SYMPOSIUM

Cogeneration and Trigeneration
Sustainability in Action

Date: **May 6 and 7, 2009**

Venue: **Seymour Centre (University of Sydney)**

The **'Cogeneration and Trigeneration – Sustainability in Action'** Symposium
was organised by the
Chemical and Biomolecular Engineering Foundation of The University of Sydney
with the support of the
Australian Institute of Energy

The University of Sydney

Chemical and Biomolecular Engineering Foundation
The University of Sydney

SYMPOSIUM: Cogeneration and Trigeneration – Sustainability in Action

Overview of the Symposium

The Chemical and Biomolecular Engineering Foundation of the University of Sydney organised the **'Cogeneration and Trigeneration - Sustainability in action'** Symposium to present real options for sustainable energy technologies. The Symposium brought together experts and will cover technical, regulatory, financial aspects of cogeneration and trigeneration energy options, as well as offer an insight into the relationship of these and utilities. In-depth reviews of case studies which looked at Cogen and Trigen facilities set up in manufacturing plants, commercial complexes (shopping centres, office buildings) and major infrastructure complexes, such as airports were also presented.

This Symposium brought together the major players in the Cogen and Trigen industries, as well as industry representatives who could learn about Cogen and Trigen concepts, and how implementing associated technologies into their organisations might be done. Most importantly, this symposium offered options to energy users, in light of the various Australian governments' warnings about expected problems with energy supply which may be experienced in the very near future.

Background to the Symposium

In June 2008 the Institution of Chemical Engineers in Australia and the Chemical and Biomolecular Engineering Foundation of The University of Sydney organised the **'Shared challenges, shared solutions - Sustainable energy and water'** Symposium, which was hosted by the Hon Verity Firth MP, NSW Minister for Climate Change and the Environment at the NSW Parliament House.

This Symposium covered issues relating to energy and water, the two topics that Australia was to examine with a view to developing a set of guidelines for governments and industry to assist in the implementation of strategies to deal with these key challenges, particularly in a world where the overriding challenge of Climate Change and environmental issues have had a profound effect on society's way of thinking

The Symposium provided the back-drop for the launch of two White/Green Papers which progressed the 'Roadmap for 21st Century Chemical Engineering'. For more information please refer to the IChemE website (**www.icheme.org/roadmap 2007**).

The 'Shared challenges, shared solutions' Symposium was the first of further Symposia that the Chemical and Biomolecular Engineering Foundation agreed to organise, thus setting up a forum for the examination of the technologies that industry might wish to consider and discuss to assist in ensuring the development of sustainability in energy and water.

Presentations: Day 1 - May 6, 2009

Order	Title	Speaker	Presentation
	Opening and Welcome	James Allen, Foundation President	The Foundation and its role in connecting industry through the organisation of activities of importance and relevance to the world of engineering.
1	Waste to Energy: Generating revenue from waste water and landfills	Dr Gareth Forde, Sustainability Team Leader, SEMF Pty Ltd	The energy and emissions reduction implications of generating electricity, heat and/or cooling from bio-gas will be discussed. Of particular interest are the emissions implications for waste water treatment and landfill under the Federal Government's National Greenhouse Emissions Reporting (NGER) Act 2007. The place of co-gen and tri-gen, its cost effectiveness and payback period will be considered.
2	Sustainable Energy	Gordon Weiss, Principal Consultant for Process Efficiency, Energetics	This talk will place cogen and trigen in the context of a world looking energy options that will carry our standards of living into the future.
3	Practicalities and Economics of Cogeneration and Trigeneration	Jim Ferretti, Group CEO, MPI Group	An overview of the rationale for the option of selecting Cogeneration and Trigeneration technologies for sustainable energy supply in a world of growing energy demand.
4	Applications of spark-ignited, dual-fuel and gas-diesel engines through an examination of a variety of case studies	Dr Jacob Klimstra, Senior Energy and Engine Specialist, Wärtsilä Power Plants	1. The district heating plant of Györhö (Hungary) that uses gas engines: concept, performance, operating experience 2. The Barajas airport cogeneration (heat and chill) + emergency power (island operation.

