

Helping firms cut greenhouse emissions in Melbourne's North 2012

NORTH Link and RMIT University GREENHOUSE AND ENERGY EFFICIENCY PROGRAM SUMMARY REPORT

December 2012

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The completion of such a project within such a short period of time would not have been possible without the efforts of many, including:

- **Students**

The nine final year Bachelor of Mechanical Engineering students, and the four Master of Engineering (Sustainable Energy) students from RMIT University, who worked so enthusiastically to complete the projects, and presented their findings with such flair and confidence at the public presentation to industry in November 2012.

- **Companies**

The eleven companies that hosted the energy-reduction research projects for students, and provided the support and mentoring that helped achieve the outstanding results documented in this report. Thanks also go to the many other companies that participated in the information dissemination program by attending seminars.

- **RMIT University**

RMIT University staff from the School of Aerospace, Mechanical and Manufacturing Engineering who assisted in the development and implementation of the program especially:

- Associate Professor John Andrews, Project Leader
- Dr. Sherman C.P. Cheung, Senior Lecturer, School of Aerospace, Mechanical and Manufacturing Engineering (SAMME)
- Professor Aleksandar Subic, Dean of Engineering and Head of School (SAMME)

The assistance of Dr Petros Lappas, Dr Matthew Bryson and Dr Bahman Shabani, Research Fellows in SAMME, in supervision of a number of student projects is also gratefully acknowledged.

Mick Butera
Executive Director
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Executive Summary

NORTH Link and RMIT University have been actively engaged in greenhouse emission reduction activities, since 1998 and have achieved many successes over that period. These activities were supported by the Australian Greenhouse Office until the end of 2008 when this organisation was disbanded.

In 2011, RMIT University and NORTH Link restarted their assistance to local industry in identifying and implementing emission-reduction measures through the reconfigured RMIT – NORTH Link Greenhouse and Energy Efficiency program. This program has been set up and run without government funding support, with participating firms making a small contribution towards the costs of running the program in return for the services they have received by way of the student projects completed.

In the 2012 program, thirteen RMIT engineering students have conducted projects with eleven firms located in Melbourne's north. The participating students comprised nine final-year Bachelor of Engineering students, and four Master of Engineering (Sustainable Energy) students. Overall, the research conducted by the students has been a great success with all participating firms set to make large energy savings as well as cutting greenhouse gas emissions.

If all the measures recommended by the thirteen RMIT students involved are fully implemented by the eleven firms in this year's program, the total greenhouse gas emission reduction potential would be around 13 000 tonnes of carbon dioxide equivalent annually, with annual savings in fuel bills to the firms being about \$1.2 million. The average simple payback period for the measures proposed is just under four years.

RMIT and NORTH Link will be running a similar program in 2013 and are keen to receive expressions of interest to participate from companies, councils and other organisations in Melbourne's north.

1 Introduction

Following the successes of its Greenhouse Challenge Support Programs over the period 2004-2008, NORTH Link and the School of Aerospace, Mechanical and Manufacturing Engineering (SAMME) at RMIT University restarted their assistance to local industry in identifying and implementing emission-reduction measures through the reconfigured RMIT – NORTH Link Greenhouse and Energy Efficiency program in 2011. The program has been set up and run in 2011 and 2012 without government funding support, with participating firms making a small contribution towards the costs of running the program in return for the services they have received by way of the student projects completed.

In the 2012 program, thirteen student research projects involving nine fourth-year Bachelor of Engineering (mechanical, manufacturing and aerospace) students, and four postgraduate Master of Engineering (Sustainable Energy) students working with selected firms, on the technical and financial evaluation, and implementation of identified emission-reduction measures, have been conducted.

As part of this work:

- Two seminars were held to:
 - Introduce firms, students and RMIT staff to the program
 - Allow students to present their findings and outcomes to invited representatives from Greenhouse Challenge firms in the northern region of Melbourne
- Student reports and findings were also presented individually to firms

The activities conducted by RMIT University were as follows:

Activity/outcome	Date of completion
Establishing undergraduate and postgraduate engineering student Greenhouse and Energy Efficiency projects involving students working with selected northern-region firms on the technical and financial evaluation, and implementation of identified greenhouse-gas emission-reduction measures.	30 March 2012
Project Proposal, including definition of project scope, activities, and Gantt chart project schedule	Friday 13 April 2012 (end of week 6, semester 1)
Seminar/training session 1: <ul style="list-style-type: none"> • For all potential and agreed participants in the student project program – students, RMIT academic staff supervisors, and company representatives • Provide background information on greenhouse issues and the Greenhouse and Energy Efficiency Program • Outline projects to be conducted and procedures Deal with queries from participants 	Friday 6 May 2012, 8.30-11 am

Thesis part 1: covering progress to date	Friday 20 May 2012 (end of week 11, semester 1)
Final project report in the form of a thesis for RMIT assessment	7 October 2012 (end of week 11, semester 2)
Final industry seminar: Oral presentations by students for public dissemination of findings, as part of the formal assessment in their courses (15% of marks – S2)	12 November 2012

The present report describes the activities conducted within and the outcomes from the RMIT– NORTH Link Greenhouse and Energy Efficiency program in 2012.

