

Karlson 'Charlie' Hargroves

Education

B.E. (Civil) (The University of Adelaide, 2000)
Visiting Academic Scholar (University of Colorado, Boulder, 2004/05)
Visiting Academic Scholar (University of Hawaii, Oahu)
PhD Candidate (Curtin University, 2010 Submission)

Employment

1997 Civil Works Project Manager, Adelaide Civil (ADCIV).
2001 Civil Design Engineer, GHD Pty Ltd.
2002 Structural Design Engineer/Draftsperson, Rogers and Jefferis Pty Ltd.
2003 Sustainability Research Officer, SA Government Office of Sustainability.
2003-2006 Sustainability Research Officer, (Project Coordinator, The Natural Edge Project), The Institution of Engineers Australia.
2004 Chief Executive Officer, Natural Capitalism Inc, Boulder, Colorado.
2007 Adjunct Senior Lecturer, The University of Adelaide.
2007-Present Research Fellow, (Director, The Natural Edge Project), Griffith University, Urban Research Program.

Short Biographical Information

After graduating from Adelaide University in 2000, and spending two years as a practicing design engineer, Mr Hargroves co-founded 'The Natural Edge Project' (TNEP) as an Australian based, non-profit, Sustainability Think-Tank. Initially incubated by The Institution of Engineers Australia (2002-2006), and including a 12 month visiting scholar position to the University of Colorado, Boulder (Civil, Environmental, and Architectural Engineering), the research program moved to Griffith University in 2007. Since the founding of TNEP Mr Hargroves has been the Chief Investigator on over 1.7 million dollars of research grants.

Since 2005, and including works in-development for 2010, Mr Hargroves has achieved 21.27 HERDC publication points, an average of 3.54 points per year. Working with the TNEP team this has included co-authoring; 5 books, 17 book chapters, 2 online textbooks, 5 journal articles, 10 conference papers, 9 industry reports, and 32 magazine articles. Furthermore, during this time, internationally Mr Hargroves has delivered 7 keynote presentations, 7 invited presentations, 4 university guest lectures, and has co-facilitated 3 workshops. In Australia Mr Hargroves has delivered 5 keynote presentations, 10 invited presentations, 4 university guest lectures, and co-facilitated 8 workshops.

Mr Hargroves has worked with or has been mentored by a number of internationally renowned experts in the field of sustainable development, including Alan AtKisson, Amory Lovins, Ernst von Weizsäcker, Gro Brundtland, Lester Brown, Leo Jensen, R. K. Pachauri, and William McDonough. The TNEP flagship collaborative 2005 book, *'The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century'* (Earthscan), was awarded the Australian Banksia Award for Environmental Leadership, Education and Training. Building on from this work Mr Hargroves has lead the TNEP team to deliver a series of international books and publications as outlined below.

Throughout this process, Mr Hargroves 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 Technopolis Association, Chicago Manufacturing Centre, IPENZ and Rocky Mountain Institute. In Australia Mr Hargroves has worked with Griffith University, 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 EPA Sustainable Industries Division.



Personal Details

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DOB: 26 May, 1974

Distinctions

- Associate Member, The Club of Rome (2008-present)
- 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)
- Delegate, Commonwealth Engineers Council Delegation, (CHOGM) (2002)
- Board Member, Vice President (volunteer), International Young Professionals Foundation (2002)
- President (volunteer), Young Engineers Australia, Institution of Engineers Australia (2001-2002)
- Foundation for Young Australians Delegate to the 'Developing Tomorrows Leaders Forum' (2001)
- Co-Founder (volunteer), Adelaide University Campus Chapter, Habitat for Humanity, (2000)
- Australian Army Reserve Officer Cadet, Adelaide Universities Regiment, Honourable Discharge (2002)

