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2012 engineering excellence awards

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2012 engineering excellence awards

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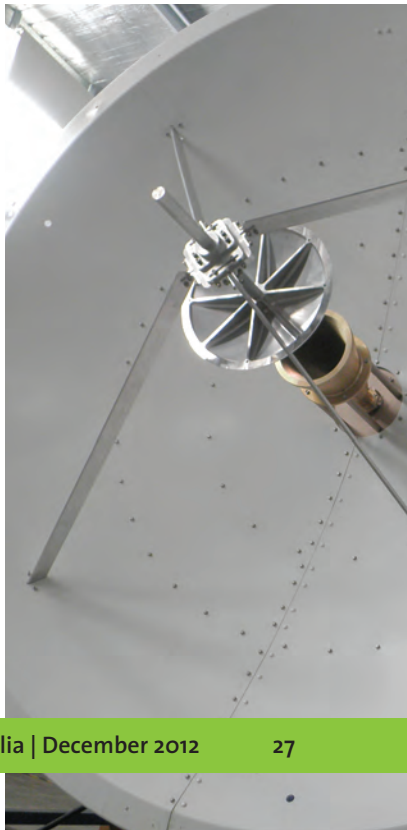
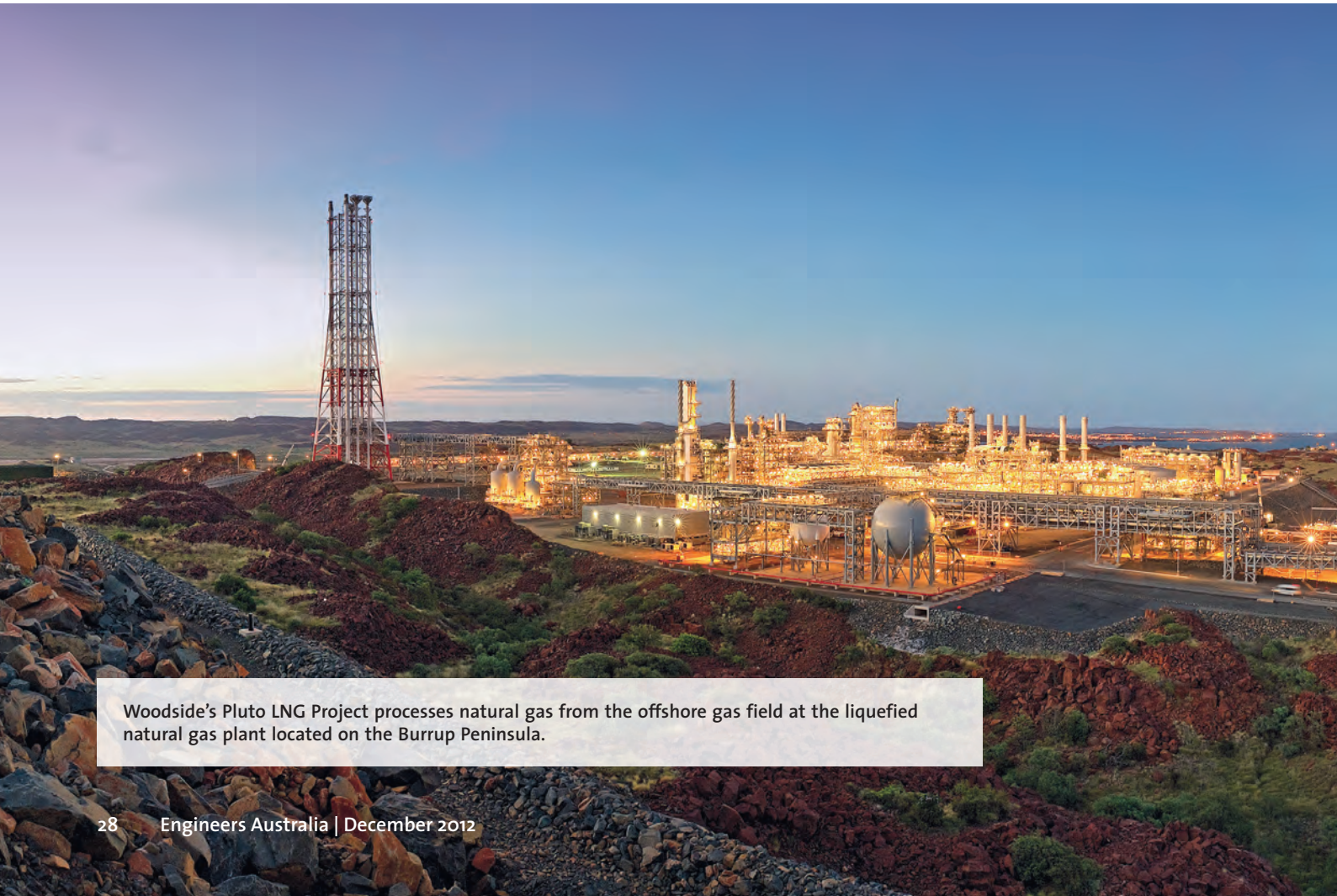
The judges for the 2012 Australian Engineering Excellence Awards were required to select the winners from a pool of 41 project finalists and 21 individual finalists. The winners were announced on 20 November during a gala function at Parliament House in Canberra.

