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Ministry for the Environment

Report on Projects to Reduce Emissions Programme

Verification of Nelson Landfill Gas Project

September 2007

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 The project

Energy for Industry (EFI), a business of Meridian Energy Limited, has developed the Nelson Landfill Gas project in order to utilise landfill gas recovered from the York Valley Landfill. The project is a collaboration between EFI, the Nelson Marlborough District Health Board (NMDHB) and the Nelson City Council (NCC). It comprises the construction and operation of a landfill gas utilisation system comprising a compression and treatment plant at the York Valley landfill, a landfill gas delivery pipeline to the Nelson Hospital and a steam boiler with an approximate output of 55,200 GJ/year.

1.2 Agreement between the Participant and the Crown

The project was awarded 28,000 emission units by the NZ Government for the 2008-2012 period. The contractual requirements for complying with this agreement require EFI to:

- Establish a baseline for the emission reduction.
- Provide annual reports to the New Zealand Government.
- If required by the New Zealand Government after submission of the annual report, provide an audit report.

1.3 The Participant's GHG emissions assertion

The project achieves a reduction in CO_2 emissions by displacing coal currently used to generate steam in the NMDHB boilers. The net project emissions also take into account the emissions from electricity used and embodied emissions from construction materials.

2. Measurement and Monitoring

Schedule 2 of the Project agreement requires the Participant to determine the average efficiency of the existing coal fuelled boilers for a period of 12 months after the Execution Date. This will be used to establish the baseline for determining coal displaced. This schedule states:

The Participant will for each year:

- Record the quantities of petrol and diesel used in the Project, the quantity of electricity purchased by the Project, and the quantities of cement, iron, steel and aluminium introduced into the Project.
- Meter and record the quantity and energy content of steam generated by the Project during the year. This metering is to take place as close as possible to the steam generator outlet. The metering and recording equipment used is to be certified by a reputable quality assurance service provider who is independent of the Participant. Note that the energy efficiencies associated with condensate return must be accounted for through temperature and flow measurement of the condensate if applicable.
- Identify and measure any other steam generation that is not part of the Project that flows through the above meters. This generation will be subtracted from the metered generation to determine the heat output of the Project.

Conversion into tCO_2-e

In respect of any year:

- The tCO_2-e in respect of each of the quantities used in, purchased by, or introduced into the Project, will be determined by applying the following emission factors and embodied emission factors, and the global warming potential of the various Greenhouse Gases.
- The tCO_2-e in respect of the steam generated shall be determined by calculating the amount of heat output from the steam generators that can be attributed to the project, using the measurements outlined above. Using the baseline efficiency of the existing coal boilers as established above, the equivalent quantity of coal required to provide the same quantity of heat shall be calculated.
- Determine the tCO_2-e in respect of the above equivalent coal input by applying the emission factor for sub-bituminous coal specified below.

Calculation of net emission reductions

The net emission reductions attributable to the Project in any year will be the tCO_2-e in respect of the coal displaced by the Project less the tCO_2-e in respect of the quantities used in, purchased by, or introduced into the Project.

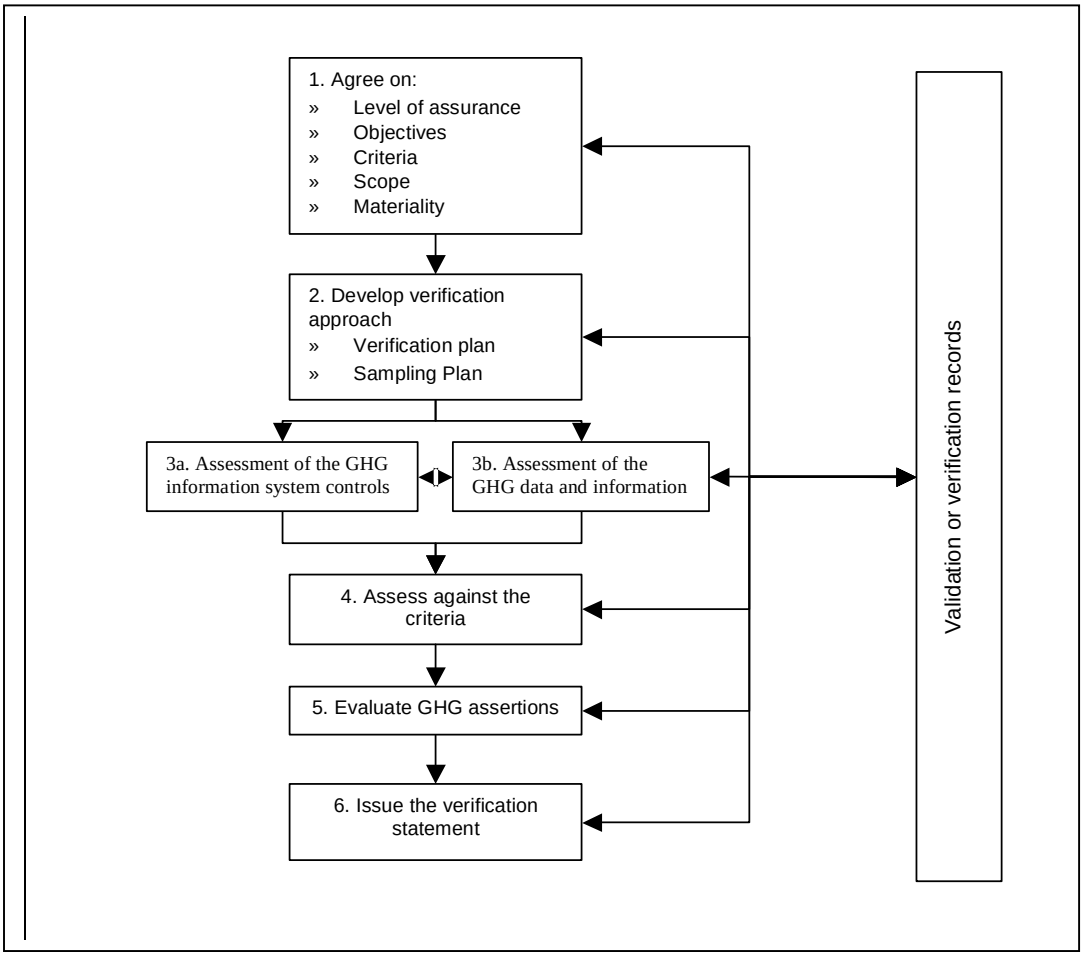
Emission factors	
Electricity	625 tonnes CO_2-e per GWh
Gas	0.0524 tonnes CO_2-e per GJ
Diesel	0.00271 tonnes CO_2-e per litre
Petrol	0.00232 tonnes CO_2-e per litre
LPG	0.00162 tonnes CO_2-e per litre
Fuel oil	0.00292 tonnes CO_2-e per litre
Coal	2.064 tonnes CO_2-e per tonne

