INTERNATIONAL ASSOCIATION FOR THE PROPERTIES OF WATER & STEAM

IAPWS

Mercury

ANNUAL MEETING 2022

GEOTHERMAL THE NEXT GENERATION

THE 2022 IAPWS SYMPOSIUM

WEDNESDAY NOVEMBER 30TH 2022 | NOVOTEL, ROTORUA

The IAPWS 2022 Symposium is a joint event with Geothermal, The Next Generation and is focused on supercritical and sub-critical geothermal steam chemistry.

The symposium includes the IAPWS 2022 Helmholtz Award lecture and will be followed in the evening by the IAPWS 2022 dinner.

This Symposium is attended together with the Thursday workshop event as a two day event.

SUPERCRITICAL AND SUB-CRITICAL GEOTHERMAL STEAM CHEMISTRY

Proudly Supported by Mercury NZ Limited

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ROTORUA, NEW ZEALAND
27TH NOVEMBER - 2ND DECEMBER

INTERNATIONAL ASSOCIATION FOR THE PROPERTIES OF WATER & STEAM

The International Association for the Properties of Water and Steam (IAPWS) is an international non-profit association of national organizations concerned with the properties of water and steam, particularly thermophysical properties, cycle chemistry guidelines, and other aspects of high-temperature steam, water and aqueous mixtures relevant to thermal power cycles and other industrial and scientific applications. IAPWS meetings have been held annually since 1929. Current Members of IAPWS are Australia, Britain and Ireland, Canada, the Czech Republic, Germany, Japan, New Zealand, Greece, India, Italy, and Switzerland.

The 2022 IAPWS meeting is being hosted by the New Zealand Association for the Properties of Water and Steam (NZAPWS) and the IAPWS meeting always contains a technical symposium related to a technical area of relevance to the host country to provide an opportunity for collaboration, discussion and networking between IAPWS members and local experts and interested parties.

GEOTHERMAL THE NEXT GENERATION

For the IAPWS2022 symposium the theme is "Supercritical and Subcritical Geothermal Steam Chemistry" and its held in conjunction with Geothermal, The Next Generation.

Supercritical geothermal fluids (>5 km, >400°C) offer significantly more energy than conventional geothermal fluids found at current depths (~3.5 km) and reservoir temperatures (<350°C).

Geothermal, The Next Generation is a GNS Science project that is attempting to address geological, geochemical and technological challenges unknown in conventional geothermal use. The team, combining expert geophysicists, geologists, experimental geochemists, modellers and strategic advisors, will investigate New Zealand's supercritical conditions and learn from international experiences.

More information at:
www.geothermalnextgeneration.com

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Principal IAPWS2022 Symposium sponsor is Mercury NZ Limited one of New Zealand's leading electricity generating and retailing companies.

