MAKING CITIES WORK
In medieval Germany, serfs who escaped from the country to the town could claim their liberty, giving rise to the saying Stadtluft macht frei – City air makes you free. Centuries later and millions continue to take the spirit of the saying to heart, as urban living has supplanted rural life for the first time in human history.

Urban growth brings progress but it also brings problems. For all their vibrancy and liveliness, cities face the challenge of providing secure and sustainable places to live. Urban populations, whether in Mumbai or Melbourne, quite reasonably expect clean water, public transport, sewerage and open spaces.

How do we ensure that our cities tread with lighter footprints? How do we balance between the needs of expanding urban areas and the regions on their fringe? How do we improve the health and happiness of our city-dwellers?

These are just some of the questions with which our researchers have been grappling as RMIT celebrates our 124th anniversary. The answers, as you will read in this magazine, come from an exciting range of disciplines – from computer science to public art, from urban planning to renewable energy technologies.

As a global university of technology and design, RMIT is committed to a philosophy of research founded in action and experience. We look to learn from, and contribute to, our partners in industry and business, government and the community.

We see the task of shaping sustainable cities as one in which we all need to be engaged. The future is urban. Breathe deeply.

Professor Margaret Gardner AO
Vice-Chancellor and President
RMIT University
Thursday 9 June 2011
And how would urban designers and architects envisage a regional Victorian city if it were to eventually double in size as its surrounding desert encroached?

Such issues of global warming and sustainability are explored in annual international architecture workshops hosted by universities in Australia, China, France, Japan, Spain and the United States.

“Bringing together different ways of teaching architecture from around the world helps create what could be called productive collisions of ideas,” explains Jan van Schaik, of RMIT’s School of Architecture and Design.

Now in their 10th year, the fortnight-long workshops draw together Masters architecture students and academics with local expertise among councils, developers and residents. Each workshop is documented in booklets and concludes with a public symposium and exhibition.

Topics have included ageing populations in Japan, dying cities in Detroit, post-oil cities in Spain and flooded cities in France.

RMIT hosted the 2004 workshop on the effects of retiring populations on Phillip Island and last year’s workshop in Mildura.

“The Mildura brief looked at the implications of its population expanding from 30,000 to 60,000,” says van Schaik. “Could the area, so long known for its irrigation of the Murray River, become known, for example, for ‘solar irrigation’? Could the urban area embrace the beautiful desert that surrounds it?”

Masters student and landscape architect Michaela Prescott was part of a workshop group which looked well into the future of Mildura, to 2100 and beyond. “We envisaged Mildura being overtaken by the desert, and worked on what that would mean for, say, power generation and the increase in salinity,” she says. “We imagined an ‘upper city’ providing shade for a ‘lower city’.”

Prescott relished the opportunity to work “in an unfamiliar place with unfamiliar people. Despite the language differences with overseas participants, we discovered the most fluent form of communication was through drawing and making. I really enjoyed stretching myself.”

Jan van Schaik says tangible outcomes of the workshops vary in degree. In the Chinese coastal city of Lianyungang, five hours north of Shanghai, several of the 2009 workshop’s academics were invited to an impromptu media conference with the mayor. “He was very interested in the workshop and exhibition and at the media conference asked us for critical comments about the city and its future.”

Masters graduate Chris Gilbert was part of a group at Lianyungang which proposed a “Future Past City”, in which the waterfront city would systematically retreat from the rising sea levels, creating a modern-day, ongoing Atlantis.

“A city is never complete,” says Gilbert, “so our proposal showed how a city can evolve even while facing decay.” Gilbert found the workshop “eye-opening and enriching” and returned to Lianyungang in 2010 for further research into his final Masters project.

The next workshop will be in November, on Reunion Island, off Madagascar. There are bound to be more productive collisions of ideas.
Professor Michael Buxton in Wyndham Vale, a rapidly developing area on Melbourne’s western fringe.
When you think of threatened species and endangered ecosystems, you think of exotic animals in lush jungles or flora in remote pristine wilderness. In reality, 50 per cent of threatened species and 40 per cent of threatened ecosystems are in urban fringe zones.

RMIT’s Professor Michael Buxton is researching peri-urban (peripheral non-urban) areas which include many of these threatened species and ecosystems. Peri-urban areas are very significant for cities as they are important repositories for natural resources.

Buxton says that historically, cities and towns are established in the most biologically rich areas. “Cities are located near rivers, harbours and abundant supplies of fresh water, fertile soil, timber, food and other natural resources. This is why people want to live in or near urban areas.”

Peri-urban areas extend from the outer metropolitan edges for up to 150 kilometres. In Victoria they are the state’s second most productive agricultural region. They include Melbourne’s water catchments and extensive tourism and recreational areas—from the Surf Coast to the Dandenongs and the Yarra Valley.

“In peri-urban areas, human needs often clash with natural values, so conflict is in-built from the start,” Buxton says. “Successful and sustainable cities this century will be those that relate to their hinterlands and broader peri-urban areas. Cities that do this will retain their thriving agriculture, biodiversity and landscapes, which in turn leads to more innovative and healthier, happier humans.”

For example, food is a huge issue in the 21st century, with demand increasing but supply becoming restricted. Therefore, retaining good quality soils near cities for growing food is very important. “Building over good alluvial land in peri-urban areas is extremely shortsighted. We need to keep our options open and optimise these areas,” Buxton says.

In the past, there have been some good planning decisions for Melbourne and the state of Victoria, as well as some bad mistakes, he says. “In the 1970s there was excellent regional planning work done which resulted in areas like the Dandenongs, Yarra Valley and the Mornington Peninsula being protected—areas which Melburnians still enjoy today. But in recent decades, Melbourne’s green wedges—the city’s lungs—have been constantly threatened, with 4,000 dwellings constructed there.

“This liberalised approach to urban and rural planning saw developments bursting out of the growth corridors anywhere and everywhere. No one kept tabs on development decisions, which were made on a case-by-case basis and which ultimately led to no policy at all.”

Now, the Melbourne 2030 policy is aiming to stop this incremental, ad hoc approach to development and the destruction of the green wedges.

The research by the RMIT team has reviewed national and international policies in peri-urban areas and has helped shift official thinking. Seven local councils have formed a Peri-Urban Group, and commonwealth and state governments have commissioned and funded RMIT research into population development and natural resources use, particularly in the water, agriculture, land use and biodiversity sectors, to discover the trends, drivers and pressures on peri-urban areas.