Section 2 describes the process followed in setting up and managing the projects, and disseminating project outcomes to all participating organisations and a much wider audience of industry and government representatives. Section 3 presents the outcomes of the research projects. Conclusions and recommendations are drawn in section 4.

Most importantly, summaries of the student projects conducted in this year's program are provided at the end of this report in Appendix A. Each presentation introduces the objectives and methodology for each project, gives the background to the company and its greenhouse gas emission profile, describes the emission reduction measures investigated, and summarises the potential emission reduction and economic benefits.

2 Student projects on emission reduction

2.1 Setting up the projects

Selection of the firms to host student projects on emission reduction was accomplished as follows:

- Mick Butera, Executive Director, NORTH Link, made an initial selection of potential firms
- Associate Professor Andrews and Dr. Sherman C.P. Cheung then visited all the short-listed firms to explain what would be involved in hosting a project and gaining provisional agreement for their participation in the program
- The list of eleven firms was then finalised, and a letter sent by NORTH Link to the firms for countersigning by the CEO, formally agreeing to host a student project.

RMIT Mechanical, Manufacturing, and Aerospace Engineering students have a choice as to topic selection for their final year project. The greenhouse program option was in competition with a range of other opportunities. In total there are over 100 students undertaking their final projects this year. The final year students to be involved in the greenhouse program were thus selected through the following procedures:

- A presentation by Associate Professor John Andrews of the opportunity at RMIT, in an information session to all (then) third year students in October 2011
- Advertisement of the opportunity at RMIT in February 2012
- Lecturers contacting students to encourage them to participate.
- Nine B. Eng. students signed up to be involved with the 2012 Greenhouse and Energy Efficiency Program.

In 2012 postgraduate students undertaking the Master of Engineering (Sustainable Energy) program by coursework at RMIT were also given the opportunity to conduct course projects with firms in the Greenhouse and Energy Efficiency Program. Four mature-age students enthusiastically took up this option.

Thus in total 13 students participated in this year's program and completed their projects.

Students were assigned to particular companies taking into account so far as possible the preferences they expressed. Each of the 11 firms were then visited by Associate Professor Andrews or Dr Sherman C.P. Cheung with the assigned student to introduce them to their company supervisor and agree on the ongoing working arrangements.

The final-year project component of the Bachelor of Mechanical Engineering and Bachelor of Aerospace Engineering at RMIT requires the submission of two milestone reports, one at the end of the first semester in early June, and the final thesis due in early October. The Master of Engineering (Sustainable Energy) students undertook their projects either as part of the course Sustainable Energy Systems and Design in semester 1 of the year, in which case their work on the program finished at the end of this semester in late June 2012; or for the course Energy Design Project (leading to a minor thesis), in which case their work was conducted over both semesters 1 and 2 and finished in November 2012.

The main RMIT staff involved with the program this year were Associate Professor John Andrews (Program Leader), Dr Sherman C.P. Cheung, Dr Petros Lappas, Dr Bahman Shabani and Dr Matthew Bryson, Research Fellows of Energy CARE Group, and Professor Aleksandar Subic (Head of SAMME and Dean of Engineering).

2.2 The projects initiated

Specifically the following projects were initiated within the program, involving 13 students working with 11 firms from the northern region of Melbourne (Table 1):

Company	Project	Students	Degree Program
Armstrong Industries	Improving energy efficiency of Corlon No.1 Oven	Chanon Lohachitranond	B Eng (Aero.)
BTI Logistics	Energy audit and follow-up	Arvind Dhaliwal	M Eng (Sustainable Energy)
Capral	Renewable energy proposal: Solar power system installation	Marco Mojarro	M Eng (Sustainable Energy)
Colonial First State	Building energy efficiency audit for the QV building	Amir A.F. Azmi	B Eng (Mech.)
Continental Australia	Reducing greenhouse gas emission for Continental Pty Ltd	Yihuan Yan	B Eng (Mech.)
Food Plastics	Energy audit for the plastic bottle production processes	Jeremy Kaddis	B Eng (Mech.)
Melbourne Water	Hydroelectric power from water flow between reservoirs	Jesse Zahra	B Eng (Mech.)
Melbourne Water	Pump energy benchmarking with Melbourne Water	Peng E. (Ernest) How	B Eng (Mech.)
Melbourne Water	Methane capture from settling pond	Mario R. Arredondo	M Eng (Sustainable Energy)
Nestle	Energy audit of food processing	Dhara P. Kakkad	B Eng (Mech.)
Olex	Energy Efficiency Opportunities for the 693 Extrusion Line	Varun Googoolye	M Eng (Sustainable Energy)
PWB Anchor	Energy audit for the chain and anchor production processes	Manpreetsingh Nanda	B Eng (Mech.)
William Adams	Energy audit and follow-up	Richeek Mohan	B Eng (Mech.)
11		13	9 B Eng 4 M Eng S E