www.mercury.co.nz

THE 2022 IAPWS **SYMPOSIUM** PROGRAM
WEDNESDAY NOVEMBER 30TH 2022

GEOTHERMAL THE NEXT GENERATION

9:00 – 9:10	Introductory Remarks	Prof. Masaru Nakahara IAPWS President, Kyoto University, Japan
9:10 – 9:55	Helmholtz Lecture and Award Presentation: How do Surfaces with Nanoscale Heterogeneity Perturb Water Structure?	Dr Amish Patel Associate Professor in Chemical and Biomolecular Engineering at the University of Pennsylvania, USA
9:55 – 10:05	Welcome to IAPWS and the IAPWS and NZAPWS Supercritical Geothermal Symposium	David Addison Chairperson NZAPWS, IAPWS PCC Chairperson, Principal Consultant, Thermal Chemistry Limited, NZ
10:05 – 10:50	KEYNOTE: New Zealand's Energy and Geothermal Future. Opportunities and Challenges	Vince Hawksworth Chief Executive, Mercury NZ Limited
10:50 – 11:20	MORNING TEA	
11:20 – 11:35	Geothermal the Next Generation Research Programme Introduction – Including thoughts on Using the Fluids at the surface and drilling to access the super critical resources	Brian Carey Geothermal Resource Management Specialist - GNS Science
11:35 – 12:35	Volcanism in the Taupo Zone and Geophysics OVERVIEW: • Magnetotellurics • Seismic Attenuation Studies - identifying rock mush • Magnetics • Depth to 560°C conditions derived for Curie Point Modelling	Pre-recorded Video Presentations Dr Geoff Kilgour Dr Craig Miller Dr Ted Bertrand Dr Stephen Banister GNS Science
12:35 – 13:20	LUNCH	
13:20 – 14:00	Overview of conditions and issues • GNS Experimental capability • Silica and anhydrite solution studies at super critical conditions	Dr Bruce Mountain Dr Peter Rendel
14:00 – 14:20	Geothermal steam sampling and online analysis of trace sodium and silica and interference removal via gas transfer membranes and sulfide to sulphate converters	David Addison Principal Consultant, Thermal Chemistry Limited, NZ
14:20 – 14:50	AFTERNOON TEA	
14:50 – 15:50	MODELLING • Methodology for national inventory of supercritical resources • Modelling to assess project potential • Deep sub critical models and the supercritical to sub critical transition with the challenges crossing the critical point in modelling • Modelling well outputs producing from 6 km deep supercritical wells	Chris Bromley Dr Warwick Kissling Dr John Burnell Julius Riveria GNS Science
15:50 – 16:10	Geothermal Supercritical Fluid Steam Transformer Design Concepts	Peter Rop (presented by David Addison) NEM Energy, Netherlands
16:10 – 16:40	Reducing Greenhouse Gas Emissions from Geothermal Power Generation	Ian Richardson Capability Lead - Operations Generation & Development, Contact Energy, NZ
16:40 – 16:50	Clean Energy European Metrology Network	Dr P. Alberto Giuliano Albo Researcher, Istituto Nazionale di Ricerca Metrologica, Italy
16:50 – 17:00	OPEN DISCUSSION: Geothermal supercritical	
17:00 – 17:15	Closing Remarks	David Addison Chairperson NZAPWS, IAPWS PCC Chairperson, Principal Consultant, Thermal Chemistry Limited, NZ

IAPWS CONFERENCE DINNER - TE PUIA, ROTORUA

Bus transports leaves front of hotel 6:00pm sharp, returns around 10:30pm.

THE 2022 IAPWS **SYMPOSIUM** SPONSORS

PRIMARY SPONSOR MERCURY NZ LIMITED

THE 2022 IAPWS **HELMHOLTZ AWARD LECTURE**

The IAPWS Helmholtz Award is given yearly to a qualified researcher who, at the time of the nomination, is at most 15 years past the time of receiving his or her last earned degree. As part of the award a Helmholtz lecture is given as part of the IAPWS Symposium. For 2022 the winner of the IAPWS Helmholtz Award is Associate Professor Amish Patel of the Department of Chemical and Biomolecular Engineering, University of Pennsylvania, USA

How do Surfaces with Nanoscale Heterogeneity Perturb Water Structure?

By characterizing how water structure is perturbed by nanostructured surfaces, i.e., surfaces with chemical patterns and/or texture at the nanoscale, my group strives to inform the design of functional soft materials as well as to understand biomolecular interactions and assembly. In this presentation, I will share examples of our recent successes in these two areas.

I will first describe our efforts in designing rough hydrophobic surfaces, which are dubbed "superhydrophobic" due to their desirable properties, such as water repellency and interfacial slip. Superhydrophobicity stems from an aversion of water for the hydrophobic surface texture, so that a water droplet in the superhydrophobic "Cassie state" contacts only the tips of the rough surface. However, superhydrophobicity is remarkably fragile and can break down due to the wetting of the surface texture to yield the "Wenzel state" under various conditions, such as elevated pressures or droplet impact. Moreover, due to large energetic barriers that impede the reverse transition (dewetting of the texture), this breakdown in superhydrophobicity is widely believed to be irreversible. Using molecular simulations and enhanced sampling techniques, we challenge this conventional wisdom. In particular, we show that water density fluctuations play an important role in dewetting the surface texture; by circumventing the classical dewetting pathways, fluctuations lead to a reduction in the free energetic barriers to dewetting. Importantly, an understanding of the mechanistic pathways to dewetting and their dependence on pressure allows us to augment the surface texture design, so that the barriers to dewetting are eliminated altogether and the Wenzel state becomes unstable. Such robust surfaces, which defy classical expectations and can spontaneously recover their superhydrophobicity, could have widespread importance, from underwater operation to phase-change heat transfer applications.