Dinner Presentation

Presentation 5 Scott Wilson, A/Team Leader Sustainability Unit (BASIX), NSW Department of Planning	**The role of cogen and trigen in achieving mandated greenhouse gas savings for multi unit residential developments under BASIX.** The BASIX tool is a mandated building standard for all new residential construction in NSW. It was introduced in 2004 for single housing in Sydney, and for all houses, apartments and residential flat buildings in NSW from July 2006. BASIX mandates the level of CO2e savings made based on a 2003 NSW energy benchmark. The use of co-gen and tri-gen allows these savings to be cost effective and achievable.

Presentations: Day 2 - May 7, 2009

Order	Title	Speaker	Presentation
6	Welcome to Day 2 and Introduction	Adjunct Assoc Professor Don White, University of Sydney	Energy in the international and global context Need for reduction in usage leads to the need for clever solutions Relationship with NSW Energy Efficiency Strategy Comment on the CPRS scheme from an environmental groups view
7	"Getting connected: Distributed generation within a regulated electricity network"	Bill Nixey Network Business Consultant EnergyAustralia	This presentation will provide an overview of the regulatory and pricing framework that enables distributed generators to be connected to an electricity network. The topics will include; an overview of EnergyAustralia's network, the take up of distributed generation, relevant rules & regulations, pricing initiatives for distributed generators, and the increasing use of embedded networks. Case studies will be included.
8	Continued: Applications of spark-ignited, dual-fuel and gas-diesel engines through an examination of two more case studies	Dr Jacob Klimstra, Senior Energy and Engine Specialist, Wärtsilä Power Plants	1. The Plains End power plant for integrating wind and solar based generation thus acting as a rapid back up and peaking system 2. The Secoya gas diesel plant using associated gas to provide electricity for oil and gas production (5% of global gas use is currently flared away).
9	MPI Cogeneration Case Studies	Toby Roxburgh, Principal Sustainable Systems Engineer, MPI Group	The presentation will cover the use of Cogeneration and Trigeneration and illustrates the implementation of these technologies in various situations, including Universities, Pools, Chilled Storage, Apartment buildings and solar integration.
10	Electrical issues in Cogeneration and Trigeneration projects	Gavin White, Principal and Regional Director, Lincolne Scott	Gavin will present an overview of the electrical implications and impediments to the development of precinct based co generation and tri generation. Amongst other issues, the overview will focus on load matching, reliability, protection and the economy of the system design versus the commercial return on investment. Gavin's experience is informed by current development of Frasers Broadway and Songdo City, Korea.
	Light lunch during visit and tour of the new Student Training Centre, School of Electrical and Information Engineering.	Presentation and guided tour, Professor Vassilios Agelidis, EnergyAustralia Chair of Power Engineering	"This will be the first opportunity for industry to view the newest, most technologically up to date university electrical engineering Student Training Centre in the world, and I am proud to have had the opportunity to develop this concept, and bring it to life with the aid of our industry partner, ABB". Prof Vassilios Agelidis.
11	Modelling GHG savings achieved by cogen within the BASIX engine.	Dr Kevin Yee, BASIX analyst in Sustainable Systems, NSW Department of Planning	Unlike many sustainability tools, BASIX follows the aims of the Kyoto Protocol, measuring sustainable outcomes in Kg of CO_2e. The methodology for modelling the GHG savings achievable by Cogen in BASIX is explained and the role of the Chatswood cogen pilot study as a verification and policy process discussed.

Order	Title	Speaker	Presentation
12	Cogeneration Installations and Modelling – meeting the thermal loads to deliver maximum greenhouse benefit.	Dr Rob Helstroom, Principal Scientist, Kinesis Pty Ltd	Rob describes the background to the CSIRO Hornsby Library heat-driven cooling cogeneration installation as well as the NSW Department of Planning's Residential Cogeneration projects with which he has been closely involved. He will also discuss widespread uptake of cogeneration in the context of the City of Sydney's 2030 "Green Transformers" initiative that has been prepared by Kinesis. Rob will conclude with an outline of some of the findings from Kinesis's cogeneration modelling work.
13	The development of biomass cogeneration plants at Condong and Broadwater sugar mills	John Hurt, Project Manager, Delta Electricity	The new Condong Sugar Mill cogen plant project. Delta Electricity's commitment to Sustainable Development in energy.
	Review of proceedings and Closing Remarks	Professor Anthony Vassallo	Summary of day's proceedings, highlighting of outcomes vis-à-vis options for future directions. Closing remarks.