Eight national excellence awards were presented, including the highest honour – the Sir William Hudson Award. Three individual awards and the President's Prize were also announced. The awards were sponsored by Snowy Hydro, American Express, AusIndustry, the University of Technology Sydney, Randstad and Standards Australia.

View highlights online



Pluto project manager Tom Brennan (l) accepted the award from national president David Hood (centre) and sponsor Ken Lister, executive officer, engineering & projects at Snowy Hydro.



Woodside's Pluto LNG Project processes natural gas from the offshore gas field at the liquefied natural gas plant located on the Burrup Peninsula.

Pluto LNG Project

Sir William Hudson Award

Pluto LNG Project is the first deepwater development tie-back to an onshore facility in Australia and the longest offshore wellstream production system in the world. The first shipment of LNG was loaded in May.

The $15 billion project has been developed by Woodside and its partners Kansai Electric and Tokyo Gas. Australian companies secured $7.6 billion worth of contracts.

The first phase of the Pluto LNG Project consists of five subsea wells at a depth of 830m connected to an offshore shallow water rise platform in 85m of water that is normally unmanned. Gas is piped along a 36 inch diameter carbon steel pipeline 180km to the onshore plant on the Burrup Peninsula. The LNG train has capacity of 4.3Mt/a. The gas storage and export facilities include storage tanks, a jetty and berth.

Woodside managed the offshore components, while Foster Wheeler WorleyParsons joint venture (FWW) had the engineering, procurement and construction management contract for the onshore elements.

Complex requirements had to be addressed to ensure that wellstream fluids – consisting of hydrocarbon gas and liquids, water, carbon dioxide and other fines from the reservoir – could reach the onshore LNG plant. For example, monoethylene glycol, a type of antifreeze alcohol, is injected into the wellstream.

The pipelines were built in a demanding geotechnical environment along a narrow section of suitable subsea terrain. The trunkline dredging successfully avoided damage to the health of nearby coral.

All of the subsea equipment is modular and can be serviced by remotely operated vehicles.

During the construction of the onshore facilities, 170 boulders with indigenous engravings were relocated under guidance of archaeologists and local indigenous representatives. The remaining rock art in the Pluto lease area remains undisturbed.

During the construction phase, the number of indigenous employees peaked at 170. Indigenous staff are also being trained to take part in operations.

The layout of the onshore facilities includes a separation distance between storage tanks equal to one storage tank diameter. The double-containment type tanks have external reinforced concrete walls and double-deck floating-type roofs with double emission seals. Pump penetrations are through the roof rather than the sides.

The export jetty and shore facilities have been designed to withstand pool fire due to condensate spill in the sea as well as extreme weather conditions such as storm surge and tsunamis.

The judges were particularly impressed that the project engaged almost every discipline of engineering. The scale, remoteness and outstanding safety shows Australia's leadership in the design and production of offshore gas facilities, they said.

Entrant: Woodside
Riser platform: Eos, a joint venture of WorleyParsons and KBR
Flow and trunk lines: JP Kenny
Subsea hardware – supply: FMC Technology
Subsea hardware – installation: Acergy
Pipelines installation: Allseas
Offshore installation: McDermott
Jetty substructure: HarbourWorks Clough
Dredging: Boskalis Australia
LNG train and related facilities: Foster Wheeler WorleyParsons joint venture
Cryogenic storage tanks turnkey: Chicago Bridge and Iron
Onshore pre-assembly unit fabrication: STP&I (Thailand)
LNG train technical advisor: Shell Global Solutions International

Roll of honour

The Sir William Hudson Award is presented to the most outstanding project of the Australian Engineering Excellence Awards. It is named after the first commissioner of the Snowy Mountains Hydro-Electric Authority, who oversaw the constuction of the Snowy Mountains Scheme. Inaugurated in 1990, the award was given bienially until 1996 and annually since then. This year the judges were Engineers Australia national past presidents: **Ian Pedersen (Chair), Peter Godfrey, Prof Doug Hargreaves, Air Vice-Marshal Julie Hammer and Merv Lindsay.**