Funded Research Projects

- Date: 2008 - 2012* *Competitive Grant (Chief 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: 2006-2009* *Non-Competitive Grants (Chief Investigator)* *Value: \$200,000*
Port of Brisbane and Griffith University, 'Sustainable Living Challenge – High School Education and Sustainable Development'.
- Date: 2008-2010* *Competitive Grant (Chief 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 (Chief Investigator)* *Value: \$139,000*
CSIRO Energy Transformed Flagship, 'Energy Transformed – Sustainable Energy Solutions for Climate Change Mitigation'.
- Date: 2007-2009* *Non-Competitive Grant (Chief 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 (Co-Investigator)* *Value: \$99,500*
National Framework for Energy Efficiency (NREE), '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 (Chief 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: 2005-2006* *Competitive Grant (Chief Investigator)* *Value: \$47,600*
Hewlett Packard, 'Sustainable IT through Sustainable Product Service Systems'.
- Date: 2004-2005* *Non-Competitive Grants (Chief Investigator)* *Value: \$45,000*
UNESCO and the Institution of Engineers Australia, 'Engineering Sustainable Solutions Program'.
- Date: 2007* *Non-Competitive Grant (Chief 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

- 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.
- 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 (Droemer, GERMANY and Shanghi Press, CHINA).
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.
- **Hargroves, K.** and Smith, M. (editors and co-authors) (2006) *The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century*, Earthscan, London. (To be released in Mandarin in 2010)
Funded by many sponsors, and carrying forewords from the likes of Amory Lovins and William McDonough, the central message of the book is that it is possible for economies to achieve high economic and job growth rates while dramatically reducing their negative impacts on the environment. Integrating a vast array of literature, it demonstrates that, far from harming economic growth and jobs, the smart application of sustainable development can yield higher economic prosperity for all economies. The book was awarded the 2005 Banksia Award for Environmental Leadership, Education and Training.

Professional Development Courses

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

Book Chapters

- **Hargroves, K.** and Desha, C. (2009) 'The State of Engineering for Sustainable Development', in: UNESCO (2009) *Engineering: Issues and Challenges for Development*, UNESCO.
- 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 Smith, M. (eds) (2006) '*Waste streams to value streams*', in: Marinova, D., Annandale, D., and Phillimore, J. (eds) (2006) *The International Handbook on Environmental Technology Management*, Edward Elgar, Northampton, MA, USA.
- 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.
- Smith, M. and **Hargroves, K.** (2005) Natural Advantage of Nations, Chapter 1 of Hargroves, K. and Smith, M. (eds) (2005) *The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century*, Earthscan, London.
- Smith, M. and **Hargroves, K.** (2005) Risks of Inaction on Sustainable Development, Chapter 2 of Hargroves, K. and Smith, M. (eds) (2005) *The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century*, Earthscan, London.
- Smith, M. and **Hargroves, K.** (2005) Asking the Right Questions, Chapter 3 of 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.** and Smith, M. (2005) A Dynamic 'Platform for Change', Chapter 4 of Hargroves, K. and Smith, M. (eds) (2005) *The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century*, Earthscan, London.
- Smith, M., and **Hargroves, K.** (2005) Thinking Locally, Acting Globally, Chapter 5 of Hargroves, K. and Smith, M. (eds) (2005) *The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century*, Earthscan, London.
- Smith, M., and **Hargroves, K.** (2005) Natural Advantage and the Firm, Chapter 6 of Hargroves, K. and Smith, M. (eds) (2005) *The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century*, Earthscan, London.
- Smith, M. and **Hargroves, K.** (2005) The Political and Social Context: A Sixth Force on Business?, Chapter 8 of 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.**, and Smith, M. (2005) Operationalizing Natural Advantage through the Sustainability Helix, Chapter 10 of 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., Burritt, R., Paton, B., Sutton, P., McLean, R., and Pillia, J. (2005) The Role of Government, Chapter 11 of Hargroves, K. and Smith, M. (eds) (2005) *The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century*, Earthscan, London.
- Smith, M., **Hargroves, K.**, and MacKenzie, A. (2005) Changing Hearts and Minds: The Role of Education, Chapter 22 of 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) Achieving Multi-stakeholder Engagement, Chapter 23 of Hargroves, K. and Smith, M. (eds) (2005) *The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century*, Earthscan, London.