Embodied emission factors	
Cement	0.46 tonnes CO_2-e per tonne
Iron and steel – imported	0 tonnes CO_2-e per tonne
Iron and steel – produced in New Zealand	2.01 tonnes CO_2-e per tonne
Aluminium – imported	0 tonnes CO_2-e per tonne
Aluminium – produced in New Zealand	1.62 tonnes CO_2-e per tonne

Global Warming Potential (GWP)	**Formula**	**GWP**
tonnes CO_2-e/tonne of other gas		
Carbon dioxide	CO_2	1
Methane	CH_4	21

3. Verification Approach

3.1 Verification process



The following process is given in ISO14064.3:2006 Specification with guidance for use for the verification of greenhouse gas assertions.

3.2 Location of information in this report

Table 1 Location of information in this report

ISO 14065.3 Requirement	Verifier Task	Location of information in this report
1. Agree on: Level of assurance Objectives Criteria Scope Materiality	Confirmed with MfE 26 July 2007	Section 4
2. Develop verification approach Verification plan Sampling Plan	**Develop an understanding** of information required to be included in the Annual Report; Based on this understanding, **prepare a verification and sampling plan**	Sections 3 and 4
3a. Assessment of the GHG information system controls	A site visit to review systems and processes; Metering and recording equipment has been certified by a reputable quality assurance service provider; Any other generation that flows through these meters is identified, measured and subtracted; Records of emissions as a result of the operation of the project; **Undertake a review of regulatory compliance**.	Section 5
3b. Assessment of the GHG data and information	Check **annual emission reductions calculations** and **annual Emission Units calculation** using standard electricity emission factors. Check that **construction emissions** are included and are calculated using the emission factors set out in Schedule 2. Review the records held by the civil contractor or the Participant that recorded emissions during construction.	Section 6

4. Assess against the criteria	**Review the Annual Report** provided by the participant organization in relation to operational emissions reductions, including appropriateness of calculation methodologies and accuracy of calculations.	Section 7.1
5. Evaluate GHG assertions	Ensure that **any other requirements** relating to the PRE Project Agreement are being followed.	Section 7.2
6. Issue the verification statement	Provide a verification statement in accordance with s.4.9 of ISO 14064-3:2006 or another mutually acceptable standard.	Section 8

4. Verification Plan

The following were agreed with MfE (the Client) prior to undertaking the audit:

Level of assurance

This verification has been prepared to provide Ministry for the Environment with a reasonable assurance that assertions made by EFI is materially correct and a fair representation of the GHG data and information, and that the Annual Report has been prepared in accordance with PRE programme guidelines.

Objectives

The objectives of this verification were to:

- Assess whether the Participant has complied with PRE program requirements in relation to preparation of the Annual Report; and
- Carry out an assessment of the likelihood that implementation of the planned GHG project has resulted in the GHG emission reductions and/or removal enhancements as stated by the responsible party.

Criteria

The role of the verifier for the PRE programme is to assess the content of the annual report submitted by the participant, including inspection of the project, discussion with the participant's personnel and the collection of any necessary documents, records or data.

Scope

The verification scope, includes, but is not necessarily limited to, assurance, checking or verification that the Annual Report includes the information detailed in Schedule 4 of the Project Agreement, specifically that:

- The construction emissions calculations using the emission factors set out in Schedule 2.
- The records of the quantities of materials, fuels, electricity purchased etc relevant to emissions during construction.
- Records of emissions as a result of the operation of the project are included.
- Metering and recording equipment installed has been certified by an independent reputable quality assurance service provider.
- Any other (electricity, heat) generation, not part of the project, that flows through these meters is identified, measured and subtracted.
- The recording and calculation of the emission reductions for the year using the relevant (e.g. electricity) emission factors set out in Schedule 2.
- The calculation behind Emission Units claimed for the year, using the net emission reduction and the request ratio ("C") set out in Clause 5.1 of the Project Agreement.
- Compliance has been achieved with the regulatory requirements of local and central government agencies.
- Within the context of verification, any other requirement relating to the PRE Project Agreement is included.

Materiality

For the purposes of this assessment, a discrepancy, or the aggregate of all discrepancies is considered to be material if it is considered probable that MFE's decisions regarding compliance of the project with PRE programme requirements would be changed or influenced by the discrepancy or discrepancies. A materiality discrepancy of 5% has been accepted for this verification.

Verification activities and schedules

The review for this verification included the following activities:

- desktop review of information provided by MfE and the Participant;
- a site inspection;
- document review; and
- interviews with personnel associated with the project.