The winners were:

2012: **Pluto LNG Project** – submitted by Woodside.
2011: **Bushlight India** – submitted by CAT Projects.
2010: **Condor Tower** – submitted by Pritchard Francis.
2009: **Three Delta Towns Water Supply and Sanitation Project** – submitted by GHD.
2008: **National Aquatics Centre, Beijing (Water Cube)** – submitted by Arup.
2007: **Council House 2** – submitted by Lincolne Scott, City of Melbourne and Bonacci.
2006: **Bayu-Undan Development Phase 1** – submitted by ConocoPhillips, Fluor and WorleyParsons.
2005: **Trunkline System Expansion Project on the Northwest Shelf** – submitted by Woodside Energy.
2004: **Sydney CBD Electricity Augmentation** – submitted by Transgrid and Energy Australia.
2003: **University of Newcastle's Science and Engineering Challenge.**
2002: **River Murray Salt Interception Schemes** – submitted by South Australian Water Corporation, Australian Water Environments and Murray-Darling Basin Commission.
2001: **A 20Gb/s Data Switch Chipset** – submitted by SMR Electronics.
2000: **Eastern Distributor in Sydney** – submitted by Leighton Contractors, Maunsell McIntyre and the NSW Roads and Traffic Authority.
1999: **Stadium Australia in Sydney** – submitted by Multiplex Constructions and SKM.
1998: **Homebush Olympic Bay Rail Link in Sydney** – submitted by Leighton Contractors, Connell Wagner.
1997: **East Spar Development on the Northwest Shelf** – submitted by WMC Resources, Kvaerner Oil and Gas Australia, Clough Engineering.
1996: **The airconditioning system for the refurbished Capitol Theatre in Sydney** – submitted by Optimus.
1994: **A hydrothermal dewatering pilot plant and a coal-fired gas turbine combustion simulator in Mulgrave, Victoria** – submitted by Generation Victoria and Process Design and Fabrication.
1992: **The electrolytic manganese dioxide plant in Newcastle** – submitted by BHP Engineering.
1990: **Foundation project for the North Rankin A platform on the Northwest Shelf** – submitted by Woodside Offshore Petroleum.

Gladstone Power Station Excellence Award

Entrant: NRG Gladstone Operating Services

An asset management system helped improve performance at Gladstone Power Station after the facility suffered a series of major equipment failures.

Queensland's largest power station, it began operations in 1976. It consists of six identical coal-fired boiler and turbo-generator units with a total output of 1680MW. The facility was sold to a joint venture of private companies in 1994 and NRG Gladstone Operating Services was established to operate the facility on behalf of the joint venture.

During 2004-2008, a series of major equipment failures saw plant availability fall to its lowest levels since final construction was completed. In addition, the operator faced other difficulties, including high staff turnover and a reduction of maintenance and capital expenditure in real terms.

In 2007 a new general manager with a strong belief in asset management principles took over. Since 2008, there has been an unprecedented period of stability and retention within the senior and front-line management team, which allowed the workers to refocus from short-term priorities to regaining control of the power station. The senior management recognised that asset management was a core business function and set up a dedicated asset management systems workgroup.

NRG Gladstone Operating Services developed a policy, manual, system and roadmap for asset management in alignment with PAS 55 Asset Management Specification. A key aspiration was to design asset management systems and processes that could be considered "manager-proof". Having a documented Asset Management Roadmap and strategy has helped to embed the asset management processes into the organisation (the contents of the roadmap can be changed, but it is difficult to walk away from the document itself).

The Asset Management Council, a technical society of Engineers Australia, audited the plant's asset management system in 2010.

Since 2008, the new asset management system has delivered a 12% increase in station availability, while reducing unplanned failure costs and risk, and improving employee satisfaction. It also secured funding for capital upgrades despite difficult economic conditions. When the Queensland floods in 2010/2011 interrupted coal supplies, Gladstone Power Station was able to keep generating power at near maximum rating levels for nearly a month, preventing grid instability in the state.

The judges said this entry demonstrated how enthusiastic leadership, team collaboration and commitment to maintenance can improve the economic viability of a business and the morale of its workers.

Top: An asset management system helped improve performance at Gladstone Power Station after the facility suffered a series of major equipment failures.
Above: National president David Hood (second left) presented the award to (l-r) Cameron Philips, Benjamin Hayden and Clinton Windsor.