Academic Articles/Journal Papers

- Desha, C., and **Hargroves, K.** (2010) 'Surveying the State of Higher Education in Energy Efficiency, in Australian Engineering Curriculum', *Journal of Cleaner Production*, Elsevier, Volume 18, Issue 7, May 2010, Pages 652-658.
- 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*.
- 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.

Peer-reviewed Conference Proceedings

- **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.** (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.
- 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,
- Smith, M. and **Hargroves, K.** (2002) 'Harnessing External and Internal Drivers for Change, Partnerships for Sustainability to Facilitate Permanent, Change in the University Sector' in proceedings for 2002 2nd National Conference of Sustainable Universities, co-organised by The University of Melbourne, RMIT and Monash University, Melbourne, Australia.

Conference Papers

- Desha, C., **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.
- **Hargroves, K.**, Paten, C., Palousis, N. and Smith, M.H. (2005) 'Making the Profitable Transition Towards Sustainable Business Practice.' In proceedings of 2005 ASEE/AAEE 4th Global Colloquium on Engineering Education, 26-29 September 2005, Sydney, Australia.
- Smith, M.H., **Hargroves, K.**, Palousis, N. and Paten, C. (2005) 'A Taste of Best Practice in Engineering Sustainable Solutions'. In proceedings of 2005 Environmental Engineering Society National Conference, 18-19 July 2005, Sydney, Australia.
- Paten, C., Palousis, N., **Hargroves, K.** Smith, M.H. (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.

Industry Reports

- 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.
- Smith, M., and **Hargroves, K.** (2007) *Executive Summary: Action on climate change can help business competitiveness and economic growth*, 8th National Business Leaders Forum on Sustainable Development, The Natural Edge Project (TNEP).
- **Hargroves, K.**, Stasinopoulos, P. and Smith, M. (2007) '*Sustainable IT' through 'Sustainable Product Service Systems - A Case Study of Hewlett Packard'*, The Natural Edge Project (TNEP), Australia.
- Prosser, M., Smith, M., **Hargroves, K.**, and Toyne, P. (2006) *Australian Plantation, Products and Paper Industry Council's (A3P) Sustainability Action Plan - Performance, People and Prosperity*, A3P.
- Smith, M. and **Hargroves, K.** (2006) '*Sustainable Development: How Does Australian business Reconcile Environmental Obligations with Competitive Advantage-Improving Competitiveness Through Effective Environmental Management.*' Australian Industry Group's Environmental Management Handbook.
- **Hargroves, K.**, Smith, M., and Lovins, H (2005) *Prospering in a Carbon Constrained World: Profitable Opportunities for Greenhouse Gas Emissions Reduction*, Chicago Climate Exchange/European Climate Exchange.
- 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.
- Toyne, P., Tate, A., **Hargroves, K.**, and Smith, M. (2003) *Sustainability Framework for the Future of Australia's Infrastructure Handbook – Australian Council for Infrastructure and Development*, AusCID.