The schedule for this verification is summarised as follows:

- initial documents received from MfE: 3 July 2007
- site visit: 24 July 2007
- additional documents requested from Participant: 31 July 2007
- document review and report preparation: 10 July – 14 August 2007
- draft Report submitted to MfE for review: 15 August 2007
- comments received: 17 August 2007
- final report submitted to MfE: 3 September 2007

5. Sampling Plan

This verification has been undertaken using a risk-based approach, with the objective of identifying material reporting and control risks, including:

- **Incompleteness:** for example, exclusion of significant sources, incorrectly defined boundaries, leakage effects.
- **Inaccuracy:** for example, double counting, significant manual transfer of key data, inappropriate use of emission factors.
- **Inconsistency**: for example, not documenting methodological changes in calculating GHG emissions or removals from those used in previous years.
- **Lack of transparency**: for example record-keeping that does not enable suitably skilled and experienced parties to understand processes that are being undertaken.
- **Data management and control weaknesses**: for example, insufficient checking of manual transfers of data from the point of origin and between calculation spreadsheets, no internal audit or review process, inconsistent monitoring, no calibration and maintenance of key process parameters/measurements.

Within the bounds of the agreed scope for the verification, the verification team identified key reporting and control risks as follows:

Sampling was undertaken with a focus on the Participant's management of these risks.

6. Assessment of the GHG information system and its controls

6.1 Controls on the GHG information system

Item	Information Source/ Evidence	Comments
Determination and monitoring of organizational boundaries for the project	Agreement between the Participant and the Crown	File records seen
Methods to identify and monitor GHG programme requirements		
Methods to identify reporting requirements		
Methods for determining the base year and scenario		
Selection of GHG sources, sinks and reservoirs		
Methods of identifying measurement technologies and data sources		
Selection, justification and application of selected GHG quantification methodologies		
Selection and application of the processes and tools used for collecting, processing and reporting GHG information		
Methods for assessing the effect of changes to other related systems		
Methods for checking GHG information, including: • Input, transformation, output error checking routines; • Checks on the transfer of information between different systems; • Reconciliation processes; • Periodic comparisons; • Internal audit activities; • Management review activities	1. EFI Operating Procedures OP001 – OP010 (energy consumption) 2. EFI local representative (steam generation) 3. NMDHB (steam generation backup)	File records seen

6.2 The GHG information system, its integrity and resourcing

Item	Information source/ Evidence	Comments
Policies that affect GHG information management	EFI Operating Procedures	File records seen
Management's direction and guidance concerning GHG information and reporting	EFI Operating Procedures	File records seen
Management's approach to identifying, monitoring and accepting GHG risks	1. NMDHB Operating Procedures, Nelson Hospital Boiler Plant 2. EFI Operating Procedures	File records seen
Management's awareness of GHG reporting requirements	Agreement between the Participant and the Crown	File records seen
Documentation of GHG sources, sinks or reservoirs	EFI Operating Procedures	File records seen
Processes for collecting, processing and reporting GHG information	1. EFI Operating Procedures OP004 - Log sheet LS001 (monthly) a. power use (KWh) b. Gas use (m^3) 2. EFI Operating Procedures OP008 - Log Sheet LS002 (weekly) a. gas pressure 3. Steam generation a. EFI Local representative b. NMDHB	Power and gas: Formal file records seen Steam generation and coal use data is collected by EFI local representative (Don Robertson, Tasman Projects Ltd): File records seen Back up data also collected by NMDHB. File records seen Formal procedures have not been prepared for steam and coal data

Item	Information source/ Evidence	Comments
Methods to ensure that the equipment associated with the monitoring and measurement of GHG data is adequately calibrated and maintained	1. Weighbridge Certificate of Accuracy, Toltec, 22/4/2005 2. Calibration Certificate Foxboro Fluke 45 83W-AD3S1SSTNA, Tag No FT201 (steam generation), 17/10/2005 3. Calibration Certificate Foxboro Fluke 45 83W-AD3S1SSTNA, Tag No Laundry flowmeter (steam generation), 17/10/2005 4. Calibration Certificate Digital Yewflo DY080-ECLAA2-4d/MV, Tag No. FT1	File records seen
Methods for identifying and reporting deficiencies in the performance of the reporting information and management system	EFI Operating Procedures OP001 – OP010	File records seen
Methods to ensure the implementation of appropriate corrective actions to identified deficiencies	1. NMDHB Operating Procedures, Nelson Hospital Boiler Plant 2. EFI Operating Procedures OP001 – OP010	File records seen
Procedures for access to important records	Access for audit	File records seen
Methods to ensure access and updating of current information	1. EFI Operating Procedures OP004	File records seen. NMDHB operation informal

Item	Information source/ Evidence	Comments
Methods to ensure that the equipment associated with the information management system is adequately maintained	1. LFG Boiler, SGS Certificate of Inspection, valid 8/12/2006 – 31/12/2007 2. Weighbridge Certificate of Accuracy, Toltec, 22/4/2005 3. Calibration Certificate Foxboro Fluke 45 83W-AD3S1SSTNA, Tag No FT201 (steam generation), 17/10/2005 4. Calibration Certificate Foxboro Fluke 45 83W-AD3S1SSTNA, Tag No Laundry flowmeter (steam generation), 17/10/2005 5. Calibration Certificate Digital Yewflo DY080-ECLAA2-4d/MV, Tag No. FT1	File records seen. All current for reporting period
Retention procedures for records and documents	Specific office hard copy file for project records	File records seen
Methods to identify and prevent breaches of information security	Assumed normal corporate office practice	Normal corporate office practices observed
The approach to assign roles and responsibilities	Assumed normal corporate office practice	Normal corporate office practices observed
The approach to establish personnel competencies	EFI Site Induction	File records seen
Methods for determining the allocation of time and resources	EFI Operating Procedures OP001 – OP010	File records seen

