Ms Cheryl Desha

Personal Details
Cheryl Desha
PO Box 120
Nathan, QLD, 4111

+61 (0)422 994 143
cheryl.desha@gmail.com

DOB: 18 July, 1976

Education

B.Eng (Environmental, First Class Honours) (Griffith University, 1999)
PhD Candidate (Griffith University, Jan 2010 Submission)

Employment

2000-2003 Environmental Engineer, Ove Arup and Partners (ARUP).

2004-Present Lecturer, Griffith School of Engineering.

2004-2006 Full Member (Deputy Project Director, The Natural Edge Project), Centre for Environmental Systems Research, Griffith University.

2004-2006 Present Full Member (Deputy Project Director, The Natural Edge Project), Urban Research Program, Griffith University.

Affiliations

2000-Present Member, Engineers Australia

Short Biographical Information

After graduating in 1999 from Griffith University's Environmental Engineering degree program (First Class Honours) and receiving a University Medal and Environmental Engineering medal, Ms Desha worked for consulting engineering firm Arup for four years, also undertaking eight months work placement within the Queensland government. In 2003 Cheryl joined the research team 'The Natural Edge Project' (TNEP an Australian based, non-profit, sustainability think-tank) in formal collaboration with Griffith University as a lecturer in the School of Engineering. She then helped move TNEP from Engineers Australia to Griffith University in 2007, where she became a full member of the Urban Research Program. Since 2003, Ms Desha has been the Co-Investigator on over 1.7 million dollars of research grants. Since 2005, and including works in development for 2010, Ms Desha has achieved 11.55 HERDC publication points, an average of 2.31 points per year. Working with the TNEP research team this has included co-authoring; 6 books, 5 book chapters, 5 journal articles, 13 conference papers, 5 industry reports, and 5 magazine articles. Furthermore, during this time, internationally Ms Desha has delivered 5 invited keynote and 6 invited speaking addresses, 5 invited presentations and has co-facilitated 2 workshops. In Australia Ms Desha has delivered 7 invited keynote and 18 invited speaking addresses, 8 presentations, 8 university guest lectures, and co-facilitated 8 workshops. In 2005 Ms Desha was selected as the Engineers Australia Young Professional Engineer of the Year. In the same year, she was a member of the TNEP team which was announced winner of the prestigious Banksia Award for Environmental Leadership, Education and Training for The Natural Advantage of Nations, and the Engineering Sustainable Solutions.

Together with the TNEP team, Ms Desha has developed a range of projects focused on education and training for sustainable development, including working with universities, professional bodies, government agencies, companies, schools and touring international keynote speakers including Hunter Lovins, Janine Benyus and Alan AtKisson. Ms Desha has worked with a range of international partners such as UNESCO, UNEP, Wuppertal Institute, University Leaders for a Sustainable Future, World Federation of Engineering Organisations, Chicago Climate Exchange, World Federation of Engineering Organisations, and the Rocky Mountain Institute. In Australia organisations include ANU, CSIRO, Engineers Australia, Purves Environmental Fund, Townsville City Council, National Framework for Energy Efficiency, HP, UniSA, KBR, VicUrban, Hatch, RMIT, GHD, QUT, and the Queensland.

Academic Career Goal

"*It is my academic career goal to further investigate options for nations to quickly build capacity for robust economic growth strategies that also reduce a range of environmental pressures. The core of my research and teaching agenda is based on an emerging framework of rapid curriculum renewal to embed new knowledge and skills into curricula. In particular my focus is on engineering and built environment education, and curricula that embeds knowledge and skills relating to advanced resource productivity improvements, whole system design and mechanisms for decoupling economic growth from negative environmental pressures.*"

Distinctions

- Australian 2020 Summit Delegate, *'Population, Sustainability, Climate Change and Water'* (2008)
- Member, Engineers Australia National Sustainability Taskforce (2005-2006)
- International Advisory Board Member (International Journal of Sustainability in Higher Education) (2005-Present)
- Judge, Queensland Division Engineering Excellence Awards *'Sustainability Category'* (2005-2007)
- *'Engineers Australia National Young Professional Engineer of the Year'* Award (also Queensland) (2005)
- Co-Recipient, '*Banksia Award for Environmental Leadership, Education and Training'* (2005)
- Co-Recipient, '*Year of the Young Engineer Award*', South Australia, Engineers Australia (2005)
- Co-Recipient, '*South Australian Engineering Excellence Award - Engineering Education & Skill Formation*', The Institution of Engineers Australia (2005)
- Co-Finalist, '*Australian Museum Eureka Awards - Allen Strom Prize for Education in Sustainability*' (2005)
- Invited participant, *'Engineers meet Parliament - Canberra'* (2005)
- Engineers Australia Nominee, Qld Smart Women Smart State Awards (2003)
- President (volunteer), Young Engineers Queensland, Institution of Engineers Australia (2003)
- Communications Team Leader (volunteer), International Young Professionals Summit, Gold Coast (2001)
- Queensland Ove Arup Scholarship for undergraduate excellence in engineering (1999)
- Griffith University Medal for Academic Excellence (1999)
- Griffith University Environmental Engineering Medal for Achievement in a Bachelor's Degree (1999)
- Philip Jones Environmental Engineering Award for commitment to Engineering (1999)
- Local Government Engineering Prize for overall achievement in Municipal Engineering (1998)
- Griffith University Academic Scholarship (1994)

Funded Research Projects ($40,000 or more)

Date: 2008 - 2012 *Competitive Grant (Co-Investigator)* *Value: $375,000*

Townsville City Council (Townsville Solar City Consortium), 'Behaviour Change for the Reduction of Energy Consumption in Residential Homes'.

Date: 2002 - 2005 *Non-Competitive Grants (Co-Investigator)* *Value: $290,000*

Multiple Sponsors including **Engineers Australia, CSIRO, RMIT Global Sustainability Institute**, ARUP, HATCH Engineering, Queensland Environment Protection Agency. 'The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century'.

Date: 2008-2010 *Competitive Grant (Co-Investigator)* *Value: $150,000*

Australian Government Department of Climate Change, Climate Change Adaptation Skills for Professionals Program, 'Water Transformed – Sustainable Water Solutions for Climate Change Adaptation'.

Date: 2007-2010 *Competitive Grant (Co-Investigator)* *Value: $139,000*

CSIRO Energy Transformed Flagship, 'Energy Transformed – Sustainable Energy Solutions for Climate Change Mitigation'.

Date: 2007-2009 *Non-Competitive Grant (Co-Investigator)* *Value: $116,000*

Purves Environmental Fund and **Griffith University**, 'Cents and Sustainability: Securing Our Common Future by Decoupling Economic Growth from Environmental Pressures'.

Date: 2006-2009 *Non-Competitive Grant (Chief Investigator)* *Value: $99,500*

National Framework for Energy Efficiency (NFEE), 'State of Engineering Education for Energy Efficiency - What is the state of education for energy efficiency In Australian engineering schools?'.

Date: 2007-2009 *Competitive Grant (Co-Investigator)* *Value: $80,000*

Griffith University, Aachen Foundation, CSIRO, and Conics Ltd, 'Factor Five: Transforming the Global Economy through 80% Improvements in Resource Productivity'.

Date: 2006-2009 *Non-Competitive Grants (Co-Investigator)* *Value: $200,000*

Port of Brisbane and **Griffith University**, 'Sustainable Living Challenge – High School Education and Sustainable Development'.

Date: 2005-2006 *Competitive Grant (Co-Investigator)* *Value: $47,600*

Hewlett Packard, 'Sustainable IT through Sustainable Product Service Systems'.

Date: 2004-2005 *Non-Competitive Grants (Co-Investigator)* *Value: $45,000*

UNESCO and the **Institution of Engineers Australia**, 'Engineering Sustainable Solutions Program'.

Date: 2007 *Non-Competitive Grant (Co-Investigator)* *Value: $40,000*

ACT Land Development Authority (in partnership with GHD), 'The Design of Sustainable Industrial Estate Developments'.

Date: 2005 - 2006 *Competitive Grant (Co-Investigator)* *Value: $40,000*

Department of Environment & Heritage, 'Whole System Design: An Integrated Approach to Sustainable Engineering'.

Books (Refer also Appendix 1: Endorsement for Publications)

- **Desha, C.** and Hargroves, K. (2010) *Engineering Education for Sustainable Development: A Guide to Rapid Curriculum Renewal*, TNEP, Earthscan, London. (In the final stage of development)

  This book will synthesise and contribute to the body of knowledge on the process of embedding sustainability within engineering curriculum, addresses key barriers to curriculum renewal to help to build momentum for a rapid and large scale transition in the engineering education sector. The authors have relied on the extensive experience and wealth of knowledge within a network of more than 40 researchers, practitioners and students from more 14 countries over 5 years.

- Smith, M., Hargroves, K., and **Desha, C.** (2010) *Cents and Sustainability: Securing Our Common Future by Decoupling Economic Growth from Environmental Pressures*, Earthscan, London. (Press)

  Funded by the Purves Environmental Fund and Griffith University, and carrying forewords from the most eminent leaders in the field of sustainable development, Dr Gro Brundtland and Prof Rajendra Pachauri, this book focuses on how to decouple economic growth from environmental pressures. Written as a response to the seminal book 'Our Common Future' the book focuses on merging economic growth with an environmental pressure reduction agenda, focusing on greenhouse gas emissions, air pollution, water extraction, waste production and the loss of biodiversity and natural system decline.

- Smith, M., Hargroves, K., Stasinopoulos, P., and **Desha, C.** (2010) *Energy Transformed: Sustainable Energy Solutions for Climate Change Mitigation – International Version*, Earthscan, London. (In final stage of development)

  Funded by the CSIRO, this book provides a comprehensive education and training package that brings together knowledge of how countries can achieve significant reductions in energy intensity, and associated greenhouse gas emissions. This book provides evidence that economies can realise at least 30 percent energy efficiency savings in the short term, while providing a strong basis for further improvement. It also provides an updated overview of advances in low carbon technologies, renewable energy and sustainable transport to help achieve a sustainable energy future.

- Smith, M., Hargroves, K., Stasinopoulos, P., and **Desha, C.** (2010) *Water Transformed: Sustainable Water Solutions for Climate Change Adaptation for Australia*, The Natural Edge Project, Australia.

  Funded by the Australian Federal Government, this online publication seeks to create a suite of freely available online training resources to support and assist education and training of students and professionals. This project will bring together leading research and practice in urban and industrial water resource management and supply to address key knowledge and professional skills training gaps. It will also bring together an up-to-date resource to provide professionals in the field with easy access to latest innovations and proven technologies in these areas.

- Von Weizsäcker, E., Hargroves, K., Smith, M., **Desha, C.,** and Stasinopoulos, P. (2009) *Factor Five: Transforming the Global Economy through 80% Improvements in Resource Productivity*, Earthscan, London. (To be released in German and Mandarin in 2010)

  In this update to the 1997 International Best Seller, Factor Four, Ernst von Weizsäcker works with a team of young Australians to present a compelling case for sector wide advances that can deliver significant resource productivity improvements over the coming century. The purpose of this book is to inspire hope and to then inform meaningful action in the coming decades to respond to the greatest challenge our species has ever faced – that of living in harmony with our planet and its other inhabitants.

- Stasinopoulos, P., Smith, M., Hargroves, K. and **Desha, C.** (2008) *Whole System Design - An Integrated Approach to Sustainable Engineering*, TNEP, Earthscan, London.

  Whole System Design is increasingly being seen as one of the most cost effective ways to both increase the productivity and reduce the negative environmental impacts of an engineered system. Published in partnership with the Australian Federal Government, UNESCO, and the World Federation of Engineering Organisations (WFEO), this book provides a clear design methodology, based on leading efforts in the field, and is supported by worked examples that demonstrate how advances in energy, materials and water productivity can be achieved through applying an integrated approach to sustainable engineering.

Book Chapters

- **Desha, C.** and Hargroves, K. (2009) 'Sustainable Development and Engineering Education', 'Environmental engineering', in: UNESCO (2009) *Engineering: Issues and Challenges for Development,* UNESCO.

- Hargroves, K. and **Desha, C.** (2009) 'The State of Engineering for Sustainable Development', in: UNESCO (2009) *Engineering: Issues and Challenges for Development,* UNESCO.

- Palousis, N., Hargroves, K., Smith, M. and **Paten, C.** (2005) 'Tomorrow's Technologies' in: Tate, A. (2005) *Towards a Sustainable Future*, Focus Publications, Sydney, pp 88 - 107.

- **Paten, C.** and Birkeland, J. (2005) 'Chapter 18 Greening the Built Environment' in Hargroves, K. and Smith, M. (eds) (2005) *The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century*, Earthscan, London.

- Hargroves, K., Smith, M., AtKisson, A., **Paten, C.** and Palousis, N. (2005) 'Chapter 23 Achieving Multi-stakeholder Engagement', in Hargroves, K. and Smith, M. (eds) (2005) *The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century*, Earthscan, London.

Refereed Academic Articles / Journal Papers

- **Desha, C.** and Hargroves, K. (2009) 'Surveying the State of Higher Education in Energy Efficiency, in Australian Engineering Curriculum', *Journal of Cleaner Production*, Elsevier, doi:10.1016/j.jclepro.2009.07.004.

- **Desha, C.,** Hargroves, K. and Smith, M. (2009) 'Addressing the Time Lag Dilemma in Curriculum Renewal Towards Engineering Education for Sustainable Development', *International Journal of Sustainability in Higher Education,* Volume 10 Number 2, 2009.

- **Desha, C.** and Hargroves, K. (2008) 'Education for Sustainable Development Curriculum Audit (E4SD Audit): A Curriculum Diagnostic Tool for Quantifying Requirements to Embed SD into Higher Education - Demonstrated through a Focus on Engineering Education', UNESCO International Centre for Engineering Education, *World Transactions on Engineering and Technology Education*, Vol. 6(2), pp. 365-372.

- Stephens, R., Desha, C, and **Hargroves, K.** (2007) 'The Philosophy and Practice of Water Sensitive Urban Design – is it Consistent with a Whole System Approach?', *Built Environment Design Practices (BEDP) Environment Design Guide*, August 2007, GEN14 8pp.

- Paten, C., Palousis, N., **Hargroves, K.** and Smith, M. (2005) 'Engineering Sustainable Solutions Program - Critical Literacies for Engineers Portfolio: Putting Sustainability as a 'Critical Literacy' into Mainstream Engineering Curricula', *International Journal of Sustainability in Higher Education,* Volume 6 Number 3, pp. 265-277.

Refereed Conference Proceedings

- **Desha, C.** and Hargroves, K. (2009) 'An Investigation into Increasing the Extent of Energy Efficiency Knowledge and Skills in Engineering Education', in proceedings of the 2009 Australasian Association of Engineering Education Conference, 7-9 December, Adelaide, Australia.

