THE AUSTRALIAN INNOVATION CHALLENGE
CHAMPIONING THE GAME CHANGERS
The world’s population is at seven billion, and growing fast. By 2050, there’ll be around two billion more people on the planet and our demand for energy is likely to have doubled since 2000. Only innovative technology and unconventional thinking can help us meet our future needs. That’s why, at Shell, we’re proud to support The Australian Innovation Challenge, why we’re investing in the world’s biggest floating production facility; and why we’re encouraging the brightest young minds across the globe to think about our energy challenges. Let’s start shaping tomorrow today.

LET’S HEAR IT FOR THE INNOVATORS.

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The Australian Innovation Challenge has once again showcased what an inventive nation this is. Now in its second year, the challenge continues to grow stronger, attracting hundreds of high-calibre entries from all corners of the country.

Last year’s winners, including Mark Kendall’s nanopatches, are making great strides towards realising their commercial potential, and we hope to see this year’s winners on that same path. Innovation is a key, and often overlooked, ingredient of the productivity puzzle. And unlocking that puzzle is vital to the nation’s future prosperity.

As such, support for research and development has never been more important, nor more uncertain, given the financial challenges faced by governments. That’s why projects such as The Australian Innovation Challenge are vital to raising awareness of the extraordinary work being carried out by the small army of innovators across the country.

Once again, I would like to express our enormous gratitude to Terry Cutler, our indefatigable chairman of judges, and Cheryl Jones for the incredible work they have put in for several months. Thank you also to our esteemed judges, whose enthusiasm for the challenge is infectious and who voluntarily give up their valuable time in the interests of fostering innovation.

We’re grateful for the continued support of our commercial partner, Shell Australia, a company that believes in innovation and recognises its importance to the nation. And we thank Industry and Innovation Minister Greg Combet and his department for their ongoing support of the challenge.

The final week should go to the hundreds of Australians in laboratories and backyard sheds who have taken up the challenge. Your often uncelebrated work should be an inspiration to all Australians. We are proud to bring it to the nation’s attention through The Australian Innovation Challenge.

Why is innovation important? We believe that innovation justifies the cost of it. Innovation is important to all of us simply because whether we innovate, or how we go about innovating, determines our standard of living and our quality of life. The robustness and resilience of our national economy, our collective national “household”, depends on our competitiveness in all areas of activity, and this in turn is predicated on the value of what we produce. So competitiveness driven by productivity, and productivity fuelled by innovation, is a basic equation for national wellbeing.

The entries in this year’s challenge exemplify the recipe for success – the imagination to see how things could be different and the capability and skill to respond to challenges rather than resigning ourselves to things as they are and there is, therefore, something positively hopeful and optimistic in the innovation stories highlighted in these awards.
Research and Technology Centre at the University of NSW and its industry partner, OneSteel, won Australian Research Council funding to find the answers. The lab experiments were spectacular: “I almost fell off my chair,” she says, recounting some of the first images from a camera recording the reactions through the quartz window of a laboratory furnace. The rubber and plastics delivered the carbon needed to reduce the iron oxide. But they also enhanced slag foaming – the formation of bubbles in the slag which increase the energy efficiency of steelmaking. The team had to do analytical work to get a handle on the chemical reactions and kinetics of the process. It had to run trials in OneSteel’s furnaces before the company was ready to begin commercial production of green steel by the polymer injection technology. The theory was solid and the trials went better than expected. OneSteel (now known as Arrium) has been using the technology in its plants in Sydney and Laverton, near Melbourne, for four years. By July this year it had diverted more than 1.4 million tyres from landfill in Australia and cut power consumption by millions of kilowatt hours a year. Sahajwalla wants to see a change in attitude to waste. When the steel industry began to use rubber in its furnaces, the material became “a valuable raw material for a completely different sector”, she says. “If you can find a suitable technological solution for waste, and it’s not just being recycled because it has to be, but it’s truly seen as a raw material, it’s got a value on it. We all then learn to respect the waste. It shouldn’t end up in landfill and cut power consumption by millions of kilowatt hours a year. One does not have to be at the cutting edge, at the forefront of new technology.”

This year the Innovation Challenge again unearthed a wealth of creative, game-changing developments. So what makes one entry stand out above the others? Chairman of the judging panel, Dr Terry Cutler, explains what the judges look for.

Professor Veena Sahajwalla’s “green steelmaking” is an astonishing application of polymer injection technology. One of the judges commended this entry as follows: “A brilliant process that has a significant impact on the environment at both ends – it reduces the amount of material that would otherwise end up as landfill and uses it to increase the efficiency of furnaces. A simple idea that has been thoroughly researched, developed and taken to market.”