7. Assessment of GHG data and information

Item	Information source/ Evidence	Comments
The completeness, consistency, accuracy, transparency, relevance and (as appropriate) conservativeness of the GHG information,	1. EFI Operating Procedures OP001 – OP010 2. Log Sheets LS001 and LS002 3. Emails on file	1. LS001 records meter readings energy consumption (electricity and LFG) at the York Valley treatment plant (monthly) 2. LS002 records gas flows, pressures, running hours, gas temperatures and monitors maintenance requirements at the York Valley treatment plant (weekly) 3. Emails on file record steam production
The appropriateness of selected GHG estimation and quantification methodologies	1. EFI Nelson Landfill gas Project Annual Report – 2006, Appendix 2. Methodology for verifying emission reductions	File records seen
The appropriateness of selected baseline scenarios and GHG baseline quantification methodologies	1. EFI Nelson Landfill gas Project Annual Report – 2006, Appendix 2. Methodology for verifying emission reductions	File records seen

Item	Information source/ Evidence	Comments
If applicable, the maintenance and calibration programme for equipment used to monitor and measure GHG emissions or removals, including confirming the accuracy of equipment to meet the required accuracy of reporting, and any changes to the programme that could have a material effect on the reported GHG information and assertions	1. LFG Boiler, SGS Certificate of Inspection, valid 8/12/2006 – 31/12/2007 2. Toltec Certificater of Accuracy, Weighbridge; 3. Yokogawa Calibration Certificate Digital Yewflo 4. W.Arthur Fisher Calibration Certificate AK96039483 Foxboro FT201 (steam) 5. W.Arthur Fisher Calibration Certificate AK96039484 Foxboro Laundry Flowmeter (steam)	File records seen. All current for reporting period

8. Findings

8.1 Records and processes

Audit trail records were made available in a well organised format and were adequate for extracting the required data. Processes for operational control and data collection and reporting at the landfill gas processing plant were excellent (the EFI Operating Procedures). The NMDHB operational control documentation for the boiler operations were good, but did not include data collection and reporting procedures.

8.2 CO_2 emission reduction

8.2.1 Construction emissions

Construction emissions were recorded as zero for the period.

8.2.2 Petrol and diesel consumption

No petrol or diesel consumption is reported for the project.

8.2.3 Electricity and gas consumption

The EFI Operating Procedures OP004 specifies the monthly logging (Log sheet LS001) of power and gas consumption. The logged energy consumption for the period of operation (June – December 2006) is appended in Appendix C.

8.2.4 Steam generation

Steam generation from the LFG boiler was metered at the meter tagged FT1 (Digital T1, DY080-ECLAA2-4D/MV), calibration certificate 292029/001/01-1, dated 21.11.2005. Steam generation from the coal boilers were metered at the Foxboro Fluke 45 83W-AD3S1SSTNA meters tagged FT201 and Laundry flowmeter, calibration certificate 98/1486, dated 17/10/2005.

Steam generation data is collected by EFI local representative (Don Robertson, Tasman Projects Ltd) and emailed to EFI. Back up data also collected by NMDHB and emailed to EFI. Data emails available on file. The logged steam generation for the period of operation (June – December 2006) is appended in Appendix C.

8.2.5 Coal displacement

Steam generation

Schedule 2 of the project agreement requires the Participant to determine the average efficiency of the existing coal fuelled boilers for a period of 12 months after the Execution Date (21 April 2005). Coal and steam data recorded by EFI for this period, (Appendix D, NMDHB steam and coal summary data for 2004-2006 calendar years) are listed in Table 2.

Table 2 Baseline Steam generation data

Year	Month	Coal (t)	Steam (t)	coal/steam (t/t)
2005	May	345	1985	0.1738
	Jun	345	2356	0.1464
	Jul	369	2427	0.1520
	Aug	401	2366	0.1695
	Sep	280	2056	0.1362
	Oct	267	1817	0.1469
	Nov	251	1640	0.1530
	Dec	268	1460	0.1836
2006	Jan	247	1427	0.1731
	Feb	187	1264	0.1479
	Mar	235	1620	0.1451
	Apr	249	1613	0.1544
	Average coal/steam (t/t)			0.1568

EFI recorded 3663 tonnes of steam production from the LFG boiler over the period June – December 2006. Steam generation was metered through the meter identified by the device tag FT1. No steam from any other source was metered through this device.

The coal displaced by LFG steam production is given in Table 3.

Table 3 Coal displaced by LFG steam production

LFG Steam (t)	3663
Coal/steam (t/t) ratio	0.1568
Coal equiv (t)	574
coal emission factor (tCO_2-e/t coal)	2.064
tCO_2-e	1185

The EFI annual report for 2006 applied the average coal/steam (t/t) ratio over the years 2004-2006 rather than for the 12-month period following the execution date specified in the project agreement. This ratio, 0.1567 t/t, is not significantly different to that calculated for the specified period. From this ratio and the recorded steam production and the calculated coal reduction reported by EFI in the 2006 Annual report was 574 tonnes. By applying the emission factor, 2.064 tonnes tCO_2-e/t coal, this converts to the equivalent of 1185 tCO_2-e.

Electricity consumption

The electricity consumption, reported on LS001 log sheets monthly, are recorded by EFI as shown in Appendix C. The consumption for the period June – December 2006, and equivalent carbon dioxide emissions are given in Table 4.

Table 4 Electricity consumption and equivalent carbon dioxide emissions

Electricity consumption kWh	78989
Emission factor tonnes CO2-e per GWh	625
tCO_2-e	49

Subtracting the tCO_2-e from the electricity consumption from the tCO_2-e reduction achieved through coal displacement gives a total tCO_2-e reduction of 1136 tCO_2-e for the audit period. The data given in Tables 2, 3 and 4 have been verified from EFI records.

These data and calculations verify the claims made in the EFI Annual Report 2006.

8.3 Other observations

8.3.1 Emission consents

Any Air Discharge consents required for the York Valley landfill and the NMDHB coal fired boilers do not affect this project. GHD Limited understands from verbal communication with EFI that an air discharge consent was not required to construct the facility and that now it is in operation, discussion with the regulatory authority on the requirement for an air discharge consent is underway.

