EMISSIONS AND REMOVALS OF GREENHOUSE GASES AT AN INSTITUTION LEVEL:

A Case Study of Massey University Turitea Campus

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ABSTRACT

The first commitment period of the Kyoto Protocol (2008-2012) has started. Being a signatory to the protocol, New Zealand is committed to reduce its greenhouse gas (GHG) emissions down to 1990 levels by the end of the first commitment period, or to take responsibility for any emissions above this level if it cannot meet this target. Although the inventory of New Zealand's GHG emissions is made at a national level, the actual reductions in GHG emissions required under the Kyoto Protocol will need to be made by individuals and institutions in society.

Little attempt has yet been made at an institution level, especially by the Universities in New Zealand, to determine their aggregated net emissions of the major GHGs: carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4). In order to help Massey University to prepare its own emission budget, estimates of current emissions were made in four major sectors - energy, agriculture, waste and forestry - at the Turitea campus and the associated 2200 hectares of the University's farms. Greenhouse gas emissions from these sectors in 1990 were also estimated to compare the current emissions with the base year of the Kyoto protocol.

An introduction to the major GHGs, their emissions, the effect of these emissions on climate change, and an overview of the approach to calculate these emissions is provided. Total emissions from the energy sector included emissions from the electricity, gas, coal, vehicles and aviation sub-sectors, that were calculated with the help of national and international emission factors. Greenhouse gas emissions from solid waste and wastewater were calculated using the Intergovernmental Panel on Climate Change (IPCC) tier 1 approach.

Emissions from the agriculture sector were calculated using a combination of New Zealand national and IPCC default emission factors. This sector accounts for emissions resulting from enteric fermentation, animal manure management and agricultural soils.

An overview of Massey University's forest estate has also been provided. At present, forestry is the only sector contributing toward the mitigation of GHGs at Massey University through Kyoto-defined plantation forests. The amounts of C sequestered by the native and exotic tree plantations, and the total amount of CO_2 absorbed by these plantations are presented. Although an assessment of C sequestered by all Massey University's tree plantations was made, only plantations established in 1990 and after were considered for inventory purposes. In the conclusions, some suggestions to reduce GHG emissions from Massey University and to improve future inventories are given.

The annual gross GHG emissions in terms of CO_2 equivalents (CO_2e) in 2004 were 26,696±2,674 Mg which were about 7.9% above the level of 1990 emissions. It was estimated that the forestry sector removed about 4,094±439 Mg of CO_2e and therefore the overall net emissions in 2004 were 8.6% below the base-line GHG emissions of 1990. At present the major contributing sector to GHG emissions at Massey University's Turitea campus is the energy sector. This contributes 71.4% of the gross emissions, whereas the agriculture and waste sectors are producing 26.2% and 2.4% respectively of the total gross emissions. About 37% of the total GHG emissions from the energy sector were contributed by commuting traffic, whereas electricity and gas collectively produced 33% of the total 19,064±1,324 Mg CO_2e energy emissions.

The largest absolute uncertainties in emission estimates were in the energy sector and some suggestions have been made as to how Massey University might reduce these uncertainties and improve the overall accuracy of the estimates of GHG emissions.

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