

GREEN DISTILLATION TECHNOLOGIES PLANT IN WARREN, NSW AUSTRALIA

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BACKGROUND

The SPREP Director General (DG) was approached informally by Green Distillation Technologies (GDT) through an independent consultant with knowledge of the company, Mr Bruce Peak, in November 2011. During their informal discussions on using coconuts, fronds and palm logs for feedstock for a bio-fuels plant, DG agreed that the issues presented should be further discussed with SPREP technical staff, and an email exchange was established.

Several climate change division staff were involved in the discussions, and it was agreed that the technology seemed promising enough to warrant in-depth investigation. Since the proposal was to work with Samoa as the pilot site, as Mr Peak is resident on Upolu, contacts were also made with the national Pacific Islands Greenhouse Gas Abatement through Renewable Energy Project (PIGGAREP) focal point for Samoa. Further email exchanges were made, and a proposal drafted for a team from Samoa to go on a study tour at the Warren plant. However, the proposal did not find full agreement from the Samoa national projects approval committee at this stage. This may have been due to the current situation with PIGGAREP in that no new approvals will be made until after the current audit and the April advisory board meeting.

In the interim, SPREP decided to take advantage of the Climate Change Adviser's (CCA) attendance at the Pilot Programme Climate Resilience (PPCR) meeting in Sydney and re-route via Warren for a visit to the GDT plant. GDT has high experience in a new methodology of 100 % emissions free energy recovery from waste organic matter. GDT is currently entering into a contract to publicly list (IPO) on the Australian stock market (ASX) in April 2012. GDT currently operates a pilot plant and is constructing a commercial scale module as part of the R/D Centre in Warren NSW Australia. Major works are being conducted on a 42 hectare site in preparation for the building of a GDT end of life tyre (EOL) destructive distillation plant to a maximum of 600,000 tyres p/a.

ACTIONS

Travel to Warren to visit plant, conduct discussions with GDT Directors and staff, and make detailed survey of current set-up at Warren.

ACTIVITIES

CCA was met at Sydney Airport by Trevor Bayley, another GDT Director, who was on the same flight to Dubbo. Upon arrival in Dubbo arrangements were made to travel to Warren by rental car. In Warren, a first informal meeting was held with Mr Bayley and Denis Randall, who is the technical expert on the technology and also a Director of GDT.



- Pictured: GDT Directors Trevor Bailey (left) and Denis Randell (right)

Discussions centered on expectations from the mission, some history of the technology and issues relating to preparing a successful programme for Samoa and other Pacific Island Countries. This included consideration of the extent of usable land for coconut plantations in Samoa, bearing in mind food security issues as well as alternate feedstock streams from for example the current coconut oil industry in Samoa. The

GDT technology has applications for all organic waste; anything containing Carbon. GDT has conducted tests on a wide range of products from Cotton Waste, Wheat Straw, and Rice Husks to Tyres. The results are production of carbon and oil with no emissions.

Pictured: Inner combustion chamber filled with regular EOL tyres



Pictured: Inner combustion chamber

Use of tyres for the process is impractical in Samoa due to lower levels of local supply of EOL tyres, as well as environmental issues pertaining to the quarantining of any tyres being imported to supplement the supply of tyres, which was a concern expressed by MNRE and SPREP in earlier discussions.

A better option is available in that Samoa has an abundance of coconuts that could be used instead of tyres and this claim is supported by credible documentation from the Ministry of Natural Resources and Environment (MNRE) and Samoan Chamber of Commerce. The economies of the Pacific Islands are supported by external sources. There is insufficient wealth generated at present in the Islands for them to be fully economically independent, especially

when compared to the abundance of natural resources. Currently the Pacific Island Countries have a commodity that is going to waste, coconuts, fronds and non producing trunks. GDT has a process that can recover the energy stored in that waste and convert it into usable forms. This energy can be used to reduce reliance on imported energy and or generate export income. While the process for this report commenced in Samoa, it is expected that the findings will be of interest to other Pacific Island Countries.

Following this consultation a visit was made the following day to the GDT plant in time to see it demonstrated in practice. While the plant was using old tires as a feedstock on this day the principles would be the same for coconuts and other organic materials. At the plant there were also examples of other organic feedstock that had been used by GDT, from cotton waste, to rice husks and wheat stalks. In all cases there was oil extracted and the remaining materials were pulverisable carbon, as well as other waste such as steel reinforcement bands from the tires. The pulverised carbon that is produced is also very pure carbon black, which can be used as a feedstock for activated carbon, in itself a valuable commodity.

