Their advice was that the international market for mixed plastics is depressed and they are moving away from those products. On this basis, the energy from waste option is the optimal outcome.

In addition, it needs to be recognized that the New Energy facility incorporates an MRF, (as detailed in Recommendation 1) that in fact will divert ferrous and not ferrous metals and inert materials for off-site recycling which is a significant improvement over the current arrangements where these materials all go to landfill. Section 4.1.2 of the PER discusses this in more detail.

Recommendation 3

Section 5.18 of the PER provides a detailed BAT assessment of the proposed air pollution control system for the project. This information will be used as a design input for the detailed design stage of the project. This is an appropriate time to compare benefits of each piece of equipment as suggested by the DEC.

We acknowledge that the BAT assessment does not adequately cover the hearth type of the selected technology. The BAT references used do not provide this detail particularly in regard to gasification processes. To assist the DEC to evaluate the hearth type we have prepared a comparison of hearth design and associated process conditions for:

- Mass burn incineration
- Fluid Bed Gasification
- Static Hearth Gasification, and
- Entech Stepped Hearth Gasification.

This comparative analysis is attached as **Appendix 2.** The information provides additional information to verify:

- Combustion efficiency

- Flexibility of system for various feed stocks
- Cleaner off gas prior to scrubbing by the AQCS.

Recommendation 4

New Energy will be constantly monitoring what is considered best practice as part of its ongoing operations as the New Energy business plan is based on constructing new 'waste to energy' facilities within Australia and Internationally. For this to be successful each new facility must demonstrably meet BAT.

As such New Energy is willing to commit to preparing a review of BAT as it applies to waste to energy facilities every 5 years for consideration by the EPA.

In terms of incorporating improvements, this would only be done where changes are necessary to ensure compliance with changed emission standards or other policies and guidelines relevant to the operation of gasification facilities.

Recommendation 5

The majority of waste streams accepted at the facility will be either MSW or sorted C&I and C & D Waste. The properties of these wastes are generally well understood and do not represent a management issue.

DEC has requested additional information on how other special materials such tyres or plasterboard will be managed to ensure that they do not adversely impact on planet performance.

- The first thing to note is that operating experience with Entech plants shows that they are very tolerant of excursions in feed quality due to the long residence time for waste in the PCG and the large mass of material in the bed in various stage of gasification. The bed may contain several tonnes of un-gasified material when new materials are fed to the gasifier. The 50 kg charge size is a relatively small change in the overall mass of gasifying material and therefore is less likely to result in radical changes in the conditions in the PCG.
- Secondly materials such as plasterboard will be sorted by the MRF prior to gasification.
- In addition, the design of the feed system is intend to allow different waste types to be blended into a single baled 50 kg packet of waste feedstock. Thus materials such as tyres will be introduced in to bales at a controlled rate to ensure that the feed to the gasifiers will at all times comply with the design input limits for sulfur or chlorine or other critical analytes.
- Finally information from the CEMS system will be continuously assessed for trends in the key parameters such as SO_2 levels and where readings are trending towards alarm limits, feed rates will be automatically be reduced or the feed composition altered,

These design and management features collectively act to ensure that feedstock quality will be controlled in a manner that prevents exceedences of performance criteria.

Recommendation 6

New Energy adopted the Class III landfill criteria as a waste acceptance criteria in order to provide limits on the level of contaminants in any particular waste stream. This is regarded as desirable to ensure that the neither the AQCS nor the ash handling systems are challenged with very high contaminant loads. The intention is not that the facility receives waste streams such as contaminated soils which contain heavy metals as these will not provide energy content and the metals will generally increase the quantity and meats content of the ash and solid residues from the AQCS resulting in a significant disposal cost to be borne by New Energy with minimal commercial benefit.

Nor is it intended that wastes will be accepted with contaminant levels higher than Class III levels and then blended with other materials to reduce contaminate levels below Class III levels by dilution.

Instead the Class III criteria will be used to assess the contaminant loads in liquid wastes and specialised waste streams that New Energy may be requested to accept to ensure that individual analytes are not at excessive levels.

A final note is that one exception to adherence to the Class III landfill criteria would be when New Energy is offered solid or liquid waste streams contaminated with combustible hydrocarbon such as oils or solvents. As the hydrocarbon and solvents represent a valuable fuel, NEW Energy would still intend to accept such materials even though they concentration of hydrocarbons or BTEX etc. may exceed the Class III criteria for these parameters. However, even with such materials the Class III limits on hazardous materials such as metals or Organochlorine pesticides would still apply.

Recommendation 7

New Energy considers that CFD is not required in the case of the Entech plant in view of the extensive operating experience with the Entech gasification and Syngas technology at a commercial scale and the relatively minor extent of scale up involved in the design of the Boodarie Gasifiers when compared to other operating facilities. In addition, the boiler system will be provided by an experienced vendor with a proven track record in delivering boilers for WtE facilities at a scale significantly larger than the Boodarie facility.

Should DEC require that CFD is required, then it would be best undertaken at the detailed design and New Energy would propose that under this circumstance it is presented to DEC as part of the assessment of the Works Approval under Part V of the Environmental Protection Act.

Recommendation 8

The PER (Section 5.7.2.3) states that the Boodarie facility will have continuous emissions monitoring system (CEMS) that will comply with BAT standards as referenced in the European Commission's "Integrated Pollution Prevention and Control Reference Document on the Best Available Techniques for Waste Incineration (August 2006)". Section 2.8.2 of the BAT reference, lists the emissions that should be monitored on a continuous basis. The Table below lists those emissions and identifies

which of those were referenced by New Energy in Section5.7.2.3 as being incorporated into the plant design.

Emission	*BAT CEMS*	*Boodarie CEMS*
Dust	Yes	Yes
HCL	Yes	Yes
SO_2	Yes	Yes
CO	Yes	Yes
C_xH_y	Yes	No
NO_x	Yes	Yes
HF	Yes	Yes

The New Energy PER did not include a CEMS requirement for C_xH_y or hydrocarbons. This was an oversight from New Energy's perspective and a CEMS probe for hydrocarbons will be included in the plant design in order to comply with BAT standards.

In addition the BAT Standard references other key process parameters that should be monitored continuously:

Process Parameter	*BAT CEMS*	*Boodarie CEMS*
Furnace Temperature	Yes	Yes
O_2	Yes	Yes
Pressure	Yes	Yes
Flue-gas outlet temperature	Yes	Yes
Water vapour content	Yes	Yes

Articles 10 and 11 of the EU WID provide specific criteria for the CEMS monitoring equipment including calibration and quality assurance. New Energy is prepared to commit to these standards as a minimum requirement and will work with DEC during the Part V Works Approval stage to document a suitable testing regimen. This approach is endorsed by the WID Standard "Article 10 Point 2", "The measurement requirements shall be laid down in the permit or in the conditions attached to the permit issued by the competent authority".

New Energy also acknowledges that periodic measurement of emissions into air and water must be carried out representatively and according to "CEN" Standards.

Recommendation 9

As referenced above, WID advises that "the measurement requirements shall be laid down in the permit or in the conditions attached to the permit issued by a competent authority". In this regard New Energy intends to address periodic monitoring of contaminants with the DEC as part of the Part V Works Approval process.

Recommendation 10

New Energy confirms the proposed gasification plant operating under the WID standard of two second retention at 850 C will not process liquids that breach WID for these process conditions, that is, liquids having chlorinated > 1% halogenated organic substances, which would require a minimum temperature of 1,100^{0}C as described by the DEC.

The ENTECH low temperature gasification process is not limited solely to solid biomass or waste disposal. The company offers the Liquifire™ Liquid & Slurry Injection System, providing efficient, environmentally acceptable disposal for many industrial and commercial liquid, slurry and sludge wastes with a wide range of CV ratings.

For disposing of high CV liquids, the system may be charged with liquid only. Low CV liquids are fired in combination with solid wastes, or auxiliary burner firing.

Consisting of a pump and flow control assembly, injector assembly and control panel, the Liquifire™ liquid and slurry injection system is capable of handling viscosities exceeding that of No. 6 fuel oil and bituminous tar. This range includes such liquids and slurries as solvents, thinners, vegetable oils, cutting oil, resins, hydraulic oils and crankcase oils, slop oil and even mud drillings.

Liquifire™ is an automatic disposal system which pumps and atomises liquids and slurries into the Pyrolytic Gasification Chamber (PCG). The Liquifire™ system has three main elements:

- a pumping and flow control assembly,
- an injector assembly and
- a control panel.

All three are precisely inter-linked to ensure that the feed rate is fully modulated and controlled by the gasification system exhaust temperature. Feed rate modulates at both upper and lower set points.

The PGC is preheated, either by loading and processing solid biomass or waste, or alternatively with the aid of the auxiliary burner. When temperature reaches preset parameters, and a series of control sequences have been activated, the injection nozzle is extended and pumping starts at a low flow rate.

The Entech control system allows for different liquid wastes to be blended if required to produce relatively uniform calorific values in feed stocks and to control sulfur and chlorine concentrations to within set limits. Although not mentioned in the PER, New Energy has subsequently been approached by a number of clients and stakeholders including the Waste Management Board with a request that the facility is set up to accept solvent in addition to oils and oily waters. New Energy seek approval to do so subject to adherence with control over the percentage of sulfur and chlorine contained in feed streams directed to the gasifiers.

Figure 4: A leading US petroleum company operating in New Guinea installed an Entech Liquifire™ and PCG system to manage drill castings from oil and gas drilling.

The management of liquid waste received and processed on site will be detailed in the Environmental Management System and agreed with the DEC in the Part V Works Approval process. New Energy however, makes the following commitments:

- All liquids received on site will be transported in accordance with relevant transport codes for packaging and signage. In particular any Dangerous Goods will occur in accordance with the *Dangerous Goods Regulations 2007* and the Environmental Protection (*Controlled Waste) Regulations 2004* where relevant.
- All liquid waste will be stored and handled in bunded areas designed in accordance with Australian Standard AS1940–2004.
- Where combustible materials are stored in bulk tanks these will confirm with relevant Dangerous Goods codes and Australian Standards.

Recommendation 11

New Energy can confirm that the syngas produced from the pyrolytic gasification chamber or PGC does not require cleaning prior to syngas firing. This statement is based on the many operating plants that Entech has installed where the syngas burner is directly linked to the PGC without syngas cleaning. In these installations no evidence has been found of tars or particulates condensing out of the syngas.

Had New Energy planned to direct fire the syngas in a combustion engine, then significant clean up of the gas would be needed. To mitigate this risk New Energy will be using the steam cycle to create electricity. Although the direct firing method produces a far better energy efficiency result, we understand the technical challenges with direct firing syngas in this way.

The proposed Entech plant does extensive cleaning of the off-gas post syngas firing.

Recommendation 12

New Energy acknowledges that untreated syngas cannot be regarded as clean as it will contain a range of hazardous air pollutants including acid gases and levels of heavy metals. The comments

were made based on a range of considerations that contribute to the gas stream being more benign that would be expected. These are:

- It needs to be recognised that the By-pass Stack is only activated in a circumstance where the boiler has failed. In these circumstances, the Syngas burner will be fully operational and the gases exiting the syngas burner chamber will be at approximately 900 ^{o}C and these temperatures would destroy the Air Quality Control System and CEMS equipment (hence the need to bypass). In the PER New Energy suggested that the Boiler failure frequency would be less than 1/year. Subsequent enquiries with boiler suppliers suggest that the frequency is likely to be less than 1/10year.

- Under By-pass conditions the syngas burner should be fully functional and therefore achieving normal DRE's for all organic compounds.