Published non-academic Articles

- Desha, C., **Hargroves, K.**, and Smith, M. (2009) 'Water solutions adapted for climate change', *CSIRO ECOS*, Issue 152, p. 10-11.
- 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.
- Smith, M. and **Hargroves, K.** (2009) 'Achieving both economic growth and reduced environmental pressures in the current financial climate', *CSIRO ECOS*, Issue 148, pp. 30-31.
- Smith, M. and **Hargroves, K.** (2009) 'Time to unleash the power of a green economy', *CSIRO ECOS*, Issue 146, pp. 26-27.
- Smith, M. and **Hargroves, K.** (2008) 'Developing partnerships can help meet Garnaut's 2050 target', *CSIRO ECOS*, Issue 142, pp. 14-15.
- Smith, M. and **Hargroves, K.** (2008) 'Clever cooperation will step up climate progress', *CSIRO ECOS*, Issue 141, pp. 16-17.
- Smith, M. and **Hargroves, K.** (2008) 'Seeing the wood for the trees: What to look for when purchasing carbon credits', *CSIRO ECOS*, Issue 140, pp. 12-14.
- Smith, M. and **Hargroves, K.** (2008) 'Energy superpower – or sustainable energy leader? 2', *CSIRO ECOS*, Issue 140, pp. 22-24.
- **Hargroves, K.**, Smith, M. and Desha, C. (2007) 'Choices, the key to progress', *The Brisbane Courier Mail*, 1 August 2007.
- Berry, M., Smith, M. and **Hargroves, K.** (2007) 'Energy superpower – or sustainable energy leader?', *CSIRO ECOS*, Issue 139, pp. 20-23.
- Smith, M. and **Hargroves, K.** (2007) 'Business signs up to support short-term cuts', *CSIRO ECOS*, Issue 138, p 4.
- Smith, M., **Hargroves, K.** and Desha, C. (2007) 'Tuning into a deeper wisdom', *CSIRO ECOS*, Issue 138, p 18-19.
- **Hargroves, K.**, Smith, M., Stasinopoulos, P. and Hargroves, S. (2007) 'Improving performances in the boardroom', *CSIRO ECOS*, Issue 137, pp. 26-27
- Smith, M. and **Hargroves, K.** (2007) 'Climate leaders: the new corporate standards', *CSIRO ECOS*, Issue 136, pp 27-29.
- Smith, M. and **Hargroves, K.** (2007) 'Smart approaches to electricity use', *CSIRO ECOS*, Issue 135, pp 12-13.
- Smith, M. and **Hargroves, K.** (2007) 'The Gore Factor - Reviewing the impact of An Inconvenient Truth', (Cover Article), *CSIRO ECOS*, Issue 134, pp. 16-17.
- Smith, M. and **Hargroves, K.** (2006) '\$uper powers - How investment funds could be driving progress in an emerging 'sustainability' economy', (Cover Article), *CSIRO ECOS*, Issue 132, pp 24–28.
- Smith, M. and **Hargroves, K.** (2006) 'Plantation, paper and milling show how it's done', *CSIRO ECOS*, Issue 132, pp 29.
- Smith, M. and **Hargroves, K.** (2006) 'Sustainable Development: How Does Australian business Reconcile Environmental Obligations with Competitive Advantage-Improving Competitiveness Through Effective Environmental Management.' *Australian Industry Group's Environmental Management Handbook*.
- Smith, M. and **Hargroves, K.** (2006) 'Inquiry encourages broader corporate reporting accountability', *CSIRO ECOS*, Issue 131, p 4.
- **Hargroves, K.** and Smith, M. (2006) 'Innovation inspired by nature: Biomimicry', *CSIRO ECOS*, Issue 129, pp 27-29.