The team’s current project is comparing two scenarios. One continues current trends to 2040; the other is an alternative scenario which retains natural values while increasing populations modestly. “Continuing current trends would lead to the loss of many of the attributes of the peri-urban areas that people value most. The alternative scenario is less costly for councils and is essential for Melbourne to exist as a sustainable city,” Buxton says.

Other research by RMIT’s Dr Sarah Bekessy is investigating biodiversity in Melbourne’s urban fringe. One ecosystem in danger is the basalt plains grassland west and north-west of the city. “As well as being a unique ecosystem, it is also a key growth area for Melbourne. If action isn’t taken, we will lose species and possibly the whole ecosystem,” she says.

Bekessy brings a background in conservation and biology to urban planning and policy issues, which results in very practical research and a different way of looking at issues. “Current conservation tools tend to look at National Park type settings rather than urban fringe areas and considering, for example, whether a new National Park should be located in a particular area. 
“This type of decision is relatively simple, as it usually involves one or two decision-makers and a limited number of conservation actions. In the urban fringe there are multiple actors and stakeholders, as well as multiple actions and uncertainties,” Bekessy says.

Actors in urban fringe areas can range from builders and developers to agricultural interests and from town councils to lobby groups. Scenarios are extremely complex and could involve a range of initiatives including offering incentives, market-based strategies, offsets, biodiversity banking or regulation.

“The multiple uncertainties only add to the difficult mix. Urban fringe areas are riddled with uncertainty, are often under-surveyed and offer poor quality data to base decision-making on,” she says.

For this leading-edge research, Bekessy and her team have received grants from the Australian Research Council, including through her membership of a new ARC Centre of Excellence for Environmental Decisions and through the Commonwealth-funded Applied Environmental Decision Analysis Research Facility. Industry partners on the projects include local and state government, a catchment management authority and a property developer.

One decision that confronts urban fringe planners is how to detect threatened species accurately in surveys. Survey information is often variable and when consultants tender for survey work the cheaper and not necessarily the best bid wins.

Research by Bekessy and Dr Georgia Garrad has developed a more rigorous process for detecting threatened plant species in the urban fringe.

“The resulting ‘detectability curves’ can be used by government agencies to determine the likelihood that surveys will find threatened species if they occur on a site. This approach has been taken up by the Commonwealth Government in its advice on threatened species,” Bekessy says.

Other research outcomes include maps of Melbourne’s biodiversity hotspots, analysis of the risks and benefits of “offsetting” biodiversity loss, and modelling urban growth scenarios for the strategic assessments that the Commonwealth Government is conducting under the Environmental Protection and Biodiversity Conservation Act.

Ultimately, RMIT research in urban fringe zones will result in more sustainable cities that benefit everyone, including threatened species.


POST-BUSHFIRE PERIPHERAL LIVING

Victoria’s 2009 bushfires served as a starting point for RMIT researchers Nigel Bertram and Gretchen Wilkins, who led a large team of people at RMIT’s Urban Architecture Laboratory to investigate design issues raised by the fires. The project also provided an opportunity to broadly rethink the limitations and possibilities of community life within bush environments on the fringes of Australian cities.

In the final project report, Bertram and Wilkins said that the Black Saturday bushfires wreaked most of their damage in the north-eastern hinterland of Melbourne’s greater metropolitan area. The communities there exist in an overlap zone of low-density peri-urban settlement, physically detached from and culturally distinct from the city, but still reliant on the metropolis for jobs, services and visitors.

Bertram says: “The affected region plays a number of roles on a regional and urban scale. The north-east ranges are Melbourne’s primary water catchment, with their high rainfall and dramatic topography providing many weekend tourism destinations, alternative lifestyle options, and fundamental water infrastructure supporting the lives of millions.

“As such, the forests, watercourses and other infrastructures of the region are important not only to local communities but to the functioning of the city as a whole.”

Wilkins adds: “The work started with a series of questions, galvanised by the tragedy of the fires, including: What does the annual cycle of fire danger mean in terms of sustainable living in such places? How can we better plan and more strategically understand our inextricable relationships with each other and with the city as a whole?”

Research started by looking at what exists: how land has been used and settled in this area over time, and the types of infrastructures and landscapes (formal and informal) that have developed to support private and community life.

“We were also literally looking at what remained after the fires: scarred bushland, concrete floor slabs and remnant infrastructure, emergency housing around football ovals, temporary buildings and makeshift town centres; all imbued with a strong sense of community resilience,” Wilkins says.

Design projects ranged from landscape interventions on the scale of a township to architectural strategies for individual properties and structures. Bertram sums up: “Ultimately the project was about rethinking the role of the rural periphery and its relationship to the city, from a personal to a regional scale.”

– DEBORAH SIPPITTS
“Quite accidentally, we ended up working together,” says Haritos, now a team leader at CSIRO’s Entomology Division. She will draw on her research on insects and other organisms and the enzymes they possess that help break down plant material as part of the $8.3 million venture.

Scientists from the Australian National University and the Universities of Queensland and Manchester are also involved in the three-year CSIRO Energy Transformed Flagship.

Trevor Stevenson is now Associate Professor of Plant Biotechnology at RMIT. It was at Calgene in the United States in the mid-1980s that he met Professor David Stalker, also now at RMIT’s School of Applied Sciences and a key figure in research on the use of plants in the ethanol production process.

Senior lecturer Dr Gregory Nugent is the third member of the RMIT team.

“We have been talking about this for a long time and it’s only recently that we have been able to secure some serious funding for this work,” Stevenson says. He and Stalker worked with the late Dr Mike Dalling, a pioneering biotechnologist, initially securing research funds from American petroleum company, Chevron Technology Ventures.

An Australian Research Council Linkage Grant made some further funding available. “In 2002, Mike, Dave and I were part of a workshop led by CSIRO’s Dr John Oakeshott, put together to initiate the development of a roadmap for Australian biotransformation industries,” Stevenson says.

“One of the things that came out of that was the need to look to so-called second-generation biofuels, which do not compete with food products from agriculture.

“The whole problem with biofuels is accessing the carbon. It’s about getting in through the lignin (the biological ‘glue’ that binds the cells, fibres and vessels which make up woody parts of plants, as in straw), and then breaking down the cellulose so that it can be fermented to make fuel.”