I will first then our efforts in uncovering the role that water plays in mediating the interactions and self-assembly of complex molecules, including proteins, peptides, and surfactants. The extent to which the inherent structure of water is perturbed by these complex molecules, determines the thermodynamics and the kinetics of their assembly. However, accurately characterizing this perturbation is challenging, because the manner in which proteins disrupt the inherent structure of water depends not only on the chemistry of the underlying protein surface, but also on the precise topographical and chemical pattern displayed by the protein. I will discuss our recent successes in quantitatively characterizing the disruption of water structure in the hydration shell of proteins, and in using this information to predict the interfaces through which proteins interact with one another and self-assemble. Our approach also informs strategies for optimally modulating protein interactions, and facilitates the design of ligands that will bind to proteins of interest with high affinity and specificity. We hope that these advances will pave the way for the discovery of novel therapeutics that specifically target proteins of interest, and the rational design chromatographic ligands for challenging protein separations.

AMISH PATEL

Associate Professor, Department of Chemical and Biomolecular Engineering, University of Pennsylvania

Received Bachelors in Chemical Engineering from the Indian Institute of Technology – Bombay in 2001 and his doctorate in Chemical Engineering, from the University of California – Berkeley in 2007. His research strives to achieve a molecular-level understanding of solvation and transport in aqueous and polymeric systems, with applications ranging from predicting protein interactions to designing advanced materials for water purification and renewable energy. To study these biological, nanoscopic, and polymeric systems, the Patel group uses statistical mechanics and liquid state theory in conjunction with the development and use of novel molecular simulation and data science techniques. For his research and teaching, Amish has received an NSF CAREER award, a Sloan Research Fellowship in Chemistry, an OpenEye Outstanding Junior Faculty Award from the Computers in Chemistry division of ACS, a Camille Dreyfus Teacher-Scholar award, the van Ness Lectureship from the Chemical and Biological Engineering department at the Rensselaer Polytechnic Institute, and University of Pennsylvania's Lindback Award for Distinguished Teaching.of geophysical models to delineate supercritical resources.

THE 2022 IAPWS **SYMPOSIUM** SPEAKERS

VINCE HAWSWORTH KEYNOTE SPEAKER

Chief Executive, Mercury New Zealand Ltd

Vince joined Mercury in March 2020. Vince has considerable experience in the energy sector in both New Zealand and Australia. Most recently he was Chief Executive at Trustpower and prior to that, Chief Executive of Hydro Tasmania. Vince qualified as a Mining Engineer, working in UK coal mines and has an MBA from the University of Waikato.

Vince commenced his career in the New Zealand energy sector at the Huntly power station and led both the generation and retail divisions at Genesis Energy. He led the demerger of Tilt Renewables from Trustpower and later oversaw the acquisition of Tilt's New Zealand assets and the Trustpower retail business by Mercury, setting the company up for a significant period of growth.

Under his leadership, Mercury has made substantial progress on its renewable generation pipeline, including Turitea Wind Farm (New Zealand's largest wind farm) and Kaiwera Downs Wind Farm which are currently in construction.

DAVID ADDISON

NZAPWS Chairperson, Principal; Thermal Chemistry

David Addison (B.Sc. (Tech), Chemistry, M.Sc. (Tech), Materials Science, University of Waikato, New Zealand) is the principal power plant chemistry consultant of Thermal Chemistry Limited (New Zealand), where he works with utility organisations worldwide helping to resolve complex water/steam cycle chemistry issues.

David Addison has worked in the power industry since 1997 and has been involved in all aspects of power station chemistry for both conventional (coal and gas), combined cycle gas turbine units, industrial steam plants, cogeneration plants, electrode boilers and geothermal power plants

David Addison has presented and chaired sessions at numerous international cycle chemistry conferences and user groups and has had multiple papers and articles published on water/steam chemistry across all plant types.

He is the current chairperson of the New Zealand Association for the Properties of Water and Steam (NZAPWS), the chairperson of the Power Cycle Chemistry (PCC) group of the International Association for the Properties of Water and Steam (IAWPS), a member of the International Advisory Board (IAB) for the PPChem journal and is involved in the development of international cycle chemistry guidelines.