- Smith, M. and **Hargroves, K.** (2006) 'Wood - another low carbon footprint solution', *CSIRO ECOS*, Issue 129, pp 12-13.
- Smith, M. and **Hargroves, K.** (2006) 'The First Cuts Must be the Deepest', *CSIRO ECOS*, Issue 128, pp 8-11.
- Smith, M., **Hargroves, K.** and Toyne, P. (2004) 'The Role of Infrastructure in Sustainability', *Engineering World*, October Edition.
- Smith, M., **Hargroves, K.** and Toyne, P (2004) 'Heavy Duty: The crucial role of infrastructure planning in Australia's move toward sustainability', *CSIRO ECOS*, Issue 121, pp 10-13.
- Smith, M. and **Hargroves, K.** (2004) 'Encouraging more sustainable practices - the easy way', *CSIRO ECOS*, Issue 121, pp 24-25.
- Burns, C. and **Hargroves, K.** (2003) 'Building beautifully', *CSIRO ECOS*, Issue 117, pp 25.
- **Hargroves, K.** (2003) 'Taking Natural Capitalism to the world', *CSIRO ECOS*, Issue 116, pp 27.
- Page, C., **Hargroves, K.** and Smith, M. (2003) 'There's money in the air', *CSIRO ECOS*, Issue 116, pp 26.
- **Hargroves, K.** and Smith, M. (2003) 'A platform for change', *CSIRO ECOS*, Issue 116, pp 15.
- **Hargroves, K.**, Smith, M. and Moody, J. (2003) 'New efficiency from our old systems', *CSIRO ECOS*, Issue 116, pp 13-14.

International Keynotes and Presentations

- 12–13 March 2010 - Invited Keynote (with travel expenses), United Nations Forum on Climate Change Mitigation, Fuel Efficiency and Sustainable Urban Transport, Seoul, **Republic of Korea**. Topic: "*Factor Five: Transforming the Global Economy through 80% Improvements in Resource Productivity*".
- 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*".
- 25-29 February 2008 – Invited Keynote (with travel expenses), Cooperation On Health And Biodiversity Conference, 'COHAB 2', Galway, **Ireland**. Topic: "*Business and Ecosystems: Innovation, Engineering and Biomimicry*".
- 15-18 April 2007 - Invited Speaker (with travel expenses), Engineering Sustainability Conference, Mascaro Sustainability Initiative, University of Pittsburgh, Pennsylvania, **USA**. Topic: "*Sustainable Engineering Solutions*".
- 24 January 2007 – Invited Student Lecture, Delhi Sustainable Development Summit, Delhi, **India**. Topic: "*Innovation and sustainable development*".
- 31-2 November 2006 - Invited Keynote (with travel expenses), UNESCO International Workshop: Engineering Education for Sustainable Development, Beijing, **China**. Topic: "*Engineering Education for Sustainable Development - Toolkit of Information and Teaching Material*".
- 26-28 July 2006 - Invited Keynote, Fifth World Technopolis Association (WTA) General Assembly, **Brisbane**, Australia. Topic: "*The Future Natural Capital of Smart Cities*".
- 13-15 April 2005 – Invited Participant (with travel expenses), International Dialogue on '*Providing Leadership for Sustainable Development*', Beijing, **China**.
- 17-19 March 2005 - Invited Speaker, NCIAA 9th Annual Conference, San Diego, **USA**. Topic: "*Engineering Sustainable Solutions*".
- October 2004 – Invited Speaker and Workshop Facilitator - Sustainability Intensive, lead by Alan AtKisson, Imperial College, London, **UK**.

- 27-29 September 2004 - Invited Keynote, Integrating Appropriate-Sustainable Technology and Service-Learning in Engineering Education, Colorado, **USA**. Topic: *"Engineering Sustainable Solutions"*.
- 26-28 May 2004 - Invited Keynote, ASEAN Australian Engineering Congress 2004, Kota Kinabalu, **Sabah**. Topic: *"Transforming Engineering Education and Practice with Whole Systems Engineering Design"*.
- 16–19 November 2003 - Invited Speaker, International Conference of the Network of Regional Governments For Sustainable Development, **Perth**, Western Australia. Topic: *"Natural Competitive Advantage of Regions: Achieving Regional Competitive Advantage, Attracting Investment, and Encouraging Eco-Innovation through Collaborative Approaches for Sustainable Development"*.

