Screw Light Bulbs

Smarter ways to save Australians time and money

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CONTENTS

Introduction

Our light-bulb moment

You're concerned about climate change. So you've changed all your light bulbs, you're driving a bit less and you're having shorter showers. But you suspect those small steps aren't enough. You're right.

This book was born in a moment of shared light-bulb fatigue, after reading—or in Liz's case writing—one too many articles about the huge threats posed by climate change, running alongside tips for individual action. And the number one tip on the list was always: 'change your light bulbs!'

As well-intentioned as that tip might be, changing light bulbs clearly doesn't match up against a problem as big and complex as this. So one day the two of us said: 'Screw light bulbs! Let's look at what we really need to do to get serious about climate change.'

A funny thing happened along the way. Instead of getting more depressed about climate change, writing this book cheered us up.

That may sound strange, given what we now know about climate change: that we've significantly altered the planet's climate, and that the consequences of that are now happening faster than previously expected in the form of worsening droughts, floods and fires. Based

on what is already being observed worldwide, the forecasts for coming decades can make for grim reading.

Yet, as you'll see, there are still some reasons for optimism. While the media tends to focus on the latest bad news about climate change, there are more and more positive examples of people and places taking practical steps to cut their greenhouse gas emissions. Many of them started out only wanting to solve one problem: businesses wanting to save money, or cities trying to unclog traffic jams. What their experiences can teach us is that, quite often, the best ways to save money and time can also prove to be the best ways to save on emissions.

The outlook for serious political action in Australia is a little more hopeful than it used to be. The 2007 federal election was an international milestone, because it was the first national election in which climate change was shown to be a crucial vote-changing issue. Leaked opinion polls for the major parties confirmed that John Howard's failure to take climate change seriously was among the top three reasons his government was kicked out of office.

In a development that could also shape the upcoming election, swinging voters—including those living in marginal suburban and regional seats—overwhelmingly named climate change as their number one reason for switching their vote. Politicians of all persuasions are now on notice that they dismiss climate change at their own electoral peril.

But there are still fierce debates about the best way to reform our economy to put a dollar price on greenhouse gas emissions, known as a carbon price. Is it better to do it with an emissions trading scheme, or a carbon tax? Questions like that will affect the lives of all of us for generations to come. That's why it has never been more important for Australians to be involved in deciding which solutions we choose to cut our emissions.

And that's what this book is all about: cutting through the political spin and jargon to offer straight answers to all sorts of questions about climate change. We'll examine which solutions for reducing emissions are best suited to Australia, what has been holding us back from acting sooner, and how all this could change the way we live, work and shop. Some of the questions we'll cover include:

- Do we risk crashing our economy by tackling climate change?
- Who's investing the most in low-carbon industries and jobs?
- Should we stop eating chocolate for the good of the planet?
- How can our checkout choices cut emissions in China?
- Was Al Gore's lunch really carbon neutral?

- Why are we burning money?
- How close are we to having 'clean coal'?
- Why is Australia's very fast train running so late?
- How did cheap petrol become so expensive?
- Why don't the new six-star housing rules go far enough?
- How can we make every drop of water count?
- Is there an alternative to the Carbon Pollution Reduction Scheme?
- What's the real story behind Australia's light-bulb ban?

On our own, individual Australians and Australia as a nation can't solve climate change. Fortunately, we don't have to: we just need to do our fair share. And as the coming chapters will show, there are plenty of solutions available, using a combination of smarter thinking, effective regulation and proven technology.

1

Climate champions

How to understand the real costs of climate change

At the first modern Olympics in 1896, Australia was represented by a lone athlete: 22-year-old amateur runner Edwin Flack, or Teddy to his mates. Teddy Flack wasn't part of any official delegation; he was just a young accountant who had moved from Melbourne to London for work, and persuaded his boss to give him a month off to go and take on the world.

Back then, it took six long days by train and ship to travel from London to Athens, so, when Flack finally arrived, he was exhausted and filthy after days of seasickness. But it didn't take long for him to bounce back in grand style, winning his heat in the 800-metres race on the opening day of competition.

On day two, Flack became Australia's first Olympic champion, streaking ahead of the American favourite to win the 1500-metres race. His win baffled the organisers, who couldn't work out where the young Australian was from: at first they tried the Austrian flag, before finally replacing it with a Union Jack.

On day three, he borrowed a tennis racquet to have a hit in the singles and doubles tennis. Although Flack didn't win his matches, he soon had another reason to celebrate, winning the 800-metres final.

On day four, he came close to winning the marathon, despite having never run further than half that distance. As other competitors wilted beneath the blazing afternoon sun, Flack kept on running. By the 30-kilometre mark, he was in the lead. But with only a few kilometres to the finish line Flack stumbled and fell, ending his dream run.

Yet Flack's inspiring effort had not gone unnoticed by the international crowd. Greece's Prince Nicholas visited Flack after the marathon, ordering brandy eggnog to aid his recovery, while people cheered and called out Flack's name in the streets. As Flack wrote in a letter home to his family: 'They tell me I have become the Lion of Athens.'

Flack's amazing tale of sporting triumph against the odds is the kind Australians have always been proud of. In the biggest sporting arenas, we've always performed far better than could be expected of a nation our size. At the Beijing Olympics, our team won 46 medals, half as many as China and the US—not bad, given our population is only a fraction of theirs. In fact, on a per-person basis, we can proudly boast that Australia consistently outperforms all of the world's superpowers in sport.

Australia's ability to be such a high achiever for such a small nation is helped enormously by the fact that we're relatively wealthy. When it comes to our lives outside sport, however, our wealth has made us over-achievers in a way we're far less keen to boast about.

If you apply the per-person ranking system to our global climate change contribution, then Australia consistently ranks up with the world's worst greenhouse gas polluters. Ranked only alongside other wealthy countries, we often top the list as having the worst per-person emission rates on the planet.

That's not the only way to look at the problem though. An alternative perspective is to ignore our per-person average, and instead just focus on Australia's total annual emissions, which are a much smaller proportion of the global total. Judged from that perspective, we don't look like such big climate culprits after all.

So, are we a nation of big polluters, or has Australia's share of the blame for climate change been overblown? The best way to judge that is by comparing our greenhouse gas emission record with the rest of the world.

Who tops the global polluter tally?

Just as they compete fiercely to take home the biggest haul of medals at each Olympics, the US, China and European nations are also the biggest players when it comes to global greenhouse gas emissions

today. But once you take historical emissions into account, going back to the start of the Industrial Revolution, there's no question which nation ranks first for greenhouse gas emissions. Since the 1800s, the US has pumped out more than a quarter of the total human-generated emissions that are causing our climate to change. If we were to divide up the bill for adapting to the impacts of climate change fairly, the US ought to be paying more than a quarter of the costs.

Similarly, European nations—in particular, a few big countries, such as Germany and Britain—have jointly contributed another quarter of historical global emissions. These historic emissions matter, because the greenhouse gases we emit today stay in the atmosphere for years. The climate change impacts that we are seeing more of now are partly caused by greenhouse gas emissions from as far back as 100 years ago.

In contrast, China and other rapidly industrialising countries such as India and Indonesia haven't contributed anywhere near as many emissions up until now. Even if you combine all of the historical emissions from those three countries, plus the emissions of dozens of the world's developing nations, their combined total contribution to climate change is still less than either the US or Europe.

However, that gap is closing fast. China now officially tops the US on total annual emissions. Although it's still a long way behind most Western countries on emissions per-person, most of the growth in greenhouse gas emissions over the next few decades is set to happen in developing nations, particularly in some of our near neighbours in Asia. The choices that countries like China make will play an increasingly crucial role in determining how much worse climate change gets in the future.

Where do Australia's emissions rank on a global scale?

For every one Australian, we officially produce around 28 tonnes of greenhouse gas a year, nearly double the per-person average among wealthy countries and more than four times higher than the world average. Only five countries in the world rank higher for per-person emissions.

As for our contribution to the global total, in both historical and current terms Australia is responsible for around 1.5 per cent of the world's human-produced greenhouse gas emissions. It might not sound like much, but it's enough to mean we rank as the 13th biggest greenhouse gas polluter on the planet—a surprisingly high impact for a nation with just 0.3 per cent of the world's population.

What's just as significant is what we've been doing about it. International studies show that, as a nation, we've done less than many other countries to reduce our greenhouse gas emissions, especially those produced by our inefficient electricity use. As a result, Australia has the fastest rate of growth in carbon dioxide emissions from burning fossil fuels—coal, oil and gas—of any rich country in the world.

The numbers speak for themselves: just as we're a nation with a long history of producing more than our share of international sporting champions, we're also a nation with a long history of producing more than our share of greenhouse gas emissions. (And, as we'll see later, the official emissions figures only tell part of the real story.)

Nevertheless, we're never going to be as significant a greenhouse polluter as either the US or China. That's a fact that you've probably heard being used to justify Australia taking it slowly, or even doing nothing, to cut our emissions until all the bigger polluters have promised to make steep cuts. It sounds like quite a rational argument, too—until you imagine what it would mean if your neighbours had the same attitude.

How did we end up becoming a bad neighbour?

Your next-door neighbour is driving you crazy. Week in, week out, he leaves his overflowing rubbish bin sitting on the curb, with extra garbage bags piled up beside it. One day you pluck up the courage to politely ask him if he'd mind cleaning up a bit. He just shrugs his shoulders and points at your other neighbours' overflowing bins up and down the street.

'Mate, you can hardly say all this mess is down to me. I'll tell you what: if you can persuade everyone else to clean up, then I'll do it too. Until then, I can't see how anything I do will make much difference.'

It's a fair point. Even if he tidied up, your neighbour is not the worst in the street. Still, you think to yourself as you bend over to untangle a slimy plastic bag from around your letterbox, it wouldn't hurt your neighbour to do his bit.

Most of us try not to trash our streets, regardless of how anyone else behaves. It's not only a matter of trying to 'do the right thing', as the old anti-littering slogan goes. It's also because you can't expect other people to behave well if you're not willing to lead by example. The same basic principle applies to climate change.

Back in 1992, governments from around the world came together at the Rio Earth Summit and agreed that it was time to stop treating the atmosphere as a global dumping-ground for excess greenhouse gases. So they came up with a treaty, the United Nations Framework Convention on Climate Change (UNFCCC), which established an agreed objective to stabilise greenhouse gas concentrations in the atmosphere 'at a level that would prevent dangerous anthropogenic [human-caused] interference with the climate system'.

Crucially, the world's wealthiest nations agreed to the principle that they should lead the way in reducing their greenhouse gas emissions. It was an acknowledgement of an unavoidable fact: four-fifths of the greenhouse gases that have accumulated in the atmosphere over the past 150 years have been generated by just one-fifth of the world's people, who live in the most industrialised countries. Wealthy countries had to agree that it was only fair to cut their emissions first, ahead of developing countries that still had far lower emissions per person.

Australia was among the first countries to sign the UNFCCC pledge, promising to help fix a problem that we'd done more than our fair share to create. That was nearly 20 years ago, and unfortunately, like most other nations worldwide, we've done very little to keep our word.

That history of broken promises is one of the key reasons why it's proving so hard to get the world to agree on legally binding global greenhouse gas cuts for 2013 and beyond, when the first phase of the Kyoto Protocol runs out. Most countries are still acting like uncooperative neighbours, making excuses about why they shouldn't have to clean up their share of the mess until everyone else does.

So where does Australia fit into the global debate over climate change? Are we too small a nation to have any real impact at an international level? The answers can be found by looking at the deal we won under the Kyoto Protocol.

Is Australia too small a nation to have any impact at a global level?

It was the early hours of 11 December 1997, on the final day of global climate talks in Kyoto, Japan. The talks, aimed at striking the first legally binding deal to cut rich nations' greenhouse gas emissions by 2012, had dragged on late into the night.

The Australian delegation had stayed quiet for much of the talks, having come to the summit demanding—and winning—a massive

concession from the rest of the world on our future greenhouse gas emissions under the Kyoto Protocol. While most other wealthy nations pledged to try to cut their emissions by an average of 5 per cent below 1990 levels by 2012, Australia held out for a target that would actually allow us to increase our emissions 8 per cent above 1990 levels.

At long last, a deal looked ready to be struck. But as the meeting's chairman read through the final text of the agreed deal, Australia's then Environment Minister, Robert Hill, spoke up, demanding the insertion of a special clause on the seemingly obscure issue of land clearing.

Back in the early 1990s, emissions from land clearing for farms and houses in Australia were high, but fell shortly after because of new laws restricting land clearing. By chance, 1990 was the year selected as the starting point for setting future greenhouse gas cuts under the Kyoto agreement, which is why you've probably heard people talking about 'cutting emissions to below 1990 levels'.

Having already won a relatively easy greenhouse gas emission target, Australia was now asking for even more leeway to keep polluting, because, if the drop in our land-clearing emissions since 1990 was factored into our overall target, we would be able to keep generating more emissions in other areas, such as from energy and transport.

At 1.42 am, weary and wanting to get an agreement, ministers representing the rest of the world agreed to the special 'Australia clause' on land clearing. Combined with our unusually generous target, Australia effectively won the right to do nothing to reduce our emissions for another 15 years.

Robert Hill declared that the result at Kyoto was 'a great victory' for Australia; one small nation had taken on the rest of the world and got exactly what it wanted. On his return to Canberra, Hill was greeted with a standing ovation from his colleagues, including the then Prime Minister John Howard, who hailed the result as 'a win for the environment and a win for Australian jobs'.

Others saw Australia's unprecedented victory differently. While European delegates expressed anger at the 'immoral' decision to let Australia increase its emissions so much, in the US and Canada some commentators muttered that their negotiators ought to have been playing hardball like us.

Yet, even after winning greater concessions out of the Kyoto process than arguably any other country, and having a greenhouse target that was so easy to meet we didn't need to lift a finger, the government later changed its mind, and reneged on its promise to ratify the deal. On World Environment Day in June 2002, Howard declared that

Australia would not support the Kyoto Protocol, now claiming that doing so would 'cost us jobs and damage our industry'. It was the same claim George W. Bush had used to pull the US out of the international agreement.

All this is ancient history though, surely, now that the Howard era is over? Unfortunately not. On the crucial issue of the economic costs of cutting emissions, the debate over climate change really hasn't moved on much from the past.

Do we risk crashing our economy by tackling climate change?

Australians can't be blamed for being worried about the costs of climate action. For years we've heard the same argument from senior politicians and most media commentators: 'Of course we want to cut our greenhouse gas emissions, but it's really expensive, so if we don't go slowly, we'll cripple our economy, and that won't help anyone.' It sounds like a persuasive argument, especially when it's backed up by what appears to be serious, independent research.

In July 2006, Prime Minister John Howard addressed a gathering of senior business leaders and journalists in Sydney, outlining his vision on future energy and water needs. One of his main claims was that Australia's economy would be hit by 'significant costs' from deep emission cuts—and as evidence he quoted shocking new figures from a report by the government's Australian Bureau of Agricultural and Resource Economics (ABARE). According to the Prime Minister, 'ABARE finds that those costs would be a 10 per cent fall in Gross Domestic Product (GDP), a 20 per cent fall in real wages, and a carbon price equivalent to a doubling of petrol prices in Australia—and, for good measure, yield no greater environmental benefits'.

In the following months, Howard's warnings became increasingly dire. Still quoting from the ABARE report, the Prime Minister said that trying to halve Australia's emissions by 2050 would cause 'a staggering 600 per cent rise in electricity and gas prices', while 'workers will see their jobs disappear and jobs exported to other parts of the world'. Condemning a proposal for a national emissions trading scheme, he warned that it would make power supplies less reliable in some states and make petrol prices jump sky-high. It all sounded pretty scary, as if Australia was set to plunge into recession as a result of deep greenhouse gas emissions cuts.

The truth is, the ABARE modelling showed no such thing.

Which worst-case scenario wasn't so bad after all?

Although it escaped the media's attention at the time, ABARE had actually modelled six different economic scenarios. Conveniently, Howard had chosen to refer only to the most extreme one, based on the implausible idea that Australia would cut emissions almost twice as fast as any other country in the world.

Even that worst-case scenario wasn't anywhere near as scary as the Prime Minister made it sound. It was true that, under that option, the modelling forecast showed just under 10 per cent of growth would be shaved from Australia's economy by 2050. There was, however, a crucial bit of information that Howard failed to mention: over that same period, the value of Australia's economy was on track to have increased by 246 per cent.

In other words, even in this supposedly doomsday scenario, the whole Australian economy would have more than trebled in value, far outstripping the costs of cutting our greenhouse gas emissions in half. When you put the costs into perspective like that, the prospect of emission cuts suddenly doesn't sound scary at all.

That ABARE report on the costs of cutting emissions wasn't unique, nor was it the first of its kind for Australia. With hindsight though, its publication was surprisingly significant. Why? Because ABARE was home to John Howard's favourite team of economists. The fact that even they concluded that cutting emissions was possible at the same time as Australians continued growing wealthier—just at a very slightly slower pace—showed just how misleading all the claims about 'crippling the economy' really were.

What do our top economic models reveal?

The finding that the costs of action had been exaggerated was re-confirmed in late 2006 by leading experts from the CSIRO and elsewhere, who did their own analyses of how cutting Australia's emissions was likely to affect the economy. Even using the same ABARE forecasts that Howard chose to misrepresent, they found that slashing emissions would have such a minor cost on the overall Australian economy that the 'do nothing' versus '60 per cent cut' lines on a graph were only separated by the slimmest of margins.

Around the same time, the World Bank's former chief economist, Sir Nicholas Stern, reached the same conclusion in his landmark review

of the costs to the global economy of cutting emissions. Declaring that climate change was 'the greatest market failure the world has seen', Stern found that the costs of action were less daunting than many thought, and that reducing the increasing rate of global growth by 1 per cent a year to tackle climate change was preferable to suffering economic shocks on a scale not seen since the World Wars or the Great Depression.

Six months later, the 2007 report from the Intergovernmental Panel on Climate Change (IPCC) reached the same conclusion, after reviewing major economic studies from around the world. Warning that time was running out, the IPCC found that major emission cuts were possible using a mix of regulation, technology and innovation, and that doing so would not cost the earth.

In 2008, review teams led by economist Ross Garnaut and the federal Treasury reached similar conclusions in their separate studies on the costs of climate action for Australia. While acknowledging there would be some short-term costs, the Garnaut Review found that cutting greenhouse gas emissions would typically have less impact on Australians' hip pockets than the introduction of the GST, shaving just 0.16 percentage points from our still increasing rate of growth in GDP each year until 2020.

Garnaut also found that working towards a more ambitious greenhouse gas emission target of cutting Australia's emissions by 80 per cent by 2050 would cost only slightly more than the government's preferred 60 per cent target. Most significantly, the Garnaut Review confirmed that, when compared with other wealthy countries, Australia had the most to gain from advocating steeper international emission cuts. That's because more extreme weather has a greater effect on our lives and our economy than in many other parts of the world. It's also because the impacts of climate change on the economies of our major trading partners, especially in Asia, will hurt our export industries.

It's worth noting that no economic model is perfect, including those used in these high-profile reports. For example, the Garnaut and Treasury studies both made contentious assumptions about how to keep costs as low as possible. These included allowing highly polluting industries in Australia to buy cut-price carbon 'offsets' from countries like Indonesia, allowing such industries to do less to cut their own emissions here.

Yet what was most remarkable about those economists' conclusions that emissions cuts made economic sense was that all their work was based on an assumption that the environment is fundamentally worthless.

How much is a coral reef worth, dead or alive?

Economics is a funny business. It can reveal all sorts of surprising facts about us, such as that Australians spend almost as much on alcohol each year as we do on our electricity and gas bills. But there are areas where mainstream economics isn't so helpful, such as measuring a whole range of things that we all value, like fresh air or clean water, which are hard to put a price tag on. As a result, there are multi-billion-dollar holes in our accounting on climate change.

Take the Great Barrier Reef. As well as being one of the world's natural wonders, the reef has become a cornerstone of the Australian economy, luring two million tourists to Queensland every year, many of whom then go on to visit other parts of the country. Conservative estimates have found that reef-related tourism is worth around $6 billion a year and employs about 63,000 people.

If the reef suffers widespread bleaching over the next couple of decades because of climate change, as experts warn looks inevitable without radical action, then the local tourism industry and tens of thousands of Australians are set to take a massive hit.

The same is true for other natural icons around Australia, from Ningaloo Reef in the west to the wetlands of Kakadu in the north and alpine areas down south. All up, the Australian tourism industry generates around $38 billion a year and is one of our biggest export earners.

Yet the economic costs caused by a downturn in tourists visiting places like the Great Barrier Reef once they are damaged by climate change are not counted in any major study on the costs of climate change, including the Garnaut Review and the federal Treasury's report. Instead, the impacts of such damage to environmental assets are still being written off as uncosted 'externalities', which essentially means something of value that isn't being counted in the current price of a product or service. And the value of the environment in tourist areas is not the only significant cost that we're not counting.

How long can we stand the heat?

Up until the devastating Black Saturday fires in Victoria on 7 February 2009, bushfires had killed around 230 people across Australia over the previous forty years. Over one terrible weekend, a further 173 people were killed, while hundreds more were injured and thousands were left homeless.

Fire is a natural part of living in the Australian bush and, as climate scientists were quick to point out at the time of the Victorian fires, no single weather event can or ever should be attributed solely to climate change. The conditions for the perfect firestorm were all there, though, including a record dry spell and high temperatures nearly a degree higher than the previous record.

The events of February 2009 are a pointer to the future under a warmer climate. Fire seasons are already starting earlier, ending later, and becoming more intense. Over the next decade, people living in south-eastern Australia can expect to experience many more catastrophic fire-danger days, increasing the number of lives and properties at risk, and pushing up insurance premiums and stretching emergency services to their limits.

All this will take a growing toll on our economy. While the long-term damage bill from the Victorian fires won't be known for years, within the first six months it was already estimated at well over $1 billion.

Yet, just like damage to the Great Barrier Reef, the growing costs of extreme bushfires were not counted by the Garnaut Review or the federal Treasury.

With average temperatures in Australia rising by just under 1 degree over the past 60 years, Australians have also sweltered through more heatwaves. One of the worst recent examples was in the weeks leading up to the Black Saturday tragedy, when searing summer temperatures sparked a wave of heat-related deaths across South Australia, Victoria and northern Tasmania.

There was almost a three-fold jump in the number of people suffering cardiac arrests. Ambulance Victoria went into major disaster mode to cope with the barrage of calls for help, with its crews busier than at any time in the service's history, including during the subsequent bushfires. In Victoria alone, the state's chief health officer found that there were around 370 extra deaths during the heatwave—more than double the number of people who died in the fires.

As health experts were warning well before that heatwave, the number of heat-related deaths in our five biggest cities alone—Perth, Adelaide, Melbourne, Sydney and Brisbane—is expected to more than triple by 2020, to between 4300 and 6300 deaths a year. That will further strain our already overstretched ambulance crews and hospitals. And that's not even accounting for the impacts outside the capital cities, particularly in remote areas where medical help is already a long way away. Yet the growing costs of higher death tolls from heatwaves were not counted by either the Garnaut Review or the federal Treasury.

Why do holes in our climate accounts matter?

To their credit, the Garnaut and Stern reviews did something that most previous economic studies hadn't done at all: they went to the effort of acknowledging many of the social and environmental externalities that they didn't attribute any economic value to in their final reports. Garnaut noted that it was possible to monetise or attribute a dollar value to many of those externalities. However, because of the uncertainties over the costs associated with a drop in tourism or higher death tolls from fires and heatwaves, it was easier in the end not to count them.

As Garnaut and others have said, if those kinds of externalities had been taken into account, then the economic case in favour of stronger emission targets would have been even clearer. That's a critical point, because avoiding economic pain from cutting emissions is still the main reason invoked by governments, including Australia's, to justify their slow response to climate change. Attitudes among political and business leaders are only just beginning to shift, as more people see the dangers of letting our problems blow up into global catastrophes.

How much are we willing to pay to avoid a global meltdown?

It took until the final months of George W. Bush's time in the White House for him to finally admit that the world was speeding towards catastrophe. For eight years, Bush and his key advisers had denied that the problem was as dire as others were saying, dismissing international warnings and reassuring concerned Americans that there was no need to worry.

Finally, they had no choice but to come clean: the problem was much bigger and much, much worse than they had wanted to admit. Having allowed the situation to get out of hand for so long, they saw that the costs of starting to clean up the mess were going to be huge. As Bush and other world leaders now agreed, doing nothing was no longer an option, because inaction would cost far more in the long run.

It's just a pity they weren't talking about climate change.

When Wall Street came under threat from the sub-prime mortgage crisis, brought on by years of poorly regulated lending practices and unchecked greed, the response of Bush and his successor, Barack Obama, was unprecedented. Both administrations handed out cheques and tax breaks, took over bad debts and bailed out giant financial institutions and car companies, all in the hope of avoiding an even costlier stockmarket crash.

The US government wasn't alone in reacting so strongly to the global financial meltdown. There were massive banking bailouts right across Europe, too: one week it was Germany pulling together a €400-billion ($A640 billion) deal; the week after, the British government topped that with a £500-billion ($A900 billion) rescue package. Even here in Australia, the government managed to find $10 billion, followed up by another $42 billion only months later.

It's been hard to keep track of just how much money has been thrown around. According to one estimate in mid-2009, within less than a year the US government alone had responded by spending or promising to guarantee private debts worth $US13 trillion ($A14.5 trillion).

There are legitimate arguments both for and against that scale of government intervention to avert even more disastrous financial crashes and job losses. In the longer term, the bigger worry is that the crash was entirely predictable and could have been avoided in the first place. A number of economists around the world had been warning for years of a global financial meltdown triggered by lax lending practices and unsustainably high levels of credit and debt. Those warnings were ignored, and we all ended up paying the price. It's eerily similar to the lack of response to warnings from scientists and a growing chorus of economists about the risks of a planetary meltdown—on a scale that would make the world's recent economic woes look like a blip.

Who is using their bailout money to get smart?

One positive to emerge from the recent economic crisis is that some countries have used it as an opportunity to invest some of their bailout packages to create much-needed jobs in emission-saving projects. For instance, even before being elected as US president, Barack Obama had been talking up the need to remake America's antiquated and massively inefficient electricity grid. Since moving into the White House, Obama has pushed ahead with an even bigger, better and smarter electricity grid upgrade than he had originally planned before the recession hit, using $US3.4 billion ($A3.8 billion) of the bailout funds. That commitment has since been backed by power utilities pledging to spend a further $US4.7 billion ($A5.2 billion).

Instead of simply continuing to patch up the country's electricity infrastructure, which was built over a century ago on the old-fashioned premise of electricity being solely sourced from giant power stations, the

US has decided to get smart. Combining modern computer technology and upgraded electricity networks, it's possible to create a more flexible, modern grid—known as a smart grid—which could reduce electricity use by more than 4 per cent in under 20 years. It's a plan backed by computing giants like Google and IBM, and there are already examples of it at work in parts of the US and Europe.

Part of why Obama can see the need for a US-wide smart grid is because it will be much better able to manage energy from a wider range of sources around the country, from roof-top solar panels and solar thermal power stations across California through to wind farms in Texas. It's also about energy security. At the moment, power outages cost the US economy US$100 billion a year. By being connected to a better-managed, broader network of electricity sources, the US will be able to reliably feed in more locally generated, lower-emission electricity, significantly cutting down on costly losses in generation and transmission. The work involved with rolling out a smart grid across the US will also create thousands of jobs.

For all those reasons, the US Department of Energy has concluded that a 21st century smart grid is a better option than sticking with their outmoded 20th century one. It's just one of the major green projects under way in the US, worth a total of $US94 billion ($A105 billion), aimed at creating more than two million new jobs before the end of 2010.

Who is investing the most in low-carbon industries and jobs?

The US is not alone in looking to turn its recession into an opportunity to generate new jobs in lower-carbon industries. China has been investing much more than the US, allocating roughly 40 per cent of its 4000 billion yuan ($A650 billion) stimulus package to environmental measures, including developing better electricity infrastructure and building 16,000 kilometres of new passenger and freight railways across the country.

China is already home to 17 of the world's 100 richest investors in lower-emission technologies, who have built factories to supply the global demand for solar water heaters, solar panels and electric cars. One of those investors is Dr Zhengrong Shi, who came to Australia in the late 1980s and studied at the University of New South Wales' world-leading solar electricity research centre. He loved it here so much that he became an Australian citizen and was keen to set up his

new solar company. But he returned to China in 2001 because the policy conditions there were better for setting up his new company, Suntech Power. Within only a few years he had become one of the world's first solar billionaires, earning the nickname 'the Sun King'. In 2009, Shi was named as *Forbes* magazine's Asian businessman of the year.

Like the US and China, Australia has been investing more in emission-saving industries, such as the Rudd government's $4 billion energy-efficient homes program, which aimed to insulate 2.7 million homes and put more solar water heaters on roofs around the country. In a change from the past, Rudd and his ministers have also talked a lot about how it's in Australia's national interest to make the transition from a high-emissions economy to 'a low carbon economy of the future'.

But actions speak louder than press releases, and the Rudd government has not been living up to its rhetoric. Less than 10 per cent of Australia's economic stimulus spending was spent on emission-saving initiatives, too many of which have since suffered from poor administration. In particular, the well-intentioned insulation and Green Loans schemes were so poorly set up that they were easy for cowboy operators to exploit.

Meanwhile, research by international market analysts shows that investment in low-emissions products and services is growing much faster than previously predicted. In 2008, around $US155 billion ($A173 billion) was invested in renewable energy and energy efficiency—overtaking investments in fossil fuels for the first time—with the biggest growth in cleaner energy happening in China, India and other fast-industrialising countries.

Among those investors is the world's second richest man, American billionaire Warren Buffett. In late 2008, Buffett bought a $US230 million ($A256 million) stake in a Chinese mobile phone, battery and car manufacturer called BYD. Since then, BYD has begun selling the world's first mass-produced hybrid car, and is gearing up to sell a fully electric car in the US, which is expected to cost less and deliver far more driving time than anything the American car makers are currently developing. Within a year, Buffett had made a 500 per cent profit on his investment—but he's not looking to cash in his shares anytime soon, instead trying to acquire an even bigger stake in the company.

Companies like BYD are just one of the reasons why the Australian Chamber of Commerce in Beijing has estimated that, by 2013,

low-emissions business opportunities in China alone will be worth as much as $US1 trillion ($A1.1 trillion). That's about the value of Australia's whole economy.

It's just one of the signs that the global economy is beginning to shift. Before we know it, no one will be talking about 'the low carbon economy of the future', because that future will have arrived. It's a trend that Australia can choose to recognise and respond to now, or risk paying the price for later.

How can businesses save money by cutting emissions?

While the federal Labor government and the Coalition have gone out of their way to placate big businesses on climate change, with promises of special deals to help them to avoid paying most of the costs of their pollution, they have paid comparatively little attention to the needs of smaller businesses. And that's a mistake, because all those small businesses could be a much bigger force for good than most people realise.

Small businesses make up 96 out every 100 businesses in Australia. Collectively, they generate more than a third of our annual Gross Domestic Product (GDP), and employ around 5 million people. When surveyed, the vast majority of small business owners say they'd like to reduce their environmental impact; the main stumbling block is that most are time-poor and unsure about how to get started. That's where practical programs like Grow Me The Money, an initiative of the Victorian Employers' Chamber of Commerce and Industry and the Environment Protection Authority, can help. (The Grow Me the Money website and all other online references are listed in the Notes.)

More than 1000 small- and medium-sized businesses—ranging from country bed-and-breakfasts, to a chain of suburban cake shops, to commercial printers—have taken part in Grow Me The Money since it began in 2007. On average, participating businesses have been able to cut their greenhouse emissions by 15 per cent in their first year, averaging out to 28 tonnes each, mostly through cheap or free solutions such as changing behaviour and tweaking thermostats.

One of the selling points of the program is its return on investment. Its joining fee is $350, yet on average participants find they are paying $6600 less on bills after only a year. For many, it's changed the way they do business, as well as giving them a new way of attracting environmentally aware staff and customers.

Pressure to keep clients happy and stay competitive in a lower-carbon economy is also driving much bigger businesses to make changes. Lindsay Fox had just one truck when he started his own business in 1956. Today, the Linfox empire overseen by Lindsay's son, Peter, has around 5000 vehicles and more than 15,000 employees across 11 countries. Several years ago, some of the company's big clients in the US started asking what Linfox was doing to reduce its environmental impact. So to keep its customers happy, in 2007 the company set a goal to cut the greenhouse gas emissions from its global operations by 15 per cent by the end of 2010.

Linfox began retraining and encouraging staff to get involved, while also setting up its own carbon accounting system to monitor performance, which covers everything down to how much diesel each truck is using. In doing so, the company has uncovered all sorts of big and small ways of doing business better. Altogether, those changes have added up to far more than expected. In late 2009, Linfox announced it had cut its greenhouse gas emissions by 28 per cent, achieving nearly double their original target in just two years.

Even if you're not a small-business owner or a senior manager at a multinational like Linfox, don't assume that it's entirely your boss's responsibility to make things happen. In 2007, the National Australia Bank's directors made a promise to become carbon neutral by September 2010. That decision wasn't driven by demands from customers or shareholders; it was driven by consistent feedback from employees that they wanted to work for a greener bank. Keeping good staff happy is worth spending money on.

Just like individuals, businesses can have all sorts of motivations for wanting to cut emissions. For some, it's primarily about wanting to save money; for others, it's about needing to look green to attract or retain customers; for others, it's all about wanting to do the right thing. Ultimately, it doesn't matter much why more businesses are changing their practices; what matters is that more of them are doing so.

By reducing their reliance on fossil fuels before Australia brings in some form of emissions trading scheme or carbon tax, those businesses are reducing their 'carbon liability'—in other words, protecting themselves from electricity and fuel price rises as burning fossil fuels becomes more expensive. It's a form of risk management. And it's not the only type of risk-averse thinking that should be shaping our response to climate change.

Why is defence the safest form of attack on climate change?

Back in 2003, when the former head of the UK's Meteorological Office, Sir John Houghton, described climate change as a 'weapon of mass destruction' that was already killing more people worldwide each year than terrorism, he was dismissed by some as a doom-monger. It didn't seem to matter that there was mounting evidence of record heatwaves, droughts and storms with high death tolls to support Houghton's statement; it sounded over-the-top, making it easy to write him off as an alarmist.