- The modular design of the facility also contributes to the relatively clean emission under by-pass conditions. With 4 gasifiers operating each unit will receive a 50kg charge of fuel at roughly 15 minute intervals. The feeding of the units will be staggered to achieve a more uniform rate of syngas production. Entech advise that approximately 80% of the volatile materials in the waste charge, including most of the acid gases, are released within 15 minutes of the charge entering the PGC. In the event of a boiler failure, feeding of the gasifiers would cease immediately. As result of the design and approach to feeding the gasifiers, within 15 minutes syngas gas volumes will reduce to around 20% of normal design volumes while the syngas temperatures will be maintained at above 850 ^{o}C by supplying additional heat and combustion air from the syngas burner. This means that the quality of air from the by-pass stack rapidly trends towards being equivalent to a natural gas fired boiler as the syngas production rate continues to trend downwards. This is why when emissions are averaged over an hour, as used in the air dispersion model, the by-pass gas quality appears to be of very good quality

- New Energy expects that within 60-90 minutes, the gasification units can then be shut down by turning of all combustion air and by-passing will cease;

Finally, in relation to the suggestion that the by-pass gases should be ducted to the main stack to improve dispersion as a result of the higher release height, New Energy elected not to do this as it would necessitate the main stack being refractory lined. In any case, the air modelling demonstrates that the plume rise under by-pass is dominated by the huge thermal input due to the very high gas temperatures of the exhaust gases (say 900 ^{o}C compared with the normal gas release temperature of around 150 ^{o}C) and as a result raising the release point for the gases under by-pass by around 20 metres will have minimal effect on ground level concentrations.

Recommendation 13

The level of dioxin formation in downstream equipment including boilers, wet scrubbers, etc is dependent upon many factors, but predominately the formation of chlorine from metal chlorides that leads to de novo synthesis of PCDD and PCDF and the presence of fly ash to act as a catalyst in the reaction process. The low temperature and ultra-low velocity of the Entech-WtGas technology minimises both vaporisation of metal chlorides and entrainment of solid particles including fly ash and PM; thereby minimising de novo synthesis in the downstream steam generator/boiler equipment.

The Entech-WtGas technology is true low temperature gasification, and at an average operating temperature of 750 ^{o}C in the PGC is well below other technologies of incineration (900 C) and high temperature gasification (1200 ^{o}C) and importantly is well below the vaporisation temperature of most metals. Further, the Entech-WtGas technology results in very low velocities in the PGC (nominally 0.17 m/sec) which is substantially below other technologies of incineration (3.08 m/sec = x 18) and high temperature gasification (1.44 m/sec = x 9).

The Entech-WtGas low temperature gasification process minimises formation of metal chlorides and has low entrainment of fly ash, preventing downstream de novo synthesis and dioxin formation. Notwithstanding these benefits, the heat recovery boiler will be supplied by an experienced WtE vendor using a number of design features to prevent dioxin formation. The most widely adopted approach for preventing de novo synthesis is to design for "cold" heating surfaces in critical temperature area for de novo synthesis of 450C – 200C, that is, maximising temperature differences between the tube bundles and off-gas to enable fast cooling of the off-gas. Experienced boiler vendors utilised by Entech such as EKR, adopt this design basis plus adopt CFD during design.

New Energy supports the concept raised by the DEC that "dioxin control should primarily be by preventing formation, rather than subsequent abatement". This concept support the use of low temperature gasification as opposed to incineration for the reasons listed above. The specific details of the boiler selected will be provided to the DEC after the detailed design stage.

Recommendation 14:

New Energy has not completed the detailed design component of the project and as such has yet to select a steam turbine and cooling system for the plant. The selection of this equipment will be detailed prior to Part V Works Approval.

Recommendation 15:

The Entech-WtGas technology adopts a completely chemical free process for De-NOx and is based upon a low NOx burner coupled with downstream exhaust gas recirculation (EGR). That is, the Entech Syngas Burner is a relatively conventional high efficiency, low NOx burner design based upon a reducing stage followed by a staged excess air combustion stage and then for maximum NOx reduction the EGR process. However we do admit that for NOx removal efficiency it's surpassed by a selective non-catalytic reduction (SNCR) process of urea ($(NH_2)_2CO$) injection into off-gases, which the SNCR process can further reduce NOx output by approx 50%.

As indicated in Section 5.4 of Appendix 8 of the PER (Entech PDP (AQCS Output Summary)) NOx discharge is calculated per mass and heat balance at 48.8 mg/Nm^3 at 11% O_2 reference, which equates to only 14.7% of the top of the acceptable MEA range of 40-100 mg/Nm^3 under EC BAT Design Regulation. With SNCR this can be reduced a further approximately 50%, however this is not recommended due to the following reason:

- The negligible NOx decrease requires 8.5-9.0 kg of 25% urea solution per tonne of WDF processed, which equates to ≈ 962 T/A of urea chemical input.
- The production of Urea is relatively energy intensive and results in CO2 emissions as does transport of the urea to site.

Recommendation 16:

New Energy notes the comment regarding the different concentrations of emitted contaminants in Tables 20 and Tables 33 and 34 and acknowledges the inconsistency. The issue arises from an error in the Title on Table 20. In fact the emission results in Table 20 are derived as an average of 10 operating Entech gasification facilities, while the emissions quoted in Table 33 and 34 are in fact specific to the Boodarie facility and calculated based on the assumptions used in the Heat and mass Balance prepared by Entech and included as Appendix 8 to the PER. Table 20 heading should have read "Comparative Analysis of MEA Control of Emissions of the Air Quality Control System on Existing Entech Projects".

New Energy has modelled worst case conditions being the upper limits of WID and submitted this report with the initial reference documents to the EPA.

New Energy has consulted our air quality modelling consultant, "Synergetics" regarding the question from the DEC regarding using only 2005 meteorological data and not five consecutive years of data. Synergetics report that they reviewed full data sets for 2005 and 2008 and chose the 2005 data due to the conservative nature. They further justified using one year of met data on the following basis:

- Synergetics have referenced Air Quality Modelling Guidance Notes, DEC WA, March 2006: Section 9 (page 4). "If using a conventional model, the proponent will need to obtain at least one year's meteorological data of the area".
- They have also used the following reference, "Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, DEC NSW, Aug 2005". This reference also states at least one year and provides some qualitative guidelines on the data sets. 2005 was selected on this basis.

The stack height has been calculated based on Entech's operating experience and the results obtained during air modelling. The calculated emissions are well within estimated compliance standards (WID as reference). Based on these findings New Energy would assert that a 30 metre stack is suitable for this project and further modelling with alternative heights need not be undertaken.

Recommendation 17

New Energy has not attempted to predict the frequency and method for the monitoring of dioxins in the absence of an Australian standard. However, we are fully aware of the monitoring parameters outlined in the WID criteria (Article 11) and as such would commit to:

- 1 measurement every 3 months for the first year of operation for heavy metals, dioxins and furans
- 2 measurements per annum for heavy metals, dioxins and furans
- There is also scope to reduce the testing frequency to once every two years if previous samples consistently show superior performance in the eyes of the regulator, in this case being the DEC.

Recommendation 18

It is noted that section 5.7.2.3 of the PER describing the Air Quality Control System (AQCS) provides limited data on the treatment of NOx, heavy metals, dioxin and furans. We would note that Table 21 (page 53) does provide additional information on these contaminants when comparing the AQCS against BAT standards.

The DEC Air Quality Branch note that specific source emission monitoring and verification can be implemented through EP Act licence conditions. This approach is endorsed by the WID Standard "Article 10 Point 2", "The measurement requirements shall be laid down in the permit or in the conditions attached to the permit issued by the competent authority".

Recommendation 19

New Energy acknowledges the comments in relation to odour and offers the following response.

The premise that a 4m/s wind would pressurize the building in an instant and in turn completely purge the total volume of air blowing into the building is unlikely to be correct, albeit a worthy consideration. Our view is informed by the following:

- Firstly, the wind direction must be accounted for. If the wind is pressurizing the back end of the building, meaning the doorway is on the lee side, the pressurization produce an area of lower pressure on the lee side, which would cause a turbulent effect at the doorway and entrain ambient, fresh air into that turbulence. Once the airstream is free of the building wake the released plume would be more dilute due to ambient air entrainment. Once free of the wake effect of the WtE building the plume is free to disperse. Another consideration must also be that a 4m/s wind is likely to be characteristic of the hotter, mid-day climate, or the induction of the sea breezes in the area. In these circumstances, the air above the site would be well mixed and the surface temperature would be sufficiently high to promote thermal uplift and as a consequence the conditions would be conducive to rapid dispersion.

  If on the other hand the wind was directed into the doorway, then the building would pressurize, but the volume of air entering would also be affected by the three air changes per hour (approx, 25,000 – 30,000m3/hr. extracted to the gasification system) which would reduce the pressurization effect given that the door will at most be open for a maximum 5 minutes in any cycle for trucks entering the building. It is therefore more likely that a partial pressurization would occur, but that the pressurization would create dilution inside the building and the fugitive odours released would be of a lower concentration than those captured inside the WTE building. The arguments about enhanced dispersion and dilution under such circumstances would also apply in this circumstance.

- Additionally, the site is quite remote from sensitive receptors, and so it is most unlikely that short-term odour releases in such highly dispersive conditions will result in odour impacts.

- Finally, the strength of fugitive odours from the Boodarie WtE facility are expected to be low in concentration and therefore any fugitive odours escaping as a result of fresh air pressurization would be further reduced in odour strength as discussed above thereby affording another level of protection from off-site impacts.

In relation to the comments on the strength of odours associated with the stockpiled MSW in the receivals area, New Energy acknowledges that the rate of decomposition in the Pilbara may be higher than that typically experienced in New South Wales. The following matters off-set this concern,

Although the Odour Unit Report is based on the assumption that up 300 t of Municipal Waste could accumulate on the tipping floor, this is a deliberately conservative assumption that was adopted to ensure that the odour modelling outcomes were also conservative in nature. Reference to Section 9.5.4.1 of the PER shows that the plant should receive no more than 70 tonnes of odourous MSW per day and the maximum accumulation of MSW on the tipping floor should never exceed 150 tonnes (two days deliveries). Even this estimate is highly conservative as New Energy has committed (refer to section 5.7.1.3 of the PER under the heading Priority Waste which describes the prioritization of the waste in the MRF) to prioritizing the treatment of potentially odourous waste so this is treated in advance of other waste to prevent the accumulation of odourous materials. As a consequence New Energy would expect that the maximum accumulation of odourous waste material on the tipping floor and in the MRF should never exceed one day's deliveries or 50-70 tonnes per day and will in fact be considerably less as waste should be progressively processed on the day of delivery into the gasifiers.

The inherently conservative nature of the approach to the odour assessment coupled with the large buffer zones associated with the facility mean that New Energy is very confident that the odour assessment is conservative in nature and that there will be no adverse odour impacts associated with the facility.

Notwithstanding, New Energy commits to preparing an updated odour assessment during the Works Approval stage of the assessment process based on the detailed design for the facility..

Recommendation 20

New Energy agrees that an odour management plan (OMP) needs to be developed as a component of our Part V Works approval stage.

We recognise that various components of the facility could generate significant odours under certain conditions. Although an odour management plan will be prepared we would like to make the following comments regarding the initial feedback from the DEC:

- We agree that there are other potential sources of odour besides the waste receivals area that will require an odour management plan. These have not been modelled at this time as they are considered to be secondary when compared to emissions from the receivals area main doors due to the enclosed nature of the facility. This is due to the relatively small volumes of waste material held (of the order of 100-200 tonnes of waste) compared to Bedminster type facilities that hold several thousand tonnes of actively composting material in addition to the 100-200 tonnes of waste in the receivals and processing areas
- It needs to be noted that the odour potential for the facility is very low compared with plants designed to compost or anaerobically digest wastes.