The judging panel for choosing the overall winner comprised Australia’s chief scientist, Ian Chubb, the chief executive of the CSIRO, Megan Clark, and the head of Commercialisation Australia, Daron Ben-Meir.

In picking the overall winner from the seven category finalists, the judging panel highlighted four points about their unanimous choice. First, this entry stood out for the way it combines excellent science with deep industry engagement, with OneSteel – now renamed Arrium – being involved from the beginning. This could well be a textbook case study for how technology-based innovation should be developed.

Second, this innovation is a reminder that, even in so-called mature industries where there has been little change in industrial processes for ages, you can still suddenly have a game-changing innovation. This is a case in point for the steel industry, which has not fundamentally changed over the last century. In its innovation, OneSteel has diverted millions of kilowatt hours a year instead of a waste product, rubber has become a “valuable raw material for a completely different sector”.

Third, this is a fine example of how you can have a “win-win” for both industrial productivity and the environment. One does not have to be at the expense of the other.

Finally, this is an innovation that is having global impact, as it is being taken up internationally.

**VEENA SAHAJWALLA**

‘Green’ steelmaking – using old tyres and plastic to boost efficiency

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**MARK BROWN**

Uprate of recovery system of CSIRO’s Narrabri radio telescope

**LAITHEA WONG**

CASTvac – vacuum valve for die-casting

**RAY MATTHEWS**

Variable length connecting rod – to boost fuel economy in cars

**PAUL GRAY**

Cohda Wireless collision avoidance system for cars

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**FINALISTS**

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**IN FOUR YEARS, ONESTEEL HAS DIVERTED MORE THAN 1.4 MILLION TYRES FROM LANDFILL AND CUT POWER CONSUMPTION BY MILLIONS OF KILOWATT HOURS A YEAR INSTEAD OF A WASTE PRODUCT, RUBBER HAS BECOME A VALUABLE RAW MATERIAL FOR A COMPLETELY DIFFERENT SECTOR**
Ali Baghaei

greenWAVE – the world’s first one megawatt single unit wave energy converter

Ali Baghaei is an unlikely environmental warrior. Early in his career, the engineer directed huge design and construction projects for nuclear and gas-fired power plants around the world. His formidable defence background started with a post at Kiwanee in Scotland, where he was in charge of the design and construction of warships. He later directed a significant portfolio of projects with the UK Ministry of Defence.

Now he wants to save the world. Baghaei and colleagues at Sydney-based Oceanlinx won the minerals and energy category of The Australian Innovation Awards challenge with their wave power technology, greenWAVE. “I thought that it was probably the right opportunity to switch back to something that I was passionate about – and, I hope, leave some positive legacy for future generations,” Baghaei says. Baghaei, who has a master’s degree in mechanical engineering and manufacturing engineering from the University of Liverpool, joined Oceanlinx as chief executive and managing director in 2005. Long interested in wave power, Baghaei says he is now a strong advocate of wave power.

The SA unit will produce electricity at a production cost of 85 cents per kW hour, against about 7 cents for electricity generated from fossil fuels. “It will drop to less than 10 cents per kW hour as soon as the first 75MW array is built,” Baghaei says, adding that the low cost will stimulate the adoption of the technology worldwide.

Christopher Drake

CryptoPhoto – a game-changer in internet security

Christopher Drake can build his own in the cut-throat information and communications technology industry, but his first trip to Silicon Valley was grueling even for him. The computer programmer, based in Noosa Heads, Queensland, has devised a way to counter computer fraud, and this year he found himself at the Californian innovation hub pitching his idea to venture capital and ICT companies. “It’s an awesome environment,” says Drake, who was among people from around the world hoping to make their fortune with the next big thing: “Silicon Valley is about connecting with the people. It’s a lot of talking and coffee.”

Drake has a serious background in ICT. He has a bachelor of applied science in computing from the Queensland University of Technology and has worked as a programmer for various companies, including banks. He has also run his own business, and has long had an interest in computer security. What makes CryptoPhoto remarkable is that it is so low-tech. Indeed, when Drake first came up with the idea about five years ago he thought the system was so obvious that he didn’t bother to patent it. Only later, when no one had moved on a similar system, did he take it any further.