Since then, Houghton and other scientists have acquired some powerful allies. Over the past few years, some of the world's most senior military and security experts—including from NATO, the Pentagon, the US National Intelligence Council, the Australian Federal Police, and emergency services chiefs from across Australia—have all echoed Houghton's concerns.

While most of the US government's risk assessments on climate change remain classified, the snippets that have been publicly released all conclude that climate change is a massive security threat, likely to cause mass movements of refugees, battles for water and other resources, and to increase the risk of major global economic shocks.

If they all agree that climate change is a huge security concern, why aren't we treating it like one?

In conventional military thinking, while our defence chiefs might hope for the best, they have to plan for the worst. That means being prepared for anything, from the possibility of a single terrorist attack right through to a full-blown world war of the kind that we haven't been part of for more than half a century. That's the justification for Australia spending about 2 per cent of our national GDP on defence, or around $26 billion in 2009. Unlike most federal government departments, which have had their funding slashed in recent years, defence has been sheltered from cutbacks and is the only department guaranteed budget increases for the next decade.

Given the warnings from people like former Australian Federal Police Commissioner Mick Keelty that 'climate change is going to be the security issue of the 21st century', how does our defence spending compare with federal funding for climate change?

For every $1 set aside for defence from 2008 to 2018, less than 6 cents has been budgeted for defending us against climate change. The greatest irony is that, as the Garnaut Review pointed out, the less that's done to deal with climate change, the more likely Australia is to be forced to raise our defence and foreign aid budgets to respond to greater instability among neighbouring Asia-Pacific nations.

Treating climate change as a matter of national security is a lot like the principle of paying for insurance. Here in Australia, we spend more than $30 billion a year on insuring our homes and businesses against the worst-case scenarios we can imagine, even though we know there's only a tiny probability of those disasters ever striking. Yet at the moment, Australia remains unprepared to cope with even the most widely predicted climate impacts.

What does the science say about future warming?

Climate change is not dangerous because it single-handedly causes extreme weather events; it's a threat because it makes Australia's already severe climate of fires, droughts and flooding rains even more extreme.

Since 1950, the average temperature in Australia has risen by 0.9 degrees. We also know that on average across the globe there's about another 1 degree of warming locked in this century, due to the delay between emitting greenhouse gases and feeling the effects of subsequent warming.

Many people have argued that we can't afford to allow temperatures to rise by any more than a global average of 2 degrees over pre-industrial levels, because of the massive impacts it would have on our lives. That's a goal that would require the world to make an unprecedented effort to decarbonise our lives—essentially, to stop burning coal, oil and gas—within the next few decades.

Given the current trends in global emissions, it's already going to be hard, maybe even impossible, to avoid a minimum of a 2 degrees temperature rise this century. For that reason, some say that aiming for a 2 degree target is pointless: we should simply accept we're already facing increases of at least 3 degrees and start preparing to adapt to those hotter and more extreme conditions.

Once that targets debate gets going, it's not long before everyone starts fighting over even more complex sets of figures, to do with atmospheric concentrations of greenhouse gases. Those concentrations are measured in parts per million, which might not sound like much but are actually very significant. That's why there are now such heated battles over aiming to keep greenhouse gas concentrations at levels below 350, 450, or 550 parts per million in the atmosphere. Cut out all the jargon, and what those arguments are basically about is how hot we're willing to risk the world becoming. On one level, that's an important debate. In practice though, it's a battle that's becoming increasingly detached from what we're seeing in the real world.

How long have we got to move from talk to action?

If the global trends in greenhouse gas emissions continue to rise at recent rates, then it's safe to say that there won't be much point in continuing to talk about a global 2 degrees temperature increase. Instead, it is becoming far more likely that we will see average temperatures climb by 5 to 6 degrees or more before the end of this century. While the 2090s may seem like a long way into the future, it's within the lifetime of most toddlers in Australia today.

According to a number of major studies based on more recent data than was used in the 2007 IPCC report, even limiting temperature rise to around 4 degrees—based on stabilising greenhouse gas concentrations in the atmosphere at 650 parts per million—would require global emissions to stabilise and start falling by 3 per cent a year by 2020.

That's not the direction we're heading in. While there was a brief dip in emissions from some countries in late 2008 and 2009 as some industries slowed down production, over the past decade the trend has been for emissions to keep rising by about 3 per cent a year. The science tells us that to keep climate impacts to manageable levels, we need to turn that trajectory around, fast. That means not just promising to act by 2020 or 2050; that means making changes now.

In an ideal world, world leaders would have agreed years ago on a comprehensive and fair plan to cut global greenhouse gas emissions. In the real world, it's hard to see that happening any time soon, especially after the spectacular anticlimax of the Copenhagen talks in late 2009.

Whether the United Nations process can deliver more than vague statements about keeping the temperature increase below 2 degrees this century, as the Copenhagen Accord noted among its non-binding goals, remains to be seen. But one thing is certain: no one likes being told what to do by people who don't practise what they preach. So if Australia wants to be treated as a credible player in the international negotiations, as a nation we need to take proportionate action to reduce our relatively high national emissions.

The first step in doing that is to reconsider some of the choices we're making today, from our personal consumption habits through to the kind of energy and transport infrastructure that we build. With that in mind, let's get started on one of our biggest and most politically sensitive sources of greenhouse gas emissions. No, it's not coal—it's our shopping.

2

Retail therapy

How to shop smarter and avoid sneaky marketing tricks

On a hot day, you can smell the Cadbury chocolate factory even before you step inside. Lying on the banks of the Derwent River, just north of Hobart, the factory is a popular destination for sweet-toothed tourists, who come to find out more about the process of combining three ingredients—cocoa, sugar and milk—to make Freddo Frogs and family blocks of chocolate.

But there's one thing that the tour guides don't discuss: the secret in every bite of chocolate. You can't taste it or see it, and it's not listed on the wrapper with the ingredients. It's carbon dioxide.

When we burn fossil fuels for energy, the carbon stored inside the coal, gas or oil binds with oxygen to become carbon dioxide. It's a natural part of the air we breathe. But it's also one of the major greenhouse gases altering our climate because we're now putting more of it into the atmosphere faster than we've ever done before. Until relatively recently, nobody had taken much interest in how much of it is released in the production of everyday products like chocolate.

The electricity used at Cadbury's Claremont factory generates comparatively few greenhouse gas emissions by Australian standards.

That's because most of Tasmania's electricity comes from hydroelectricity, produced by running water rather than by burning coal or gas. Where Cadbury's chocolate does rack up a higher carbon count is from the oil burnt for its 'food miles', from transporting the ingredients to their factories through to getting the final products to the supermarket. While the Claremont factory's milk is locally produced in Burnie, their sugar comes from plantations around Mackay in Queensland. Their cocoa comes from even further afield: grown in Ghana in western Africa, roasted and processed in Singapore, before finally being shipped to Tasmania.

All up, the three main ingredients in a block of Cadbury chocolate have travelled more than 21,000 kilometres just to reach Claremont—equivalent to more than five cross-continental trips from Perth to Sydney. And that doesn't even include the carbon dioxide released in other ways, from making the cardboard and plastic for the wrapping to transporting the chocolate around the country.

Should we stop eating chocolate for the good of the planet?

Of course, the answer is not as simple as everyone boycotting chocolate. The real point is to recognise that almost everything we produce and consume creates greenhouse gas emissions. The challenge we face is to find more ways to reduce those emissions wherever possible, so that we minimise climate impacts while still being able to enjoy the things we value most in life.

Most books and articles written about Australia's contribution to climate change focus on our use of electricity and transport. It's the most obvious approach to take, if you look at the official greenhouse reports that the federal government releases every year. According to those figures, Australia produces around 580 million tonnes of greenhouse gases. When you read the breakdown of that total, the three biggest greenhouse-polluting sectors are energy, followed by agriculture and transport.

Yet, once you do a bit more digging into what's included in those official figures, it soon becomes clear that the 580 million tonne figure is a massive underestimate of Australia's real contribution to climate change. That's partly because the official figures are incomplete, not accounting for things like international flights and shipping. But a much greater source of uncounted emissions is from our consumption of imported goods, particularly from countries like China, which make so many of the products we take for granted in our lives.

Of course, it's not all a one-way street: Australia generates emissions for goods and resources that we then export. But in terms of worrying global trends, the growth in China's emissions is one of the biggest problems we face, and it's a problem that Australia is indirectly contributing to.

Experts have calculated that net emissions associated with Chinese exports—what the country exports, minus what it imports—account for a third of its overall emissions, adding around 1.7 billion tonnes to China's national greenhouse gas pollution tally. Without such high demand for imported goods in wealthy nations, emissions in many countries like China would be far lower.

In acknowledging the emissions that we effectively create in other countries, we have to confront an issue that's even more politically sensitive than the touchy debates over burning coal or driving petrol-powered cars: we have to rethink the way we shop.

How much are our credit card bills really costing?

When our grandparents were young, it was normal to save up for things that they wanted. These days, we can just charge whatever we want to our credit cards: we swipe them at the supermarket to pick up groceries, use them to fill up on petrol, pay bills over the phone and buy concert tickets online. We might still need coins to get a newspaper at the local milk bar, but for everything else there's Mastercard™.

Nationally, credit card debt had blown out to a whopping $41 billion by 2007, about six times more than it was 20 years ago. As we're now beginning to recognise, our high levels of spending and debt are having more than just a financial impact. We're also racking up an atmospheric debt that future generations will pay for.

The actual impact of our spending depends on what we're paying for, and how much energy and other resources went into producing it. Thanks to a groundbreaking study of the Australian economy by CSIRO and University of Sydney researchers, we can now estimate how much impact each dollar we spend has in terms of climate change.

Comparing the different impacts of spending money on everything from buying beer, cosmetics and confectionery right through to using materials such as steel and concrete, the researchers found that, for every one dollar that we spend in Australia on goods and services, we indirectly generate an average of 1 kilogram of greenhouse gases.

That may not sound like much, but just think about how much you've spent in the past year, or even just what you charge to your credit card each month. For example, if you've got a $3000-a-month credit card bill, that credit card spending alone is adding roughly 36 tonnes of greenhouse gases a year to the planet's carbon overdraft. It gives a whole new meaning to 'buy now, pay later'.

If you're surprised by how high the greenhouse gas impact is from our consumption, you have every reason to be. Almost no one, including the politicians who are supposed to be leading the climate debate, wants to talk about consumption. As a result, we rarely hear the whole truth about our household emissions and the fact that our direct use of energy and transport only accounts for a surprisingly small share of our contribution to climate change.

Why do we need to rethink our Think Climate campaigns?

Stop for a moment, and try to think of all the different government-funded television ads, brochures and fridge magnets you've seen about climate change over the past few years. In that time, we've been told to Be Climate Clever, Climate Smart, to Change the Globe by Changing Light Bulbs, as well as the federal government's recent Think Climate, Think Change campaign. All those campaigns have cost Australian taxpayers millions of dollars—and what is most interesting about them is not what they have been saying, but what they have chosen to leave out.

Despite ostensibly being aimed at educating us about how to reduce our household emissions, by and large the campaigns have focused on talking about the need to turn off our lights and drive less whenever possible. That's not bad advice, although it is fairly obvious. The problem is that those sorts of tips blatantly ignore the bigger picture, which is that our direct use of electricity and transport accounts for only about a fifth of a household's total greenhouse gas emissions. The remaining four-fifths are generated by our consumption, mainly from the energy and resources that go into the goods and services that we use.

To be fair, when you're trying to come up with snappy fridge magnet–style tips, it's much easier to say 'change your light bulbs' than to try to explain more complex ideas about the benefits of becoming a smarter consumer and opting for quality over quantity. Governments are not keen to bring up the issue of consumption, because doing so raises complex debates about what we value in our economy, and

what we don't value, such as some of the environmental and social externalities that we saw examples of in chapter one.

The mainstream news media doesn't help much either, although they're also in a tricky position. Not only are most media organisations largely reactive to what they perceive to be mainstream public attitudes, but many are struggling to stay commercially viable at a time of falling advertising revenue.

Even environment groups find it hard to talk about over-consumption, because they are, after all, green groups, which means that they already have to overcome suspicion about being a bunch of killjoys in our consumer society.

In other words, while over-consumption is a huge problem, it's one that is hard to have an honest debate about because no one has much vested interest in bringing it up. As taxpayers, though, it is in our interests to tell governments to stop wasting our money on misleading climate change education campaigns, which ignore the potential for changing our consumption habits to be part of the solution to climate change.

If politicians want to keep running campaigns urging Australians to Think Climate, that's okay; we just need to keep reminding them that those campaigns shouldn't leave out the need to Think Consumption.

How can our checkout choices cut emissions in China?

No matter where you shop or what you're shopping for, there are three little words that now seem to be attached to everything: Made in China.

China is the world's biggest exporter of consumer goods, producing more than half of the cameras for sale around the globe, around a third of televisions and air conditioners and a quarter of washing machines and fridges. Just as importantly, they are also the world's factory for the bulk of industrial goods like steel.

Nowhere is China's dominance in our daily lives more obvious than in our wardrobes. A generation ago, many of the clothes at department stores like Target were still made in Australia. Now, more than 80 per cent of the clothing for sale across Australia is imported from China.

At the height of China's economic boom, the country was reportedly opening the equivalent of a new coal-fired power station every week to ten days, generating enough extra electricity to power all of Adelaide. China's government is taking more action than many to reduce emissions and improve air pollution, including closing down a number

of dirty old power stations in favour of using more modern ones. Even so, China is now burning more than twice as much coal as any other country, and its forecast growth in demand for even more coal has it on track to be pumping out double the amount of carbon dioxide emitted by the world's 26 richest countries put together by around 2030. That's a terrifying prospect for those living in China, particularly those in coal-mining cities, where the skies are already so choked with soot and other pollution that drivers can be forced to use their headlights during the day to see the road ahead of them. It should be no less terrifying for the rest of us, because of the damage China's greenhouse gas emissions will cause in further disrupting the Earth's climate.

With those sorts of figures in mind, some people argue that it's entirely up to the Chinas and Indias of the world to change, and that smaller nations like Australia are irrelevant in the global debate. Yet that argument ignores how interconnected the world has become, which means that, more than ever before, Australians can make a difference in reducing greenhouse gas emissions well beyond our national borders.

All we have to do is buy less stuff.

What's the fastest way to start cutting our credit card and carbon debts?

The idea of buying less stuff is not about going to ridiculous extremes of forsaking all worldly goods and taking a vow of poverty. In fact, there's nothing more annoying than the kind of advice that suggests that to be truly green, we should all have to bake our own bread and hand-make our own clothes. Let's face it, very few of us have the time, let alone the skills or inclination, to do that.

Instead, buying less stuff is about learning to be more thoughtful about how we choose to spend our money and remembering the value of investing in quality over quantity. In doing so, we can end up with less cluttered and stressful lives, while reducing our contribution to climate change.

That's all very well in theory, but how can it work in practice? To give you a practical example, let's take a look at our clothes. As a lot of Australians know all too well, feeling short of time because of too much work and too much debt can have a flow-on effect to all parts of our lives. That can even include finding it hard to make time for shopping.

Let's say you need some more work clothes. The easiest solution often seems to be to look for shops with big red sale signs on them, and

go in and grab the first shirt or a jacket that looks okay. It's not only a trap for shopaholics; as a lot of people who hate shopping will know, one way to get the whole thing over with as quickly as possible is to pick the first thing that looks about right and then get out of there.

The cost of shopping like that becomes abundantly clear if you do what fashion stylists recommend we all do more often for the sake of looking good: go through your wardrobe regularly, to make sure you haven't accumulated a whole lot of junk.

If you haven't cleared out your wardrobe for a long time, it can be astonishing to watch as the mound of clothes that you thought looked good in the shops, but have hardly ever worn since, grows bigger and bigger. Even if you bought everything you own on sale, the cumulative cost of all that 'cheap' stuff can be incredibly expensive. In trying to save time and money, it's easy to end up wasting both.

The smarter way to approach shopping is to buy less, but buy things that will last, rather than the cheapest made-in-China T-shirt on the rack that you know will only last a few washes before it looks terrible. The same principle can apply to most of other types of shopping as well.

As a simple first step, it's a good idea to do an occasional wardrobe clear-out, after which you can either give away or sell some of your old stuff. You can even end up with a better wardrobe for free, by taking part in a clothes-swapping party.

Where can you get cool clothes for free?

If you haven't come across clothes-swapping parties, the idea is that people bring along good clothes they no longer wear and exchange them. One example is the Clothing Exchange, which was started back in 2004 by fashion student Kate Luckins, after she read about a survey showing that nearly $2 billion worth of clothes was gathering dust in Australians' closets. That wasn't where the huge amount of waste ended either: according to the survey, more than $10 billion a year was being spent on goods and services that were bought but rarely or never used, particularly food that ended up going to waste.

Luckins realised that being a dedicated follower of fashion was likely to add to this problem, unless she tried a different approach. So she did—she threw a clothes-swapping party.

Since then, the idea has taken off right across Australia. There are My Sister's Wardrobe parties for women wanting to get rid of what

they call 'guilt-inducing skinny jeans and those designer shoes that were always a half-size too small'. There are Curvy Sister's Wardrobe parties for women wanting stylish clothes in bigger sizes. There are also Mums and Bubs parties, as well as parties where men get a chance to get in on the swapping action.

Swapping what you don't need for what you do doesn't stop at clothes. The Freecycle Network has over six million members across the globe. It's an online community of local groups, where members give and get things for free by posting online messages about what they have, but don't want; or what they want, but don't have.

Which suburbs are racking up the biggest carbon debt?

Over the past few years, more than 130 local climate-action groups have sprung up in suburbs and towns right across Australia, from Tasmania up to the Torres Strait, and from Albany in Western Australia across to Newcastle in New South Wales.

While there are people from all walks of life involved with these groups, it's no coincidence that many of them have been set up in wealthier areas. For many people, the decision to join a climate-action group came after the realisation that they had more responsibility than others to cut their personal carbon emissions, because their lifestyles generate more greenhouse gases than the average Australian's.

In fact, studies have shown that rich, well-educated Australian households typically contribute more than twice as much to climate change as average households—and almost three times more than pensioners—because of their higher spending. The richer we become, the more we tend to spend on things we don't use, whether that's food that we throw out or clothes that we don't wear. That difference in average carbon footprints has even been mapped on a suburb-by-suburb basis by University of Sydney researchers.

You don't have to be a millionaire to be racking up a heavy carbon debt. If you've got a decent income and are living in a wealthy country like Australia, chances are you're in a global minority of people with the largest carbon footprints. That means we have a greater responsibility to the majority of other people around the world to cut our emissions. On the bright side, for people like us who are starting out with a bigger-than-average carbon footprint, we have more scope to make greater cuts than many others.

Is green consumerism the solution?

Not so long ago, calling someone a greenie was usually intended as an insult. These days, everyone from Rupert Murdoch down seems to want to be seen as green, with fashion magazines like *Vogue*, *Marie Claire* and *Cleo* declaring that 'green is the new black'. The more that issues like climate change and water shortages dominate the news headlines, the more companies are scrambling to be seen as environmentally-friendly.

There is a downside to the current boom in environmental awareness: the false hope being sold by advertisers that we can buy as much as we like and somehow end up with a healthier planet. As positive as it is that more people want to be green shoppers, the truth is that green consumerism can inadvertently contribute to the problem of over-consumption, because it encourages people to simply switch brands rather than to ask the more fundamental question: do I really want or need this?

Buying less stuff goes against the grain of an economic culture driven by the myth that endless growth and consumption is possible, no matter how many people there are trying to live on the one planet. It's a myth that some economists and politicians seem reluctant to give up believing in, having convinced themselves that the best way to judge a nation's worth is by its Gross Domestic Product—in other words, how much is produced and consumed. Yet, on its own, GDP is a simplistic measure of a nation's true wealth and wellbeing, as even organisations like the Australian Bureau of Statistics are increasingly pointing out.

A small minority of people are so wedded to the idea of unlimited economic growth that they genuinely believe 'so-called global warming' is a giant con dreamt up solely to overthrow capitalism. Fortunately, not everyone is so blinkered. Today, many respected economists agree that current consumption rates are out of control and must be curbed to avoid catastrophic climate change.

The kind of attitude that they're suggesting we need to adopt is not new or radical. More than anything, it's an old-fashioned acceptance that our grandparents grew up with, which was that just because they wanted something didn't mean they actually needed it. If they really did want it, they knew they would have to work for it, because handing over a plastic card and worrying about how to pay it off later wasn't possible back then.

Still, there are plenty of things in life that we do need, which means we can't completely opt out of being consumers. That raises the

question of whether green products are living up to their marketing claims.

How can anyone tell genuine green products from dodgy ones?

These days, we're supposed to believe that just about everything is good for the environment. We can buy 'tree-friendly' toilet paper at the supermarket, pack it away in 'Earth-friendly' bags made from a longer-lasting form of plastic than the old disposable bags, and then drive home in a 'climate-friendly' car.

A tiny number of conscientious people do exhaustive research before they go shopping to try to cut through the spin. But as anyone who's tried doing it knows, remembering all that research isn't easy when you're confronted by the incredible array of products in the vast aisles of a supermarket or department store. This leaves the overwhelming majority of people to trust that we're not being lied to and that our tree-friendly toilet paper isn't actually the remains of old-growth rainforest.

The car industry has been among the most shameless in trying to 'greenwash' their image, a strategy that involves spending big bucks on marketing to create a misleading appearance of environmental credibility. As we'll see in more detail in chapter four, many major car manufacturers here and overseas have fought long and hard against tougher minimum fuel-efficiency standards. Of course, facts like that rarely get in the way when it comes to advertising.

If we want to make going shopping a bit easier, we need to crack down harder on misleading advertising. That is exactly what the Norwegian government did with car commercials when it recognised that no car can honestly be described as clean, green, or environmentally-friendly, given the massive amount of energy required to make and run them. The Norwegians did something simple: they banned advertisers from using any of those phrases, unless the car makers could provide evidence that their claims were true. If car makers choose to ignore the new advertising rules, Norway's consumer ombudsman has the power to fine them.

What's being done to wipe out greenwash?

One of the most blatant examples of greenwash in Australia was an advertising campaign a few years ago for Saab cars, in which giant billboards and magazine ads screamed 'Grrrrrreen' above a picture of the car, accompanied by other phrases including: 'Every Saab is green. With carbon emissions neutral across the entire Saab range', and 'shift to neutral'.

The claims were based on the fact that Saab would plant 17 native trees for every new car sold, supposedly enough to balance out the greenhouse gas emissions for the life of the car. As it turned out, at best, the carbon offsets would only cover the first year of an average person's driving.

Unfortunately for Saab's local supplier at the time, GM Holden, their ad campaign coincided with a spike in complaints to the Australian Competition and Consumer Commission (ACCC) about the number of greenwashed products hitting the market. Responding to a complaint from the New South Wales Greens, the ACCC took GM Holden to the Federal Court, alleging 'misleading and deceptive conduct and false representations'. And the ACCC won.

As well as suffering from bad publicity and being ordered to pay the ACCC's court costs, GM Holden promised to retrain its Saab marketing staff. The company also agreed to plant 12,500 native trees, which it estimated was enough to offset the emissions produced from driving all of the Saab cars sold during the advertising campaign.

But the ACCC has limited resources to investigate every case of greenwash. Rather than leaving it up to them to fix it, we need to develop a stronger system of rules and penalties to deter dodgy advertising. Doing that could save taxpayers' money on unnecessary court cases and save shoppers time trying to distinguish between real and fake green claims.

In the meantime, if you are going to buy something and would prefer to buy products that are a bit better for the environment, there are a few credible places to do your homework. A good place to start is with consumer group Choice's website or magazine.

Or, if you're looking to buy a car and don't want to buy one claiming to be 'Grrrrrreener' than it really is, then check out two federal government websites where you can compare the fuel use and greenhouse gas emissions for different models. For newer cars, try the Green Vehicle Guide website, while for cars sold between 1986 and 2003, go to the Fuel Consumption Guide site.

Why are our gadgets designed to die?

There's an obvious reason why we're consuming a lot more than any generation before us: many of the things we can buy today simply didn't exist 20 years ago. The trouble is, manufacturers are only too aware of our love of acquiring shiny new electronic toys, and they're using it to their advantage.

In a trend known as planned obsolescence, manufacturers design products that work for only a few years. Take the iPod, one of the most popular gadgets around. While Apple's co-founder Steve Jobs has boasted that his company has 'a really strong environmental policy', he has also been happy to declare that 'if you always want the latest and greatest, then you have to buy a new iPod at least once a year'.

Apple's environmental policy obviously wasn't taken seriously by the iPod's original designers, either. With their in-built battery, many iPod owners over the years have found it's easier, and not much more expensive, to buy a whole new iPod rather than bothering to send their old one off to Apple to replace the battery.

It was a design fault that particularly annoyed a Mac-lover from New York, Casey Neistat. Back in 2003, Neistat was a 22-year-old with an 18-month-old iPod. When its battery was dying, he called Apple's helpline and asked about a replacement, which at that stage would have cost him US$255, almost as much as a brand new iPod.

After getting nowhere with the company directly, Neistat figured it was worth alerting others to the problem. So he made a stencil that read 'iPod's Unreplaceable Battery Only Lasts 18 Months', got a spray can, and went around the streets of Manhattan, updating dozens of iPod posters. His brother filmed him doing it, and they posted it on the web. Within six weeks, 'iPod's Dirty Secret' had been watched more than a million times, and the pair found themselves being interviewed by *Rolling Stone* and the BBC.

Soon afterwards, Casey Neistat got a call from Apple. The company was launching a new $99 battery replacement program for out-of-warranty iPods, a fraction of the $255 price Neistat was originally quoted. 'Are you calling me in response to the film that we made?' Neistat asked the Apple spokesman. 'We can neither confirm nor deny that we have seen that film,' the spokesman reportedly replied.

How full is your box of old gadgets?

Hidden away inside most Australian homes lies a graveyard of modern technology. In some homes, it can be found in a box shoved under the stairs. In others, it's in the bottom drawer of a bedroom cupboard. It's the place where we abandon our old gadgets to die, buried in a jumble of tangled charger cords and long-expired warranty cards.

While our bottom drawers get fuller by the day, we rarely stop to think about the real costs of that consumption. Even the tiniest of gadgets is built from hundreds of components, each carrying its own legacy of expended energy and resources. We're not just talking about small handheld devices like iPods and mobile phones; just think of all the televisions, videos and DVD players that get replaced every Christmas or two.

One conservative estimate is that well over five million old computers are now gathering dust in garages and sheds around Australia and another two million are sitting in storage, while a further 1.6 million have been sent to the tip. That's nearly nine million computers going to waste. In contrast, only half a million have been recycled, even though they contain a cocktail of toxic substances including lead, mercury and arsenic, along with rare materials including gold, platinum and silver.

Probably the best example of what's become known as electronic waste, or e-waste, is the mobile phone. Twenty years ago, a mobile cost around $5000, was a status symbol that only the super-rich could afford and came in just one size: extra large. Today, there are more than three billion mobiles worldwide—or roughly one phone for every two people. Most Australians replace their phones about every 18 months, with the result that there are now more mobile phones in Australia than people. Yet about half of those handsets—more than 16 million—aren't in use any more, having been consigned to our bottom drawers at home.

Under pressure to do something about all that waste, Australia's mobile-phone industry has organised a voluntary scheme to recycle unwanted phones. It's worth doing, because more than nine-tenths of the phones' components can be recycled to make a range of new products, ranging from stainless steel to plastic fence posts and even jewellery. There are, however, some problems with the way the current Australian scheme works. Even with increased funding for the industry's voluntary Mobile Muster scheme, only about one in 20 phones is being recycled.

There's also a more fundamental question about why the phones collected through Mobile Muster are being stripped of their parts and melted down, when many could be fixed and reused. That's what the Aussie Recycling Program does, paying charities $3 to $5 per handset for old mobiles that can be fixed up and resold in the second-hand markets of Asia, Africa and Eastern Europe. As the company's managing director has argued, if Australian phone retailers really wanted to reduce their environmental impact, they could try using their marketing muscle to promote the benefits of reusing old phones in Australia, especially for people who just want a cheap handset, instead of only pushing the most expensive new models.

How can we make it easier to recycle our old stuff?

At the moment, only a tiny fraction of Australia's e-waste is being recycled, with much of the rest of it going straight to the tip. Some of it is finding its way to other countries too: shipments of discarded computers, televisions and mobile phones from Australia have been found on cargo ships bound for China, part of a growing illegal trade in toxic electronic waste.

Fortunately, there are solutions that can help reduce our mounting piles of electronic waste. Product stewardship is a practice pioneered in Europe, which requires manufacturers, retailers and product users to share responsibility for reducing the environmental impact of throwing stuff away. It's been applied to most consumer goods and has already had an impact.

It works like this: when you buy a television, a small extra fee is added onto the upfront price to account for the future cost of disposing of it. When you want to get rid of the television, the manufacturers and retailers have to help out in taking it off your hands and disposing of its parts properly. The European system of product stewardship has been coupled with stricter standards, designed to increase the recyclable content of their products.

Proposals for introducing similar systems of product stewardship here in Australia have been under review by state and federal environment ministers for years. At long last, in late 2009, ministers led by Peter Garrett agreed to bring in a national recycling scheme for televisions, computers and other electronic parts, due to start in 2011.

In order to make that scheme work, governments and industry will need to cooperate to provide far more local places for people to drop off

their e-waste. There are some good model schemes already running in parts of Australia, such the ByteBack program in Victoria, which is jointly funded by the state government and a dozen big computer companies.

Old electronic equipment is only one of many things we need to get better at either repairing or recycling. If you're looking for more help on recycling anything from old computers to old fridges through to hazardous materials like asbestos, oil and paint, a good place to start is the Recycling Near You website.

It's worth remembering why the old slogan of 'reduce, reuse, recycle' was written in that order: reusing and recycling things is usually better than doing nothing, but the most environmentally-friendly option of all is to reduce needless waste in the first place.

What can we do to cut emissions from what we eat?

Agriculture contributes around a quarter of the world's greenhouse gas emissions, and only slightly less than that proportionately here. The overwhelming majority of the emissions from agriculture comes from one area: the production of meat and dairy products.

The world's livestock—which are mainly cattle and sheep—are the fastest growing source of agricultural emissions, already producing more greenhouse gases than all the world's planes, trains and automobiles. While cows burping out methane is a big contributor, clearing the vast areas of land needed to feed them is also a major source of emissions, particularly in Latin America, where massive swathes of the Amazon have been felled for grazing.

Farmers and the meat and dairy industry are working on ways to reduce their emissions. For instance, the Australian beef industry has been trying to find ways to reduce methane emissions from livestock through improved genetics and feeding practices. Others are trying to work out whether there's a way to change the kind of microbes in the stomachs of cows and sheep to make their stomachs more like the stomachs of kangaroos, which only produce a tiny fraction of the methane.

However, as the industry's own experts will concede and as the IPCC has confirmed, there's only limited evidence to show that the current research will deliver significant greenhouse gas savings any time soon. For now at least, there are no proven technological solutions to dramatically reduce those emissions. That leaves just one proven way to cut emissions produced by making meat and dairy products: changing what we eat.

Who says less meat means less heat?

Every year, people living in wealthy countries like Australia eat roughly their own weight in meat, consuming an average of more than 80 kilograms each, or about 220 grams a day. (That's the equivalent of almost two quarter-pounder burgers.) It's a significant increase on how much we used to eat only a couple of generations ago. Back in 1970, the average was more like 65 kilograms of meat a year.

What we eat in wealthy countries is proving to be influential in poorer nations as well. Like so many of our consumption habits, our diets are increasingly being mimicked by people in rapidly industrialising countries, even in countries where red meat and dairy products haven't traditionally been a major part of the diet. Demand for meat in poorer nations has almost trebled over the past 30 years, although they're still a long way behind our consumption, averaging just 29 kilograms a year, or about 80 grams of meat a day.

These findings were part of a study by a team of international health experts, published in the medical journal *The Lancet*, looking at the interconnected issues of greenhouse gas emissions, global equity and health. Their main finding was simple: less meat means less heat from climate change. Given the huge difference between the average quantities of meat being eaten in rich versus poor nations, they also concluded that the only equitable solution was to focus on reducing meat consumption in wealthy countries first.

Without drastic measures, greenhouse gas emissions from meat consumption are set to soar, because of the combination of global population growth and increasing global demand for meat. Even if the goal was simply to stop emissions from rising above today's levels, the researchers concluded that people in wealthy countries would need to more than halve their daily meat intake over the next 40 years, including replacing some of our red meat intake with other options such as chicken, fish and kangaroo.

At present, the global average meat consumption is 100 grams per person per day. The study proposed slightly cutting that global average to 90 grams per day by 2050, with rich nations working to progressively scale down their meat consumption to that level in order to allow people in poorer nations to be able to eat more.

Even for meat lovers, there would be some benefits from a gradual change in diet. Reducing red meat consumption from today's record highs would actually be good for many people, mainly by reducing risks of serious health problems, including heart disease, obesity and cancer.

For those who want to go further than *The Lancet* study suggests, other studies have concluded that eliminating meat from your diet completely can save an average of 1.5 tonnes of greenhouse gases per person each year.

In many ways, the old saying that 'we are what we eat' is true. This is one area where we can't really point the finger at governments or industry and tell them to fix it for us. Despite knowing that less meat and dairy products would mean less heat, our choices are currently creating more demand for them than ever before. Our choices can also reduce that demand, starting today.

Can't we just offset our emissions?

The concept of carbon offsetting is relatively simple. When you pay for something that generates a lot of greenhouse gas emissions, such as plane travel, you have the option of paying an additional fee to cover an estimate of those emissions. It's supposed to be an act of balancing the books: by buying carbon credits, you pay off the carbon debt you've just racked up. As for how that offsetting is done, it varies, but some of the most common methods are planting trees, investing in wind farms and installing energy-efficient light bulbs.

On one level, most people agree that carbon offsetting has been successful in increasing public awareness about the hidden costs of greenhouse gas emissions. Thanks to that growing grassroots awareness of climate change and carbon costs, our business and political leaders are having to work harder than ever before to improve their environmental credentials.

But beyond its awareness-raising value, is offsetting a practical way to reduce emissions? That's where the debate gets more complicated.

Some people argue that the whole concept of offsetting is a waste of time and money. Others will only support offsetting efforts that lead to long-term changes, like promoting more renewable energy generation or encouraging energy efficiency. But the biggest argument is over whether planting more trees is as effective as its promoters claim.

Can planting trees neutralise climate change?