8.3.2 Gas pipeline

The EFI Operating Procedures OP001-OP010 includes details for the routine inspection of the pipeline at the gas treatment plant and at the hospital regulator station. The EFI OP010 specifically addresses procedures to protect the pipeline from intrusive earthworks in its vicinity. LFG pressures are logged at the treatment centre and at the hospital regulator station (LS002).

8.4 Assessment against verification criteria

The Participant:

- Has used GHG estimation, quantification, monitoring and reporting approaches and methodologies that meet the requirements of Schedule 2 of the Project Agreement.
- Has not yet completed a full year of routine operation and thus has not met the GHG performance requirements or targets specified by Schedule 2 of the Project.
- Has reported GHG information that is adequate for this audit process.
- Has an adequate understanding of the principles and requirements of the GHG program and is competent to conform to them.
- Has achieved a level of assurance that is consistent with the principles and requirements of Schedule 2 of the Project Agreement.

- Has not made any significant changes to organizational boundaries or the GHG project and its baseline scenario that lead to material change in the organization's or project's GHG emissions, removals, emission reductions or removal enhancements since the previous verification period, and which affect the organization's or GHG project's ability to conform to the requirements of Schedule 2 of the Project Agreement.

8.5 Evaluation of the GHG assertion

The project GHG assertion is to achieve a reduction in CO_2 emissions by displacing coal currently used to generate steam. The Participant has met the GHG-related performance criteria established by the Project Agreement by:

- Establishing a baseline for the emission reduction;
- Metering and recording the quantity of steam generated by landfill gas;
- Metering and recording the quantity of steam generated by coal;
- Conversion into tCO_2-e in respect to any year by:
    - The tCO_2-e from any source introduced into the project.
    - The tCO_2-e the baseline quantity of coal required for steam generation.
    - Applying the emission factor for sub-bituminous coal to determine the tCO_2-e for the equivalent coal input displaced by the project.
- Subtracting the tCO_2-e in respect to any source introduced into the project;
- Provision of an annual report complying with Schedule 4 of the Project Agreement; and
- If required by the New Zealand Government after submission of the annual report, the provision of an audit report.
- EFI has provided evidence of data collection and recording sufficient to verify the claim that coal reduction is being achieved.

9. Verification statement

9.1 Purpose of the verification

Ministry for the Environment (the Client) commissioned GHD Limited (GHD, the verifier) to verify the data and content of Projects to Reduce Emissions Annual report prepared for the EFI project (the project) for the period 2006 by EFI (the responsible party).

In undertaking this verification GHD confirms:

- That it is not responsible for the preparation of any part of the Annual Report or any other activity associated with the Project: and
- That the objective of its service provision to MfE is to independently assess whether the Annual Report provides an accurate and complete reflection of greenhouse gas emission for the project for the 2006 calendar year.

9.2 Methodology and scope of verification

GHD based its approach on the recommended by ISO 14065.3:2006 *Specification with guidance for use for the verification of greenhouse gas assertions.*

The scope of the verification was to:

- Review the Annual Report for any significant anomalies by checking the reliability of the content against the contract between MfE and the Participant.
- Execute an audit trail of randomly selected statements and data to determine the level of accuracy in collection, transcription and aggregation.
- Check the Annual Report is factually correct and balanced i.e. that it represents a fair assessment of data collection and reporting procedures.

9.3 Verification process

Verification was carried out in July 2007 and involved:

- Interviews with key personnel.
- Review of the 2006 Annual Report and associated base data off site prior to the onsite visit.
- Review the site processes and significant greenhouse emission sources and correlate those with the reporting in the 2006 Annual Report, and note any anomalies.
- General examination of participant's data selection, data collection, data analysis and reporting procedures associated with the Project.
- Execution of an audit trail of randomly selected data for each significant emissions inventory item.
- Review supporting documents and information management processes.
- Evaluating sampled data to ensure that it is factually correct and that a robust audit trail exists from initial collection to final reporting.

Data was reviewed for its reasonableness and where practical checked to the order of magnitude but detailed calculations were not carried out.

9.4 Conclusions

Based on the audit process no other significant or material anomalies were identified. Evidence was found of systematic data collection, appropriate reporting procedures and appropriate application of internationally recognised data. As such, GHD Limited has found that the Annual Report prepared by EFI provides a reasonable assurance that assertions made by EFI are materially correct and a fair representation of the GHG emissions reduction activities for 2006, and that the Annual Report has been prepared in accordance with PRE programme guidelines.

An assessment of resource consents held in relation to the project identified the lack of a resource consent for discharge to air for the gas fired boiler. The participant agreed that this was an oversight on their part and are seeking to rectify this.

10. Recommendations

The verifier recommends that in order to improve record keeping in the future and to aid future verification, the following actions be undertaken:

- Formalised procedures for data recording and reporting, based on the OP series for the treatment plant, should be developed for the NMDHB gas and coal fired boilers.
- The baseline for future annual reports should be based on the average efficiency of the existing coal fuelled boilers for a period of 12 months after the Execution Date (as specified in Schedule 2 of the project agreement).
- The participant should ensure that consent for discharge to air is gained from Nelson City Council if required. This has been discussed with the participant.