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Chairpersons

- Day 1: Mr Ian Maitland - Global Group Practice Leader – Thermal Generation, SKM
- Day 2: Professor Anthony Vassallo – Delta Electricity Chair in Sustainable EnergyDevelopment,, School of Chemical and Biomolecular Engineering, The University of Sydney.

Ian Maitland

Ian Maitland is a Senior Principal of Sinclair Knight Merz and is the Group Practice Leader for Thermal Generation. Ian has had over twenty five years experience in the concept design, feasibility study,
installation and commissioning of power generation plant including cogeneration and trigeneration plants. He has managed projects, studies, independent reviews and multi-disciplinary
engineering teams on power generation projects within Australia and SE Asia. Fields in which Ian has special competence include technical reviews for finance of power generation projects (he has signed off on over 10,000 MWs of generation) and high level advice on generation efficiency and greenhouse gas emissions. He also has expertise in the provision of independent engineering advice to clients during the development and implementation phase of power generation projects. Ian is currently working on a trigeneration plant for Westmead Hospital and has recently provided owners engineering services on 2 x 30 MW biomass fired cogeneration plants in northern NSW. He has also been involved in the delivery of several gas turbine cogeneration plants including some of the early build, own and operate plants completed in Australia.

Professor Tony Vassallo

Tony Vassallo holds the inaugural Delta Electricity Chair in Sustainable Energy Development at the University of Sydney. He took up this position in October 2008.
Before joining the University, Tony was a Senior Principal Research Scientist in the Division of Energy Technology with the CSIRO, followed by a period of consultancy to industry and government in the field of sustainable energy technology. Tony's 2006 report on cogeneration for the NSW Department of Planning provided the pathway for the NSW government to encourage developers to include cogeneration in multi-unit dwellings, which triggered a wave of new interest in cogeneration for residential and commercial developments in NSW. Tony has also acted as advisor to the Australian Greenhouse Office and the US Department of Energy, for energy storage technologies.
While with CSIRO, Tony was the Founding Director of the CSIRO Centre for Distributed Energy & Power, (CenDEP) a consortium of industry and government organisations providing leadership in the technological aspects of distributed generation. Tony's energy storage research has been recognised with the CSIRO Chairman's Medal, for the Low Emissions Vehicle Team (joint) in 2000. He also shared the CSIRO Medal for Research Achievement in 2004, as joint team leader of the High Power Supercapacitor Team.
Tony is a Fellow of the Royal Australian Chemical Institute and a Fellow and Vice-President of the Australian Institute of Energy.

Keynote Speakers

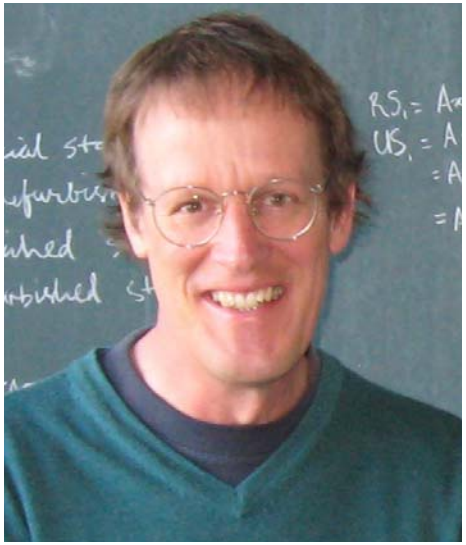
- Mr Jim Ferretti – Group CEO and Principal Mechanical Engineer, MPI Group
- Dr Gareth Forde – Sustainability Team Leader, SEMF Pty Ltd (Melbourne)
- Dr Rob Helstroom – Principal Scientist, Kinesis Pty Ltd
- John Hurt – Project Manager, Delta Electricity
- Dr Ing Jacob Klimstra – Senior Energy and Engine Specialist, Power Plants Department, Wärtsilä, Zwolle, The Netherlands
- William Nixey – Network Business Consultant, EnergyAustralia
- Mr Toby Roxburgh – Principal Sustainable Systems Engineer, MPI Group
- Mr Gordon Weiss – Principal Consultant for Process Efficiency, Energetics
- Adjunct Associate Professor Don White – University of Sydney
- Mr Gavin White – Principal and Regional Director, Lincolne Scott
- Mr Scott Wilson – A/Team Leader Sustainability Unit (BASIX), NSW Department of Planning
- Dr Kevin Yee – BASIX analyst in Sustainable Systems of the NSW Department of Planning