As trees grow, they take carbon dioxide out of the atmosphere and store the carbon in their trunks, branches and roots. There can be a range of

environmental benefits from planting trees, such as potentially restoring habitat for endangered animals. However, the idea of planting trees to balance out the emissions generated from burning fossil fuels while flying, driving or using electricity is a dubious solution.

There have already been numerous examples of dodgy offset companies, in Australia and internationally, selling offset credits to people for trees they haven't even planted yet, or for trees that have died and not been replaced. While some of the worst operators have been exposed, some have simply renamed their companies and carried on with their businesses. Still, to be fair, for every disreputable offset company, there are others run by people genuinely wanting to make a difference.

But the fundamental problem is that the basic maths behind tree offsets just doesn't add up. Let's say you had just come home from an overseas holiday and felt bad about the emissions racked up in doing so, so you decided to go online and find out what it would cost to offset these flights. The first thing you would probably notice is how wildly variable the estimates can be for how many trees are needed to balance the carbon debt and how much that costs.

Then there's the time taken to offset your emissions. Let's take a typical return trip from Sydney to London, which involves about 22 hours of flying each way. If you pay extra for one of the airlines' tree-planting offset schemes, how long will it typically take for your trees to soak up enough carbon dioxide to balance out the emissions from your 44 hours of flying? Anywhere between 40 to 100 years. It's not exactly an instant replacement. That's a major problem, given what the science shows about the need to reduce emissions now, particularly as so many greenhouse gases remain in the atmosphere for decades.

Then there's the issue of permanence: how do you guarantee that a tree planted this year doesn't die in a drought or bushfire? More reputable offset companies are trying to deal with that problem by planting extra trees as insurance. But the fine print of product disclosure statements can be revealing, with many companies reserving the right not to replace dead trees even in the event of major losses.

There are good reasons why offset companies might be reluctant to offer absolute guarantees about protecting trees into the future—and one of those reasons is climate change itself. If temperatures rise by several degrees over coming generations, as we're currently on track to experience, then many of today's carbon 'sinks'—areas that are currently soaking up or storing more greenhouse gases than they release, whether it's forests in Australia or the Amazon, or the methane-rich bogs and

tundras of northern Europe—will become hotter, drier and more prone to fires or widespread diebacks. So the very areas we're counting on to reduce greenhouse gas emissions could end up becoming sources of even more emissions than before.

There is no question that we need to do more about deforestation, which now accounts for about a fifth of global greenhouse gas emissions. That will mean doing more to protect existing forests, and replanting some areas that have been cleared. But pretending that planting a few trees provides an instant, one tonne-for-one tonne 'offset' for emissions generated from flying, driving or using electricity from burning fossil fuels is dangerously misleading.

What, then, about the broader issue of offsetting using other means? Well, perhaps the best way to answer that is to go out to lunch with Al Gore.

Was Al Gore's lunch really carbon neutral?

Eating out with Al Gore isn't cheap. In late 2007, the former US Vice-president flew to Australia to speak at a series of business lunches and dinners in Sydney and Melbourne. The 'cheap' seats cost $1000 each. If you were a Very Important Person with very deep pockets, there was the option of forking out $25,000 for a table for 10 near the front, which bought you a slightly fancier three-course meal, as well as time for a private meet and greet with Gore.

On the day of the Melbourne lunch, the Sofitel Hotel's Grand Ballroom was buzzing with a who's who of business, politics and the media. As the crowd waited for Gore's arrival, the waiters began serving the lunch: roast honey and macadamia-nut marinated chicken, followed by shallot and rosemary-encrusted loin of spring lamb, then honey-yoghurt pannacotta for dessert.

As the guests tucked into their meals, the event's MC Eddie McGuire got up on stage to acknowledge all the sponsors, including the company that was offsetting the emissions from putting on the lunch. Never mind that it was a high-carbohydrate, high-carbon meal, whose main speaker had flown halfway around the world—the entire event was, McGuire said, completely carbon-neutral. 'So we can all feel comfortable that we are absolutely clean,' he said.

McGuire then went on to thank the event's main sponsor, car maker Lexus, for sponsoring Gore's visit to Australia to coincide with the imminent release of the 'world's first luxury hybrid SUV'. Flanking

the stage were two gleaming new Lexus cars. Finally, after more introductions, it was time for the main event: 'Thank you for coming… I'm Al Gore, I used to be the next President of the United States of America…'

Later, as the audience spilled out into the hotel lobby on its way home, a few people stopped to inspect the large silver Lexus RX 400h parked by the escalator. According to the company's advertising material, the new four-wheel-drive with a hybrid engine was a 'guilt-free performance luxury SUV with a conscience'.

A hybrid with a conscience, associated with Al Gore: it sounds like the ideal car for climate-conscious drivers. But don't believe the hype. As a quick search of the federal government's Green Vehicles Guide reveals, there are hundreds of types of cars on sale in Australia that produce fewer greenhouse gas emissions per kilometre than a Lexus hybrid, for the simple reason that it's such a big, heavy car.

Dealing with climate change is not a question of guilt, and it can't be fixed by paying a bit extra so that our consciences feel 'absolutely clean'. It's a question of science. We're releasing more greenhouse gases than we've ever done before, and in doing so, cranking up the planet's thermostat.

Carbon offsetting is something that many people have paid for and promoted with good intentions to try to reduce the impact of our consumption. But as the Al Gore lunch demonstrated, offsetting does nothing to address the fundamental problem we have: the attitude that we can keep consuming and burning fossil fuels at today's rates and delay paying the financial and environmental debts we're racking up for another day. There are more useful ways to act on climate change than simply paying off our guilt with carbon offsets—and we can start by doing something super.

How can anyone become a super hero?

These days the vast majority of Australians are shareholders through the superannuation money invested on our behalf by super funds. It's a $1 trillion industry, and large Australian superannuation funds invest in everything from city skyscrapers to shares in power stations and mines, both here and overseas. The rules they set on how to invest that money—your money—can make a real difference.

It's not a choice between your retirement savings and doing the right thing, either. Only a decade or so ago, ethical investment was seen as a

fringe activity. These days, it's increasingly big business, and for good reason: companies with a stronger focus on corporate responsibility and good governance are proving to outperform their rivals, typically delivering higher rates of return on investment than companies that are entirely focused on shorter-term profits at all costs.

A growing number of Australian super funds are led by business people with genuine concerns about climate change and the legacies they're leaving behind. Today, about half of Australia's super funds and other large institutional investors are members of the Investor Group on Climate Change (IGCC), which advocates a more sustainable, long-term approach to making money. Representing more than $500 billion in funds under management, the IGCC has the kind of financial clout that company executives and politicians can't ignore. Crucially, the IGCC has also begun to act as a climate watchdog, pointing out that if a few high-polluting industries win exemptions in paying their fair share for greenhouse gas emissions, it will mean other companies and taxpayers end up footing the bill on their behalf.

The IGCC is part of an expanding international network of investors with more than $13 trillion in assets, which has collectively called for science-based emission targets to be the basis for any international climate deals. This includes a 25–40 per cent reduction target for wealthy nations like Australia by 2020, together with greater government support for energy-efficient and low-carbon technology.

More money invested in sustainable investment funds means more pressure on companies and governments alike to do more on climate change. So if you want to do one thing to make a difference, pick up the phone, call your super fund, and ask them for information about their sustainable investment options. You can also consider switching to another fund with a good reputation for sustainable investment. It doesn't have to take a lot of time, and you may well discover that you're currently being ripped off in an underperforming fund with higher-than-average management fees.

Money isn't the only thing you can invest differently to make a difference. Time is more precious than any amount of cash, and it's something that you can choose to use in all sorts of positive ways, including helping out a local environment group. Whether it's with your money or your time, by getting more actively involved you'll be doing more good than if you buy a few carbon offsets and then carry on without making any significant changes in how you live.

How big a concern is population growth?

Roughly every two minutes a new Australian is born. Add the fact that we gain a new migrant at a rate of every 150 seconds, and our population rises even more. Balance that with a death just under every four minutes, and there's an overall increase of one person being added to Australia's population roughly every 70 seconds. At this rate, our national population is forecast to hit 35 million people by 2050. It's a trend we can't afford to ignore much longer, given the trouble we're already having in many parts of Australia in providing reliable water and electricity services, housing and transport for everyone.

The Australian population increase reflects the global trend. Right now, the planet is home to nearly 7 billion people, but that is forecast to rise to 9 billion by around 2050. If those population forecasts really do come true, it's little wonder that so many people are concerned about how we'll be able to substantially reduce global greenhouse gas emissions.

For a long time, Australian politicians have been reluctant to talk about the connection between rising population numbers and climate change, mainly because population is such an incredibly touchy subject. The population debate is becoming increasingly hard to ignore though, particularly in the hard-fought international negotiations over which countries should agree to make the steepest emission cuts.

Who is Australia's true king of spin?

It was a public display of spin that would have made Shane Warne jealous.

In December 2008, Kevin Rudd was the guest of honour at a National Press Club lunch, where a packed house of journalists, industry and environmental lobbyists were waiting for him to finally reveal Australia's 2020 greenhouse gas targets. Even before he spoke, Rudd knew that the targets he was about to announce—promising to cut emissions by 5 to 15 per cent below 2000 levels by 2020—would be attacked by many as scientifically unsound, as well as weak compared with the European Union's targets of 20 to 30 per cent cuts below 1990 levels by 2020. (It's little wonder that the Rudd government later bowed to criticism by offering to consider aiming for a conditional 25 per cent target.)

Facing a tough crowd, the Prime Minister needed a convincing defence against the inevitable criticism that his targets weren't tough enough. That's where population growth suddenly came in handy.

Claiming that Europe's population wasn't expected to increase at all over the next decade, Rudd argued that Australia's growing population made it pretty much impossible for us to agree to any more than a 15 per cent target. In fact, Rudd argued, if you took population into account then Australia's 2020 targets were superior to the European Union's, if you compared our efforts on a future per-person basis.

Taken at face value, it almost sounded convincing. But on closer inspection, Rudd's speech was a reminder of the old saying about different ways of telling fibs with 'lies, damned lies and statistics'.

For a start, some of the population figures Rudd quoted were either misleading or wrong. Europe's population is actually growing too, although not as fast as here. As for per-person emissions, somehow Rudd forgot to mention just how much higher our emissions per person are today—and will continue to be for decades to come, if we stick with the kind of greenhouse gas targets proposed by his government.

In 2006, Australia produced 26.1 tonnes per person of greenhouse gas emissions, while in Europe in the same year, the average was 10.4 tonnes. If we adopt the targets that the Rudd government has committed to meeting without any strings attached, then in the year 2050 our per-person emissions would be 10.6 tonnes—at the level Europe was at in 2005.

But that wasn't Rudd's best bit of spin. Even more impressive was that, during the speech, Rudd conveniently ignored the fact that population rates are highly dependent on government policy. Just one example is the federal government's baby bonus, which costs more than a $1 billion a year and was introduced to encourage people to have 'one for mum, one for dad, and one for the country', as then Treasurer Peter Costello put it. The government also sets immigration levels, which have hit record highs under the Howard and Rudd governments.

To be fair to the Rudd government, having more people than before obviously does make it harder to cut emissions. But to take that argument a step further, as Rudd has done, and use population as an excuse to justify weaker emission targets is a risky move. Why? One word: China.

Who has raised the idea of getting credit for unborn babies?

As the world's biggest greenhouse gas polluter, China is justifiably feeling the heat over its climate change strategy. Without tougher action over the next few years, by 2030 China is on track to be producing

roughly a third of the world's greenhouse gas emissions. Clearly, what China does—or doesn't do—matters, for all our sakes.

Despite its antagonistic negotiating tactics at the UN's Copenhagen climate summit, China has recognised that acting on climate change is in its national interests. That's partly because of scientific warnings that China is likely to experience some of the most catastrophic climate impacts, from worsening droughts in some areas to the flooding of some of its biggest and richest coastal cities, such as Shanghai.

But it's economics, rather than science, that really started driving China to do more about climate change. While communist in name, China is highly entrepreneurial by nature. Over the past few years, its government has been quietly becoming a global leader in a few strategic areas, including developing renewable energy technologies. It's all part of China positioning itself to be one of the major manufacturers of solar panels, wind turbines and smaller, lower-emission cars to sell to the rest of the world.

Even so, China's emissions are still rising, resulting in mounting pressure to curb its greenhouse gas pollution, coming both from other countries and—just as significantly—from its own people. When Australia's Lowy Institute conducted an independent opinion poll in China in 2009, they were particularly struck by one finding: out of nine possible threats to the nation's security, Chinese people overwhelmingly nominated 'environmental issues like climate change' and 'water and food shortages' far ahead of traditional threats like armed conflict with the US or Japan.

Facing that internal and external pressure, the Chinese government has also resorted at times to playing the population card to argue for special treatment on its emissions. In China's case, it's all about population control. The 'one child' policy was introduced in the late 1970s to slow down the country's birth rate. Over the past three decades, the restrictions on having extra children have meant around 300 million fewer children have been born in China than forecast. As Chinese officials have pointed out, if you multiply all those avoided births by the global average of greenhouse gas emissions per-person, then they've arguably been responsible for avoiding more than 1 billion tonnes of extra emissions every year. That's roughly equivalent to wiping out the entire emissions of Germany, the world's sixth biggest greenhouse gas polluter.

So who's right in all this? Should China get special credit for its action to curb population growth? Or should we forget about the past, and focus only on future emissions—in which case, is Australia justified in trying to get a special deal because we're experiencing population growth?

The answer is that we can't afford to give in to either government's special pleading. Any increase in population around the world naturally increases demand for resources like fresh water, food and land, which in turn increases greenhouse gas emissions. Fortunately, there are proven ways of reducing population pressures, which can in turn help us in addressing climate change. Those proven solutions include micro-credit loans to help people lift themselves out of poverty, and investing in giving women access to education and safe contraception.

On a globalised planet, where more people and goods than ever before are on the move between countries, the rest of the world's problems are Australia's problems too. That's why it's in our national interest to lift our personal and government contributions to reducing poverty and inequality worldwide. If you want to help, check out the work of organisations such as the Australian-based International Women's Development Agency or the Grameen Bank.

Which contributes more to climate change: over-population or over-consumption?

In Australia, we're yet to have a mature debate about population, economic growth and where we're heading as a nation over the next few decades. Too many of our political and business leaders seem to believe that growth in GDP is worth having at any price, even if the only way they can achieve it is by encouraging rapid population growth with costly baby bonuses and unprecedented levels of immigration.

Having a rational discussion about immigration levels is not easy, partly due to the fear of people who want to hijack it for racist purposes. That's not a good enough reason for immigration and population to be treated as taboo.

Australia is a migrant nation, and that's something to celebrate. Australia is also a nation with a booming population. We need to start talking about that fact. We need to ask ourselves hard questions about how well we're building our cities and towns to cope with more people, particularly in terms of things like transport and water supplies. We need to consider how much native bush and farmland we want to keep or bulldoze. Until we do that, we're operating without any kind of plan for the future.

Having said all that, the importance of population in driving climate change is regularly exaggerated. Whether deliberately or not, some campaigns about the links between over-population and climate change

sometimes come close to suggesting that the problem would largely go away if people in Africa and Asia would just stop having so many kids. As the facts show, that's not true.

In one of the many studies done in this area, the director of the Princeton Environmental Institute, Stephen Pacala, calculated that the wealthiest 7 per cent of the people in the world have been responsible for generating around 50 per cent of global carbon dioxide emissions. In contrast, the poorest 50 per cent of people have been responsible for just 7 per cent of emissions.

Rather than being powerless about climate change, Pacala's findings confirm that people living in countries like Australia and the US have a disproportionately large role in determining whether global emissions continue to rise or fall.

Our choices really do matter. We can all start making smarter shopping choices today if we want to—and one of the ways to do that is to better understand why we're all so susceptible to the lure of retail therapy.

What price would you pay for happiness?

Compared with previous generations, Australians have never been as rich as we are today. On average, we're now about eight times wealthier than Australians were a century ago, earning and spending more money even in relative terms than people in the past dreamt of.

Yet, in order to pay the bills for consuming more, living longer and having higher expectations of how much stuff we ought to own, we're often paying a high price. Many Australians are living with heavy debts, working longer hours, putting on weight, and, in too many cases, leading lives of quiet desperation.

We want to be happy, but somehow we just never have the time. So we opt for the second-best option of going shopping, to buy the hit of happiness that advertisers promise their products will deliver.

Many people find that retail therapy does make them feel better, at least in the short-term; that's because it replicates the excitement we all felt as children when unwrapping new toys. The trouble is, it only buys a fleeting form of happiness, and one which comes at a high price to our bank balances, not to mention the climate. While money can buy peace of mind for those who are really poor, studies have found that once people have enough to meet their basic needs, the difference in life satisfaction between being middle class and a

millionaire is negligible, because the more people own, they more they want.

It's easy to blame over-consumption on greed and the ability of advertisers to persuade us that we really want more things that we don't need. But there's another factor involved, which the marketers are more acutely aware of than we are. It's all about an evolutionary trick of the mind.

Why are our minds playing tricks on us?

Whether we admit it or not, all of us enjoy getting doped up on chemicals. Getting high is something we do all the time—and it's all in our heads.

The pleasure that we experience is thanks to a chemical, dopamine, which is released in our brains when we anticipate doing something new or exciting, or see someone we're attracted to. It makes us feel more alert, helps us learn ways of behaving that make us feel happy, and is linked to our sex drive.

There's just one problem: the ways that we end up seeking a quick hit of dopamine are not always good for us. Back in the 1950s, Canadian neuroscientist James Olds ran an experiment with rats to test the limits of pleasure, by wiring up a thin electrode to the part of the rats' brains responsible for desire. The wire was attached to a switch the rats could press to give themselves a hit of pleasure. Before long, the rats were hooked: forgetting everything else, they kept pressing the switch again and again, losing all interest in sex, food and drink. The rats only avoided enjoying themselves to death because, after a few days, the scientist unhooked them from the fatally attractive machines.

As humans, we can see similar patterns of self-destructive behaviour in people with extreme addictions, whether it's drugs, alcohol, sex or gambling. The impulse is in all of us, because it's how our brains evolved. In the faraway past, when life as a human was largely about survival, the anticipation of pleasure was an important survival mechanism, keeping people motivated even when life as a hunter-gatherer was tough.

To a large extent, our brains still operate as if we're living in the Stone Age. Of course, the world we live in today is very different; instead of food scarcity, our biggest health problem in the West is eating more than is good for us. But there is no shortage of other modern pleasures to give us a happy dopamine high, including going on spending sprees that we know we can't really afford.

What psychological games are being played at your supermarket?

The object of your desire might be anything from a new pair of shoes to a vintage car. Even the simple act of looking at them and thinking how nice it would be to own them can be enough to make you feel happy. The trouble is, that level of imagined happiness is hard to sustain if we end up getting what we want. It's a crucial reason why so many of us go shopping. We are thrilled with our purchases at the time, but fairly soon we need to go out shopping again in search of something better.

Unfortunately, the people whose job it is to sell us more stuff usually understand how our minds work better than we do ourselves.

There are a million marketing tricks used to entice us into buying more than we really want, some of which you're probably aware of. For instance, most supermarkets now have their own in-house bakery. One of the reasons is that studies have found the smell of freshly-baked bread makes people feel hungrier. As most of us know from experience, hungry shoppers buy more food.

Similarly, supermarkets stock many of their most popular products in the middle of the aisles, encouraging people to do laps up and down each aisle. It's a tactic designed to increase what the industry calls 'dwell time'—the amount of time each shopper spends inside the store.

That's only the beginning of the mind games being played on us every time we go shopping. Many of the world's best and brightest neuroscientists, psychologists and even surveillance experts are employed by marketing divisions of companies to discover new ways to keep us buying more. Forget customer surveys; these days, all the cutting-edge research is being done with brain scans, tracking devices and even covert cameras.

Who's watching you at the shops?

In a study of shopping behaviour at a large UK shopping centre, British company Path Intelligence, together with the Massachusetts Institute of Technology, worked out how much time shoppers were spending there by plotting the positions of their mobile phones, which automatically transmit their locations to the phone network. They found that for every 1 per cent longer that people spent in the shopping centre, sales rose by 1.3 per cent.

Security cameras are also being used for more than just watching shoplifters. For instance, one US company has used video footage to analyse people's beer-buying habits, using image-recognition software to show how different shoppers behaved, according to age, gender and ethnicity.

Meanwhile, a US coffee chain, Aroma Espresso Bars, has already been trying out facial recognition technology to provide customised ads on video screens as people approach the counter, based on their age, gender, and what they're ordering. It's the new version of upselling; instead of a sales assistant offering you extra products, now a video screen can ask whether you'd like a muffin to go with your cappuccino.

These techniques are all about encouraging our subconscious brains to desire more than we originally intended to buy. Similar mind games are used to try to appeal to our emotions. 'Share the happiness this Christmas', 'The power of dreams', and 'Because you're worth it' are slogans for a mobile phone, a car and a brand of cosmetics. Forget the products; they're trying to convince us that we can buy happiness.

How can we learn not to succumb to the tricks that marketers and our own minds can play on us, to become smarter, less indebted and more sustainable shoppers? Luckily, there is an answer: we can change our minds.

How can we avoid falling for sneaky marketing tricks?

We're all capable of retraining our brains. It's not always easy, particularly when it comes to our consumption habits, because spending money to try to buy happiness is a deeply ingrained part of our consumer culture. Over time, though, remarkable changes are possible.

The first step is realising that every time we fall into the advertisers' trap of trying to buy happiness with a quick hit of consumption, we actually become more susceptible to opting for that quick fix again, and again, and again—just like the poor Canadian rats.

You can spot similar patterns of self-reinforcing behaviour in other areas of our lives as well. Just think of all the times you've been in a car with someone who gets wound up by other people's bad driving, swearing at anyone who dares to get in their way. What they're actually doing is training their brain to cope with the stress of driving by succumbing to road rage. The more often they do that, the harder it becomes for them to stop. Studies have shown that the more we

practise a habit—regardless of whether it's good or bad for us—the more we reinforce neural pathways in our brain.

It's the same with any habit. We can control our impulses to swear, or eat more junk food than is good for us, or shop till we drop. The hardest part can often be learning to spot the triggers for those habits before you find yourself at the cash register, handing over your credit card.

In the past, some people believed that our brains were hardwired, meaning that we were stuck with what we were born with. Now we know that's not true; our brains are a lot more open to change than scientists used to give us credit for.

As the latest research reveals, we make and break about a million connections in our brain every second. Our extraordinary capacity for change, known as neuroplasticity, means that everything we think, do and experience is continually retraining our brain.

The more we use a particular neural pathway, the stronger it becomes. If we've developed habits of behaviour that aren't good for us, it does take a while to create new habits and strengthen different neural pathways—but it can be done.

What can Einstein teach us about becoming smarter shoppers?

Neuroscience can teach us some useful ways to change our habits. Whether you're trying to learn to eat more healthily, exercise more, or shop more thoughtfully, the secret is not to simply go cold turkey. Instead, the key is to concentrate on forming better habits. If, for instance, you find yourself in a clothes shop where the clothes are half price and your old habit was to snap up as many 'bargains' as you could carry, stop and try to remind yourself of the pleasure you can get from making a different choice—to use that same money to save up and buy one really top-quality item that's designed to last.

The other important thing to realise about your mind is that buying stuff isn't the only way to get a happy dopamine rush. That's because a lot of the pleasure is in the anticipation. By not falling for the trap of splurging, but instead saving up and making more considered shopping choices, you'll get more lasting pleasure from the delayed gratification. It's one of the reasons why kids often enjoy gifts more than adults do: children don't have the option of whipping out a credit card and buying whatever they like on a whim. When they do finally get a toy they've been wanting for ages, the delayed gratification can enhance their appreciation for what they're getting.

As consumers, we can become less susceptible to marketers' tricks simply by being more aware of the kind of mind games they play, so that we realise that the smell of fresh bread, the design of their stores and the slogans that sound like they're able to sell us happiness are sneaky ways of appealing to our subconscious minds. It's just like watching a magician's performance: their tricks are only convincing if you don't know how they work.

As the rest of this book shows, if we want to get serious about tackling climate change, then we'll need to implement all sorts of big political, technological and economic solutions. But those solutions will be far more effective if we start to change the way that we think and consume.

It's a lesson that Einstein tried to teach us a long time ago, when he said, 'The problems that exist in the world today cannot be solved by the level of thinking that created them'. That lesson doesn't just apply to our shopping habits—it applies to everything we do, including how we solve Australia's looming energy crisis.

3

The lucky country

How to keep the lights on without burning money

The city was in chaos. Traffic lights went out and cars smashed into each other at intersections in a cacophony of blaring horns and shattering glass. The fire brigade scrambled to answer calls for help from people trapped inside lifts. Computer screens went blank, as office blocks went dark and began heating up as their air conditioners shut down. Across the state, hundreds of thousands of people tried to turn their lights back on and found that they didn't work.

It sounds like the kind of extreme scenario that climate scientists have long warned will happen more often due to growing risks of extreme weather shutting down critical infrastructure. Those worst-case scenarios are already becoming a reality.

On a hot summer's afternoon in 2007, the temperature in Melbourne and across much of Victoria had soared to above 40 degrees. As firefighters fought back huge bushfires blazing across the state's north, ash and smoke smothered a crucial interstate electricity transmission line. It triggered an automatic series of rolling blackouts, shutting down power in Melbourne, Geelong, Ballarat and Bendigo, as well as in smaller towns and outlying suburbs right across the state.

All up, around 700,000 people were affected, and, by the time the problem was fixed, the power outages had cost the economy $500 million. For all the reassurances of the electricity companies and politicians, people started to question just how secure their power supply really was.

Until recently, Australians have never had to worry about running short of electricity, because, more than any other country in the world, we're spoilt for choice in energy sources. We're one of the world's major exporters of coal, gas and uranium. The sun shines more intensely over Australia than on any other continent. Strong winds and tides buffet our coastlines. We can even tap into hot rocks underground to generate geothermal power. Yet, for all the choices we have, when it comes to generating electricity we remain unusually dependent on just one thing: burning coal.

Can we afford to keep burning so much coal?

Coal-fired power stations generate three-quarters of Australia's electricity. They may be big and dirty, but coal generators have maintained their dominance in the Australian energy market largely because burning coal has been dirt cheap.

Our abundant resources of black and brown coal, combined with generous government subsidies over many decades, has meant that Australians have enjoyed some of the lowest electricity prices anywhere in the world. But those low prices have encouraged some extraordinarily expensive and wasteful energy habits.

If you put aside the indirect greenhouse gas pollution we generate through our consumption, half of Australia's official greenhouse gas emissions come from the energy sector, largely from burning coal to make our electricity. Part of the reason for those huge emissions is that Australia has some of the highest-emission coal-fired power stations in the world. As a result, our emissions from burning coal are on track to almost double by 2020 compared to 1990 levels.

If there was technology available to remove greenhouse gas emissions from burning coal at a price we could afford, then we might not have such a big problem. But there isn't. As even the coal and electricity industries acknowledge, we're still decades away from knowing if we can build commercial-scale, coal-fired power stations that capture and store most of their carbon dioxide.

Whatever happens with coal in the future, in the short-term we know we need to be burning a lot less of it. That means we need a national energy strategy to start changing the way we use and produce electricity.

While the Rudd government has been working on a long-term national energy strategy, known as the Energy White Paper, the thinking behind the strategy has been largely based on outdated assumptions that, if demand for energy shows no sign of slowing down, it is inevitable that we will keep burning more coal. But as we'll see shortly, there are other places in the world where they've started to rethink those old assumptions and, in doing so, saved money and energy while reducing greenhouse gas emissions.

Why are we burning money?

If you believe the legend, on a cold, rain-soaked night in a remote corner of Scotland, two retired British pop stars made a bonfire and burnt £1 million in the name of art. Hunched over the flames in an abandoned stone boathouse, the pair spent two hours unpeeling 20,000 £50 notes, scrunching them up and throwing them into the fire. Swigging whiskey as they watched the last of their money curl up and turn to ash, Jimmy Cauty and Bill Drummond—who had once fronted the chart-topping acid house group The KLF—laughed and joked about how long it was taking. 'Well that's okay,' said Cauty, according to a reporter who was invited to witness the bizarre incident. 'It'd take a long time to spend it. Can I spend an hour out of my life to burn a million quid? … All the time you say about things, "I haven't got the time to do that." Well, I've definitely got time to do this.'

Believe it or not, in Australia we are effectively doing what the KLF did—only here we're burning through more than that amount of money every single day.

In 2004, Australia's first major national energy strategy, *Securing Australia's Energy Future*, detailed how, by implementing even half of the known energy-efficiency activities with a payback time of four years or less, Australia could save $975 million annually and reduce greenhouse gas emissions by around 10 million tonnes a year. The report also said that reforming the energy market to encourage better demand management from energy users could save a further $630 million and 3.5 million tonnes of emissions a year.

It wasn't the first time our politicians had been told about the opportunities to save billions by acting on inefficient energy use. There had been similar findings in countless official reports for successive Labor and Coalition governments going back several decades. Many of those reports suggested sensible solutions for dealing with the problem,

regularly recommending tougher government regulation that would slash the nation's energy bills. Yet, instead of acting on those findings, our political leaders have sat back and allowed the amount of money we waste on inefficient energy use to keep piling up. Pop stars can only dream of having so much cash to burn.

Why is Australia wasting so much energy?

One of the reasons why so little has been done about energy efficiency is because of how boring it sounds. It's not controversial, so most journalists aren't interested. Most politicians aren't interested either, because you can't easily see saved energy, which means there are no ribbons to cut for photo opportunities.

Another reason, which we'll examine later, is that the big energy users and producers have traditionally dictated energy policy in Australia. With more coal to burn than we've known what to do with, there hasn't been much pressure to change. In contrast, countries like Japan and Sweden cottoned on years ago to the benefits of making their economies run more efficiently by doing more with less electricity. To be fair, those countries didn't have the choice not to act, because they didn't have the amount and range of domestic energy resources that Australia has. But the end result was that their governments have cracked down on inefficiency, while their industry leaders recognised that wasting energy was bad for business.

Whenever Australia's efforts in reducing energy inefficiency are lined up and graphed alongside other comparable Western countries, it is embarrassing to see how little we've managed to do. As studies by the International Energy Agency (IEA) and others have consistently shown, Australia has made only a fraction of the energy savings achieved in other wealthy countries over the past generation.

Although Australia is a particularly inefficient user of energy, we're not alone in wasting our energy. Globally, the potential savings from energy efficiency are so huge that the IEA has identified ways for energy efficiency alone to reduce global greenhouse gas emissions by around six billion tonnes by 2030—which would be like wiping out all of the emissions coming from the US today.

So when people ask how we can affordably start making significant cuts in greenhouse gas emissions, energy efficiency ought to be right at the top of the list. The economic and environmental benefits of doing so are well-established, thanks to the examples set by places like

California, which first began enacting stricter energy-saving laws in response to the oil shocks of the 1970s, as well as more recently under the muscular leadership of a former Hollywood megastar.

How did Arnold Schwarzenegger become a real action hero?

Most Australians know Arnold Schwarzenegger best as The Terminator, a monosyllabic, muscle-bound cyborg who would blow up anyone standing in the way of meeting his objectives. After wiping out as many people as he could in the original film, he switched sides and saved humankind in two sequels. Arnie obviously preferred the sequels.

In 2003, Schwarzenegger swapped making movies for the real-life drama of politics, becoming Governor of California. After an unremarkable first term in office and facing an electoral wipe-out, in 2005 Schwarzenegger surprised everyone by announcing some of the most aggressive policies on climate change and energy policy reform anywhere in the world.

Living up to his reputation as an action hero, after his re-election the Governator got on with setting short- and long-term greenhouse gas reduction targets, including for the state's high-emission industries. With demand for energy-efficient technologies estimated to be worth at least $US180 billion ($A200 billion) a year, he was convinced that California could achieve those deep emission cuts while boosting the state's economy and employment.

Meanwhile, venture-capital investment in energy-efficient technologies is expected to have created more than 52,000 jobs, along with more than $US11 billion ($A12.3 billion) a year in extra revenue, by the time Schwarzenegger's term as governor ends in 2010. Schwarzenegger's policies also include the Million Solar Roofs Initiative, which has created incentives to put solar electric panels on one million solar roofs of residential and commercial buildings by 2018.

Schwarzenegger could never have achieved so much during his two terms as governor without the pioneering work of visionary people who, years earlier, laid the groundwork for implementing good energy policies. One of those pioneers was David Freeman, who was the general manager of a major utility, the Sacramento Municipal Utility District (SMUD), during the 1990s.

Freeman was an unusual power-company boss because he was best known for saving, rather than selling, electricity. As strange as it might sound, Freeman realised that there was more money to be made

by selling 'energy services' rather than by simply selling electricity. Providing energy services is all about ensuring that people could still enjoy a cold beer from their refrigerator or have a hot shower, by finding ways to deliver those energy-dependent services using less electricity than in the past.

With Freeman at the helm, SMUD began paying people to trade-in inefficient appliances, offering discounted solar water heaters and planting trees to shade their homes, all of which would dramatically reduce their customers' demand for electricity. It was a completely different way of thinking for a power company. It was all based on the realisation that encouraging greater energy efficiency among their customers could save SMUD money. Power stations of all varieties—coal, gas, nuclear, solar, wind or any other type—are expensive to build, requiring massive upfront investments and extra infrastructure. By reducing the need to build new power stations through reduced demand, SMUD reduced its costs as well.

The end result was that SMUD still made money, customers got more energy-efficient homes and greenhouse gas emissions were reduced. Everyone was a winner. The approach proved that good business could also be good for the environment.

Schwarzenegger and Freeman form part of a longer history of political and business leaders looking for smarter ways to deliver better, more efficient services. Following the oil shocks of the 1970s, California introduced some of the toughest energy-efficiency laws anywhere in the world. As a result, 30 years on, the per-person demand for electricity has barely increased. It's an impressive achievement, especially when you compare California with the rest of the US, where average electricity use over the same period soared. The state's energy-saving programs have had another positive effect too, creating an estimated 1.5 million jobs in energy services and other new related industries since the 1970s. Thanks to that history of visionary leadership in politics and business, California has become a hot destination for people with big ideas about how to tackle climate change, including some of Australia's leading energy entrepreneurs.

Where is the future looking bright for solar base load power?

For 30 years, physics professor David Mills tried without success to convince Australian politicians and business investors that solar power could generate enough electricity to compete with coal-fired power stations.