- Hargroves, K. and **Desha, C.** (2009) 'Doing More with Less through Factor Improvements: An Emerging Engineering Education Imperative', in proceedings of the 2009 Australasian Association of Engineering Education Conference, 7-9 December, Adelaide, Australia.

- **Desha, C.** and Hargroves, K. (2008) 'Mainstreaming EESD: Elements of Rapid Curriculum Renewal', in proceedings of the 2008 Engineering Education for Sustainable Development Conference, 22-24 September (Graz, Austria), EESD 2008, Graz, Austria.

- **Desha, C.,** Hargroves, K., and Smith, M. (2007) 'A Summary of the 'Engineering Education for Sustainable Development - Toolkit of Information & Teaching Material', in proceedings of AGS Annual Meeting 2007, Barcelona, Spain.

- Palousis, N., Hargroves, K., Smith, M. and **Paten, C.** (2006) 'Re-thinking Sustainable Solutions – Innovation Inspired by Nature'. In proceedings of 2006 Australian Rangelands Society: 14th Biennial Conference, 5–7 September 2006, Renmark, Australia,

- Hargroves, K., **Paten, C.,** Palousis, N. and Smith, M. (2005) 'Making the Profitable Transition Towards Sustainable Business Practice', proceedings of 2005 ASEE/AAEE 4th Global Colloquium on Engineering Education, Sydney, Australia, 26-29 September 2005.

Other Conference Papers (Non-Refereed)

- **Desha, C.** and Hargroves, K. (2007) 'Education for Sustainable Development: Elements of Rapid Curriculum Renewal in Engineering', paper presented to the Griffith University School of Engineering Research Conference, 29-30 October 2007, Logan.

- **Desha, C.** and Davis, G. (2007) 'Engineering Education for Sustainable Development: A Snapshot of global transitions, with a focus on the UK and Australia', Paper presented to the Griffith University School of Engineering Research Conference, 29-30 October 2007, Logan.

- Palousis, N., Hargroves, K., Smith, M. and **Paten, C.** (2006) 'Re-thinking Sustainable Solutions – Innovation Inspired by Nature'. Submitted to the Australian Rangelands Society: 14th Biennial Conference (Renmark, Australia), 5–7 September 2006.

- Smith, M., Hargroves, K., Palousis, N. and **Paten, C.** (2005) 'A Taste of Best Practice in Engineering Sustainable Solutions', proceedings of 2005 Environmental Engineering Society National Conference, 18-19 July 2005, Sydney, Australia.

- **Paten, C.,** Palousis, N., Hargroves, K. and Smith, M. (2005) 'How Do You 'Teach' Sustainability to Engineers? Introducing the Engineering Sustainable Solutions Program', in proceedings 2005 Environmental Engineering Society National Conference, 18-19 July 2005, Sydney, Australia.

- **Paten, C.**, Palousis, N., Hargroves, K. and Smith, M. (2005) 'How Do You 'Teach' Sustainability to Engineers? Introducing the Engineering Sustainable Solutions Program', 2005 Environmental Engineering Society National Conference, Sydney, 18-19 July 2005.

- Smith, M., Hargroves, K., Palousis, N., **Paten, C.** (2005) 'A Taste of Best Practice in Engineering Sustainable Solutions', 2005 Environmental Engineering Society National Conference, Sydney, 18-19 July 2005.

Industry Reports

- **Desha, C.**, Hargroves, K. and Reeve, A. (2009) *An Investigation into the Options for Increasing the Extent of Energy Efficiency Knowledge and Skills in Engineering Education*, Report to the National Framework for Energy Efficiency, The Natural Edge Project (TNEP), Australia.

- Hargroves, K., Smith, M., **Desha, C.** and Stasinopoulos, P. (2009) *Executive Summary: Action on climate change can help business competitiveness and economic growth*, 10th National Business Leaders Forum on Sustainable Development, The Natural Edge Project.

- Smith, M., Hargroves, K., Stasinopoulos, P. and **Desha, C.** (2008) *Analysis of the Costs of Inaction versus the Costs of Action on Climate Change for Australia*, Submission to the Garnaut Climate Change Review, The Natural Edge Project and Griffith Business School.

- **Desha, C.,** Hargroves, K., Smith, M., Stasinopoulos, P., Stephens, R. and Hargroves, S. (2007) *State of Education for Energy Efficiency in Australian Engineering Education—Summary of questionnaire results*, Report to the National Framework for Energy Efficiency, The Natural Edge Project.

- **Paten, C.,** Vance, P., Hargroves, K., Smith, M. and Palousis, N. (2004) *Inventory of Resource and Energy Usage Efficiency for Priority Industry Sectors in Queensland*, Queensland Environmental Protection Agency.

Published non-academic Articles

- **Desha, C.** and Hargroves, K. (2009) 'Re-engineering higher education for energy efficiency solutions', CSIRO ECOS, Issue 151, p. 16.

- Smith, M., Hargroves, K., **Desha, C.,** and Stasinopoulos, P. (2009) 'Factor 5 in eco-cement: Zeobond Pty Ltd', CSIRO ECOS, Issue 149, p. 21.
- Smith, M., Hargroves, K., Stasinopoulos, P., and **Desha, C.** (2009) 'Stand-out progress from our corporate first-movers', CSIRO ECOS, Issue 148, pp. 14-15.
- Hargroves, K., Smith, M. and **Desha, C.** (2007) 'Choices, the key to progress', *The Brisbane Courier Mail*, 1 August 2007.
- Smith, M., Hargroves, K. and **Desha, C.** (2007) 'Tuning into a deeper wisdom', *CSIRO ECOS*, Issue 138, p 18-19.

International Keynotes and Presentations

- 1-2 July 2010 - Invited Keynote (with travel expenses), 3rd International Symposium on Engineering Education, **Ireland**, Topic: "Rapid Curriculum Renewal for a Rapidly Changing World".
- 25 May 2009 – Invited Speaker, Australia-Japan Higher Education Symposium: Knowledge and Skills for Sustainability, **Japan**. Topic: "Rapid Curriculum Renewal towards Engineering Education for Sustainable Development.
- 30 January 2009 – Invited Presentation, School Assembly, Rosehill College, **Mauritius**. Topic: "Sustainable Development: What can we do?"
- 29 January 2009 – Invited Presentation, Rotary International, **Mauritius**. Topic: "Sustainable Development: What can we do?".
- 5–7 January 2009 – Invited Keynote, Fifth International Conference on Environmental, Cultural, Economic and Social Sustainability, **Mauritius**. Topic: "*Cents and Sustainability*".
- 16–18 October 2008 – Invited Speaker and Workshop Facilitator (with travel expenses), Asia Pacific Academy of Business in Society Annual Conference, **Singapore**. Topic: "*Energy Transformed: Responding to the complexity of the challenge of climate change*".
- 26-29 March 2008 – Invited Presentation and Panel Participant (with travel expenses), UN-Habitat hosted International Urban Training Centre Workshop, **Korea**. Topic: "*Curriculum Design & Renewal: Experiences – The Natural Edge Project*".
- 19 March 2007 - Invited Speaker (with travel expenses), 'Engineering Education for Sustainable Development Forum' hosted by MIT, **Spain**.
- 18–21 March 2007 – Invited Speaker, Alliance for Global Sustainability (AGS) Annual Meeting 2007: Pathways to Our Common Future, hosted by the Technical University of Catalonia, **Spain**. Conference paper and Poster. Topic: "A Summary of the 'Engineering Education for Sustainable Development - Toolkit Of Information & Teaching Material".
- 28 September 2007 – Invited Speaker, Asia Pacific Healthy Cities Forum, Gold Coast, **Australia**. Topic: "Environmental Climate Change & Impacts on Communities: The Role of Higher Education for Healthy Cities".
- 21 December 2006 – Invited Speaker, NISSAN Workshop in IPoS 2006 - Post-Meeting on Sustainability Education, 'How to deal with diversity in sustainability education?', **Japan**. Topic: "Engineering Education for Sustainable Development - Toolkit of Information and Teaching Material".
- 4–5 October 2006 – Invited Keynote, 2006 CLAIR (Japan Local Government Centre) and Townsville City Council Conference 'Grassroots Sustainability – International Lessons', Townsville, **Australia**. Topic: "Greening the Built Environment".
- 18-22 July 2006 – Invited Poster Display, International Earth Dialogues Conference, Brisbane, **Australia**. Topic: "Sustainable Living Challenge".
- 28 April 2006 – Invited Presentation to TuTech Innovation Life Sciences, Hamburg, **Germany.** Topic: "The Natural Edge Project".
- 28 September 2005 – Invited Keynote, Global Colloquium on Engineering Education (Star City), Sydney, **Australia**. Topic: "Transformational Change in the University Sector".

- 26 September 2005 – Invited Co-Keynote, Young Engineers Workshop, Global Colloquium on Engineering Education (Star City), Sydney, **Australia**. Topic: "The Natural Advantage of Nations".

- 5 July 2005 – Invited Presentation, Arup Office Presentation, London, **United Kingdom**. Topic: "The Natural Edge Project".

- 7 July 2005 – Invited Keynote, Earthscan Book Launch 'Natural Advantage of Nations', London, **United Kingdom**. Topic: "The Natural Advantage of Nations".

- 30 November 2004 – Invited Speaker, Showcase Presentation, 'International Young Professionals Summit, Griffith University, Brisbane, **Australia**. Topic: "The history of The Natural Edge Project and how to 'walk the talk' in making sustainability make business sense".

- 26-29 October 2004 – Invited Panel Member & Speaker, 2004 Engineering Education in Sustainable Development Conference (Catalunya University Polytechnic), Barcelona, **Spain**. Topic: "Engineering Sustainable Solutions Program - Critical Literacies for Engineers Portfolio: Putting Sustainability as a 'Critical Literacy' into Mainstream Engineering Curricula".

- 29 September 2004 – Invited Speaker, '2004 Australasian Association of Engineering Education Conference', 2nd Environmental Academics' Educators' Workshop, Toowoomba, **Australia**. Topic: "Engineers, Sustainability and Education: Sustainability Modules for Engineering".

- 6-19 July 2004 – Invited Tour Participant, AtKisson Inc, **Japan**. Topic: "Sustainable Development", Tokyo and Osaka, including participants from the National Institute for Environmental Studies, Japan (NIES) and Japan for Sustainability; along with meetings with the Japan Council, ESD-J, and the Japan Environmental Education Forum

Australian Keynotes and Presentations

- 7 December 2008 – Invited Speaker, Environmental Engineering College Workshop, **Brisbane**. Topic: "Education for Sustainable Development – An Update of Global Dialogue".

- 13 March 2008 – Invited Speaker, Department of Environment, Water, Heritage and the Arts, **Canberra**. Topic: "Frontiers Presentation: Education & Training to Achieve 60% by 2050".

- 25 February 2008 – Invited Speaker, Resilience Alliance 'Managing the Challenge of Climate Change', **Byron Bay**. Topic: "The Natural Advantage of Nations".

- 12-13 September 2007 – Invited Speaker, IDC Engineering Training & Learning Conference **Brisbane**. Topic: "The Importance of Sustainability in Engineering Education: A Toolkit of Information & Teaching Material".

- 11 September 2007 – Invited Speaker, IDC Engineering Training and Learning Conference, **Brisbane**. Topic: "The Importance of Sustainability in Engineering Education: A Toolkit of Information & Teaching Material".

- 7 September 2007 – Invited Keynote, EIANZ Far North Queensland Forum: E3P – The Third Wave of Environmental Practice, **Townsville**. Topic: "Education for Leadership in Environmental Practice".

- 1 June 2007 - Invited Speaker, Greenbuild and Renewable Energy Exhibition – GREX, **Sydney**, Australia. Topic: "*Overview of The Natural Edge Project*". (including a free booth at the exhibition)

- 29 May 2007 – Invited Keynote (Opening Address), Swinburne University 2007 Learning & Teaching Forum, Melbourne. Topic: "Learning to Inspire through Hope for a Sustainable Future".

- 15 April 2007, Invited presentation, Carrick EMAP Workshop, **Brisbane**. Topic: "Engineering Meta Attributes Project".

- 22 February 2007 – Invited Keynote, The Year of Women in Engineering Cocktail Evening, **Brisbane**. Topic: "The Changing Face of Women in Engineering".

- 22 February 2007 – Invited Presentation, Indonesian Minister's of Environment Visit 24 – 26 February 2007, **Brisbane**. Topic: "Education for Sustainable Development".

- 9 February 2007 – Invited Presentation and Panellist, Carrick Institute Leadership Conference, **Sydney**. Topic: "Opportunities for Early Career Academics to Lead, in Educating for the Future".

- 30 November 2006 – Invited Presentation, Centre for Environmental Systems Research Seminar Presentation, Griffith University, **Brisbane.** Topic: "The Role of Engineers & the Built Environment Profession in SD - Equipping Engineers & the Built Environment Profession with the 'Sustainability Toolkit' to Change the Way we Service Society's Needs & Wants"

- 20 September 2006 – Invited Presentation, Faculty of Environmental Sciences Seminar, Griffith University, **Brisbane**. Topic: "Engineering for the 'Next Industrial Revolution".

- 14 September 2006 – Invited speaker, Origin Energy, **Brisbane**. Topic: "Engineering Sustainable Solutions - Equipping Engineers with the 'Sustainability Toolkit' to Change the Way we Service Society's Needs & Wants".

- 22 August 2006 – Invited School Presentation (Assembly), **Hobart**. Topic: "Putting the Puzzle Together: Creating a Positive Future"

- 21 August 2006 – Invited Speaker, Pitt and Sherry Consulting, **Hobart**. Topic "Greening the Built Environment: The Natural Advantage".

- 21 August 2006 – Invited Speaker, Transend Power, **Hobart**. Topic "Greening the Built Environment: The Natural Advantage".

- 21 August 2006 – Invited Speaker, Young Engineers Australia Gen2X Dinner, **Hobart**. Topic "The Role of Engineers in Sustainable Development".

- 14 August 2006 – Invited Speaker - Master of Ceremonies, Engineers Australia Queensland – National Engineering Week Event: Engineering for young people, **Brisbane**.

- 17 July 2006 – Invited Speaker, Science & Engineering Challenge Dinner. Topic: "Putting the Puzzle Together: Creating a Positive Future", **Brisbane**.

- 11 July 2006, - Invited Speaker, Australian Science Teachers Association Conference 'CONASTA55', **Adelaide**. Topic: "Education for a Sustainable Future"

- 22 June 2006 – Invited Keynote Speaker, Griffith University Industrial Affiliates Program – Project Expo Day, **Brisbane**. Topic: "Youth in the future of information technology, engineering & science".

- 25 May 2006 – Presentation - Sustainable Living Challenge Launch, Coordinated and participated in the launch of Griffith University's role in the national Sustainable Living Challenge, **Brisbane**.

- 26 March 2006 – Invited Speaker, Townsville City Council and the Centre for Tropical Design 'Engineers Visioning a Sustainable Future' Conference, **Townsville**. Topic: "International and national trends in sustainable infrastructure".