P. ALBERTO GIULIANO ALBO

Researcher, Istituto Nazionale di Ricerca Metrologica, Italy

Graduated in Physics at the University of Turin, he got the doctorate in Metrology in 2006 at the Politecnico di Torino. He has been working at Istituto Elettrotecnico Galileo Ferraris and INRiM since 2003 on research topics dealing with thermodynamics and thermometry, mainly developing new instrumentation for measuring density and speed of sound of fluids. He contributed to the new determination of the Boltzmann constant obtained using primary acoustic thermometers. In 2019, the obtained results have been used to fix the value of the Boltzmann constant, without uncertainty, today adopted to provide a new definition of the kelvin in the International System of Units (SI). Before the introduction of the 4th generation refrigerants, he contributed to the preparatory researches necessary to collect speed of sound and density measurements used by ISO working groups to implement standard equations of state.

Today interest is focusing on the development of new instrumentation suitable to be used as transfer standard for reducing the gap between laboratory and on-site calibrations in the field of power-to-gas, power-to-liquids, steam turbines, LNG, decarbonisation and carbon dioxide reprocessing.

STEPHEN BANNISTER

Seismologist, GNS Science

Stephen's research involves imaging Earth structure and examining Earth processes using earthquake seismic waves. He investigates seismic phenomena (triggered earthquakes; low frequency earthquakes, seismic tremor) and images the heat source in the mid-crust beneath New Zealand's geothermal fields and subduction processes using seismology approaches.

In the GNG Programme, Stephen will improve the coding and resolution of seismic models, and be involved in the integration of geophysical models to delineate supercritical resources.

TED BERTRAND

Senior Magnetotelluric (MT) Scientist, GNS Science

Ted leads the Thermal Processes Project in the Te Riu-a-Māui Zealandia Programme, researching how heat, magma and metals are transferred within the crust. His primary interests are using MT to investigate geothermal, volcanic and tectonic processes in the Taupo Volcanic Zone. Over the past decade this research has imaged connections between geothermal fields and their underlying magmatic roots, revealing pathways of heat transfer through the crust. Ted's work has contributed to both exploration of geothermal resources in NZ and to their sustainable management. He also contributes MT expertise to geothermal projects overseas. Ted enjoys fieldwork and has undertaken MT measurements in Canada, USA, Taiwan, New Zealand, Japan, and Antarctica.

THE 2022 IAPWS **SYMPOSIUM** SPEAKERS

CHRIS BROMLEY

Geophysicist, GNS Science

Chris Bromley had conducted resource assessments, geophysical exploration, and environmental studies of geothermal fields in Indonesia, Philippines, Japan, Kenya, Iran, Chile, Australia and New Zealand.

In the GNG Programme, Chris will link the research with similar international projects and associations with interests in supercritical development.

JOHN BURNELL

Energy Research Leader, GNS Science

John is the Energy Research Leader at GNS Science, New Zealand's leading earth sciences research institute. His research expertise is in computational modelling of heat and mass flows. Most of his recent work has focussed on developing models of geothermal systems throughout the world. He has developed models of systems in New Zealand, the Philippines, Japan and Papua New Guinea. A key focus of his work is to develop models that are realistic representations of the physical system that allow robust assessments of future development options. For the last eight years, John has led two research programmes focussed on developing new methodologies for modelling geothermal systems. He is currently the NZ convener of the IPGT Reservoir Modelling Group.

BRIAN CAREY

Geothermal Specialist; Project Leader, GNS Science

Brian is a mechanical engineer and geothermal specialist, well-versed in geothermal resource utilisation having managed energy delivery from two geothermal fields in New Zealand. He currently provides advisory services to geothermal field operators, regulatory and government agencies. Brian is also the secretariat for IEA Geothermal, working internationally to foster the uptake of geothermal energy.

In the GNG Programme, Brian has the pivotal role of bridging the scientific and communication activities to ensure the results are applicable.

WARWICK KISSLING

Numerical Modeller, GNS Science

Warwick extensive experience using the geothermal simulation code TOUGH2, and has developed special-purpose versions of this code for supercritical fluids and for high temperature, hyper-saline brines. His research interests include developing software, modelling fracture networks and flow in fractured rock, and combining fluid flow and rock-mechanics codes.

In the GNG Programme, Warwick will investigate large-scale permeability conditions and the influence of brittle-ductile on different rock types in the TVZ rifting environment.

CRAIG MILLER

Volcano Geophysicist; Project Leader, GNS Science

Craig is a volcano geophysicist specialising in imaging volcano, magmatic and hydrothermal systems using potential field geophysical methods, such as gravity, magnetics and resistivity. Through inverse and forward models these data are turned into images of the Earth's crust to locate features of interest. He has a broad background in geosciences having worked in mineral exploration, volcano monitoring and geothermal assessment.