Table 1 Participating companies, project topics and students in the RMIT-NORTH Link Greenhouse and Energy Efficiency Program 2012

The first seminar in the student project component of the program was held on 19 June 2012 at RMIT's Bundoora East campus. This seminar provided an update on the climate change issue internationally and nationally, and an overview of the student project component of the overall program. It also allowed students and company representatives to meet as a whole group and swap ideas and contacts.

The invitation to this seminar is included in Appendix B.

2.3 Final industry seminar: Student presentations to companies

Each student made an eight-minute PowerPoint presentation on their project and the main findings, including the emission reductions identified and the financial assessment of those measures, at a major industry seminar held at RMIT University on Tuesday 12 November 2012. The invitation and agenda for this seminar are included in Appendix B.

The seminar was very successful, attended by nearly 50 people including representatives of the host firms, many representatives from local industry, councils and the Victorian Government, along with RMIT staff and the students involved in projects.

To open the seminar, Project leader – Associate Professor John Andrews gave a short presentation on the role of sustainable energy in tackling the challenge of climate change and the latest statistical data released in The Australian Government's Energy.



Figure 1 Associate Professor John Andrews and Dr. Sherman C.P. Cheung with this year Greenhouse and energy efficiency program students

AProf. Andrews then introduced the student presentations in turn. After each presentation, the company supervisor gave a short comment on the company's experience with the program and their intentions with regard to implementation of the recommended emission-reduction measures. All spoke in a very positive way about the benefits of their project and commitments to putting into practice the recommendations. AProf. John Andrews offered comments and suggestions on the transferability of the findings to other firms.

3 Findings from research projects

The main findings from each of the research projects are presented in Table 2. The estimated reduction in annual greenhouse gas emissions for each measure investigated is presented, together with its capital cost, estimated annual savings, and simple payback period. In their reports and Powerpoint presentations students also estimated the net present value (NPV) of the benefits of each measure over its full lifetime, both at current real energy prices, and assuming an increase in these prices due to the carbon tax and emissions trading.

Overall, the research conducted by the students this year has been a great success with all participating firms set to make substantial energy savings as well as reducing their greenhouse gas emissions and gaining net economic benefits.

If all the measures recommended by the nine RMIT Bachelor of Engineering, and four Master of Engineering (Sustainable Energy) students involved are fully implemented by the eleven firms in this year's program, the total greenhouse gas emission reduction potential would be 13 000 tonnes of carbon dioxide equivalent annually. There is a further potential saving of over 17 000 tonnes/y if the theoretical potential for improving pump efficiency through an efficiency benchmarking exercise at Melbourne Water can be realised in practice.

For the measures where financial figures are available, the total annual savings in energy bills would be just over \$1 million per year, for a total capital investment of a little over \$5 million. The average simple payback period for all these measures would thus be about 5 years.

Summaries of the presentations made by students on their projects at the November industry seminar are provided in Appendix A, including the project aims, company profile, method, emission reduction and economic evaluation.

Company	Project	Students	Degree Program	Projected emission reduction (tonnes/yr)	Annual saving in fuel bills (\$'000)	Capital Cost (\$'000)	Payback period (years)
Armstrong Industries	Improving energy efficiency of Corlon No.1 Oven	Chanon Lohachitranond	B Eng (Aero.)	953	63.8	370	6
BTI Logistics	Energy audit and follow-up	Arvind Dhaliwal	M Eng (Sustainable Energy)	25.8	4.5	12.7	3
Capral	Renewable energy proposal: Solar power system installation	Marco Mojarro	M Eng (Sustainable Energy)	N.A. ¹	N.A.	N.A.	N.A.
Colonial First State	Building energy efficiency audit for the QV building	Amir A.F. Azmi	B Eng (Mech.)	729	82.4	115.4	1
Continental Australia	Reducing greenhouse gas emission for Continental Pty Ltd	Yihuan Yan	B Eng (Mech.)	T.B.C. ²	T.B.C.	T.B.C.	T.B.C.
Food Plastics	Energy analysis and reduction at Food Plastics Co.	Jeremy Kaddis	B Eng (Mech.)	569	50.5	12	0.2
Melbourne Water	Hydroelectric power from water flow between reservoirs	Jesse Zahra	B Eng (Mech.)	8412	769	4550	6
Melbourne Water	Pump energy benchmarking with Melbourne Water	Peng E. (Ernest) How	B Eng (Mech.)	17500*	8040*	N.A.	N.A.
Melbourne Water	Methane capture from settling pond	Mario R. Arredondo	M Eng (Sustainable Energy)	N.A.	N.A.	N.A.	N.A.
Nestle	Energy audit of food processing	Dhara P. Kakkad	B Eng (Mech.)	T.B.C.	T.B.C.	T.B.C.	T.B.C.
Olex	Energy Efficiency Opportunities for the 693 Extrusion Line	Varun Googoolye	M Eng (Sustainable Energy)	609	53.2	16.2	0.3
PWB Anchor	Energy audit for the chain and anchor production processes	Manpreetsingh Nanda	B Eng (Mech.)	1453	128.4	30.2	0.2
William Adams	Energy audit and follow-up	Richeek Mohan	B Eng (Mech.)	T.B.C.	T.B.C.	T.B.C.	T.B.C.
11		13	9 B Eng 4 M Eng S E	12749**	1152**	5107	