- All MSW received will be baled and wrapped in film plastic to contain odours.
- The gasification plant design has five (5) trains with one redundant at all times. This will ensure high plant availability for fast treatment of received MSW.
- The odour management plan will detail a procedure to divert waste in the event the gasification plant is not available. We would envisage that the MSW would be diverted to the South Hedland landfill. The OMP will detail when to divert MSW to the landfill including maximum allowable time for waste bales to be stored within the facility.
- New Energy will implement extraction fans above the dirty MRF in recognition of this being a high odour source.
- New Energy will remodel the odour emissions after detailed design is complete and submit this to the DEC for review.
- It should be noted that the possibility of total power failure resulting in the buildings losing negative pressure is extremely low. In periods where the plant is not generating its own power, it will be drawing power from the local electricity grid.

We acknowledge the DEC comment that the facility has no neighbours and should not be a significant problem in the near future. However, New Energy commits to submitting an odour management plan as an output of the detailed design stage of the project development.

Recommendation 21

The DEC comments in relation to providing greater certainty regarding the quantity and nature of solid waste streams are noted. NEC has provided its best possible indication of the quantity and quality of ash in the PER (refer the information presented in the response to recommendation 22 and 23 below). It is not possible to provide exact information on the solid waste streams as they are largely dependent on the nature of the feed stocks fed to the gasifiers. The information present at this time has been developed based on:

- Actual measurements of ash quality at operating sites; and
- An estimation of the elemental composition of the waste streams and calculations presented in the heat and mass balance (See Appendix 8 in the PER) of how heavy metals will partition between the ash and gas streams.

The experience with other Entech facilities demonstrates that the ash and residues will be essentially inert and of low leachability.

Recommendation 22

In order to adhere to the WID standard for Total Organic Content (TOC) or Loss on Ignition (LOI) of bottom ash, it must be less than 3% TOC. The Entech technology routinely achieves this level in plants operated internationally and New Energy will commit to this standard in ash produced by the Boodarie facility.

The claim that the project will achieve the target of less than 3% TOC in the bottom ash is made with the following design parameters of the system in mind:

- Pre-treating waste in the MRF: the MRF will allow New Energy to introduce more homogeneous bales of waste that have been processed from the heterogeneous loads that are received at the MRF.
- Waste Preheated: the waste received in the Entech gasifier is ignited using auxiliary fuels at the beginning of the PGC.
- Residence time: the Entech gasifier has one of the longest residence times of any combustion technology currently on the market at 16 – 24 hours. The design is conservative and results in a large plant footprint. However, the benefit of this design feature is a complete burn out of waste is achieved.
- Process Control: the temperature of the PCG provides an interface with the plant control software. Low temperature can result in the addition of natural gas burners to ensure full burn out of the waste.
- Agitation of the waste: the patented rams in the Entech gasification plants ensure that all waste is exposed and fully combusted. This is particularly important in the absence of excess air (incineration) to pneumatically agitate the waste. The rams enter from the bottom of the PGC as it's also important not to over agitate the waste. As highlighted in WID this over agitation may adversely affect waste burnout.

The above referenced design features are all supported by the European Commission's "Integrated Pollution Prevention and Control Reference Document on the Best Available Techniques for Waste Incineration (August 2006)" Section 4.2.17.

Recommendation 23

New Energy asserts that a high level of information has been provided in the PER regarding the volume of ash produced at the facility. Drawing D120224-3 (sheets 1 & 2) in Appendix 8 provides a high level of detail regarding ash volumes based on the waste specification provided in the PER. To summarise:

- Total volume of waste to be gasified per annum 85,933 tonnes per annum (Table 13 PER).
- Calculated ash production will be 4.3% of feed to the gasifier (Section 5.7.2.3 PER).
- Therefore calculated volume of ash per annum is 3,695 tonnes per annum.

In regards to the expected metals content of the ash produced in the process, this has also been calculated in Appendix 8, Drawing D120224-3. New Energy would like to reiterate the highly conservative nature of these metals predictions based on the following assumptions:

- Reaction of Heavy Metals (HM) in the thermal conditions has been referenced against a well established European report UK-DEFRA 2004. This provides a robust guide to the metals that will be retained in the ash at the completion of the combustion process.
- The level of HM in the feed to the gasifier has been overstated by a factor of 10 to ensure that:
    - The level of HM in the ash was not understated
    - Any variation or spike in HM content in actual waste feed will still fall within these design parameters.

- The design input of HM above (10 x greater than expected) does not take into account the removal efficiency of metals in the MRF. The actual design of the MRF will ensure that both ferrous and non-ferrous metals have 95% removal efficiency.

In regards to the leachability of the ash when disposed at landfill we would make the following points:

- The retention time of the PGC is between 16 and 24 hours. This ensures that all waste received has been thoroughly combusted with the remaining resides being almost entirely composed of oxides inorganic residues. Evidence from other Entech facilities shows that the metals contained in the ash remain "fixed" and in the ash and are therefore essentially non-leachable.
- The PER (Plate 18 Section 7.5.3) details the leach tests carried out on ash from an Entech plant processing medical waste. The results show that the leachate test would pass the Australian Standard ALSP 1 Toxicity Characteristics Leaching Procedure requirements.
- The level of contaminants (particularly) heavy metals processed in the Entech reference plant are far higher than any levels that would be accepted at the Boodarie facility due to the Class of the waste to be processed.
- Based on the ALSP 1 results and Total Concentration of contaminants predicted the ash will be able to be safely disposed of at a licensed landfill and not pose a significant risk to groundwater once disposed.

In order to validate the claims made above, New Energy will implement a testing regimen on the ash as part of the Environmental Management System and Part V licence conditions.

Recommendation 24

The DEC's comments are noted with respect to the preparation of an ASS and Dewatering Management Plan depending on the scale of dewatering (if required). However, as New Energy has not completed the detailed design for the project, it is not yet in a position to ascertain whether dewatering is needed or not. Information relating to the proposed depth of excavation or dewatering will be available prior to submitting a Works Approval and therefore, the risks associated with disturbing potential acid sulfate soils will be better understood at that stage.

New Energy draws the DEC's attention to Section 9.3 of the PER which indicates that the proponent will be required to fill the site to achieve a finished level above the 100 year ARI flood level. This will reduce the likely depth of excavation or likely requirements for dewatering thereby reducing the risk of disturbing potential ASS.

As outlined in the PER (See Section 7.6), there is limited groundwater data for the Boodarie region. Based on the groundwater contours depicted in BHP Billiton's Outer Harbour PER documentation, the depth to groundwater is expected to be approximately 7 to 8m below ground level (BGL) at the New Energy site. However, given the lack of groundwater data in the Boodarie region, New Energy has committed to the preparation of a Site Drainage and Groundwater Management Plan (See Section 9.3.5.2 of the PER). In addition, New Energy will install and monitor a network of

groundwater monitoring wells at the site (Section 9.3.5.2) which will better define the depth to groundwater.

Recommendation 25

In the event that waste cannot be processed at the facility for an extended period of time, it will then be diverted to the South Hedland landfill or another suitable licensed facility such as the 7 Mile Landfill in Karratha.

The conditions which will necessitate diversion of waste to landfill will be documented in the site Environmental Management Plan and New Energy will seek confirmation of these alternative disposal options with both the Town of Port Hedland and the Shire of Roebourne.

With the high level of redundancy built into the plant design (particularly 5 gasification trains with one on standby) the risk of having to divert all waste is considered low.

Recommendation 26

New Energy notes that the Clean Energy Act 2011 is relevant to this project. The tax applicable to the CO_2-e emissions resulting from non-renewable sources has been considered and added as a liability in the project financials.

Recommendation 27

New Energy accepts the advice received from the DEC's Climate Change Unit that a cooperative approach is taken between the proponent and EPA to verify actual CO_2-e savings from the installation of a waste to energy plant.

We do note however that the National Greenhouse Accounts factors are constantly being updated and revised. We provided the information based on available information at the time. It will be vital for New Energy to accurately capture this data once the plant is operational for the following reasons:

- Verification of carbon tax liabilities.
- Verification of "Renewable Energy Certificates" in power generation.

The capture and recording of this data will form an important part of the plants Environmental Management Plan.

Recommendation 28

New Energy acknowledges that the greenhouse gas emissions factors used in the PER were from 2006 and have been updated (2012), which reflects an over estimate of estimated emissions.

Recommendation 29

New Energy notes that due to advice in 27 & 28 above that the net emissions benefits are overstated.

Recommendation 30, 31 & 32

All these recommendations are for noting and New Energy thanks the Climate Change Unit for the advice provided.

REFERENCE PROJECT - 1162

ENTECH – WtGAS RENEWABLE ENERGY SYSTEM

- **PROJECT: 1162**
- **THERMAL CAPACITY.: 14.2 MWt**
- **APPLICATION: Waste Derived Fuel (WDF)**
- **WDF TYPE: Biohazardous Waste (≈ 40 MJ/kg)**
- **WDF CAP.: 30 T/dy (≈ 70-80 T/dy of MSW)**
- **ENV. STD.: Compliance to EUD2000/76**
- **CUSTOMER: FMS Corporation**
- **DATE INSTALLED: 2008**
- **LOCATION: Malaysia**

← Syngas Burner

→ Energy Utilisation Heat Exchanger / Steam Boiler

← Air Quality Control System

→ Exhaust Stack with CEM

← Plant Control Room

ENTECH RENEWABLE ENERGY SOLUTIONS

REFERENCE PROJECT

ENTECH – RENEWABLE ENERGY SYSTEM

- **PROJECT NO.: 1123**
- **THERMAL CAPACITY: 5.8 MWt**
- **APPLICATION: Waste Derived Fuel (WDF)**
- **WDF TYPE: Byproduct of Food Processing (@ 7 MJ/kg)**
- **WDF CAPACITY: 72 T/dy**
- **ENV. STD.: Compliance to equal of US-EPA**
- **CUSTOMER: Singapore Food Industries**
- **DATE INSTALLED: 1997**
- **LOCATION: Singapore**
- **ENERGY OUTPUT: 4.0 MWt (as Steam)**

↑ Auto-residue Collection (direct into waste skip). Sealed process.

↑ Energy Utilization Heat Exchanger – steam boiler

ENTECH RENEWABLE ENERGY SOLUTIONS

← Air Quality Control System

PROJECT DETAILS: Cognizant of implications related to disease control; primary producers, abattoirs and meat and bone meal producers are faced with limited options for ecologically and environmentally safe food byproduct-biomass disposal. Some foods including meat and bone meal in particular, are excellent renewable energy or fuel sources.

The ENTECH – Renewable Energy System gasifies food byproduct-biomass. The syngas produced is oxidized in the Thermal Reactor type gas burner and fired into a fire-tube type steam generator. Steam is used for process needs, or cogeneration can be adopted for electricity generation. Though food byproduct-biomass conversion into energy is economically attractive, the major benefits are ecological and environmental protection. Destruction of this type of biomass ensures the "contamination chain" of serious infectious diseases such as BSE or "Mad Cows Disease" (which has now evolved into a human variant) is broken.