In the GNG programme, Craig will lead the interpretation and modelling of gravity, magnetic and MT datasets, supported by a wealth of borehole and rock property information to find likely targets for drilling for supercritical fluids.

BRUCE MOUNTAIN

Hydrothermal Geochemist; Project Leader, GNS Science

Bruce specialises in geothermal and mineral chemistry, and has a background in geological engineering. His research includes experimental hydrothermal geochemistry related to geothermal systems and ore-forming environment, and temperature stability of organic molecules in geothermal environments.

In the GNG Programme, Bruce will conduct geochemical experiments on New Zealand rocks at supercritical and sub-critical conditions.

THE 2022 IAPWS **SYMPOSIUM** SPEAKERS

PETER RENDEL

Hydrothermal Geochemist, GNS Science

Peter's is a researcher in the Hydrothermal Systems and Mineral Team at GNS Science. He earned his BSc and MSc in geology, and his Ph.D. in geochemistry at Ben-Gurion University of the Negev, Israel. His research expertise is on water-rock interaction geochemistry in Geo-Energetic related systems including geothermal energy, energy storage, geological carbon storage and utilization, and enhanced hydrocarbon recovery. Peter is a leading experimental geochemist in the research Geothermal - The Next Generation programme, focusing on Aotearoa's supercritical geothermal potential, and is leading a research proposal to evaluate sub-surface energy storage solutions for NZ.

JULIUS RIVERIA

Geothermal Reservoir Engineer, GNS Science

Julius is a Geothermal Reservoir Engineer working for GNS Science with experienced in reservoir engineering, resource management, and resource and field optimisation projects. He graduated with Bachelor of Science in Chemical Engineering at the University of the Philippines and earned his Master of Engineering in Engineering Science at the University of Auckland in New Zealand. Julius specialises in wellbore modelling and simulation, production engineering, data analysis, and reservoir evaluation. He worked on geothermal production fields in the Philippines and is well versed in root cause analysis, well design and well integrity risk management. Some of his notable works are wellbore modelling of Chile and Peru geothermal prospect, wellbore modelling for supercritical well production in New Zealand, and downhole pump technology project. He is currently involved in the Geothermal: Next Generation (GNG) project for the supercritical ultra-hot well production simulation work.

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Contact Energy

Created in 1996, we're one of New Zealand's largest listed companies with over 550,000 customers across electricity, natural gas and LPG products, supported by a team of over 1000 employees located up and down the country, all working to help New Zealanders live more comfortably with energy. Our focus is on delivering great value, great products and great service to customers. We currently offer electricity, natural gas and bottled LPG generated through our 11 hydro, geothermal and gas-fired power stations.

We're always looking to the future and are constantly trialling new products and services; all inspired by what our customers have told us they value.

Ecolab

Ecolab has a profound influence on how we live our lives, and the impact we have on our planet. From clean water to safe food and healthy environments, we are at the very forefront of environmental innovation and business technology, keeping people safe and preserving our resources. Ecolab. Driving progress and protecting our vital assets. Anticipating the future and enhancing your world.

Energy Plant Solutions

Energy Plant Solutions Limited (EPS) are specialists in the supply and installation of energy plant for industry. Our sole focus is to provide high efficiency package boilers, turn key projects from design through to implementation, top quality service, ongoing maintenance, repairs, upgrades, and efficiency improvements for our industrial clients.

EPS is helping New Zealand move towards a more sustainable and energy efficient future. Because industrial energy plant is our sole focus, we are able to provide innovative, cutting edge products, knowledge and services not offered by other engineering firms. Many EPS products and services are centred on energy efficiency, environmental impact minimisation and reduced CO2 emissions. The benefits of working with EPS are immense. We value our staff, we value our clients, and we look forward to further discussing our role as your preferred energy plant supplier.

Fonterra

We are a New Zealand Co-operative made up of everyday good people who work together to do good things with dairy. Good things with the land we work on and good things for the people that our products end up with. We are passionate about doing amazing things with dairy.

In Aotearoa, the indigenous peoples, Māori, have a spiritual connection between people and the land – the wellbeing of one sustains the wellbeing of the other. It's a spirit we adapt as New Zealanders, and one we share with many cultures around the globe, that connects and unifies us all.