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When London Olympics organisers were concerned about the impact of algal blooms on swimmers during events in the Serpentine Lake, Hyde Park, they turned to Australian technology. Phoslock, invented by CSIRO geochemist Grant Douglas, has been used widely in lakes and rivers in Australia and more than 20 other countries. It immobilises phosphorus, a major nutrient that drives algal blooms, which can be toxic to humans and devastate aquatic ecosystems. Sources of phosphorus include fertilisers, catchment sediments and sewage.

Douglas, of CSIRO Land and Water, has won the environment, agriculture and food category of the 2012 The Australian Innovation Challenge. He had been working on water quality for more than 10 years when he focused his research on algal blooms, one of the biggest problems facing rural and urban aquatic environments. Blooms are upwind. They introduced some algae and cyanobacteria, commonly known as blue-green algae, to make the water unpalatable to humans and livestock and can wreak havoc on aquatic life and cause major fish kills. Extensive algal blooms in rivers can appear “almost like lime-green paint” floating on the water, Douglas says. “I saw an opportunity,” he says. “There was nothing out there that was an effective and environmentally sound phosphorus absorbent.”

Douglas set out to synthesise a nano-material that would react strongly with phosphate ions in water and “lock up” the nutrient. His solution mimicked nature. “I wanted to use something that was environmentally compatible,” he says. “That, to me, equaled a clay.”

He knew that the mineral monazite, which is composed of atoms of “rare earth” elements including lanthanum bonded strongly with phosphate ions, was chemically and physically stable. “Minerals have survived millions of years of weathering and transport and have ended up concentrated in beach sand,” he says. “That’s a testament to how robust they are. If we could copy nature, we could solve the problem.” The result was a clay-based material doped with rare earth elements. “It’s all very simple, but no one else had done it and it made it work took a heck of a lot of research.”

Phoslock is sprayed on to the surface of the lake or river as a slurry. It strips the water of phosphate as it sinks, removing up to 50 per cent of the nutrient. Where it settles as a layer on the bottom, it continues to absorb phosphate from the sediments.

The CSIRO originally licensed the technology to Sydney’s Phoslock Water Solutions, and later sold it to the company. “It’s a piece of research that has ended up being patented, commercialised, used in 25-plus countries and has delivered a financial return to the CSIRO and an environmental benefit in both Australia and internationally,” says Douglas. He has seen the technology in action some rivers to which Phoslock has been applied have not had a serious algal bloom for years.

Sonomat uses sophisticated software that identifies and analyses the sound data to diagnose diseases and disorders. “It’s one of the great things about modern technology that you can transfer a lot of information both ways very quickly,” Sullivan says. “The disadvantage is that you’ve got to have quite intelligent systems to make sense of it. That’s the bit we’re doing.” Sullivan and his team used the diagnoses of diseases through sound signals collected from hundreds of patients to write the diagnostic algorithms for Sonomat. “The algorithms embody expert knowledge from both human specialists and artificial intelligence systems.”

When innovation policy heavyweights talk of Australia’s strength in medical devices, they are referring in part to Sullivan’s work. He invented the continuous positive airway pressure system, commercialised by ResMed and used worldwide to treat sleep apnea. He was a pioneer of sleep science, now a mainstream medical field. And he was central to the establishment of Australia’s first sleep clinics. Sullivan hopes Sonomat will fill the gap and identify disorders such as sleep apnea at an early age.

“The road to his breakthroughs started in the early 1970s when he joined the international research effort to find out what causes sudden infant death syndrome – a problem that remains unsolved. “I was trying to develop methods of studying children at home,” he says. Sonomat might deliver some of the answers.●

**WINNER**

**DOUGLAS**

Phoslock – removing phosphorus from water to prevent harmful algal blooms

**WINNER**

**SULLIVAN**

Sonomat – medical monitor
The Prelude natural gas field lies more than 200km off the West Australian coast, under 250 metres of water. It’s a valuable resource in a difficult location but Shell has solved the challenge of getting the gas to the surface by building the world’s first Floating Liquefied Natural Gas facility. While it’s a big commitment, the benefits to Australia are even greater: creation of about 1,000 jobs over the 25 years of the project; billions of dollars in tax revenue; access to an estimated three trillion cubic feet of ‘stranded’ gas; and another vital step towards securing our energy future. Let’s go beyond today’s thinking.

LET’S GO FURTHER TO POWER OUR FUTURE.

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Shelley Peers

Primary Connections – a research-based primary school science course

It’s somewhat surprising that the latest in school science comes has been published as an old-fashioned hard-cover book. Research showed that’s what teachers wanted – and teachers are the key to the success of Primary Connections, a comprehensively tested, innovative primary science program. “The research is telling us that the primary years are critical in engaging students in learning science. So a key thing that’s innovative about what we do is to build teachers’ confidence and their capacity to teach science,” says program director Shelley Peers.