- 31 March 2006 – Invited Speaker, Engineers Australia National Leadership Conference, **Sydney**. Topic: "The future direction of engineering in society".

- 16 November 2005 – Invited Speaker, Engineers Australia Queensland Division Young Engineers Breakfast Series, **Brisbane**. Topic: "Progress and Leverage Opportunities through Higher Education & Vocational Learning".

- 3 November 2005 – Invited keynote (Opening Address), Australian Campuses Towards Sustainability Conference, James Cook University, **Cairns**. Topic: "A perspective on embedding Sustainability in the Higher Education System in Australia".

- 15 October 2005 – Invited keynote, Engineers Australia Queensland Division Local Chapter conference, **Toowoomba**. Topic: "Managing Resources for a Sustainable Future: Achieving a a Natural Advantage in Resources Management, through a Whole of Society Approach".

- 26 September 2005 – Invited Keynote, Environmental Engineering Educators' Workshop, Global Colloquium on Engineering Education, Star City, **Sydney**. Topic: "Update on the trial of the Engineering Sustainable Solutions Program".

- 26-29 September 2005. Invited Speaker, Environmental Engineering Educators' Workshop, **Sydney**, Australia. Topic: "*Transformational Change in the University Sector".*

- 30 June 2005 – Invited Guest Speaker (evening presentation) to Bovis LendLease Staff, **Canberra**. Topic: "Greening the Built Environment".

- 4-5 April 2005 – Invited Presentation, National Business Leaders Forum on Sustainable Development, **Melbourne**, Australia. Launch of '*The Natural Advantage of Nations*' by the Rt. Hon Sir Ninian Stephen, Former Governor-General 1982-89.

Teaching Port-Folio: Griffith University (Refer Appendix 2: Practice Overview)

2010 Responsibilities

First Year Advisor, Nathan Campus (150 students – environmental and electronic engineering)
School Committee Member

Semester 1 – 1001ENG Engineering Practice & Sustainability (Common Course: Approx 150 on Nathan)
Campus Convenor: Coordination of 4-person teaching team on Nathan Campus, liaison with Gold Coast Campus Convenor to ensure comparability of course, and 2 1-Day Field Trips (all students), embedding of student retention initiatives

Semester 2 – 4207ENG/ 7407ENG Environmental Management Systems

Convenor (100%), Approx 120 students anticipated

Semester 2 – 2003ENG Engineering Design Fundamentals (35 Students)
Teaching team (50% of course) Whole System Design content taught as a 6-week module

2009 Responsibilities

School Committee Member

Semester 1 – Teaching buy-out (PhD Writing Semester; Draft submitted to Supervisor June 2009)

Semester 2 – 4207ENG/ 7407ENG Environmental Management Systems

Convenor (100%), 116 students (12 undergraduate, 56 on-campus, 48 off-campus)

Semester 2 – 2003ENG Engineering Design Fundamentals (35 Students)
Teaching team (50% of course) Whole System Design content taught as a 6-week module

2008 Responsibilities

School Committee Member

Semester 1 – 1001ENG Engineering Practice & Sustainability (Common Course: Approx 250)
Teaching Team: Sustainability Module (4 weeks); 2-Day Field Trip Coordinator (40 Environmental Engineering students). Significant renewal of course content to keep up with field, exam questions.

Semester 2 – 4207ENG/ 7407ENG Environmental Management Systems

Convenor (100%), 110 students (20 undergraduate, 24 off campus and 66 on campus masters)

2007 Responsibilities

Semester 1 – 1001ENG Engineering Practice & Sustainability (Common Course: Approx 200)
Teaching Team: Sustainability Module (4 weeks); 2-Day Field Trip Coordinator (Env students). Significant renewal of course content.

Semester 2 – 2335EVE Sustainability Principles & Practices (Approx 35 Students)
Convenor (100%) Teaching 70% of material. Significant renewal of course content.

Semester 2 – 4155/7135EVE Environmental Management Systems
Convenor (100%), 98 students (21 undergraduate, 45 off campus and 20 on campus masters), 12 special Singapore Class (externally enrolled, including a Singapore intensive teaching trip to teach in Week 10). Existing course content.

Semester 2 – 1003ENG Engineering Materials & Design (Common Course: Approx 150 Students)
Teaching Team: Sustainable Materials (3 weeks); Campus Contact (Env students). Content Creation.

2006 Responsibilities

Semester 1 – 1115EVE Introduction to Engineering & Sustainability (Approx 35 Students)

Convenor (100%) & teaching 100% of material, including 2-Day Field Trip. Significant renewal of course content.

Semester 2 – 2335EVE Sustainability Principles & Practices (37 Students)
Convenor (100%) & teaching 100% of material. Significant renewal of course content.

Semester 2 – 4155/7135EVE Environmental Management Systems (64 Students)
Convenor (100%) – flexible delivery course (18 undergraduate, 30 on campus and 17 off campus). Significant renewal of course content.

2005 Responsibilities

Semester 1 – 1114/1115EVE Introduction to Engineering & Sustainability (Approx 30 Students)
Convenor (100%) & teaching 100% of material, including 2-Day Field Trip. Creation of new materials.

Semester 2 – 2114EVE Professional Practice 2 (Approx 30 Students)
Teaching Team – teaching sustainability module within course. Creation of new materials.

Semester 2 – 4155/7135EVE Environmental Management Systems (98 Students)
Convenor (100%) – flexible delivery (14 undergraduate, 84 on campus). Use of existing materials.

Semester 2 – 1084EVE Materials & Design (Approx 35 Students)
Teaching Team: teaching 100% of course. Creation of 100% course materials.

2004 Responsibilities

Semester 2 - 1084EVE Mechanics and Materials (Approx 30 Students)

Re-wrote course for first year students, providing a new perspective on the material (curriculum development & powerpoint materials). More interactive classes (informal student presentations) and group assignment which encouraged students to think laterally about innovations in materials and their potential for use in society. Guest lecturers.

Semester 2 - 2114/2115EVE Professional Practice 2 (Approx 30 Students)

Through my collaborative role with The Natural Edge Project, I trialled part of a sustainability module that I had helped develop in the previous 6 months, in part of this second year course (2 weeks).

Semester 2 – 4115/7135EVE

Convenor (100%) – flexible delivery (19 undergraduate, 40 on campus and 17 off campus). Significant renewal of course content.

Key Teaching Related Grants:

Year: July 2008
Investigators: **C. Desha**, K. Hargroves
Amount of Grant: $5,000
Host Institution: Griffith University
Details of Granting Agency & Type of Grant: SEET Group Special Project Funding
Aim: Assistance to undertake copy-editing and publication preparation for the manuscript *Engineering Education for Sustainable Development: A Primer for Rapid Curriculum Renewal* (to be published early 2010)

Year: January 2005
Investigators: **C.Desha**
Amount of Grant: $900
Host Institution: Griffith University
Details of Granting Agency & Type of Grant: Environmental Sciences Faculty Grant
Aim: Internal funding to perform a search of sustainability resources relevant to staff education and research.
Contribution: Engaged and managed a research assistant to undertake this work.

Year: November 2004
Investigators: Dr P. Williams, **C. Desha**
Amount of Grant: 2004-2005: $3,000
Host Institution: Griffith University
Details of Granting Agency & Type of Grant: Signature Grant Application. This internal University Grant to engage staff, students and the community.

Other University Teaching and Curriculum Development

- **Queensland University of Technology** (QUT), Faculty of Built Environment and Engineering. The co-development, with C. Desha, of a Faculty-wide 'Introducing Sustainability' unit, including facilitating preparatory workshops, delivering base lecture material, and assisting in tutor training and support.

- **University of South Australia,** Louis Laybourne Smith School of Architecture and Design. The co-development, with K. Hargroves, of two coursework units for the Master of Sustainable Design, "Sustainable Design Theory - Sustainability and Society" and "Sustainable Design Theory - Sustainable Design Principles".

- **Griffith University and RMIT.** The co-development, with K. Hargroves, of a masters equivalent courses based on TNEP education programs, *'The Role of Engineers in Sustainable Development'.* Followed by the co-delivery, with K. Hargroves, twice in 2007.

- **University of New South Wales and Griffith University,** Sustainable Living Challenge. The co-development, with K. Hargroves, of a set of senior secondary education resources on sustainable development.

Guest University Lectures

- 11 October 2009 – Queensland University of Technology Masters Course (BEB903), **Brisbane**. Topic: "Engineering Sustainable Solutions: Tools for Capacity Building".

- 4 April 2007 – UQ Research Forum, **Brisbane**. Topic: "Short Presentation on Research Dissertation".

- 1 March 2007 – Royal Melbourne Institute of Technology – Monthly Meeting Research Presentation, **Melbourne**. Topic: "Embedding Sustainability within Engineering Curriculum".

- 19 September 2006 – Indonesian Ministry of Environment, International Executive Management Training Program, Griffith University, **Brisbane**. Topic: "Sustainable Built Environment: The Natural Advantage".

- 21 August 2006 – University of Tasmania, **Hobart**. Topic "The Role of Engineers in Sustainable Development".

- 10&17 May 2006 – Invited Student Lecture, **Queensland University of Technology**, 'MMB451 Energy Management', Brisbane, Australia. Topic: "*Profitable Greenhouse Solutions".*

- 21 July 2005 – Guest Lecture, University of Mauritius, **Mauritius**. Topic: "The Natural Edge Project – The Natural Advantage of Nations".

- 8 August 2005. Invited Guest Lecture, Centre for Environment Population and Health, Griffith University, **Brisbane**, Australia. Topic: "*Where does Sustainability Fit into the Picture?".*

- 21 July 2005. Invited Guest Lecture, University of Queensland Winter School, **Brisbane**, Australia. Topic: "Developing global guidelines & practices for sustainable design*".*

Co-Facilitation of Workshops

- 16 October 2008 – Invited Workshop with K. Hargroves, Asia Pacific Academy of Business in Society Annual Conference, **Singapore**. Topic: "MBA Graduate Attributes for Sustainable Business Practices" and "Sustainable Business Practices and Energy Efficiency in the Industrial and Commercial Sectors".

- 15 February 2008 - Invited Workshop with K. Hargroves, 6th Symposium on Accountability, Governance & Performance, **Brisbane**, Australia. Topic: "Developing Effective Strategies and Policies for Organisational Sustainability".

- 12 December 2007 - Invited Workshop with K. Hargroves, International Conference on Engineering Education and Research, iCEER 2007, **Melbourne**, Australia. Topic: "Elements of Curriculum Renewal to Embed Sustainability into Engineering Education".

- 7 December 2007 - Invited Workshop with K. Hargroves, Eighteenth Annual Conference of the Australasian Association for Engineering Education, **Melbourne**, Australia. Topic: "Emerging Engineering Education Curriculum for Sustainable Development".

- 12 December 2006 – Invited workshop with Mr Malcolm Wolski, Information Services, Griffith University, Annual Planning Retreat, **Brisbane**, Australia. Topic: "Senior IT Planning Workshop Sustainability Session"

- 15 November 2006 – Invited lead facilitator of a 1-day and 2-day Design Charrette, in collaboration with Townsville City Council and the Centre for Excellence in Tropical Design as part of the 2006 Ecotourism Australia International Conference, **Townsville**.

- 4-5 August 2006 – Contracted Workshop with K. Hargroves, Sustainability Education & Capacity Building Framework Workshop, KBR, **Brisbane**. Topic: "KBR Sustainability Education and Capacity Building Framework".

- 5-10 March 2006 – Contracted Workshop with K. Hargroves, Engineers Visioning a Sustainable Future Conference, **Townsville**, Australia. A full day seminar for professional engineers on sustainability and two half-day workshops for Year 12 high school students, and 1st Year Engineering students (James Cook University) respectively, all based on the Engineering Sustainable Solutions Program.

- 26 September 2005 – Invited Workshop with K. Hargroves and N. Palousis, Young Engineers Australia National Forum, **Sydney**, Australia. Two hour workshop with 190 young engineers focusing on their ability to effect real change in their workplace around the theme of sustainability.

- 23 October 2004 – Contracted Co-Facilitator with K.Hargroves, Sustainability Intensive, lead by Alan AtKisson at Imperial College, **London**, UK.

Industry Collaborations

- **KBR Government & Infrastructure**, "*Selected KBR staff attended workshops, courses and seminars by The Natural Edge Project (TNEP). These resulted in the development of an in-house sustainability program through which we will educate and support our wider staff in the Asia Pacific region as the field of sustainable engineering continues to develop. This program has set the benchmark for our global counterparts in KBR and has provided a robust framework upon which we can build a sustainable future. We will continue to collaborate with TNEP as we progress towards sustainability*." Bridget Kelly, Sustainability Technical Sector Leader, KBR Government & Infrastructure.

- **CSR Limited** (Diversified Manufacturing) TNEP worked with CSR limited to assist in the development of a position paper to the Board. "*Working with the team from TNEP was a pleasure and their professional expertise and operational understanding was evident right from the first meeting. TNEP have added a great deal to our understanding of sustainability and how it can relate to the industry segments with which we are involved. I would highly recommend them to others*." Martin Jones, General Manager, Government Relations, CSR Ltd.

- **Plastics and Chemicals Industry Association (PACIA) -** Sustainability Leadership Framework for Industry. Contribution to a discussion paper to communicate the value of sustainability to the plastic and chemicals industries and its stakeholders, as well as identifying priority areas and tools to assist the industries contribute to sustainability – in social, environmental and financial spheres.

- **Hewlett Packard** - The development of a White Paper, "Sustainable IT' through 'Sustainable Product Service Systems - a case study of Hewlett Packard". The research investigated and outlined the benefits of shifting to a product service model for the provision of IT services and the impacts on environmental performance of suppliers and customers.

- **Australian Plantation Products and Paper Industry Council (A3P) -** Contribution to A3P Sustainability Action Plan, 'performance, people and prosperity', launched at the 7th National Business Leaders Forum on Sustainable Development in Brisbane, 15 May 2006. The Plan raises 21 issues and lists specific actions for addressing each, including targets, measures, and reporting.

- **Santos** (Oil and Gas) Contribution with consulting associate, Dan Atkins of Sustainable Business Practices, to provide a range of services to Santos including; sustainability indicators selection, prioritisation and data collection; development of the 2005 Santos Sustainability Report and research to enhance the sustainability content of the Santos website.