An academic at University of Sydney, Mills had long had a vision of building huge solar thermal power stations in the deserts of outback Australia, in the heart of the sunniest continent in the world, capable of generating huge amounts of renewable, base load electricity.

The trouble was, successive federal governments didn't share his vision. They refused to introduce long-term policies to support renewable energy or, at the very least, to stop effectively subsidising coal- and gas-powered generation by failing to charge them for their greenhouse gas pollution.

Eventually, Mills decided it was time to take his ideas elsewhere. So, in early 2007, he packed up and moved to California. His visionary plans soon attracted the attention of a particularly savvy businessman and the co-founder of computer giant Sun Microsystems, Vinod Khosla. Khosla has a track record of investing in new industries just before they take off; he was one of the investors who put money into Google, back in the days before the website became a verb.

Together, Mills and Khosla formed a company called Ausra, based in Silicon Valley. In 2007, Ausra opened a huge solar thermal manufacturing factory in Las Vegas and a small-scale power plant in the desert north of Los Angeles. It's now signed a contract with one of California's biggest electricity utilities, Pacific Gas and Electric, to build a larger 177-megawatt power plant in central California, able to power 120,000 homes—that's roughly the equivalent of Canberra's electricity needs. They're also working on signing other contracts for new solar thermal plants in other parts of the US while spreading their wings internationally, recently opening an Australian office.

In the meantime, Mills hasn't stopped at producing electricity from the sun. Ausra is currently integrating thermo-chemical storage systems into its power stations, so it will soon be able to supply electricity even at night. Elsewhere, as we'll see shortly, a rival Spanish solar thermal company has already proven that in-built heat storage systems can work.

While different types of storage technology continue to be developed, solar thermal can also be run in conjunction with gas generators to provide electricity around the clock. Ausra has been talking to big mining companies in Australia about powering entire resource projects with these hybrid solar thermal and gas power stations. It's little wonder that when Arnold Schwarzenegger opened one of Ausra's plants in late 2008, he made a point of saying how glad he was that Mills had brought his Australian-made solar thermal technology to California, describing it as 'one of the best companies in California and the world'.

How can going solar be made easier and cheaper for households?

Imagine if going solar was as easy as entering your address on the internet, being given three different options for your solar electric system and then choosing and clicking on one of them to order it. No paperwork hassles or complicated rebate forms to fill in; a few clicks and you're done. Within the week, a qualified technician would come around to install the system for you.

It's solar made easy for busy people, offered by a company called Sungevity, set up several years ago by Sydneysider Danny Kennedy. Unfortunately, Australians can't use Sungevity's services because the company is based in California.

Kennedy is a long-time environmentalist turned businessman, who spotted an opportunity to be part of California's solar boom after Schwarzenegger rolled out the Million Solar Roofs Initiative. While Kennedy would have been happy to stay in Australia to set up his business, there wasn't the same level of policy support that has attracted so many new renewable energy businesses, including Sungevity, to California.

With innovative software that uses satellite imaging to zoom in and calculate your roof's size, slope and orientation, Sungevity's computerised system cuts out many of the usual add-on costs that push up the price of home-scale solar electric businesses. There are videos on its website to answer frequently-asked questions, as well as programs to calculate the return-on-investment for the system that has been recommended for you. By streamlining the entire process, from a homeowner first considering solar electricity to getting the panels installed on their roof, everyone saves time and money.

Once again, Californians are enjoying the benefits of smart Australian thinking. But while sun-soaked California is an obvious place to start a solar empire, it can't claim that it's the home of the world's biggest solar industry.

Which cloudy country has become a solar superpower?

If you've ever visited Germany, you'll know why it's such a surprising place to find so many solar panels: clouds blanket most of the country's skies for two-thirds of an average day, and there are only a handful of cloud-free days there every year.

Only a decade ago, Germany and Australia produced roughly the same amount of electricity from solar energy: virtually none. Today, more than half of the world's solar photovoltaic panels are installed in Germany, which has built a booming manufacturing industry, employing 57,000 people and exporting solar products worth €2 billion ($A3.2 billion) a year. One company alone, solar cells manufacturer Q-Cells, started in 2001, now has 2000 workers. In comparison, Australia's entire solar industry employs 3500 people.

While Germany remains a largely coal- and nuclear-powered nation, the rate of uptake in renewables has been remarkably fast by world standards. Back in 1997, Germany, along with other European nations, set a target of getting 12 per cent of their energy from renewables by 2010. Some people dismissed it as an impossible task because at the time Germany had less than half that much capacity built. Yet by 2007 they had already reached 14 per cent. Since then, the government has announced higher renewable targets, aiming for a 30 per cent renewable share by 2020 and 45 per cent by 2030.

Going solar has proven incredibly popular with the Germans, and not only in big cities; in regional areas, farmers have begun covering their roofs and fields with solar panels to harvest the sun. That's because under German energy policy, households, businesses, farmers and community groups receive subsidies for all the renewable power they generate. All up, there are now a quarter of a million Germans employed by renewable energy companies, particularly in locally run small and medium sized businesses, in an industry that is now worth €35 billion ($A56 billion) a year.

Why does Australia need a gross solution?

One of the crucial policies that the German government introduced to support decentralised renewable electricity generation was a scheme that pays people producing renewable energy a premium rate for all the electricity they produce. The government took this approach to reflect the community-wide financial benefits of reducing electricity demand at peak times of day, when electricity prices are at their highest. Reducing that peak demand slows down the need to build expensive new power stations. The policy wasn't limited to solar power either; it aimed to encourage investment in a wide range of renewable electricity sources, including wind, small-scale hydropower, geothermal, biomass (burning wood) and biogas (natural gas from rubbish, sewage and mines).

Dozens of national and state governments worldwide have since followed Germany's lead in adopting that policy, which is known as a 'gross' feed-in tariff. Yet in Australia, New South Wales and the Australian Capital Territory are the only state or territory governments to so far introduce a similar gross feed-in policy.

Most other Australian state governments have chosen to bring in 'net' feed-in tariffs, which only pay for any excess electricity fed back into the grid, once the amount consumed on-site is subtracted. The net feed-in tariff is cheaper for governments in the short-term, but it's a short-sighted move because it will do little to boost the growth of renewable power generation. Most states have also put tight restrictions on their schemes, meaning that only very small household rooftop solar systems get the benefit. That's in contrast with Germany, where some of the most enthusiastic beneficiaries of the scheme have been farmers, harvesting the sun's power with panels on their sheds and in their fields.

The fact that the gross feed-in tariff was set out in legislation was vital to its success in Germany, because if there is one thing that makes life harder for people trying to do business, it's uncertainty. Knowing that they had long-term support from the German government, businesses responded by building new factories and investing in new companies.

In an ideal world, you wouldn't need policies like the gross feed-in tariff, if the cost of electricity accounted for the environmental and health problems created by air and greenhouse gas pollution. Realistically though, that's not yet the case, either here or in Europe. Gross feed-in tariffs are a way of beginning to bridge that gap.

For decades, the Australian renewable energy industry has suffered from a lack of consistent, long-term national energy policies. That has led to a cycle of boom and bust investment, which has driven many of our brightest energy innovators overseas. To understand a bit more about why we keep getting these flawed policies, it's worth taking a closer look at one of those times when a promising renewable energy boom was cut short.

Which renewable scheme was stopped for working too well?

John Howard came close to being remembered as the Prime Minister who began a renewable energy revolution in Australia. In 2001, his government introduced the Mandatory Renewable Energy Target (MRET) scheme, which required electricity retailers to source a small

share of their total electricity supply from renewable energy. It was hailed by many as a crucial first step towards making better use of Australia's vast renewable resources.

However, some senior government ministers and business leaders were less thrilled about the beginnings of a shift to more renewable energy. So, a couple of years later, the government set up a review headed by a Country Liberal Party Senator, Grant Tambling, to see if the scheme was worth continuing.

Unfortunately for those looking for an excuse to scrap it, the lengthy Tambling review came back with some conclusions they didn't like: that the scheme was driving faster than expected investment in renewables; that it had already generated more than 6000 jobs, including many in regional areas; and that, while it wasn't the cheapest way to cut emissions, if Australia failed to further invest in renewables in the short-term, we risked being left behind by other countries who already were. On balance, the government's review recommended expanding the renewable energy target scheme to 2020 and beyond, 'as a sensible insurance policy against significant greenhouse gas abatement measures being introduced in the future'.

Yet barely six months after publicly releasing the review's findings, in July 2004 the Howard government unexpectedly announced that instead of being expanded, the MRET scheme would go no further. The decision stunned Australian companies, with many, such as renewable energy company Pacific Hydro, subsequently forced to move most of their work offshore to New Zealand and South America. Some had their suspicions about what had motivated the decision, but for a while no one could really explain why the Howard government had pulled the plug on what was already a successful scheme.

Those reasons became clearer a few months later, when detailed minutes of a secret meeting in May 2004 were leaked to the media. Among those sitting around the table at that meeting were then Prime Minister John Howard, Industry Minister Ian Macfarlane, and eight senior executives from some of Australia's biggest energy and mining companies: Rio Tinto, Alcoa, Edison Mission Energy, Energex, Origin Energy, BHP Billiton, Boral and Orica.

According to the minutes, written by a Rio Tinto executive, Howard explained that he was looking for ideas from the executives for a different scheme to replace MRET, which would protect industry at the same time as promoting 'super dooper' (his words) technologies.

Industry Minister Ian Macfarlane then elaborated on why the government had decided to shut down MRET, explaining that the

Tambling review had found the scheme worked too well, generating investment in renewable energy much faster than expected. The government was keen to replace it with a cheaper version, which he stressed would be run by government and business, not a group of scientists.

After an hour, Howard and his advisers left. But Macfarlane stayed on, and the minutes record him having a go at the executives for their 'roaring silence' in failing to publicly attack MRET and letting the renewable industry get so much positive media coverage, which was going to make it harder for the government to phase out the scheme. Later, as the meeting wrapped up, Macfarlane stressed the need for absolute confidentiality about the government's plans, warning that if the renewable industry found out there would be a huge outcry.

With that kind of government support for renewables, it's no wonder that there has been so little progress in reducing Australia's dependence on burning fossil fuels. In fact, while the amount of electricity we're using as a nation has grown enormously over recent decades, the proportion of that electricity coming from renewable sources has gone down. In 1965, nearly a quarter of Australia's electricity came from renewable energy, largely from hydroelectricity in Tasmania and the Snowy Mountain Scheme. Since then, the share of renewable electricity fed into the electricity grid has steadily fallen, dropping to just 8 per cent of Australia's electricity by the time the Howard government left office.

How much has really changed in our energy policy since Howard's end?

While they were still in opposition, countless Labor MPs accused the Howard government of having its head stuck in the sand on climate change. Some even called the Prime Minister 'a fossil fool' in parliament for his anti–renewable energy policies. Since being elected, the Rudd government has kept its promise to revive the Renewable Energy Target scheme with a 20 per cent renewable target for 2020, although some of the details of how the scheme has been designed remain highly contentious. The government has also pledged more money to low-emission technology research and one-off projects, particularly for 'clean coal' and solar power.

But even now, long after Howard's end, there are still echoes of the past in how energy policy is being written in Australia. Just one example of that has been the behind-the-scenes process of preparing

the Rudd government's Energy White Paper, a strategy that is supposed to set out Australia's energy pathway for the next 20 years.

Early in the process, the government set up a 'high level consultative committee', whose members were described as representing 'a cross-section of stakeholders in Australia's energy sector'. Somehow, that supposedly representative group ended up being another roomful of company executives with predominantly coal and oil investments: Xstrata Coal, Rio Tinto, Shell, BHP Billiton, Santos, Woodside Petroleum, AGL Energy, Origin Energy, the Energy Supply Association of Australia and the Australia Petroleum Production and Exploration Association.

In mid-2009, after several mentions in the media about it, the committee's membership was belatedly expanded to include a few extra voices, including a company working on wave and 'clean coal' technology, an environment group and a union representative.

But the most glaring omission still wasn't fixed, even after those extra appointments were made. Despite the huge potential of energy efficiency to deliver major greenhouse gas emission cuts at an overall benefit to our economy, somehow there wasn't room at the table for a single independent energy-efficiency expert. It reflects a broader lack of vision about Australia's capacity to generate electricity more cleanly and efficiently than we do today.

Special deals for certain industries also persist. In 2009, high-emission export industries—including aluminium, steel, cement and paper, among others—won the right to avoid paying 90 per cent of their share of the costs associated with meeting Australia's 2020 renewable energy target. It followed on from a promise to give those industries up to 95 per cent of their emission permits for free under the proposed Carbon Pollution Reduction Scheme. (More on that in chapter six.)

The aluminium sector alone consumes more than 15 per cent of Australia's electricity each year and generates 6 per cent of the country's official greenhouse gas emissions. You might think that they would be reasonably happy to have negotiated getting a 90 per cent discount on a new electricity charge for the next decade. Instead, the industry has continued to press for an even greater reduction.

Australia is not alone in doing special deals for high-energy industries. Other countries—including those with much tougher climate policies than ours—have continued to create similar loopholes and exemptions for their high-energy industries too. But such economic protection doesn't come for free. To achieve the 2020 renewable target, Australians

will need to spend money on new renewable generation. If some industries pay a lower share of that cost, the rest of the bill has to be covered by the rest of the community, including other businesses, public bodies like hospitals and universities, local councils and households.

How can solar power produce electricity in the dark?

One of the most common myths about energy in Australia is that we need to wait for an ideal one-size-fits-all solution that can fix all our climate and energy security problems at once. It's a hard myth to dispel, not helped by the fact that most media coverage of the issue rarely gets beyond asking 'if coal is a problem, is the solution solar or nuclear?' It's a false debate, which ignores the much wider array of energy choices we have as a nation. It also ignores the reality that different types of power and technology come with different costs, advantages and disadvantages. Rather than waiting for one perfect solution, the real choice we face is what kind of mix of technologies we adopt—and that mix will increasingly include more renewable energy.

Solar electric (photovoltaic, or 'solar PV' for short) systems are capable of providing more of Australia's peak energy needs, especially for smaller, specialised uses. Among their advantages are that they can be installed close to where the electricity is needed, such as on a rooftop, and that they produce the most electricity at precisely the times when it's needed and worth the most: in the middle of hot days. Summer peak conditions, when Australians crank up air conditioners in offices and homes to stay cool, are the times when wholesale electricity prices soar to their highest levels. Those times are also when the electricity grid is the greatest risk of blackouts because of surging demand.

Again, contrary to popular myth, Australia currently has more than enough base load and intermediate load power; the greater growth in demand is for peak power. Peak power can come from a whole variety of sources including hydro and gas, but in most parts of Australia solar electric systems can provide a good match for local power needs and reduce the risks of blackouts on hot days.

The obvious question mark over solar power is how it performs on overcast days or when the sun goes down. That's where storage becomes a big issue, and where another type of technology—solar thermal—is coming into its own.

In Australia, the most common use of solar thermal technology is still in small, gas-boosted solar hot water systems on our rooftops. But

there are other kinds of solar thermal technologies too, which can provide electricity on an industrial level for a much lower price than solar electric panels.

Solar thermal technology essentially uses mirrors or lenses to concentrate the sun's rays, generating heat that is focused to superheat water or oil. The heated fluid is used to drive turbines to produce electricity, in just the same way that coal-fired power stations operate.

Thanks to improved storage solutions, solar thermal power stations can now generate electricity at night. High on a dry plateau in Spain, the Andasol solar thermal power station traps surplus heat during the day in tanks of liquid salt. Later on, this heat is used to provide electricity for more than 7 hours after the sun has stopped shining. That storage time is expected to double within the next few years as more advanced plants continue to be built.

What's the forecast for wind and 'hot rocks'?

Now that solar power is moving ahead and showing it can produce electricity even when the sun isn't shining, what about some of the other types of renewable energy?

As anyone who has passed a wind farm on a stormy or still day will have seen, wind turbines can stop turning when the breeze is blowing too hard or not at all. However, that doesn't mean that when the wind stops blowing in one spot that the whole wind power network isn't working. International experience has shown that with enough turbines spread over a wide enough area as part of a larger electricity network, wind can provide a level of constant power at any time of day or night. Like solar, there is also work underway on storing wind power, such as with high-pressure underground air chambers.

Cheaper to build in most parts of the world than other renewables, the global wind industry has been expanding at a rate of knots in recent years. In China, an enormous wind-power project nicknamed the 'Three Gorges Dam on the land' began construction in Gansu province in 2009. By the time the entire project is completed in 2020, this $17.6 billion, 20-gigawatt project will be China's biggest wind power station. Yet, even with projects on that scale being built, China is still trailing behind the world's wind leader.

The US is currently home to more wind-power generation than anywhere else and has won some surprising backers, such as T. Boone Pickens. A Republican billionaire from Texas, Boone Pickens made

most of his $US3 billion ($A3.3 billion) fortune from past oil investment. But he now spends his time warning that the days of cheap oil are over and that it's time to start investing serious money and effort into other forms of energy generation. With strong, steady winds blowing across scarcely populated areas of Texas, the state government has been won over by the vision of people like Pickens, and is investing billions in connecting new wind farms into the main electricity grid.

There are even more radical proposals for wind-power storage in Europe. One proposal is to set up a new kind of transmission system to enable back-up power generation a long way from its original source. For instance, surplus wind power generated in Spain could be used to pump water into hydropower stations in Norway for later conversion back into electricity when it is most needed. All these international developments in renewable energy storage are important for Australia, given our massive renewable energy potential.

In Australia there's also a new player: geothermal power. Just like a fossil-fuel-fired power station, geothermal electricity is created by high-pressure steam rushing past turbines. Unlike fossil fuels though, the electricity is generated without emitting greenhouse gases. That's because the technology uses the heat of the earth to heat up water that's pumped down to it, as there is huge potential to do in South Australia, Queensland and Tasmania. Alternatively, it's possible to take advantage of water naturally occurring deep down in sandstone or limestone rocks, such as those found in the Otway and Gippsland basins in Victoria and in the Great Artesian Basin in Queensland and South Australia.

The potential for low-cost base load electricity from geothermal power is enormous, which is why many large energy companies are investing in geothermal companies and exploration sites. One of the main stumbling blocks to getting that renewable energy fed into the grid is transmission: getting the electricity from where it's generated to where it's needed. In many cases, new transmission lines need to be built—and at the moment it's not clear who's going to cough up the money for them. Traditionally, state governments have invested in this kind of infrastructure, recognising that these sorts of upfront costs bring with them huge benefits in the form of new industries and more jobs. That kind of government support has certainly been available in the past for coal-fired power stations and aluminium smelters. That's the sort of commitment this new renewable energy industry needs to allow it to take off and provide millions of Australians with 24/7 renewable base load electricity.

How much power can renewables provide?

It's difficult to accurately estimate how much electricity could be provided by solar, wind, geothermal and other renewables in Australia, both in the short-term and in the future, because so much depends on political and economic decisions. As long as we continue to effectively subsidise high-emission power stations and energy-intensive industries by not introducing a real carbon price—that is, the cost associated with the pollution caused by emitting the carbon dioxide—then the energy market is not a level playing field.

What we do know is that we have far more renewable energy resources than we need to power our lives. The fact that we remain so heavily dependent on coal is not because we have no other choices available to us; more than anything, it's because of our ingrained belief that we can't do anything else, and the failure to factor in the cost of pollution associated with burning coal.

A century ago, it was common practice for many factories and abattoirs in Australia to dump their industrial waste, contaminated water and blood out their back doors into the nearest river. Eventually, when the rivers became so putrid that people protested, politicians were forced to bring in laws to prevent dumping and industry was made to clean up its act.

The same principle needs to be applied to greenhouse gas emissions. Until there is a price charged for those emissions, there is no financial incentive for industry to stop burning fossil fuels. The current situation provides a massive economic subsidy to high-polluting industries, skewing the entire energy market and putting every other form of lower-emission energy-generating technology at a significant disadvantage.

Even so, to give you a better idea of what is potentially possible today, bodies like the IPCC have conservatively concluded that, with current forms of renewable technology at today's prices, about a third of the power fed into a central electricity grid like Australia's could come from renewable energy. As well as that, using renewable energy created directly where it's needed could increase the percentage share of renewable fuels even more. To make that happen, we need to rethink how we use electricity, while recognising that power stations can come in all shapes and sizes.

Why does generating power closer to where it's needed save energy?

Generations ago, when Australia first began to build coal-fired power stations, bigger was always seen as better. Most of the power stations were built close to where the richest deposits of coal were found, in places like the Hunter and Latrobe valleys. We ended up with a centralised system of generating electricity, in which big power stations in a few parts of Australia are connected to the rest of the country through a vast network of transmission lines. From these transmission lines, distribution lines branch off, carrying electricity to our homes, businesses and industries.

The long distances that the electricity has to travel to get to where it's needed means that a lot of energy ends up being wasted. Once you step into a big coal-fired power station to see how they work, it quickly becomes clear that there's a lot of energy being wasted in there as well.

Inside Australia's coal-fired power stations, vast amounts of coal come in on conveyor belts, are crushed to a fine powder, mixed with air, and burnt. The heat produced is used to boil water, and the steam that is produced rushes through turbines forcing blades to spin, in the process converting chemical power, through mechanical power, into electricity. All the way along this chain of conversions, energy is lost—so much so that on average for every 100 units of chemical energy put in at the start, only about 30 units ever make it to the other end where it's used.

The other 70 units of power are lost through heat escaping in combustion gases and condensation, as well as through resistance in the transmission and distribution wires. In addition, all coal-fired power stations use about 7 per cent of the electricity they generate to power their coal conveyors, crushers and other machinery. Put it all together, and by the time you flick on a light switch in your house, more than two-thirds of the energy that went into making the electricity has effectively been lost.

We don't have to waste so much energy. One way around the distribution loss is to produce electricity directly at the place where it is needed, or as close by as possible. This is the idea behind distributed electricity generation, where a number of smaller, decentralised power stations are linked together to provide a similar amount of electricity as one larger generator. There are also important gains from the distributed model due to the increase in energy security—with the distributed system, the number of customers experiencing blackouts falls

considerably. That's because with multiple smaller electricity generators, one going off-line will cause less disruption to the overall system than if a big central power station shuts down.

There are other ways to increase the efficiency of burning fossil fuels, especially by capturing the wasted heat. Thomas Edison realised that this was a good idea back in the late 1800s, when he used the heat from his power stations to warm nearby homes and factories. A century on, the power company he founded, Consolidated Edison, still pipes heat to thousands of Manhattan buildings.

Excess heat isn't only useful in winter either. You can use it to heat both water and air, or to cool water in heat exchanges and absorption chillers to run air conditioning. These multifunction power stations have different names, depending on how many functions they perform. Co-generation plants—sometimes also called combined heat and power plants—produce electricity and heat. Tri-generation plants produce heat, electricity and cooling. Quad-generation plants provide the services of tri-gen plants, and produce fresh water as well.

There are a growing number of these more efficient local energy generators already installed in Australia, directly supplying buildings and retail centres, although they're far more common in Europe. Co-generation works best as part of a distributed generation system, with a number of smaller, decentralised power stations linked together. To see some in action, let's take a trip to a small town in the UK.

What's the secret to supplying cleaner energy with lower bills?

Of all the places in the world for Martians to land, the quiet English town of Woking was always an odd choice. Just over a century ago, local science fiction writer H.G. Wells put the small town on London's outskirts on the map by making it the setting for a deadly alien invasion in his best-selling novel, *The War of the Worlds*. But, as the Martians soon discovered, there wasn't much to see around Woking, so they quickly moved on to London where there were more people to kill with invisible heat rays.

Despite countless blockbuster radio and film adaptations of Wells's book over the years, Woking remains much the same quiet place as it always was. Today, this otherwise unremarkable town is becoming famous for a whole new reason, thanks to its local council and the vision of one remarkable man.

With his thatch of grey hair and neatly pressed pinstripe suits, engineer Allan Jones makes an unlikely-looking revolutionary. While working for Woking council back in the early 1990s, he began to take an interest in climate change. When he was asked to redesign the town's heating supply systems, he grabbed the initiative to try something far more ambitious.

Being a no-nonsense engineer, Jones took a close look at the old-fashioned way of producing energy in coal-fired power stations hundreds of miles away and thought there must be a better way of going about it. When he did a bit of digging into the economics of making and distributing electricity, Jones discovered that around three-quarters of a typical electricity bill isn't for the electricity itself: the biggest costs are to pay for all the different taxes, transmission and distribution charges lumped on top of the cost of producing power.

Jones realised that if Woking had its own system of power lines to distribute locally-produced electricity, it would be possible to avoid paying all those extra costs. With those savings, the council could afford to build more expensive—but much less polluting—renewable energy and low-emission fossil fuel energy generators for the town. The best part of all was that the council could do all that and charge residents less for their energy.

So that's exactly what Woking has done. Over the past 20 years the council has set up an award-winning public–private partnership that has installed a whole new network of interlinked power lines and local electricity generators. Unlike big, old-fashioned power stations, Woking's local energy generators are mostly so small that people walk past them without even knowing that they're there.

For instance, the Woking town centre tri-generation plant is built onto the side of a car park. It provides reliable low-cost, low-emissions electricity, heating and cooling to neighbouring buildings, including two hotels, a nightclub, an entertainment complex, the H.G. Wells Conference and Events Centre and the Woking council offices.

Nearby, the Woking pool and leisure centre's heating and electricity comes from a hydrogen fuel cell—a proven technology used to supply heat, electricity and drinking water to US astronauts back in the 1960s.

Solar power is also being put to use around Woking. In the centre of town, the Woking train station entrance now boasts a curved steel and glass canopy covered with 35,000 solar cells. Elsewhere, there are solar panels on building rooftops, solar-powered lights and solar-powered parking ticket machines.

Woking is still connected to the national electricity grid, meaning the town can export electricity when producing more than the locals need, and draw on the mains when they need more than the town's generators can provide. On several occasions, when the national grid has failed and neighbouring areas have been blacked out, life and business in Woking has gone on as normal because the town had its own network to rely on. Thanks to its decentralised system of tri-generation, solar and other small-scale power generators around town, the council is using around 75 per cent less energy than it was before, saving it around £1 million ($A1.8 million) a year on bills. Along the way, greenhouse gas emissions right across Woking have been cut by 19 per cent. Not bad for an initiative that began with one man deciding to rethink a town's outdated heating system.

How can small towns and suburbs make a world of difference?

When Woking started winning national and international applause, Jones was asked to share his experience in bigger cities. He has since gone on to head London's Climate Change Initiative, which is working on innovative solutions to cut greenhouse gas emissions, such as taking the vast volumes of food scraps from London's restaurants and using the waste gas from those scraps to power tri-generation facilities.

The ripple effect of what has happened in Woking has spread well beyond London. In Australia, the City of Sydney has been among the local governments leading the way in boosting tri-generation use. Led by independent mayor Clover Moore, the council responded to Woking's example by commissioning research showing that tri-generation—which the council sometimes refers to as 'green transformers'—has the potential to generate around 70 per cent of the city's electricity needs by 2030, producing just a fraction of the greenhouse gas emissions.

Woking is only one of a growing number of towns and communities worldwide setting a positive example of what can be done to cut emissions. There are plenty of other places doing the same: the small Kansas town of Greensburg, USA, which was largely wiped off the map by a devastating tornado, but where the locals responded by deciding to rebuild their town to be a model of higher energy-saving standards; the German city of Freiburg, which for decades has been pioneering schemes promoting sustainable energy, housing and transport; and

the Australian suburb of Coburg, home to the Moreland Energy Foundation, which works with schools, households and businesses on practical projects to save money and reduce greenhouse gas emissions.

Whether you're talking about Greensburg, Freiburg, Coburg or Woking, the lesson to be learnt from such communities is clear. Small towns, suburbs and cities can make an impact that reaches far beyond their local area, through leading by example and inspiring others to learn from their experience.

Why will we need to rely more on gas?

While we're confident in the future of renewables to supply our energy needs, we do have to figure out a way to bridge the gap between a high-emissions, mainly coal-dominated present and what looks like being a low-emissions, more renewable energy future. While making that transition from burning one type of fossil fuel, coal, we will need to use more of another fossil fuel in its place: natural gas.

Burning gas to produce electricity generates about a third of the greenhouse gas emissions produced by burning brown coal. Using gas to replace less environmentally-friendly fuels—particularly in commercial space heating, electricity generation and transport—would deliver big savings in Australia's greenhouse gas emissions. It would have a bonus side effect of improving our air quality because we'd be reducing toxic trace elements that are released into the air when coal is burnt.

That doesn't mean that the answer is to simply switch from building big coal-fired power stations to building big gas-fired power stations. Instead, the smarter solution is to try to use as little gas as possible to keep costs down, by opting for ultra-efficient local generators, like the tri-generation plants that have worked so well in Woking and in many large office towers and shopping complexes in Australia.

Fortunately there are lots of natural gas deposits in Australia, mostly in Western Australia, as well as in the Northern Territory, Victoria, South Australia and Queensland. There are also huge opportunities to tap into other non-traditional sources of gas that too often go to waste. Coal-seam methane projects, for example, capture gas that is typically associated with coal seams that are too deep or difficult to mine for coal.

Waste gas projects can also be built in our cities. For instance, when rubbish is taken to landfills and left to rot, methane is released from the decomposition process. Sending less waste to landfills is obviously the best way to reduce those emissions. Given the huge mounds of rubbish

we already have to deal with, a growing number of waste and recycling companies are making better use of that biogas by using rubbish to generate electricity.

The Macarthur recycling facility in Sydney's south-west has been capturing waste gas and using it to supply virtually all of its own electricity needs. At times, the Macarthur facility has generated enough extra electricity to be able to sell it to the national grid.

Once you start to piece together all the different steps we've already outlined—saving and managing energy better, switching to renewables and, where necessary, building new hybrid gas-fired power stations—it's clear that Australia has plenty of potential to make massive greenhouse gas emission reductions very quickly. That's just as well, because we still have to confront one of our biggest energy challenges: cutting back on burning coal.

How did we end up burning fossilised forests?

If you want to understand the scale of Australia's reliance on coal to power our lives, it's a good idea to pack a picnic basket. At the end of a winding road, on a hilltop two hours' drive east of Melbourne, is the George Bates Lookout. There are wooden tables and free electric barbecues provided, but what's most impressive about this picnic spot is its view.

Stretching out beneath the lookout is the Loy Yang brown coal pit, one of the biggest open-cut coal mines in the southern hemisphere. The open-cut pit is about 200 metres deep, 3 kilometres long and 2 kilometres wide—making it 30 times the length of the Melbourne Cricket Ground and ten times as wide. It's so big that the jumbo jet–sized excavators digging away inside the pit look like tiny Tonka toys. On an average day, four giant excavators operate 24 hours a day, feeding coal directly to the neighbouring power station's boilers via a conveyor belt. Each year, approximately 30 million tonnes of coal are extracted. The coal being dug up to fuel the power station next to the pit is brown coal, one of the two types of coal we use in Australia. Living up to their names as fossil fuels, brown and black coal are both incredibly old. At 15 to 30 million years old, brown coal from Victoria's Latrobe Valley is the fossilised remnants of trees and ferns that once covered the region's grassy slopes.

Unlike the hard black lumps most people think of when picturing coal, brown coal looks and feels like damp, crumbly soil when it is first

dug out of the ground. That's because about two-thirds of the weight of newly mined brown coal is water. This high water content means that brown coal is too heavy to move cheaply, so it has to be burnt close to the mine site. Even then, large amounts of electricity go into drying it enough so it can be burnt. For all those reasons, brown coal is an inefficient, high-emission way to produce electricity.

Many more mines are found in New South Wales and Queensland, only they're digging out black coal. It is essentially the same as brown coal, but around 200 to 300 million years older. The extra time underground has allowed it to be compressed and heated, so that much of its moisture has been squeezed out. That's why black coal is more efficient to burn.

What brown and black coal have in common is that they're both largely composed of carbon; when burnt, that carbon combines with oxygen to form carbon dioxide, one of the major greenhouse gases. The trouble is that humans have never before released so much of our planet's carbon stores so quickly. It's one of the reasons why there are now such heated debates about burning coal and the future prospects for 'clean coal' technology.

How close are we to having 'clean coal'?

There are a lot of different terms bandied about these days to do with coal. There's 'carbon capture and storage', 'CCS', 'geosequestration', 'clean coal' and even 'NewGenCoal'. Some of them are scientific terms; others have been invented by PR companies trying to clean up coal's image. The constant name changes can make it baffling for anyone trying to get to grips with whether there really is a future for coal in Australia's energy mix, assuming we're serious about cutting greenhouse gas emissions.

The first thing to note is that many of those terms are nothing more than blatant greenwashing. Even if the technology to capture and store emissions from major coal-fired power stations can be scaled up to a commercially viable level, there is no such thing as 'clean coal'. At best, a coal plant with carbon capture and storage technology attached to it would only be expected to bury around 85 to 90 per cent of its emissions underground, leaving a sizeable chunk of emissions with nowhere to go but up into the atmosphere.

The second thing to look at is how carbon capture and storage (CCS) is supposed to work. On paper, one of the major CCS

approaches goes something like this: first, you build a power station that has the capacity to separate the carbon dioxide from the exhaust gases created from burning coal. Once separated, you compress the gas, then pipe it to where you can pump it underground to be stored in, for example, disused oil or gas reservoirs. (There are some other methods being explored, such as pre-combustion capture, a process that extracts the carbon dioxide before the coal is burnt—but after it has been chemically transformed into carbon dioxide and hydrogen—which avoids the tricky step of separating it from the other exhaust gases.)

But there are some crucial problems with these technologies that haven't yet been solved, starting with timing. At a time when all the science says urgent cuts need to be made, even strong backers of CCS concede we're still decades away from seeing commercial-scale power stations with CCS in Australia.

More than anything, the coal industry is worried about the economics of CCS. Coal's key advantage today is its low price, because the environmental and social costs of its pollution are not factored into its cost. One thing that no one disputes is that using CCS technology will drive the costs of burning coal much higher. As the Rudd government's own Global Carbon Capture and Storage Institute has found, the extra energy needed to capture, filter, compress and pipe the carbon dioxide is expected to raise the price of electricity from a power station with CCS by up to 78 per cent. Experts also predict that CCS power stations would also need to generate around a third more electricity to perform all the extra steps involved in the carbon capture and storage process. In other words, in trying to cut down emissions from coal, we would end up needing to dig up and burn more coal than ever before.

Who is paying most of the bills for carbon capture projects?