Notes: 1. N.A. – Not Available. 2. For lighting efficiency measures only

Table 1: Participating companies, project topics and students in the RMIT-NORTH Link Greenhouse and Energy Efficiency Program 2012

¹ N.A. – Not available

² T.B.C. – To be confirmed

* Theoretical potential, preliminary estimation

** Excluding Melbourne water pump energy benchmarking (see *)

4 Conclusions and recommendations

This program has once again provided the participating engineering students with highly valuable and practical career skills in energy auditing, and improving the energy and cost efficiency of industrial processes and equipment that will definitely enhance their employment prospects.

It has helped create a culture of environmental stewardship amongst both the students and within the participating firms that have hosted projects, making all parties more aware of the cost saving potential of greenhouse gas emission reduction measures. These benefits will persist well beyond the life of the program and thus will help achieve its capacity-building objective.

Overall, the program has provided the students with a great learning opportunity through working directly with firms to identify new and practical energy-saving measures. The firms have also benefited from the new ideas and cost free research capacity, cutting their fuel bills and meeting their greenhouse emission reduction targets.

The eleven firms involved in this year's program have the opportunity to cut their total carbon dioxide emissions by some 13 000 tonnes each year, if they implement all the measures proposed. Most firms indicated a high probability of implementation of the measures at the final seminar in the program.

The firms based in Melbourne's north who participated in the Greenhouse and Energy Efficiency Program have the potential to achieve annual savings of over \$1 million upon implementation of the recommendations made by the students involved in the program. The total capital investment needed to implement these emission reduction measures would be just over \$ 5 million so the package as a whole has provided a very attractive financial outcome for participating firms with an average simple payback period of around five years, with many options having payback periods of less than two years.

In view of the continued success of the program in achieving emission reductions, financial savings to firms, and raising awareness and expertise among students in this area, we will be running the program once again next year. RMIT and NORTH Link are thus keen to receive expressions of interest to participate from companies, councils and other organisations in Melbourne's north.

Appendix A: Summaries of Student Research Projects

Summaries of the presentations made by the students on their projects at the final seminar on 12 November 2012 are provided after this table.

Company	Project	Students	Degree Program
Armstrong Industries	Improving energy efficiency of Corlon No.1 Oven	Chanon Lohachitranond	B Eng (Aero.)
BTI Logistics	Energy audit and follow-up	Arvind Dhaliwal	M Eng (Sustainable Energy)
Capral	Renewable energy proposal: Solar power system installation	Marco Mojarro	M Eng (Sustainable Energy)
Colonial First State	Building energy efficiency audit for the QV building	Amir A.F. Azmi	B Eng (Mech.)
Continental Australia	Reducing greenhouse gas emission for Continental Pty Ltd	Yihuan Yan	B Eng (Mech.)
Food Plastics	Energy audit for the plastic bottle production processes	Jeremy Kaddis	B Eng (Mech.)
Melbourne Water	Hydroelectric power from water flow between reservoirs	Jesse Zahra	B Eng (Mech.)
Melbourne Water	Pump energy benchmarking with Melbourne Water	Peng E. (Ernest) How	B Eng (Mech.)
Melbourne Water	Methane capture from settling pond	Mario R. Arredondo	M Eng (Sustainable Energy)
Nestle	Energy audit of food processing	Dhara P. Kakkad	B Eng (Mech.)
Olex	Energy Efficiency Opportunities for the 693 Extrusion Line	Varun Googoolye	M Eng (Sustainable Energy)
PWB Anchor	Energy audit for the chain and anchor production processes	Manpreetsingh Nanda	B Eng (Mech.)
William Adams	Energy audit and follow-up	Richeek Mohan	B Eng (Mech.)