- **VicUrban** (Urban Development) Contribution with VicUrban to assist in the development of a suite of Environmental and Urban Design Performance Measures and Indicators for Industrial and Business Park Developments. In collaboration with partners Janis Birkeland (research) and Hatch (review) to develop the Indicators.
- **HATCH** (Minerals Processing) Contribution to the development of training material focused on sustainability critical literacy skills, relevant to the minerals processing industry. The training materials strongly align with the leading sustainability tools within Hatch.
- **HASSELL** (Engineering and Project Management) Co-delivery, with K. Hargroves, of a briefing to the HASSELL sustainability team on issues related to energy and greenhouse gas emissions reductions.
- **SKM** (Engineering) Contribution to a briefing on issues related to energy and greenhouse gas emissions reductions.
- **GHD** (Engineering) Contribution to a national survey program to assess the skills gaps and requirements for increasing the capacity of the Australian economy to undertake energy efficiency assessments.
- **Environs Australia**. Contribution to the development of a database of best practice in local government sustainability.
- **Dell** – E-Waste Research and Education Grant. Contribution to research content on emerging trends and activities relating to E-Waste, to develop educational material for university students.

PhD Summary:

Status:

- Commenced August 2005 (Part-time)
- Confirmed July 2007
- January 2010 Submission

Thesis Question:

"How can embedding sustainability knowledge and skills within engineering programs be effectively undertaken, in the context of rapid curriculum renewal in urgent and challenging times?"

Supervisors:

- Primary: Professor David Thiel, School of Engineering, Griffith University
- Associate: Professor Neil Dempster, School of Education, Griffith University
- External: Professor John Fien, Professor of Sustainability, RMIT
- External: Mr Karlson Hargroves, Project Director, The Natural Edge Project (Griffith University and Australian National University)

Abstract:

This thesis is a dissertation about issues, challenges, processes, and resolutions that occur when curriculum renewal is sought in urgent and challenging times, focusing on a prime example within the candidate's field of engineering education. A literature review of challenges in engineering education for the 21st Century identified that engineering education for sustainable development is both urgent and necessary, yet there is not yet a significant shift in the curriculum of most engineering education institutions.

With this knowledge of the curriculum situation in one discipline within the higher education system, and drawing upon the field of curriculum renewal theory and personal experiences as an engineering educator and researcher, the literature and personal experiences were investigated to understand how rapid curriculum renewal might be undertaken in such a context.

The dissertation presents the investigation undertaken to identify a number of potential 'process elements' of curriculum renewal which could form a preliminary framework for rapid curriculum renewal in changing and difficult circumstances, which complements existing models, procedures and priorities for curriculum renewal. It is concluded that this theoretical framework could be studied further and applied in other disciplines experiencing similar imperatives for rapid curriculum renewal.

Methodology Overview:

In this dissertation, a slightly unorthodox mixed-method approach is used, situated largely within a qualitative research paradigm. The phenomenological research design was iterative and involved multiple methods, drawing from the perspectives of both an armchair theorist and field-based researcher, where:

- The armchair perspective is evident where the candidate has sought to ascertain the state of education for sustainable development and elements of rapid curriculum renewal through contextual and integrative literature reviews.
- The field-based research perspective is evident in a phenomenological approach that places particular emphasis on the individual's view, where the candidate draws in personal commitment to and involvement in projects that provide insights and potential learning out of the process.

In summary, the method to address the research question included literature review (contextual and integrative), autobiographical narrative, survey and peer-review to arrive at research findings grounded in documented evidence and personal experiences in the higher education sector.

Referees:

Academic Supervisors / Advisors:

Professor David Thiel
Former Head of School, Senior Lecturer,
Griffith School of Engineering
E: d.thiel@griffith.edu.au

Professor John Fien
Professor of Sustainability, Royal Melbourne Institute of Technology
E: john.fien@rmit.edu.au

Professor Roger Hadgraft
Director, Engineering Learning Unit, Engineering
University of Melbourne
E: roger.hadgraft@unimelb.edu.au

Professor Walter Leal Filho
Editor, International Journal of Sustainability in Higher Education
E: walter.leal@ls.haw-hamburg.de

Research Colleague:

Mr Karlson Hargroves
Research Fellow, Griffith University
Director, The Natural Edge Project
E: k.hargroves@griffith.edu.au

Mr Peter Stasinopoulos
PhD Student, Australian National University
E: peter@naturaledgeproject.net

Students:

Ms Natasha Smith (2004-2009, Undergraduate)
Bachelor of Environmental Engineering
E: angie.reeve@student.griffith.edu.au

Mr Giles Austen (2009, Postgraduate)
Environmental Management Systems
E: peter@naturaledgeproject.net

Professional:

Mr. David Singleton
Chairman, Global Infrastructure Business, Arup
E: bjgrear@netadvantage.com.au

Mr Philip Bangerter
Hatch - Global Director of Sustainability
E: PBangerter@hatch.com.au

Tony Marjoram, PhD, CPEng, FIEAust
UNESCO Engineering Sciences and Technology
Programme Specialist responsible for Engineering
E. T.Marjoram@unesco.org

Mr. Greg Bruce
Director, Integrated Sustainability Services,
Townsville City Council
E: Greg.Bruce@townsville.qld.gov.au

Appendix 1:
Endorsement for Publications

Endorsements for "The Natural Advantage of Nations" (Earthscan 2005):

Quotes from the Foreword Authors

"We have learned a lot of lessons since Natural Capitalism came out in 1999, that I think will make the next explications of this subject even more powerful and effective, so working with our Natural Project Edge collaborators I think shows great promise, these are very diligent and well informed people that I think are doing valuable work and we are looking forward to cooperating with them in ways that will help us all to learn faster and get more done better."

Amory Lovins, Co-Author of 'Natural Capitalism: Creating the Next Industrial Revolution', CEO Rocky Mountain Institute

"The continuing explosion of creative and determined efforts to build a world that is environmentally, economically, socially and humanly healthy is hope-giving…If this book's "to-do list for a sustainable civilization" is not worth the dedication of a life's work, what is?"

Alan AtKisson, Author of 'Believing Cassandra: An Optimist Looks at a Pessimist's World', CEO, AtKisson Group

"The Natural Advantage of Nations… shows that what many people saw as impossible just 15 years ago is now already happening. Within these pages you will see that there is reason for robust hope, and as you read, we hope you will be inspired to contribute to this magnificent re-evolution of human enterprise, a moment in our history when the things we make and build and grow can become a truly regenerative force"

William McDonough, Co-author 'Cradle to Cradle: Remaking the Way We Make Things', Partner, William McDonough & Partners

"Young people often ask me what gives me hope. Many things make me hopeful, but the best answer, just now, is this book… The numerous examples given here of profitable ways to improve the environment, human well-being and the bottom line. proves a belief that has grown in me for several years that while the tipping point of environmental devastation may be frighteningly close, the people with the commitment to implement the solutions we already know can solve the problems that are at hand."

Hunter Lovins, Co-Author of 'Natural Capitalism: Creating the Next Industrial Revolution', President, Natural Capitalism Inc.

Quotes from Australian Leaders

"I have been to a presentation given by some of the contributors to this book and found it inspiring as the editors were young professionals who got together to talk about sustainability issues and found that they were frustrated at not 'doing'. So they did by contacting key people in the field of sustainability and this book is the result."

M/s Leonie Newnham, MBA, DipEd, BA, Strategic Policies and Projects, Department of Sustainability & Environment, Victoria, Australia (International Federation of Surveyors Newsletter 3/05)

"The pivotal element of this process (sustainable development) is education, and I find it really heartening that so many people are thirsty for knowledge and wanting to implement the 'new' principals and methodologies that you (TNEP) have developed and promoted. The really exciting aspect is that this drive for a sustainable future is being led by an inspirational team of Australian young engineers, in a year when we are celebrating their wider role and contributions."

Professor Andrew Downing, President Engineers Australia 2004/05

"The editors of the Natural Advantage of Nations have put together an excellent compilation - not just of their own ideas on sustainability - but one that incorporates the ideas, attitudes and experiences of the world's leading authorities on sustainability. A book that is rich in anecdotal experience embracing all cultures and technologies. A book that is responsive to the urgent need for the education of engineers as well non technical leaders of all disciplines, who must understand and embrace the principles of sustainability to carry their businesses forward in the most competitive way, while preserving the environment for all current and future generations to enjoy. The Natural Advantage of Nations undoubtedly provides the urgently needed foundation for the new paradigm of sustainability - to promote its assimilation into every development in every sphere of industry and business around the world. I strongly endorse this book and its teachings."

Doug Jones, President Engineers Australia 2003/04

“Among the stewards of our country’s future, our young leaders are setting the pace to achieve a sustainable future. The Natural Edge Project reflects much of the Institutions thinking on sustainability and with their enthusiasm it’s bound to succeed. They’ve assembled an incredible network which will definitely ensure a positive triple bottom line and multi-sectoral involvement.”

Dr Peter Greenwood, President Engineers Australia 2001/03

“I am delighted at the achievements of two years of TNEP. The Sustainable Industries Division of the Queensland EPA is proud to have supported to project and we look forward to using the book and related educational modules. The TNEP book, The Natural Advantage of Nations, will be a very useful educational tool for government and industry in showing how to make the right steps toward a sustainable economy. The Natural Advantage of Nations will provide a graphic and compelling view of the kind of future we all might have if we truly commit to achieving sustainable development. I have ordered 100 copies of The Natural Advantage of Nations to help the sustainability leaders we have identified in Queensland industry and government. Relevant information about best practice and the lessons from industry innovators helps us build the momentum toward a Smart State economy, internationally competitive because of its sustainable industries.”

Dr John Cole, Executive Director, Sustainable Industries Division, Environmental Protection Agency Queensland

“It is time that we made a stand and started spreading the message of how important Sustainable Development is. We see that if our clients don't adopt sustainable principles then they will go out of business. If they go then we go to, enlightened self interest really. I am in wholehearted support of your book and see it as timely in its content and message.”

Steve Gale, Australasian Sustainable Development Leader, Hatch Engineering

“Arup’s interest in The Natural Edge Project arises from wanting to be a part of an initiative that showcases sustainability success stories in the Asia Pacific Region, raises awareness of the sustainability imperative, and that encourages collaboration between industry, academia, private and public organisations. We see this project as an opportunity to further network with other like-minded individuals and organisations.”

David Singleton, Chair, Global Infrastructure Business, Arup.

Quotes from International Leaders

"It is a great book following up on findings we published in Factor Four and linking it all to the business community. I also liked the emphasis on urban planning, and that in a highly unconventional manner. I shall quote Hargroves and Smith."

Ernst Ulrich von Weizsäcker, co-author of 'Factor Four' and the recently published 'Limits To Privatization'.

"I found NAON to be a encyclopedia on Sustainability and ideal for manufacturers that can not afford a Sustainability Expert... the book is a great way to learn and/or review all the key concepts and programs that are moving the world of Sustainability. It is a guide on how to position your company to profit or at least not lose out in this new world of manufacturing."

Marvin Klein, PortionPac Chemical Corporation

“A must read for anyone serious about understanding the global phenomenon and trend of sustainable development. This comprehensive and well-documented book shows specific examples of how sustainable innovation can and needs to transform our globally linked society and economy. While it's a dense read, it's an important book. We're using this book at the Chicago Manufacturing Center to generate ideas for our GreenPlants program that helps manufacturers change to sustain in an incredibly competitive global economy. Contrary to the popular idea that business and environmental and societal stewardship are at odds, the Natural Advantage demonstrates that the time for new multi-stakeholder collaborations between industry, government, and the global community is here.”

Karen Wan, GreenPlants Program Director Chicago Manufacturing Center

“CSIRO is pleased to be a sponsor of The Natural Edge Project, and of the book resulting from the efforts of its two prime movers, Charlie Hargroves and Michael Smith. "The Natural Advantage of Nations" promises to be a work of inspiring impact, bringing together as it does leading thinkers from business, economics, technology, innovation and the environment to tackle the major challenge of the 21st Century - sustainability. The book is built upon the premise that achievement of sustainability rests upon cooperation across business, government and civil society. It is widely understood that we must shift towards a sustainable future, and increasingly it is agreed that in order to do so we must move beyond rhetoric and into hard-edged, pragmatic forward steps. This book is a vital contribution to that forward movement, and I commend it to you.”

Dr Steve Morton Group Chair, Environment and Natural Resources CSIRO

“The book is a collection of articles about sustainability written by leaders in each of the fields. It's a useful source book for anyone interested in sustainability issues in all fields and is well indexed with an excellent range of references. The book is edited by Charlie Hargroves and Michael Smith. They are part of a team of young Australians known as The Natural Edge Project (TNEP) hosted by Engineers Australia. TNEP is a not-for-profit partnership that focuses on assisting nations to achieve a natural advantage through a whole-of-society approach to sustainability. The book contains a huge range of theoretical models and practical examples of sustainable principles in action. It would be of particular use for anyone requiring objective evidence of the impact of sustainable practices.”

Green Building Council Australia

“This volume pulls together thirty of the top thinkers in sustainability for a provocative and stimulating journey that happens to be easy to read. Its title echoes two famous works: Adam Smith’s Wealth of Nations and Michael Porter’s The Competitive Advantage of Nations, and it also gives a nod to an influential publication down under called Natural Advantage: Blueprint for a Sustainable Australia... The industrialized world, the essays contend, needs to focus not just on sustainable development but also on “sustainable re-development,” which would shift the focus from solving environmental problems to eliminating them. In the book’s view, businesses have the resources, management, leadership, and skills necessary to solve these problems; they just need to commit. And they should, because shareholder value is enhanced by a firm’s ability to nurture talent and new ideas, as well as its reputation and brand identity... impressive examples used throughout the book to drive home the point that innovation and sustainability go hand in hand...”

Cynthia D. Churchwell, a business information librarian at Baker Library, Harvard Business School, with a specialty in the international economy

“I teach hundreds of business school students every year. For many, my course is their first academic exposure to how business can, in the words of Interface Inc’s Chairman Ray Anderson, “take nothing, waste nothing, do no harm, and do very, very well by doing good”—good for the planet, for people and

for profits. I am finding that The Natural Advantage of Nations is the perfect text for getting this message of hope across in a very practical way. That's not to say it's short on theory. By no means! The reader is introduced to Porter's Competitive Advantage of Nations, Robert's Natural Step, the Lovins's Natural Capitalism, Stakeholder Theory and much more. For American students, who tend to be assigned rather parochial texts for the most part, The Natural Advantage of Nations is an eye-opener to the innovative initiatives occurring around the world. It can serve as a wake-up call for them to waste no time engaging in the tri-sector generation of solutions! I particularly like the way this book crosses traditional boundaries and bring insight into how students of business, engineering, and public policy, can and should all work together to build a powerful and positive future for all of us. Hargroves and Smith make a clear business case for the Triple Bottom Line--optimizing economic, social and ecological value for the enterprise. Through theory and case studies, they show that any size company in any industry can "pick off the low hanging fruit" of easy cost savings to invest in adaptations and innovations for the long term. With contributions from 30 leaders in the sustainability field, this book contains a wealth of practical, as well as theoretical, frameworks."