View online

Hunter River Remediation Project

Excellence Award

BHP Billiton's Hunter River Remediation Project (HRRP) is the largest cleanup project of its kind to be undertaken in Australia.

It has involved the dredging, immobilisation treatment, off-site road transport and engineered emplacement of contaminated sediment, from the Hunter River's South Arm from 2009 until 2012.

The river sediment was contaminated by activities of the former BHP-owned Newcastle Steelworks, which operated from 1915 until 1999. Of principal concern were polycyclic aromatic hydrocarbons (PAHs) from the coke making process. Other contaminants included petroleum hydrocarbons, heavy metals (cadmium, chromium, copper, lead, mercury, nickel, and zinc), cyanide and ammonia.

Sediments with PAH concentrations above regulatory criteria were brought onshore, treated using cement stabilisation technology in Mayfield and disposed in purpose-built emplacement cells at Kooragang Island or other permitted facilities.

In total, approximately 1.2 million cubic metres of sediment was dredged, of which 800,000m^3 was stabilised and permanently emplaced in permitted facilities.

Sediment with PAH concentrations below regulatory criteria was disposed in the ocean.

From an environmental engineering perspective, this was one of the most complex projects ever undertaken within Australia. The work involved characterising, removing, handling and emplacing an unprecedented volume of highly contaminated sediment of variable quality and moisture, within Australia's seventh largest city and one of the most active industrial ports in the world. This waterway also has highly sensitive natural environmental features, including nearby wetlands and habitats protected by international agreements.

BHP Billiton shared its experience, and lessons from the HRRP have been shared with regulatory authorities and industry at seminars and conferences.

The judges were impressed by the extensive research, investigation and planning to identify the appropriate technology. Also noted was the successful expansion of port facilities enabling further growth in exports through one of Australia's busiest bulk material ports.

Entrant: BHP Billiton
Principal contractor: Thiess Services
Feasibility assessment, design and owner's engineer: CH2M Hill
On-shore sheet pile wall design: WorleyParsons
In-river sheet pile wall design: Parsons Brinckerhoff
Geotechnical consultant: Douglas Partners
Kooragang Island emplacement cell design: Aecom
River validation works: GHD
Environmental monitoring: ERM
In-river sheet pile wall construction: Waterways Construction
On-shore pile wall construction: Daracon Construction
On-shore sheet pile ground achoring: Menard Bachy
Dredging: Heron Construction, Boskalis Dredeco JV

Top: The dredging and treatment site at the former BHP Steelworks in Newcastle. Above: The prize was accepted by Brad Foot (l) and Allan Dann.

SeaUrchin Marine Power Generator Excellence Award

The SeaUrchin marine power generator is intended to be cheaper to manufacture, install and maintain than competing marine generators.

In addition, it is designed to operate in a wide range of flow rates, making it deployable in a variety of ocean and river locations around the world.

SeaUrchins can be mass-produced from proven, inexpensive materials and components currently used by boat builders and marine electrical equipment manufacturers.

Based on original research conducted by Michael Urch, a mechatronic engineer who co-founded Elemental Energy Technologies (EET), SeaUrchin prototypes have been designed, manufactured and tested by engineering organisations based in Newcastle, NSW and Pune, India.

The SeaUrchin design addresses the known problems of "propeller" marine power generators. Its optimised rotor blades are bonded to a customised, integrated shroud to extract more energy from the tidal flow. Its is equipped with an augmented bell mouth and a slotted ejector, and has a larger sweep diameter than conventional marine generators.

The scalable design from 2kW to 1MW with one moving part and no gearbox is designed to provide high reliability, and low manufacture and installation costs.

In 2009 the first prototype was designed, manufactured and tested to demonstrate the SeaUrchin concept. A scaled-down SU190 prototype was tested by the University of NSW Water Research Laboratory.