Project:	Improving energy efficiency of Corlon No.1 Oven
Company:	Armstrong World Industries
Researcher:	Chanon Lohachitranond

Project aims

- Analyse the current energy consumption and operation of Corlon No.1 Oven at Armstrong World Industries
- Identify options for improving overall energy efficiency and reduce the greenhouse gases emission of Corlon No.1 Oven
- Evaluate options in terms of greenhouse gas emission and operating cost reduction

Brief company profile

- Armstrong World Industries, Inc. is a global leader in the design and manufacture of floor and ceiling coverings. The company makes resilient vinyl flooring products and acoustic ceiling systems, and extended their manufacturing to Australia in 1960. Armstrong has two flooring plants in Australia, both in Victoria: at Braeside and Thomastown

Emission reduction measures investigated

- Replace existing electric heater with catalytic gas burner and shut off hot air flow to the oven

Method

- Investigations on the current Corlon No.1 Oven, including a mass-energy balance.
- Selection of a suitable alternative heater to meet the requirements
- Greenhouse gas emission, economic reliability analysis of the proposed system

Potential emission reduction

- Replace existing electric heater with catalytic gas burner could reduce greenhouse gas emissions by 953 tonnes per year
- The annual saving in electricity bills would be nearly \$64,000

Financial payback/net benefits

- Capital investment for catalytic gas burner is \$370,000. Payback period is 6.4 years



Project: BTi Logistics Energy Audit

Company: BTi Logistics

Researcher: Arvind Singh Dhaliwal

Project aims

- Determine the current annual energy (electricity and gas) consumption
- Propose measures that can be taken to reduce energy consumption
- Perform a triple bottom line analysis of the proposed measures

Brief company profile

- BTi Logistics is an Australian-owned company, which was established in Melbourne in 1981 as a privately-owned ocean freight forwarder, NVOCC. In the initial years, the company concentrated primarily on the U.S. inbound market requirements of its customers and gained a reputation for sound, reliable service in that area

Emission reduction measures investigated

- Installation of energy efficient lighting
- Elimination of power losses from appliances using timers or manual shut down

Method

- Analysis of building energy consumption
- Evaluation of electricity and gas usage of the selected company building

Potential emission reduction

- Higher energy efficiency lighting could reduce greenhouse gas emission over 40 tonnes per year

Financial payback/net benefits

- Annual energy saving from energy efficient lighting would be over 29,000 kWh, which will lead to savings of around \$7,000 on electricity bills. The overall payback period is just over 4 years

CAPRAL



Project:	Solar Power System Installation
Company:	Capral
Researcher:	Marco Mojarro

Project aims

- Assess the technical and economic feasibility study of an onsite solar power system
- Estimate potential reduction in greenhouse gas emissions
- Develop a preliminary design of the solar power system

Brief company profile

- Capral Aluminium is an Australian company established in 1936 by Alcan Aluminium of Canada. It is the largest Australian producer of aluminium extrusion profiles, employing 900 people and with operations in five states. The company supplies its products to fabricators in the automotive, building, mining, energy and other industries

Emission reduction measures investigated

- Solar photovoltaic power system for on-site electricity generation

Method

- Analysis of gas and electricity usage at Capral's Campbellfield site
- Design of the functional solar power system

Potential emission reduction

- Installing a solar system has the potential to supply 20% of Capral's annual electricity consumption

Financial payback/net benefits

- Capital investment will be \$230,000 and payback period is over 22 years



Global Asset Management

Project:	Improving the energy efficiency of retail based building
Company:	Colonial First State
Researcher:	Amir A.F. Azmi

Project aims

- Conduct level 3 energy audit of the site
- Identify potential opportunities for energy and cost saving
- Evaluate the prospects in terms of potential greenhouse gas emission reduction and net economic benefits of the managing company

Brief company profile

- Colonial First State Global Asset Management is the third largest property management and development group in Australia and New Zealand. It is a division of Commonwealth Bank of Australia and has an extensive portfolio of 38 shopping centres across Australia including Chadstone and QV in Melbourne and Chatswood Chase in Sydney

Emission reduction measures investigated

- Closing the voids in retail precinct using air curtain
- More energy efficient operation of CO sensors in the car park
- Installation of energy efficient lighting
- Building Automation System (BAS)/Building Management System (BMS) optimisation

Method

- Collect data on energy use at QV Melbourne
- Analyse energy consumption by end use gas and electric equipment, systems and services
- Compare current state with alternative measures
- Evaluate measures in terms of emission reduction and economic benefits

Potential emission reduction

- Implementation of the recommended measures could reduce greenhouse gas emissions by around 1194 tonnes per year