Janet Graaff, Instructor, University of Colorado Leeds School of Business

"This is a scholarly book providing policies, strategies and methodologies aimed at achieving global sustainability in human activities. While noting that many current policies are unsustainable the book takes a positive approach, unlike many previous commentaries on the environment and the future of the planet. An essential message throughout the book is that competitive advantage and sustainability of companies and/or nations are not mutually exclusive; there are many examples of companies increasing profitability because they change practices so that sustainability is improved. Michael Porter from Harvard Business School is quoted, "The notion of inevitable struggle between ecology and the economy grows out of a static view of environmental regulation, in which technology, products, processes and customer needs are all fixed." He goes on to say that in the real changing world, "managers must start to recognise environmental improvement as an economic and competitive opportunity, not as an annoying cost or inevitable threat." The book has been put together from contributions by many authors who have been brought together by a group called The Natural Edge Project (TNEP); this group has a great many members and cooperating partner and supporting organisations. The majority of members in TNEP are Australian with a small sprinkling of international supporters. The group includes a very broad range of specialisations so that they can comment authoritatively on economics, business practices, energy technologies, production technologies, city planning, transport, building design, education, ecological and social imperatives and government policies. The book commences with Forewords by five eminent international environmentalists and business people. This sets the scene for the overall thrust of the topic, which includes consideration of the need for a new approach to designing the future, incorporating sustainability as an element that brings prosperity and a better global society. There are specific sections covering natural advantage as a business imperative; policies to achieve a natural advantage of nations; sustainable cities for the 21st century; and a national collaborative approach for societies to work together. It is a book of over 500 pages and at times somewhat repetitive as different authors elaborate similar points. The two editors have clearly worked hard to achieve a consistent style throughout and to avoid overlap of themes, but they have not always achieved this. I would recommend the book as an excellent text for studies in economics and sustainability. It is also an important source of ideas for business and industry leaders, engineers, architects, government planners and society generally.

R H Brown, Manufacturing Society of Australia, April 2005

If you only read one book on sustainable development this year, make it The Natural Advantage of Nations. "Smart companies believe that sustainable development makes them more competitive and more resilient to shocks. It can also make them more at ease with employees, regulators, governments and society", says Bjorn Stigson, head of the World Business Council for Sustainable Development. This argument is at the heart of a new Australian book that draws together seminal texts such as Natural Capitalism and Competitive Advantage of Nations to build an overview of the 21st century business case for sustainable development. A raft of books has attempted this task, with varying degrees of success. The Natural Advantage of Nations has pulled it off, thanks in no small part to an impressive range of contributors, a who's who of sustainable development from Amory and Hunter Lovins to Alan AtKisson

on the international stage, and Phillip Sutton to Peter Newman on the local one. All up, the book incorporates the works of more than 30 sustainability leaders and plenty of case studies to illustrate key points along the way. Extensively researched and referenced … The book delves deeply into such thinking, providing a blueprint for business, civil society and governments in the age of sustainable development. Why is it needed? The world economy could grow fourfold in the next 50 years, according World Bank projections, meaning new development paradigms are needed to cope with spiraling eco-system pressures and resource demands."

Waste Management and Environment (WME) - Richard Collins

Endorsements for "Whole System Design" (Earthscan 2008):

Quotes from the Forewords

"I was thrilled and impressed reading this manual that features an integrated approach towards resource productivity and, ultimately, sustainability both at small and large scale. Each chapter in this book is self-explaining and self-sufficient, making for easy reading and teaching, but taken as a whole it is a wonderful contribution to engineering design, as you would expect from a book with this title. Good luck, readers, students, and teachers!"

Professor Ernst Ulrich Von Weizsäcker, Co-recipient of the 2008 DBU German Environmental Award and former President of the Wuppertal Institute for Climate, Environment and Energy, Wuppertal, Germany

"The authors have provided a publication which can, and must, be widely used in our university and technical training institutions. The examples highlight the simple application of the theory presented and make the book suitable for self learning as well as in classroom or tutorial use."

Mr Barry J. Grear AO, President, World Federation of Engineering Organizations (WFEO), 2007-2009, Paris, France

"The work of the Engineering Sustainable Solutions Program of The Natural Edge Project, and this publication, could not be more timely and relevant."

Dr Tony Marjoram, Senior Programme Specialist, Head of Engineering Sciences, Division of Basic and Engineering Sciences Natural Sciences Sector, UNESCO, Paris, France

"Implementation of the principles and concepts of whole system design can be effectively applied in the design and development of any type of system... I sincerely believe that implementation of the concepts presented will greatly facilitate... the design and development, production, and installation of future systems which are robust, reliable and of high quality, supportable, environmentally sustainable, and will be highly responsive in meeting the needs of the customer/user... I feel that following the guidelines presented within will lead to much success in the future."

Emeritus Professor Benjamin S. Blanchard, Department of Industrial and System Engineering, Virginia Polytechnic Institute and State University, Co-author of Systems Engineering and Analysis, Author of Logistics Engineering & Management

"Speaking recently, I outlined what I thought were the requirements for the engineer of tomorrow. I was quickly corrected. Today's engineer needs to be engineering with tomorrow already clearly in mind. This book encourages and leads today's engineer on a journey to meet tomorrow's needs. Systems thinking and asking the right questions opens up far more design options and solutions than we first think. And some of those solutions bring the breakthrough improvements that go far beyond the incremental. Like many books, this one seems a little too simple at first, but I challenge the reader who feels that way to jump to the back and look at the examples. Then go back and read again. There is real power in its simple approach. Engineers are often caught up in looking for the incremental improvement, but I would suggest that our current challenges need more than that. I'd encourage all engineers to look at this book. Dip into it at first, then, come back to it. There is an elegance in the approach it advocates. I had

a design lecturer once who commented that I had correctly answered the question, but that I might have done better by asking a very different question. I think he would like this book."

Martin Dwyer, Director, Engineering Practice and Continuing Professional Development (CPD), Engineers Australia

"'Whole System Design' is a comprehensive resource to support professional, academic and student engineers in complex problem solving around sustainability – an area of focus recommended by the 2008 Review of Engineering Education in Australia: 'Engineers for the Future'. As the book shows, engineers and designers can make a significant difference to the current global environmental crisis by reducing environmental impacts in the design phase of a wide range of projects."

Associate Professor Roger Hadgraft, Director, Engineering Learning Unit, Melbourne School of Engineering, The University of Melbourne, Australia, President of Australasian Association for Engineering Education

"The Natural Edge Project's 'Whole System Design' book will provide a valuable resource that can contribute significantly to technical design curriculum in university courses and professional training. I have used a whole system design approach, as is described and demonstrated in this book, to improve resource efficiency of products and industrial processes often by a factor of 2 or better. An exciting consequence of applying a whole system design approach is the drastically reduced need for end-of-pipe treatment, both in the local area and potentially in the wider air, soil and waterways. This book is the first free resource that I've seen that goes into sufficient detail for the reader to comprehensively grasp the concepts involved in a Whole System Design approach. A great attribute of the book is that it is not simply a set of a stand-alone ideas – it provides a strong foundation for embedding sustainable design into the popular design process already taught to students and professionals in Australia and around the world. It is evident that a great deal of thought went into ensuring that the ideas in the book could be quickly and easily integrated with current practices, and ensuring that the ideas are universally applicable to all engineering and technical design disciplines. I commend The Natural Edge Project for their efforts and the Department of the Environment and Water, Heritage and the Arts for supporting the project."

Adjunct Professor Alan Pears, School of Global Studies, Social Science & Planning, Royal Melbourne Institute of Technology, Australia, Co-Director of Sustainable Solutions

"I have gone through your Whole System Design Suite and am greatly impressed with what has been accomplished! The material seems to be VERY well organized, quite comprehensive, and quite complete. I like the rather unique approach in your material, addressing ALL categories of systems from a total life-cycle perspective, which facilitates broad application. Congratulations on producing an excellent package. It sounds like an exciting time ahead."

Emeritus Professor Benjamin S. Blanchard, Department of Industrial and System Engineering, Virginia Polytechnic Institute and State University, Co-author of Systems Engineering and Analysis, Author of Logistics Engineering & Management

"It is becoming increasingly clear that climate change and climate variability will have serious impacts on virtually every facet of our lives. While much work remains to be done to better understand the world's climate system, it is crucial that humanity rapidly innovates to reduce global carbon intensity whilst at the same time preparing for the inevitable impacts of climate change on communities, industries and ecosystems. Wherever possible, we must seek to convert adversity into opportunity. Solutions to these complex problems will inevitably involve a "whole of system" response - one that pushes the frontiers of innovation by bringing together knowledge and expertise at the boundaries of our traditional disciplines. Accordingly, the publication of this book is both timely and important given its focus on whole system design and I commend it to researchers, practicing engineers and designers."

Dr Andrew Johnson, CSIRO Group Executive, Environment, CSIRO, Australia

"Whole System Design underpins efforts to help get our societies onto sustainable pathways. This book is a much needed contribution providing, in detail, instructions on how to implement sustainable design

for green buildings, more eco-efficient products, ICT systems and fuel efficient cars to help us build healthy cities."

Dr Steve Morton, CSIRO Group Executive, Manufacturing, Materials & Minerals, CSIRO, Australia

"Climate change poses a significant challenge but also a great opportunity. Mitigating climate change successfully will involve transforming our energy systems. As part of this transformation, it is vital that existing technologies and designs are re-examined to identify new ways to make them more energy efficient. The Whole System Design approach presented in this book offers engineers an advanced strategy to enable them to achieve large energy efficiency savings. We urge you to read and absorb the book's whole system design framework and then see how whole system design can be applied to achieve large energy efficiency savings in the book's detailed technical case studies. For those interested in more examples of how a whole system design approach can be used to reduce greenhouse gas emissions we commend the online textbook 'Energy Transformed: Sustainable Energy Solutions for Climate Change Mitigation' by the same authors, which the CSIRO Energy Transformed Flagship funded."

Dr John Wright, Director, CSIRO Energy Transformed Flagship, CSIRO, Australia

"'Whole Systems Design' (WSD) developed by The Natural Edge Project (TNEP) will be an invaluable resource in the near future for the education of systems engineers on matters of sustainability and design. It provides a seamless link between the traditional system engineering design approach and the wider perspective of environmental and social effects that future engineers need to consider. The WSD material is lucid and concise but also has sufficient technical depth to be useful and challenging for all students in the tertiary sector. In particular, the high impact examples and case studies clearly illustrate the new systems thinking. I am already integrating the WSD book into the systems engineering curriculum of the ANU Engineering undergraduate programme. Students are being introduced to the WSD book in 2nd year (2007 and 2008) and the impact, in terms of sustainability awareness and responsibilities for future engineer practice, is immediate. The TNEP material is, therefore, already changing the perspective and thinking of our future engineers and aligning their design skills to address the global environmental challenges."

Dr Paul Compston, Associate Dean (Undergraduate), Faculty of Engineering and Information Technology, Australian National University, Australia

"We all have a major role to play in reinventing our business model and shaping our future, whether we are engineers, designers, governments, business people or entrepreneurs… small, simple steps won't cut it to deal with major global challenges of climate change and environmental degradation we are all facing. There are thousands of cases that demonstrate that, yes we can, transform these challenges into the foundations of a more sustainable, profitable, and desirable societal model. But where to start? What is the most effective, profitable and desirable way to implement the change we want to see? 'Whole System Design' provides essential, hands-on guidance to kick-start this next industrial revolution. This book moves the reader from thinking "hmmm… this is interesting" to "I'm gonna do this!" It reframes the future not as fate, but as choice. A choice each one of us can define, prioritize and execute."

Professor Serge de Gheldere, Founder and managing director of Futureproofed, Guest Professor and Director at Group T University College Leuven, Belgium

"The book 'Whole System Design' is a clever feat of engineering that bridges the traditional divide between technological and design thinking. It shows how we can cross the giant chasm between conventional and sustainable systems in small, easy steps – provided we start now. It should be read by all engineers as a matter of urgency."

Professor Janis Birkeland, School of Design, Queensland University of Technology, Australia, Author of Positive Development

"'Whole System Design' gives a comprehensive introduction to whole system design approach as the basis for transformative action. Education for Sustainability has to be more than 'bolt on' environmental

papers in existing programmes, and this is the best example I've seen of resources to support sustainability as an integrated and transformative driver."

Associate Professor Samuel Mann, Department of Information Technology, Otago Polytechnic, New Zealand

"As an environmental scientist & educator for 48 years and as Editor-in-Chief of the Journal of Cleaner Production for 17 years, I have supported the development of holistic, systems approaches to understanding human interactions with our eco-sphere upon which we are all totally interdependent. During that time it has become increasingly evident that many of our 'problems' have been caused or are being worsened due to the fact that 'experts' in science or technology proposed 'solutions' which caused unanticipated, negative consequences. This was/is due, at least in part, to the fact that many engineers and scientists did not have the benefit of a holistic systems-based education to help them to holistically define the problem(s) to be solved, and to develop holistic solutions. Global climate change, species diversity losses, habitat destruction, human population growth and abject poverty are illustrative challenges that require that we educate 'students of all ages' to help societies make the transition to sustainable societal patterns. In order to accomplish the urgently needed changes, educators and students must have sound educational materials, models, tools and experiences that provide them holistic and systems understanding. I am convinced that, The 'Whole Systems Design' (WSD) book developed by The Natural Edge Project (TNEP) team will, if widely used, contribute much to help societies make the urgently needed, holistic changes. My compliments and wholehearted support for the developers of this excellent material and to the organizations that are making it available to faculty and students, globally."

Professor Don Huisingh, Retired Senior Scientist in Sustainable Development and Editor-in-Chief of the Journal of Cleaner Production, Institute for a Secure and Sustainable Environment, University of Tennessee

"We see an urgent need for curriculum that develops professionals who can create sustainable solutions for society. This 'Whole System Design' textbook provides the rationale and information needed to incorporate academically rigorous sustainability content into curriculum for built environment professionals."

Wynn Calder, Director, Association of University Leaders for a Sustainable Future

"Whole System Design is an excellent aid for teaching sustainable development to engineering student who are not exposed to sustainability in any other engineering course."

Professor Rajaratnam Shanthini, Faculty of Engineering, University of Peradeniya, Sri Lanka

"I was buried in Whole System Design. It's a real little gem and I look forward to using it. It's very clear, straightforward and I love the examples. The online supports are also a tremendous facility and together they can play a significant role in practical terms in helping realise a sustainability informed engineering education curriculum globally."

Edmond Byrne, Department of Process & Chemical Engineering, University College Cork, Ireland

"The Industrial Pumping Systems Chapter is nice example that illustrates the point well."

Emeritus Professor Bruce R. Munson, Department of Aerospace Engineering, Iowa State University, USA, Co-Author of Fundamentals of Fluid Mechanics

"The Chapter on Domestic Water Systems within 'Whole Systems Design' developed by The Natural Edge Project (TNEP) eloquently captures the current household water challenge, that is, achieving both fit-for-purpose and efficient water use, to reduce the water footprint of this sector of the economy. Current data about water consumption, available technology, and cost across the life cycle of the technology; illustrate sensible, simple and appropriate design solutions for engineers looking to understand and implement best-practice water systems engineering. Capital and operating costs are included by TNEP through case studies, to confirm that water efficient design is the only way forward to meet water needs

for households, on a least cost basis, and a quality appropriate to purpose. In addition, the chapter will enlighten users on the environmental and economic benefits of moving from linear household water use, treatment and disposal systems, to more enclosed water use systems, through appropriate and sensible engineering design."

