

# Mr Peter Stasinopoulos

## Education

BEng (Mechatronic, First Class Honours) (The University of Adelaide, 2003)  
 BMa&CompSci (The University of Adelaide, 2003)  
 MEng (Manufacturing Engineering) (University of South Australia, 2009)  
 PhD Candidate (Australian National University, 2012 submission)

## Employment

2004-Current Research Associate, The Natural Edge Project



## Personal Details

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DOB: 13 Oct, 1981

## Short Biographical Information

Peter Stasinopoulos is a graduate of the University of Adelaide, holding a Bachelor of Mathematical and Computer Science, and Bachelor of Mechatronic Engineering with First Class Honours. He is also a graduate of the University of South Australia, holding a Master of Engineering. Peter is undertaking a PhD degree in the field of dynamical systems with a focus on materials in the automotive industry.

Peter joined The Natural Edge Project Volunteer Working Group in 2004, became a part time Research Assistant in 2005, and became a Research Associate in 2007. Peter has worked on a variety of TNEP's research and consulting projects, including the development of book publications, educational resources, and industry reports.

## Funded Research Projects

*Date: 2008 - 2012*                      *Competitive Grant (Co-Investigator)*                      *Value: \$375,000*  
**Townsville City Council** (Townsville Solar City Consortium), 'Behaviour Change for the Reduction of Energy Consumption in Residential Homes'.

*Date: 2006-2009*                      *Non-Competitive Grants (Co-Investigator)*                      *Value: \$200,000*  
**Port of Brisbane** and **Griffith University**, 'Sustainable Living Challenge – High School Education and Sustainable Development'.

*Date: 2008-2010*                      *Competitive Grant (Co-Investigator)*                      *Value: \$150,000*  
**Australian Government Department of Climate Change**, Climate Change Adaptation Skills for Professionals Program, 'Water Transformed – Sustainable Water Solutions for Climate Change Adaptation'.

*Date: 2007-2010*                      *Competitive Grant (Co-Investigator)*                      *Value: \$139,000*  
**CSIRO Energy Transformed Flagship**, 'Energy Transformed – Sustainable Energy Solutions for Climate Change Mitigation'.

*Date: 2007-2009*                      *Non-Competitive Grant (Co-Investigator)*                      *Value: \$116,000*  
**Purves Environmental Fund** and **Griffith University**, 'Cents and Sustainability: Securing Our Common Future by Decoupling Economic Growth from Environmental Pressures'.

*Date: 2006-2009*                      *Non-Competitive Grant (Co-Investigator)*                      *Value: \$99,500*  
**National Framework for Energy Efficiency (NFEI)**, 'State of Engineering Education for Energy Efficiency - What is the state of education for energy efficiency In Australian engineering schools?'.

*Date: 2007-2009*                      *Competitive Grant (Co-Investigator)*                      *Value: \$80,000*  
**Griffith University, Aachen Foundation, CSIRO, and Conics Ltd**, 'Factor Five: Transforming the Global Economy through 80% Improvements in Resource Productivity'.

*Date: 2005-2006*                      *Competitive Grant (Co-Investigator)*                      *Value: \$47,600*  
**Hewlett Packard**, 'Sustainable IT through Sustainable Product Service Systems'.

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

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

Date: 2007

Non-Competitive Grant (Co-Investigator)

Value: \$40,000

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

Date: 2005 - 2006

Competitive Grant (Co-Investigator)

Value: \$40,000

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

### Books (Refer also Appendix 1: Endorsement for Publications)

- Smith, M., Hargroves, K., Desha, C., and **Stasinopoulos, P.** (2009) *Water Transformed: Sustainable Water Solutions for Climate Change Adaptation*, The Natural Edge Project, Griffith University, and Australian National University, Australia.

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

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

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

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

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

- Smith, M., Hargroves, K., **Stasinopoulos, P.**, Stephens, R., Desha, C., and Hargroves, S. (2007) *Energy Transformed: Sustainable Energy Solutions for Climate Change Mitigation*, The Natural Edge Project, Australia, CSIRO, and Griffith University, Australia.

*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.*

### Book Chapters (Refer also Appendix 1: Endorsement for Publications)

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

### Academic Articles/Journal Papers

- **Stasinopoulos, P.**, Compston, P., Newell, B., and Jones, H.M. (2011) 'A System Dynamics approach in LCA to account for temporal effects – a consequential energy-LCI of car body-in-whites', *International Journal of Life Cycle Assessment*, submitted.

### Peer-reviewed Conference Proceedings

- **Stasinopoulos, P.**, Compston, P., and Jones, H.M. (2010) 'A System Dynamics Approach to Calculating the Energy Consumed in Car Component Production', in: *Sustainable Automotive Technologies 2010: Proceedings of the 2<sup>nd</sup> International Conference*, Springer.

## 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.
- 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.

## Published non-academic Articles

- Smith, M., Hargroves, K., Desha, C., and **Stasinopoulos, P.** (2009) 'Factor 5 in eco-cement: Zeobond Pty Ltd', *CSIRO ECOS*, Issue 149, p. 21.
- Smith, M., Hargroves, K., **Stasinopoulos, P.**, and Desha, C. (2009) 'Stand-out progress from our corporate first-movers', *CSIRO ECOS*, Issue 148, pp. 14-15.
- Hargroves, K., Smith, M., **Stasinopoulos, P.**, and Hargroves, S. (2007) 'Improving performances in the boardroom', *CSIRO ECOS*, Issue 137, pp. 26-27

## University Teaching and Curriculum Development

- **University of South Australia**, Louis Laybourne Smith School of Architecture and Design. The co-development of two coursework units for the Master of Sustainable Design, "Sustainable Design Theory - Sustainability and Society" and "Sustainable Design Theory - Sustainable Design Principles".
- **University of New South Wales and Griffith University**, Sustainable Living Challenge. The co-development of a set of senior secondary education resources on sustainable development.

## Guest University Lectures

- 19 & 21 April – Invited Student Lecture, **Australian National University** School of Engineering, Canberra, Australia. Topic: "*Whole System Design*".

## Industry Collaborations

- **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.
- **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.

- **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.

**Referees:****Research Colleague:**

Mr. Karlson 'Charlie' Hargroves  
Adjunct Fellow, University of Adelaide  
E: [charlie@hargroves.net](mailto:charlie@hargroves.net)

Dr. Cheryl Desha  
Lecturer, Queensland University of Technology  
E: [c.desha@griffith.edu.au](mailto:c.desha@griffith.edu.au)

**Academic Supervisors/Advisors:**

Assoc. Prof. Paul Compston  
Associate Head, Engineering (Coursework),  
Australian National University  
E: [paul.compston@anu.edu.au](mailto:paul.compston@anu.edu.au)

Assoc. Prof. Barry Newell  
Adjunct Associate Professor and Visiting Fellow,  
Australian National University  
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Dr. Haley M. Jones  
Senior Lecturer, Australian National University  
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## **Appendix 1:**

### **Endorsement for Publications**

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

"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 Huisingsh, 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 Eda, 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)*