We want farming in Aotearoa, New Zealand to continue for generations to come that is why we are committed to farming in a way that regenerates our farms and the environment.

H2O Engineering

The H2O Group of companies begun in 2007 with H2O Systems providing specialist service and maintenance support for municipal and industrial clients. In 2010 the projects division was added and shortly after a third division of equipment sales was added. The group of companies currently has 16 full time staff.

Our philosophy and commitment is based on our desire to be the best in our industry and deliver facilities designed and constructed to the highest level. We strive to be the contractor that clients and head contractors do not need to be concerned with due to good communication and consistently delivering on time.

We specialise in developing conceptual and process designs into detailed designs, then building and delivering those detailed designs to hand over to the client. Ongoing service support can then ensure that any system built can continue to operate as designed.

The wide range of industries that H2O operate in is a testament to the experience of the staff as well as the proven track record in delivering process systems which are out of the ordinary. These industries include fossil and geothermal power generation, dairy plants, municipal and waste water, and aquariums zoos, aquatic centres and municipal water features.

IXOM

IXOM understands the fundamentals of a secure, sustainable, and competitive world class chemical solution provider includes the following components:

- Assurance of supply
- Assurance of safety
- Assurance of quality
- Legal compliance
- Internationally competitive value
- Technical and operational support
- Innovation
- Ixom – Suppling Industrial Water solutions since 2008
- Distribution agreement with VEOLIA in 2014
- Exclusive Channel Partnership agreement with VEOLIA in 2017
- World Class chemistry
- World Class technology
- Local Service expertise
- Regional Subject matter experts
- Global partnership

MERCURY NZ LIMITED

We generate electricity from 100% renewable sources: hydro, geothermal and wind. Our electricity generation sites are located along the Waikato River (hydro), the nearby steamfields of the northern part of the Central Plateau (geothermal) and in the Manawatū, South Taranaki and Otago regions (wind). We are currently building our Turitea wind farm in the Tararua Ranges of the Manawatū region, which will be New Zealand's largest wind farm once complete. We have a pipeline of future wind development sites across the country. We are also a multi-product utility retailer of electricity, gas, broadband and mobile services through our retail brands (Mercury, Trustpower and GLOBUG), and are focussed on delivering wonderful solutions for New Zealanders at home, at work and on the move. Our mission, which guides us in what we do and why, is Energy Freedom for all. This is about Aotearoa New Zealand being stronger economically and more sustainable through better use of homegrown, renewable energy. We're listed on the New Zealand Stock Exchange and the Australian Stock Exchange with foreign exempt listed status. The New Zealand Government (the Crown) holds a legislated 51% shareholding in the Company

Solenis

A global specialty chemical company headquartered in Wilmington, USA.

We solve tough water treatment and process improvement challenges for customers in the consumer, industrial and pool water markets through people, experience and technology.

We are strongly invested in the Geothermal Power industry and have developed technologies proven to control deposition, corrosion and microbial growth. We have also developed chemical and application processes to rejuvenate - and stimulate - production and reinjection wells.

Check us out at www.solenis.com

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Spirax Sarco Engineering

We have three world-leading Businesses helping a diverse range of global industrial clients. Our Steam Specialties Business (Spirax Sarco and Gestra) provides products and services for the control and management of industrial and commercial steam systems; our Electric Thermal Solutions Business (Chromalox, Thermocoax and Vulcanic) provides electrical process heating and temperature management solutions; while Watson-Marlow has been providing pumps and associated fluid path technologies to customers for over 60 years.

SWAN Analytical

SWAN Analytical Australia and New Zealand proudly distribute SWAN Analytical Instruments in Australia, New Zealand, and the greater pacific.

SWAN instruments are developed on the principles of simplicity, precision and reliability.

Our range of analysers for pure, ultrapure and cooling water applications cover a wide variety of parameters including pH, Conductivity, ORP, Dissolved Oxygen, Silica, Sodium, Phosphate, Chlorine, Chlorine Dioxide, Bromine, Iodine, Ozone, and Turbidity as well as Aluminium Chloride, COD, Colour, Fluoride, Iron, Manganese, Phenol, Total Organic Carbon, Total Alkalinity and Total Hardness).

If there is anything you'd like to ask or discuss, please call by our booth during the conference.

Duff and Macintosh

Duff and Macintosh are exclusive agents in Australia Pacific for Sentry Equipment Corporation.