Agricultural crop residues such as cereal straw could provide huge amounts of ligno-cellulosic waste that could potentially be used as feedstock for fermentation and biofuel production.

But Stevenson says while production of ethanol from plant biomass is relatively straightforward, the pre-treatment of biomass with significant amounts of enzymes of fungal or bacterial origin makes this feedstock commercially not viable, and production on a significant enough scale is not yet feasible.

The alternative that he and his team are looking at is using biotechnology to make and store the ligno-cellulose-degrading enzymes in the plant tissue; essentially, getting the plant to make and store the enzyme in advance – and for free.
Amid the debates about the carbon tax, one region is taking the lead in preparing for change. Gosia Kaszubska reports.
It seemed a perfect opportunity to reskill a workforce and keep a local economy alive. A Welsh steel factory was closing down, just at the time when Professor Peter Fairbrother was in the UK working on transition plans for the European steel industry. But instead, the one-size-fits-all efforts of the local authorities became the perfect example of well-meant ineptitude.

“All the operators were trained up as forklift drivers, so all of a sudden they had this surplus of forklift drivers and only a handful of forklift jobs in the local area,” he recalls. “In the end they were still forced to leave to find work, taking their families with them, resulting in the usual, disastrous knock-on effect on the local economy.”

Since arriving in Australia in 2009, Fairbrother has turned his focus on a region expected to be one of the hardest hit by the difficult transition to a low-carbon economy. Home to the state’s huge brown coal deposits and four power generators, the Latrobe Valley in Victoria’s south-east is one of Australia’s most trade-exposed regions, but talk on the ground is about creating opportunities rather than mourning the past.

Working closely with key stakeholders, Fairbrother and his RMIT colleague Dr Darryn Snell are helping develop transition plans. Fairbrother is a founding member of a recently established Latrobe City Council committee which brings together the council, employers, local unions, the power industry and farming groups.

For Fairbrother, who is Director of the Centre for Sustainable Organisations and Work in RMIT’s College of Business, it’s a chance to inject a robust evidence base into the policy decisions ahead.

The first step for Fairbrother and Snell will be a comprehensive skills profile of the region. Latrobe City has a population of 76,000, largely based in four regional centres. The 2006 census showed just over half the population had no qualifications and 42.4 per cent had left school at year 10 or earlier.

But the skills audit is about more than formal qualifications. “It’s about their embedded skills, the knowledge they’ve gained through their working lives and also outside of the workforce, volunteering for the local footy team or leading a fundraising committee at the primary school,” Fairbrother says.

“That kind of in-depth analysis and research is time-consuming and difficult. But the rewards are rich, because you reveal the real depth of knowledge and experience in the area.”

Once a true picture of the regional skills base is uncovered, analysis of new and emerging economic opportunities follows. Off-farm developments in the local agribusiness industries offer great potential, says Agribusiness Gippsland chair, Alex Arbuthnot AM. “The food production of tomorrow will be as much about processing and marketing as the actual work on the farm,” he says.

“A whole range of services will be needed, from engineering to welding. Finding ways to fill these skills shortage gaps will go a long way towards addressing one of the major challenges that is currently restricting the expansion of the agricultural economy.”

Fairbrother adds: “What we need is training that enables people to work across industries. A welder in the power industry may not have qualifications to do welding in stainless steel, as the dairy industry needs, but it’s not a big task to adapt those skills.”

Having learned the lessons of power industry privatisation in the early 1990s, which caught much of the community by surprise, local unions have been deeply involved from the start of the project.

A number of education forums led by the Gippsland Trades and Labour Council and RMIT have laid a solid foundation for engaging stakeholders by building awareness of the critical need to start planning for change. GTLC secretary John Parker says the focus is on a “just transition”.

“If we can get it right here and plan the way forward by bringing round the table all those affected – the workers, employers, local government, community – we’ll have a model not just for coal mining regions but for any area facing major change,” Parker says.

The Latrobe transition planning model of community education, skills analysis and skills futures is readily adaptable and has already caught the attention of the ACTU, which has begun discussions with Fairbrother on spreading the work to trade-exposed areas around the country.

“The best policy is evidence-based, and it is here that social and economic research can make a particular contribution,” Fairbrother says. “Based on this knowledge, we can identify practical and credible strategies that can smooth the transition to low-carbon but also work to revitalise this regional economy, stimulating job growth and prosperity.”

To watch an exclusive video of this story, visit www.rmit.edu.au/news/makingcitieswork
When you visit another city do you feel safe? Do you trust the new city as much as you trust your own? For Natalia Toledo, an artist from Oaxaca, Mexico, the first thing that she noticed about Australia was “trust”. Trust in the streets and trust in places where people meet.

While in Melbourne working on the Alternative Worlds project with RMIT’s Design Research Institute (DRI), Toledo was out at night with Geoff Hogg, Coordinator of Public Art at RMIT, and Karla Saenz, Director of the Kopalli Foundation, Mexico. Walking down one of the city’s famous alleyways she mentioned the “trust” she felt.

“It was interesting to be out in your own city late at night with a visitor telling you how much she trusted Melbourne and how she could feel trust in every part of the city. This is rather different from many media views of Melbourne,” Hogg says.

Out of this comment grew “Trust: Intervention Through Art”. The project aims to reframe social experience in the urban context, and is investigating the social value of trust between individuals in public urban spaces by design interventions through art.

“The proposition is that the shared exercise of trust between individuals, often in a cross-cultural context, can contribute to safer communities. By encouraging individuals to interact through aesthetic participation with one another, trust can develop and can mitigate against anti-social behaviours which manifest as crime,” Hogg says.

The project jointly won DRI’s 2010 Design Challenge on Crime. Brandon Gien, Managing Director of Good Design Australia and Chair of the Australian International Design Awards, says the project captivated his attention and that of his fellow judges. “It’s a unique project as it leverages the role of public art in helping create not only a more aesthetically pleasing environment, but a safer and more trustworthy one,” he says.

RMIT’s partners in the project include Dianella Community Health in Melbourne, the City of Melbourne, the municipality of Sile, Turkey, and the National Centre for the Arts and Kopalli in Mexico.

In Sile, part of Istanbul, the collaboration has resulted in a project based on the notion of the handshake developed in partnership with local government. In Mexico it is helping to create a safer city. Safety is a huge national issue in public spaces in Mexico City, and Kopalli decided to focus on public transport. Starting at the metro stations, the project gets people to tell their life stories via a range of media including posters, performances and video works.