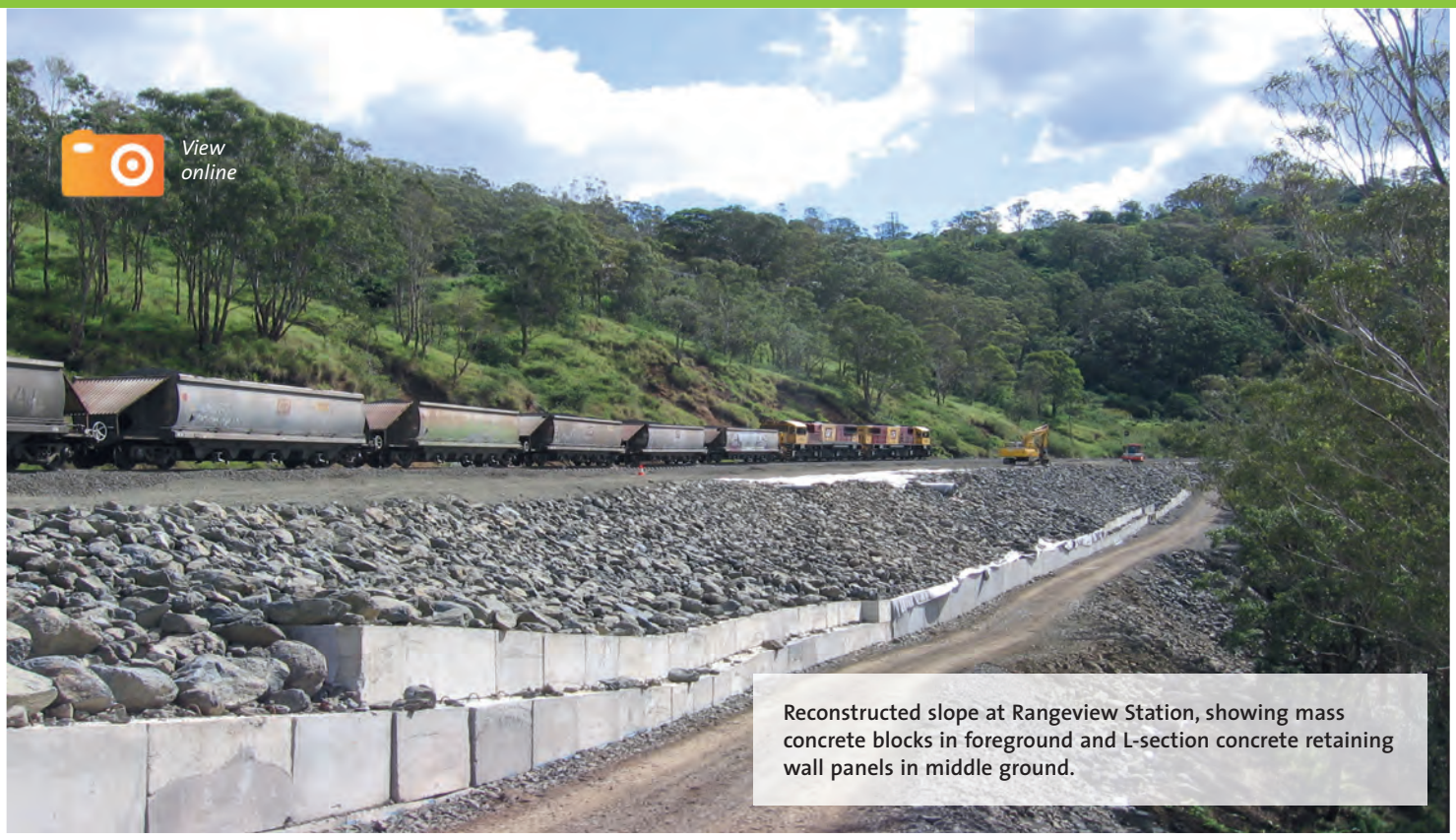
Development of an SU550 2kW prototype was commenced in October 2010. The SU550 units were trialled in Newcastle Harbour and Georges River in Sydney in 2011.

In the short-term, EET will focus on small scale applications of the SeaUrchin technology to generate low-cost renewable energy in remote locations with limited infrastructure. The company hopes to then progress to energy generation on larger scales and eventually to generate baseload power. Distribution partnerships have been established in southeast Asia, India, China and Japan.

The judges were impressed with the simple, elegant design to create technology with wide application.

Entrant: Elemental Energy Technologies
Finite element analysis, structural design: RPC Technologies
Manufacturer: Kirloskar Integrated Technologies
Project management, data management, configuration control, generator design and development, test and trials design and management: ATSA Defence Services
Computational fluid dynamics analysis, frame design, trials observation and review: e3k
Power cables: Prysmian Group
Trials collaboration: Patrick, Svitzer, Forgacs, Newcastle Ports Corporation, Brook & Byrne, Weldtech

Left: A SeaUrchin marine power turbine. Above: National president David Hood (centre) presented the award to Michael Urch (left) and Darren Burrowes.



Reconstructed slope at Rangeview Station, showing mass concrete blocks in foreground and L-section concrete retaining wall panels in middle ground.

Toowoomba Range Railway Flood Recovery Excellence Award

On 10 January 2011, Toowoomba and the Lockyer Valley were struck by what is now described as the worst flood in Queensland's history. The Toowoomba Range Railway – a vital rail link used by over 100 trains transporting nearly 200,000t of freight a week – suffered severe damage and was forced to close.