Jim Ferretti

Jim Ferretti is the Founder and Principal of MPI and a practising Mechanical Engineering Consultant since 1985. Jim is a former Chairman of the Mechanical Branch of the Institution of Engineers Australia and the founding chairman of the Building Services Panel. He has been involved in the research, planning, analysis, design, construction and review of virtually all types of buildings and has been working on Cogeneration and Trigeneration for over 15 years.
Jim has worked as a Consulting Engineer as well as a Management Consultant in a diverse range of fields including Engineering Design, Project Management, Financial Modelling and Privatisation.
His project experience covers a wide range of disciplines and Project types in the areas of Built Environments, Renewable Energy, Bio-fuels, Cogeneration, District Energy Systems, Waste to Energy and Manufacturing Facilities.
He is a former Chairman of the Mechanical Branch of the Institution of Engineers Australia and the founding chairman of the Building Services Panel.
He has been involved in the research, planning, analysis, design, construction and review of many different projects. He has wide ranging experience and expertise in the key areas of Project Feasibility, Project Financial Modeling and structuring for financial and strategic optimization.
Many of Jim's roles and projects are driven by a desire to achieve environmentally sustainable outcomes that incorporate sound economic and financial principles, thus bringing together two objectives that are not always compatible when viewed separately.
Jim presented a key paper: Cogeneration: Applications to Commercial Buildings, at the International Electrical Engineering Congress, Sydney in December 1994.

Dr Gareth Forde

Dr Gareth M. Forde is the Sustainability Team Leader for SEMF Pty Ltd, an Australian engineering and consulting firm. Gareth received his Bachelor of Engineering at the University of Queensland, his PhD (Biochemical Engineering) at Cambridge University (UK) and is currently both a Chartered Engineer and Chartered Scientist. Gareth is based in SEMF's Melbourne office where be consults in the areas of carbon neutrality strategies, green-house gas reporting, and low emissions solutions. Gareth has a fractional appointment at Monash University where he is engaged in sustainable engineering, biotech, and renewable fuels research at the Bio Engineering Laboratory (BEL). He has won numerous awards including an Innovation Fellowship from the Victorian Endowment for Science, Knowledge and Innovation, a 2008 Future Summit Leadership Award and the Freehills Prize for Innovation for co-inventing a more sustainable technology to purify bio-molecules. Email: **Gareth.Forde@semf.com.au**



Dr Rob Helstroom

Dr Rob Helstroom graduated from The University of Melbourne in 1983 with a Ph.D in experimental atomic physics and a strong interest in high-energy electrical, electrostatic and magnetic systems as well as in the physics of energy conversion processes. In 1984 Rob joined CSIRO as a Post-doctoral Research Fellow, and his research work there led into a long and productive association with NSW and interstate power generation industry.

In the years leading up to his 2003 departure from CSIRO Energy Technology, Rob increasingly applied his interest and knowledge of practical electrical and electrostatic systems. This work has extended further into energy transformation processes in the form of small power generation systems (such as microturbine or gas engines) combined with building heating, ventilation and air-conditioning plant. As part of these interests, Rob played a key role in the calculation of greenhouse gas emissions for the ClimateCam initiative of Newcastle City Council and biogas energy recovery from landfill.

Following relocation of CSIRO's Energy Technology Laboratories to Newcastle, Rob joined the NSW Department of Planning to work on an innovative housing sustainability project, BASIX. As the principal scientist behind the BASIX assessments of water consumption and greenhouse emissions, Rob Helstroom was responsible for ensuring the calculations were not only supported by good physics, but also well-grounded in reality. Prior to joining Kinesis as Principal Scientist in December 2007, Rob initiated a joint project between the Department of Planning and two major housing developers to demonstrate the greenhouse benefits of cogeneration in high-density apartment housing in Sydney.

At Kinesis, Rob is working with various state and private agencies to identify and assess sustainable energy and water solutions for housing, commerce and industry.