Financial payback/net benefits

- Annual reduction of energy usage would result over \$130,000 saving in energy bills. The overall payback period would be just over one year



Project:	Reducing greenhouse gas emission for Continental Pty Ltd
Company:	Continental Australia
Researcher:	Yihuan Yan

Project aims

- Analyse the current situation for electricity demand and amount of greenhouse gas emissions at Continental
- Develop a number of energy-efficiency and PV supply options for both the short-term and long-term
- Evaluate the options with respect to the reduction of greenhouse gas emissions and potential economic benefits

Brief company profile

- Continental Australia is a subsidiary of Continental Corporation, a leading multinational automotive components supplier with 169,000 employees in 46 countries. In Australia, Continental operates two world class manufacturing facilities with around 300 employees at Bundoora and Campbellfield, Victoria. The range of Continental's products includes instrument clusters, multifunctional displays, control units, radios, multimedia and navigation systems.

On-going project started in July 2012 to be completed by mid-next year



Project: Energy analysis and reduction at Food Plastics Co
Company: Food Plastics Co
Researcher: Jeremy Kaddis

Project aims

- Conduct energy audit
- Identify options for improving energy efficiency
- Evaluate options in terms of greenhouse gas emission reduction potential and economic benefits

Brief company profile

- Food Plastics Co. is a family-owned business specialising in the supply of quality plastic bottles to the food, dairy and beverage industries, was launched in 1999 with a single machine. With a combined 45 years experience in the food and beverage industry, the Directors seek to manufacture a high-quality reliable product that is competitive in the market

Emission reduction measures investigated

- Upgrade existing lighting system to improve energy efficiency
- Minimise compressed air leakage
- Install a capacitor bank for power factor correction

Method

- Identify and collect all the data required
- Thoroughly observe manufacturing machinery and operations practices
- Evaluate all the data and come up with solutions

Potential emission reduction

- Replacing T8 fluorescents with T5 LED lamps can reduce greenhouse gas emission by 31 tonnes per year
- Reducing compressed air leaks can cut greenhouse gas emissions by 55 tonnes per year
- Installing a capacitor bank for power factor correction can reduce emissions by up to 22 tonnes per year

Financial payback/net benefits

- Total investment for new lighting system would be \$6,700 and the payback period is less than 3 years
- Annual saving in energy bill by minimising compressed air leakage would be \$4,841
- Annual saving in energy bill by installing capacity bank would be \$2,061 and payback period is less than 3 years



Project:	Hydropower Station Design: A Feasibility Study
Company:	Melbourne Water
Researcher:	Jesse Zahra

Project aims

- Identify opportunities for using low head hydro-turbine in Melbourne water operations
- Evaluate these opportunities in terms of technical feasibility, greenhouse gas emission reduction, and cost effectiveness
- Assist in developing and recommend turbine and generator options for selected sites

Brief company profile

- Melbourne Water is owned by the Victorian Government. Melbourne Water manages water supply catchments, treat and supply drinking and recycled water, remove and treat most of Melbourne's sewage, and manage waterways and major drainage systems in the Port Phillip and Westernport region. Sustainability is a core principle and central to all its operations. Melbourne Water has set strong targets for greenhouse gas emission reduction – namely zero net emissions by 2018 – and plans to employ 100% renewable energy by that year.

Emission reduction measures investigated

- Low head hydro power generation at St Albans, Waverley, Mitcham Olinda, Mitcham Harris Gully, and Sydenham station

Method

- Visit sites and assess their individual viability
- Analyse potential power generation at each site with technologies available
- Perform a cost analysis of purchasing and installation
- Make recommendations about which solutions will be cost effective

Potential emission reduction

- Installing Francis hydroelectric turbines at St Albans, Waverley, and Mitcham Olinda stations, and a pump as turbine at Mitcham Harris Gully and Sydenham stations would save 8,412 tonnes per year

Financial payback/net benefits

- Initial cost of would be \$450,000 and payback period is just under nine years



Project:	Pump energy benchmarking with Melbourne Water
Company:	Melbourne Water
Researcher:	Peng E. (Ernest) How

Project aims

- Establish an effective pump efficiency chart that sets the threshold for pump performances
- Collect data from various water treatment centres and set up an energy efficiency parameter

Brief company profile

- Melbourne Water is owned by the Victorian Government. Melbourne Water manages water supply catchments, treat and supply drinking and recycled water, remove and treat most of Melbourne's sewage, and manage waterways and major drainage systems in the Port Phillip and Westernport region. Sustainability is a core principle and central to all its operations. Melbourne Water has set strong targets for greenhouse gas emission reduction – namely zero net emissions by 2018 – and plans to employ 100% renewable energy by that year

Emission reduction measures investigated

- Establish an effective pump efficiency chart to identify inefficient pump below threshold value