Working collaboratively, Queensland Rail, Golder Associates and Thiess used an alliance-like delivery model, and innovative engineering and construction methods to repair 262 damaged sites along a 30km stretch of railway corridor. Five sites were identified as critical: Kings Bridge, Holmes, Ripper Falls, Spring Bluff and Rangeview. Each site sustained considerable damage which included major washouts, major landslips, drainage blockages and damage to structures such as bridges and culverts.

The project team commenced work to recover the five critical sites on 23 January 2011, with the first freight train returning to service on 28 March 2011 and the full recovery works completed on 18 April 2011, three months ahead of schedule. This is largely attributed to the collaborative approach, with high levels of trust and flexibility between all parties, full transparency, an open book policy and a cost-plus fee arrangement with fixed margins.

The delivery method maximised the use of on-site or locally available materials, used rapid survey methods, facilitated accelerated construction techniques, accelerated approval of design elements not covered by the standard Queensland Rail specifications and allowed design to be modified during construction to suit conditions.

Another important consideration was the heritage status of the railway, which required the project team to adhere to heritage protection guidelines while working to reinstate the infrastructure as quickly as possible.

Entrants: Queensland Rail, Golder Associates and Thiess

The award was accepted by (l-r) Jeremy Kruger, Thiess; David Starr, Golder Associates; and Tim Woltmann, Queensland Rail.

The Ukhaa Khudag CHPP Excellence Award

The first coal handling and preparation plant in Mongolia, the Ukhaa Khudag (UHG) CHPP, has set a benchmark for remote and extreme weather conditions.

Brisbane-based engineering company Sedgman designed and constructed the first of three 5Mt/a CHPP modules in the South Gobi Desert, 500km south of the capital Ulaanbaatar. The facility was situated in an area where temperatures vary between 40°C and -40°C, and winds reach speeds of 150km/h.

The plant was housed in a purpose-built insulated building with a specialised heating system designed to maintain temperatures inside at 10°C-15°C. The plant is also fully automated with controlled and sequenced start-ups and shut-downs which result in less maintenance and lower operating costs.

The construction team poured concrete in temperatures as low as -27°C, using thermal heating equipment and anti-freeze concrete additives. Wind also hindered slab erection.

Most of the materials and supplies were transported along a potholed track from China.

The new design and process solutions have the potential to be applied for other mines located in areas with extremely low temperatures.

The first phase of the UHG CHPP was completed on time and on budget. Successful delivery resulted in Sedgman being awarded the operations management contract. The company was also contracted to design and construct stages two and three.

The judges were impressed with the scale and enormous logistical challenges of this project, as well as the successful engagement with the local community. The project was seen to take Australian leadership in design and construction of coal handling plants to the international stage.

David Proud, Sedgman manager of project development, accepted the prize from national president David Hood.

Entrant: Sedgman
Client: Mongolian Mining Corporation
High-capacity feeder breakers: McLanahan
High-capacity screens: Ludowici
Dense medium cyclones: Minco Tech
Nuclear density gauge: Endress & Hauser

View online

The first coal handling and preparation plant in Mongolia at Ukhaa Khudag has set a benchmark for remote and extreme weather conditions.

CSIRO Ngara Rural Point to Point Microwave Backhaul Technology

Innovation Award

The CSIRO Ngara backhaul project team has developed the world's fastest microwave backhaul system which can provide symmetric data rates up to 10Gb/s over a distance up to 50km. By comparison, existing microwave systems can only provide a few hundred Mb/s.

The system can achieve data rates similar to fibreoptic systems and can be used in rural areas where deployment of fibre is uneconomic. CSIRO Ngara backhaul can flexibly operate at any combination of channels in the 6GHz, 6.7GHz and and 8GHz microwave bands.

Entrant: CSIRO

The team developed new system design, signal processing, and hardware and firmware implementations. An intellectual property portfolio, including five patents, has paved the way for commercialisation.