Saenz says: “People are finding images from the project more human and appealing than the advertising they are used to. Through it, people often feel a connection with someone they don’t know in a crowded urban space. People love being part of it.”

In Melbourne later this year, noted Aboriginal artist Karen Casey will create a major intervention as part of the project, building on connections between indigenous communities first explored in the Alternative Worlds project.

Professor Elizabeth Grierson, Head of RMIT’s School of Art, says that trust is a value that the world needs. “I seriously believe that we can make a difference through public art. This project is captivating people around the world, from women on trains in Mexico City to people in coffee shops in Istanbul.”
With land at a premium in Australia’s largest cities, the last 10 to 15 years have seen an upsurge in the conversion of former industrial sites to residential use. Many industrial sites have contaminated soil and groundwater, requiring remediation before they can be approved for homes.

Reliable estimates place the number of contaminated sites at more than 80,000 nationally. Given the potential implications for investment risk, public health and environmental sustainability, you’d think it would be relatively straightforward to find out whether and how a site is contaminated, and who’s responsible for remediation. Not so.

“Federally, there are general guidelines for assessing site contamination,” says RMIT financial accounting specialist Professor Craig Deegan. “At the state and territory level, ‘polluter pays’ and strict liability principles mean that the entity or person who contaminated the site is responsible for assessment and clean-up. There’s no need to prove intent, negligence or fault.”

In practice, the situation is murkier. If the polluter is no longer in business, or if they can’t afford the clean-up costs, responsibility passes to the owner or occupier. If responsibility can’t be established, the buck passes to the relevant state or territory government.

What’s more, although there are national contamination assessment guidelines, responsibility for management lies with state, territory and, occasionally, local governments. “Some jurisdictions have contaminated site registers,” says Deegan’s colleague Sophia Ji, “but these registers are rarely comprehensive. Some jurisdictions don’t have registers, while others don’t require responsible parties to remediate contamination at all.”

Company balance sheets aren’t much help, either. “It’s a breach of Australian Accounting Standards to include items in a balance sheet unless they can be measured reliably,” says Deegan. “If the owner knows they have contaminated sites, but can’t reliably estimate assessment and remediation costs, they’re not required to disclose the sites in the balance sheet.”

Against all this, approval standards for rezoning land from industrial to residential use are becoming increasingly high. “This can make remediation costs quite prohibitive,” Ji says. “Investors need to weigh the risks against the benefits of eventual redevelopment.”

Investors aren’t completely powerless in this situation. They can make the contract of sale subject to an environmental assessment by an independent expert, or negotiate a cheaper purchase price in return for taking the responsibility for remediation.

However, Deegan and Ji believe several reforms would place investors in a stronger position. “First,” says Deegan, “there should be mandatory disclosure of known contaminated sites, via a national register. Such a register would include information about each site’s location, past and current ownership, the nature of contamination, responsible parties, and the extent of remediation.

Second, the Commonwealth Government should amend the Corporations Act to require that companies disclose contaminated sites in their directors’ report or notes to the financial statements, even if they can’t put a figure on the clean-up cost. “Simply knowing these sites exist would help investors make better informed decisions,” says Ji.

Finally, Deegan and Ji believe the accounting profession should develop guidelines for stricter disclosure of contingent (potential) liabilities, including contamination remediation costs. “In the end,” says Deegan, “it’s about risk assessment and right-to-know. The more information investors have, the better for them, potential residents and the local environment.”

Sophia Ji and Professor Craig Deegan are calling for a national register of known contaminated sites.
ISLANDS TO TREASURE

A self-sustaining resort will help save one of China’s most important lakes and lead the way for a new model of urban development. Paul Noonan reports
Taihu three treasures consist of silver-fish, white shrimps and crabs. These delicacies are plentiful in China’s third-largest freshwater lake, Taihu. Famous for majestic limestone and mysterious caves, Taihu Lake has links to the renowned Grand Canal of the Sui Dynasty (581-618).

An hour from Shanghai, the lake supplies water to about 30 million people. It also suffers from outbreaks of dreaded cyanobacteria, known as blue-green algae.

Associate Professor Rosalea Monacella and Craig Douglas from RMIT’s School of Architecture and Design are working with global engineers Arup to develop a radical urban model for an eco-resort in the Jiaoshan Islands at Taihu Lake.

“The Chinese authorities have given us a brief to be world-leading in all aspects of the design of an alternative sustainable urban model, and in doing so produce an exemplary outcome that would become a benchmark for development in the region and set standards in world practice,” Monacella says.

“We developed a masterplan around self-sustainability, water harvesting, recycling, low-impact construction and mass off-site customisation of building elements.

“The plan retains much of the fishing and orchard industry on the existing main island and will use it as a filtering device to use and clean the lake water.

“The model is for the resort to have the ability to generate its own alternative and renewable energy source and to run a self-sustained supply network.

“It will also manage, use and recycle its own sewage and waste, and supply its own water through systematic collection, regeneration, storage and distribution.”

The project is being run by the Office of Urban Transformations Research (OUTR), a research network of RMIT professionals, for Wujin Taihu-Bay Tourism Resort Commission, Changzhou Municipality.

Its genesis is in the three-decade relationship between the Victorian State Government and its counterpart in Changzhou, says Dom Tassone, Project Director with Australian Urban Systems (AUS), which operates under the Victorian Government.

“Back in 2008, AUS took a very large delegation there, led by the then Premier, which resulted in a memorandum of understanding about cleaning up the lake,” Tassone says.

“RMIT gave a presentation under the AUS umbrella. The director of the local tourism authority was very impressed with what RMIT had to offer – both in landscape architecture and in urban framework development, both of which are central to this project.”

Monacella adds: “Yes, we are delivering expertise to China, but we are also learning an enormous amount given the scale and complexities of urbanisation in China, where infrastructural, environmental, social and economic issues are amplified.

“As a response to the challenges of a complex rapidly changing world, including issues such as urban density and the associated challenges in Sydney and Melbourne, OUTR is ideally positioned to offer specialist skills and knowledge to industry and government.”

To watch an exclusive video of this story, visit www.rmit.edu.au/news/makingcitieswork
It takes one to know one. Or, in the case of some organic pollutants, it takes one to destroy another.