Another critical cost factor to bear in mind in relation to CCS is the need for long-term insurance. In principle, the vast majority of the carbon dioxide injected underground is meant to stay there for millions of years. But no private insurance company is interested in insuring CCS projects against any long-term risks, such as the risk of carbon dioxide leaking out. Once again, taxpayers are going to have to pick up the tab. Under the Offshore Petroleum and Greenhouse Gas Storage Act passed by the Rudd government in late 2008, taxpayers are now

liable to pay for any long-term leaks or problems at sites where carbon dioxide has been pumped underground.

There are also some important region-specific issues. Some areas, like Victoria's Latrobe Valley, are thought to have excellent potential for storing carbon dioxide in old gas reservoirs in the Bass Strait. That isn't the case for one of Australia's biggest coal-mining regions, New South Wales' Hunter Valley, where there are no known storage sites nearby.

Then there's the question of who is paying the most to develop the technology to be able to build commercial-sized power stations. The Australian Coal Association—which represents the biggest coal mining companies—says on its NewGen coal website that it recognises 'the urgent need' to generate power with fewer emissions, and that its members are committed to developing technologies like CCS to cut emissions from coal. The industry even has a decade-long Coal21 Fund, set up in 2006, to raise $1 billion to fund CCS and other 'clean coal' projects.

Although $1 billion sounds like a huge investment, when you look a bit more closely it soon becomes clear that it's less impressive than it sounds. That amount is being raised over a decade, and it works out to be only about 0.3 per cent of the industry's total revenue over that time. When challenged about spending so little on what is portrayed as an urgently needed technology, the Australian Coal Association hasn't denied that it's only a small percentage of its revenue, instead arguing that cleaning up emissions from burning coal is a shared responsibility. The industry says its current contribution to CCS funding is fair: industry picking up a third of the bill, leaving taxpayers paying for the remaining two-thirds.

How do we stop emissions from coal rising so fast?

Given the massive amount of greenhouse gas emissions currently being pumped into the atmosphere from our coal use, and the slow pace of developing CCS technology, it's becoming increasingly clear that it's time to start making some tough decisions about coal.

Long-time US government adviser and chief climatologist at NASA, Dr James Hansen, has been warning for years that global greenhouse gas emissions are rising dangerously fast, and that the only way to fix that problem will be by burning less coal. If you look at his track record on climate change, it becomes clear that Hansen's warnings are worth listening to.

Twenty years ago, many scientists were already seriously concerned about climate change. In 1988, the World Meteorological Organization and the United Nations' Environment Programme got together to set up an international scientific body to regularly assess and report on climate science: the IPCC. In the same year, the US Senate held hearings on whether climate change was something the government ought to be acting on, and Hansen was invited to provide expert testimony. What Hansen said at that June 1988 hearing reflected what a growing number of scientists thought, but weren't yet prepared to say in public just yet: that he was 99 per cent sure that 'the greenhouse effect has been detected, and it is changing our climate now'.

At the time, it was considered a shocking thing to say. But slowly the evidence mounted to back up Hansen's warning and by the late 1990s the scientific community had overwhelmingly come to the same conclusion as Hansen had more than a decade earlier.

In the last ten years, the science has become clearer, with real-world observations of melting glaciers and deadly heatwaves validating concerns that climate change is already hitting us harder and faster than previously thought.

Meanwhile, Hansen has moved ahead of the pack again. For the past couple of years, he has been calling for a ban on building new coal-fired power stations. His reasoning is that while emissions from coal-fired power stations continue to rise, the technology and economics of CCS that might be able to rein in these emissions remain unproven. He believes that when CCS is proven, and only then, could building coal-fired power stations with CCS be considered. Meanwhile, over the next decade, decommissioning of the most emissions-intensive coal-fired power stations should be planned.

A generation ago, Hansen was branded an alarmist for warning that climate change had become a reality. Until not so long ago, he used to get that same response when talking about the risks of building more coal-fired power stations. Not any more.

Who says that investing in burning more coal is risky business?

In 2008, three of the biggest investment banks in the US—Citigroup, JP Morgan and Morgan Stanley—announced that they were introducing new risk assessment standards, requiring companies wanting to borrow money to build a coal-fired power station to show that the power

station wouldn't become too expensive to operate in a lower-carbon economy.

The banks said it had become inevitable that the US Congress would eventually pass laws to limit greenhouse gas emissions, making coal and other fossil fuels more expensive to use. Bearing in mind that inevitable future carbon price, the banks said they considered it safer to invest their money in energy efficiency and renewable energy than investing in more coal-fired power generation.

It might sound like a radical message coming from major investment banks, but it was really just business as usual. Smart investment is all about managing risk. With the US moving to regulate and put a price on greenhouse gas emissions, just as the banks predicted, there is a growing long-term risk of a high-emission coal-fired power station turning into an unprofitable liability.

That economic risk has been a key factor in slowing down and even stopping the construction of many new coal-fired power stations in the US, with around 100 proposed coal-fired power stations being rejected by state governments across the US over the past decade. Similar decisions to slow down or stop new coal-fired power stations being built have been made in parts of Canada, Germany and the UK, at both a state and national government level.

Here in Australia, we've got a particularly big challenge ahead of us. Shutting down every coal-fired power station around the country overnight is not a practical solution, assuming you want to keep the lights on while tackling climate change. But neither is what we're currently doing, which is trying to protect the status quo for as long as we can.

At the moment, the distant promise of one day being able to burn coal with fewer emissions is being used as an excuse to stifle any real debate over what will happen if CCS or other 'clean coal' technologies turn out to be impractical or too expensive. It's a cross-our-fingers and hope-for-the-best approach to planning for Australia's future energy needs. That's a risky strategy, especially with something that affects all of our lives.

The truth is, for now and the foreseeable future, there is only one scientifically proven way to deliver the kind of steep reductions in rising emissions from coal that we need: to burn less of it. Achieving that will require a mix of solutions: from energy efficiency, to better managing demand for energy at peak times, to generating more energy closer to where it's needed.

What about the nuclear solution?

Going nuclear is an option that Australia considered back in the 1960s, when sites in Jervis Bay in New South Wales and French Island in Victoria's Westernport Bay were seen as possible sites for nuclear power plants. Apart from a shortage of local engineers and expertise, there are no serious technical barriers to stop Australia from going nuclear in the future. If we picked a site and the local community didn't object, in theory we could have our first nuclear power station up and running by 2025.

It sounds fairly straightforward in theory, but in practice it's much more complicated, starting with the need to find the right site. Several years ago, nuclear physicist Ziggy Switkowski headed a federal government review into expanding Australia's uranium production and starting a nuclear power industry. Switkowski described the ideal location for a nuclear power station as: close to major population centres, where there is a high demand for electricity, and close to a large, dependable water supply, because nuclear stations need massive amounts of water to keep their reactors cool. In other words, somewhere just outside a big city, and not far from a beach or river. It would be the mother of all planning battles.

Right now, the nuclear debate is just that—a debate only, with no prospect of becoming a reality in Australia. In fact, building a nuclear power station is currently illegal under federal law, and it's hard to see either of the major parties deciding it is worth the political pain to change that. For the sake of argument though, it's worth asking whether nuclear power could fulfil its promise of delivering low-emission electricity, and, if so, at what price.

How climate-friendly is nuclear power?

One of the biggest arguments in favour of nuclear power is that it's a low emission way of producing electricity. That argument is based on rough estimates of whole-of-lifecycle greenhouse gas emissions for different types of energy, which go beyond simply counting the emissions from generation to also factor in emissions such as the materials needed to build a power station or manufacture turbines.

The trouble with whole-of-lifecycle estimates is that the nuclear process is particularly long and complex, and not every step of the process—from digging up and processing the uranium, through to

using it in a power station, to disposing of the waste—can easily be accounted for.

For example, ever since the September 11 terrorist attacks, there have had to be some major upgrades in construction and extra security measures for nuclear facilities. Even in Australia, our only nuclear reactor—a research facility at Lucas Heights in Sydney's south-west—has been given added protection. The reactor now has a giant steel cover encasing the reactor that the facility's managers say has been designed to 'stop aeroplanes in their tracks'. Security has had to be bolstered all the way through the fuel cycle, from mining, milling, refining and transporting the uranium to its storage and disposal.

This additional level of construction and security, which no other form of electricity generation needs, increases the overall greenhouse gas emissions associated with going nuclear. Still, just because the whole-of-lifecycle figures are hard to draw clear conclusions from doesn't mean we should necessarily write off nuclear power. So let's assume that nuclear power is and can remain a relatively low-emission power source for the next few decades, and take a look at how the costs of nuclear power stack up.

How much would it cost to go nuclear?

In some ways, running a nuclear power station is not that different from running a big coal-fired power station: you boil water and the steam turns fan blades connected to a generator, which creates electricity. But the need for extra care in safely managing radioactive material means that even new nuclear power stations tend to be beset with long delays and cost blow-outs. A good example for Australia to consider is Finland, the first Western European nation to allow the construction of a new nuclear power station after the explosion at Chernobyl in 1986.

Finland's Olkiluoto 1.6 gigawatt reactor is set to be one of the biggest nuclear power stations in the world. Originally expected to cost €2.5 billion (around $A4 billion), its construction is now running several years behind schedule—and more than €2 billion ($A3.2 billion) over budget. The power station's construction has been plagued by a series of problems, including the discovery that the station's base had been made of poor quality concrete, had dodgy welding, used sub-standard steel in the cooling pipes, and the steel containment lining—needed to protect against radiation leaks—had almost 50 holes drilled in the wrong places.

It has since been even further delayed, among other reasons because of a belated decision to add an extra layer of protection against terrorist attacks with a large cover over the reactor, similar to the one now in place at Lucas Heights. Higher security costs are just one factor in why the costs of building the next generation of nuclear power stations are rising rather than falling.

In the US, home to a quarter of the world's existing nuclear power stations, energy companies have bluntly told the US government that they will only build new nuclear power stations with guaranteed multi-billion-dollar subsidies and an even more valuable promise that taxpayers would pick up most of the bill from any major nuclear accident. The upfront costs of building nuclear power stations and the potentially massive safety and insurance risks associated are so high that even major multinational companies are loath to take on the risk by themselves. But that's exactly what would need to happen in Australia to persuade any bankers to invest in a nuclear power station here.

Even according to the fairly optimistic Switkowski review, producing nuclear power in Australia would probably cost around 20 to 50 per cent more than producing electricity from burning coal at today's prices. Once that price gap begins to narrow after the introduction of a carbon price, the report conceded that extra government support—such as the massive subsidies and free insurance coverage agreed to in the US—would be a prerequisite for them to be cost-competitive. There are important historical factors to consider in how some countries, such as the US or France, have ended up with well-established nuclear industries. Nuclear power emerged in these countries as a product of major national military research, together with government-owned power companies, giving the nuclear industry access to essential subsidies. Those conditions don't exist in Australia today.

High upfront costs aren't the only barrier to nuclear power in Australia. All around the world, countries that built their first nuclear power stations back in the 1960s and 1970s are now grappling with the political and financial nightmare of safely decommissioning them. In the UK, the government's latest estimate of this decommissioning cost has climbed to more than £70 billion ($A126 billion), £22 billion more than initially thought. After 40 years of operation, the reactors are expected to take about 120 years to fully decommission. There then is also the uncertainty over the final cost of building secure burial sites for spent nuclear reactor fuel and other high-level waste, which remains radioactive for at least 100,000 years.

Few of the countries closest to opening a high-level waste facility, such as China, are forthcoming about these costs. In the US, the federal government spent more than 30 years and billions of dollars studying the Yucca Mountain site in Nevada to see whether it could ever be used to store high-level radioactive waste. After years of embarrassing revelations, including claims that scientists had fabricated data on how much water could seep through the mountain, President Obama ruled that the Yucca Mountain radioactive waste site would not go ahead.

One lesson Australia could learn from other countries is that when it comes to the price of nuclear power, it's safe to assume that the advertised cost and the final bill are likely to be very different. Given the high price we would have to pay to invest in such a high-risk technology, it's hard to see why Australia would choose to go nuclear. We have other choices, both from learning to be smarter about our energy use and from our extraordinary access to other energy resources. In the end, nuclear power is just not a practical or cost-efficient solution for powering Australia.

Why is producing power such thirsty work?

If we didn't have enough reason to overhaul Australia's energy system, there are another two more pressing problems to act on sooner rather than later: energy security and cost.

The first of these problems is that our power stations are already running dry. It's obvious why water shortages affect hydroelectricity plants like the Snowy Hydro. But many other types of power stations also require billions of litres of water to operate, mainly for cooling water. For instance, Victoria's coal-fired power stations are entitled to use around 125 billion litres of water a year, which is equivalent to a third of Melbourne's entire annual water use. In the past few years, many of Australia's major coal, gas and hydroelectricity generators have had to shut down or scale back their operations because they simply didn't have enough water. Coal and hydro are particularly vulnerable, whereas gas plants typically use far less water.

More work is needed to supply electricity with lower water use as well as lower emissions. For instance, a National Water Commission report found that if commercial coal-fired power stations ever do get built with carbon capture and storage technology, they could be between one-quarter to one-third more water intensive than at present. The report also said that water supplies could be a factor for where solar thermal and geothermal power generation could be built.

In case Australia does consider nuclear power in the future, it's worth noting it is a particularly water-intensive way to generate electricity. A nuclear power station typically needs at least as much water as a coal-fired power station and more often closer to double that amount. That's because, for safety reasons, nuclear power stations need to run at lower temperatures and pressures. Another water-related climate impact on nuclear power generation worth bearing in mind is that, as global temperatures continue to climb, warmer cooling water is becoming a real problem. During recent summers, several nuclear stations across Europe have been forced to shut down in the middle of peak demand periods in hot weather, because they can't operate using over-heated or reduced amounts of cooling water.

Here in Australia, climate impacts on our electricity infrastructure are a serious concern. And, according to the CSIRO, water shortages are only one of many climate impacts set to increasingly affect our electricity supplies. With hotter, less predictable weather on the way, more electricity would be lost in transmission on hot days; higher risk of bushfires means more danger of power lines going down and coal mines being set alight, as happened at Hazelwood in Victoria in 2007; and the heightened fire risk means that even more water will be needed to damp down coal pits to stop them spontaneously combusting.

Climate change is forcing Australian electricity companies to start valuing water in a way that they never have before. Many are now investigating expensive desalination or wastewater recycling projects, such as a $1.7 billion recycling project to supply Queensland coal power stations. Both for the sake of energy security and for economic reasons, water use should be treated as a critical factor in deciding what kind of electricity generation we invest in for the future.

What price will households pay for cleaner power?

Whenever the topic of climate change and energy comes up, there's one question everyone wants to know: are my bills about to go up? Here's the honest answer: yes, they are. In some states, they already have. But there's something you're not being told. For all the fuss about rising electricity bills, the price of electricity will actually rise even more over coming decades if we don't hurry up and overhaul our energy system, as well as our attitudes to electricity use.

That was the finding of a two-year project led by the CSIRO and involving most of Australia's biggest energy companies and energy users,

including Rio Tinto, BHP Billiton, Alcoa and Origin Energy. The project compared the effects of different energy policies out to 2050. Its conclusions were clear: strong, early action to transform Australia's energy sector will cost less in the long-term than delayed action. Further delays risk higher electricity bills, more frequent blackouts, and investor uncertainty that would prevent billions of dollars being spent on vital new energy projects. Even worse, we could end up wasting more money on more high-emission power stations that will become a growing environmental and economic liability.

Interestingly, the study and a range of others—including industry bodies directly representing big electricity generators—have also found that, though our household energy bills will rise, over the same period our wages are expected to rise faster. It's a finding that rarely gets reported in all the news stories about 'power bills to soar'. There's a whole range of reasons for this, but one of them is undoubtedly that bad news is usually easier to explain, and always makes for better headlines.

How long can our luck last?

In 1964, social researcher Donald Horne published *The Lucky Country*, a blistering critique of contemporary Australian society, the final chapter of which began, 'Australia is a lucky country run mainly by second-rate people who share its luck'. His main criticism was that, while other rich countries were making their own luck through innovation and smart leadership, Australia's prosperity was based almost entirely on the good fortune of having a wealth of natural resources.

Australia is still the lucky country when it comes to energy, and the ironic twist Horne gave to that phrase remains relevant today: the blessing of so many energy resources has also been a curse, because it has allowed us to be complacent.

Now we need to put our luck to better use. The potential we have to power our lives more efficiently and with fewer greenhouse gas emissions is enormous. Getting the right mix of policies and technology in place will be vital to cutting Australia's greenhouse gas emissions. The biggest challenge of all is to change our old attitudes to energy, which have allowed us to think that needlessly wasting energy is okay, that cheap electricity from burning fossil fuels has no hidden costs, and that how we generate our electricity doesn't matter, as long as our bills stay low.

Having recognised that our electricity use is significantly contributing to climate change, it's good that our politicians have finally started to

do something about it. Federal and state governments have rolled out some energy-saving programmes, while talking up the need to reduce emissions across the energy sector.

But we still need stronger action. Spending billions of dollars on household grants and a handful of larger solar and 'clean coal' projects is not the same thing as real, systematic energy reform. Real reform involves long-term policies, starting with getting serious about energy efficiency and introducing an effective carbon price for greenhouse gas emissions. If they're serious about climate change, our political leaders will have to make some tough decisions, including banning the construction of more old-fashioned coal-fired powered stations until it's clear whether the technology to bury carbon dioxide emissions is economically feasible.

Most books on climate solutions suggest that the best things you can do to cut greenhouse gas emissions from energy are to change your light bulbs, turn your appliances off at the wall and switch to GreenPower. What they often fail to mention is that you have a voice, a vote and a wallet. Those are powerful tools for change. Use them.

Support politicians, business leaders and environment groups with the courage to say we need to do more than phase out old-fashioned light bulbs; we need to phase out the highest-emission coal-fired power stations too. Later on, we'll look at how to ensure your views are being heard.

You can also make a difference in your home and workplace by finding out more about saving energy. For instance, getting an assessment of your home's energy and water use can reveal surprisingly easy ways to save more. In doing so, you'll be protecting yourself from future price rises.

Even if you work for someone else, you can ask if your company has performed an energy audit. Ask what they're doing to reduce their energy use. Ask what you can do to help. Some of the best ideas for workplace improvements come from employees, who can see the potential to do things better in their corner of the office or factory floor.

But before we get stuck into those building renovations, we need to take a detour to see how we can use less of another fossil fuel—oil—or else face paying a high price for our travel.

4

Beating the traffic

How to stay on the move while driving down emissions

Imagine being invited onto a game show where some contestants are guaranteed to win a prize worth $750,000. To compete for that money, there's no need to do anything embarrassing like sing and dance or be a trivia whiz. In fact, you don't even need to bother to enter this game, because it turns out that you, like every other Australian, are already a contestant. But before you get too excited, be warned: the rules of this game are rigged—and it's almost impossible to win unless you live in the 'right' part of town.

In this unofficial game of *Who Wants To Be a Transport Millionaire?* the biggest winners are people living in areas well-served by public transport. If you're lucky enough to be among them, chances are you're from an inner suburb of a capital city. As well as being only a short walk away from shops and schools, you probably have at least some choice between walking, cycling, or catching a bus, tram or train to work. That gives you the option of driving less or not at all, and the less car-reliant you are, the more money you stand to save.

Transport experts have calculated that owning one less car per household saves thousands of dollars a year. Take those savings and

invest them in superannuation, and by retirement the money you can save as a less car-reliant household is typically worth around $750,000. Add that to your existing superannuation contributions, and you could realistically expect to retire with a nest egg of well over a million dollars.

Having extra money in your pocket is not the only benefit of a less car-dependent lifestyle. Both globally and here in Australia, transport is now one of the biggest and most rapidly accelerating sources of greenhouse gases. Without tougher action, Australia's greenhouse gas emissions from transport are on track to climb nearly 80 per cent higher by 2020 than they were in 1990. Cutting our emissions will require action right across the country, including in regional areas where trucks loaded with road freight are a rapidly growing source of emissions. We also need to start taking more responsibility for the emissions we generate internationally, particularly from flying and shipping.

Within Australia's borders, our biggest climate challenge in transport is to beat the traffic where most of the greenhouse gas pollution is being generated, which is in our cities and suburbs.

It's easy to say that the best solution is for everyone to stop driving so much. But that's not always a practical solution, because in most parts of Australia driving a car is not just a lifestyle choice—it's the only choice there is.

Before we can start making major greenhouse gas savings, we'll have to invest some serious time and money in giving people better options for getting around. Those solutions include much better public transport, especially along the busiest routes in and out of town. A good train service is hard to beat for getting masses of people around easily, especially for daily commuting.

But we can't ignore the fact that most of Australia's cities have been designed around car use, which means cars aren't going to vanish from our roads any time soon. So this chapter will also look at ways to support a switch to lower-emission cars.

Even if climate change wasn't a problem, there are other reasons why we need to urgently tackle Australia's heavy reliance on cars and trucks. Being stuck in traffic is taking a toll on our time and health. Then there's the cost and availability of oil, which is set to play an increasingly influential role in setting the price of virtually everything, from our weekly grocery bills right through to where we can afford to live.

What price are we paying to be stuck in traffic?

It's early in the morning, but somehow you're already running late. Breakfast was what you grabbed on your way out the door, and you still haven't had your morning coffee. The radio is full of gloomy news, while the traffic reports sound even worse. It's just another long morning on the way to work.

Today, most Australians are not only putting in long hours at work, they are also spending longer getting there and back. For many people, it's become quite normal to lose at least two hours to commuting every day. Over a year, that adds up to more than a month of sitting in traffic—the equivalent of losing your annual holidays.

While we're losing time, many of us are making gains in ways that we aren't so happy about. More than half of Australians are now overweight. The problem isn't just about what and how much we're eating; it's also about how we're getting around. Over the past 30 years, there's been a 70 per cent increase in the number of cars being driven to work each day—and that heavy car dependence is having the unfortunate effect of making us heavier all round.

As experts warned at a recent federal government inquiry into obesity, without drastic changes in our sedentary lifestyles—including better urban planning to encourage people to walk and cycle more—we can expect to see an extra 700,000 people admitted to hospital in the next 20 years with heart attacks, strokes and blood clots. This is expected to cost our health system an additional $6 billion each year. And that's just one of the health problems that's closely connected to the way we get around.

Road traffic is the main contributor to air pollution in our cities, with children at particularly high risk of respiratory illnesses such as asthma. Thousands of them end up in hospital each year, joining tens of thousands of other people injured in road crashes, at a combined cost of more than $18 billion every year.

Then there's the road toll itself. Each year, around 1600 Australians die in road fatalities, taking an incalculable toll on surviving families and friends. Nearly 180,000 Australians have been killed on our roads since 1925—twice as many deaths as the combined Australian casualties from World War I, World War II, Korea and Vietnam.

While it's impossible to put an objective price on the human cost of so many lives cut short, there are ways to at least estimate some of the main economic costs of all those indirect health and social costs, together with other costs associated with road building and maintenance.

According to those government estimates, the hidden costs of road transport to Australia's economy add up to more than $30 billion a year. That's double the amount of revenue raised from road and fuel taxes.

That's all before you even start to think about climate change. Transport is one of the fastest growing sources of Australia's greenhouse gas emissions. On current trends, it won't be long before it's overtaken agriculture as the second-largest source of emissions in Australia.

Trains, trams, buses and rail freight combined account for less than a tenth of our greenhouse gas emissions from transport, and generate fewer greenhouse gas emissions per kilometre travelled. So when we're talking about emissions from the transport sector, the key problems to deal with are our cars and trucks. Whichever way you look at it, road transport is costing us more than we're told—and all the evidence says that the cost is set to climb even higher.

How will peak oil affect almost everything we do?

Peak oil—the point at which more than half of the world's readily available oil reserves are gone—used to be an easy issue to ignore. For decades, big oil companies emphatically denied that there was any sign of their supplies drying up. International energy organisations largely took those public denials at face value, advising national governments that it was a problem that future generations could worry about. That left most politicians free to dismiss peak oil activists as a bunch of cranks with too much time on their hands.

Those 'cranks' have turned out to be right, as the oil industry has finally been forced to admit. With global demand for oil growing faster than the rate of production, even senior executives from most of the major car and oil companies now openly acknowledge that the point of peak oil has either been passed already, or will be passed within the next decade.

Peak oil can sound a bit boring and academic, until you stop and consider how virtually every activity we do and product we consume these days has oil as one of its components. Petroleum is used in everything from toys, plastic bottles and bags, and synthetic clothing materials like nylon, through to pharmaceuticals, car parts and computer equipment.

But, for the most part, when we think of oil, we think about our cars. And the outlook for petrol prices is not good if your household is heavily car-dependent. While world oil prices have fluctuated down as

well as up over the past couple of years, the longer term trend for petrol and other petroleum products is absolutely clear: the only way is up. For that reason, the CSIRO has warned that global oil shortages could see petrol prices climbing to as high as $8 a litre within this decade.

Higher oil prices tend to go hand in hand with higher inflation; when inflation is rising fast, the Reserve Bank usually responds by raising official interest rates, which means bigger monthly mortgage repayments. House prices in areas with public transport nearby already command premium prices, and that gap in property values is set to grow further with rising petrol prices.

Rising oil prices also indirectly increase the cost of groceries, particularly fresh fruit and vegetables, because of all the oil-based chemicals used to grow them and the petrol needed for them to be trucked around the country.

Among the few positives to emerge from all the bad news is that some people have started switching to cheaper alternatives to get around, including public transport and cycling, cutting greenhouse gas emissions in the process. But that switch has been happening faster than our governments have planned for, and so in most cities public transport services are being stretched to the limit. It's particularly noticeable on many train lines, where carriages are packed beyond capacity at peak hour with frazzled commuters. Yet in some ways those train travellers are comparatively lucky, given the countless people living in outer suburbs with little or no public transport services at all.

Today, many Australians have given up on the idea of having fast, convenient, reliable public transport to get around. But it wasn't always like this. Not so long ago, many Australian cities boasted public transport services that moved more people around every day than today. If previous generations managed to get it right, what's stopping us providing better services now? Before we try to fix the transport troubles we have today, it's worth stepping back in time to see how Australia's biggest city gradually ran off the rails.

Why did Sydney run off the rails?

Sydney is a city haunted by ghosts. Although they mostly hide out of sight, you can sometimes catch a glimpse of them in unlikely places: lurking in parks, running beside racetracks, even popping up in the middle of busy intersections. These ghosts tell tales from the days before Sydney's streets became choked with bumper-to-bumper cars; before the

days of expensive private tollways; and before people began spending more time commuting than they spend with their own families.

These ghosts recall a different time, less than a century ago, when Sydney had a world-class transport system. At the heart of the system was Sydney's tram network, which was one of the biggest in the world, with three times more trams operating than Melbourne has today. Their tram network wasn't just big, either; it was fast. Trams used to rocket along Oxford Street at up to 80 kilometres an hour, faster than you can drive along there now. There was just one problem: too many people were reliant on them. By the 1920s, central Sydney was grinding to a halt during the morning peak, as tram after crowded tram banked up around the edges of the CBD.

Fortunately, one man saw the congestion problem developing, and came up with a plan to unlock the city's streets. Visionary government engineer Dr John Bradfield argued that Sydney urgently needed to electrify its suburban rail lines, create an underground city railway and link up people on the north and south sides of the harbour. Although it took a few years to get state parliament to back him, Bradfield's big ideas were finally approved in the early 1920s.

Within less than a decade, Bradfield's three big projects had all been delivered, including the iconic new link across the harbour, the Sydney Harbour Bridge, which carried trams, trains and cars. Bradfield's vision didn't end there: he also planned for and oversaw the building of more train tunnels than were needed at the time to enable the railway network to expand well beyond his lifetime, in the expectation that in the decades to come there would be a massive extension of rail out to the city's west, east and south.

Even as more people began switching to trains and cars, Sydneysiders still relied on trams to get around. Trams carried the crowds to Randwick Racecourse to watch Phar Lap thunder down the home stretch, and to the Sydney Cricket Ground to applaud Don Bradman as he notched up his hundredth century. They also remained the most popular way to go to the beach. The trip to Bondi was so famously fast that it spawned a local catchphrase: 'they shot through like a Bondi tram'.

But by the 1950s, cars were increasingly reshaping Sydney's streets. The National Roads and Motorists' Association (NRMA) lobbied fiercely to rip out the trams to make way for more cars, and eventually convinced the Labor state government of the day. Knowing they would face public opposition to taking trams away, the government was keen to cover its tracks fast.

The fate of the Pitt Street tram was typical of tram closures in the late 1950s. When the final tram clattered back to the depot around 1am on a Sunday morning, the overhead wires were pulled down within minutes, while the tracks were paved over only a few hours later. In 1961, exactly 100 years after Sydney got its first trams, the city's once world-famous tram network reached the end of the line. A few trams were sold, but most were stripped for scrap and then burnt in giant bonfires at the old Randwick tram workshop.

Today there are still fleeting reminders of Sydney's past, with glimpses of old metal tram tracks appearing like ghosts from beneath well-worn roads and near city landmarks like the Sydney Cricket Ground.

There are also lingering reminders of what might have been around the city's railway lines. At Wynyard train station, platforms 1 and 2 were once the final stop for trams crossing the Harbour Bridge. Today, the platform numbers at Wynyard start at 3, because after the trams were pulled off the rails platforms 1 and 2 were demolished to become part of the car park.

Meanwhile, at nearby St James station, there are hidden tunnels that were partially dug out back in the 1920s under Bradfield's visionary plans for a future expansion of Sydney's rail network. In the absence of visionary political leaders since then, the extension of train services to all corners of the city has been put on hold.

What happens when roads are all the rage?

Like other state governments in recent decades, successive New South Wales governments have had only one answer to Sydney's growing traffic snarls: build more roads. But rather than directly using government money, about a decade ago the appropriately named Carr government decided to enlist private companies to build new roads.

To entice the companies to invest, the government offered sweeteners in the form of generous tax breaks, payouts and promises to restrict future public transport along the road routes. The government refused to reveal many of the contracts' details, which were deemed commercial-in-confidence. Some of the secret deals have since come to light, including the Sydney Cross City Tunnel contract, which promised the private developers hundreds of millions of dollars in compensation if a future New South Wales government funded new bus or train services offering people a better option than paying the car toll.

With the traffic getting worse every year, Sydneysiders started to look like they might take their road rage out on the government at the ballot box. Finally, the then New South Wales Premier Bob Carr realised he was in trouble, so he asked world-renowned transport expert Professor Peter Newman to devise a Metropolitan Strategy, with the aim of turning Sydney into a more sustainable city over 25 years.

When Newman reported back, his conclusions echoed one of John Bradfield's messages from generations earlier: to keep Sydney moving, the government needed to not only expand public transport along existing routes but also to plan for the future by investing in new rail lines out into high-growth outer areas.

In his decade as Premier of New South Wales, Carr oversaw the building of huge new motorways while failing to do much about public transport. However, in one of his last acts before quitting politics, he announced $8 billion for a major expansion of train routes to the high-growth north-west and south-west of the city, as Newman had recommended.

No one was terribly surprised that the planned expansion never happened. Barely three years later, Carr's successor, Morris Iemma, casually dumped one of the key foundations for Sydney's Metropolitan Strategy by scrapping the $8 billion rail upgrade, instead promising a completely different, even more expensive, underground railway to be built as a public–private partnership. In doing so, Iemma wrought havoc with the best-laid plans of local councils, businesses and weary commuters. It's a pattern that continues to be repeated: grand plans for new public transport that attract lots of headlines but usually come to nothing. And, sadly, Sydney hasn't been alone in stuffing up its transport planning.

Has public transport fared better or worse outside the Harbour City?

Like many other cities across Australia, Brisbane once had a popular tram service. In its heyday in the 1940s, Brisbane's trams carried almost as many people as Melbourne's combined tram and train system does today. In 1969, only a few years after Sydney, the Brisbane City Council took all its trams off the tracks. It didn't take them long to regret the decision, with endless government studies commissioned since the early 1980s examining whether to bring trams back.

While Melbourne kept its trams, its public transport system has also suffered from chronic mismanagement. More than a decade ago, the

Victorian government decided that the only way to get better services for less money from Melbourne's run-down train and tram system was to privatise it. Today, Victorians are paying more than before privatisation to subsidise trains that have set new records for being late, cancelled and chronically overcrowded. They're paying more to catch trams without conductors, where the only staff you're likely to see are roaming packs of ticket inspectors. And they're paying more for a ticketing system that has run years behind schedule to introduce, blown its budget several times and is now costing well in excess of $1 billion.

Despite not building a new train line since 1930, Melbourne still has one of the largest train and tram networks in the world, thanks to the foresight of past city planners. That extraordinary capacity has been badly underused for decades: in 2008, there were fewer trains arriving at Flinders Street during peak hour than there were back in the 1960s.

Similar stories can be told about many cities and country areas right across the country. In most parts of Australia, there haven't been new train lines built since World War II.

As for the main alternative, buses, there has been some significant improvement to services thanks to new dedicated bus lanes. However, in too many places bus services remain slow and infrequent, often the result of bizarre funding deals with private bus companies based on kilometres covered, rather than on how many passengers they carry—meaning the companies get paid just as much for an empty bus as for a full one.

Fortunately, we are beginning to see some major reinvestments in public transport and bicycle paths. Many of those big spending projects are only just getting underway, so it's too soon to judge their success.

Federal governments have long left public transport for the states to worry about, while spending tens of billions on new roads—particularly in marginal electorates. So it was significant that, in 2009, the Rudd government began to address that problem by offering some funding for major public transport projects. Building better public transport is finally being perceived as a vote winner by senior politicians in Canberra, resulting in more money being spent on some much-needed extra services.

It's long overdue investment, because Australia's public transport services don't compare well internationally. Megacities such as London, New York, Tokyo and Moscow aren't the only places that put our services to shame; so do many relatively small cities of just a million people, such as Vienna and Zurich. If other countries have figured out how to run their trains, trams and buses so reliably that you can set your watch by them, why can't we?

How is a Tube full of Oysters helping to cut emissions?

When trains first rumbled through the London Underground, the city's streets were lit with gas lamps, the banks of the Thames were crowded with slums and horse-drawn carriages clattered over cobblestone roads. Almost 150 years later, today's London is neon-lit, shiny skyscrapers have replaced the slums and the horse-drawn carriages have made way for cars. Through all those changes, the trains in the Tube kept the city moving. But, as the oldest underground railway in the world, as well as the largest, it's hardly surprising that by the end of the 20th century the Tube—along with the city's buses—desperately needed an overhaul.