The site was photographed extensively, and the process monitored together with the GDT plant staff.



Pictured above: Oil collection unit

Pictured left: The distillation chamber

Pictured: Pre-heating of gas chamber



Pictured: Lower level of the distillation area

OUTCOMES

The GDT process of destructive distillation involves a pyrolysis based process and GDT refined the technical concept during two years of pilot plant operations. Feedstock has included various agricultural crop wastes, however commercialisation in Australia has focused on energy recovery and recycling end of life tires as the primary feedstock, for environmental demand reasons. The process produces oil, carbon and excess heat.

The innovation is unique in terms of the methodology to process a range of feedstock in four principal areas;

1. the process is self sufficient in terms of energy usage
2. the quality and quantity of the oil and carbon produced
3. the process is environmentally neutral in terms of emissions
4. the application of products (oil and/or high grade carbon) and process heat to generate electricity.

As mentioned, the process has been made to work on a great variety of agricultural crop wastes, and GDT are confident that there should be applicability of the concept to coconuts, coconut waste (husks, coir, shells, fronds) as well as coconut lumber (from felled coconut palms that are no longer producing nuts). The process is a sort of recombinant distillation, and the oil that is produced is not necessarily going to be of a similar nature to coconut oil produced by traditional pressing methods. This has been shown by the current use of tires at GDT, whereby the oil that is recovered is of a greater quantity than that which is actually utilized in the production of the tires. This probably originates from the rubber used in the tire production.

It is expected that similarly the oil produced will be a recombinant of the various oil components in the coconut and waste. In addition as mentioned there is high quality carbon black produced by the process and this can be used as a feedstock for activated carbon.

One element to the process that requires further investigation is at what temperature the feedstock will reach its flash point, meaning that it has been gasified sufficiently to catch on fire. The process needs to be halted at a temperature below that in order to complete the distillation process. GDT have assured that they are able to do that testing at the Warren plant.

A further informational requirement is a more in-depth understanding of the scale of the potential scale of the feedstock that could be utilized. It will be important to bear in mind several conditions if a proposal should proceed. First of all, the project should not impinge on the availability of low-cost coconut supplies for food security. Secondly, existing producers of virgin coconut oil and other coconut products for exports should also not be adversely affected. Thirdly, the project should be closely integrated with national efforts at reforestation and reducing deforestation.

It is likely that all these three caveats can be met satisfactorily. A state of agriculture and forestry report issued by MAFF suggests that there are 90,000 hectares of land suitable for coconut production in Samoa. Of that, 28,000 hectares are currently listed as being under management, with a reported wastage of some 30% of the coconuts harvested. This suggests that food security should not be an issue if the project is targeted at the under-managed or non-managed hectares and includes reforestation measures and protection of reforested areas under the project. The actual status of those non-managed areas needs to be verified with MAFF and other agencies such as WSTC. It would also be necessary to close follow MAFF/MNRE policy on reforestation.

The GDT plant is a modular design, enabling scaling of each plant according to input feedstock volume and energy demand in the region. Oil and carbon can be supplied to a third party for a range of applications or power generation infrastructure can be included at GDT plant site.

This flexibility provides great potential for replacement or supplementation of current energy usage for power generation according to individual circumstances. Another development of interest is the experiment carried out by Qantas in flying a sector between Sydney and Adelaide using fuel manufactured from vegetable oil, albeit imported from the US at considerable expense. The company that supplied the fuel SkyNRGY is based in Rotterdam, and was contacted by GDT to explain the work at Warren. This company have expressed an interest in securing samples of the oil to evaluate for their purposes, i.e. further refining into jet usable fuels. In discussion with the technical experts GDT feel that any oil that results from the coconut project would be ideally suited to this process and could provide a very lucrative market. A lot of work needs to be done in this regard, but it can be incorporated in the R&D, perhaps at additional cost which can be sourced from airlines or some other interested party.

For Samoa, or other Pacific Island Countries the projected benefits include;

- reduced imports of fuel (diesel)
- utilization of a plentiful and otherwise wasted resource - excess coconuts
- reduced cost for electrical energy generation
- greenhouse gas abatement contribution in line with PIGGAREP objectives
- reduced cost, or avoidance/minimization of cost increase, for consumers of electrical energy

- a regional leadership opportunity for the development of clean energy using local resources
- the relatively short lead time to establish a plant and deliver tangible benefits.