Nick Edgerton, AMP Capital Sustainable Share Fund, formerly of the Institute for Sustainable Futures at the University of Technology Sydney, Australia

Endorsements for "Factor 5" (Earthscan 2009):

"As economic, environmental, and security imperatives converge, advanced resource productivity is quickly rising to the top of the global agenda. But let's make no little plans: new technologies, artfully combined via integrative design, can now quintuple the work wrung from energy, water, and other resources. Building on our 1997 collaboration in Factor Four, and cross-pollinating with new findings in Australia and around the world, this exciting synthesis combines a powerful efficiency toolkit with farsighted policy insights-vital to ensure that efficiency's gains are not offset but reinforced to create a richer, fairer, safer, and cooler world."

Amory B. Lovins, Chairman and Chief Scientist, Rocky Mountain Institute, Co-Author of 'Factor Four'

"This book shows once again, even to the most conservative critics, that not only are significant improvements possible, they are more profitable, and when coupled with the understanding that reducing environmental devastation is critical, provide a vital message of hope for the future, which I have dedicated my life to help achieve."

Hunter Lovins, President, Natural Capitalism Solutions, Co-Author of 'Factor Four'

"The scientific assessment of climate change requires urgent action in mitigating greenhouse gas emissions. These could come dramatically from technological innovation, particularly in industries like cement and steel. These sectors could reduce emissions by 80% on an economically viable basis, which would be good news for world leaders and their negotiators on climate change. Factor Five provides several such win-win strategies."

Dr R K Pachauri, Chair of the Intergovernmental Panel on Climate Change, and Director-General, The Energy and Resources Institute, Delhi (TERI)

"Over the last few years, politicians have got used to mouthing some of the language associated with resource efficiency, zero waste and low-carbon wealth creation. But their actions still lack their words, and they are still way off the pace that is now required. So the arrival of Factor Five couldn't be more timely - or more significant."

Jonathon Porritt, Founding Director, Forum for the Future, UK

"A significant contribution to the current debate on how to maintain prosperity in a carbon constrained world. Sceptical government and corporate leaders will be surprised to find that a Factor 5 transition to a robust green economy is within their grasp employing various strategies that are both politically and economically attractive."

Jim MacNeill, Chairman Emeritus International Institute for Sustainable Development and Secretary-General, Brundtland Commission

"The exciting thing about Factor Five is the combination of boldness and realism. An 80 percent gain in resource productivity is precisely what is needed to get civilization back onto an economic path that is environmentally sustainable. This is a book that should be translated not only into English, Chinese, and German, but all the world's major languages."

Lester R. Brown, President, Earth Policy Institute

"The mounting concern about climate change has distracted attention from the fact that CO2 emissions are just part of the existential problem facing humanity. We need urgently to reduce our use of ALL the resources, not just fossil fuels. This new book is the best point of departure I know for doing that. The fivefold increase of resource productivity it describes is impressive, but perfectly feasible, and it would give the world a bit more time to learn how to adapt to ecological collapse. The book has two especially

important innovations. The authors deal seriously with the rebound effect, and they base their scenarios on a long term trajectory of rising energy prices."

Dennis Meadows, Co-author Limits to Growth and 2009 Japan Prize Laureate

"Is it possible to imagine a world where we can actually phase out fossil fuels before the climate phases us out? It's now feasible by reading Factor Five."

Peter Newman, Professor of Sustainability, Curtin University and author of 'Resilient Cities'

"No sustainable development without a sustainable development of companies. Factor Five provides compelling arguments and examples that sustainable business is achievable and profitable on a large scale and that companies play a key role in creating sustainable development. Factor Five confirms the crucial role of increasing eco-efficiency to foster sustainable development."

Stefan Schaltegger, Professor of Sustainability Management, Leuphana University

"The world needs radical eco-innovation to shape an opportunity out of the current crisis. This books provides excellent key examples in a systems perspective. Written by radical thinkers with a unique experience on how change can be managed, this book is a must-reading for both leaders and academics."

Prof. Dr. Raimund Bleischwitz, Wuppertal Institute, Co-Director 'Material Flows and Resource Management'. Professor at the College of Europe, Bruges/Belgium

"Some may have ignored the message of Factor Four 15 years ago. We can no longer afford to ignore it, and should now embrace the strengthened message of Factor Five."

Professor Bedrich Moldan, Senator, Czech Republic, Former Chairman, European Environment Agency, and former Czechoslovak Environment Minister

"We are living in the most exciting era of human history. We are in the process of expanding our perspectives from a focus on short-term economic and materialistic growth to a whole-system approach with true, long-term happiness for all at its core. We are adding the need for "sufficiency" to "efficiency" and "productivity" in our discussions on how to reduce human impacts on the Earth. Economy and ecology are not an "either-or" trade-off. We now know that both are critical in every aspect of society. We must advance science and technology based on values and vision. The "leapfrog" effect should be promoted in developing nations—not only in terms of technology but also in terms of lifestyles and societal values. Our urgent imperative is to figure out how to maximize happiness while minimizing environmental impacts. "Factor Five" provides the West and East alike with a compass to set our visions and to measure our progress."

Junko Edahiro, Environmental Affairs Journalist, co-Chief Executive, Japan for Sustainability

"Factor Five is the clearest non-partisan handbook on ecological renaissance available to date. It should be read by every policy maker and practitioner irrespective of their political position on global change."

Professor Calestous Juma, Harvard Kennedy School

"We all know what will happen if we go on producing and consuming the same way as in the twentieth century. But we don't really know how to produce and consume in the planet-friendly way. This is why we need this book. So urgently."

Brice Lalonde, French Climate Ambassador, former environment minister of France

"Strong economic signals and innovative technologies make a powerful combination, and are the best hope - indeed, the only hope - of the changes needed to protect the environment. Building on the robust foundation of Factor Four, Ernst von Weizsäcker and his colleagues write an inspiring manifesto for change to reduce resource use while minimising the impact on living conditions. If their recipe is sometimes over-optimistic, that is a good fault. The environment needs some optimistic friends these days."

Frances Cairncross, Exeter College, Oxford (Author of 'Costing the Earth')

"Climate change represents the biggest challenge our generation has experienced. Factor Five shows us through sustainable business practices we can achieve positive environmental and economic outcomes. They are not mutually exclusive concepts, sustainability is just good business."

Dan Atkins, Managing Director, Shaper Group

"Even if the climate were not changing, the need for the transition from fossil fuels to renewable, regenerative systems would be just as urgent. This is a recipe book for a far more economically rational world, as well as a more sustainable one."

Professor Janis Birkeland, Queensland University of Technology (QUT), and author of 'Positive Development'

"Every lawyer and lobbyist who is asked to defend 'Business As Usual' should read 'Factor Five'. This manual for re-engineering the future holds out both hope and profit in equal parts – if only we can get the political framework right, and align the lobbies with the interests of humanity."

Tom Spencer, Former Member of the European Parliament, Founder and Executive Director of the European Centre for Public Affairs, and Vice Chairman, Institute for Environmental Security

"Today, the world is faced by many challenges which all derive from the unsustainable practices with which we use our resources. Despite the most severe global economic crisis, resource prices have not retuned to the low price levels of the 1990's, demonstrating that we have to reduce our "resource obesity" as an economy and come to sustainable levels of resource consumption. A factor five improvement in resource efficiency is not only necessary, it is imperative for economies and companies to survive in a new resource and atmosphere-constrained world. This book not only clearly makes this point, but also shows that it is possible with what we know today. This key message makes this book essential reading."

Professor Ernst Worrell, Utrecht University, Lead Author, IPCC Working Group III, Fourth Assessment Report (2004 - 2007)

"Factor Five is about how to achieve the resource productivity gains that are necessary for the world to avoid a future with declining human wellbeing. It provides a clear way forward. In the past, the pursuit of efficiency gains has sometimes led to loss of resilience, resulting in unexpected and unwanted outcomes (like salinized irrigation systems). I applaud the Factor Five initiative, and urge it to embrace the equally important goal of maintaining resilience in the face of the looming global shocks confronting the world."

Dr Brian Walker, CSIRO Research Fellow, Resilience Alliance Program Director and Chair of Board

"Surely the ingenuity and creativity of human civilisation can rise above economic activity saddled with collateral damage? The opportunity to build new markets, new industries and new jobs while rebuilding ecosystem resilience is an exciting challenge. Are we up to the task of our future? Well, only if we act speedily. Read Factor 5 and rejoice that there are still options. Then ask what role you can play to make sure the global effort arrives in time and at sufficient scale."

Fiona Wain, Chief Executive Officer, Environment Business Australia

"Factor Five links together the two pillars of future planetary sustainability: (1) implementation of 'five-times' as productive technologies and systems across resource intensive industries and (2) adoption of new political frameworks and understandings for promoting rapid, ethical and just transition away from a prosperity that creates unacceptable environmental damage. We now have the tools! Do we have the courage?"

Professor Mary E. Clark, Author of Contemporary Biology, Ariadne's Thread, and In Search of Human Nature

"Factor Five is an essential reference which shows companies who were inspired to action by 'An Inconvenient Truth' how to radically reduce CO2 emissions AND reduce costs. It is one of the first books to feature worlds best practice sectoral case studies and then explain how they have achieved such large CO2 reductions cost effectively. It will help all CEOs identify significant cost saving opportunities and strategies to reduce risks in a carbon constrained future. We must all be committed to achieving significant greenhouse gas reductions -- and Factor Five shows us how!"

Molly Harriss Olson, Founder National Business Leaders Forum on Sustainable Development and Phillip Toyne, Director EcoFutures

“There is a paucity of publications which holistically address the needs seen in pursuing the goal of sustainable development in a realistic way. Factor Five is thus a welcome addition to the body of knowledge and literature available today, since it shows to both policy makers and society as a whole the various solutions and policy options which are available. All we need to do now is to implement them.”

Professor Walter Leal Filho, Hamburg University of Applied Sciences (HAW Hamburg)

“Factor Five is an important contribution to a growing corpus of work regarding energy and resource efficiency, work that is critical if the world is to meet the looming challenges of greenhouse gas emissions, sensible resource use, marketplace success, and global equity. Factor Five is especially appealing because it asks the right questions about what we do, why we do it, and, most importantly, how we do it. The authors have not only delved into the major resource-consuming systems we humans create, but rigorously explore how they can be improved – by at least five times or more.”

Cameron M. Burns, Senior Editor and Journalist, Rocky Mountain Institute

“Everyday and all around us, you can see the earths resources being wasted by us and our style of consumption, as if there is no tomorrow. Doing more with less has been around in many cultures for thousands of years, but not ours today, as you and me mostly don't do it at all. We all need to practice in our everyday work, business and home choices the immediate consideration and behaviours of using less in ways which allow both more and retention of a quality of life. If this new book, Factor Five, can provide us with inspiration from practical and meaningful examples then we better get on with it now, and start acting on it's tips. Bring Factor 5 into your consumption choices at home and at work, with your colleagues and friends and stop wasting our planet by 80% as if life on earth didn't count. Make Factor 5 your first choice not your last"

Greg Bruce, Executive Manager - Integrated Sustainability, City of Townsville

“The Climate Exchange concept has proved that once GHG reductions programs build momentum there is no limit to the innovation and creativity that can be harnessed within companies. And of course innovation will be a critical part of the solution. Factor Five shows the potential for major resource intensive sectors to significantly reduce greenhouse gas emissions in a cost-effective manner. Whether through emissions trading or other market-based mechanisms, our experience at the Chicago Climate Exchange and the European Climate Exchange has made clear that companies that lead to confront the challenge will be leaders in their sectors.”

Richard L. Sandor, Executive Chairman of Climate Exchange plc. (CLE.L), an AIM-listed company which owns the Chicago Climate Exchange, Chicago Climate Futures Exchange and the European Climate Exchange

“In an ever more crowded and production oriented world, the need to reduce the global ecological footprint and hence provide the ‘space’ for ecosystem services to support a healthy biosphere, is paramount. Factor 5, through its exploration of the interwoven roles of technology, regulatory and economic tools and socio-political frameworks in achieving greater resource use efficiency, provides the basis for transition to a lower footprint future. This is an important book not least because it provides clear directions for achieving a more secure and sustainable planetary future.”

Dr Ronnie Harding, Institute of Environmental Studies, University of New South Wales

“The authors articulate the technical and legislative solutions needed to drive massive resource efficiency and realign consumption patterns with natural renewal rates by taking a whole systems approach. It is obvious that our challenges have as much, if not more, to do with leadership and political will than with technical challenges. Factor Five provides case studies that challenge the status quo and will inspire every engineer, architect, and technician to strive for greater resource efficiency and address rapidly encroaching global constraints. At the same time, it provides a vision and road map for legislative solutions and a platform for elected officials to be purposeful leaders – exactly what we need right now to solve the most pressing problems human civilization has faced. A must read!”

Archie Kasnet, Partner, Aedi Group

“Throughout my experience as a young scientist across several countries, I have learned that working solely in environmentalism is not enough to tackle the problem of climate change; the integration of politics, science and the global economy are necessary to provide solutions. Factor Five embodies these principles and provides a clear path forward to realize the lowest hanging fruits in resource efficiency.”

Mary Louise Gifford, Energy and Resources Group, UC Berkeley

“As natural resources become more scarce and we begin to price water and carbon, resource productivity becomes a critical driver for future growth. This book will be an essential tool for all those who wish to understand and seize the opportunities of this future world.”

James Bradfield Moody, Executive Director, Development, CSIRO, and past member and co-founder of The Natural Edge Project

“A deeply-researched report on the increasing worldwide potentials of energy and water productivity. The authors are renowned experts in this vital field and show in this book where the greatest improvements are to be found. Essential reading!”

Hazel Henderson, Author of ‘Ethical Markets: Growing the Green Economy’, and President of Ethical Markets Media (USA and Brazil)

“We've seen some change since Factor Four was published 12 years ago, but more is possible, and much more is needed. There are still those in the building, construction, steel and cement sectors who argue that four to five fold efficiency gains are not possible, and policy makers who don’t understand what is needed to drive that change. Factor Five is a timely reminder of just what is possible, and a clarion call to policy makers that we need a new sense of direction and political decisions on framing conditions to realise that change.”

Maria Atkinson, Global Head of Sustainability, Lend Lease Corporation

“In the wake of a global financial crisis, climate change, water scarcity and energy security, the question of “Resource Efficiency” for many professional engineers and their clients is no longer why?, but rather how? Factor Five is the perfect companion for decision makers and solutions providers who are seeking the answers to that important question.”