John Hurt

John Hurt is a Project Manager with Delta Electricity. He is a Mechanical Engineer (UNSW 1974) and started his engineering career at Australian Iron and Steel's plant at Prot Kembla. He moved to the Electricity Commission of NSW in 1978 and has since undertaken roles in operation and maintenance at a number of the states power stations.
In 1999 he joined Delta Electricity's team developing the cogeneration project. During the development of this project he has been involved in technical feasibility assessments, preparation of technical specifications, co-ordination of the environmental assessments, preparation of contract documents, tender assessments and contract administration for both the Condong and Broadwater plants.

Dr Ing. Jacob Klimstra

Jacob Klimstra received his Bachelors degree in Electrical and Electronic Engineering from the Technical College of Leeuwarden, NL. He joined N.V. Nederlandse Gasunie in 1970 to work on pulsating combustion and on vibrations based gas turbine diagnostics. Jacob subsequently studied Mechanical Engineering at the University of Southampton, UK, which was concluded with a Ph.D. thesis on the optimisation of reciprocating engine/compressor combinations. He then worked on the introduction and improvement of cogeneration based on reciprocating engines fuelled by natural gas. During that process, he wrote many international papers on subjects related to reciprocating engines and gave numerous presentations. He also converted diesel buses and boats to natural gas. From 1993 to early 2000, Jacob was Head of Department of Industrial gas Applications at Gasunie Research. In that capacity, he studied modern management techniques and implemented these in research management.
Jacob received the Richard Way Memorial Prize for his Ph.D. thesis, the Van Oostrom Meyjes Prize from The Royal Netherlands Institution of Gas Engineers for his work on engine-driven cogeneration and received 5 Oral Presentation Awards and the Distinguished Speaker Award from SAE. In September 2000, he received the ICE Division Speaker Award from the American Society of Mechanical Engineers. In 2003, he became recognised as Registered Energy Advisor.
Jacob is also a paper reviewer for SAE and ASME. He serves in many national and international committees related to energy use and is active as a board member and adviser of educational institutions.
From the year 2000, Jacob is employed by Wärtsilä in Zwolle, NL, as senior specialist for engine-driven power systems fuelled by natural gas. At Wärtsilä, he has written and presented about 90 papers on energy supply, cogeneration and engine development. In January 2005, he received the 2004 Quality Award from Wärtsilä. In June 2007, Jacob received a Best Paper Award at the PowerGen Europe Conference in Madrid. At the PowerGen Europe 2008 conference, he gave a key note presentation on the future of electricity generation.

Bill Nixey

Bill Nixey is a Network Business Consultant for EnergyAustralia. Located in Network Regulation & Pricing, Bill is extensively involved in developing the network policies for; pricing, metering, customer contestability, embedded networks and distributed generation. Prior to EnergyAustralia, Bill worked for other utilities such as Electricite de France and the Australian Gas Light Company. He has degrees in Chemical Engineering and Commerce from the University of Sydney, and a Graduate Diploma in Applied Finance from FINSIA.

Toby Roxburgh

Toby Roxburgh is the Principal Sustainable Systems Engineer for MPI Group. Toby project manages, designs, installs and commissions Cogeneration and Trigeneration projects for clients. These are integrated into other systems and optimised through modelling for performance and return on investment. Toby integrates generation into holistic building sustainability design, incorporating Building Ratings and Environmentally Sustainable Designs together. As well as designing new systems incorporating a wide range of options, Toby currently maintains Macquarie University's Trigeneration Control System.

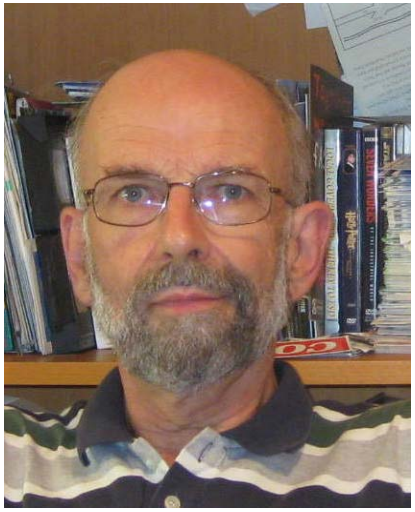
Prior to MPI Group, Toby worked for Snowy Mountains Engineering Company (SMEC) in geothermal power generation, biomass and biogas generation, mini-hydro generation, energy efficiency, and sustainable power generation.