Method

- Establish global benchmarking
- Pump performance analysis

Potential emission reduction

- Improvement of pump performance has the potential to reduce electricity usage by 14.5 MWh/y electricity and hence lead to a reduction of 1750 tonnes per year in greenhouse gas emissions

Financial payback/net benefits

- Financial analysis was outside the scope of this project



Project:	Proposals for Dissolved Methane Gas Extraction from the Western Treatment Plant
Company:	Melbourne Water
Researcher:	Mario R. Arredondo

Project aims

- Investigate potential techniques that may be able to extract the dissolved methane gas in the water treatment plant effluent before it is released

Brief company profile

- Melbourne Water is owned by the Victorian Government. Melbourne Water manages water supply catchments, treat and supply drinking and recycled water, remove and treat most of Melbourne's sewage, and manage waterways and major drainage systems in the Port Phillip and Westernport region. Sustainability is a core principle and central to all its operations. Melbourne Water has set strong targets for greenhouse gas emission reduction – namely zero net emissions by 2018 – and plans to employ 100% renewable energy by that year.

Emission reduction measures investigated

- Existing technologies for extracting dissolved methane gas, including: activated carbon, ultrasound and degassing membrane

Method

- Literature review
- Perform a cost analysis of purchasing and installation
- Make recommendations about which solutions will be cost effective and which won't

Potential emission reduction

Not assessed

Financial payback/net benefits

- The estimated economic benefits show average annual savings of up to \$1.2M dollars



Project:	Energy Audit at Nestle Pty Ltd
Company:	Nestle Pty Ltd
Researcher:	Dhara Kakkad

Project aims

- Analyse the energy consumption in the company
- Reduce the leak in the compressor and make it more efficient
- Evaluate the options technically and internally of potential greenhouse gas emission

Brief company profile

- Nestle is a Swiss Multinational nutritional and health related consumer goods Company originated in 1866. Nestle Campbellfield produces all types of Nestle Chocolates and supply all over Australia and New Zealand. Nestle Australia has taken steps to reduce carbon emission and believes in sustainable environment

On-going project started in July 2012 to be completed by mid-next year



Project:	Energy Efficiency Opportunities for the 693 Extrusion Line
Company:	Nexans Olex
Researcher:	Varun Luvlesh Googolye

Project aims

- Review previous work done on extruders in terms of energy efficiency
- Identify energy efficiency opportunities for the current 693 extrusion line
- Quantify energy efficiency opportunities in terms of their economic and environmental potential

Brief company profile

- Nexans Olex is an Australian manufacturer of electrical cables with more than 65 years of experience servicing the Australian and Asia Pacific energy, construction and industrial markets. As Australia's largest power cable manufacturer, Nexans Olex is a well respected supplier, providing a full range of general purpose fixed and flexible cables as well as special purpose cables. Nexans Olex also provides specialist technical services, cable design and other value added services gained from our extensive experience in the cable industry. The main manufacturing and product development centre is at Tottenham in Victoria, Australia. This is also the Olex Holdings Corporate head office. In total, there are three Nexans Olex manufacturing facilities – Tottenham, Lilydale (Victoria) and New Plymouth (NZ), and all are quality certified to ISO 9001

Emission reduction measures investigated

- Improving the power factor of the 693 line with installation of a capacitor bank
- Improving the energy efficiency of plastic extruders

Method

- Theoretical calculations and on-site power quality measurements

Potential emission reduction

- Potential total emission reduction of 609 tonnes per year

Financial payback/net benefits

- Capital investment in the plant will be \$16,200 and simple payback period is just over 0.3 years



Project:	Energy Audit at PWB Anchor
Company:	PWB Anchor
Researcher:	Manpreetsingh Nanda

Project aims

- Perform level 2 energy audit of the plant at PWB Anchor
- Estimate the annual energy consumption and the greenhouse gas emissions
- Identify measures to minimize greenhouse gas emissions and energy use on site

Brief company profile

- The origins of PWB Anchor were in the amalgamation of the Bennett Chain Company and Pitt Waddell Pty Ltd in 1962, a company that merged in 1987 with Australia's premier hoist manufacturer of the time, Anchor Engineering. PWB Anchor's co-operative relationship with its international network of suppliers remains as strong today as in the early '60s. The ongoing exchange of industrial information ensures that PWB Anchor has ready access to the latest advances in chain technology and lifting equipment being developed within Australia and throughout the world

Emission reduction measures investigated

- Replace gate valves with ball valves on the air compressor system to reduce air leaks
- Shut down machines when in idle condition and reschedule production processes

Method

- Investigations on the current compressed air system
- Analysis of potential energy savings through reducing leaks
- Greenhouse gas emission impact, economic and reliability analysis of the proposed measures