Darren Bilsborough, Director of Sustainability, Parsons Brinckerhoff, and Adjunct Professor of Sustainability, Curtin University

“For too long politicians and industry, amongst others, have prioritised economic growth and regarded it as the key measure of success. Even when we became aware of the ecological impacts of that growth, we were reluctant to revise our thinking because of the perceived cost. Climate change now leaves us with little choice. All sectors have to face up to the fact that our future is indeed bleak if we do not mitigate greenhouse gas emissions dramatically and rapidly. We need to adopt a ‘whole systems approach’ to production, regulation, and consumption. ‘Factor Five’ sets out an agenda for achieving this and gives us hope that it may be achievable.”

Professor Juliet Roper, Associate Dean of Sustainability, Waikato University Management School and President of the Asia Pacific Academy of Business in Society (APABIS)

“Nobel Laureate Albert Szent-Gyorgyi (1893 - 1986) once said that "Discovery consists of seeing what everybody has seen and [then] thinking what nobody has thought." - and so it was with Factor 4. Genuine ideas staring us in the face until brought to light by people looking at it a little differently. The application of the ideas in Factor 5 will enhance ones design work, but the process and approach you will learn from reading it, can only enrich ones work and transform our society.”

Philip Bangerter, Global Director - Sustainability, Hatch Engineering

“The world faces numerous complex “diabolical” policy and technical challenges that are unprecedented in human history. How do we maintain prosperity, feed and power a growing population, and ensure healthy natural ecosystems in a carbon constrained, climate challenged future?? The challenge can only be addressed by a comprehensive, integrated response at global, national and local scales. This publication makes a significant contribution in responding to the global change imperative and should be required reading for politicians, industry leaders and ordinary citizens alike”

Dr Andrew Johnson, Group Executive – Environment, CSIRO

“Griffith University has long had a focus on the environment and sustainable development, and this work from some of our early career academics is another welcome contribution to the field. Facilitating the capacity for people to lead productive and fulfilling lives is a key role of the higher education sector and in the coming years we will see increasing emphasis on the importance of sustainability in that equation. Innovations in energy, water and materials use will need to be accelerated and progressively incorporated into university education. Griffith University co-hosts The Natural Edge Project and is a proud sponsor of this work which we think will make a significant contribution to addressing these needs.”

Professor Ned Pankhurst, Deputy Vice Chancellor (Research), Griffith University

“The Aachen Foundation Kathy Beys is proud to have supported the development of this book, to bring to the worlds attention the significant opportunities associated with resource productivity, balanced with many years of policy and operational understanding. The Foundation has been focused on progressing the ‘Factor X’ resource productivity agenda for more than 10 years, and we look forward to seeing the work in Factor Five become a reality over the coming decades.”

B. Stephan Baldin, Aachen Foundation Kathy Beys

“The two big challenges facing our generation are our population explosion (physical growth), and Climate Change (managing our natural resources). Leadership, vision and partnership are essential ingredients in meeting these challenges, and many governments around the world are now providing such leadership, particularly the US and UK governments, and also the Premier of Queensland who has called for a Climate Change Council of which I am honoured to be a part. But Government cannot meet these challenges without creative partnerships with Industry and the community. Factor Five is a crucial imperative, and hence the reason why Conics Ltd agreed to be a major sponsor in its development. Governments and industries around the world can find in the following pages a wealth of opportunity not only to significantly increase resource productivity but to reduce environmental pressures. I commend the team behind the book and look forward to seeing its lessons expanded and implemented across the globe.”

Jim McKnoulty, Chairman, Conics Ltd

“For too long, the deep, crucial issues of resource use efficiency and decoupling of production from material and energy throughput have lacked a coherent framework and synthesis. Factor Five provide this in a superbly timely fashion, setting out positive pathways for policy and practice - the book is a cause for optimism and action.”

Professor Stephen Dovers, Fenner School of Environment and Society, Australian National University

Endorsements for “Cents and Sustainability” (Earthscan 2010):

"I commend the team from The Natural Edge Project and their partners for undertaking to develop a response to 'Our Common Future' to mark its 20th anniversary. The focus of this new book, 'Cents and Sustainability', is to bring together significant evidence from the last 20 years to demonstrate that environmental and social sustainability and economic growth need not be incompatible but rather can reinforce each other. The book will cover a range of efforts, studies, policies and mechanisms designed to show how effective and proven strategies of achieving social and environmental sustainability are already helping economic growth."

Dr Gro Harlem Brundtland (Foreword)

“It gives me great pleasure to contribute this foreword to ‘Cents and Sustainability’ and support a response by our next generation to the seminal publication Our Common Future, following its recent 20th anniversary. The Natural Edge Project is to be commended for tackling this vitally important issue and highlighting where in the world already communities, regions and nations are creating solutions to this great challenge of our time.”

R. K. Pachauri, Chief of the Intergovernmental Panel on Climate Change (IPCC), accepting the 2007 Nobel Peace Prize on behalf of the IPCC (Foreword)

“The leitmotif of this book is how to decouple environmental pressures from economic growth while simultaneously making progress towards attaining the millennium development goals. It thus addresses a number of economic, social, and environmental dimensions of sustainable development. The book restates the case for reducing environmental pressures. Failure to do so will entail very high costs to ourselves and future generations; the technological means and the policy tools needed already exist and, in most cases, have been deployed in one country or another; finally, the costs of implementing a decoupling agenda are eminently affordable, amounting to only a few percentage points of future increases in GDP.”

Dr. Kenneth G. Ruffing, formerly Deputy Director and Chief Economist of the OECD Environment Directorate from 2000 to 2005 (Foreword)

“It is not wise simply to hope that our decision makers will make the right choices, especially given the fact that there are still powerful vested interests who do not want to see a transition to sustainable development. In the end, it is up to each and every one of us to leave as positive a legacy as possible to future generations. Cents and Sustainability, with its inspiring world class success stories, our earlier 1987 report to the United Nations entitled Our Common Future, and free online education and training packages by The Natural Edge Project will help empower you to play your part in helping achieve a sustainable future.”

Jim MacNeill, O.C., Secretary General, World Commission on Environment and Development, and Chief Architect and lead author of Our Common Future (1987) (Introduction)

"The members of the Natural Edge Project are representatives of Australia’s next generation of decision-makers and thought leaders. The Purves Environmental Fund is therefore delighted to support the work of this committed and talented team. Cents and Sustainability takes on the critical issue of how we can improve human welfare while not exceeding the limits of the natural world we inhabit. To quote Ray Anderson, 'How to do well and do good at the same time is the challenge'. This book addresses that challenge. As with the Natural Edge’s previous publication, The Natural Advantage of Nations, Cents and Sustainability is a tremendous achievement and a timely and important contribution. I commend it as essential reading for anyone who is concerned with long-term sustainability and prosperity."

Robert Purves, Chair, Purves Environmental Fund (Welcome Introduction)

Appendix 2:

Teaching Portfolio – Overview

Practice overview:

Engineering educators around the world are witnessing a significant shift in societal expectations of the engineering profession, to help address immediate and longer-term sustainable development challenges. Over the last few years in particular, there have been unprecedented calls for society to both mitigate greenhouse gas emissions, and to adapt to an altered climate regime.[1] Within the education sector, there has also been a global call for capacity building in the 2005-2014 Decade of Education for Sustainable Development. As sustainable development advocate and expert, Jonathan Porritt acknowledged at the 2007 Global Sustainability Forum on the future for engineering education, *"The 'business as usual' model, where profits come before sustainability, is absolutely finished. We now have a window of ten to 15 years to adopt a sustainable approach before we reach a global 'tipping point'- the point at which mankind loses the ability to command growth and development"*.[2] After graduating from Griffith in 1999, I re-entered academia in July 2004 with this educational philosophy in mind, with the aim of exploring how sustainability content could be improved within engineering education. In 2005 I began my PhD (part time) on this topic. After arriving at Griffith University I worked to move the research team for which I am the Education Director (The Natural Edge Project, TNEP), from the peak national engineering body (Engineers Australia) to be hosted by Griffith University and the Australian National University. This collaboration has been particularly exciting in being able to immediately apply theoretical learnings from research with TNEP to higher education teaching.

I am now in the final stages of writing my thesis and realise that I have been given a timely opportunity through this nomination, to formally reflect on the challenges and learnings from my teaching and learning journey alongside my research journey into engineering education for sustainable development. My research on the state of engineering education for sustainable development (EESD) could not find a rigorous global or national review of the discipline, which is problematic for engineering educators in addressing what needs to be done. As the World Federation of Engineering Organisations President and former President of The Institution of Engineers Australia, Barry Grear AO reflected to me last year, *'In light of the wealth of information available to the engineering profession, there is significant impetus to review what we do and how we do it. However, our references to Sustainable Development are for the most part still at too high a level. There must be a greater degree of detail provided by educators so that students have to think very carefully about the issues at hand. It is sobering for our profession to realise that this is not yet the norm for most of our engineers in training'*.[3]

I have spent the last 6 years exploring in collaboration with TNEP, how sustainability content can be creatively embedded within engineering curriculum, but moreover within the most pedagogically effective way possible for both small and large class sizes, and considering international audiences. The Griffith School of Engineering has provided me with a number of opportunities to ground-truth the challenges and practicalities of integrating sustainability content in these various situations: firstly for undergraduates, through embedding sustainable material content into a 2nd year mechanics and materials course (S2 2004-6, approx 30 students/year), teaching whole system design content in a 2nd year design (S2 2004, 2007-9 approx 30 students/year), working sustainability content into a 1st year introduction to engineering (S1 2005-9, approx 30 students/year); and secondly for postgraduates, through building the concept of 'beyond compliance' into an existing masters course on Environmental Management Systems 'EMS' (S2 2004-9, steadily increasing to 120 students/year). I have been most able to evaluate my progress over time with regards to my improvement in pedagogy and content through the EMS course, as course convenor being able to run it each year, rather than in my experiences as a course convenor and team teacher in other courses of the engineering program, which have changed significantly each year due to restructuring.

In 2005-6 I was also given the opportunity through 2 internal Signature Grant projects, to practice the tasks of awareness raising and curriculum development for sustainability within the engineering school, based on my research. In 2007 the (then) Carrick Institute invited me as an early career academic guest panel speaker, to the Leadership Forum Program in Sydney, where I shared my experiences and

[1] Desha C, Hargroves K, and Smith M. (2009) 'Addressing the Time Lag Dilemma in Curriculum Renewal towards Engineering Education for Sustainable Development', *International Journal of Sustainability in Higher Education,* Vol 10, Issue 2.

[2] Porrit, J. (2007) "Keynote Speech: Global Sustainability Forum: The Future for Engineering Education", http://www3.imperial.ac.uk/globalsustainability, accessed 12 July 2009.

[3] Grear, B. (2008) Personal Communications with the applicant, 29 August 2008.

challenges in trying to embed a new concept into an established program in a timely manner. This year the Griffith Business School requested *Environmental Management Systems* as a core subject in their Graduate Certificate of Sustainable Enterprise (now a formal collaboration with the Griffith School of Engineering), and I have just been given the responsibility of being the Campus Coordinator for the first year *Introduction to Engineering* course for 2010 (approx 100 students), which includes reviewing the content and structure of the course to strategically embed sustainability content, underpinning other foundational topics. I have co-authored a number of papers on research findings into the practicalities of embedding sustainability into engineering education, peer-reviewed a report commissioned by the federal government on the topic, sat on conference panels and journal editorial board, which have all been informed by my learning and teaching practices.

Approaches to Learning that Influence, Motivate and Inspire Students to Learn

I have tried to find motivational approaches that are also practical and efficient (given my ongoing PhD commitments alongside teaching), for both small class sizes (i.e. for the undergraduate courses in 2nd year), and very large class sizes for the first year course and masters environmental management systems (EMS) course, which has a combined masters class that is the largest within the SEET group in 2008 and 2009. I strongly believe that students will be inspired by sustainability content related to their discipline, given the potential for innovation and entrepreneurship. My focus has therefore been on ensuring that the documented content is comprehensive, academically rigorous and up to date (using content developed by TNEP), from which foundation I can then facilitate learning through either on-campus highly interactive classes, through to off-campus blended learning, with learning@griffith based interactions using the announcements page, discussion board and regular email contact. An example of this approach is my introduction of a frequently asked questions (FAQ) document for EMS in 2006 with the surge in student numbers (please see the course data summary in my curriculum vitae), to address the many queries about similar questions that I could anticipate from previous years in running the course. This online document has grown from 5 pages to 32 pages in 4 years, now providing a comprehensive conversational approach to answering questions under themes of queries, from assessment rationale and content considerations through to layout requirements and submission logistics. This format for addressing student questions still encourages students to critically think, learn independently and find answers for themselves, but in a supported environment.

My formal evaluation of my teaching began in 2004 with a self-written paper questionnaire to students, followed by the university questionnaires in subsequent years. I have tried to use similar questions each year, to gauge how my teaching practices have improved for the students' benefit. An example summary of upward trends in student satisfaction for Environmental Management Systems, related to the use of documents within the course and overall student learning, is shown below (see also the attached SECs). These comprise one standard question (the first question listed below), and two of my own generation: *1) How effective were the supporting resources used in this course in helping you to learn?; 2) How useful were the Frequently Asked Questions (FAQ) part of the Study Guide? (in 2006 this was introduced, and subsequently refined over the years); and 3) How effective was this course in increasing your knowledge about EMS*? The tabulated SEC data for the course supports the effectiveness of this tool to assist the large number of students in this course with their studies, with the students' response to the question about the FAQ document increasing from a mean of 4.6 to 5.8 in three years for postgraduates, and 5.1 to 5.5 for undergraduate students.

Year	Response Rate*	Responses (Mean) to the Questions [see above text]		
		Q1	Q2	Q3
2005	64%/ 40% #	5.4/ 5.2	-	5.8/ 5.2
2006	38%/ 47% ^	5.3/ 5.6	5.1/ 4.6	5.4/ 5.3
2007	35%/ 40% / 75% ^ ^	6.0/ 5.7 / 5.4	5.2/ 5.8 / 5.2	5.2/ 5.4 / 5.0
2008	65%/ 53%	5.3/ 5.3	5.5/ 5.8	5.4/ 5.7

** data represented as "undergraduate/ postgraduate responses/ Singapore class (2007 only)"*

 # Evaluation forms handed out in class, resulting in a high response rate (all on-campus students)

^ Relatively low response rates partly attributed to me not understanding the electronic evaluation system, and how to help remind students to fill in the evaluations (giving the correct links and explanations), which has improved over the years.

^ ^ Please note that the student response rates for this course are incorrect for 2007 (discussed with the Evaluation @ Griffith team, but nothing could be done), due to the issue of Singapore and Australian internal students responding using the same course code. Corrections are noted in this table.