Industrial chemists at RMIT have found that adding one organic pollutant to another can help destroy particular pollutants in industrial waste water streams.

This means the water can be used again in the manufacturing process and the quality of the end product is enhanced. It also means the waste water that finally flows into waterways is much, much cleaner.

"The water is free from those organic pollutants which are otherwise hard to oxidise," says RMIT’s Professor Suresh Bhargava.

The research is part of a range of collaborative projects grouped under the CSIRO Light Metals Flagship that concentrate on what are known as “wet co-oxidation techniques”.

Bhargava has also led a large research team of scientists and engineers from RMIT and Alcoa who have developed and proved the concept for a new catalytic process for removing the naturally occurring organic contaminants from Bayer liquor, a by-product of refining bauxite to produce alumina.

The technology has successfully undergone industrial pilot plant trials, and has the potential to be implemented on a large scale and to make significant improvements in the overall efficiency of the Bayer process.

“It will also reduce the environmental impacts of the process through significantly reducing gaseous emissions created by volatile organic compounds,” Bhargava says.

RMIT researchers have also worked with Alcoa on research projects looking into removing mercury from condensate, and with the Australian Aluminium Council on removing odorous compounds from alumina refinery waste water.

Alcoa has been an RMIT research partner for more than 20 years. “The relationship with RMIT has been a long and fruitful one, which has focused on using smart science to solve problems in the complex area of alumina manufacture,” says Dr Ian Harrison, Director of Research and Development for Alcoa’s global refining system.

“We value our relationship with RMIT in many areas and always look forward to the annual visit by Professor Bhargava’s industrial science class to our R&D facilities and alumina refineries and mines in Western Australia.”

GREAT LAKES PROJECT MAKES A SPLASH

In 2008, the Milwaukee Water Council in the US contacted Professor Paul James, of the RMIT-based UN Global Compact Cities Programme, seeking assistance to promote water sustainability.

“We found that despite people living and working by the Great Lakes, which hold 20 per cent of the world’s surface freshwater supply, there was often a lack of cultural understanding of water sustainability,” says James.

Education and research programs became key tools as in three short years the Council turned around the City of Milwaukee’s approach to water so effectively that it became an inaugural winner of a US Water Prize.

“Often it can take a decade or a generation to shift attitudes, but there’s been a complete turnaround in such a short time. The Council is an amazing group,” says James.

James returns to Milwaukee this month to scope a project with IBM about how information technology can contribute to the Council’s award-winning work.
One of the arguments against green power is that the supply isn’t reliable enough to provide large amounts of power. Yet more and more consumers want to contribute to the electricity grid by installing solar panels.

This presents a challenge: solar power is disrupted when the sun clouds over and fades away at nightfall, making it hard to feed into the power grid, especially when demand is at its peak. Surplus renewable energy fed back into the grid can also change the direction of energy flow and the voltage profile along a distribution line.

But help is at hand, with RMIT researchers collaborating with MIL-Systems, a Melbourne inverter manufacturer, to find better ways of integrating home-generated solar and wind power into the electricity grid. The Victorian Department of Primary Industries is backing the $1.7 million project with a Sustainable Energy Research and Development grant of $646,900.

Grahame Holmes, Innovation Professor in Smart Energy Systems at RMIT, says that as more home-owners generate their own power with wind generators and solar panels, more want to feed their surplus energy back into the grid.

“This can lead to challenges for electrical distribution networks to deliver high-quality electricity supply at a regulated voltage,” he says. “There is a whole lot more to putting energy into the grid than putting solar cells on top of a house.”

The project involves developing a leading edge reactive power control inverter to better regulate the flow of power within the grid as energy is injected from renewable systems. Holmes says his team will also investigate how to control large numbers of inverters to maintain voltage regulation along a distribution line as local loading conditions vary.

“This research is an essential precursor to allowing the widespread implementation of enhanced voltage regulation for electricity grids with integrated solar energy systems,” he said. “Solar cells can change their output by 30 per cent in a few seconds, and the grid has to pick up the slack.

“The last thing the grid operators want to do is build a distribution system that runs at a small fraction of its capacity for a significant period of time. Our project is addressing these problems from an academic perspective.”

The Australian Energy Market Operator’s 2010 Electricity Statement of Opportunities shows that each state has different needs and capacity for different types of renewable energy. For example, Victoria has announced it will generate more of its electricity through gas and wind, while Queensland is committed to feeding its growing need for energy through gas-fuelled power stations. Tasmania expects to use biomass and wind to generate its electricity.

While large-scale solar power is still some time away, localised solutions are already emerging. For example, the Federal Government says Alice Springs may soon be able to meet its power needs through solar generation, as the city has more than 300 sunny days a year.

Holmes says Australia is behind a lot of other countries, which are well past the small-scale trial phase that we are just entering and which are now investigating significant localised distributed generation systems.

“A smart grid should use modern technology to manage real and reactive power better, so that you are able to do things you otherwise could not do. It should be more efficient in the energy it distributes, while at the same time making it less expensive for residents and businesses,” he says.

All Things Energy

The first global International All Energy Congress will take place in Sydney in November. Hosted by the International Energy Foundation and sponsored by RMIT, it will discuss the efficient generation and use of energy, with minimum adverse impact on the environment.

RMIT’s Professor Sylvester Aibaneriba, Regional President of the IEF, says rather than limiting the debate to saints and sinners, the focus is on how human ingenuity can mitigate risk and realise the benefits of all forms of energy.

To register or exhibit: www.iaec2011.com
Diabetes is the nation’s fastest growing chronic disease, with 3.3 million Australians expected to be diagnosed with Type 2 diabetes by 2031. Researchers are thinking outside conventional approaches to offer hope.
ENGINEERING EXERCISE INTO OUR CITIES

The frustration is clear when Professor John Hawley gets started on our misguided approach to health. It’s the exasperation of someone who knows what works in tackling the Western world’s biggest health issues, has the science to prove it, yet finds himself up against the twin brick walls of human nature: impatience and laziness.

“I don’t understand why we spend so much time and money looking for secondary and tertiary treatments when the most natural, inexpensive option is also one of the most effective in preventing these diseases in the first place,” he says. “Unfortunately, most people are looking for a quick fix.”

Hawley’s solution is deceivingly simple: exercise. The Exercise Metabolism Research Group he leads in RMIT’s Health Innovations Research Institute is one of a small number of research groups in the world looking at the role of exercise in the prevention and treatment of obesity-related conditions such as diabetes and insulin resistance in humans.