As suppliers of instrumentation for 95 years, Duff and Macintosh have specialised in SWAS for over 50 years.

With the technical assistance of Sentry, Duff and Macintosh now supply a broad range of steam and water sample conditioning components:

- Sample Conditioning Components
- ASME-coded sample coolers
- Pre-engineered ASME-coded single line sample panels
- Complete wet-racks to the latest EPRI, ASTM and IAPWS guidelines

Sentry's equipment, though competitive, is built to the highest standards ensuring your chemistry's quality and certainty with system longevity.

Utrex

Utrex Limited is a key supplier of niche Industrial Services. Utrex is 100% privately owned and operated in New Zealand which enables us to provide ultimate flexibility for clients.

The vision is to build an organization that operates and grows sustainably, building knowledge and expertise to support our chosen fields. Whilst focusing on the needs of New Zealand's current heavy industries, we are also dedicated to transitioning to the service needs of future clean energy providers.

Services include chemical cleaning and maintenance on boilers, heat exchangers, pipelines, tanks and evaporators. Tank cleaning of class 8, class 3 and class 5. Equipment rental, mechanical repairs, fitting, welding, PVC welding, hydrotesting and pneumatic testing. API tank design and tank repair work, HSNO tank installations and approval, turn key consulting and project management services.

Visentia

Visentia Limited was founded in 2016 by a group of like-minded professionals who believed there was a better way to provide water treatment chemicals and services to New Zealand industries. The company's tag line is "better water, better lives". We live by this, we mean it, and we make our decisions based on this principle.

Founded on the opinion that a business exists to serve the needs of customers and employees first and foremost, Visentia strives to maintain an environment where people are supported, and where work is fun.

In practical terms, this translates to not overworking staff, carefully listening to each other, encouraging new ideas and innovation, being quick to adopt new technologies, and removing bureaucracy and inefficient processes wherever we can.

We challenge everything, and we will gladly abandon the status quo if it does not deliver the value that our employees and/or our customers deserve. We believe these principles are not only good for people's lives and the water we treat, but that they are the way to sustain and further develop a successful and vibrant business.

Waltron

Waltron manufactures and distributes analytical industrial instrumentation and supporting reagents used for the management of ultra pure steam and water chemistry. Founded in 1903 under the name "Bull & Roberts" as a laboratory testing boiler water for ocean going vessels, Waltron is one of the world's oldest companies in the water industry. The original company was at the forefront of many technical innovations in the management of steam and water chemistry, including the first modern boiler water treat ment program, the first nuclear water chemistry program on a commercial ship, and the founding of the American Council of Independent Laboratories.

Currently, Waltron supplies a full line of online instruments for the ultra pure water market. Starting in 2013, Waltron embraced luminescent technology as our only method for dissolved oxygen analysis, and has just released the latest version, the 9165 with completely new electronics, as well as the 9165S "smart sensor" as a limited sensor only version that c an be directly connected to a plant DCS system to provide an analog milliamp signal to the DCS. In 2019, Waltron released the 3054 Filming Amines analyzer, the first online analyzer for film forming amines.

Windsor Energy

Windsor Energy is a division of Windsor Engineering Group. Well established in NZ with a history of nearly 50 years Windsor has earned their reputation building timber drying kilns, heat exchangers, air pollution control, acoustic silencers and industrial heating and combustion solutions.

In 2019 Windsor acquired RCR Energy and formed the new division Windsor Energy. Windsor attained the rights to the previous RCR IP including industrial boilers and indirect gas-fired air heaters. The entire RCR Energy engineering and service teams were retained and continue to provide thermal energy solutions to industry around our core products.

As well as our in-house designs up to 20MW capacity we hold a design licence with Babcock & Wilcox USA to build Towerpak boilers for solid fuel solutions and FM boilers for gas fired solutions above 20MW. Complementing our in-house designs, we are the Australasian representative of Elpanneteknik from Sweden for industrial Electrode Boilers.

Our team of 30-strong engineers based in Napier provide full project delivery solutions covering all engineering disciplines. Project management, procurement and construction resources in the Energy Projects team enable full end-to-end project execution capabilities.

Additionally, our nationwide Energy Service team provides regular service and annual survey support for delivered projects.

INTERNATIONAL ASSOCIATION FOR THE PROPERTIES OF WATER & STEAM

IAPWS

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