RECOMMENDED ACTION

The following actions are identified, to be addressed sequentially on the assumption of positive outcomes for each.

1. To facilitate assessment of the technical process, the GDT operations, plans, company and capability, it is recommended that a delegation from Samoa or other Pacific Island Countries visit Australia. This would require a visit to Warren (NSW) via Sydney.
2. A business case is developed by GDT in cooperation with nominated representatives from Samoa or other Pacific Island Countries.
3. Formal application for project funding assistance is sought from appropriate agencies and international programs such as PIGGAREP and SIDS Dock.
4. Application should also be made to agencies providing funding or assistance in relation to reforestation or reducing deforestation.

SPREP should disseminate this report and other technical papers relating to the proposal to stakeholders in Samoa and Pacific Island Countries, through PIGGAREP, as well as to SIDS Dock.

DEVELOPING A PLAN OF ACTION

GDT has completed sufficient research to know, and through Dr Denis Randell has already completed the calculations as shown during discussions to support the thesis that the process can recover energy from coconuts fronds and trunks.

In order for the process to be built to a commercial standard there is a need to conduct exhaustive R&D on volumes, processing times, material handling and products. As GDT are at present focused on bringing energy recovery from tyres, should Samoa, other Pacific Island Countries and supported by SPREP decide to investigate the viability of using coconuts, fronds and trunks as feedstock then GDT will require funding to complete the R&D.

GDT has estimated the costs for the R&D at AU\$ 750,000.00. This would likely include:

- Design and commission appropriate material handling systems.
- Reconfigure the R/D Centre at Warren to establish proof of process.
- Research and refine the appropriate process for extraction of oil from fronds and trunk.
- Complete documentation for ISO and ASNZ accreditation to enable insurance for plant, product and process to be applied both for domestic and International clientele.
- Design and commission appropriate materials for construction
- Research and report quality and purity of oil and carbon.

- Research and report potential for add on process such as electricity generated by transfer of waste heat to steam turbine thus leaving our key component carbon for an activation process.

Following this, the next steps would be suggested:

Commence at the R/D site at Warren by putting together a schedule, submitting same to the project appointed body for evaluation and approval to proceed. The Directors of GDT would come to Samoa to meet with pre interested parties (Government, National Provident Fund and Private Enterprise) in the establishment of a suitable Joint Venture partnership.

While R/D is being conducted in Australia GDT will commence a comprehensive report to enable a business model (BM) to be presented to the stakeholders covering projected costing, projected earnings and return of investment (ROI). Outcomes of Environmentally clean process, Global Benefit and Commercial sustainability will be in the BM. The BM may recommend that a plant that handles 100 million nuts be the built and as production increases plant can be scaled to size accordingly. BM will include reforestation and new growth areas viability.

Visits to proposed sites for plant location will be conducted and evaluated on suitability and needs basis. Continuous water supply to an 8 meg dam (swimming pool size) will be required at the site to handle excess waste heat to steam for steam turbine generation to grid

Interviews with Trucking Transport Companies will be conducted to enable a short list to tender for the weighing and pickup of nuts, fronds and trunks. From our R/D the handling of the fronds and trunks at the plant will establish methodology to handling both outside and inside plant.

Inquiries will be made with an Australian or New Zealand rental group for the supply and service of digital read out scales with a docket print out. TCC's may be required to supply purpose built 1 x 1 x1.2 meter baskets made to specification weight to enable assessment of weight and appropriate payment docket. Basket will have side top hooks and swing open hinged side.

Discussion will take place with Samoa Commercial Bank and National Bank of Samoa for the supply of a cash van and payment exchange for weigh docket.

Recovery of oil can either be sold to Australia or enter into a gate price contract with PPS fuels to receive oil and deliver to its customers. PPS is the logical company to supply EPC on both Islands as a replacement for imported Diesel.

Interviews with EPC will take place to supply from waste heat the power generated at site via a Steam Turbine to a substation at site to enter EPC grid .

Interviews will take place with local shipping company for the handling and export of Carbon Black (partners and stakeholders to confer quantities)

The Port Authority and Samoa Shipping will have to work hand in hand with this project as a dedicated ferry will be required to transport fuel to Mulifanua wharf and return to the Port of Savaii with coconuts, fronds and trunks collected from Upolu as same principle pickup methods will apply to that Island.

Government support will be required to assist this project by bringing the community to GDT united and knowing that many companies will be contracted to long term performance contracts and thousands of villagers will benefit from ongoing employment, good payment for their hard efforts.