Insulin resistance, a precursor to Type 2 diabetes, impairs the ability of skeletal muscles to take up and dispose of glucose effectively. One of the team’s earlier breakthroughs was finding that exercise was just as effective as insulin-sensitising drugs in treating the condition. But the question remained: why does exercise work so well? The answer lay in the muscles.

“Our research has shown that muscles are the locus of control for the whole body – it’s where everything starts to go wrong,” Hawley says.

“In a normal, healthy person about 80 per cent of the glucose load from a meal is taken up by our muscles. But in obese people, or those with insulin resistance, the glucose that isn’t absorbed stays in the bloodstream and raises blood glucose levels. The diseased muscle can’t dispose of glucose in the same way as a healthy muscle, and the key difference is the levels of mitochondria.”

Mitochondria are the powerhouse of cells. The more mitochondria in the muscle cells, the better their ability to convert fuels such as carbohydrates and fat into useful energy.

“Boosting the mitochondria means your body doesn’t just have a bigger engine but a better, more efficient one – like moving from a clapped out 1.2L to a new model V8.”

Aerobic exercise, and to some extent resistance-based exercise programs, increases the levels of mitochondria. “Combining aerobic-type exercise such as walking, cycling or swimming with resistance training to increase muscle mass will give you the best bang for your dollar,” Hawley says.

Even small amounts of daily exercise can be enough to turn around insulin resistance. And it’s here that the design and development of our cities is crucial, Hawley believes.

“We’ve engineered exercise out of our society and we’re paying the costs. But there is an alternative to pouring out billions of dollars on treating these preventable conditions over the next few decades, and right now is the time to act.”

A NATURAL ALTERNATIVE TO PRESCRIPTION DRUGS

With the annual financial burden of Type 2 diabetes estimated at $10.3 billion just in Australia, the race to find new and better drugs for treating the disease is intense. Conventional drug discovery is having limited success, but researchers investigating natural products with ancient medical roots are finding great potential.

“Natural products have long been a vital source for drug discovery – about 30 per cent of current drugs originate from natural products,” Associate Professor Jiming Ye says.

“Essentially, traditional Chinese medicines are largely natural products that have been used to treat diseases for thousands of years with documented efficacy. But the scientific evidence base that we need for these treatments to become part of the regular armoury of medical approaches to this disease isn’t there – and that’s where our work comes in.”

Ye leads the Molecular Pharmacology for Diabetes Group at RMIT, part of the Traditional and Complementary Research Program in the Health Innovations Research Institute. Their approach – targeting traditional Chinese medicine for the discovery of new drugs to treat diabetes – is unique in Australia.

The conventional approach for drug discovery starts from chemicals in a laboratory and the success rate in developing a drug actually used in medical clinics is extremely low. “The advantage of working with Chinese medicine is you have a clue from the clinical usage about which herbs to target before you start, and you already know they are relatively safe for human consumption,” Ye says.

Collaborating with the Garvan Institute and chemists in the Shanghai Institute of Materia Medica in the Chinese Academy of Sciences, the researchers look for compounds that have significant effects on blood sugar, blood lipids, body weight, food intakes, glucose tolerance and insulin sensitivity.

Two drugs with strong potential have been identified: berberines, found in plants such as Goldthread, and triterpenoids, derived from bitter melons.

Berberine is already in use in China as a non-prescription drug for other conditions and, since the findings, trials by a number of Chinese hospitals have demonstrated its effectiveness in improving insulin action and lowering blood lipids. Laboratory studies have shown both herb-derived compounds work as well as one of the most commonly prescribed diabetes drugs, metformin.

Ye was initially trained in conventional, Western medicine in China, before obtaining his PhD in Australia. With extensive research experience in developing new diabetes drugs with leading pharmaceutical companies, he moved his team to RMIT in 2010 because of the greater potential to combine his basic research work with the University’s investigations into Chinese medicine.

“Instead of East meets West, for me it’s been more a case of West meets East,” he says. “You may start from two different streams in what we do, but eventually they should come together. We should fully embrace the research concepts and tools of the scientific mainstream in our research of Chinese medicine. Science is science – if there’s evidence, there’s got to be something there.”

SWEET! JUST TEXT FOR BLOOD SUGAR ADVICE

Managing a chronic disease like diabetes could be as simple as sending an SMS, thanks to new developments in the integration of technology into healthcare delivery in Australia. RMIT’s Professor Nilmini Wickramasinghe is collaborating with INET International on a new interactive health application that takes advantage of the ubiquity of mobile phones and wireless technology to help patients improve their self-care.

Patients will be able to test their blood sugar before or after a meal, send the data to a health care provider via their mobile phone and receive instant feedback.

The advice will detail what kind of exercise they should do or how they should eat, to maintain healthy blood sugar levels.

The research is part of the Healthcare Technology Cluster led by Wickramasinghe, within RMIT’s School of Business IT and Logistics. Researchers collaborate internationally with leading healthcare organisations to investigate how incorporating information communication technologies can improve health and to find cost-effective ICT solutions for healthcare systems.
We’ve grown up with the idea of the city-country divide. The city provides us with products and services. The country’s job is to look pretty and keep the city fed. Food comes from paddocks, right? Well, yes and no. In the past few years the story has become a tad more complicated.

Take a stroll through suburban streets, especially in the inner suburbs, and there’s a growing chance of finding nature strips where the grass has gone, replaced with carrots. Or potatoes. Or, depending on the season, lots of free-range tomatoes.

Look over the front garden fence, too. More and more households are pulling out the roses and planting pumpkins. The concrete is beginning to crack, creating gaps for a veggie patchwork quilt of micro food production.

“People are moving towards little farms in their gardens. They’re raising chickens in the city, even goats,” says Dr Tania Lewis, who is fascinated by the way cultural hangovers from the hippy era and a modern anti-materialism are entwining.

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“There’s clearly a cultural shift and an awareness that land should be used for productive purposes. And veggies in the front garden has a cool factor …”

Lewis, a senior research fellow at RMIT and co-editor of Ethical Consumption: A Critical Introduction (Routledge, 2011), sees the rise of the urban veggie patch and associated swap meets for inner-city growers as part of an attempt to create a greater sense of community. “People are looking to turn suburbia into something playful – building community and having fun.”