In fact, ENTECH Renewable Energy System's simultaneously addresses four key environmental problems with positive results, namely:

- **Fossil fuel consumption.**
- **Biomass or waste disposal.**
- **Atmospheric emissions.**
- **Disease control.**

ENTECH RENEWABLE ENERGY SOLUTIONS

REFERENCE PROJECT

ENTECH – RENEWABLE ENERGY SYSTEM

- **PROJECT NO.: 1072**
- **THERMAL CAPACITY: 3.5 MWt**
- **APPLICATION: Waste Derived Fuel (WDF)**
- **WDF TYPE: MSW (@ 10.0 MJ/kg)**
- **WDF CAP.: 30 T/dy**
- **ENV. STD.: Compliance to US-EPA**
- **CUSTOMER: Chung Gung Municipality**
- **DATE INSTALLED: 1991**
- **LOCATION: Taiwan**
- **ENERGY OUTPUT: 2.3 MWt (Steam)**

↑ Energy Utilization Heat Exchanger, where Syngas is fired.

↑ Air Quality Control System (emissions are comparable to firing of natural gas).

PROJECT DETAILS: A large university and surrounding municipality adopted an ENTECH – Renewable Energy System as a model for "eco-friendly" waste management practices. Dictionary definition of recycling is *"conversion of waste into a usable form".* The system converts around 30 T/dy of MSW-biomass and dried sewage biomass into steam for in-house use. The process is environmentally superior to combustion of many conventional fuels, plus is more efficient than many other forms of recycling.

ENTECH
RENEWABLE ENERGY SOLUTIONS

REFERENCE PROJECT

ENTECH – RENEWABLE ENERGY SYSTEM

PROJECT: 1142
THERMAL CAPACITY: 3.5 MWt
APPLICATION: Waste Derived Fuel (WDF)
WDF TYPE: Byproduct of Pharmaceutical Mfg. (@ 20 MJ/kg)
WDF CAPACITY: 15 T/dy (~ 30 T/dy of MSW)
ENV. STD.: Compliance to US-EPA
CUSTOMER: Scinopharm Corporation
DATE INSTALLED: 2002
LOCATION: Taiwan
ENERGY OUTPUT: 2.6 MWt (Steam)

PROJECT DETAILS: In the application above, ENTECH's unique "Liquifire"™ liquid injection system is adopted to inject and atomize liquids into the Pyrolytic Gasification Chamber. Gasification occurs and syngas having similar properties to methane gas is produced. The syngas is fired in a Thermal Reactor type gas burner and fired into a fire-tube type steam generator. Steam is used for process needs, or cogeneration can be adopted for electricity generation.

Complete environmental impact assessment reveals:

- **Fossil fuel consumption is negated (or reduced).**
- **Reduced emission of pollutants from waste gasification as compared to combustion of some conventional fuels.**
- **Greenhouse gas production from waste decomposing at landfill is negated.**
- **Landfill leachate is negated.**

As well as the significant environmental benefits, the ENTECH Renewable Energy System provides for relatively short-term return on investment; by alleviating or reducing purchases of fossil fuel.

ENTECH
RENEWABLE ENERGY SOLUTIONS

REFERENCE PROJECT - 1164

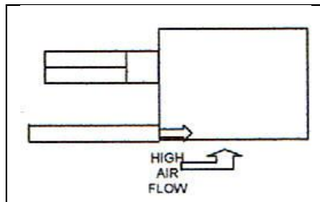
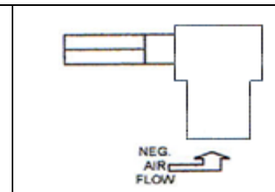
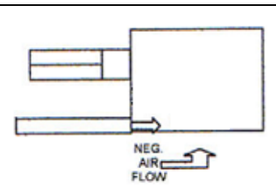
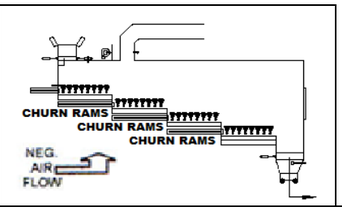
ENTECH – WtGAS RENEWABLE ENERGY SYSTEM

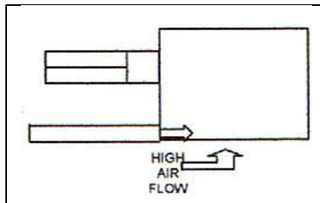
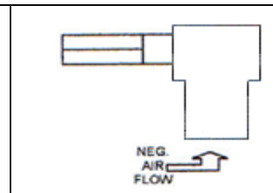
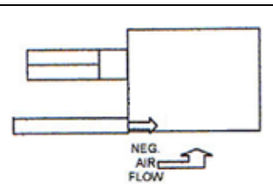
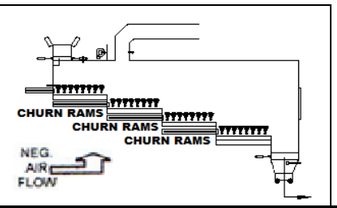
- **PROJECT: 1164**
- **THERMAL CAPACITY.: 5.8 MWt**
- **WDF TYPE: Biohazardous (≈ 35 MJ/kg)**
- **WDF CAP.: 15 T/dy**
- **ENV. STD.: Compliance to EUD2000/76**
- **CUSTOMER: Gorzow Medical Institute**
- **DATE INSTALLED: 2012**
- **LOCATION: Poland**

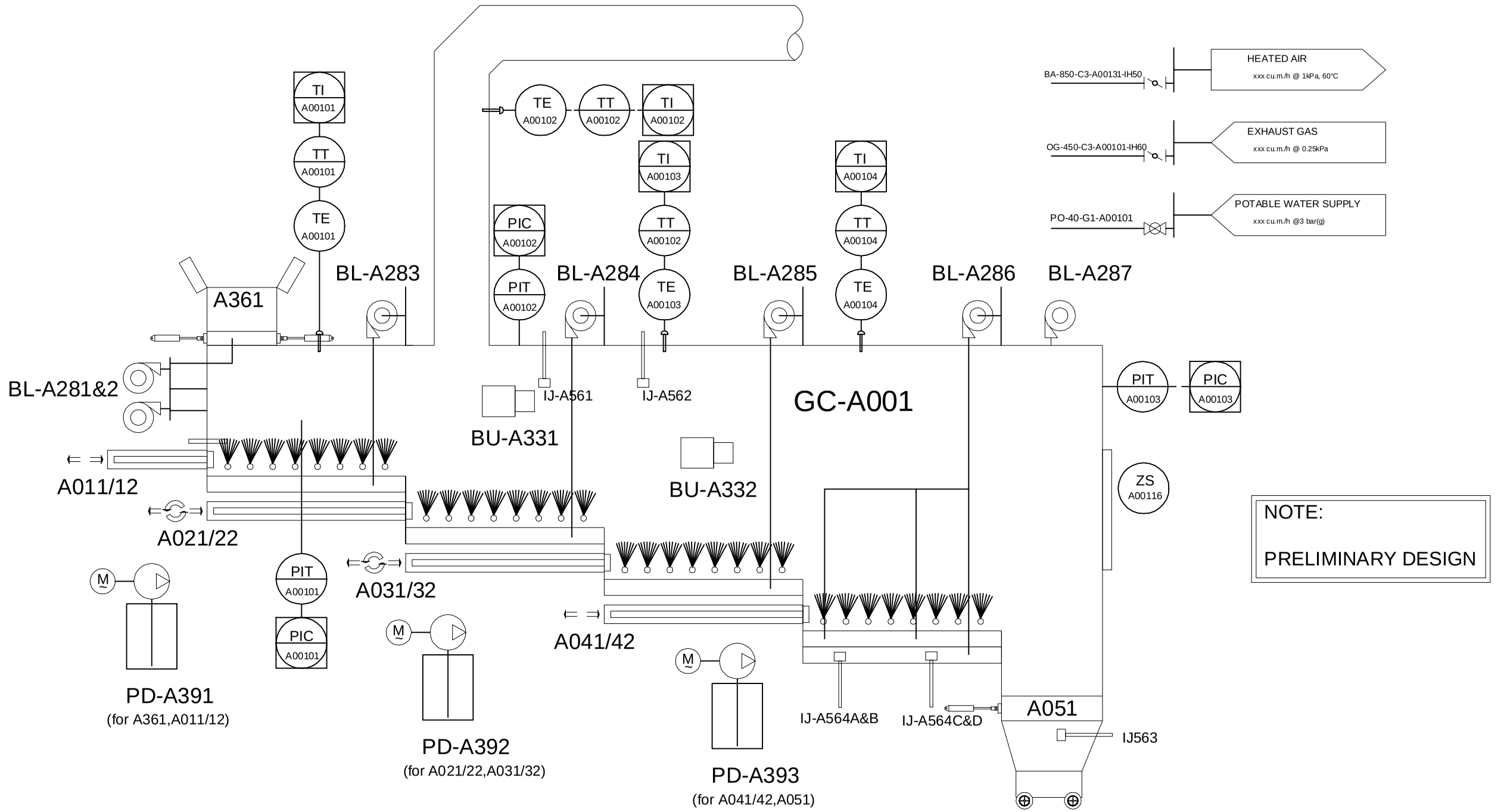
Feeding of WtGas Plant

WtGas Plant Building

PROJECT DETAILS: The customer needed to replace an incineration facility due to regulatory constraints and community concerns. An international search of gasification technologies by the customer revealed that the ENTECH-WtGas-RES system is relatively unique in that most other technologies are still at pilot or demonstration plant stage, whilst ENTECH's technology has been commercialised with successful plant operation for more than 15 years. Plant emissions are superior to firing of fossil fuels and renewable energy in the form of HP steam is available. Community, customer and the environment all benefit.

						
ITEM	**DESCRIPTION**	**MASS BURN INCINERATION**	**FLUID BED GASIFICATION**	**STATIC HEARTH GASIFICATION**	**ENTECH STEPPED HEARTH GASIFICATION**	**COMMENTS**
A	**SUMMARY OF TYPICAL PROCESS PARAMETERS:**					
	a. Process Temperature	850 - 950 C	1150 - 1250 C	1150 - 1250 C	650 - 850 C	SUMMARY OF THE DETAILED ANALYSIS HEREIN: The Entech stepped hearth gasification process is unique in that it provides for high surface area exposure + very long retention + very high agitation of the process matter. These process factors results in a very high degree of capability to process extremities in waste variation (e.g. CV, density, humidity, ash content, etc).
	b. Process Stoichiometric Air	200%	50%	50%	15%	
	c. Surface Area Exposure of Process Matter to Heat & Air (Hearth Loading)	230 kg/m^2/hr	830 kg/m^2/hr	370 kg/m^2/hr	80 kg/m^2/hr	
	d. Description of Agitation of Process Matter	Typically Grate Stoker	Pneumatic	Typically Mechanical Stoker	Multi Churn + Stoker System	
	e. Degree of Agitation of Process Matter	Minimal	Very High	Minimal	Very High	
	f. Retention Time of Process Matter Before Ejection as Ash	1 - 2 hr	¾ - ½ hr	1½ - 2 hr	16 - 24 hr	
	g. Volumetric Loading	115 kg/m^3/hr	280 kg/m^3/hr	120 kg/m^3/hr	40 kg/m^3/hr	Additionally, the Entech low velocity process conditions results in ultra-low entrainment of PM & HM into downstream equipment.
	h. Process Velocity	3.08 m/sec	1.44 m/sec	0.65 m/sec	0.17 m/sec	
	i. Entrainment of Pollution Concerns (PM & HM)	High	Very High	Low	Very Low	
B	**PROCESS CONDITIONS REQUIRED TO MAXIMIZE THERMAL DEGREDATION**	**A. Maximise surface area exposure of process matter to heat and air (hearth loading)** **B. Maximise agitation of process matter (to loosen high density and high moisture waste and expose it to the process)** **C. Maximise retention to increase time of exposure of process matter to heat and air + increase time of agitation.**				Though combustion doesn't occur, thermal degradation efficiency for gasification processes is commonly referred to as "combustion efficiency".
C	**PROCESS EFFICIENCY COMPARISON:**					
	a. Surface Area Exposure of Process Matter to Heat & Air (Hearth Loading)	← Low →	← Very Low →	← Low →	← High →	- Higher is superior for combustion efficiency.
	b. Process Matter Trapped from Exposure to Heat & Air (Volume Loading)	← High →	← Very High →	← High →	← Very Low →	- Lower is superior for combustion efficiency.
	c. Pneumatic Agitation	← High →	← Very High →	← Low →	← Very Low →	- Higher is superior for combustion efficiency.
	d. Mechanical Agitation	← Low →	← Nil →	← Low →	← High →	- Higher is superior for combustion efficiency.
	e. Time of Process Matter Exposure to Agitation	← Low →			← High →	- Higher is superior for combustion efficiency.
	f. Time of Process Matter Exposure to ALL Process Conditions Above	← Low →			← High →	- Higher is superior for combustion efficiency.
	g. Retention Time of Solid Residue / Ash Prior to Ejection	← 1-2 Hrs →			← 16-24 Hrs →	- Higher is superior for combustion efficiency.
	h. Overall thermal degradation / combustion efficiency	**← Moderate →**		**← Low →**	**← High →**	**- Higher is superior.**