Appendix A

Register of Information Reviewed and Personnel Interviewed

Information	Source
Nelson Landfill Gas Project Annual Report 2006	EFI 2007
Nelson Landfill Gas Project Annual Report 2005	EFI 2006
PROJECT AGREEMENT T205	MfE and Meridian Energy 2005
Nelson Landfill Gas Project Operating Procedures OP001 – OP008, OP010	EFI 2006
Nelson Landfill Gas Project Form LS002 Operational Logsheet	EFI 2006
Nelson Landfill Gas Project Form LS001 Meter Readings	EFI 2006
Nelson Landfill Gas Project: Energy supplied by Nelson City Council	EFI 2006
NMDHB Maintenance Department: Operating Procedures – Nelson Hospital Boiler Plant	NMDHB 2006
Nelson Landfill Gas Plant Monthly Readings	EFI 2007
Letter of Requirement: Nelson Hospital LFG Boiler -Operation	EFI 2006

Alan de Lima, Energy for Industry, Wellington was the primary contact and provider of information. Other people involved in the project include:

David Reid: Energy for Industry

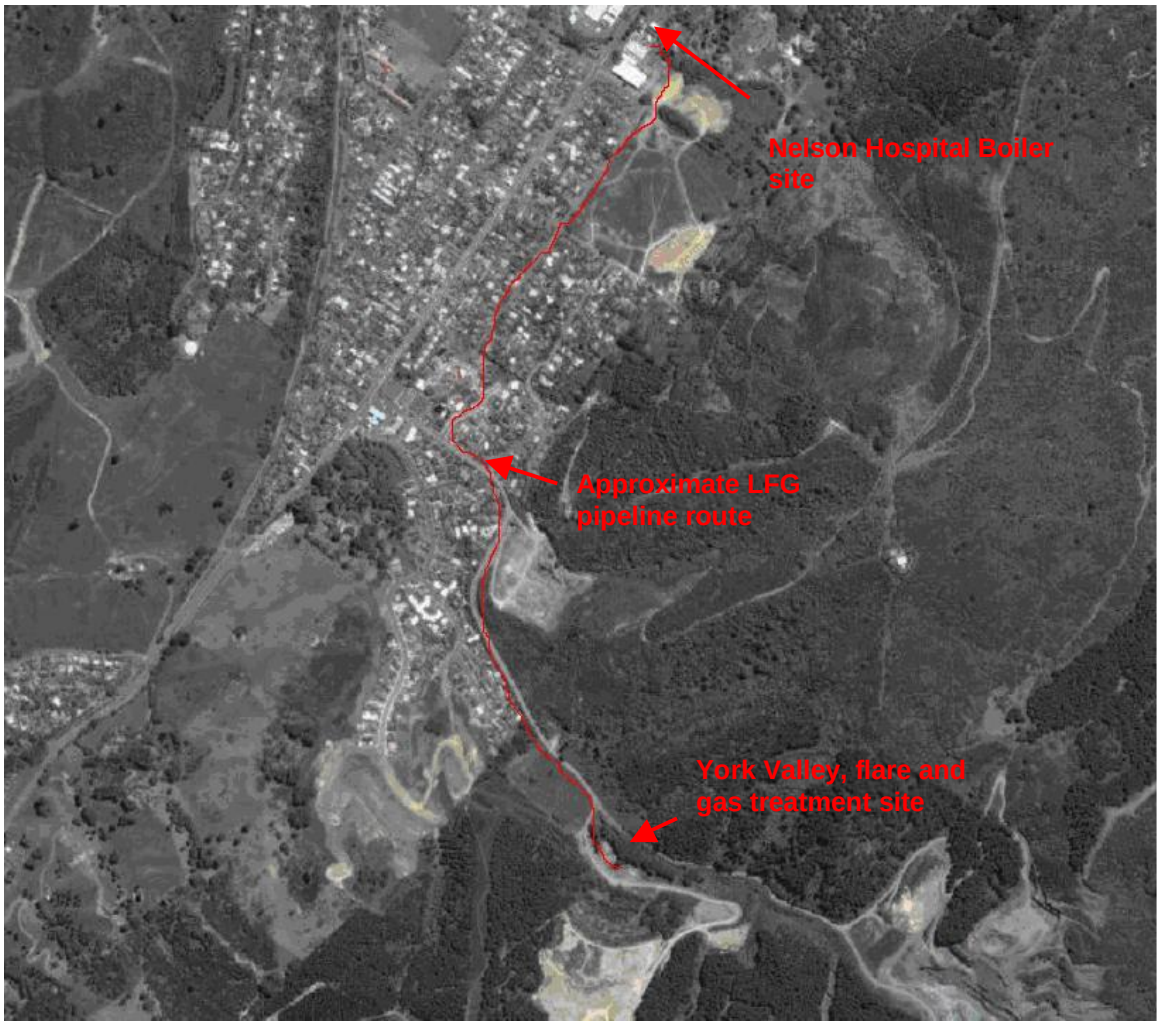
NMDHB Maintenance staff (names not recorded)

Nelson City Council Officers retain control of landfill gas supply (not interviewed)

Don Robertson (Tasman Projects Ltd) is retained by EFI as their local representative (not interviewed)

Appendix B

Site Photographs



Location and approximate pipeline route

	Landfill gas treatment plant, Flare in background
	Landfill gas treatment plant. Incoming gas is compressed, filtered, and chilled before sent to the hospital boiler via an underground pipeline. The gas is typically 55% methane and 45% carbon dioxide. Faults in the landfill gas collection system occasionally allow air ingress lowering this ratio. Such faults are monitored by the NCC and remedied quickly.