In the 1990s, Londoners had legitimate reasons to grumble about their public transport services, with patronage falling as more people got sick of catching clapped-out trains and buses. As more people got into their cars, the city's streets were grinding to a halt with gridlock. The worse all those problems got, the more fed up Londoners became and the more they complained; the more they complained, the more politicians got the message that it was time for serious transport reform, not just more tinkering around the edges.

In 2000, the change they were demanding began to happen, thanks to the combination of a new reformist mayor and a new central transport authority. Running on a platform of clearing the city's gridlock, Ken Livingstone—nicknamed Red Ken for his fiery temper, hair colour and politics—was elected as mayor of London. At the same time, a new integrated transport body called Transport for London was established and, importantly, was given responsibility for not only managing the city's public transport but also its roads. With a clear public mandate for stronger action and the power they needed to act, Red Ken and Transport for London didn't waste any time.

An average of £1 billion ($A1.8 billion) a year was spent on improving the Tube services and cleaning up the stations. Plans for a massive £16 billion ($A29 billion), decade-long expansion of the underground network were approved. Bus services were upgraded, putting 90 per cent of all Londoners within 400 metres of a bus route. Smartcard tickets, called Oyster cards, were successfully introduced, making it quicker and easier to get around. Ticket prices for students were cut. Bike lanes and footpaths were made safer. Information on how to get around without a car was made more easily available, such as by working in partnership with city employers on travel plans that showed staff how to avoid getting stuck in traffic.

As public transport services began to improve, Livingstone pushed ahead with a controversial solution first introduced in Singapore back in the 1970s: a congestion charge. Designed as a way to reflect the high but often hidden economic and social costs of road traffic—such as the loss of productive time, extra greenhouse gas emissions and the health costs of air pollution—the congestion charge meant that people driving into central London had to pay a price for adding to the city's traffic jams. Importantly, that revenue was then poured back into better public transport services and safer bike lanes and footpaths.

Initially, the congestion charge was hugely unpopular with drivers and many considered it so radical that they assumed the fiery mayor would be thrown out. They were wrong: the city's gridlock eased after its introduction, and Livingstone was voted back in for another term.

Most Londoners and even former critics, including Livingstone's Conservative successor Boris Johnson, were eventually won over, with the congestion charge still in place in the central city. Stockholm, Milan, Oslo and a number of smaller cities across Europe have also introduced congestion charges.

Since then, while the number of people travelling into central London every morning has continued to increase, the proportion of people driving in has dropped, stopping traffic jams from getting even worse. Bus patronage is back at levels not seen since World War II. Since 2000, the number of bicycle trips within the inner city has nearly doubled to more than 480,000 a day. As for the Tube, it's carrying a third more passengers than it did a decade ago, with more than one billion trips now made each year.

Most impressive of all, London's greenhouse gas emissions from transport only rose by 1 per cent between 1990 and 2007. In comparison, in a sprawling and more car-dependent Australian city like Melbourne, emissions rose 27 per cent over the same period.

Which city has inspired a cool new underground movement?

London's impressive performance is all very well, but they did start out with a lot of existing services to build upon, especially the Tube. What about a city without that kind of long-established infrastructure? To see just how much is possible in those circumstances, it's worth visiting India's bustling capital, Delhi.

Like a lot of capital cities in rapidly industrialising nations, Delhi is growing at an extraordinary rate, attracting hundreds of thousands of

new residents each year. Every boom has its downsides though, and for Delhi those have included worsening road congestion, slowing down the buses that carry most of the city's commuters.

Instead of simply trying to squeeze more buses onto already crowded roads, the city's planners came up with an ambitious alternative: to build a new underground railway network from scratch, with the aim of making it bigger and better than London's world-famous Tube.

The government-owned Delhi Metro opened in 2002, ahead of schedule and under budget, at a cost of $2.5 billion. In the first stage of construction alone, 59 stations and 65 kilometres of track were built. By 2020, the network will span a massive 414 kilometres, which would see Delhi steal London's claim to fame as having the world's biggest underground rail system.

But size isn't everything; giving people a good ride is the key to the Metro's success. Trains depart every three to five minutes, and the carriages are clean and air-conditioned, making them the best way to travel in Delhi's extreme summer heat.

Delhi's Metro is no poor imitation of the London Tube. Local design touches include a special sari guard on escalators to prevent loose clothing getting caught in the automated stairways. A runaway hit with Delhi commuters, the Metro has helped inspire a rail revival across the country, with almost a dozen Indian cities either building or planning underground railways.

How does it feel to travel as fast as a speeding bullet?

While Delhi and London can both boast impressive reinvestments in public transport, one city demonstrates better than any other why what we call public transport in Australia is better known as mass transit overseas. Every day, the equivalent of Australia's entire population catches a train in greater Tokyo. Home to more than 35 million people, Tokyo already has the world's biggest rail network. If the city planners there had failed to keep expanding their train network in the same way that most Australian cities have, by now Tokyo would have ground to a halt.

Instead, Tokyo continues to invest in new stations and train lines in anticipation of new demand. While some peak hour trips can be a tight squeeze, for the most part the Tokyo Metro deserves its reputation as one of the cleanest, safest, most reliable train systems anywhere in the world.

The option of getting around quickly and easily by rail isn't just confined to Tokyo's city limits. Back in the 1960s, the Japanese built the

world's first super-fast Shinkansen trains, nicknamed bullet trains, capable of zooming between cities at more than 300 kilometres an hour.

Rapid inter-city trains make business travel around Japan incredibly easy. Get up in the morning, catch a train into central Tokyo, switch straight onto a bullet train, work on your laptop while watching Mount Fuji whiz past, and, exactly two and a half hours later, arrive in Osaka, 550 kilometres away, right on time for a lunchtime meeting. It's a lower-stress, lower-emission way to travel long distances in comfort and style.

What are the secrets to living the fast life in a big city?

Compared to Australia's major cities, London, Delhi and Tokyo clearly have bigger, more densely packed populations, which make it easier to argue the economic and logistical case for investing in more frequent public transport services. But there are still invaluable lessons we can learn from them in how to keep cities on the move.

For a start, London, Delhi and Tokyo all demonstrate that large public transport systems can be well-managed and even built from scratch. Doing so requires long-term planning and sustained political commitment rather than the kind of short attention spans and constant revision of transport strategies that occur too often in Australia.

Having well-coordinated transport management so that all the timetables and services are properly integrated also makes a huge difference. After all, if Japan had fast inter-city trains but its suburban trains were always running late, the thought of catching public transport would be far less appealing than it currently is.

Excellent service can also be delivered outside megacities like London and Tokyo. In fact, some of the world's best-managed, most reliable public systems can be found in smaller cities, such as in the Swiss capital, Zurich, where only a few dozen people run the city's central transport authority, the ZVV, and where the trams, trains and buses really do run like clockwork.

The greater Zurich area—including its surrounding suburbs and towns—is less densely populated and more spread out than most Australian cities. Yet the area still manages to attract far more people onto public transport than we do here, with around a third of all the trips made in Zurich using public transport, another third by walking and a third by car. That makes them less than half as reliant on cars as we are in Australia's suburbs and cities.

If London and Zurich are such different cities, yet they're both managing to deliver better public transport, what's the shared secret of their success? One aspect of it is simple: accountability. In both cities, everyone knows who is responsible for getting the trains and buses to run on time: Transport for London and the ZVV. Contrast that with many Australian cities, where politicians and private companies seem to spend half their time squabbling over who is more to blame when the public transport system runs off the rails, and it's easy to see why Australian transport experts say that we need similar transport authorities here.

Long-term planning and accountable transport management aren't exactly the most exciting solutions to climate change that you'll ever hear about. But both are important if our goal is to end up with better-run, more reliable, more attractive public transport services as part of a broader plan to reduce transport emissions. And there are other examples of how long-term vision and planning can make a real difference, right here in Australia.

Which car-dependent city has found a smarter way to beat the traffic?

It's a frustrated commuter's dream come true. Imagine a new express lane suddenly opening up in the middle of a crowded freeway, where none of the usual road rules apply. There's no overtaking allowed down this express lane, but there's no need for it—on this part of the freeway, cars and trucks are not allowed to cut you off or get in your way. You can go a lot faster, too—even during peak hour, when the other lanes are jammed with traffic, you can safely speed along at 130km/h, without worrying about running into anyone else or getting booked by speed cameras. The best part is that you don't have to pay any tolls or extra charges for the express lane. Amazingly, choosing the express route will cost less than crawling along in traffic.

It sounds like a dream, but it's not. Welcome aboard the Mandurah to Perth train, which has been running down the centre of the Kwinana Freeway since the end of 2007. Its route was chosen deliberately, so that frustrated commuters have a daily reminder that there is a faster, easier way to get to work, without the stresses of being stuck in traffic and paying more for petrol. It's a visible statement of change in a city where, not so long ago, roadside signs on the outskirts of Perth used to declare: 'Your car is as welcome as you are'.

The revival of public transport in Perth began more than a generation ago. The turning point was a decision in 1979 by the then Liberal state government to close the Fremantle line and tear up the tracks to build a new freeway. But the locals refused to give up on their train without a fight and launched a dogged community campaign that saved the tracks. In the process, their campaign showed the Labor opposition that there were votes to be won in speaking up for public transport. Four years later, there was a change of state government. The new Labor government not only reopened the Freo line, but also started to reinvest in building new train lines.

How much has Perth done to change directions?

Over the past two decades, Perth's public transport services have changed for the better. A new transport planning authority, Transperth, was set up to run and be accountable for all the city's train, bus and ferry services, similar to the authorities operating in London and Zurich. New underground train stations were built in the central city. Bus routes were upgraded. In a bid to change people's travel habits from an early age, student ticket prices were slashed to 50 cents. Despite opposition from the roads lobby, the government approved plans to double the size of the city's small railway network, including the 70-kilometre Perth to Mandurah line.

In a stunning reversal of decades-old spending priorities, the Western Australian government began spending around five times more on public transport than on roads, while also revising old plans to keep endlessly expanding freeways. It made for a stark contrast with transport funding in other states.

The reinvestment in Perth's public transport has since paid dividends. Passenger numbers have doubled over the past decade and are on track to double again, with half a million more trips made on public transport in January 2008 compared with the year before.

Having seen Labor pick up votes from more pro-public transport policies in the 1980s, the Liberal opposition of the time conceded it had been wrong to close the rail line. Since then, many of the changes in the city have been at least broadly supported by both major parties. Even after a change of government and a slowdown in the state's economy, there are still plans underway for further rail expansions over the next decade. But the true credit for the shift in politicians' attitudes to public transport really belongs to the community, particularly the local

campaigners who inspired the change in transport policy by refusing to give up on getting their train back.

In many ways, Perth had more potential for rapid change than other, older capital cities, especially because it didn't have many rail lines to begin with. While a lot has been achieved there in a generation, Perth still has more work to do to improve its public transport. Even today most people in Perth are still heavily reliant on their cars.

So Perth is not only an example of the potential for change—if you build it, they will come, as the Mandurah line shows—but also of the challenges and hard work we face in trying to make those changes. Having spent decades pouring most of our money and effort into creating heavily car-dependent cities, it isn't realistic to suddenly ask everyone to leave their cars at home and jump on a train. In many places, we still need to build a local train line or bus stop to use first. But at least if we recognise the need to change our priorities and invest in better infrastructure to make public transport the faster, cheaper, and more convenient way to travel, we'll finally be heading in the right direction.

Who should we listen to for advice on where to go?

Perth hasn't been alone in taking some steps in the right direction on transport. Brisbane has a growing network of car-free busways, making it quicker and easier to get around the inner city. The city council is also adopting a Paris-style bicycle hire scheme, as well as investing $100 million on new bikeways by 2012.

In central Victoria, the historic goldfields city of Bendigo is embarking on a makeover of the city centre's design and road rules. It's part of Bendigo's plan to learn from pedestrian-friendly European cities, so that people can get around more easily and more safely on foot. Further south, in the coastal town of Warrnambool, the bus operator commissioned a study into how it could best help disadvantaged people in the area by improving services. The study found that many potential passengers—particularly students, the elderly and people working early-morning shifts—couldn't catch a bus even if they wanted to, because the services didn't run when and where they needed them. With extra funding from the state government, the Warrnambool Bus Company began delivering extra services, while working more closely with local schools, businesses and the university to ensure its services match the locals' needs.

Too often, state governments and the people running public transport networks fail to start with that most basic step: to ask us, their customers, what services we need to get around. Alternatively, sometimes when they do bother to go through expensive consultation processes, they simply ignore the findings unless the results match what they want.

A classic example of this occurred nearly a decade ago, when the Victorian government was preparing a grand plan to create a more sustainable Melbourne by 2030. Its consultants sought the views of a cross-section of Melburnians, and, of the 1500 people they talked to, fewer than ten nominated bigger roads or more freeways as their priority. The rest asked for better, more reliable public transport, as well as safer footpaths and bike paths.

When the Melbourne 2030 strategy was released, there were plenty of grand promises about improving public transport. But it wasn't long before those promises were quietly shelved. In contrast, the plans for new roads and privately-operated freeways—which had been given far less prominence in the strategy—went ahead as planned. A decade on, there are now dangerous levels of overcrowding on the city's trains, while the traffic snarls on the roads keep getting worse.

The moral of the story for state governments and private transport providers should be clear: ask people what they want and act on it, as they've done in Perth and Warrnambool, and you get happier passengers. Ask people but then ignore what they say, and everyone pays the price.

It's a lesson we're yet to learn on a national level. For one final example of a short-sighted transport decision that Australians have reason to regret today, look no further than the tale of the very fast train that never showed up.

Why is Australia's very fast train running so late?

Unlike Japan's punctual trains, the very fast train linking Sydney to Melbourne is running seriously late. First proposed in 1984 by CSIRO chief Dr Paul Wild, the plan was to build a fast train line between Sydney and Melbourne via Canberra, modelled on France's slick Train à Grande Vitesse (high-speed train) network, or TGV. Australians loved the idea, and the federal Labor government commissioned countless studies into how it could be done. But when it came time to give the green light for construction, the government stalled on a final decision.

Years passed, until at last, under a new Coalition government, the fast train looked like it would finally get on track. In 1998, John Howard

announced that the Speedrail consortium—including Australian developers Leighton Holdings and French engineers Alstom, which had built the TGV—were the winning bidders to build a fast train from Sydney to Canberra. Howard hailed the fast train as 'a nation-building project', declaring that the trains would rival planes as the best way to travel to and from the national capital.

The Speedrail consortium was already a step ahead of the government, drawing up plans to extend the fast trains on to Melbourne and Brisbane. Construction was set to start in early 2000, with the first trains due to run in October 2003. If all had gone to plan, the Melbourne extension could have started being built as early as 2005. Yet, barely two years after Howard's triumphal announcement, the government ditched the fast train, unwilling to chip in its $1 billion share of the project's cost.

In the quarter of a century since Dr Wild's Australian proposal, France's TGV trains have carried nearly two billion passengers, while two-thirds of people travelling between London and Paris now choose to do so on the high-speed Eurostar train. Very fast trains are also luring passengers out of the skies, forcing budget airliner EasyJet to abandon its Paris–Marseilles route. It's not hard to see why people prefer the train: sipping wine in the buffet car as the French countryside glides past at 300km/h, the sleek, aerodynamically designed TGV carries passengers right into the heart of Paris and Marseilles, avoiding the usual pre- and post-flight trek between the airport and the city.

It's a similar story across much of Europe. Spain alone has rolled out more than 2000 kilometres of high-speed rail tracks over the past decade, with plans to extend its network five-fold over the next decade. If that eventuates, around 90 per cent of Spaniards would live within 50 kilometres of a fast train station.

Internationally, very fast trains are now operating or being built on every major continent—Africa, Asia, Europe and the Americas—except for Australia. In Argentina, a 710-kilometre high-speed rail corridor will slash the travel time between Buenos Aires and Cordoba from 14 hours to just three. In Vietnam, more than 1600 kilometres of old tracks from the northern capital of Hanoi down to Ho Chi Minh City are being re-laid so they can carry Japanese bullet trains. China had its first fast-rail services running in time for the 2008 Olympics, and is now constructing dozens more lines. In the US, President Obama is starting his high-speed rail plan by spending $US8 billion ($A9 billion) on upgrading ten rail corridors, which will provide an alternative to flying on busy airline routes such as Washington DC to Florida.

As for the company that wanted to build Australia's fast train, Alstom, it's been busy developing an even faster version of the TGV trains. Capable of speeding people to their destinations at up to 360km/h, the new models will make it possible to travel 1000 kilometres in around three hours.

Meanwhile, here in Australia we're still stuck with old diesel trains, which take 11 hours to crawl between Sydney and Melbourne, run only twice a day, yet still cost as much to travel on as a plane.

Is it worth trying to get fast trains back on track?

Most people assume that the only reason Australia hasn't built a very fast train network connecting our major cities is size: we're a big country, with a relatively small population, so it's reasonable to assume that there simply wouldn't be enough passenger demand for those services, even between Sydney and Melbourne.

That assumption is wrong. Believe it or not, there is so much demand for travel between Sydney and Melbourne that it's the fourth-busiest air route anywhere in the world, carrying more than half a million passengers every month. That's obviously bad news for climate change, because it means we're generating a lot of emissions from our interstate travel. It's also bad news for frustrated travellers. The lack of alternatives to flying, combined with Sydney's already overstretched airport services, means that the number of flights delayed or cancelled in or out of the Harbour City continues to rise each year.

We shouldn't just be laying tracks between Sydney and Melbourne either. Just as very fast train networks continue to expand overseas, the network here could also be connected to other cities such as Brisbane and Newcastle.

More than two decades have passed since the first proposal to build a fast train line from Sydney to Melbourne via Canberra. The only advantage of having stalled this long is that there are now even more companies with proven records of building fast trains, including Leighton Holdings and Alstom, two of the companies prepared to start construction here years ago.

Does flying really cost the earth?

At first glance, it might seem hardly worth the effort to cut Australia's greenhouse gas emissions from flying. According to the federal

government's official greenhouse gas accounts, flights around Australia contribute less than 1 per cent of our national emissions, or around five million tonnes a year. As the aviation industry is keen to point out, today's passenger jets are 70 per cent more fuel-efficient than planes built 40 years ago, while the next generation of planes such as the Boeing 787 Dreamliner can fly more people with less fuel per person. Based on all that, it might seem that flying is too small an issue to bother worrying about.

But as we saw in chapter two, official greenhouse gas accounts only tell part of the story. When it comes to transport, there are holes in those accounts big enough to fly a jet through.

Australians have a well-earned reputation as seasoned globetrotters, flying overseas to visit bazaars and beaches in every part of the world. Yet when you board a flight from Perth to Phuket, the greenhouse gas emissions produced en route aren't added to either Australia or Thailand's official greenhouse gas inventories. In fact, no country in the world currently accounts for the greenhouse gas emissions racked up by their citizens through international plane travel. It's as if thousands of ghost planes are criss-crossing the earth every hour, whose contribution to climate change isn't a problem any nation has to tackle. This accounting problem doesn't only affect aviation: it's the same with global shipping.

How much do Australians contribute to climate change through our international travel? At the moment, no one knows. There are also only vague figures for the global impact of aviation. A decade ago, the IPCC came up with a rough estimate that aviation was responsible for around 3.5 per cent of global climate change. It's clearly well below other contributors to climate change, such as burning coal—but the trend in aviation emissions is a real concern.

The airline industry is banking on global passenger numbers doubling between now and around 2020, accompanied by big increases in air freight. That may not happen: if fuel prices keep climbing or a carbon price for the flight's greenhouse gas pollution is added on to the ticket price, then growth in demand for flying is expected to slow. But if current rates of demand continue as the IPCC suggests, aviation could be contributing as much as 15 per cent of global greenhouse gas emissions by 2050.

How can we stop aviation emissions from soaring?

Although new planes are capable of much greater fuel efficiency and lower emissions per passenger, the typical lifetime of a plane can be

30 years or longer. So it's going to take many years for all the older planes to be retired and replaced.

In the meantime, there are things that the airlines can do to reduce their emissions, starting with one obvious solution that many have quietly adopted in recent years to protect their profits: flying more slowly. The faster you go, the more fuel you burn, so when fuel prices have soared, airlines including Qantas have responded by flying a bit slower to cut down their fuel bills. Other airlines, including Virgin, are trying other measures, including working with air-traffic control to spend as little time as possible taxiing around before take off or circling in the skies before landing, both of which also save on fuel and emissions.

Yet, as the industry itself concedes, there's no sign on the horizon of new super-planes or fuels that will allow people to jet around the world at high speeds without producing large amounts of greenhouse gas emissions.

Unfortunately, for a country like Australia—girt by sea, and lots of it—we don't have many travel alternatives. Flying is the main way for Australians who need to get out of the country for work or who want to see the world, as well as for tourists to visit us. Still, we can't afford to keep pretending that our international travel doesn't have any impact: the cost of flying does need to rise to include a carbon price for the pollution that we're producing. It's going to happen, whether we like it or not: from the start of 2011, emissions from all domestic and international flights between European airports will attract a new greenhouse gas levy, to be extended to all international flights flying in or out of the EU from 2012.

At an individual level, cutting back on air travel is often the single quickest way to cut your personal carbon footprint. Humans have only been flying for about a century, with commercial flights only available for half that time. Is it really such a big ask to opt more often for a holiday lying on an Australian beach rather than flying over to Bali or Fiji?

What will make an even greater global impact would be to bring in a carbon charge in the fares we pay, as the EU is doing. The UK government has proposed that the money raised from that kind of carbon levy on flights could be used to collect much-needed funds for emission-saving and climate adaptation projects in poorer nations. It's a fair solution, because only people with enough money to fly would be paying the levy. It's also a solution that could go some way towards resolving a major sticking point at international climate talks, to do

with global equity—the fact that a relatively small number of people and nations are generating a much higher proportion of emissions than people in the rest of world.

In the meantime, we should be doing everything possible to minimise the need for domestic air travel. Among the solutions we need is to make better use of technology to cut down on business travel. One example of that is a Rudd government initiative to link Parliament House in Canberra with an office in every state and territory, using a video-conferencing system already used by Telstra and some other large businesses.

At a cost of around $6 million to set up and then $4 million a year to run, the new system involves building identical meeting rooms, centred around a large table and a large video screen, so that the people on the video screen look like they're sitting on the other side of the same table. The government's goal is to slash the number of interstate flights it approves, with the potential to save more than $250 million a year in travel expenses, while also saving thousands of tonnes in greenhouse gas emissions. As that kind of technology continues to improve, we can expect to see more businesses using video- and internet-based conferencing facilities in coming years.

What's the main driver of our growing transport emissions?

When it comes to transport emissions, our biggest problem is on our roads. Nearly 90 per cent of Australia's official transport emissions come from the exhaust pipes of cars and trucks, which together produce around 75 million tonnes of greenhouse gases each year. Buses and motorcycles barely register in comparison, producing less than a couple of million tonnes between them, or about as much as all the trains running around the country. Out of all of them, cars are doing by far the most damage, pumping out more than 45 million tonnes each year and rising.

On the one hand, it's not surprising that cars are such big contributors: there are now 12 million vehicles on the road, nearly one for every Australian of driving age. What's more surprising is the fact our cars produce so much more greenhouse gas pollution than in many other countries.

Just compare a typical car sold in Europe and one sold in Australia from a couple of years ago. A typical European car averaged 161 grams

of greenhouse gas emissions per kilometre driven, while the Australian average was 226 grams. It may not sound like much of a difference on that small scale, but it is a difference that can add tonnes of extra emissions for every car.

What's even worse is how little improvement there has been in fuel consumption in most of the cars for sale. Despite the barrage of advertising about how 'smart' and 'green' new cars are these days, the truth is that we're not using any less petrol to run our cars than people were way back in the 1960s. Unlike the ads, the numbers don't lie: in 1963, the average fuel consumption was 11.4 litres per 100 kilometres; in 2006 it was exactly the same.

Although we have the ability to make our cars much more fuel-efficient, we've been giving away those efficiency gains by buying bigger, heavier cars. Some of the extras weighing down today's cars have been good for us, particularly safety features like air bags. Much of it is just for show though, ranging from in-built DVD players and bigger engines to super-sized designs that many people buy thinking they'll be safer, not realising that many four-wheel-drives are at greater risk of rollovers because they have a higher centre of gravity. The end result is that we're not only producing more greenhouse gas emissions than necessary from our cars, but we're also paying more for petrol to fill them up.

Who keeps killing off more efficient car standards?

Car and oil companies have the strongest financial incentives to sell us ever bigger and more powerful cars, because there's more profit to be made from doing that than from selling compact, more efficient cars. With that in mind, it's not surprising that many global car and oil companies have been found to have quietly funnelled millions of dollars to 'sceptic' groups, whose campaigns have obfuscated and delayed action on climate change.

It's not the behaviour you'd hope for from responsible global companies—but then, who wouldn't expect them to be anything but ruthless in fighting to protect their interests? After all, company executives are legally obliged to maximise dividends for their shareholders. As former Shell chief executive Jeroen van der Veer has said, it's unrealistic to expect industry to make moral decisions about acceptable levels of greenhouse gas pollution—that's a decision for governments to make.

The trouble is, when governments opt out of making those kind of tough decisions, we end up paying a high price in the form of greenhouse gas emissions and rising petrol bills.

How did cheap petrol become so expensive?

While petrol costs have fluctuated wildly in Australia over recent years, one thing has remained constant: by world standards, Australians pay relatively little for fuel. You'd never know it from the constant complaints from local car-lobby groups, but fuel prices here are the fourth lowest among OECD nations, behind Mexico, the US and Canada. This is mainly because we pay less than half of the average tax charged for fuel elsewhere—which may sound like a good thing, until you see what studies conclude about the long-term impact of low fuel taxes.

Over the past 30 years, people living in countries with relatively low fuel prices—Australians, North Americans and Canadians in particular—have ended up driving the least fuel-efficient vehicles. In contrast, in places where fuel costs more at the pump because of higher taxes, such as Japan and Europe, people are demanding, and being sold, more fuel-efficient cars.

Although it might sound counter-intuitive, people living in countries with higher fuel taxes typically spend less on petrol than we do in Australia. That's because while they're paying more per litre, the higher costs encourage them to drive more fuel-efficient cars, meaning they use less petrol and pay less overall. Higher petrol prices also keeps the pressure on politicians to provide better alternatives to driving, forcing them to invest more in trains and buses. It's a key reason why public transport in Europe and Japan is generally light years ahead of what we have here.

So beware of politicians promising to 'help Australia's working families' by doing things like cutting the fuel excise to counteract the effect of the proposed Carbon Pollution Reduction Scheme, as the Rudd government was pressured into doing. It's yet another compromise that delays an inevitable shift to more fuel-efficient forms of transport in Australia. It also leaves our entire economy more vulnerable than many others to fluctuating global oil prices.

Cutting fuel excise isn't the only government policy in Australia that is seriously undermining our national efforts to cut greenhouse gas emissions. There are other astonishingly counterproductive policies that make climate change and traffic jams even worse, like the fact that we're paying people to get stuck in traffic.

Why are we giving people tax breaks to drive more?

Like most Australians, Richard and Susan are worried about climate change and the environment. They've done all sorts of things to reduce their emissions at home, including changing all their light bulbs, taking shorter showers and putting in a water tank to reduce the amount of mains water they use.

But when it comes to transport, they have a big problem. It's not just that they drive a lot; it's that they deliberately go driving for no other reason than to push their odometer higher, despite knowing that it generates tonnes of extra greenhouse gas emissions, wiping out the emissions savings they make at home.

In some years, Richard and Susan have worked especially hard at driving a lot further than they wanted to go. Over four exhausting weekends in March, they clocked up more than 4000 kilometres in day trips from their family home in Melbourne's outer eastern suburbs to towns across Victoria. They'd get up, drive for three hours, get out at towns like Benalla and Bendigo for a coffee, then get into their car to drive back again. Other years, they've made up the extra kilometres with driving trips to New South Wales and South Australia, when they would have been just as happy to go somewhere closer to home.

As strange as it sounds, in dollar terms Richard and Susan would have been crazy not to drive that much. Under what has to be one of the loopiest tax schemes ever devised, the more people drive their salary-packaged car, the less fringe benefits tax (FBT) they pay. Cars travelling fewer than 15,000 kilometres a year are taxed at 26 per cent; if they reach 25,000 kilometres, the tax rate plummets to 11 per cent; and for those covering more than 40,000 kilometres, it's only 7 per cent.

Richard and Susan's extra driving keeps their odometer ticking over 25,000 kilometres each year, earning them an extra $2500. 'All things being equal, I'll try to make environmentally sustainable choices, and sometimes even when it's slightly more expensive we will choose the greener option anyway,' Richard says. 'But the way the tax system works, all the incentives are for you to drive more—and we're not so flush with cash that we can knock back an extra $2500.'

The Melbourne couple is far from alone in making that choice. When one of their friends realised that he hadn't been keeping up with the extra driving needed to fall into a lower tax bracket, he took his family on a driving holiday to Queensland. A recent survey showed just how widespread the problem has become, finding that at least a fifth of

people claiming the tax break were going out of their way to rack up extra mileage in order to be taxed at a lower rate.

Those drivers are not put off by rising fuel prices, because running costs like petrol are typically covered under the car leases. So, unlike other motorists, most people with salary-packaged cars have no incentive to avoid filling up as often as they like. As for why employers don't offer similar salary-package deals for public transport tickets, that's because doing so would incur the maximum FBT rate of 48.5 per cent.

Around half a million cars on Australia's roads today are being subsidised under the FBT scheme. We're not talking about small change to help poor people, either. The subsidy costs taxpayers $2 billion-plus every year, and the extra cash largely ends up going to people earning $125,000 a year or more.

Some transport experts estimate that about half of the cars on Sydney's roads during peak hour are FBT-subsidised company cars. What makes it even worse from a greenhouse gas perspective is that virtually all of those company cars—including those leased by most state and federal governments—are high-emission V6s and V8s. The Institute of Chartered Accountants, environmentalists, insurance companies and welfare groups have all been calling for an end to these tax breaks for years, pointing out how stupid it is to be paying people to drive more than they want to, which just makes road congestion and greenhouse gas emissions worse. That's why it's called a 'perverse' incentive—and there are lots of other payments just like it.

How many other perverse loopholes are lurking in our tax system?

If you think that paying people to drive more than they want to is crazy, it gets loopier. An even more expensive perverse incentive is the fuel tax credits scheme, which costs us more than $4.9 billion a year. This tax break is intended to reduce fuel costs for high-use industries, such as the trucking and mining industries. All up, more than half of the money collected goes to large mining, forestry and transport companies including BHP Billiton, which isn't exactly cash-strapped. In 2008, BHP Billiton announced another record profit of $18 billion, yet it was still eligible for tens of millions of dollars in fuel subsidies from Australian taxpayers. The Rudd government decided to not only retain the scheme, but also to go ahead with a Howard-era plan to extend the tax credits to industry use of unleaded petrol.

Then there's the fact that for the past decade, people buying four-wheel-drives have paid only half of the import tax charged for other foreign-made passenger cars. In theory, this tax break was to help farmers buy all-terrain work vehicles. In practice, it's a key reason behind the huge growth in the number of four-wheel-drives on suburban roads.

Then there is the freeze on the fuel excise rate, which had traditionally been linked to the rate of inflation so that the tax on petrol matched the rate of growth in the economy. That link to inflation, known as indexation, was dumped in a panic by the Howard government in 2001, early in an election year when its popularity was suffering over introducing the GST and rising petrol prices. While the cost of just about everything else we consume has risen roughly in line with inflation since then, the tax rate for fuel hasn't budged—so, in real terms, the taxes we pay on fuel have actually fallen by more than $3 billion a year.

Some states and territories have traditionally offered local fuel subsidies, although Queensland recently scrapped the most expensive state rebate scheme, which will save the state's taxpayers more than $2.4 billion in just four years.

There have also been tax cuts in recent years for aviation fuel, which has been another $900-million drain on the federal budget.

It's a strange way to help Australians adjust to the reality of being part of a world where oil production is not on track to keep up with future demand. It's like deciding to get fit but then spending the day lying on the couch, binge eating, and telling yourself that you'll do something tomorrow. At some point, if you want to get fit, you've got to get off the couch. Similarly, the longer we put off adjusting to higher fuel prices, the harder we're making it for ourselves in the long-term.

Where can we find more money for better transport?

If you start to add up the costs of all the counter-productive federal and state government subsidies for fuel use alone, it's not long before you're looking at a bill of billions of dollars a year. For all the claims of tight budgets and not having the money to spend on improving public transport, the truth is that there is a surprisingly large pot of money available—it's just being spent on populist, short-term giveaways, rather than investing for the long-term.

Australia is not alone in offering billions of dollars a year in subsidies for high-polluting transport. One international study estimated that

during the mid-1990s, about $US225 billion or 0.85 per cent of the world's total economic activity was spent on transport subsidies, most of which was known to result in higher greenhouse gas emissions. The International Energy Agency has said that eliminating fuel subsidies could cut global greenhouse gas emissions by around 12 per cent by 2050. Both globally and locally, it's not in our interests to keep being so perverse. We just need governments to show a bit more spine in taking on big companies, as the Rudd government did on one issue in the lead up to its first budget.

In 2007, the Rudd government was desperate to find cost savings to fund its promises on tax cuts. So the Treasurer's advisers were unusually receptive when non-government organisations including GetUp and the Australia Institute pointed out that oil companies had been enjoying a 30-year holiday from paying any tax on the extraction of a light crude oil known as condensate.

The tax break on condensate was originally introduced back in the 1970s as an incentive to develop gas fields in the North West Shelf, located off the coast of Western Australia. With oil and gas prices far higher than they were in the '70s, and with the North West Shelf having since become Australia's biggest resource project, there isn't much argument for the tax break anymore. By simply removing the old tax break, the government raised an extra $2.5 billion over four years. Although the big oil companies involved complained bitterly about it, three decades of tax-free earnings on condensate doesn't seem to have been such a bad deal for them.

If we did the same thing with even a few of the perverse transport incentives we've looked at, it would free up billions of dollars to invest in ways to help Australians get around more easily, while producing fewer greenhouse gas emissions.

How much is an Australian-made 'green' car really worth?

Australians have been extraordinarily generous to foreign car manufacturers. Through a host of federal grants, state government funding and other industry protection measures, foreign-owned companies building cars in Australia have long been subsidised to the tune of more than $1 billion a year—which works out to around $17,000 a year for each of their Australian employees. A small business owner can only dream of having the government subsidise their profits like that.