						
ITEM	**DESCRIPTION**	**MASS BURN INCINERATION**	**FLUID BED GASIFICATION**	**STATIC HEARTH GASIFICATION**	**ENTECH STEPPED HEARTH GASIFICATION**	**COMMENTS**
D	**PROCESS EFFICIENCY IMPLICATION TO CAPABILITY:**					- NOTE: Low combustion efficiency of the static hearth gasification process is why these systems can handle easy feed-stocks (e.g. biomass), but have failed to commercialise for difficult feed-stocks such as MSW, C&I, RDF.
	a. Overall Thermal Degradation / Combustion Efficiency (per above)	Moderate	Moderate	Low	High	
	b. Efficiency → Capability for Homogenous / "Easy" Feed-Stock	High	High	High	High	
	c. Efficiency → Capability for Heterogeneous & Dense Feed-Stock	Moderate	Low	Very Low	High	Efficiency is relative to agitation + time exposure of process matter.
	d. Efficiency → Capability for High Humidity Feed-Stock	Low	High	Low	High	Efficiency is relative to agitation + surface area exposure + time exposure of process matter.
	e. Efficiency → Capability for Subliming Feed-Stock (e.g. some plastics, rubber, etc that "pool" upon heating)	Low	Low	Very Low	High	Efficiency is relative to agitation + exposure time of process matter.
	f. Efficiency → Capability for High CV Feed-Stock	Moderate	High	High	High	
	g. Efficiency → Capability for Low CV Feed-Stock	Very Low	High	Very Low	High	Efficiency is relative to agitation + surface area exposure + time exposure of process matter.
E	**CALCULATION ENTRAINMENT OF POLLUTION CONCERNS:**					- NOTE: Due to limited availability of data for commercialised fluid bed and static hearth gasification for MSW; the comparison is based upon 1.2-t wet and 1.0-t dry feed.
	a. Typical Dimensions	3.5mL x 1.5mW x 2.0mD	3.5mD x 1.2mL x 1.2mW	4.5mD x 1.8mL x 1.8mW	8.0mL x 1.6mW x 2.4mD	
	b. Hearth Loading	228 kg/m^2/hr	833 kg/m2/hr	370 kg/m^2/hr	80 kg/m^2/hr	
	c. Volumetric Loading	114 kg/m^3/hr	278 kg/m^3/hr	119 kg/m^3/hr	40 kg/m^3/hr	
	d. Volume Occupied by Process Matter	0.5m Deep	0.75m Deep	0.75m Deep	0.5m Deep	
	e. Cross-Section of Unoccupied Area	1.5m x 1.5m = 2.25m^2	1.2m x 1.2m = 1.44m^2	1.8m x 1.8m = 3.24m^2	1.6m x 1.9m = 3.04m^2	
	f. Typical Gas Flow Rate	@ 200% Stio = 200/15 x 0.52 = 6.93 Am^3/sec	@ 50% Stio = 200/50 x 0.52 = 2.08 Am^3/sec	@ 50% Stio = 200/50 x 0.52 = 2.08 Am^3/sec	@15% Stio = 0.52 Am^3/sec	Reference is the Entech M&HB for Boodarie Pj. At 15% stoichiometric = 0.52Am3/sec
	g. Typical Gas Flow Velocity (V = Q / A)	V =6.93 Am^3/sec ÷ 2.25 m^2 = 3.08 m/sec	V = 2.08 Am^3/sec ÷ 1.44 m^2 = 1.44 m/sec	V = 2.08 Am^3/sec ÷ 3.24 m^2 = 0.65 m/sec	V = 0.52 Am^3/sec ÷ 3.04 m^2 = 0.17 m/sec	
	h. Velocity Comparison	(x) 18	(x) 9	(x) 4	Datum (x) 1	
	i. Entrainment of Pollution Concerns (PM & HM)	**Very High**	**High**	**Low**	**Low**	PM & HM refers to solid matter, namely particulate matter and heavy metals



NOTE:

PRELIMINARY DESIGN

REV	DESCRIPTION	SIG.	ISS.	DATE
0	PREL DESIGN	PL	02/12	02/12

ENTECH
RENEWABLE ENERGY SOLUTIONS

DRAWN	DATE
PL	02/2012
CHKD	DATE
NM	02/2012
AUTH	DATE
NM	02/2012
JOB No.	SCALE
	1 : XXX

3rd ANGLE PROJECTION

MATERIAL .

SPECIFICATION .

FINISH .

WEIGHT .

ENTECH RENEWABLE ENERGY SOLUTIONS
POSTAL ADDRESS: PO Box 1088, Canning Vale DC W.A. Australia 6970
TELEPHONE: +61-8-9414 7888 EMAIL ADDRESS: eho@entech-res.com
FACSIMILIE: +61-8-9414 7166 WEB ADDRESS: www.entech-res.com

TITLE PROPOSED ENTECH-WtGAS-RES (72MWt) FOR BOODARIE PJ.

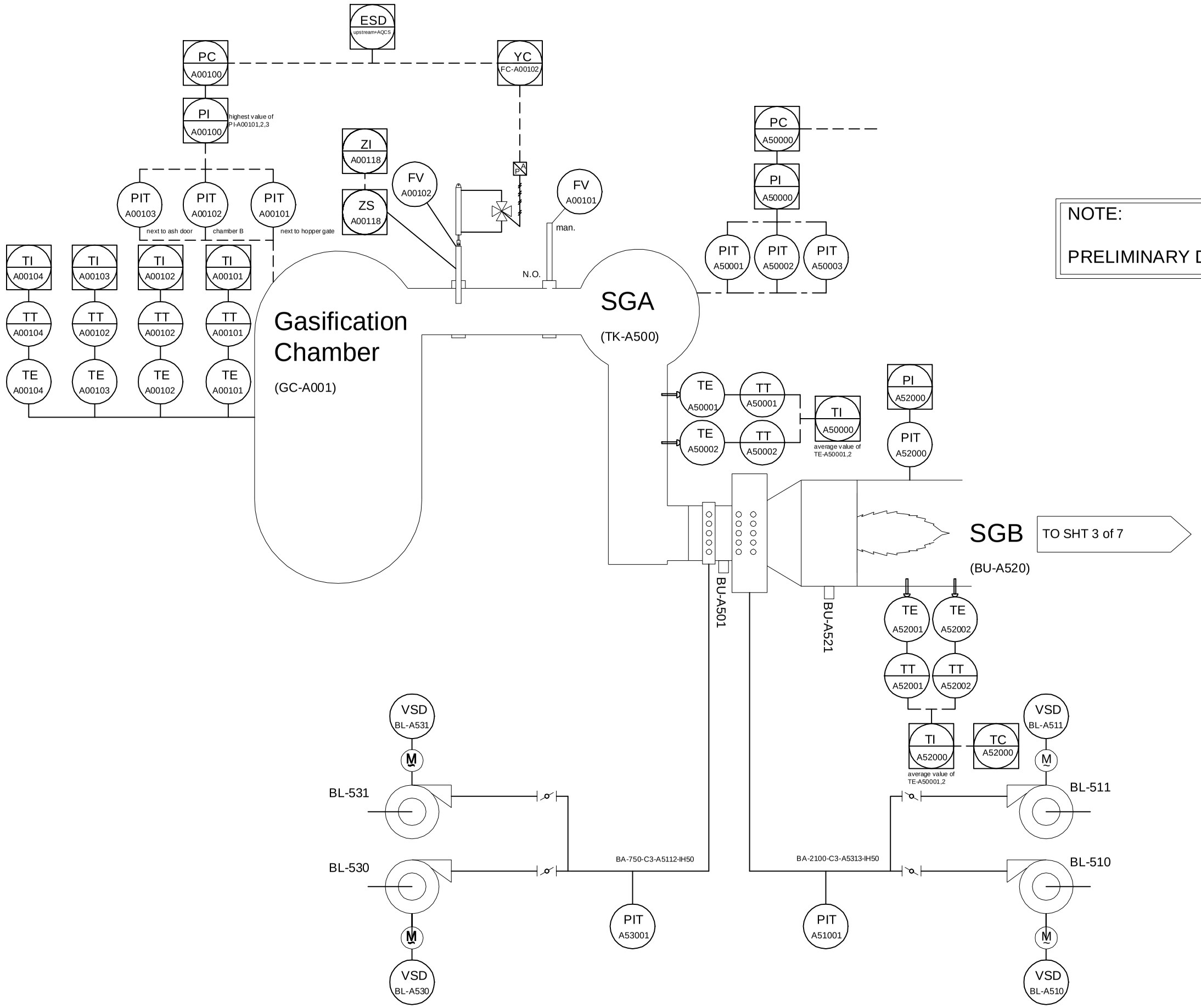
PRELIMINARY PIPING & INSTRUMENTATION DIAGRAM

DRAWING No. D120224-8-01

D120224-8-01.dwg

SHEET 1 OF 9 SHEETS

REFERENCE DRAWING | DRAWING NUMBER



NOTE:

PRELIMINARY DESIGN

REV	DESCRIPTION	SIG.	ISS.	DATE
0	PREL DESIGN	PL	02/12	02/12

REFERENCE DRAWING	DRAWING NUMBER

ENTECH
RENEWABLE ENERGY SOLUTIONS

DRAWN	DATE
PL	02/2012
CHKD	DATE
NM	02/2012
AUTH	DATE
NM	02/2012
JOB No.	SCALE
	1 : XXX

3rd ANGLE PROJECTION

MATERIAL .

SPECIFICATION .

FINISH .

WEIGHT .

ENTECH RENEWABLE ENERGY SOLUTIONS

POSTAL ADDRESS: PO Box 1088, Canning Vale DC W.A. Australia 6970
TELEPHONE: +61-8-9414 7888 EMAIL ADDRESS: eho@entech-res.com
FACSIMILIE: +61-8-9414 7166 WEB ADDRESS: www.entech-res.com

TITLE PROPOSED ENTECH-WtGAS-RES (72MWt) FOR BOODARIE PJ.