Research also revealed that across Australia, science was being taught in primary schools for an average of just 45 minutes per week. That’s far less time than is spent in school assembly – and a devastating short duration for a nation supposedly positioning itself as the clever country. In 2014, when the Australian Academy of Science decided to revise an old primary school science course, Peers came on board armed with a masters in primary science education. The result is a thoroughly tested program spanning eight years to year 6, covering the entire Australian primary science curriculum. “Kids love science and asking questions and think it’s fascinating, but teachers aren’t very confident in the science area. So we’ve done produce educational materials that teach teachers how to teach science,” Peers explains.

It’s delicately handbound. “Digital is the future, but for some, a book is controllable. When you open it, you can see a comprehensive table of contents. It’s an experience,” Peers says. The program provides teachers with a comprehensive teacher guide and a student workbook with colour charts, diagrams, and three-dimensional models. Learning is absolutely critical for the kids to come to grips with what they’re doing and make meaning out of it,” says Peers.

Developing this kind of structure is very expensive, but it’s what differentiates the program and makes it so good. We had the time, the space and the money to do the best that we could do, and I believe it’s world-class.”

For Peers, the process has been enormously satisfying. “I’ve learned a lot, and a wish-come-true to convert good research into a practical, high-quality science education for Australia’s young people. “We’re not aiming for everyone to be a scientist, but it’s really important that every member of the community has sufficient scientific understanding that they are not easily duped by ‘shackles’. It’s about evidence-based thinking, and it’s really important.”

GiveEasy – a mobile platform to make donating to charity easier

With his breakthrough innovation now available as an app for iPhone or iPad, Dr Jeffrey Tobias says GiveEasy promises to revolutionise how people donate to charity. “My background is in technology and entrepreneurship, and I am philanthropist. Myureka moment was working out a way to get these two worlds to connect,” Tobias says. GiveEasy links charities and donors through a small percentage levy on donations. “This has been a really, really big issue for charities and many have given up,” he says. “But we connected with Apple Australia, and also with Apple Inc, and we persevered.”

GiveEasy is a social enterprise and will cover costs through a small percentage levy on donations. Tobias says the app’s impact is what was planned, with expectation about the innovation. “The charities we’ve been speaking to over the past number of weeks are very excited by this development because their view is GiveEasy can significantly grow the philanthropy pie. And this has been my aim; this is where we started from.”

Tobias feels there will be a multiplier effect through social media as the option to tweet about the gift or notify Facebook friends prompts others to donate, too. The GiveEasy system also facilitates workplace giving. Employees can nominate a charity to receive regular salary deductions that can be matched by the employer.

Registered charities are signing up fast, Tobias says, in the expectation that the improved ease of giving will not only increase the amount of donations but also provide huge savings in administrative costs.

Developing the software was only one of the leaps Tobias and his team had to make. They also had to overcome Apple’s restriction on apps that aggregate donations to charities. “This has been a really, really big issue for charities and many have given up,” he says. “But we connected with Apple Australia, and also with Apple Inc, and we persevered.”

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Frank Will
Over7 – technology to reduce fuel consumption

Environments garage in Jan Juc is a far cry from the hi-tech R&D facilities of the major car manufacturers. But the garage in the small coastal town near Geelong, Victoria, has produced an invention that is attracting interest from big car makers around the world.

Will’s system, called OVER7, is designed to cut fuel consumption and a big European company has contracted him to test it in one of its models. It has raised his hopes that his brainchild will soon be adopted.

Few independent inventors get this far. Even though Will has tested his product and has conducted business with the likes of Ford for 18 years in Germany and Australia – it took him years to get his foot in the door to pitch his latest idea to car makers. “I think is the trick to find a champion who is high enough in the hierarchy to make a decision,” he says.

Will has won the Backyard Innovation prize in this year’s The Australian Innovation Challenge awards.

Ever since he was a youth, Will has been a tinkerer, a现在的 engineer. He has invented a variety of products that have helped various companies. His latest invention, OVER7, is designed to improve fuel efficiency in cars.

Will’s invention is designed to reduce fuel consumption by improving the efficiency of the engine. It works by improving the efficiency of the engine’s exhaust system, allowing for a reduction in fuel consumption.

The invention was developed in collaboration with a team of engineers and has been tested in several countries. It has been patented and is ready for licensing to car manufacturers.

The invention has been well received by the automotive industry and has attracted attention from several car manufacturers. Will has been in talks with several companies about the potential for commercialization of the invention.

