

ANNEX 1

Memorandum of Understanding (MOU) between the University of Newcastle (UoN) and the Secretariat of the Pacific Regional Environmental Programme (SPREP) - 2016

PROJECT TITLE

UoN Technical Assistance for the PacWaste Contingency for Disaster Waste (Green Waste Utilisation)

OBJECTIVE

Green waste is a significant post disaster waste problem that is poorly dealt within in the region and is exacerbated by the already poor management which exists in the Pacific that result in widespread disposal to dumpsites, landfill or open burning.

But there is potential for post disaster green waste streams as well as green waste gathered during regular collection to be better utilised for the recovery of energy and agricultural products. SPREP in concert with UoN via the MOU agreement have identified a range of tests on various green wastes using UoN and partner technologies that will provide important new information on a range of green wastes.

The tests, analysis and reports will target a range of for pre and post disaster green waste streams for their reuse and resource recovery potential (primarily energy, ethanol production and biochar (soil carbon products) which can be used to inform future disaster waste projects.

AGREED ACTIONS**(A) Testing**

The research will be coordinated by Dr Dusan Ilic located at the Centre for Bulk Solids and Particulate Technologies (CBSPT) at the University of Newcastle (UON). The research will focus on three areas, namely:

1. The handleability of the biomass in terms of compressibility and dilation for efficient biomass handling system design.
2. Assessment of small biomass volumes using gasification process for energy production and biochar generation.
3. Assessment of large biomass volumes for second generation ethanol production
The biomass assessment is based on two types of waste from SPREP associated pacific island nations, namely invasive trees and green waste. The specific work is detailed below

1: Handleability Assessment

In order to determine the handleability of the invasive tress and green waste, it is proposed to perform flowability assessment at the University Labs using the following configurations:

- Bulk density assessment and pressures from 0 to 100 kPa
- Wall friction assessment on a mild steel plate and varying pressures
- Flowability assessment using a Uni-axial tester to determine:
 - o Compressibility behaviour
 - o Dilative Behaviour
 - o Hysteretic response of each biomass material
 - o Failure modes

2: Biomass gasification

This element is aimed at determining the feasibility in a new gasification process of the two biomass products to generate heat and electricity. The new process is aimed at solving a missing link in the gasification of biomass – using green waste and by-products to generate heat and electricity. In particular, the new

gasification process will address key issues including fuel flexibility, tar removal and heat recovery in the gasifier. The initial assessment process will involve characterisation of the following elements:

- Determining the energy unit for each biomass product
- Determining the gasification rate of each biomass product

3: Ethanol production Assessment – Ethtec process

Economically viable conversion of woody or fibrous materials to 'cellulosic' ethanol is internationally recognised as being the basis of an environmentally sustainable industry that is able to deliver this liquid fuel in the volume required to meet projected demand. The Ethtec process brings distinct environmental and production advantages over other ethanol production processes."

Major advantages of the new process technologies, which are:

- Greenhouse gas reduction. The UN's Intergovernmental Panel on Climate Change has concluded that use of fuel ethanol properly produced from woody or fibrous biomass results in almost no carbon dioxide emission.
 - Positive energy balance for ethanol production. The Ethtec process converts fibrous biomass to ethanol and generates surplus electricity from combustion of the lignin co-product.
 - Closed loop water cycle. The process captures production water and other liquids and treats and recycles them.
 - Use of waste fibre as feedstock. The process enables the use of abundant supplies of waste fibre from existing industries, particularly sawmill wood residue and sugar production waste known as bagasse.
- The initial assessment process will involve characterisation of the following elements:
- Determining the conversion unit per wet and dry tonne of each biomass product
 - Determining the waste fibre volume per Biomass product

Bulk material Sample Requirements

100Kg of each Biomass product (invasive weed and green waste) is required.

(B) Reporting

The contract deliverables are:

1. Develop an initial work plan for the proposed interventions in concert with SPREP and the relevant partners and national stakeholder.
2. Liaise with relevant stakeholders in the countries targeted for green waste assessments (Samoa, Fiji, Tuvalu)
3. Complete interim and final reports for the assessments conducted on the different green waste streams in relation to the technology applications which are identified above.

(C) Timeframe

The time frame will be for a period of 7 months commencing from the date of Annex approval.

BUDGET

UoN will conduct works at cost rate only with the actual total value of the UoN works being approximately USD \$44,000. SPREP will therefore be covering 50% of the entire value of the investigation (as indicated below) and UoN will cover the other 50% including costs for a senior researcher (wages), overall project management, on costs (Super, leave etc) and facilities costs.

SPREPs total budget contribution would therefore be **USD \$22,000** (costs only) provided from the PacWaste Contingency funds from savings made on work in Tuvalu.

UON resources and associated costs for research and assessment are as follows:

- Field visits, research costs and production of reports and other deliverables = \$10,500
- Flowability, Gasification and ethanol assessment of the biomass products = \$8,500
- Shipment and irradiation of Biomass products = \$3000.