	View of the Flare and gas treatment station from the entrance to the landfill. The marker at the culvert indicates the gas pipeline, buried at 1 m depth. These markers are located at 200 m intervals on the 2 km pipeline route. The route is marked on the NCC District Plan maps
	Gas control valves at the Nelson Hospital site

	Gas fired boiler with coal fired boiler to the left

Appendix C

Energy Supplied by Nelson City Council

efi ENERGY FOR INDUSTRY

Energy for Industry
Nelson Landfill Gas Project
Energy Supplied By NCC

21 May 2007

Electricity	Device Tag	Units	January	January - March	March - June	July	August	September	October	November	December	January	February	March	April
Date of Meter Reading			11 Jan 06	5 Mar 06	29 Jun 06	3 Aug 06	1 Sep 06	2 Oct 06	2 Nov 06	1 Dec 06	10 Jan 07	1 Feb 07	1 Mar 07	2 Apr 07	1 May 07
Meter Readings															
Incomer Meter - Day	E	kWh / 48	-	12	384	528	736	960	1,157	1,276	1,340	1,684	1,896	2,132	2,364
Incomer Meter - Night	I	kWh / 48	-	88	128	228	312	420	508	560	600	760	855	962	1,064
Treatment Plant Meter		kWh	-	-	9,540	19,600	32,092	44,818	56,191	61,312	76,849	85,283	96,874	108,234	121,317
Actual Consumption															
Incomer - Day		kWh	-	480	10,752	6,768	9,224	8,808	7,348	4,372	10,796	5,908	8,096	8,448	8,480
Incomer - Night		kWh	-	2,400	1,580	4,020	3,468	4,840	3,520	2,876	5,248	2,788	3,800	4,208	4,096
Treatment Plant		kWh	-	1,940	9,548	10,068	12,492	12,516	10,581	6,121	15,537	8,434	11,591	13,360	12,083
NCC flare (by difference)		kWh	-	1,940	5,787	722	192	530	487	727	459	252	305	336	212
EFI proportion of total consumption				50%	62%	93%	98%	97%	94%	86%	91%	97%	97%	97%	98%
NCC proportion of total consumption				50%	38%	7%	2%	3%	6%	14%	9%	3%	3%	3%	2%
Meridian Rates (EXCL GST)															
MeridianPlus Daylight Day		c / kWh	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.80	20.80	20.80	20.80
MeridianPlus Daylight Night		c / kWh	11.24	11.24	11.24	11.24	11.24	11.24	11.24	11.24	11.24	12.49	12.49	12.49	12.49
EC Levy Charge		c / kWh	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.15	0.15	0.15	0.15
Calculated Charges - Energy Only															
EFI															
MeridianPlus Daylight Day		$	-	$ 48.48	$ 1,709.48	$ 1,274.26	$ 1,839.84	$ 1,634.47	$ 1,457.61	$ 861.41	$ 2,179.82	$ 1,181.84	$ 1,640.79	$ 1,914.25	$ 1,719.84
MeridianPlus Daylight Night		$	-	$ 101.88	$ 110.38	$ 421.15	$ 383.62	$ 475.26	$ 378.24	$ 308.87	$ 831.81	$ 337.33	$ 462.45	$ 521.69	$ 488.88
EC Levy Charge		$	-	$ 4.07	$ 20.04	$ 21.12	$ 26.29	$ 26.26	$ 22.12	$ 13.85	$ 31.87	$ 12.65	$ 17.39	$ 20.87	$ 18.39
Prompt payment discount	10%	$	-	$ (4.35)	$ (166.04)	$ (171.65)	$ (224.43)	$ (217.90)	$ (185.91)	$ (134.30)	$ (364.24)	$ (134.22)	$ (212.06)	$ (245.60)	$ (222.72)
TOTAL - INCL GST		$	-	$ 219.27	$ 1,674.90	$ 1,944.88	$ 2,009.89	$ 1,958.44	$ 1,672.26	$ 974.73	$ 2,658.36	$ 1,288.08	$ 1,908.57	$ 2,210.41	$ 2,015.47
- EXCL GST		$		$ 186.91	$ 1,428.20	$ 1,373.21	$ 1,795.44	$ 1,740.84	$ 1,458.49	$ 866.43	$ 2,279.92	$ 1,233.78	$ 1,696.50	$ 1,964.81	$ 1,788.79
NCC															
MeridianPlus Daylight Day		$	-	$ 18.48	$ 1,048.81	$ 92.89	$ 39.20	$ 44.14	$ 67.89	$ 102.33	$ 84.39	$ 37.81	$ 43.18	$ 50.43	$ 43.80
MeridianPlus Daylight Night		$	-	$ 101.08	$ 87.83	$ 36.70	$ 5.89	$ 12.33	$ 17.41	$ 24.27	$ 16.67	$ 10.49	$ 11.17	$ 10.88	$ 12.72
EC Levy Charge		$	-	$ 4.07	$ 12.15	$ 1.54	$ 0.40	$ 0.69	$ 1.02	$ 1.53	$ 0.92	$ 0.39	$ 0.48	$ 0.53	$ 0.47
Prompt payment discount	10%	$	-	$ (9.36)	$ (112.77)	$ (9.81)	$ (2.45)	$ (5.74)	$ (8.55)	$ (12.88)	$ (8.48)	$ (4.79)	$ (5.58)	$ (6.53)	$ (5.71)
TOTAL (INCL GST)		$	-	$ 214.27	$ 1,004.82	$ 113.62	$ 31.84	$ 51.43	$ 76.87	$ 115.37	$ 93.57	$ 43.12	$ 50.22	$ 58.81	$ 51.39
TOTAL															
MeridianPlus Daylight Day		$	-	$ 56.96	$ 2,777.90	$ 1,367.14	$ 1,853.25	$ 1,718.62	$ 1,524.78	$ 963.84	$ 2,263.80	$ 1,220.66	$ 1,683.97	$ 1,965.16	$ 1,763.64
MeridianPlus Daylight Night		$	-	$ 202.16	$ 197.59	$ 457.85	$ 388.90	$ 487.52	$ 395.50	$ 333.14	$ 858.48	$ 346.82	$ 474.62	$ 532.57	$ 501.59
EC Levy Charge		$	-	$ 8.15	$ 32.20	$ 22.65	$ 26.69	$ 26.95	$ 23.14	$ 14.38	$ 32.79	$ 13.04	$ 17.86	$ 20.80	$ 18.86
Prompt payment discount	10%	$	-	$ (13.71)	$ (279.77)	$ (181.18)	$ (227.88)	$ (223.64)	$ (194.46)	$ (121.17)	$ (272.84)	$ (139.01)	$ (217.64)	$ (251.14)	$ (228.43)
TOTAL (INCL GST)		$	-	$ 433.54	$ 2,808.82	$ 1,667.47	$ 2,050.92	$ 2,010.87	$ 1,748.23	$ 1,090.18	$ 2,882.24	$ 1,441.12	$ 1,958.79	$ 2,269.22	$ 2,066.66