Australian Keynotes and Presentations

- 12 February 2009 – Invited Keynote, Committee for Economic Development of Australia (CEDA), 'Sustainability: The Next Economic Opportunity?', **Perth**, Australia. Topic: *"Cents and Sustainability: Securing Our Common Future"*.
- 26 February 2009 – Invited Keynote, Committee for Economic Development of Australia (CEDA), 'Sustainability: The Next Economic Opportunity?', **Adelaide**, Australia. Topic: *"Cents and Sustainability: Securing Our Common Future"*.
- 30 October 2008 – Invited Speaker, Advanced Manufacturing Australia 2008 International Conference, **Melbourne**, Australia. Topic: *"The Impact of Climate Change on Advanced Manufacturing in Australia"*.
- 8–9 October 2008 – Invited Keynote, The Great Energy Debate, **Adelaide**, Australia. Topic: *"Greenhouse gas mitigation and economic growth"*.
- 22–23 May 2008 – Invited Keynote and Event Master of Ceremonies, Sustainability and Business Growth Summit, **Sydney**, Australia. Topic: *"Sustainability in the Era of Climate Change"*.
- 25-29 February 2008 - Invited Speaker, 3rd National Water Education Conference, Australian Water Association, **Gold Coast**, Australia. Topic: *"Education in Water Resource Management and Supply to Respond to Climate Change"*.
- 25-29 February 2008 - Keynote Speaker, Water Industry Capacity Development (WICD) Conference 2008, Australian Water Association, **Gold Coast**, Australia. Topic: *"A strategic approach to embedding sustainable development into engineering education to support the water industry"*.
- 19 October 2007 – Invited Gala Dinner Panellist, Environment Institute of Australia and New Zealand (EIANZ) 20th Anniversary Gala Ball, **Sydney**, Australia.
- 6 - 9 September 2007 - Invited Speaker, International Urban Design Conference, Gold Coast City Council, **Gold Coast**, Australia. Topic: *"Engineering Sustainable Solutions for our Urban Cities"*.
- 31 - 3 September 2007 - Invited Speaker, Asia Pacific Cities Summit (APCS), Brisbane City Council, **Brisbane**, Australia. Topic: *"Innovation and Engineering for Sustainable Development"*.
- 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)
- 26-29 September 2005. Invited Speaker, Environmental Engineering Educators' Workshop, **Sydney**, Australia. Topic: *"Transformational Change in the University Sector"*.
- 18-19 July 2005. Invited Speaker, Environmental Engineering Society 'EES' 2005 – Creating Sustainable Engineering Solutions, **Sydney**, Australia. Topic: *"Prospering in a Carbon Constrained World"*.
- 4-5 April 2005 - 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.

- 29-30 May 2003 - Invited Speaker, National Business Leaders Forum on Sustainable Development, **Melbourne**, Australia. Topic: Closing Words (Steering Committee Member).
- 16 August 2002 - Invited Speaker, National Science Festival – '*A Whole of Society Approach to Sustainable Development*', **Canberra**, Australia. Topic: "Engineering Sustainable Solutions".

University Teaching and Curriculum Development

- **Griffith University** - A number of guest lectures, tutoring and course development activities have been undertaken between 2007 and 2009. Including co-teaching with Cheryl Desha 2335EVE "Sustainability Principles & Practices" in 2007, and teaching into 1001ENG "Engineering Practice & Sustainability" in 2007 and 2009.
- **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 C. Desha, 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 C. Desha, of a masters equivalent courses based on TNEP education programs, '*The Role of Engineers in Sustainable Development*'. Followed by the co-delivery, with C. Desha, twice in 2007.
- **University of Khartoum**, Sudanese Virtual Engineering Library. Undertaking a UNESCO funded 1 week visiting scholar position to assist in the development of a website on 'Virtual Library on Engineering for Sustainable Development'. The resource now contains 1000 records in full text and 700 records in bibliographic databases.
- **University of New South Wales and Griffith University**, Sustainable Living Challenge. The co-development, with C. Desha, of a set of senior secondary education resources on sustainable development.