PRELIMINARY PIPING & INSTRUMENTATION DIAGRAM

DRAWING No. D120224-8-01

D120224-8-01.dwg

NOTE:

PRELIMINARY DESIGN

FROM SB OUTLET
IN SHT 2 of 7

OG-4650-C3-A00101-1H325

FE B05001 | FIT B05001 | FI B05001

HS-300-C2-B00101-1H175 — TO CONSUMER

VN-200-C2-B05001

VN-200-C2-B05002

VENT TO ATMOSPHERE AT NOT LESS THAN 2m ABOVE ROOF LEVEL OR ANY PERSONNEL ACCESS

ESD (upstream AQCS) | LA B05001 (AH, AL, ALL) | LI B05001 | LC B05001 (AH, XH, XL, AL) | LS B05001

PA B05001 (AHH) | PS B05001 | PI B05001

PI B05002 | PIT B05002 | TI B05001 | TE/TT B05001

NO | NC

ND-25-C1-B05003

TK-B050
(steam drum)

EUHX-101/
102

BD-32-C2-05051-1H75

PS-100-C2-B00121-1H50

SW-150-S1-B10112-IH50

BD-32-C2-B05052-1H50

FE B00111 | FIT B00111 | FI B00111

OG-2500-C1-D00101-1H200

TO SHT 4 of 7

PIT b00111 | PI D00111 | TE B00112 | TE B00111 | TT B00112 | TT B00111

TI B00110 (average of TE-B00111&12) | TC B00110 (sp=220°C)

LA B05202 (AL) | LC B05202 (XH, XL) | LS B05202

FV B05201

SW-25-S1-B10103-IH50

LI B05201

SP-10-P1-B02801

SP-10-P1-B02701

VN-100-C2-B05151-1H50

PD-B028 | PD-B027

TK-B052

TK-B054 | TK-B053

YI PD-B028 | YC PD-B027, 028 | YI PD-B027

YC PC-B025, B026

FI B02501 | FA B02501 (ALM=no flow)

PC-B025

PIT B02501 | PA B02501 | FIT B02501

PC-B026

PI B02601 | PA B02601

YI PC-B025 | YC PC-B026

PI B05101 | LS B05101

TK-B051

YC PC-B029 | YI PC-B029

to TK-B051
ND-40-C1-B05152

PC-B029

PI B02901

REV	DESCRIPTION	SIG.	ISS.	DATE
0	PREL DESIGN	PL	02/12	02/12

ENTECH
RENEWABLE ENERGY SOLUTIONS

DRAWN	DATE
PL	02/2012
CHKD	DATE
NM	02/2012
AUTH	DATE
NM	02/2012
JOB No.	SCALE
	1 : XXX

3rd ANGLE PROJECTION

MATERIAL .

SPECIFICATION .

FINISH .

WEIGHT .

ENTECH RENEWABLE ENERGY SOLUTIONS
POSTAL ADDRESS: PO Box 1088, Canning Vale DC W.A. Australia 6970
TELEPHONE: +61-8-9414 7888 EMAIL ADDRESS: eho@entech-res.com
FACSIMILIE: +61-8-9414 7166 WEB ADDRESS: www.entech-res.com

TITLE PROPOSED ENTECH-WtGAS-RES (72MWt) FOR BOODARIE PJ.

PRELIMINARY PIPING & INSTRUMENTATION DIAGRAM

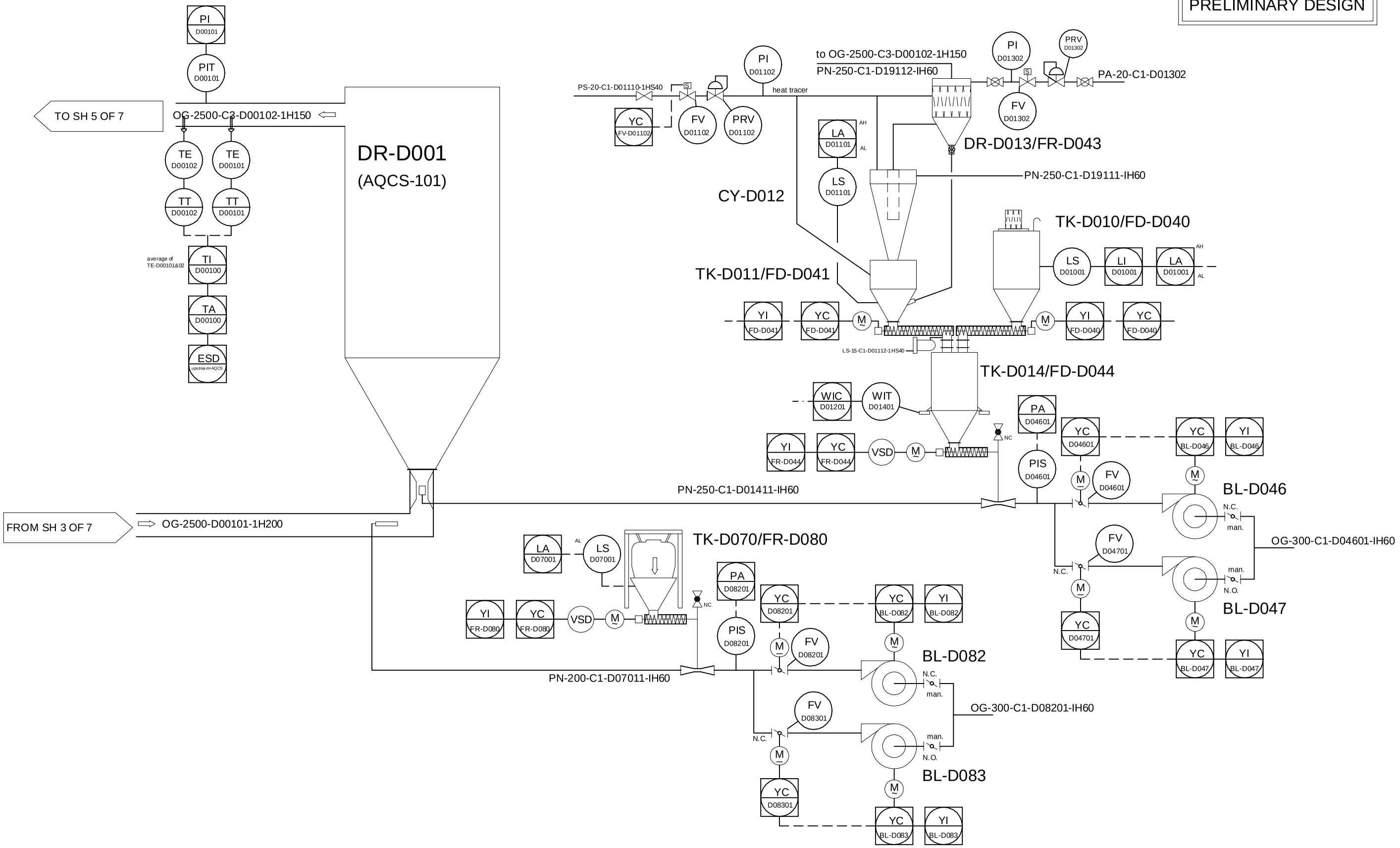
DRAWING No. D120224-8-01

D120224-8-01.dwg

REFERENCE DRAWING | DRAWING NUMBER

NOTE:

PRELIMINARY DESIGN



		THE INFORMATION AND DESIGN DISCLOSED BY THIS DRAWING IS THE PROPERTY OF ENTECH RENEWABLE ENERGY SOLUTIONS PTY LTD ABN No 46 009 443 378 AND IS DISCLOSED ON THE UNDERSTANDING THAT IT CANNOT BE USED NOR DISCLOSED TO OTHERS WITHOUT THEIR WRITTEN PERMISSION. © COPYRIGHT RESERVED						ENTECH RENEWABLE ENERGY SOLUTIONS	DRAWN PL DATE 02/2012; CHKD NM DATE 02/2012; AUTH NM DATE 02/2012; JOB No. ; SCALE 1 : XXX; 3rd ANGLE PROJECTION	MATERIAL . / SPECIFICATION . / FINISH . / WEIGHT .
			0	PREL DESIGN	PL	02/12	02/12			
REFERENCE DRAWING	DRAWING NUMBER		REV	DESCRIPTION	SIG.	ISS.	DATE			

ENTECH RENEWABLE ENERGY SOLUTIONS

POSTAL ADDRESS: PO Box 1088, Canning Vale DC W.A. Australia 6970

TELEPHONE: +61-8-9414 7888 EMAIL ADDRESS: eho@entech-res.com

FACSIMILIE: +61-8-9414 7166 WEB ADDRESS: www.entech-res.com

TITLE PROPOSED ENTECH-WtGAS-RES (72MWt) FOR BOODARIE PJ.

PRELIMINARY PIPING & INSTRUMENTATION DIAGRAM

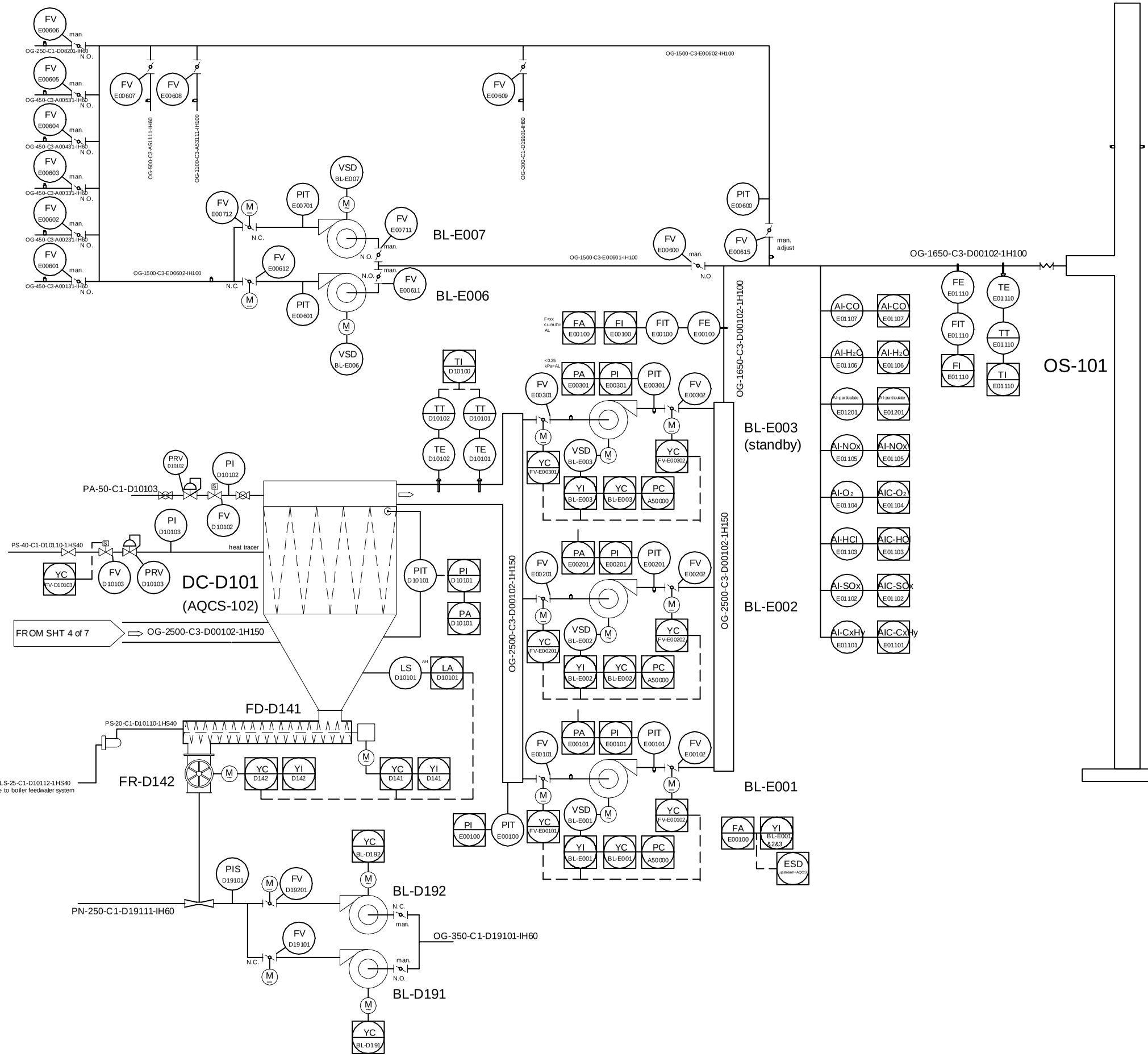
DRAWING No. D120224-8-01

D120224-8-01.dwg

SHEET 4 OF 9 SHEETS

NOTE:

PRELIMINARY DESIGN



		THE INFORMATION AND DESIGN DISCLOSED BY THIS DRAWING IS THE PROPERTY OF ENTECH RENEWABLE ENERGY SOLUTIONS PTY LTD ABN No 46 009 443 378 AND IS DISCLOSED ON THE UNDERSTANDING THAT IT CANNOT BE USED NOR DISCLOSED TO OTHERS WITHOUT THEIR WRITTEN PERMISSION.								
		© COPYRIGHT RESERVED	0	PREL DESIGN	PL	02/12	02/12			
REFERENCE DRAWING	DRAWING NUMBER		REV	DESCRIPTION	SIG.	ISS.	DATE			

ENTECH RENEWABLE ENERGY SOLUTIONS

DRAWN	DATE
PL	02/2012
CHKD	DATE
NM	02/2012
AUTH	DATE
NM	02/2012
JOB No.	SCALE
	1 : XXX

3rd ANGLE PROJECTION

MATERIAL .