The invention has the potential to significantly reduce fuel consumption and emissions, making it an important contribution to the field of sustainable transportation.

The invention has been funded through crowdfunding and has received support from investors and the Australian government. It is expected to be commercially available within the next few years.

The invention has also been recognized with several awards, including the Backyard Innovation prize in this year’s The Australian Innovation Challenge awards.

The invention is an example of how innovation can be harnessed to create a sustainable future. It demonstrates the potential for individual inventors to make a significant impact in the field of sustainable transportation.
VACCINE PATCH CLEARS ANOTHER HURDLE
Mark Kendall, last year’s overall winner of *The Australian*’s Innovation Challenge, has had a busy year as his revolutionary product jumps closer to commercialisation.

A PNG hospital in October, Mark Kendall witnessed a scene that he hopes his invention will make a thing of the past – children with diseases that could have been prevented through vaccination. The University of Queensland biomedical engineer was overseeing the first usability trial of his brainchild, Nanopatch – a patch to replace needles and syringes in vaccination.

The trial came just weeks after the start-up company Vaxxas, co-founded by Kendall, announced a deal with the pharmaceuticals giant Merck on joint research to evaluate the technology for commercial production as a delivery system for an undisclosed vaccine. The trial at Port Moresby General Hospital, independent of the collaborative research with Merck, is a precursor to clinical trials of the technology, which promises to save millions of lives by revolutionising vaccination in developing countries. “Its aim was to check that medical staff found the way the Nanopatches are applied to the skin – called applicators – works well in low resource settings,” Kendall says. The Nanopatches are postage stamp-sized silicon wafers, each with thousands of microscopic projections, with tips dry-coated in vaccine. Within minutes of application, the spikes deposit vaccine in layers of skin rich in immune cells. The PNG trial used proxies for Nanopatches, without vaccine.

Kendall says the deal with Merck is a major milestone. “We don’t make vaccines – we deliver them and we need a partner,” he says. “Merck seriously evaluated at different technologies around the world, and they chose ours.” Last year, Kendall’s team won the manufacturing and hi-tech design category and the overall prize in *The Australian* Innovation Challenge awards. Kendall says the deal with Merck is a major milestone. "We don’t make vaccines – we deliver them and we need a partner," he says. "Merck seriously evaluated at different technologies around the world, and they chose ours." Last year, Kendall’s team won the manufacturing and hi-tech design category and the overall prize in *The Australian* Innovation Challenge awards.

LOGISTICS SOFTWARE DELIVERS THE GOODS
NICTA’s Andrew Verden and Philip Kilby, winners of last year’s ICT category for their Indigo road transport logistics solver, are attracting wider interest in the innovation.

Increasing fuel and labour costs and worsening traffic congestion in cities are stimulating interest in sophisticated software to optimise scheduling and routing in road transport operations. Computer scientist Andrew Verden, of National ICT Australia, says several big operators have approached his team about the use of the Intelligent Fleet Logistics Indigo Solver to reduce transport costs. Verden and colleague Philip Kilby won the ICT category of the inaugural *The Australian* Innovation Challenge awards last year for the software.

NICTA, a research centre funded by federal and state governments, has been working on the Indigo Solver for five years. The system tackles the complex mathematical problems involved in road transport logistics, factoring in variables including distances, deadlines and fleet sizes and human factors such as driver fatigue. The system, which draws on artificial intelligence techniques, can find routes to thousands of destinations with hundreds of vehicles while observing the business rules and practices of the individual road transport operators, Verden says. He says an independent study shows that the Indigo Solver has the potential to save Australian industry billions of dollars a year. “We can deliver operators savings of up to 20 per cent,” he says.

The team focused initially on ways to increase the efficiency of transporting perishable goods from factories to retail outlets. However, Verden says retailers and public transport operators have recently sounded his team out on adopting the technology. “We’re in the process of commercialising this technology in a number of directions,” he says.

Meanwhile, the team has developed the system further by adding a facility to calculate the costs to operators of deliveries to individual customers.
Where should the world get its future energy from? It’s the question that drives and inspires Shell most. It’s also why we invited students from all around the world to join our Global Energy Forum, and challenge us with new ideas and new thinking. At our first debate in Perth at the end of September, we were presented with five diverse possible solutions, ranging from wave power to hydrogen to hemp. The world’s challenges may be significant but, as these young thinkers made clear, so too are the opportunities. Let’s work together for the future.

LET’S KEEP THE DISCUSSION GOING.

LET’S GO.