Potential emission reduction

- Replacement of the existing gate valves with ball valves to minimise compressed air leakage could reduce emission by 625 tonnes per year
- Shutting down idling machines and re-scheduling the production processes to make more intensive use of furnaces could reduce emissions by 827 tonnes per year

Financial payback/net benefits

- Installation of ball valves on the compressed air system will cost around \$10,200 and the payback period is only 2 months
- Shutting down of idling machines and re-scheduling production process will cost around \$20,000 and the payback period is only 4 months

William Adams

Project:	Energy Audit
Company:	William Adams
Researcher:	Richeek Mohan

Project aims

- Conduct an energy audit at William Adams premises in Clayton, Victoria
- Identify options for reducing energy use and emission for detailed analysis
- Evaluate these options technically and internally of potential greenhouse gas emission reduction and net economic benefit

Brief company profile

- William Adams was established in 1926. William Adams supplies Caterpillar (CAT) products and provide services to construction, mining, agriculture, on-highway truck and marine market. Their services include sales, lease and servicing Caterpillar products. They have 22 branches in Victoria and Tasmania

On-going project started in July 2012 to be completed by mid-next year

Appendix B: Seminar Invitations and Agendas



School of Aerospace,
Mechanical and Manufacturing
Engineering



Invitation to Introductory Seminar Energy and Greenhouse Gas Reduction Projects 2012

Thank you for your support and participation in the projects comprising the 2012 RMIT – NORTH Link Greenhouse and Energy Efficiency program.

NORTH Link and RMIT University are delighted to invite you to this introductory seminar to meet students and the other organisations undertaking projects. Arrangements are in place for final-year Bachelor and Master of Engineering (Sustainable Energy) students to conduct 11 projects with 9 organisations during 2012, and further projects are due to start in July. This seminar provides a wonderful opportunity to hear brief introductions to the projects under way, and discuss various approaches to energy cost reduction.

Come and join us to meet all participants and students, and see a presentation on climate change issues and policy responses, Australia and internationally.

Following this introductory seminar, the B Eng students in the program will be making short presentations (15 minutes each) on their projects as part of their formal academic assessment. Industry hosts and representatives are welcome to stay on for these presentations as well if they wish.

Time: 8.30am – 10.00am, Tuesday 19 June 2012

Location: Building 253, Room 253.02.02
RMIT University (Bundoora East Campus)

*Enter off McKimmies Rd
Right turn from Plenty Rd heading north, at end of tram tracks
Take first left, then check with Security for directions. See map attached.*

...PTO

Agenda

- 8.30am Light breakfast
- 8.45 am Welcome
Professor Aleks Subic, Head, School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University
Mick Butera, Executive Director, NORTH Link
- 9.00 am *Greenhouse policy responses: Australia and the world
Energy and Greenhouse Gas Reduction Projects 2012*
Associate Professor John Andrews, School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, *RMIT University*
- 9.20 am Introductions to participating firms and students
- 10.00 am Close of introductory seminar
- 10.30 am – 12.45 pm** Presentations on projects by B Eng students as part of their formal academic assessment in their project course. Those attending the introductory seminar are welcome to stay on for these presentations if they wish.

RSVP to Deb Redmond: d.redmond@latrobe.edu.au





School of Aerospace,
Mechanical and
Manufacturing Engineering



INVITATION

"How to reduce energy costs in our carbon economy"

Featuring company case studies from: Armstrong World Industries, BTI Logistics, Capral, Continental Automotive, Colonial First State, Food Plastics, Nestle, Melbourne Water, Olex, PWB Anchor, William Adams

Date: Monday, 12 November 2012
 Time: 8.30am – 12.00pm
 Venue: Building 224
 RMIT University, Bundoora West Campus
 Plenty Rd, Bundoora 3083 (See map attached)
 Entrance to campus off Plenty Road, parking area marked.

RMIT University final-year Bachelor of Engineering and Master of Engineering (Sustainable Energy) students will present energy and emission reduction case studies undertaken this year with sixteen companies. These case studies will provide your organisation with a great opportunity to obtain and discuss new ideas on energy cost cutting and greenhouse gas abatement in the coming emissions trading era.

Agenda

8.00 am	Registration
8.30 am	Welcome and Introduction <i>Professor Aleksandar Subic, Dean of Engineering and Head of School, School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University</i>
8.45 am	Industry Case Studies <i>Chaired by Associate Professor John Andrews, SAMME, RMIT University</i>
10.30 am	Morning coffee
10.45 am	Industry Case Studies conclude
11.50 am	<i>Mick Butera, Executive Director, NORTH Link</i>
12.00 pm	Close

RSVP to Deb Redmond, NORTH Link, by 9th November 2012 by email to d.redmond@latrobe.edu.au Telephone 9479 3339 for further information.