SPECIFICATION .

FINISH .

WEIGHT .

ENTECH RENEWABLE ENERGY SOLUTIONS

POSTAL ADDRESS: PO Box 1088, Canning Vale DC W.A. Australia 6970
TELEPHONE: +61-8-9414 7888 EMAIL ADDRESS: eho@entech-res.com
FACSIMILIE: +61-8-9414 7166 WEB ADDRESS: www.entech-res.com

TITLE PROPOSED ENTECH-WtGAS-RES (72MWt) FOR BOODARIE PJ.

PRELIMINARY PIPING & INSTRUMENTATION DIAGRAM

DRAWING No. D120224-8-01

D120224-8-01.dwg

PROCESS : GASIFICATION

PROCESS PARAMETER			PROCESS CORRECTION
Process Set Value (SV)	Temp	700°C	
	Press (vac)	(-) 65 Pa	
note 1	Feedstock flow	4190 kg/h	
Process Upset	HiTemp	850°C	throttle combustion air supply to 30 % of set-value
	HiHiTemp	900°C	stop combustion air suppply,stop feedstock flow, stop stoking ram
	LoVacPress	(-) 20 Pa	throttle combustion air supply to 30 % of set-value
	LoLoVacPress	(-) 5 Pa	full open A00102 valve, stop combustion air supply, stop feedstock flow, stop stoking ram

note 1: flow rate is for 1 x line of 18MWt, total of this plant is 16,762 kg/h of feedtsock with avg CV= 15 MJ/kg

PROCESS : SYNGAS FIRING

PROCESS PARAMETER			PROCESS CORRECTION
Process Set Value (SV)	Temp	900°C	
	Press (vac)	(-) 350 Pa	
	Off-Gas flow	278842 kg/h	
Process Upset	LoTemp	750°C	turn-up MinTemp flame fuel valve to max. set-value, modulate-down cooling air supply below set-value until 900°C
	HiTemp	950°C	turn-down pilot flame fuel valve to min. set-value, modulate-up cooling air supply above set-value until 900°C
	HiHiTemp	1000°C	turn off pilot flame fuel valve, increase cooling air supply to max setting, throttle gasifier combustion air to 30 % set-value
	LoVacPress	(-) 300 Pa	modulate-up ID Fan speed until (-) 350 Pa
	LoLoVacPress	(-) 200 Pa	increase ID Fan speed to max, throttle gasifier combustion air to 30 % set-value

PROCESS : OFF-GAS HCl CONTENT REMOVAL-in DRI

PROCESS PARAMETER			PROCESS CORRECTION
Process Set Value (SV)	Temp	165°C	
	Press (vac)	(-) 1350 Pa	
	Off-Gas flow	278842 kg/h	
note 2	Reagent flow	720 kg/h	
note 3	HCl conc.	4 mg/Nm3	
Process Upset	HiHCl conc.	6 mg/Nm3	modulate-up Reagent flow to 80 % above flow set-value, throttle gasifier combustion air to 30 % set-value
	HiHiHCl conc.	8.5 mg/Nm3	increase Reagent flow to 120 % flow set-value, stop gasifier combustion air flow & stop feedstock charging until conc. drops back to HiHCl

note 1: Reagent used is $NaHCO_3$/Trona powder.
note 2: HCl concentration is measured at operational stack by CEMs. Emission Limit is 10 mg/Nm3

REV	DESCRIPTION	SIG.	ISS.	DATE
0	PREL DESIGN	PL	02/12	02/12

REFERENCE DRAWING | DRAWING NUMBER

ENTECH
RENEWABLE ENERGY SOLUTIONS

DRAWN	DATE
PL	02/2012
CHKD	DATE
NM	02/2012
AUTH	DATE
NM	02/2012
JOB No.	SCALE
	1 : XXX

3rd ANGLE PROJECTION

MATERIAL .
SPECIFICATION .
FINISH .
WEIGHT .

ENTECH RENEWABLE ENERGY SOLUTIONS
POSTAL ADDRESS: PO Box 1088, Canning Vale DC W.A. Australia 6970
TELEPHONE: +61-8-9414 7888 EMAIL ADDRESS: eho@entech-res.com
FACSIMILIE: +61-8-9414 7166 WEB ADDRESS: www.entech-res.com

TITLE PROPOSED ENTECH-WtGAS-RES (72MWt) FOR BOODARIE PJ.
PRELIMINARY PIPING & INSTRUMENTATION DIAGRAM

DRAWING No. D120224-8-01
D120224-8-01.dwg

PROCESS : OFF-GAS SOx CONTENT REMOVAL-in DRI

PROCESS PARAMETER			PROCESS CORRECTION
Process Set Value (SV)	Temp	165°C	
	Press (vac)	(-) 1350 Pa	
	Off-Gas flow	278842 kg/h	
note 4	Reagent flow	720 kg/h	
note 5	SOx conc.	20 mg/Nm3	
Process Upset	HiSOx conc.	30 mg/Nm3	modulate-up Reagent flow to 80 % above flow set-value, throttle gasifier combustion air to 30 % set-value
	HiHiSOx conc.	42 mg/Nm3	increase Reagent flow to 120 % flow set-value, stop gasifier combustion air flow & stop feedstock charging until conc. drops back to HiSOx

note 4: Reagent used is $NaHCO_3$/Trona powder.
note 5: SOx concentration is measured at operational stack by CEMs. Emission Limit is 50 mg/Nm3

PROCESS : COMBUSTION EFFICIENCY - SYNGAS FIRING

PROCESS PARAMETER			PROCESS CORRECTION
Process Set Value (SV)	Temp	900°C	
	Press (vac)	(-) 350 Pa	
	Off-Gas flow	278842 kg/h	
note 6	CO conc.	5 mg/Nm3	
note 7	TOC conc.	2 mg/Nm3	
Process Upset	HiCO conc.	10 mg/Nm3	modulate-up combustion air until CO conc=5mg/Nm3, modulate-up MinTemp flame fuel valve to compensate for temp drop
	HiTOC conc.	4 mg/Nm3	modulate-up combustion air until TOC conc=2mg/Nm3, modulate-up MinTemp flame fuel valve to compensate for temp drop
	HiHiCO conc.	25 mg/Nm3	increase combustion air & cooling air supply, MinTemp flame to to max setting,throttle gasifier combustion air to 30 % set-value
	HiHiTOC conc.	7 mg/Nm3	increase combustion air & cooling air supply, MinTemp flame to to max setting,throttle gasifier combustion air to 30 % set-value

note 6: CO concentration is measured at operational stack by CEMs. Emission Limit is 50 mg/Nm3
note 7: TOC concentration is measured at operational stack by CEMs. Emission Limit is 10 mg/Nm3

PROCESS : NOx - SYNGAS FIRING

PROCESS PARAMETER			PROCESS CORRECTION
Process Set Value (SV)	Temp	900°C	
	Press (vac)	(-) 350 Pa	
	Off-Gas flow	278842 kg/h	
note 8	NOx conc.	50 mg/Nm3	
Process Upset	HiNOx conc.	80 mg/Nm3	modulate-up recirculated flue gas to combustion zone, modulate-down combustion air until NOx conc=50mg/Nm3
	HiHiNOx conc.	120 mg/Nm3	increase recirculatd flue gas to combustion zone to max setting, decrease combustion air to min setting

note 8: NOx concentration is measured at operational stack by CEMs. Emission Limit is 200 mg/Nm3

REV	DESCRIPTION	SIG.	ISS.	DATE
0	PREL DESIGN	PL	02/12	02/12

ENTECH
RENEWABLE ENERGY SOLUTIONS

DRAWN	DATE
PL	02/2012
CHKD	DATE
NM	02/2012
AUTH	DATE
NM	02/2012
JOB No.	SCALE
	1 : XXX

3rd ANGLE PROJECTION

MATERIAL .
SPECIFICATION .
FINISH .
WEIGHT .

ENTECH RENEWABLE ENERGY SOLUTIONS
POSTAL ADDRESS: PO Box 1088, Canning Vale DC W.A. Australia 6970
TELEPHONE: +61-8-9414 7888 EMAIL ADDRESS: eho@entech-res.com
FACSIMILIE: +61-8-9414 7166 WEB ADDRESS: www.entech-res.com

TITLE PROPOSED ENTECH-WtGAS-RES (72MWt) FOR BOODARIE PJ.
PRELIMINARY PIPING & INSTRUMENTATION DIAGRAM

DRAWING No. D120224-8-01
D120224-8-01.dwg

REFERENCE DRAWING | DRAWING NUMBER

LEGENDS FOR PIPING & FITTINGS

GATE VALVE

GLOBE VALVE

BALL VALVE

BOILER BLOWDOWN VALVE-QUICK OPENING

BOILER BLOWDOWN VALVE-SLOW OPENING

CHECK VALVE

Y-STRAINER

BASKET STRAINER

ELECTRIC SOLENOID VALVE-2 WAY

ELECTRIC SOLENOID VALVE-3 WAY

PRESSURE REDUCING VALVE

PRESSURE RELIEF VALVE

DIAGHRAGM SEAL

DIRCETIONAL SOLENOID VALVE

BUTTERFLY AIR DAMPER

FLEXIBLE CONNECTION

XX-YYY-ZZ-SSS-AABB

- XX — SERVICE
- YYY — PIPE/DUCT SIZE-in mmNB or ID
- ZZ — MATERIAL SPEC.
- SSS — LINE #
- AA — INSULATION TYPE
- BB — INSULATION THICKNESS-in mm

SERVICE

AA : AQUEOUS AMMONIA
BA : BLOWER AIR
BD : BOILER BLOWDOWN
CA : CAUSTIC SOLUTION
CW : COOLING WATER
FO : FUEL OIL
FG : FUEL GAS
HS : PROCESS STEAM HIGH PRESSURE
HO : HYDRAULIC OIL
IA : INSTRUMENT AIR
JW : JACKET WATER
LS : CONDENSATE
LY : LIME SLURRY
OG : OFF-GAS
OF : OVERFLOW
OX : OXYGEN
ND : NON-CORRSIVE DRAIN
NI : NITROGEN
PA : PLANT AIR
PN : PNEUMATIC CONVEYOR
PO : POTABLE (CITY) WATER
PS : PROCESS STEAM LOW PRESSURE
SD : SEWER & SANITARY DRAIN
SP : SODIUM PHOSPHATE
SW : SOFT WATER
VN : NON-CORROSIVE VENT
WL : WASTE LIQUID

MATERIAL SPEC.