There’s no movement in the conventional sense driving this process, rather what Lewis terms “collectivised individualism”. Some people engage in guerrilla gardening, cultivating or prettifying public land. Others opt for permablitzing, where a group will descend (by invitation) on a private garden and transform it into productive space.

“People want to bring pleasure and enjoyment back into their lives. People are sick of speeded-up, alienated living,” Lewis says.

This rise of lifestyle politics and a greater sense of ethical consumerism morphs seamlessly into other spheres: the rise of garage sales and op shops, the growing popularity of farmers’ markets and even the emergence of online communities sharing information on hard rubbish collections.

Lewis says this is more than a passing fad. “The lifestyle movement has been on the up since the 1990s at least, reflecting some of the initiatives of the earlier hippy movement. But now the neo-romantic hippy element is becoming mainstream.”

Perhaps the biggest signal that a modified Nimbin is knocking on the doors of North Brighton or the North Shore is Channel 10’s decision to run the show, Guerrilla Gardeners.

“It’s an interesting marker. The channel has a young audience, but not a radical one,” Lewis says. In one episode, the presenters took over a boring Sydney roundabout and landscaped it, complete with row boat and palm tree. The local council sought an injunction – only for local residents to rise up in defence of the show.

It seems that our cities are beginning to welcome their inner urban jungle.

To watch an exclusive video of this story, visit www.rmit.edu.au/news/makingcitieswork
The two have this much in common – each has played host to a study by researchers from RMIT and the University of South Australia on innovative methods to help communities take action to reduce greenhouse gas emissions.

“We put out an expression of interest to a number of local government authorities and those two came back to us and said they would like to put resources into the project and have some carbon footprint assessment done,” says Professor Ralph Horne, director of RMIT’s Centre for Design, which coordinated the Carbon Neutral Communities – Making the Transition project.

They completed the three-year project late last year with partners including the Northern Alliance for Greenhouse Action, Moreland Energy Foundation and Community Power, the International Council of Local Environmental Issues (ICLEI) and Consumer Affairs Victoria.

The research team used three methods to estimate greenhouse gas emissions at suburb level, including one developed by the ICLEI Cities for Climate Protection program. They then undertook renewable resource assessments, taking into account land available, housing types with different amounts of roof space, and existing energy demand.

They wanted to know to what extent existing energy demand could be substituted with renewable technologies. “We found that although there were differences between the two local authority areas, in each case around half of the household energy demand could be met by renewable technologies which are currently within market cost parameters,” Horne says.

They arrived at a set of renewable technologies that were both simple and familiar, such as solar panels on housing. A PhD student had worked on a project to measure the area of residential north-facing roofs. The researchers also worked on ways to accommodate small wind turbines without contravening planning controls.

“We found that both the local authority areas could indeed be so-called carbon neutral communities from the point of view of generating the bulk of their energy demand from within the local area,” Horne says.

The team has since set up the Beyond Behaviour Change Research Group, which advises government, community organisations and commercial clients on social change programs, from green retrofits to changing air travel practices.

“It’s a great example of how one project leads to another and how we can apply our new knowledge from a local authority-based project out into completely different sectors,” Horne says.

Dr Susie Moloney, a research fellow at the Centre for Design when she worked on the project, now draws on the research findings in her lectures. She concentrated on social dimensions. “You can have people living in six-star houses who are not living six-star lives,” she says.

Moloney put together a database of about 100 programs across Australia aimed at changing household energy use, and interviewed organisers and householders involved in several of the initiatives. New approaches to changing behaviour were presented to a range of organisations and local authorities around changing social practices.

“The transition to carbon-neutral communities will require change at a number of levels and will involve collective effort,” she says. “Targeting individual behaviour without addressing the factors that shape behaviour is just not adequate.”

Local government areas are readily typecast. The City of Playford, north of Adelaide, is known as home to several of South Australia’s largest industries. Manningham, north-east of Melbourne, on the other hand, is associated with bushland, river and creeks.
Like in so many slum districts around the world, collecting, sorting and trading rubbish has been the main source of income for the 195 families crammed into this strip of land between government and industrial buildings, just metres from the business district in Porto Alegre, Brazil. With the rubbish used to build both dwellings and livelihoods, the challenge of shifting people away is far greater than simply building them new homes. But for those who live in Chocolatão, rubbish is also a means of survival.

“Shifting Chocolatão to a new housing project could easily have been treated as just a way to remove an ugly sight from the city’s historical centre, but the focus instead has been on sustaining and improving the lives of the people involved and achieving long-term social cohesion.”

Kath visited Chocolatão in March for the UN Global Compact Cities Programme. Directed by RMIT’s Professor Paul James, the Cities Programme works closely with 14 cities around the world and has an additional 40 signatories to its principles. The focus is on intractable urban issues, bringing an alternative management approach to the delivery of real, on-the-ground solutions. Porto Alegre engaged in the Cities Programme in 2003 to improve the quality of life for slum dwellers and work towards moving them into proper housing, with full consultation. “Simply moving people out of slums fails to address the problems of house abandonment and inability to pay debts, so the priority areas in this process needed to be education, health and labour,” James says.
Portland cement is a key ingredient of concrete, and one way of making the material more environmentally friendly is to replace it with fly ash, a by-product of coal-powered electricity production. This has the added benefit of putting waste to good use.

The USA and European countries have been using fly ash in concrete for years, and the use of 20 per cent fly ash was a condition in the construction of Melbourne’s Docklands development.

Now, RMIT researchers are working out just how much fly ash can be used to produce concrete that still retains its strength and construction integrity, while helping keep extra CO₂ out of the atmosphere.

Dr Indubhushan Patnaikuni says he and colleagues are assessing cement mixes that include up to 70 per cent fly ash. “This gives the concrete high workability, good durability and high strength.”

Other new concrete mixes using geopolymers that contain fly ash rather than cement may reduce CO₂ emissions by as much as 80 per cent. The research will investigate the use of finely ground fly ash and how it combines with basalt, or volcanic rock, fibre.

Associate Professor Sujeeva Setunge says the use of geopolymers would eradicate the need to use cement in concrete. However, curing the geopolymers requires heat, while the fly ash compounds do not.

“Some work has been done on fly ash but much higher volume, ultra-fine fly ash with basalt fibre has not been explored,” Setunge says. “Geopolymers are more useful for the precast industry, as production in a factory enables heat curing, while the new fly ash mixture should be suitable for use on site.”