Guest University Lectures

- 22 Feb – 12 March 2010 – Invited Visiting Scholar Visit, **University of Hawaii**, Honolulu, Hawaii. Various topics.
- 12 February 2009 – Invited Staff Lecture, **Curtin University**, Australian Sustainable Development Institute's (ASDI), 'Opening the Curtin Sustainability Dialogue', Perth, Australia. Topic: "*Cents and Sustainability: Securing Our Common Future*".
- 6 November 2008 – Invited Forum Lecture, **Griffith University** School of Business, Brisbane, Australia. Topic: "*The cost of inaction: reducing greenhouse gas emissions*".
- 9 May 2007 – Invited Student Lecture, **Adelaide University**, 'Engineering Practice and Design', as part of 'Senior Adjunct Lecturer' position at Adelaide University in 2007.
- 13 April 2007 – Invited Student Lecture, Donald Bren School of Environmental Science and Management, **University of California**, Santa Barbara, USA. Topic: "*Advanced Resource Productivity and Innovation for Sustainable Development*".
- 24 January 2007 – Invited Student Lecture, The Energy and Resources Institute, **TERI University**, Delhi, India. Topic: "*Innovation and sustainable development*", as part of Delhi Sustainable Development Summit.
- 10&17 May 2006 – Invited Student Lecture, **Queensland University of Technology**, 'MMB451 Energy Management', Brisbane, Australia. Topic: "*Profitable Greenhouse Solutions*".
- 9-26 May 2005 – Course Co-Instructor, **University of Colorado**, Boulder. Topic: "*Natural Capitalism for Engineers*", 3 week intensive masters course, Boulder, Colorado, USA.

- 20 November 2003 – Invited Staff Lecture, **Murdoch University** – Institute for Sustainability and Technology Policy (ISTP), Perth, Australia. Topic: *"Overview of The Natural Edge Project – History, Achievements and Goals"*.

Co-Facilitation of Workshops

- 16 October 2008 – Invited Workshop with C. Desha, **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 C. Desha, **6th Symposium on Accountability, Governance & Performance**, Brisbane, Australia. Topic: "Developing Effective Strategies and Policies for Organisational Sustainability".
- 12 December 2007 - Invited Workshop with C. Desha, **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 C. Desha, **Eighteenth Annual Conference of the Australasian Association for Engineering Education**, Melbourne, Australia. Topic: "Emerging Engineering Education Curriculum for Sustainable Development".
- 4-5 August 2006 – Contracted Workshop with C. Desha, **Sustainability Education & Capacity Building Framework Workshop, KBR**. Topic: "KBR Sustainability Education and Capacity Building Framework".
- 5-10 March 2006 – Contracted Workshop with C. Desha, **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.
- 16-19 November 2005 – Invited Workshop Series with N. Palousis, **Sustainable Living Tasmania – Annual Sustainability Series**. Topics: "The Role of Engineers in Sustainability", "The Business Case for Sustainability", "Cultural Change and Sustainability within Universities" and "Sustainability - Being Realistic AND Optimistic".
- 8 November 2005 – Invited Facilitator with N. Palousis, University of South Australia - **Formulas for a Thriving Planet Forum**, Adelaide, Australia. Topic: "Youth dialog with WWF Australia CEO, Mr. Greg Bourne, on topical environmental matters and active solutions".
- 26 September 2005 – Invited Workshop with C. Desha 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 Facilitator, **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.
- **Chicago Climate Exchange (CCX) / European Climate Exchange (ECX)** - The development of a report to the member of the CCX and ECX titled, 'Prospering in a Carbon Constrained World - Profitable Opportunities for Greenhouse Gas Emissions Reduction'.
- **Australian Council for Infrastructure Development (AusCID)** – Contribution to the AusCID 'Sustainability Framework for the Future of Australia's Infrastructure Handbook', outlining a potential framework for the future of Australia's infrastructure.
- **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 C. Desha, 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.

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 book 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 returned 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 earth's 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)

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