C1 : CARBON (BLACK)STEEL PIPE-MEDIUM TO AS 1074 or ASTM-SCH 40
C2 : CARBON (BLACK)STEEL PIPE-HAEVY TO AS 1074 or ASTM-SCH80
C3 : MILD STEEL SHEET/PLATE TO AS3678-250
G1 : GALVANISED STEEL PIPE-MEDIUM TO AS1074 or ASTM-SCH40
G2 : GALVANISED STEEL PIPE-HEAVY TO AS1074 or ASTM-SCH80
G3 : GALVANISED STEEL SHEET/PLATE TO AS3678-250
S1 : STAINLESS STEEL PIPE-SUS316-AS1769
S2 : STAINLESS STEEL PIPE-SUS304-AS1769
S3 : STAINLESS STEEL SHEET-SUS316-AS1449
P1 : POLYETHYLENE PIPE TO AS1667
P2 : PTFE PIPE TO AS1198
CP : COPPER PIPE

INSULATION TYPE

IH : HOT INSULATION
IC : COLD INSULATION
IS : PERSONNEL PROTECTION

REV	DESCRIPTION	SIG.	ISS.	DATE
0	PREL DESIGN	PL	02/12	02/12

REFERENCE DRAWING | DRAWING NUMBER

ENTECH RENEWABLE ENERGY SOLUTIONS

DRAWN	DATE
PL	02/2012
CHKD	DATE
NM	02/2012
AUTH	DATE
NM	02/2012
JOB No.	SCALE
	1 : XXX

3rd ANGLE PROJECTION

MATERIAL .
SPECIFICATION .
FINISH .
WEIGHT .

ENTECH RENEWABLE ENERGY SOLUTIONS
POSTAL ADDRESS: PO Box 1088, Canning Vale DC W.A. Australia 6970
TELEPHONE: +61-8-9414 7888 EMAIL ADDRESS: eho@entech-res.com
FACSIMILIE: +61-8-9414 7166 WEB ADDRESS: www.entech-res.com

TITLE PROPOSED ENTECH-WtGAS-RES (72MWt) FOR BOODARIE PJ.
PRELIMINARY PIPING & INSTRUMENTATION DIAGRAM

DRAWING No. D120224-8-01
D120224-8-01.dwg
SHEET 8 OF 9 SHEETS

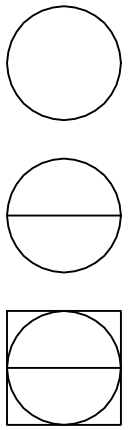
LEGENDS FOR EQUIPMENT & INSTRUMENT

XX-YYYZ

EQUIPMENT CODE — TAG#

EQUIPMENT CODE

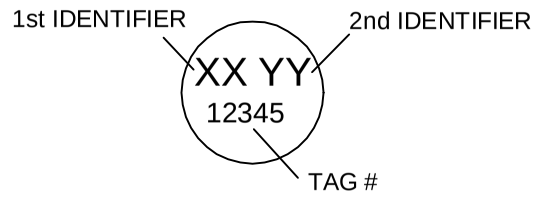
AD : AIR DEAERATOR
AG : AGITATOR/MIXER
BL : AIR BLOWER
BU : BURNER
DC : DUST COLLECTOR-FF BAGHOUSE
DR : DRY SORBENT REACTOR
EX : BOILER/HEAT EXCHANGER
FD : SCREW FEEDER
FR : ROTARY FEEDER
FV : FLOW CONTROL VALVE/DAMPER
GC : GASIFICATION CHAMBER
HP : HOPPER
IJ : INJECTOR
PC : CENTRIFUGAL PUMP
PD : DIAPHRAGM PUMP/METERING PUMP
PG : GEAR PUMP
SS : BLOWDOWN TANK(FLASH TANK)
SH : STEAM HEADER
ST : STACK
TK : TANK



LOCALLY MOUNTED INSTRUMENT

FRONT PANEL MOUNTED INSTRUMENT

SHARED DISPLAY, SHARED CONTROL-PLC/SCADA



1st IDENTIFIER

A : ANALYSER
B : BURNER , FLAME
ESD : EMERGENCY SHUTDOWN
F : FLOW
L : LEVEL
P : PRESSURE
DP : DIFFERENTIAL PRESSURE
pH : ACIDITY/AKALINITY
T : TEMPERATURE
Y : STATE, EVENT
Z : SWITCH

2nd IDENTIFIER

A : ALARM
C : CONTROL
E : ELEMENT
I : INDICATE
S : SWITCH
T : TRANSMITTER

OTHERS

AHH : HIGH-HIGH ALARM
AH : HIGH ALARM
XH : HIGH INTERLOCK
XL : LOW INTERLOCK
AL : LOW ALARM
ALL : LOW-LOW ALARM

REV	DESCRIPTION	SIG.	ISS.	DATE
0	PREL DESIGN	PL	02/12	02/12

REFERENCE DRAWING | DRAWING NUMBER

ENTECH RENEWABLE ENERGY SOLUTIONS

DRAWN	DATE
PL	02/2012
CHKD	DATE
NM	02/2012
AUTH	DATE
NM	02/2012
JOB No.	SCALE
	1 : XXX

3rd ANGLE PROJECTION

MATERIAL .
SPECIFICATION .
FINISH .
WEIGHT .

ENTECH RENEWABLE ENERGY SOLUTIONS
POSTAL ADDRESS: PO Box 1088, Canning Vale DC W.A. Australia 6970
TELEPHONE: +61-8-9414 7888 EMAIL ADDRESS: eho@entech-res.com
FACSIMILIE: +61-8-9414 7166 WEB ADDRESS: www.entech-res.com

TITLE PROPOSED ENTECH-WtGAS-RES (72MWt) FOR BOODARIE PJ.

PRELIMINARY PIPING & INSTRUMENTATION DIAGRAM

DRAWING No. D120224-8-01

D120224-8-01.dwg

NEW ENERGY CORPORATION PTY LTD
ABN: 16 139 310 053
Suite 1, 12 Parliament Place, West Perth, WA 6005
PO Box 1036, West Perth, WA 6872
T +61 8 9226 0722 F +61 8 9481 8023
www.newenergycorp.com.au

19th October 2012

Mr Richard Sutherland
Assessment and Compliance Division
Office of the Environmental Protection Authority
Locked Bag 33, Cloisters Square,
Perth, WA, 6850

Dear Mr Sutherland,

Boodarie Waste to Energy and Materials Recovery Facility, Port Hedland (Assessment No: 1911)

We are responding to a letter received from our former case officer Anne Stubbs on the 19th September 2012. Ann was forwarding a submission received from the Department of Health (DOH) dated 10th September 2012 in response to the PER submission from New Energy as referenced above.

The Department of Health has made three (3) comments regarding the PER and this letter is our formal response to the issues raised.

1. ***Mosquito-borne Disease Control Program and Services***:

   Section 9.3.4.3 of the PER describes that the risks associated with mosquitoes is exacerbated during and immediately following the wet season in the Port Hedland region. The Town of Port Hedland (ToPH) advised New Energy that mosquito numbers typically increase during the wet season, particularly after a cyclone. At the time of preparing the PER, the Town advised that there had been 7 reported cases of Ross River virus since December 2011.

   Section 9.3.4.3 states that mosquito breeding could potentially occur on site or in surrounding floodplain areas. In terms of on-site breeding sources, the following were identified as potential breeding areas:

   - Fire water storage tanks;
   - Perimeter drainage swale; and
   - Waste handling facilities.

The risks associated with mosquito breeding and exposure will be managed via the following measures which are described in Section 9.3.5 of the PER:

- The site will be filled above flood levels and levelled such that the site drains to a perimeter swale which will be designed to avoid surface ponding for prolonged periods by either infiltrating stormwater from smaller events, or draining stormwater away from the site;
- Waste handling facilities will be located within buildings to prevent capturing of stormwater;
- Water use will be minimised on-site and spillages will be cleaned in a timely manner;
- Information relating to mosquito risk and management will be included in personnel induction programs;
- Mosquito management will be discussed during toolbox meetings, particularly during peak mosquito breeding season (i.e. the wet season);
- Personnel will be required to wear protective clothing (long, loose-fitting clothing) when outdoors to reduce the risk of direct exposure with mosquitoes;
- Personnel and visitors at the site will be provided access to insect repellent containing diethyl toluamide or picaridin, preferably in the form of a gel or lotion as these are most effective;
- New Energy will monitor local media outlets and the ToPH's media alerts during peak season for mosquito breeding (i.e. the wet season which runs from November to March); and
- New Energy will periodically dose fire water storage tanks with a suitable agent (such as Aquasafe®) which keeps water storage tanks free of mosquito larvae for up to two months.
- In addition to the above, New Energy will work with the ToPH once detailed site plans are available to ensure all aspects of mosquito management are covered off.

2. ***Toxicology Programs and Services***

- ***Ambient Air:***

The DOH asserted that they were not satisfied with the source data used for establishing background data for $PM_{2.5}$ and CO and that the DEC "would" have air quality monitoring stations in closer proximity to the Boodarie site. New Energy refutes this claim on the following basis

- No such monitoring stations exist.
- New Energy was directed by the DEC Air Quality Management Branch to source background data from the "Port Hedland Industry Council" (PHIC).

- New Energy subsequently acquired the data from PHIC at considerable expense and used it to establish the background data as referenced above.
- Subsequent advice received from the DEC Air Quality Management Branch does not raise the data set as an issue.

- ***Odour:***

DOH has deferred to the DEC Odour unit for advice over air modelling data submitted by New Energy. We acknowledge this advice and shall refer to DEC in this regard.

3. **Health Impact Assessment:**

We note the comment by Department of Health (DoH) with respect to Health Impact Assessment (HIA). New Energy is aware that the DoH has been working on developing an HIA framework for WA that integrates effectively with the current sophisticated Environmental Impact Assessment (EIA) process that has operated for more than two decades under the *Environmental Protection Act 1986.* The difficulty of integrating the two methodologies has so far prevented the introduction of a formal HIA system. Instead HIA has been completed informally either through the EIA process with the DoH having the opportunity for input and comment through the public and agency submission processes or as separate voluntary process.

New Energy has discussed the public health aspects of the proposal with staff from the DoH Toxicology and Environmental Health groups and the feedback received was that they were comfortable that the impacts could be successfully managed under the EIA process provided the facility was designed in accordance with national and international best practice guidance.

Given the non-hazardous nature of the waste streams to be handled at the Boodarie facility, the only significant public health risk associated with the proposed facility is associated with the potential for emissions of air toxics from the stacks. The control technologies and monitoring systems for assessing and managing these emissions are very well established in Europe and the USA (if not in Australia) and this provides a very high degree of confidence that these proven technologies and methodologies will safeguard public health from any adverse impacts.

As a result, New Energy considers that additional more detailed Health Impact Assessment is not warranted at this time given the detailed scrutiny of air emissions that is already occurring through the EIA process and the very well established national and international ambient and emission criteria for air toxics that are

detailed in the PER which are designed to be protective of public health as well as the environment.

Once again thank you for the feedback on our submission and please let us know if there are any further questions in regards to comments made by the Department of Health regarding the aforementioned PER submission.

Yours sincerely,

Jason Pugh
General Manager