Now there's a new way for us to give even more to the car companies. It's Rudd's 'New Car Plan for a Greener Future', and it's going to cost Australian taxpayers $6.2 billion over the next decade, including the $1.3 billion Green Car Innovation Fund. This fund is supposed to encourage Australian companies to invest in research and development and to commercialise technologies that significantly reduce the fuel consumption of cars over the next decade. If you believe the press releases, it's a smart way to tackle climate change. But on closer inspection, it doesn't take long to see that it's not; it's really just another thinly disguised bailout package for foreign car companies.

As the government's own Productivity Commission has pointed out, pouring money into locally built green cars is unlikely to either lead to technology breakthroughs or reduce greenhouse gas emissions: 'The Green Car Innovation Fund will likely encourage some buyers to switch from taxed, more efficiently produced imported hybrid and fuel-efficient vehicles to subsidised, higher cost, locally-produced ones—without markedly increasing green car sales overall.'

In other words, scrape away the greenwash and you'll find that the 'green' car plan is not really intended as a climate change solution: it's just another massive car industry subsidy.

Australia has spent decades building a small number of big cars, and it's unrealistic to think we could suddenly turn around and compete with bigger countries in mass-producing small, low-emission cars. If you want to buy the lowest emission car on the market, there are already plenty of models available that produce fewer emissions than the proposed new locally assembled Toyota Camry petrol-electric hybrid, which was the first car to win funding through the green car fund. Unfortunately, it doesn't make sense to try to buy Australian-made if the local product simply isn't as good.

What was even more embarrassing was that Toyota, the world's most profitable car company, said that it had already decided to assemble the Camry sedan in Australia before it was handed $70 million from the federal and Victorian governments. Toyota's then president Katsuaki Watanabe even acknowledged the company's surprise at being given the cash, saying 'we are not sure how we will use it'.

Most economists agree that it's hard to see car manufacturing surviving in Australia in the long-term. We need to start asking whether we can afford to endlessly subsidise the industry like this, and instead consider what other industries might offer more secure job prospects for the 68,000 Australians currently working in the car industry.

Is anything being done to cut greenhouse gas emissions from our cars and trucks?

Unlike the green car fund, there are some federal government schemes that have started delivering greenhouse gas reductions, mainly by targeting emissions from driving. There's the Environmental Strategy for the Motor Vehicle Industry, which includes voluntary targets agreed on by the local car industry to improve average fuel efficiency.

Then there are the Government Biofuels Measures, mandating the extra production and use of fuel made from crops, as well as an Alternative Fuels Conversion Program, which aims to demonstrate the commercial viability of new fuels in the transport industry. It does this by subsidising about half of the costs of converting petrol or diesel engines in heavy commercial vehicles to run on either liquefied petroleum gas or compressed natural gas or by using hybrid engines.

Throw in a few state schemes, and it starts to sound like an impressive mix of measures to drive down emissions. Well, it sounds impressive until you hear their results.

If Australia sat back and did absolutely nothing to cut our emissions, it's expected that by 2020 we will be emitting around 109 million tonnes of greenhouse gases a year from transport. How much difference are all of those industry and biofuels strategies expected to have made by then? According to the government's own reports, if all their schemes work then we might be hoping to produce around 104 million tonnes instead. It's not exactly the dramatic turnaround we need. That's why we need to start implementing bigger and bolder solutions to deliver faster greenhouse gas savings on our roads.

What's the most effective way to drive down emissions from cars?

For more than 20 years, the Australian car industry has been promising to build less fuel-guzzling cars, working with successive Labor and Coalition governments to set voluntary targets for what they would deliver. However, for more than 20 years the industry failed to meet those targets, despite continuing to pocket billions in taxpayer-funded subsidies.

In 2003, having been publicly warned by the federal government to stop messing around or face mandatory fuel standards, the Australian car industry agreed to a much tougher target: to produce new passenger

cars that use an average of 6.8 litres of petrol per 100 kilometres by 2010. But only two years later, the types of vehicles covered, as well as the target, were changed with some creative accounting, so that the new target became 222 grams of greenhouse gas emissions per kilometre, equivalent to 9.3 litres per 100 kilometres.

While that revised target now looks likely to be met, the evidence shows that this will be almost entirely due to higher petrol prices and consumers choosing to buy more fuel-efficient imported cars, with around 80 per cent of new cars sold in Australia now being imported. And, as we saw earlier, even if we do meet that target, the average Australian car is still producing about 40 per cent more emissions per kilometre than an average car in Europe.

That gap is set to widen even further. Tired of its car makers failing to meet voluntary targets, the European Union has agreed to introduce mandatory emissions standards from 2012. The details of how those legally-binding standards will work are still being finalised, with some car manufacturers fighting hard for special exemptions and loopholes to protect their profits. The limit set by the EU is likely to be a fleet-wide average of 120–130 grams of carbon dioxide per kilometre, down from the current level of around 160 grams, with increasing fines for companies that exceed the limit.

The Europeans aren't the first to set mandatory fuel-efficiency standards; several key Asian car-making countries, including Japan and China, introduced them years ago. In China, thanks to a combination of factors including emissions standards introduced back in 2000 and the smaller average size of Chinese cars, in 2010 a typical car in China is expected to use nearly a fifth less fuel than the Australian average.

Even the US is getting in on the act. While California and some other states have led the charge on minimum standards in the past, in just his first week as US president Barack Obama signalled how seriously he took the issue by announcing he would introduce new national fuel-efficiency standards. Obama has since followed through on that pledge, with regulations coming into force from 2011 that will require a 30 per cent cut in emissions from cars and trucks by 2016. That means a typical car in the US will go from getting about 10 kilometres from every litre of fuel—which is also roughly the current average in Australia—to travelling about 15 kilometres per litre. The US targets still trail slightly behind Japan and the EU, but it's a significant step to lower emissions and will reduce demand for oil from the world's most car-dependent country.

When Obama took action, others such as the Canadian government almost immediately followed suit, promising to match the mandatory US standards. In contrast, here in Australia the federal and state governments responded by commissioning another round of studies and consultation papers.

The fact that Australia is being left behind by the rest of the world on mandatory emissions standards doesn't just mean higher emissions, it means higher costs, too. A study for the National Roads and Motorists' Association found that cutting the fuel excise by five cents a litre—an easy-to-explain tax cut that politicians know goes down well on talkback radio—would save motorists about $2 billion a year. In contrast, the less exciting-sounding but smarter policy of introducing compulsory fuel consumption standards had the potential to reduce our national fuel bill by more than $10 billion a year. For a typical motorist, that would translate to savings of more than $700 a year at the petrol pump.

Having stalled for so long, Australia won't be able to catch up with European or Japanese fuel standards overnight. But if the Rudd government was serious about helping 'working families' save money, it would be aiming to at least be on par with comparable industrialised countries within the next few years. Australia can't afford anything less.

Although higher standards for new cars are important, only one in 20 cars on our roads is new. So we also need to create a more fuel-efficient second-hand car market, which is where corporate car fleets can play a key role.

How can government and corporate car fleets lead the way?

Government and corporate car fleets account for nearly one in five new car sales, but their turnover is so high that they generate roughly one in two second-hand car sales. Currently, the vast majority of the cars in those fleets are locally made six- and eight-cylinder cars. The federal government and many state and local governments have started adding some hybrids and smaller cars to their fleets, while some companies have started offsetting their emissions from driving by planting trees. While it's good that they're all finally recognising that emissions from these vehicles are a problem, it's only a half-baked response.

Government and corporate cars are contributing more than their fair share to our traffic and emission problems, with studies estimating

they typically make up 40 per cent of peak-hour traffic in Australian cities. It's about time all levels of government and businesses with corporate car fleets took more responsibility for reducing those emissions. That doesn't mean their only option is to break their contracts and trade-in all their V6s overnight. Apart from that being highly unlikely to happen, trading in a lot of old cars for new ones doesn't necessarily deliver huge emissions savings, for reasons we'll examine shortly. What governments and businesses can do right now is to declare that the next time they sign a contract they will opt for more efficient cars, regardless of where the cars are made. Doing that would send a powerful signal to the market and, in the longer term, would help improve the average emissions and fuel efficiency of Australia's second-hand cars.

Governments could also change their road taxes to charge little or no on-road taxes or registration fees for low-emission cars, with steeper charges for bigger, higher emission cars. Such changes have already been introduced in the UK, and here, in the Australian Capital Territory.

However, we can't afford to focus solely on the level of emissions coming out the exhaust pipe of a car. That's because every new car comes with a feature that car makers prefer not to advertise: its hidden carbon debt.

When is it better not to buy a new 'green' car?

Even before a new car is taken out for its first test drive and sold, it's already racked up emissions during the manufacturing and transport process. On average, around 15 to 20 per cent of a car's emissions are estimated to have been generated during that initial phase, even before the car hits the road. But when you go to buy a brand new car, don't expect to be told anything about that built-in carbon debt, sometimes also referred to as embodied emissions.

Instead, the only information you'll get are stickers on the windscreen with estimates of the emissions that will come from driving. It can make buying a new 'green' car seem more climate-friendly than it really is. (Manufacturing trains, trams and buses all generates emissions too, but the carbon debt involved in building a train, for instance, is quickly balanced out by the fact that it will be used to transport thousands of people each day with fewer emissions per person than if they all drove.)

A lot of Australians are understandably keen to replace their old gas-guzzler with a new 'green' car, both for fuel-saving reasons and to be seen as doing their bit to reduce their greenhouse gas emissions. Yet when you take into account embodied emissions and how much you drive, you may be doing the planet and your bank balance a favour if you stick with your older car.

For example, let's say you owned a big, high-emission car but lived in an area with good public transport, so only drove it a few kilometres each week. As tempting as it may be to buy a new hybrid car, according to some estimates it could take you more than a century of driving to repay the carbon debt from manufacturing it.

In contrast, if you drive a lot and spend a lot of time in stop-start traffic, then trading up to the most efficient new hybrid you can get makes more sense, because hybrids save the most fuel in those kinds of driving conditions. Because the car is being driven so much, the lower emissions from driving will soon balance out with the new car's extra embodied emissions.

Or on the other hand, if you live in the country and constantly cruise up and down the highway on long trips, an efficient diesel car is likely to deliver better performance on greenhouse gas emissions and fuel use than any of the better known 'green' car brands. In other words, there is no simplistic one-size-fits-all answer when it comes to buying a car; the lowest-emission option partly depends on what kind of driving you do.

How can you drive without owning a car?

If you're going to drive, one way to save emissions and money is to not own your own car at all, but rather to spend that money on a combination of catching taxis and sharing a car with others, either informally or by signing up with a car-share company. If you think that wouldn't make financial sense for you, it's worth doing the sums to check.

Most of the big car insurance companies have online calculators, where you can get a better idea of how much your car is really costing you each year. Paying for petrol is just one of the costs they calculate; more often than not, what makes owning a car so expensive are its running costs and its rapidly diminishing value.

Take a small car, like a Holden Barina. Once you start adding up all the costs for petrol, insurance, registration and other longer-term costs

like repairs and depreciation on the car's value, it will typically cost more than $7000 a year. For a bigger people-mover like the Toyota Tarago, it's more like $14,000 a year.

While car-sharing can work anywhere, it works best in densely populated inner-city areas where it can also reduce congestion and demand for parking. So it's good to see some local councils in Australia supporting car-share companies with specially marked, free parking-spaces along busy streets.

In Paris, the city's council is going a step further. Having set up the world's biggest bicycle-share scheme, they're now establishing an electric-car-share scheme called *autolib*, with 4000 cars to be made available for hire around the city. For a monthly fee, Parisians will be able to use any of the cars, saving them money on running costs and paying for parking, while reducing the overall number of cars on the road. But if all goes according to plan, Parisians could soon be jealously eyeing off a much bigger and more practical electric-car scheme being set up in Australia.

Who wants to make the world a Better Place?

While electric cars have a reputation as a nice idea that might work one day in the future, they have a much longer history than many people realise. As far back as 1897, there was a fleet of electric cabs driving around New York, and in the early 1900s there were more fully electric cars being driven on US roads than cars with fuel-powered internal combustion engines.

More than anything, what killed the electric car from becoming the 20th century's car of choice was the lack of electricity infrastructure to recharge them, especially once you got out into the countryside. In contrast, because North Americans already had many local gas stations for their home gas needs, it wasn't so hard to adapt them to create a nation-wide network of petrol stations.

How do you turn the electric car from being a nice idea that never quite worked out, into a practical transport and climate change solution? You do it with smarter thinking.

Shai Agassi made his first fortune in Silicon Valley by developing innovative software. Since 2007, he and his company Better Place have been working on a much bigger, more ambitious project: to reduce the world's dependence on oil by making it easier and more affordable to drive cars powered with clean electricity instead.

There is nothing particularly innovative about the cars that Better Place customers will be able to drive within the next few years, which are being built by French car maker Renault and will be fitted with replaceable batteries with the capacity to run for 160 kilometres on a single charge. The real secret behind Better Place's success is not its technology, it's the innovative thinking behind it.

Better Place's business focus is on building and operating a huge network of plug-in points that look like parking meters, as well as battery-swapping stations that will automatically switch your car's battery for a fresh one in just a few minutes. With that infrastructure in place in cities, suburbs and along highways, its customers will be able to recharge at home or while popping into the shops or, if their battery is running low and they're going for a long drive, have their battery swapped over for a fully charged one, in less than the time than it takes to fill up a tank of petrol.

The costs of doing all that will be paid for through a monthly subscription fee, much like paying for a mobile phone bill—only instead of paying for time talking on the phone, you'll be paying for driving time by paying for the amount of electricity you use each month. Better Place's goal is to give electric car drivers the same peace of mind that people driving petrol-powered cars have today: the knowledge that almost anywhere they need to go, there will be somewhere to refuel if they need it. The main selling point for potential customers is that the running costs for the cars are expected to be significantly less than paying for petrol.

Among the first investors to back Better Place was an Israeli company that owns a number of oil refineries, whose chief executive Idan Ofer was won over by Agassi's plans to roll out electric car infrastructure around the world. As Ofer has said: 'Coming from the oil business, I know that oil is becoming more and more difficult to find'.

Several state and national governments in the US, Europe and the Middle East have since signed agreements to support a mass rollout of Better Place recharging infrastructure in their countries from about 2011. Israel and Denmark, two geographically small nations with long-held national policies of trying to reduce foreign oil dependence, are leading the way.

The company has big plans for Australia as well. Having signed up investment bank Macquarie and AGL Energy as local partners, Better Place has been working to raise the $1 billion needed to build a network of recharging points and battery stations along the east coast of Australia, starting in Canberra from 2012.

Who else is reviving the electric car?

Better Place is not the only electric car initiative in Australia. There is now a growing number of mechanics here who can pull out the oily engine from under the bonnet of your car and put in a new electric motor. Some, like the Blade Electric Vehicle company, even sell their own locally adapted fully-electric cars for around $40,000.

Internationally, the competition for the electric car market is also heating up. A decade ago, General Motors famously crushed a popular line of electric cars it had been selling in California, a story retold in the documentary *Who Killed the Electric Car?* Since then, GM has admitted that was a mistake and is desperately trying to get back into the electric car market, trying to release its plug-in electric Volt before it's beaten by rivals, including Toyota. Meanwhile, Chinese car company BYD has quietly pulled ahead of all those bigger US and Japanese car companies, already selling a plug-in electric car with back-up fuel tank to Chinese drivers, while preparing to be the first to sell a mass-produced fully electric car in the US.

Of course, electric cars are not a perfect solution to cutting emissions from road transport. For a start, there are the embodied emissions associated with making each new car. Then we need to consider the kind of electricity those cars will be fuelled with. Using oil produces fewer greenhouse gas emissions than burning coal. So there is little point switching to electric cars unless we're simultaneously changing Australia's electricity mix, with less power coming from coal and with more coming from renewables and gas.

To its credit, Better Place has recognised that fact, and has an agreement with AGL to pay for extra wind turbines and solar generators to provide green electricity to run its customers' cars. With other car companies also planning to start selling electric cars here within the next few years, it's yet another reason why we need to move much faster to ramp up the amount of renewable energy being fed into the electricity grid.

If we're looking for the best, smartest, most integrated solutions, then electric cars still can't beat public transport on greenhouse gas emissions, traffic and health grounds. However, since cars aren't going to vanish from our roads any time soon, we clearly need to be doing far more to provide renewable energy to fuel them.

Why can't we afford to keep on trucking at today's rates?

We also need to hit the brakes on another fast-growing source of road emissions: trucks. Truck emissions are now rising at a faster rate than emissions from cars, and compared with 1990 levels are on track to have roughly doubled by 2020. This is unsurprising given that, in yet another example of perverse subsidies, truck companies are given a 19 cents a litre rebate on their fuel bills, meaning that they effectively pay only half the fuel excise rate paid by motorists.

These rebates encourage inefficiency. For example, vegetables grown in far north Queensland are regularly trucked south to Brisbane markets, where they are then sold and trucked to Sydney warehouses, before in some cases being trucked back to Queensland to be sold in supermarkets. In theory, fuel tax rebates are given to road freight to keep the cost of consumer goods lower. Every year around 170 million tonnes of food is transported around Australia, covering a staggering 2.5 billion kilometres, almost all of it by road. Rail used to carry more of that load, but road freight has now become the main way to deliver food to our tables.

This is because the rebates keep the price of road freight artificially low, putting the lower emission alternative of rail freight at a significant disadvantage. Decades of neglect of the country's rail freight infrastructure hasn't helped either: while the Hume Freeway has been almost entirely rebuilt and duplicated over the past 30 years, vastly improving travel times for trucks barrelling up and down between Sydney and Melbourne, rail freight lines have only recently begun to attract serious government funding. Not surprisingly, all this has contributed to the growing dominance of trucks as the main way to carry freight around the country. That doesn't just mean more greenhouse gas emissions; it also means more big trucks and semi-trailers using our freeways and suburban roads each year.

There are some smarter solutions that we ought to be encouraging businesses to adopt, which can lower transport costs and save on emissions without the wasteful tax breaks. For instance, in the US the world's biggest retailer Wal-Mart has responded to its rising fuel bills by choosing to buy more of its fresh produce directly from smaller, local farms rather than just from a couple of big national distribution centres. Its transport emissions and fuel bills have been slashed, saving the company millions of dollars a year. It's better for business, better for climate change and means Wal-Mart customers get better, fresher fruit and vegetables.

How do we fill the potholes in our freight funding?

In a positive move, the Rudd government and some state governments have recently acknowledged that rail freight needs greater investment, and they have started to slightly reduce the massive gap between rail and road funding.

But upgrading rail tracks alone won't be enough to lead to significant change; that requires a wholesale rethink of transport spending, including all the multi-billion-dollar perverse subsidies that only make it harder for Australia to achieve major greenhouse gas cuts.

The federal government could learn from initiatives in several European countries on road freight. For instance, in Germany the nation's trucks have been fitted with equipment that calculates a road toll based not only on the distance travelled but also on the vehicle's size and the average amount of greenhouse gas emissions and air pollution it produces. The idea behind it is to better reflect the real costs of heavily-laden trucks, including the wear and tear they cause on roads, as well as their contribution to climate change and air pollution.

It's a fairer way of distributing the costs of road transport among all road users, because the amount of damage caused by a car or truck on a road is roughly proportional to its weight and mileage—so the bigger your vehicle and the further you drive, the more you ought to pay for the costs of patching up potholes and maintaining safe roads around the country, as well as for the long-term health and environmental costs of road transport.

Yet there's no point increasing the costs of road freight without simultaneously making it faster, easier and more efficient to use rail freight. Whether it's passenger or freight transport, the principles are the same: while we do need to charge a more accurate price for high-emission, high-impact forms of transport, the lower-emission options urgently need to be improved.

What are the benefits of beating the traffic?

The traffic on our roads is getting worse, but we won't fix the problem by endlessly building wider roads. Household bills are soaring because of rising petrol prices, but we won't fix it by cutting petrol taxes. Australians are becoming increasingly fat and sedentary, but we won't fix that problem by telling everyone to go on a diet.

Today, Australia is facing many complex, interconnected problems, of which climate change is only one. If we are serious about tackling any of those problems, we need to stop treating their symptoms in isolation. There are integrated solutions to many of our problems, which we can begin implementing today.

We can stop offering counterproductive tax breaks that pay people to drive more than they want to.

We can use some of those billions of dollars we're currently giving away in perverse incentives to invest in high-quality, reliable, convenient public transport and rail freight, to offer better low emission choices to move people and products around the country.

We can look at the best-managed transport networks in the world, and try to learn from their successes and failures.

We can introduce fuel-efficiency standards to cut our driving emissions and our fuel bills, rather than simply propping up complacent car manufacturers.

By doing all that, we can start to cut emissions from transport, while helping more Australians get out of the traffic.

Our potential to change is huge. In many parts of Australia, including our biggest cities, we used to carry more people and goods around on public transport and rail freight than we do today. If past generations managed to do that, when they weren't being confronted by a problem like climate change, then we can do it again.

But investing in better transport in isolation will only get us so far. Catching a train or riding a bike isn't the only way to reduce your emissions from commuting. Just as we've needed to rethink our current consumption, energy and transport habits, the same is true for our cities.

As we're about to see in the next chapter, better urban planning can help to cut down on long commuting times by curbing urban sprawl and attracting new jobs to areas closer to where people live. At the same time, we can't ignore another inter-linked and surprisingly large source of greenhouse gas emissions: our buildings.

It's time to get started on a renovation of the nation.

5

Renovation rescue

How to make our buildings and cities better places to live and work

The average office pot plant doesn't have a long or happy life. After spending its early days in a nursery, before long it's all grown up and ready to enter the workforce—and that's when its life takes a turn for the worse. Instead of enjoying fresh air and sunlight, plants in a typical office spend their days under artificial lights, sucking up a mixture of toxic air pollutants and stale, air-conditioned air. Even for plants specially bred for indoor conditions, it's tough going. Not surprisingly, many simply wilt under the pressure, which is why there's a whole mini-industry of indoor-plant suppliers, who sell, lease and regularly replace office plants.

While it's not much of a life for the plants, it's a good thing for us that they're there. Studies have found that indoor air in Australia is typically five to seven times more polluted than outdoors. Without fresh-air circulation, toxic compounds emitted from office clutter—the computer terminals, laminated desks, plastic chairs and inky printers—end up trapped inside. In fact, the only place you're likely to breathe in nastier fumes is standing on the side of a freeway.

Plants can reduce those indoor air pollutants, mainly through the hard work of microorganisms in their soil that can break down toxic

compounds. Even with those tiny bugs working overtime, many people working in typical offices still suffer from 'sick building syndrome'. The symptoms probably sound familiar: an irritated throat, nose and eyes, headaches, tiredness and nausea.

A decade ago, the CSIRO estimated that the health and productivity costs of poor internal air quality in Australia could be as high as $12 billion a year, yet little has been done to improve the situation. If you're feeling sick of going to work, there might be more to it than the fact that your boss won't give you a pay rise.

However, for a lucky few Australians there are some workplaces where plants and people can both thrive.

What's the secret to a healthier workplace?

Tucked behind Melbourne's Town Hall is a ten-storey office block that's now home to most of the city council's staff. Known as Council House 2, or CH2, its office pot plants were put in when the building opened, back in 2006. Instead of being replaced all the time, these plants need to be regularly pruned because they're growing so well. That's because CH2 is one of the greenest office buildings in Australia, using just a fraction of the energy and water of similar workplaces, producing less waste and making better use of natural light and fresh air.

Surveys have found that the improved air quality has made a big difference to how the staff at CH2 feel: they've stopped getting the mid-afternoon headaches and drowsiness that afflict most office workers, while far fewer of them are falling ill, leading to a dramatic drop in sick days.

Good design also allows more natural light into the office, not only reducing lighting bills but also ensuring that just about everyone has a desk with a view, rather than only a select few with a corner office. On top of all those energy-saving measures, there are also a range of low-emission energy generators on site, including a gas co-generation plant that makes use of waste heat, as well as solar hot water and solar photovoltaic panels.

Thanks to those features, CH2 is on track to achieve the council's target of generating less than a fifth of the greenhouse gas emissions of another similar-sized council building nearby. Those substantial energy and emission savings did come at a cost though. CH2's long list of green features added around 20 per cent, or $11 million, to the final bill for constructing the building. So, apart from having happier employees and plants, was it really worth the investment?

Why are bad buildings bad for business?

If you're an employee, you're probably worth more to your boss than you realise. For most businesses, whether they're small shops or giant corporations, staff salaries are by far the single biggest cost to their bottom line. When staff members are regularly sick, tired or daydreaming about working somewhere nicer, productivity rates take a dive.

CH2's results demonstrate the flipside of that problem. The move into the new building happened only a few months before the council launched a controversial cost-cutting drive that saw nearly 200 of its employees quit or take redundancies. Understandably, the staff wasn't too happy at the time.

Yet, despite the move happening during a difficult period, anonymous staff surveys revealed that most people felt healthier and happier at work than before. At the same time, staff productivity improved by around 11 per cent, more than double the rate that the council had hoped for after the move to CH2.

Thanks largely to that higher-than-predicted productivity increase, which has boosted the council's budget by more than $2 million a year, the council now expects that the extra money spent on making CH2 a greener, more efficient building will have paid for itself within only seven years. After that, it will be returning a profit on the investment for decades to come.

On its own, CH2 does not conclusively prove the benefit of green buildings because, as anyone who's changed jobs knows, there's usually some novelty factor involved in moving to a new workplace. There is always a chance that the change of location could have been an underrated factor in making the council's staff feel better.

A better way to test if green buildings improve productivity is to do a comparison with the same group of people at an existing workplace, before and after renovations that improve air quality and save on energy, water and waste. One such study was carried out just across town from CH2, with revealing results.

How can we cut back on workplace sickies?

500 Collins Street in Melbourne used to be just another 1970s high-rise tower, with as large a carbon footprint as other buildings of its era. A few years ago, the tower was given a complete overhaul from within,

upgrading everything from the insulation to the cooling, heating and lighting, in Australia's first major green refurbishment of an existing high-rise commercial building.

It proved to be a wise investment, not only for the property owner, the Kador Group, but also for tenants like law firm Oakley Thompson, which saw a 39 per cent drop in average employee sick days after its offices were refurbished. The firm's secretaries and lawyers also found that they were getting more work done for clients in less time.

Healthier, happier staff work better; that's hardly surprising. But it does confirm a common-sense conclusion, which is that the benefit of a greener and healthier working environment goes beyond simply making us feel good; it's also good for business.

Unfortunately, for every one building in Australia like CH2 or 500 Collins Street, there are still thousands of ordinary offices and homes wasting enormous amounts of energy and water. That's a serious problem, because, as it turns out, buildings are surprisingly big contributors to greenhouse gas emissions, not only here but worldwide as well.

How can better buildings change the world?

Here's a pop quiz question: which would you guess produces more of Australia's greenhouse gas emissions each year?

A) all the cars on our roads, or

B) our offices and homes?

If you guessed B, you're right—and by a long way. Almost a quarter of Australia's official emissions is generated by our commercial office buildings and homes. That's nearly three times the emissions produced by cars in Australia—and the share of emissions generated by buildings rises even higher if you factor in other types of buildings too, such as shops, factories, schools and hospitals.

At a global level, buildings are the source of around 40 per cent of the world's greenhouse gas pollution from human activity, or more than 11 billion tonnes of emissions a year. So renovating and constructing better buildings need to be treated as top priorities in any plan to tackle climate change.

Yet the impact of buildings is usually underestimated in the climate debate, largely because greenhouse gas emissions from buildings are generated indirectly, from the materials used to construct them to their use of electricity from coal-fired power stations. Even something as simple and commonplace as cement has a huge impact: the cement industry

alone accounts for about 4 per cent of global greenhouse gas emissions. More than anything, buildings are surprisingly large greenhouse gas contributors because of the massive and often very wasteful use of energy inside them, particularly the use of inefficient heating, cooling, ventilation and lighting.

Yet the extraordinary inefficiency of our buildings is also, oddly enough, a reason for hope.

As countless international studies have found, the building sector offers by far the biggest and most affordable opportunities for drastic greenhouse gas cuts. Globally, the potential for emissions savings from better buildings over the next decade or two is so huge that it could eclipse all the emissions cuts made from the industry, transport and energy sectors combined.

Similar findings have been made here. For instance, a study by international consultants McKinsey & Company concluded that it would be possible to achieve a 60 per cent cut in Australia's emissions by 2030 without major technological or lifestyle changes. Reducing wasted energy in buildings, such as with better insulation and more efficient lighting, topped McKinsey's list of how to cut emissions and save money.

It's a conclusion echoed in countless other reports. The benefits of using energy and materials more efficiently include saving on unnecessary extra energy infrastructure, as well as improved air quality from burning fewer fossil fuels. Those added benefits are why studies consistently find that upgrading buildings is the most cost-effective way to cut emissions, offering the potential to boost Australia's economy by around $38 billion a year by 2050.

Rethinking and renovating our buildings is one of the key solutions for Australia in tackling climate change. But it's not enough to construct better buildings in isolation. We also need to reconsider some old assumptions about our cities and the ways that we live within them because, as we'll see later in this chapter, even things like the way we use water are becoming surprisingly significant contributors to Australia's growth in greenhouse gas emissions.

First though, let's take a look at how much money and energy we could be saving with better buildings, starting on the home front.

Who says size matters?

Standing on the front step of an award-winning display home in south-east Melbourne, Alan Pears is momentarily lost for words. 'Wow,' says

Professor Pears, who is one of Australia's leading energy-efficiency experts. Dazzled by the ten halogen lights beaming down from the porch of the single-storey home, he says, 'This is truly impressive. Right here you're looking at more than a tonne of greenhouse gas emissions each year, even before you step inside the front door.'

Just ten of these standard halogens can drain as much electricity each year as was needed to fully light a normal-sized home built 20 years ago, even using old incandescent bulbs. Not only that, but simply keeping these porch lights on each night would add about $140 a year to the household's electricity bills.

Next door, there's a four-bedroom, double-storey display house that's even bigger, a perfect example of everything that's still wrong with home-building today. At 400 square metres, it's more than 50 per cent bigger than average existing suburban homes, with an open floor plan that will require massive spaces to be heated in winter and cooled in summer. Compounding that problem, the two-storey house faces west, with large unshaded windows and a dark roof that will make it uncomfortably hot on sunny days.

Then there are all the lights: a total of 101 halogens, spread over its two floors. Even if only a third of those lights were turned on each night, they would need four to five times more electricity than in an average-sized existing home, generating about 4.5 tonnes of greenhouse gas emissions each year. In a house that size, with that many halogens, you can easily rack up a quarterly electricity bill of $1000-plus, as more Australian families are discovering the hard way.

New homes in Australia are now bigger than anywhere else in the world, even topping homes in the US. That expansion in average size has happened extraordinarily fast; today's homes are a third bigger than those built here just a generation ago. At the same time, we've been busy filling all that extra space with extra lighting and appliances. While the trend towards bigger homes is easy to see in new housing estates in outer suburbs, it's also happening in more expensive inner and middle suburbs, with many existing homes being renovated to add on new rooms.

For obvious reasons, it's been in the interests of builders and developers to promote a 'bigger is better' approach, marketing large homes as symbols of success, while fitting halogens and other high-energy products as standard in new homes. There's a lot of money to be made by up-selling and super-sizing our homes. For instance, many new house and land packages offer home buyers only one option for their lighting: to install lots of halogens. Because it takes so many

halogens to light a room and takes more time for an electrician to wire up each one, that lack of choice can add thousands of dollars to the final house price, as well as to the ongoing electricity bills.

As consumers, we don't have to buy any of it. The recent global financial crisis has been a wake-up call for many Australians about the risks of getting too heavily into debt to pay for homes that are bigger and more expensive than we can afford to live in. There's never been a better time to stop and reconsider whether continuing to super-size our homes is really such a good idea, given the impact it's having on the size of our cities, our contribution to climate change and the sizeable costs we all have to pay as taxpayers for new infrastructure.

Along with reconsidering our individual choices, we also need stronger political leadership to promote better buildings. Nowhere is that need for leadership more obvious than when it comes to improving basic building standards.

What happens when your standards are too low?

If you believed everything you read in the real estate ads, almost every property for sale or lease in Australia is 'unique' and offers its future tenants 'a truly enviable lifestyle'.

Unfortunately, the reality is a lot less impressive than the marketing pitch. In fact, the average Australian home measures up poorly by world standards in a number of ways, especially on 'thermal efficiency'. Thermal efficiency is all about how well a building maintains a stable, comfortable temperature, ideally by making the most of things like good orientation to the sun, through insulation and by minimising draughts. In Australia, we use a star-rating system to measure that efficiency. The more stars the building gets, the better it is. Unfortunately, the average Australian home rates at barely more than two stars, which is terrible by international standards.

There have been some improvements over the past few years, thanks to government regulations first introduced in Victoria, and later in several other states, aimed at saving energy and greenhouse gas emissions. Those regulations have imposed minimum standards requiring all new homes to get at least a five-star rating for thermal efficiency, which makes them about 50 per cent better than in the past, saving substantial amounts of energy.

Most people quite reasonably assume that a five-star home has been built to world's best standards. We expect good food from five-star

restaurants, good beds in five-star hotels, and any film good enough to get five stars from a top movie critic is likely to be a classic.

There's no doubt that without the current five-star minimum standards, Australia's residential greenhouse gas emissions would be increasing even faster than they currently are. But five-star homes are not as flash as they sound. Even with the five-star rules in place, studies have found that the average thermal efficiency of our homes trails a long way behind average thermal efficiency in other countries. Meanwhile, our building standards simply ignore many other factors that also affect energy demand, such as the size of the building or how well it is designed to allow fresh air to flow through from one side of the home to another.

That's a big problem, because in most new five-star homes, the energy savings from improved thermal efficiency are being more than wiped out by the enormous increases we've seen in average house size and extra appliances inside those bigger homes. As a result, new homes being sold to us as greener than in the past are actually using more energy and producing more emissions than our parents' homes.

Our building regulations have been too weak for too long. Why have we been so slow to lift our game in Australia? It largely comes down to a question of money—and to the questionable claims of some powerful lobbyists.

Who won the housing 'Star Wars'?

The building sector is one of Australia's biggest industries, employing around 800,000 people to undertake work worth $70 billion a year. With that kind of economic muscle, the industry's lobbyists have no trouble getting through the doors of Parliament House, whether in Canberra or in our other capital cities. The fact that many developers and the construction unions are generous donors to the major political parties doesn't exactly hurt, either.