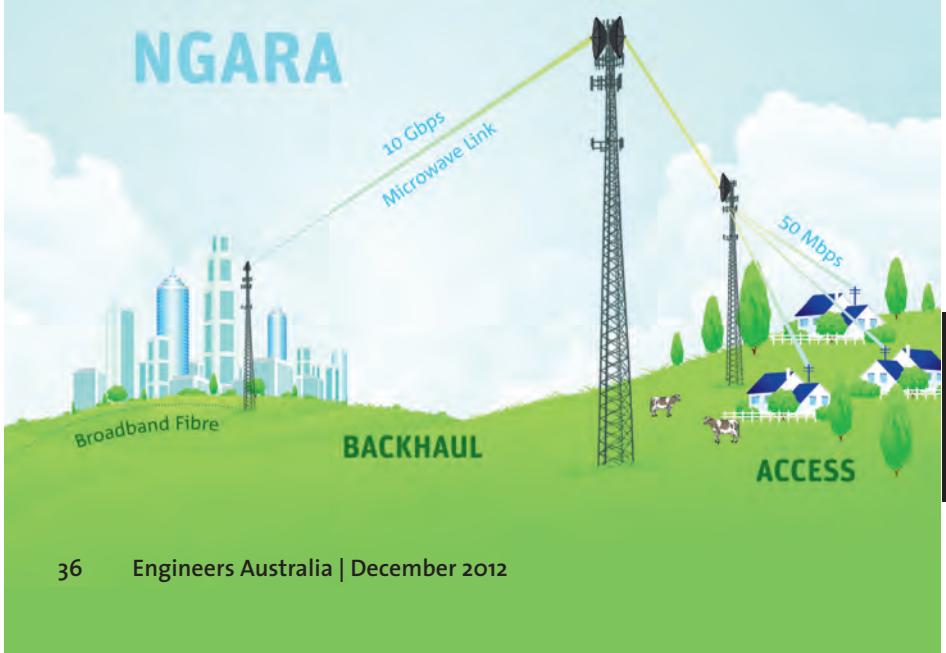
Traditionally, each microwave channel in a microwave band is used individually. Multiple sets of equipment need to be stacked together if multiple channels and higher data rates are required. Ngara relies on innovative spectrum aggregation schemes to effectively use multiple channels in different bands. A unified baseband signal is generated from each band, combined in the RF chain and transmitted through a single antenna.

Most of the engineering challenges stemmed from high-speed processing and large bandwidth signal processing. Numerous complex parallel structures are used in the firmware to meet the high speed requirement. Designing RF and antenna components supporting large bandwidth signals was also equally challenging.

Another innovation is reducing out-of-band emissions by adjusting the emissions of signals from different subcarriers so that they largely cancel each other in the out-of-band range.

The data rates provided by Ngara can also be shared by multiple customers, each using different channels. Thus, it can be deployed as a piece of infrastructure and data rate can be provided for wholesale.

The judges were particularly impressed with this project's potential for cost-effective, high-speed delivery of data and its capacity to reach regional communities.



Top: Senator Kate Lundy presented the award to (l-r) Dr Darrell Williamson, Dr Xiaojing Huang and Dr Yingjie Jay Guo. Left: CSIRO Ngara backhaul can provide high-speed data transfer for rural areas.

Gorgon Project Shore Crossing

Environmental Engineering Award

The Gorgon Project gas processing plant along with related infrastructure, including subsea pipelines and shipping facilities, are being constructed on Barrow Island, a Class A nature reserve with a unique terrestrial and marine environment.

The Chevron-operated Gorgon Project is developing the Gorgon and Jansz-lo gas fields approximately 130km off the northwest coast of Western Australia.

Gorgon Project Shore Crossing involved meticulous planning and construction of a shore-based gas pipeline crossing while preserving the natural environment. The island supports 24 species and subspecies not known to occur elsewhere, and another five species with restricted distributions. It is also a nesting area for threatened sea turtles.

Horizontal directional drilling (HDD), which avoids open trenches, was seen as the best way of constructing the crossing while minimising the impact on the environment. However, geological conditions can pose significant challenges to HDD. Geotechnical and geophysical investigations involved drilling a series of vertical boreholes to gather data.

North Whites Beach was selected due to its suitable geology and its reduced impact on flora and sea turtles. The work was successfully completed and the site was demobilised in early 2012. The holes remained stable. While some "frac-outs" occurred during construction, there was little impact on the marine environment because a low-toxicity water-based drilling mud was being used.

The methodology may be applicable to other large-diameter pipeline construction projects in Australia.

The judges said the project demonstrated how innovative engineering can succeed in providing economic benefits and wealth to a nation within even the most sensitive environments. ●

Entrant: Chevron Australia
EPCM contractor: Gorgon Upstream Joint Venture, comprising Technip and JP Kenny
Horizontal directional drilling: Lucas
HDD consultant: Stockton Drilling Services

Top: Construction of gas pipelines on Barrow Island minimised impact on its unique terrestrial and marine environment. Right: National president David Hood (second right) presented the award to (l-r) drilling consultant Charles Stockton, upstream facilities project manager David Equid and upstream execution manager Milton Bruce.