Given the wide range of courses taught with this approach of comprehensive documentation supported by high levels of student participation in class and online (rather than passively teaching from powerpoint), I have also sought detailed feedback on the resultant student experience from a current student who has experienced all of my key courses taught to date. Their reflective written feedback on this is quoted below:

To whom this may concern, I am happy to write this letter to express my support for Cheryl Desha's application. I have had the opportunity to be a student in three of Cheryl's courses as a part of my Environmental Engineering degree (1115EVE: Introduction to Engineering and Sustainability; 2335EVE: Sustainability Principles and Practice, and 4155EVE: Environmental Management Systems). These courses adeptly introduced to me the concepts of sustainability, and broadened my knowledge and understanding of the field beyond a commonly quoted definition to include practical design methodologies (including accessible case studies which showed their effectiveness), emerging fields of study (both within engineering and across disciplines) and illuminated for me many alternative career possibilities as an environmental engineer of which I had previously been unaware. I can say with some confidence that it was the first time I, along with many of my peers, had heard of these concepts, and been so inspired to continue my studies and pursue a career as an environmental engineer. This was perhaps more notable as I felt it contrasted somewhat with most of my other courses, which while still for the large part were aimed at environmental engineers, I felt were still not able to incorporate sustainability as an integral component. I found Cheryl to be an inspiring teacher. Her courses were demanding in their expectations, but were presented in a way which was engaging and easy to follow. I found the information to be relevant and up to date, and her personal enthusiasm for the material, and field of environmental engineering, encouraged me also to look beyond the traditional roles of engineers. Cheryl made herself available to provide additional assistance to students, and seemed always pleased to be able to give further clarification to ensure we all understood the course content and requirements. I know that for myself and for many of my colleagues, these courses have been amongst the more influential of my degree to date. I would not hesitate to recommend Cheryl for this award, as I feel her teaching was exceptional, and the courses she presented invaluable.

Angie Reeves, final year engineering student, 0415 175 930, s2572515@student.griffith.edu.au

Using this approach, over the last 6 years I have moved from being a prolific user of powerpoint with hundreds of slides per lecture, to relying on tailored course notes which then inform interactive and reflective discussions with students about the knowledge, using powerpoint very occasionally, and guest speakers for stimulus quite often. The receptivity of students to this changed style has been significant, as observed in the high mean scores in the annual SEC results for EMS, and the 2007 SET scores for the same course (Q2, Q3, Q6) between 5.3 to 6.00 (30-35% response rate across undergraduate and post graduate students).

Development of Curricula and Resources that Reflect a Command of the Field

My motivation for joining Griffith University as a staff member was in seeing the potential to trial and fine tune content developed by my research team TNEP (which I have contributed to building to various degrees, see www.naturaledgeproject.net 'curriculum and course notes'), with undergraduate and postgraduate students (i.e. including a significant research-led teaching approach). Hence, in the spirit of the modular content being intended for use by 'anyone anywhere' who is a competent teacher with a science or engineering background, I have taken every opportunity available (through program restructuring, staff sabbaticals, and course renewal) to incorporate approximately 40 hours of the 130 hours of rigorous content freely available online, to use in existing courses within the engineering program. Within the TNEP team, I have been primarily responsible for ensuring that the pedagogy of the modules is appropriate for a higher education audience, including a scaffolded framework with clear sign-posting of content and flexible formatting to facilitate teaching styles from powerpoint through to problem based learning. I have sought evidence for achievements using this approach in the form of written reflective feedback from two colleagues in the School of Engineering who have been involved in such processes over the years, in program and course strategic planning (Carol-Joy Patrick), and in course delivery (Igor Agronovski):

Cheryl Desha has an extraordinary commitment and passion for teaching sustainability. I was involved with her in an initiative arising out of a strategic grant to embed sustainability into an Engineering generic attributes course where I saw first-hand the quality she puts into curriculum development, and I was also a participant in a workshop where she helped the whole of the newly merged Engineering

school map how sustainability skills could be embedded throughout the curriculum. She continues to sustain this passion and is, I believe, a role model for other academic staff, and certainly for her students. Cheryl is unquestioningly a valuable asset as a Griffith staff member, and I look forward to watching her substantial contribution to the University, and to sustainability in general grow along with her academic career. Dr Carol-Joy Patrick, IAP Convenor, Griffith School of Engineering (Peer Review, August 2009)

With regards to your contribution of Whole System Design into the design course, I would like to say that this module is very important part of the subject strongly appreciated by the students. It summarises previously covered materials and shows how various design concepts could be incorporated to produce a final integrated product suitable for implementation in industry. It provides comprehensive design approach and focuses on sustainability issues, which should be considered for any design project. As the subject convenor, I look forward to run your module in the future. Prof Igor Agronovski, Convenor 2003ENG, (Peer Review, 2009)

Approaches to Assessment and Feedback that Foster Independent Learning

Over the years, in parallel with learning how best to create modular material (through my role as the TNEP Education Director), I have also been interested in what mechanisms can best be used in remote learning and classroom situations (i.e. during intensive teaching sessions) to build the students' independent learning skills – especially as the sustainability field is so rapidly emerging, and that life-long learning will be very important for engineering professionals in order to address the significant 21st Century challenges that society faces. Key examples of tools that I have found very useful, and which can be explained to students as part of the assessment brief, hence being adaptable for remote learning situations, are highlighted as follows:

For courses that I convene, I now incorporate at least 1 formative assessment item within the first 5 weeks of the semester, which is returned to the students as quickly as possible – within a few days of submission, either in hard copy or using comment functionalities within Microsoft word (electronically). This assessment is then submitted with their major assessment item for the summative assessment. In undergraduate courses I also include a pre-submission peer-review of the assessment item, whereby student groups are assessed (5%) on their ability to critique another group's report. Students then need to show how they have addressed this feedback in their final submission, and usually there is a formal group presentation. For major assessment items, to encourage students to be responsible for their own learning, I require students to self-evaluate their submission, using a Leichardt-scale form that explores each of the assessment criteria. I do not mark the students on their self-evaluation, but have had very positive feedback that it has encouraged them to look at the assessment criteria much more carefully during assessment preparation. Given the critical need for graduates to be able to work in interdisciplinary teams and in groups, my major assessment items for all courses are group work where students are marked for their team contribution and must complete and sign a 'contribution table' as part of their submission, to ensure that I can reward those students in the group who have participated well. This has been very helpful over the years in reducing student issues in groups and their marks to approximately 2-3 groups out of 40 groups each year (evidence based on review of correspondence for the EMS course and second year courses 2006-2009). For my second year Whole System Design module and my EMS course, I use a problem based learning approach where students (in their groups) choose their own issue to explore (facilitated through the course notes, lecturers and tutorials with provocative guest speakers), through a set of questions, or following the EMS standard. In this way students are learning about their own area of interest (in such a wide topic area as sustainability), and this appears to translate very well into their continued exploration after graduation, as evidenced by the following unsolicited feedback (first item), and a testimonial from former students:

Your EMS subject has been most worthwhile, I am currently writing and updating environmental procedures for Brisbane City Council's Corporate EMS. Paul Maxwell, EMS 2008 (unsolicited, 2008)

Well, I graduated with Masters in Environmental Engineering in Nov '04. The EMS course was my favourite during my degree. The best part was the actual training involved. I got a chance to implement the Environmental Management Program as a part of the course, which helped me train myself to be able to implement it similarly if not better, in the field after graduating. What I learnt in EMS now defines my position as a site based Project Environmental Advisor on a ~$210 million project, with one of the largest construction company in Australia. Practical understanding and training involved in the course is exceptional, especially looking at sustainability as an opportunity rather than a risk … It has not only helped myself but also my friends who did this course with me. For example, my friend Naresh Racha is a process engineer with BMA Coal (earning big $$$ in just 4 years after graduation). He went and did his EMS assignment with Smorgan Steel which helped him to get the job with BMA coal … for continual development I will be undertaking a professional Lead Auditors training course too

… I am glad and very thankful, that that I had such an opportunity to study EMS course with your coaching. Testimonial, Pratik Patel, former student EMS, 2004

Respect and Support for the Development of Students as Individuals

In helping to develop so much modular content, for EMS and for the TNEP sustainable development modules, I initially did not realise the extent of additional 'real-time' support that students would expect in their learning experiences, as highlighted in the GIHE 2005 course. Over the 6 years, reviewing my email correspondence with students (I keep a separate file for student queries for each course), I realise that I have undertaken several activities to effectively and empathetically address student needs given: a) the very large international dimension with up to 70% of students coming from overseas (see SEC course evaluations for the composition of courses), having very different cultural backgrounds and English speaking abilities; b) the large mature age student composition, with approximately 30% of my undergraduate students being mature age, in addition to postgraduate classes; c) the increasing number of undergraduate and postgraduate students who are in full time employment and hence have issues arising regularly with balancing workload and study; and d) the increasing diversity of disciplines enrolling in both the undergraduate and postgraduate courses from education, planning, business and law. These activities range from strategically introducing sustainability vocabulary to students by writing it on the board each week for students to learn, providing peer review opportunities for checking English spelling and grammar, ensuring mixed cultural groups for assignment work, providing guidance on expected tasks like 'the ABC of group work etiquette', the use of mindmaps in lieu of essays to convey ideas to me, and incorporation of Gantt charts into assessment.

In addition, with the consolidation of the first year engineering courses, there is now a very large first year class where student retention is a significant priority (1001ENG) and for which I have been nominated as the Nathan campus coordinator after team teaching within the course since I arrived at Griffith. For 5 years I have run a very interactive 2-day field trip for all environmental engineering students in this course, which has received excellent feedback through formal evaluation (see also the attached 2006 and 2008 reports, which demonstrate student satisfaction through a formal evaluation survey). My colleague, long term mentor, and former HoS Associate Professor Margaret Greenway has provided the following testimony in this regard, *'Her involvement with first year is particularly worthy of mention as she has been instrumental in enthusing students though her course work and though a 2 day field excursion to Stradbroke Island. There is no doubt that lectures like Cheryl are highly instrumental in improving first year retention rates'.* Given the number of areas listed, I have reviewed post-course correspondence with former students to find examples of their appreciation with assistance in their individual circumstances, varying from: 1) a mature age student who was just returning to study; 2) a student with life-changing circumstances; and 3) a foreign student who had significant cultural integration issues, with class interaction and in the assessment.

What a ripper!! Thanks, Cheryl, for the your positive and constructive comments on our assignment and an altogether very affirming outcome. Edwin Clarke, Mature Age student, 2008 EMS (unsolicited)

I just wanted to take this opportunity to say thank you again for your support during the semester, especially near the end when I was in a personal pressure point what with undertaking the IVF. I can now happily confirm that I am 6 weeks pregnant! … Thanks again for your understanding. Debbie Cleary, 2008 EMS

I am Sepehr Malekizadeh former Ali! your previous naughty!!! student 3 years ago in EMS course in Griffith. I want to thank you very much! because honestly the best and most useful thing I learnt during study at Griffith was your course and now! I exactly understand what you said! Iranian Student, 2005 EMS (unsolicited)

I would like to take this opportunity to commend you on your excellent teaching style. Beginning as a mature age student and having three young children, the flexibility you have shown has enabled me to succeed in my studies. Whether it has been your understanding of classes missed due to my kids being sick, having them sit in on lectures or just recently the birth on my fourth child and my having to miss a major component of your course. At no time have I ever felt that I had to choose between my commitments as a mother and being a student. The understanding and flexibility you have shown me has greatly aided my success throughout the course, allowing me to qualify for my honours and generally enjoy the whole uni experience. On a final note I would just like to say that during my first semester when everything was very daunting, having you as one of my main lecturers was a godsend. Every time I had doubts I could see you standing in front of the class: a strong independent woman, someone that knew what she wanted with a passion and thirst for knowledge who always had a smile on her face. You were my proof that I could do it. Natasha Smith, Current Student

1. Scholarly Activities that Have Influenced and Enhanced Learning and Teaching

Given my research and teaching interest in embedding sustainability into engineering education, in parallel with my interaction with students through course work, I have been conducting and publishing research in education and sustainability related journals, as demonstrated in curriculum vitae. This process over the last 3 years has led to running 3 invited workshops at international engineering education conferences, and receiving peer review on the 6 paper that I was co-authoring by more than 62 colleagues internationally. I am now in the process of turning these into a Guide for rapid curriculum renewal, co-authoring with a TNEP colleague, to be published by Earthscan Press in early 2010 (also supported by the SEET Group). Evidence of the value of this process for me and for colleagues elsewhere includes the following testimonials,

At a time when it is more critical than ever for education for sustainability in higher education to be mainstreamed, I look forward to publishing this novella on curriculum renewal in collaboration with The Natural Edge Project. Prof Walter Leal-Filho, Editor, International Journal of Sustainability in Higher Education

This is a wonderful compilation of local and international initiatives that highlight ways of embedding sustainability and sustainable development issues, from the outlying teacher scenario of 'I'll include it if I must' (assuming the staff has heard of the topic and sees any need) to the very core of any teaching, and the needs of the student experience – the Raison D'être. Dr Euan Nichol, Senior Lecturer, School of Architectural, Civil and Mechanical Engineering, Victoria University

At a school level, I am have been on the School committee for the last year, and a number of other working parties during the restructure, which has given me insight into the mechanisms behind course and program coordination. At a course level, I have undertaken two formal reviews of my teaching practice to date, through the EMS course, in 2006 and 2007, for both undergraduate and postgraduate enrolments (see attached SET results) – I intend to do another this year. These results, in particular with regard to the use of guest lecturers and course materials, have helped me to further improve my practices. Additional opportunities to advance my skills in evaluation and reflective practice in the education for sustainability international community of practice have arisen through the following key avenues: International editorial board member for the *International Journal of Sustainability in Higher Education,* Emerald Press for the last 4 years; reviewer for conference papers (e.g. Dubrovnik 2009) and conferences (e.g. IR3S *Sustainability Science* Journal), invited reviewer on behalf of TNEP for the national ARIES 2007 Report on 'Shifting Towards Sustainability - An action inquiry into the professional development of engineers, architects, landscape architects and planners in climate change adaptation'; Invited TNEP Representative to the 2008 Expert Group Meeting on Business Models of Training Centres in the Field Of Sustainable Urban Development', in Korea supported by UN-HABITAT.

In addition to the Griffith University grants summarised in the curriculum vitae, key external grants that I have helped to secure and work on in the topic area, which have further helped me to work on pedagogically strong modular curriculum development include (additional investigators (TNEP): C.Hargroves c.hargroves@griffith.edu.au, M. Smith, P.Stasinopoulos): 1) 2007 - 2008: ($80,000) National Framework for Energy Efficiency. *Survey on embedding sustainability into engineering curriculum, with 27 of 33 universities responding, and barriers and benefits assessment for academics to embed energy efficiency into engineering education in Australia;* and 2) 2006-2007: ($130,000) CSIRO. *Education and training material funded by the CSIRO Energy Transformed Flagship. The project delivered three peer-reviewed capacity-building modules (30 lecturers) on cost-effective low-carbon energy approaches and energy efficiency options.*