Similar strengths to traditional concrete have been achieved in the trial mixtures. Other potential benefits of these blends are the lower risk of thermal cracking and an overall reduced production cost.

Patnaikuni says China and India consume large amounts of cement and together produce more than 300 million tonnes of fly ash a year, making the outcome of the research of great interest to them. Australia has a capacity to produce eight million tonnes.

Many of us are unaware that for such a ubiquitous building material, concrete is also damaging to our environment. The production of one tonne of its Portland cement component produces one tonne of carbon dioxide or CO₂, and concrete accounts for 6 to 8 per cent of human-generated CO₂.

Even though Australia and most other countries have regulations to prevent fly ash being a pollutant, it is still a waste product that takes up valuable storage space. What could be more environmentally friendly, and economically sustainable, than to put this waste to use in something we all need?

To watch an exclusive video of this story, visit www.rmit.edu.au/news/makingcitieswork
The devastation left by the recent earthquakes in New Zealand and Japan drove home the importance of mobilising rapid, efficient responses to provide emergency shelter, food and medical care. But what happens when the emergency is over and aid teams pull out?

“When it comes to housing, the designs used for emergency shelter are very seldom appropriate for the community’s longer-term needs,” says RMIT architect Dr Esther Charlesworth. “Whether the disaster is natural or man-made, reconstruction efforts in countries already rendered vulnerable through economic or social disadvantage tend to be spearheaded by aid teams that come in from outside.”

This creates what Charlesworth calls the “triple disaster phenomenon”. After the initial disaster subsides, there’s a political disaster, because the government is ill-equipped to deal with the situation. Then comes the reconstruction disaster. Albeit with goodwill, Western aid organisations go into vulnerable communities, build prefabricated or culturally inappropriate housing, and leave. There’s little community consultation or consideration of longer-term sustainability issues. “I’ve seen deserted prefab houses littered all over post-tsunami Sri Lanka,” says Charlesworth, “because they were built for nuclear families in communities where multi-generational living was the norm.”

What’s more, post-disaster housing is often climatically inappropriate and unsustainable. “Design and construction requirements are quite different for desert areas compared with the wet tropics, for example, but too often there’s a one-size-fits-all approach.”

Charlesworth also contends that most housing in vulnerable communities fails the economic sustainability test. Builders often use imported materials and labour – depriving local communities of employment opportunities. And it’s not just post-disaster zones that suffer. Communities experiencing longstanding social marginalisation also bear the brunt.

“I’ve seen it time and again in the Northern Territory,” says Charlesworth. “Fly-in/fly-out workers roll out housing programs in remote communities, while residents continue to experience high unemployment.”

To begin addressing some of these issues, Charlesworth has just embarked on a four-year study of successful sustainable housing design in vulnerable communities. With the help of a $600,000 Australian Research Council grant, her team is looking at four case studies in communities experiencing vulnerability: Vietnam (climate change), New Orleans (natural disaster), Sri Lanka (civil war) and remote indigenous communities in Australia (social marginalisation).

Charlesworth and her team are investigating the most significant changes each housing project has created. Collaborating with local community representatives, funding agencies and not-for-profit housing design organisations, the team is examining how these success stories could help other communities and agencies deal with disasters and marginalisation.

In Vietnam, students from RMIT’s campus in Ho Chi Minh City are participating in the research. “Vietnam is highly vulnerable to climate change,” says Charlesworth, “but as yet there’s little evidence of sustainable housing solutions.”

Her team is also looking at the role of architects. “I want to examine how our profession can deal more effectively with disaster mitigation and humanitarian issues, and how we can embrace this field as a mainstream pursuit.”

Above all, Charlesworth hopes the project will make a lasting difference. “Architects are trained to diagnose problems and find tangible solutions,” she says. “When post-disaster or marginalised communities see a model of their new town, they feel enormous hope that, despite their trauma, they can start afresh.”
The 19th century bequeathed us the carbon economy. The wealth it generated also left us with a heritage of imposing architecture, of buildings big on grandeur and short on little luxuries – like efficient heating, cooling and use of water.

Today’s challenge is salvaging the best of Victorian design while minimising its climate footprint. The newly refurbished Francis Ormond Building at RMIT, only the second heritage-listed building in Victoria to gain a five-star environmental rating, shows what is possible.

The building incorporated a main lecture chamber, workshops, classrooms and laboratories when it opened in 1887. Over the decades, it was extended and adapted, turning into a rabbit warren of partitions.

A two-year renovation program completed in 2010 succeeded in combining the best of the 19th and 21st centuries. It stripped the building back to its original neo-gothic elegance, liberating long-lost features such as leadlight windows, archways and hollow, fluted cast-iron columns. And it introduced the kind of environmental features that are only now becoming standard in new developments.

The design includes rainwater harvesting for garden irrigation, toilet flushing and solar hot water generation; chilled beams, intelligent lighting controls and systems; underfloor air distribution; low-volatile organic compound paints, carpets and finishes; glazing to reduce solar gain; and a shared boiler.

The work is part of a $600 million capital works program, centred on Melbourne’s CBD, which has sustainability at its heart. RMIT Vice-Chancellor and President, Professor Margaret Gardner AO, says the University is on track to reduce greenhouse gas emissions by 32 per cent by 2020.

“New and refurbished buildings will be distinguished by sustainable design, including a commitment to achieving a minimum 4-Star Green Star rating for all refurbishments and a 5-Star Green Star rating for all new buildings,” she says.
Tens of thousands of drivers on Melbourne’s Eastern Freeway hurdle past each day, unaware they are passing within metres of one of the last natural billabongs along the Yarra River.

Less than a decade ago, the Burke Road billabong was choked with weeds, pocked with rubbish and little more than an off-road playground for dirt bike riders.

Today, thanks to Stanley Barker, the oasis is reborn. Weeds have been replaced with more than 1,000 trees and areas cleared of Wandering Tradescantia and Creeping Moth vine, allowing the dormant seed bed beneath to regenerate.

Barker came across the site while studying Conservation and Land Management at RMIT and involved his teacher, Helen Corney. Since then, students have conducted field trips and restoration work and authored a management plan.

The area is now being reinvigorated by owls, parrots, possums and frogs, providing habitat for water birds when wet, and forming part of a corridor linking healthy vegetation along the Yarra.

– DAVID GLANZ