Andrew King
President's Prize

Chemical and environmental engineer Dr Andrew King received the President's Prize for his picture book *Engibear's Dream,* which aims to convey the excitement of engineering to children. In rhyme, it tells the story of Engibear and his trial-and-error attempts at building a helper robot, Bearbot.

The book is illustrated by architect Benjamin Johnston.

The President's Prize is issued by the national president of Engineers Australia to an organisation or individual that significantly contributes to Engineers Australia's strategic goals.

"After an incredible journey, and the sinking thousands of dollars of his funds, and countless hours of writing and sketching, and being knocked back by publishers, and initially by EA, he has finally come through with *Engibear's Dream,* which I launched with him in August this year," said Engineers Australia national president David Hood.

Engibear's Dream, is available from EA Books at www.eabooks.com.au.

Left: Engibear introduces children to the excitement of engineering.
Right: Dr Andrew King.

Menno Henneveld
Professional Engineer of the Year

Menno Henneveld

Menno Henneveld, commissioner of Main Roads WA, is one of the state's longest-serving senior public servants. A civil engineer, he began his career with the Public Works Department. He went on to hold senior roles at the Water Corporation before being appointed to head Main Roads in 2002.

Under Henneveld's leadership, Main Roads has moved towards innovative delivery methods and relationship contracting, including alliances, program alliances, early contractor involvement, and planning alliances. He has overseen the introduction of integrated service arrangements for integrated operational asset management, network operations and road maintenance.

He also oversaw the creation of Roads Foundation, which aims to address workplace shortages by facilitating traineeships in civil construction for young people in regional areas. As part of fostering stronger relationships between future engineers and Main Roads, Menno is involved as a lecturer and presenter in the University of WA Engineering Practice Unit for final year civil engineering students.

In 2006 he was appointed Australia's first delegate to the World Road Association, where he is a member of the Executive Committee and chairman of the Communications and International Relations Commission. He is a strong advocate for road safety and community-based engineering approaches to the state's road infrastructure.

He is a member of the National Engineering Registration Board and is involved in many other organisations.

Hugh Tait

Young Professional Engineer of the Year

In his role as Opus International Consultants Newcastle manager, Hugh Tait has grown the unit from just himself to eleven staff in two years, recruiting staff from overseas when locals could not be found. He oversees all technical and business matters in the Newcastle office, which services a wide range of clients. His procedures for forecasting and analysing staff utilisation are now used throughout Opus' NSW operations.

With a previous career in the yachting industry, where parts for repairs are sourced from around the world and the yacht itself can be anywhere, Tait has developed a strong logistical skill set. He has adapted these skills to the management of large engineering inspection projects.

His strong understanding of project scope combined with the empathy for clients, has consistently won many jobs including repeat work with many key clients. Tait's strong focus and understanding of local government work benefits the whole community. Clients have been impressed with not only the high level of technical output delivered, but also excellent service delivery.

Tait is also the secretary of Opus' national asset management group, which sees him organising national teleconferences, and communicating new projects and technical initiatives.

Within four years of graduation, Tait achieved CPEng status. He also finished a master of engineering management and an MBA.

An ambassador for the engineering profession, Tait has promoted engineering as a career choice, including mentoring two Year 10 students through their work experience. He actively participates in Engineers Australia and sailing.

Hugh Tait

Geoff Kimmins

Engineering Associate of the Year

Wing Commander Geoff Kimmins

Wing Commander Geoff Kimmins is deputy director, engineering and technical, at the Directorate of Personnel, Royal Australian Air Force in Canberra. He leads a team of career managers, who are responsible for the formulation and implementation of RAAF career management policy including appointments, promotions and postings of Air Force aerospace engineers and technical workforce. His team provides an essential service in delivering engineering and technical capability.

Kimmins has identified that Australian Defence Force engineers and technicians face rapid changes in technology and support concepts for new military platforms, including aircraft and ground-based telecommunications systems. He developed new concepts for training the future Australian Defence Force engineering and technical workforce, which provided immediate short-term improvements in the quantity and quality of graduates from the School of Technical Training, and longer-term input into engineering and technical personnel training, development and capability planning.

His expert analysis of aircraft accidents has enhanced flying safety.

His engineering competence has been formally recognised at the highest levels via a Conspicuous Service Cross, awarded in 2003 for outstanding achievement as the senior engineering officer at Number 38 Squadron.

In January 2012 Kimmins received a Medal of the Order of Australia for service in the Directorate of Flying Safety, Maintenance Management and Planning Implementation, and the School of Technical Training.