Steam	Device Tag	Units	June	July	August	September	October	November	December	January	February	March	April
Date of Meter Reading			1 Jun 06	1 Jul 06	1 Aug 06	1 Sep 06	1 Oct 06	1 Nov 06	1 Dec 06	1 Jan 07	1 Feb 07	1 Mar 07	1 Apr 07	1 May 07
Meter Reading														
Total Steam Flow	FI	tonnes	6,039	6,701	7,189	8,036	8,441	8,793	9,093	9,702	10,647	11,561	11,979	12,891
Steam Generated		tonnes		662	488	848	405	352	276	608	745	714	814	926

Landfill Gas (based on steam generated)	Units	June	July	August	September	October	November	December	January	February	March	April
Boiler Efficiency	%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%
Steam Energy (92°C feedwater to 10 bar(g) steam)	MJ / tonne	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Energy Input into steam	GJ	1,589	1,171	2,038	967	848	648	1,534	1,788	1,714	1,954	2,198
Energy Input required in fuel	GJ	2,270	1,673	2,911	1,382	1,209	925	2191	2,554	2,448	2,791	3,141
Landfill Gas Price (excl GST)	$ / GJ	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Landfill Gas Cost (excl GST)	$	$ 1,135	$ 837	$ 1,456	$ 691	$ 603	$ 463	$ 1096	$ 1,277	$ 1,224	$ 1,395	$ 1,570

Appendix D

NMDHB Steam and Coal Data Summary 2004-2006

Energy for Industry
Nelson Landfill Gas Project

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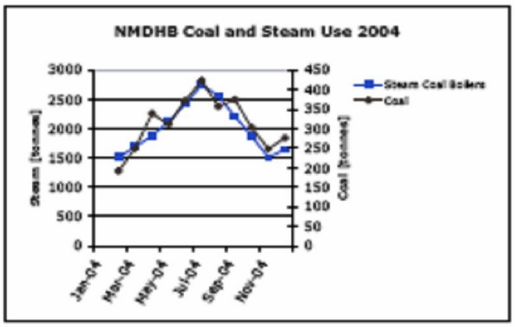
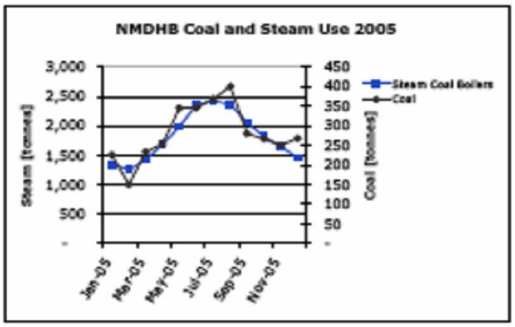
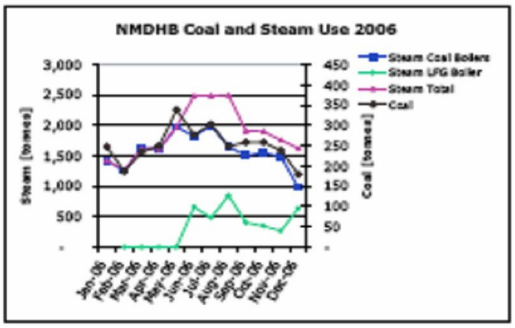
NMDHB Steam and Coal Data Summary 2004 - 2006

			Steam - Coal	Coal/ Steam	Steam - LFG	Steam - Total
	tonnes	MJ/kg	tonnes	t / t	tonnes	tonnes
Total 2004 - 2006	9,851		62,871		3,663	66,534
Average 2004 - 2006		21.47		0.1567		
2004						
Jan-04						
Feb-04	192		1,512			1,512
Mar-04	249		1,691			1,691
Apr-04	339		1,876			1,876
May-04	311		2,114			2,114
Jun-04	371		2,421			2,421
Jul-04	423		2,750			2,750
Aug-04	357	21.43	2,562			2,562
Sep-04	374	21.81	2,212			2,212
Oct-04	303	21.96	1,874			1,874
Nov-04	248		1,505			1,505
Dec-04	276		1,642			1,642
Total 2004	3,443	21.73	22,159	0.1554	-	22,159
2005						
Jan-05	226		1,347			1,347
Feb-05	150	21.61	1,252			1,252
Mar-05	233	21.29	1,416			1,416
Apr-05	254		1,685			1,685
May-05	345		1,985			1,985
Jun-05	345	20.93	2,356			2,356
Jul-05	369	20.99	2,427			2,427
Aug-05	401	21.43	2,366			2,366
Sep-05	280	21.59	2,056			2,056
Oct-05	267		1,817			1,817
Nov-05	251		1,640			1,640
Dec-05	268	21.69	1,460			1,460
Total 2005	3,388	21.36	21,807	0.1554	-	21,807
2006						
Jan-06	247		1,427			1,427
Feb-06	187		1,264		-	1,264
Mar-06	235		1,620		-	1,620
Apr-06	249		1,613		-	1,613
May-06	339		1,978		-	1,978
Jun-06	277		1,823		662	2,485
Jul-06	303		2,000		488	2,488
Aug-06	248		1,650		849	2,499
Sep-06	259		1,505		403	1,908
Oct-06	259		1,551		352	1,903
Nov-06	238		1,488		270	1,758
Dec-06	180		986		639	1,625
Total 2006	3,020		18,905	0.1598	3,663	22,568







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