In March 2003, while on secondment to the NSW Government Toby co-authored a review on the Cogeneration Development Program by the NSW Sustainable Energy Development Authority (SEDA). This identified key barriers to be addressed which would allow wide uptake of cogeneration.

He has a degree in Electrical and Electronic Engineering University of Edinburgh (1998-2002) and produced a program to identify key wind sites in the UK for his University Thesis just as wind energy was beginning to be installed in large numbers.

Gordon Weiss

Gordon Weiss is a Principal Consultant at Energetics, Australia's largest specialist management consultancy in the business of climate change. He has over 25 years experience across a range of process industries, with a particular focus on improving energy performance. Gordon has a BE and PhD in Chemical Engineering, and is a Fellow of IChemE.



Adjunct Associate Professor Don White

Don has thirty years' experience as a manager and engineer and in manufacturing and engineering for the process and chemical industries. His career was largely with ICI, later renamed Orica, and now some components are known as Qenos. More recently he practised as a Consulting Engineer and engaging in University teaching. He has managed large petrochemical and Chlor-alkalai plants and been responsible for the supply of Engineering Services. Don was also Commissioning Manager for the Australian Magnesium Corporation in Gladstone, Qld, for their $48 million demonstration plant and later provided consulting services for the $1,000 million magnesium plant during its design stage. He left Orica in 1998 and consults to the Petrochemical, Chlor-alkalai, Chemical and Magnesium metal industries.
Don has considerable interests in Sustainability, Conservation and local government issues. Particular roles include:

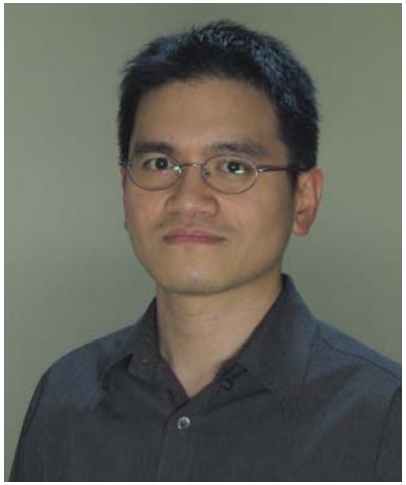
- Board member of the Environmental Protection Authority of NSW (Part of the NSW Department of Conservation and Climate Change)
- Chairman of the Nature Conservation Council of NSW (the peak group for non-government conservation groups) and active on several of its committees
- Director of the Nature Conservation Water Fund Pty Ltd and its Water Trust
- Membership of several consultative committees including State Water Community consultative Committee, Load Based Licensing Technical Review Panel and member of the Environmental Trust - Waste Advisory Committee
- Trustee of Paddy Pallin Foundation Pty Ltd and Management Committee member of the Paddy Pallin Natural Environment Fund

Gavin White

Gavin is a Principal and Regional Director of Lincolne Scott. Gavin has worked for numerous years in the UK where he managed several high profile projects including Channell4 Television studios and the Reuters European data hub in London. Both projects included extremely complex fit out stages. Since his arrival in Sydney 12 years ago, Gavin has worked on a variety of large highly complex projects including the recently completed Queensland Gallery of Modern Art. More recently Gavin has played a leading role as Design Director in the Parramatta Justice Precinct and Fraser Broadway. Frasers Broadway will be one of the first projects to be reviewed under the GBCA precinct tool. As a lead Engineer and Design Director, Gavin maintains a 'hands on' engineering role within the office. He has extensive experience of working with architects in developing services solutions to meet specific site requirements.

Scott Wilson

Scott Wilson is the A/Team Leader Sustainability Unit (BASIX), NSW Department of Planning.
Scott is responsible for management of the NSW BASIX online sustainability tool. Accessible on-line, BASIX mandates energy and water saving provisions for all new residential construction in NSW.
Scott has Bachelor Degree in Architecture and a Master of Town Planning. He has over 25 years experience in the construction and development industry in both the private and public sector. Within the Department of Planning he has been involved in policy and strategic development assessment, including planning for sustainable cities through the NSW City Centres program.
Scott's role in managing the BASIX team also includes contribution to the National agenda for achieving sustainable water, energy and greenhouse gas targets.



Dr Kevin Yee

Kevin Yee is the BASIX analyst in Sustainable Systems of the NSW Department of Planning. He is involved in the development, monitoring and verification of models used in evaluating the Building Sustainability Index (BASIX). Kevin has extensive experience in estimating the material and energy consumptions of processes according to their capacities and technologies. Prior to the NSW Department of Planning, Kevin has worked in Hong Kong where he developed the cost models of chemicals produced in China. Kevin has degrees in Chemical Engineering and Commerce from the University of Sydney, and a PhD in Chemical Engineering from the University of New South Wales. His doctoral thesis focused on the modelling and optimization of an industrial wastewater treatment facility that utilizes membrane separation technology.

Host of Symposium participants – tour of the School of Electrical and Information Engineering's new lab facilities

- Professor Vassilios Agelidis – EnergyAustralia Chair of Power Engineering, Director, Power & Energy Engineering, School of Electrical and Information Engineering, The University of Sydney

Professor Vassilios G. Agelidis

Vassilios G. Agelidis holds the EnergyAustralia Chair of Power Engineering at the School of Electrical and Information Engineering, University of Sydney. Professor Agelidis leads the largest, most dynamic and internationally recognised power engineering research group in Australia towards finding:

- Innovative and economical means to operate electricity infrastructure
- Advanced electronic control of electricity grids using utility power electronics
- Electrical energy generated with sustainable energy sources
- Increased efficiency of delivery and quality of electrical power
- New technologies that integrate telecommunication, computer and software systems with power system principles to deliver the intelligent grid of the future

His most significant research contributions so far have been in the field of power-electronic energy conversion, with the goal of achieving more efficient energy use through motor control and electrical energy processing. He has reported design methods of advanced equipment for electrical utilities able to support a 'smarter' grid infrastructure based on fast automated electronic control. In the area of sustainable energy systems, his work includes grid integration techniques of distributed generation based on solar, wind and fuel-cell energy converters through electronics and more economic direct current (DC) transmission technologies using voltage-source converters. In 2004, he received the UK's most prestigious research fellowship for a young researcher, the advanced research fellowship from the Engineering and Physical Sciences Research Council. His research involves collaborations with various companies and government organisations and many universities worldwide. In 2007, he received an Endeavour Executive Award from the Australian Government for a three-month visit to Seoul National University of Technology, South Korea where he worked on research projects with fuel-cell energy conversion systems. In 2008-09, he was a VESTAS visiting research Professor at Aalborg University, Denmark for a period of three months working on high-voltage direct current (HVDC) interconnections of large offshore wind farms with the electricity grid.

For further information contact Skender Bregu, Executive Officer, Chemical and Biomolecular Engineering Foundation, The University of Sydney
Tel 02 9351 5284 Fax 02 9351 2854 Email: s.bregu@usyd.edu.au

Australian Institute of Energy

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The Foundation acknowledges the support of all those involved in this Symposium, including the Chairs, Presenters, and their associates, and thanks them and the companies and organisations they represent for their time, input and advice.

The Foundation also acknowledges

- **Australian Institute of Energy in the first place, and the Institute's Sydney Branch Secretariat, Gwen Cant**
- **The Australian Institute of Food Science and Technology**
- **Engineering Australia**
- **The Institution of Chemical Engineers (IChemE)**
- **The Warren Centre for Advanced Engineering of the University of Sydney**

for their support and assistance in promoting the Symposium by informing their members

A special vote of thanks is also given to all the others that provided advice and assistance, among whom are Associate Professor Tim Langrish, Head of School of the Chemical and Biomolecular Engineering of the University of Sydney, Bob Germaine of the Greater Western Sydney Economic Development Board, Chris Derksema of the City of Sydney and finally, but most importantly, Professor Anthony Vassallo, who holds the inaugural Delta Electricity Chair in Sustainable Energy Development at the University of Sydney and has provided advice, assistance and, most importantly, encouragement in the effort building up to this event.

And finally, the Foundation recognises the support and input provided by the sponsors of the Symposium, Wärtsilä Australia Pty Ltd, and Schneider Electric.