So, when a group like the Housing Industry Association (HIA) takes a strong stand on an issue, its concerns are taken seriously. That's what happened in 2005, when state governments were pushing to introduce national green building standards, based on what Victoria had already done.

The HIA was among the most vocal industry critics of the proposed five-star energy-saving rules, claiming that home buyers would be slugged up to $15,000 extra for a $200,000 home, at a cost to the

Australian economy of tens of billions of dollars. When the HIA was repeatedly asked by politicians and experts on the Australian Building Codes Board to back up their claims with hard evidence, the best the industry lobby group could come up with was a survey, in which builders had been asked to give a guesstimate of what they thought the changes might end up costing.

That lack of hard evidence didn't stop the media from reporting the HIA's claims, sparking a flurry of press releases from all sides. But the fiercest battles over the five-star rules took place behind closed doors at meetings between industry and government representatives, which prompted some insiders to give the stoush a nickname: the 'Star Wars'.

In the end, the problem was resolved after the federal and state governments commissioned independent research to check on the validity of the HIA's dire warnings. Those studies—which in some cases were kept secret for several years—confirmed what has since proven to be true: that, far from being radical, the five-star rules would still mean that new Australian homes require more energy to be kept at a comfortable temperature than homes in comparable parts of the US, Canada and the UK. New homes from overseas were found to rate much better than here, averaging more than seven stars on the Australian scale, with some ordinary homes from California rated at nine stars. Meanwhile, the studies also cast doubt on the HIA's cost estimates, suggesting that the real cost was likely to be only a fraction of what it claimed.

Despite the objections of the HIA and some other industry groups, the five-star standards for new housing were eventually approved, and finally came into force in 2006. Despite the predictions, the sky has not fallen since then. As subsequent studies have shown, improving minimum levels of insulation and thermal efficiency can be done in most new homes for $1500 or less—just a tenth of what the HIA had predicted—with the investment paying itself off through cheaper electricity and water bills. In many cases, the energy savings can be achieved for nothing, thanks to cost-free, common-sense solutions, like properly orientating the building to make the best use of the sun for heating in winter and using eaves for shade in summer.

Our homes aren't the only places where big energy improvements can be readily made. There's also huge scope to save energy and emissions in our commercial buildings—and some of the proven solutions are surprisingly cool.

How did we all get air-conned?

In a city skyline dominated by flashy glass towers and concrete office blocks, 39 Hunter Street stands out as a rare survivor from a bygone era. Built at the beginning of World War I as insurance company Perpetual Trustees' Sydney headquarters, it was designed to impress, from the grand marble columns flanking its entrance through to the soaring ceilings inside. Comfort was also important for a company trying to woo new customers, which was another reason for the high ceilings: they helped keep the building cooler.

By the 1960s, Sydney was changing fast in its rush to look like a more modern city. Countless grand old buildings were demolished, making way for taller concrete towers, complete with new air-conditioning systems. Determined not to look old-fashioned, Perpetual Trustees decided that its head office needed air conditioning. There was only one problem: the high ceilings that had helped keep its building naturally cooler for decades meant that there would be more air space to artificially cool.

The solution? They simply covered up its grand old ceilings with lower false ceilings, and in went the air conditioning. The same thing happened in older buildings right around Australia.

Barely a decade ago, less than half of all Australian households had an air conditioner; today, more than two-thirds have them, and they're now fitted as standard in virtually all new homes and offices. This growing reliance on air conditioning in every part of Australia—even in Tasmania, sales have more than doubled since 2000—comes at a huge hidden cost to the climate and to our hip pockets.

According to a government study in Queensland, each new air conditioner costs the overall power system about $13,000, because of the added burden of needing extra electricity infrastructure such as transmission lines to cope with expensive peak power demand. One of the reasons why it's so expensive is that major spikes in peak demand don't happen very often or for very long—the biggest spikes tend to be for only a few hours, on a few days of extreme heat in summer. But in order to ensure secure electricity supplies, massive amounts of extra transmission capacity and power generation have to be built to cope with those times. In other words, households without air conditioners are subsidising the bills of those with air conditioning, at an average extra cost of $75 to $300 a year for electricity infrastructure that they're not creating demand for.

Yet it is possible to keep our cool without wasting so much energy or producing so many emissions, and the old Perpetual Trustees building has recently become an example of how to do it.

Who isn't wasting their energy?

In 2006, 39 Hunter Street was bought by the Kador Group, the same company behind 500 Collins Street's makeover. Since then, it has been transformed with Australia's first six-star energy renovation of a heritage-listed building.

One of the first things the company did to start making it a greener building was to remove the false ceilings. Combined with better air flow and passive chilled beam cooling—which is where cold water is passed through pipes in the ceilings to cool the surrounding air—the building has been designed to need just a fraction of the energy than it used before. Sometimes the best solutions can start with undoing the mistakes of the past.

Similarly, Australian-based property giant Lend Lease has been championing green buildings for years. Its Sydney headquarters, 30 The Bond, was the first big commercial building in Australia to use chilled beam cooling, since used at CH2. Together with common-sense features that our great-grandparents would have taken for granted, like good external shading, the temperature inside 30 The Bond can be kept at 23 degrees, even on a 40-degree day.

What's even nicer for Lend Lease staff is that they're breathing fresh, cool air rather than having the usual blasts of cold, stale, conditioned air. Thanks to good design and ongoing monitoring of energy use in the building, the nine-storey Lend Lease office produces about a third less greenhouse gas emissions from its energy use than a typical building of its size.

Meanwhile, leading the way among Australia's major property managers is Investa, which owns $9 billion worth of skyscrapers and smaller office buildings across the country. Put all those buildings together, and Investa has a collective carbon footprint of around 125,000 tonnes of greenhouse gas emissions each year. Since 2003, Investa has worked with its tenants to reduce electricity use by 21 per cent, gas use by 43 per cent and water use by a third. Many big commercial air-conditioning systems churn through thousands of litres of water a year, so one of the ways that Investa has been simultaneously saving on energy and water is by improving its buildings so that they need less air conditioning.

Today, a growing number of builders, developers, architects and property owners are recognising the importance of adapting their business practices to save on greenhouse gas emissions and energy, not to mention water, waste and other resources. But we can't afford to leave it up to a few exceptional individuals and companies: what we really need is the kind of systematic national reform that turns the exception into the rule.

Is anything being done to improve our existing buildings?

There have been a few tentative steps in the right direction on building standards under the Rudd government. In April 2009, at a meeting of the Council of Australian Governments (COAG), the Prime Minister, state premiers, territory chief ministers and a local government representative all signed off on a list of new measures to make buildings more energy-efficient.

As a result, all homes and commercial buildings put up for sale or lease in Australia will have to declare how well they rate on energy efficiency. It's a lot like having a certificate to show that a building has been inspected for bugs and cracks: it's one more way to help new owners and tenants avoid nasty surprises once they have moved in.

It's not a new idea. The Australian Capital Territory introduced mandatory disclosure for homes back in 1999. Since then, the demand for energy-smart homes has slowly been growing, to the point where homes in the ACT with higher ratings now command a premium price when they're sold. For a median-priced Canberra home in 2005, worth $365,000, every one star of extra energy efficiency added around $9000 to the sale price.

But that new national policy needs to be taken further, as even former sparring partners from the Housing Industry Association and the Green Building Council of Australia agree. New buildings represent only about 2 per cent of the property market, which means that upgrading the remaining 98 per cent of existing buildings should be our top priority. To do that, there needs to be a minimum level of efficiency below which a building can't be sold or leased without having to be upgraded first. It's just like getting a roadworthy certificate for a car: if it's a complete bomb, it has to be fixed up or taken off the market.

Unfortunately, some of the other measures announced at that same national COAG meeting were a huge let-down, especially the decision

to bump up the minimum standard for all new homes from five stars to only six stars by 2010.

How can it be a bad thing if the minimum standard rating is going up to six stars? Although they might not want to admit it, our governments had considered going harder and faster than that.

Why don't the new six-star housing rules go far enough?

In the year leading up to that crucial April 2009 Council of Australian Governments meeting at which the decision to bring in the six-star rules was signed off, there had been serious behind-the-scenes consideration of aiming higher. Even towards the end of 2008, government representatives had been working on proposals looking at moving to a seven-star minimum by 2010, to be followed up by going to eight or nine stars by 2012. It was recognition that the current five-star standards are lagging way behind basic standards in many other countries.

Even more promisingly, government leaders had asked about how they might broaden building regulations to deal with the expanding size of many homes. One proposal they considered was to go beyond the current minimum standards to incorporate important factors like size. Factoring a new building's size into energy efficiency regulations would mean that if, for instance, you were keen to build a new house that was significantly bigger than the average, then that house would be required to be made extra energy-efficient. That would allow people the choice to build a super-sized home, although they would be required to pay more for efficiency measures to reduce their demand for energy, also reducing the need for more expensive peak power stations that everyone pays for through increased bills. After all, it's hardly fair that people who can afford to build the biggest homes should have the running costs of their air conditioners subsidised by everyone else.

For much of 2008, insiders who had been through the Star Wars battle to bring in the five-star standards were hopeful that Australia was about to get serious about tackling climate change and the huge amounts of wasted energy and water from our homes. Then along came the global financial crisis—and from late 2008 on, everything changed. Government interest in issues like building regulations vanished, and with it went the opportunity to take more ambitious action on building standards.

In the short-term, it's understandable that governments have only so much attention and resources, especially when facing up to a possible recession. But in the long-term, the decision to adopt a six-star standard for new homes, without a definite timetable for going further in the future, is going to cost Australia dearly. As home buyers, consumers and taxpayers, we're the ones who'll end up footing the bill for the lack of vision demonstrated by our federal, state and territory leaders.

How can we grab the lead on appliances again?

While many of Australia's energy policies still trail behind the best international standards, in a handful of areas we have been among the trendsetters. One of those areas is in appliances, where we were among the first nations back in the 1980s to introduce compulsory energy-saving standards and consumer labels on fridges, freezers and some air conditioners. It was a smart thing to do, because appliance standards are among the most cost-effective ways to save money, energy and greenhouse gas emissions.

Australia hasn't been alone in recognising the value of better appliances. Japan's Top Runner program requires all new appliances to meet the energy-efficiency level of the most efficient product at the time the standard is set. This means that the standard of new appliances is constantly improving, because every time one product improves, competing manufacturers have to lift their game to stay competitive.

Just as importantly, the worst-performing appliances are gradually banned from sale. As a result, in the decade since Top Runner came into force, some products for sale in Japan have become as much as 50 per cent more energy-efficient.

Meanwhile, as we saw back in chapter three, California's tough stance on energy efficiency has meant that it's achieved something that very few parts of the industrialised world have done: it has kept per-person demand for electricity virtually flat for three decades. That has saved California a staggering amount of electricity, with the lower demand for electricity being mainly due to the state's strong building and appliance standards.

In Australia, higher-efficiency appliances have been saving us electricity and money. But there is potential to save even more, as the Rudd government has acknowledged by expanding the original set of standards to cover a wider range of appliances, such as televisions. That more comprehensive system of energy ratings and labels is an

important step forward, and will help save us money through lower electricity bills.

However, even with the improved labels on some appliances, many household electrical goods still won't be covered by energy-saving rules, and don't come with labels to help Australian consumers make better choices. Our minimum standards also need to be regularly reviewed and toughened up. For instance, the best fridges made in Turkey and China use less than half the electricity of average fridges for sale in Australia.

We also need to be tougher in enforcing the law to protect consumers. As the ABC's *Four Corners* program exposed back in 2007, many air conditioners were much less energy-efficient than their labels said. It's all too easy for cheap imported air conditioners or other appliances to fraudulently claim to meet Australian standards.

While using more energy-efficient technology can deliver significant emission savings, it's important to bear in mind that even the most efficient new models come with a legacy of greenhouse gas emissions from being manufactured and transported to our stores. Every time we throw out a perfectly good working appliance—or one that needs just a simple repair job—we encourage manufacturers to keep making products designed not to last. Over the past generation, many local repair businesses around Australia have been shutting their doors. Most of those have been small, family-run businesses, generating local jobs. Discarding appliances without a second thought isn't just a waste of resources; it's also killing what was once a thriving small industry of repairers who helped us to make better use of our stuff.

If you're buying new, it's worth taking energy-rating labels into account in your purchase. As a first step though, it's always worth pausing to consider whether the appliances you already have really do need replacing.

How can our appliances, buildings and cities help cut emissions overseas?

As a large importer of foreign-made goods, one of the best things that Australia can do is to ban the very worst quality products from being sold here. Doing that on our own won't change the world. But as more consumer countries—particularly in Europe and the US—increasingly demand higher efficiency standards, overseas manufacturers are forced to lift their standards to maintain sales.

As strange as it might sound, the same principle applies to our buildings and cities. At the moment, the fastest growing cities in Asia and the Middle East are being modelled largely on the car-dependent, high-consumption lifestyles that we have in Australia and the US. If all those cities end up repeating our mistakes, including by not having stronger standards for buildings, appliances and urban design, then we're all in trouble.

Take just eight of the biggest Asian megacities: Beijing, Shanghai, Tianjin, Mumbai, Kolkata, Bangkok, Jakarta and Manila. By 2020, those eight cities combined are projected to have a population the size of the US. The air-conditioning demand just to keep their commercial offices and apartment blocks cool is driving more investment in coal-fired power stations across the region than all of their big industrial factories.

Australia's green buildings are increasingly attracting attention worldwide, particularly because they're proving to be good for business through lower long-term costs and higher productivity. Thanks to that practical, hands-on experience, Australia's architects, engineers and commercial builders are in demand across Asia and the Middle East to help design and build the global megacities of the future.

Even if climate change weren't a problem, creating better buildings and cities in Australia is worth doing for our own sakes. But what we do here has a global impact, and that makes it all the more important that we get on with the job of the renovation of our nation.

What are our governments doing right?

Given how much Australian politicians talk about the need to cut our greenhouse gas emissions, the one place you would expect all these positive changes to be happening would be in government buildings. So what is being done to improve the buildings that our taxes are paying for?

Over the past few years, a number of governments around Australia have adopted minimum energy-saving standards for their office buildings, and have encouraged their staff to become involved in conserving energy and water. Among the state and territory governments, the South Australian, Victorian and Queensland governments have generally done the most on this front, demanding high minimum standards for the offices they lease or build.

This is more than just a symbolic issue. In practical terms, governments wield enormous clout in the property market because they take up a lot

of space: the New South Wales government alone pays more than $270 million in rent each year. Setting those sorts of minimum standards—as long as they are adhered to—sends a powerful signal to commercial building owners that, if they want government tenants, they had better start renovating first. So when governments do go green, it's a huge spur for green building and renovation everywhere.

All levels of government in Australia could be doing more to promote greener building practices. Beyond demanding greener office spaces for government staff, there needs to be minimum standards set when commissioning any new government-funded public buildings: from schools to public housing through to major multi-billion-dollar projects.

What happens when we don't think outside the square?

Federation Square is one of those rare public places where almost anything goes. Early in the morning, a quiet group of office workers and retirees gather to practise tai chi on its cobblestone plaza. All day and well into the night, visitors stream in to visit its galleries and restaurants or to meet up for festivals and rallies. If there's a major sporting event happening anywhere in the world, whether it's the AFL Grand Final or the World Cup soccer, thousands crowd together beneath its big screen to cheer on their team.

But Fed Square, as it's called by the locals, wasn't always so popular. Before it opened in late 2002, the project was plagued by years of bitter wrangling over its design and budget. Some of those battles were heavily reported in the media, particularly the arguments about the project running late and over budget, as well as about whether it would block out views of the historic cathedral behind it. Other crucial battles between the government, the project managers and the architects were also happening out of the public spotlight, and it was only years later that the consequences of those backroom brawls became embarrassingly clear.

The two key architects on the project, Peter Davidson and Donald Bates, were both keen to make Fed Square as sustainable as possible. But the project managers and successive state governments were more focused on cutting costs and speeding up construction, and just about anything with a tinge of green was seen as an optional extra.

Every month, the project managers suggested a list of features that they thought could be cut out to save money, arguing that the project could still be called green if it kept just a few of its original features.

Every month, the architects had to fight to get most of the sustainability features back in.

One of the features that they narrowly saved from being axed was a hidden labyrinth sloping underground beneath the centre of the square. While the labyrinth's walkways are wide enough for people to walk through, it's not a secret tourist attraction: it's actually a cleverly designed ventilation system. In summer, fresh cold air is drawn in from the outside, cooling the labyrinth's jagged concrete walls. Later in the day, when the air outside is hot, it can be pumped through the labyrinth, cooling down as it passes over the concrete, before it's released up through wooden floor vents into the Atrium, a huge indoor area next to the National Gallery of Victoria. The labyrinth is one of the reasons why the Atrium can stay up to 12 degrees cooler than the outside during summer, using just a tenth of the electricity than used by conventional air conditioning.

But there were a few battles that the architects lost. One was a last-minute decision not to install a network of water tanks to catch and store rainwater running off Fed Square's huge roof to flush toilets and water its gardens, saving millions of litres of water a year.

As the years passed, and with a long drought draining the city's dams of water, the public began demanding to know why big projects kept being built without water-saving measures in place. So in 2008, Federation Square management took matters into its own hands, paying to have more than 70 tanks able to hold 160,000 litres of rainwater retrofitted into the site, enabling them to reduce their average annual water use by around 14 per cent, or 14 million litres a year. They have also introduced some new features, like a 'rain garden' that filters the water running off the car park roof, improving the quality of the water flowing into the river. But as Fed Square management has acknowledged, it would have been far less expensive and complicated to have included water-saving measures such as the tanks from the beginning.

Even with the benefit of hindsight, some mistakes can be too hard to fix. Back when Fed Square was being built, extra pipes were installed throughout the National Gallery of Victoria and neighbouring ACMI building, so that recycled greywater could be used for flushing toilets. Inexplicably, somewhere along the way that dual-pipe system was sealed off. The huge cost and disruption involved with unblocking the pipes makes it unlikely they will ever be used.

What has happened at Fed Square is a telling example of the long-term costs of short-term thinking. Good building design has been shown to save money at the same time as saving water, energy and

greenhouse gas emissions too. That's why we need to keep the pressure on governments and businesses to include water- and energy-saving features in buildings from the outset.

Why do we need to be better prepared for stormy weather?

From south-west Western Australia, right across southern Australia and up along the eastern seaboard, there's now an increasingly clear link between climate change and drought. In southern Australia particularly, the decline in rain has been worse than even the scientists' worst-case scenarios. At the same time, when it does rain, it's increasingly in heavy downpours and storms, which results in a deluge of polluted water flooding into our streets and down our drains.

If Australia's cities keep expanding at their current rates, without any regard to the fact that average rainfall in many areas has been dropping off faster than most climate models can keep up with, more cities are going to start feeling as nervous about their water supplies as Adelaide already is today.

Put together Australia's growing population and the forecasts of ongoing declines in rainfall in the places where most of us live, and it becomes clear that ensuring water security for our cities and farms is going to be hard work. It's little wonder that state governments are worried about being seen to be able to guarantee future water supplies. And nothing says water security quite like a giant water-making factory, otherwise known as a desalination plant.

The rush to build desalination plants around Australia reflects a much broader problem: the highly reactive nature of governments and the media, both of which tend to favour quick-fix solutions to complex problems.

When demand for electricity rises, the quick-fix solution is to build another power station. When roads get clogged with traffic, the solution is to build more roads. When our cities and towns look like running out of water, the solution is to build big desalination plants or even giant pipelines.

But if there's one thing we ought to have learnt by now, it's that quick fixes usually come with massive long-term costs. Desalination is a particularly short-sighted fix for all sorts of reasons, ranking among the most expensive, energy-intensive and high-emission ways to produce drinking water. That's why desalination ought to be seen as an absolute last resort.

The craziest thing about our situation is that even at a time of supposedly critical water shortages, we're giving our water virtually free of cost to private companies, even when doing so results in higher greenhouse gas emissions.

How did we end up with so much oil in our water?

When it comes to imposing water restrictions, there's one set of rules for households and another very different set of rules for big businesses. Just one example of those different rules in action was a deal allowing bottled-water company Sunkoshi Limited to extract 150 million litres of water from an underground aquifer east of Melbourne, at the extraordinary price of just $2.40 per million litres. Just picture it: for the price we pay as consumers for one standard-size 350ml bottle of water, private water companies get to extract nearly three million times that amount. In contrast, residents in a nearby country town, whose water comes from the same underground source, have been forced to live on water restrictions. The Powelltown residents and their local council have tried unsuccessfully to challenge Sunkoshi's water allocation.

Similar examples can be found all over the country, involving some high-profile multinational companies. For instance, in late 2008 Coca-Cola won a court battle to pump up to 66 million litres of water from Mangrove Mountain on the central New South Wales coast for its Mount Franklin and Pump brands. Once again, local residents, businesses and the council tried to stop Coca-Cola's expansion plans, but the court decision means Coca-Cola can keep extracting water from the area until 2011.

Despite most parts of Australia enjoying good quality tap water, the bottled water business is booming. Australia's bottled water industry is worth around $500 million a year and is just one part of the wider bottled soft drink industry, which is worth billions more. Most of these disposable plastic bottles are made from oil-based products, and although they're recyclable, two out of three bottles ends up at the tip.

A New South Wales government study in 2006 found that more than 450,000 barrels of oil went into making and transporting bottled water in Australia, depleting an increasingly scarce and expensive fossil fuel while generating an extra 60,000 tonnes of greenhouse gas emissions. Then there's the cost to all of us as consumers: for the same price of one new bottle of water, you can refill your own bottle 1350 times.

As consumers, opting for tap water whenever it's available is a relatively easy choice. It's only part of the solution though. To truly make every drop count, we need bigger-picture changes as well, starting with rethinking the price of water and the kind of water infrastructure we invest in.

How can we make every drop count?

At the moment, our water authorities don't charge anywhere near the real cost of our water. This is a major problem. Just like energy, as long as it's cheap, it's easy to waste and take for granted. The good news is that Australia has plenty of opportunities to conserve and use water more effectively, from stormwater harvesting, recycling and better water management in buildings. The beauty of many of those solutions is that they address several problems at once—reducing our greenhouse gas emissions at the same time as helping us adapt to climate change.

For instance, even if you don't own a beachfront home threatened by rising sea levels and storm surges, there's a good chance that your home will still be increasingly vulnerable to worsening stormwater flooding when the drains beneath our streets simply can't handle the volume of water flooding into them, leaving the water to flood down our streets instead.

Climate change is one factor in why stormwater flooding is becoming increasingly costly, but it's not the only one. Even now, we're still building new homes on areas of land that were traditional floodplains. Ageing infrastructure is a problem too; many of our richest suburbs are in long-established inner-city areas, whose drains were first built a century or more ago.

So how can we reduce our contribution to climate change while also protecting ourselves better from stormy weather? One answer is with rainwater tanks.

By collecting water from our roofs, we're making use of a local resource rather than water from distant dams or even high-energy desalination plants, which saves on electricity and emissions. By stopping that rainwater from rushing down our pipes and down the drain, we can lower the risk of stormwater floods. By reducing stormwater flooding, we can cut down on damage to our homes, save on insurance premiums, reduce the chance of cars getting stranded in washed-out roads and reduce the amount of rubbish polluting local creeks and rivers, which can trigger toxic algal blooms.

Water authorities and governments often argue that decentralised solutions such as installing more rainwater tanks in suburban areas are too expensive to bother with as water-saving measures. That's true if you take a narrow view and ignore the broader economic benefits of avoiding flooded roads, polluted waterways and increased greenhouse gas emissions from extra demand for mains water. Factor those costs in, and rainwater tanks start looking like a much more sensible option.

In a study conducted for the Victorian government, which was only made public after a Freedom of Information request, it was found that taxpayers would save more than $600 million on long-term stormwater management and water supply costs if every new house and apartment block in Victoria was built with a rainwater tank. That's because each year in Melbourne alone, a staggering 400 billion litres flows down the drains as stormwater—roughly the same amount as the entire city's annual water consumption. If more of that water were diverted for use on people's gardens and to flush toilets, it would avoid the need to use billions of litres of centrally-supplied drinking water. Given the rising costs of repairing old drains and removing algal blooms after heavy downpours, some water experts say that the $600 million-plus saving outlined in the study for just one state could be a considerable underestimate.

This approach is being trialled in a new suburb in Warrnambool, on Victoria's south-west coast, where houses are being built with pipes that will carry water from their roofs to an underground tank and pipe system. The water will then flow downhill for two kilometres to the city's dam, where it will be purified and used to top up drinking water supplies. With as few as 3000 homes involved, they expect to be able to harvest around 450 million litres of water a year. It's the kind of integrated problem-solving that we need more of. Instead of simply asking 'how many more dams and desalination plants do we need to supply us with more water?', we ought to be asking, 'are we really making the most of the water we're using now?'

Why are our cities so central to tackling climate change?

The year 2008 marked a turning point in human history. According to the United Nations, it was the year when, for the first time ever, the majority of the world's population lived in cities. That's an incredible change from the past; even a century ago, fewer than one in eight people were city-dwellers.

That global shift looks set to continue, with two-thirds of people expected to be living in urban areas by 2050. If that happens, it could send global greenhouse gas levels through the roof. That's because people in cities currently use more energy than people in the country. As a result, more than three-quarters of the world's greenhouse gas pollution today is generated by city living.

However, denser city living results in massive economies of scale; for instance, the city of London produces around a third less greenhouse gas emissions from its transport than Melbourne does, despite having around double the number of people living there.

That means there is plenty that can be done to reduce emissions from our sprawling cities. Not only do we need to provide better public transport to outer areas; we also need to rethink our planning rules and where we allow new population growth to occur, because the lack of consistent, long-term planning is only entrenching the problems we have.

Fixing our cities is more important in Australia than in most countries, because we're an unusually urbanised nation, with more than four out of five of us living in cities. That means we have more potential than most places to make big greenhouse gas cuts in our cities and towns, through a combination of better buildings, better transport and smarter planning.

It's a particularly urgent challenge for fast-growing cities such as Darwin, Brisbane and Perth, whose populations are predicted to more than double over the next 50 years. If people in those cities want to avoid facing transport and other infrastructure shortages in future, they could do worse than to study the growth of Melbourne, which within the next two decades is set to rival Sydney as Australia's most populated and most sprawling city.

What's the missing link in our outer suburbs?

Not so many years ago there were more cows than people living in Epping North, on the northern outskirts of Melbourne. Today the old paddocks are mostly gone, sub-divided and built over with row upon row of new houses. While the outer suburbs used to be marketed as the place to go for a cheap house and land deals, today's sales pitch is much more sophisticated. Now it's all about buying a better quality of life, and being green is all part of the package.

One of the most promising of these new housing developments is the Aurora project. Built by the state government–owned developer

VicUrban, it's the largest six-star housing development in Australia, which means the new homes there are all well above the Australian average on energy efficiency. By including from the outset features like north-facing orientation and good insulation, the developer keeps costs low, adding almost nothing more to the cost of a new terrace house, and only about $2000 to the cost of detached houses.

Those are only some of the green features on offer. There's also recycled water piped to every house for flushing toilets and watering gardens, as well as a construction process that drastically reduces waste materials. VicUrban even planned ahead to make it easier to live a healthier, more sustainable lifestyle—crucial for combating chronic health problems like obesity—by building parks, shops and community centres within walking distance of most homes.

But Aurora's most exciting sustainability feature of all wasn't its homes or its parks: it was the new train line, shown on the original sales maps as running straight through the centre of the development. The entire project was designed around that future train line and station, partly thanks to the advice of Perth transport guru Professor Peter Newman, who describes railways as the spine that holds together all well-connected cities.

Mimicking the design of an inner suburb, higher density terrace homes were planned to be built close to the station, while bigger, more spread-out houses were located slightly further away. The idea was to make catching the train possible for everyone, with early promotional material and maps showing that the new train station would be within about 800 metres of most homes.

It looked like integrated planning at its best. Instead of making the same old mistakes—building a new suburb designed with only cars in mind, waiting for the traffic build up, and only then considering whether residents might like public transport—VicUrban was smart enough to build around public transport from the outset, to make catching the train one of Aurora's main lifestyle attractions. At least, that was the plan.

Young couples and families have already begun moving into Aurora. Over the next decade, around 25,000 people will settle here, with tens of thousands more in the surrounding estates. When people buy a house in Aurora today, however, the promised train station has vanished off the map. Instead, the only public transport on offer is a bus that runs just once every 40 minutes during the week, with even less frequent services on weekends.

It's not VicUrban's fault: the real problem lies with politicians who have ignored their own reports that strongly recommended the train extension through Aurora as the number one transport priority for this area. Several new roads and even a freeway upgrade were ranked as being much lower priorities, yet they have all been completed.

Successive governments have figured that, as long as they kept building new roads to the new housing estates, everything would be fine. The end result is that metropolitan Melbourne now stretches nearly 100 kilometres from one side to the other, and ranks as one the most car-dependent and sparsely populated cities anywhere in the world.

It's a situation that leaves new Aurora residents with the same lack of choice as in so many other outer suburbs: get in your car, or stay home.

Why should we beware the VAMPIRE?

A decade ago, the cost of buying a typical new home in Australia was about four times the average annual wage; today it's nearly twice that much. That growing gap has made housing affordability one of the hottest topics around and one of the most politically sensitive, especially because it's a big concern in so many marginal electorates. That's why state and federal governments know they need to be seen as doing something about it. The trouble is, there are serious doubts about how effective many of the government's so-called solutions have been.

Take the billions of dollars spent Australia-wide on various federal and state first home-owner grant schemes since 2000. While the grants have spurred an increase in first home buyers, much of the evidence shows that the overwhelming effect of those multi-billion-dollar subsidies has been to drastically inflate prices in the cheapest end of the property market—creating a property bubble that threatens to burst again when interest rates rise.

The real housing affordability crisis in Australia today goes far beyond simply the costs of buying a new home; instead, it's a bigger crisis to do with the cost of living. As it turns out, it's a crisis that is biting the hardest in many of the outer suburbs that are marketed as being the most affordable places to buy or rent.

Researchers from Griffith University came up with a name for the problem: the VAMPIRE effect, which stands for the Vulnerability Assessment for Mortgage, Petroleum, and Inflation Risks and Expenditure. As its full title suggests, the VAMPIRE assessment covers

a wider range of household costs, not just the upfront cost of housing, so it's a much more sophisticated way of looking at affordability. Using their results, the researchers created maps of Perth, Adelaide, Melbourne, Sydney and Brisbane, revealing the areas where people find it hardest to cope when interest rates, petrol prices and the cost of groceries go up.

The suburbs coloured green on their maps show the areas where increases in the cost of living don't have a major impact on people's household budgets; suburbs coloured red show where price rises really hurt. What stands out on the maps is that it's the outer suburbs where people are most deeply in the red.

While some suburbs are ranked as being at high or very high vulnerability because people in the area are on low incomes, if you overlay a map of the cities' public transport networks—particularly train lines—it's remarkable how much the maps match up. Generally speaking, the further out you travel from the city and the further away from reliable public transport routes you live, the darker the red becomes. If you live in one of those suburbs and have occasionally felt like your wallet is being bled dry at the petrol pump, you're far from alone.

But let's say you don't live in one of those suburbs; perhaps you live in the country or the inner city. You might be thinking, 'well, urban sprawl's not great, but at least it's not really my problem'. Unfortunately, that's not true either: we're all paying for it.

How did urban sprawl become so taxing for all of us?

While building a brand-new suburb on previously undeveloped land might seem like the easiest way to provide new housing, this solution is a growing cost burden for every Australian taxpayer. That's because of the indirect economic costs of urban sprawl—hidden costs that include the amount of productive time lost in commuting and the many health costs associated with heavily car-dependent lifestyles. There are also the mounting bills for infrastructure, which are largely being paid for by governments rather than developers. Ultimately, that means all of us pay for it.

Research covering several Australian capital cities concluded that every 1000 new homes on the urban fringe costs around $653 million in long-term infrastructure, health and environmental expenses. That's more than double the $309 million estimate for the same number of homes within existing suburbs. Those higher costs are largely due

to the need to build extra roads and public transport services, but also account for other infrastructure—including sewerage, electricity, telecommunications, schools and hospitals—the building of which costs more than upgrading existing infrastructure.

There's also a huge greenhouse gas emission toll from our sprawling cities. With most jobs still centred in the central business district, people living on the edges of our cities have to drive much more. That's why a typical Australian living in the outer suburbs ends up producing up to ten times more greenhouse gas emissions from transport than those living in inner suburbs.

While many Australians are doing their best to cut emissions at home, the additional driving they need to do to get to work means they're often racking up extra emissions in their cars. But it's not a problem that individuals alone can fix. We urgently need our governments to get serious about urban planning and better public transport.

How far would you go to escape the city limits?

For many Australians, going away for a beach holiday is a sacred summer ritual. It's a place to escape from work and the stresses of city living. Yet the future of many of our best-loved beach escapes is under threat, not only from climate impacts such as rising sea levels, but from something just as insidious: the gradual creep of urban sprawl.

In 2006, a major federal government report warned that the rapid expansion of major cities along the eastern coast of Australia was already seeing an increasing number of quiet coastal towns and quality farmland being swallowed up by new outer suburbs. In a chilling conclusion, the report said that, if left unchecked, the coastal development would soon give way to a virtually unbroken mega-suburbia down our east coast, stretching from Hervey Bay in Queensland to the Surf Coast in Victoria.

It's a warning that conjures up an image of endless traffic, even in the places where we used to go for holidays to unwind and get away from it all. It's a future we can already see becoming a reality in some of our most popular beachside towns, where the summer traffic jams can be as long and painful as anything you'll hit while driving in the city in peak hour.

Curbing urban sprawl isn't easy, not least because of the influential lobby groups with an interest in letting our cities continue to grow, including the car and oil lobbies, as well as road builders and

construction unions. Then there are the most obvious suspects of all, the property developers.

There's a lot of money to be made from buying up cheap farmland in areas beyond the city fringes that are supposed to be off-limits to development—a practice known in the industry as land banking—and then lobbying local and state governments with persuasive claims about the need to re-zone the land to build affordable housing. People with a lot of money at stake tend to be generous supporters of political parties, with the property industry ranking among the biggest donors to both major parties.

What's the solution? We can start by learning from the revival of a dying city centre.

How did a lost city find its way again?

Getting lost in the middle of Melbourne can be a lot of fun. Take a wrong turn down a dark alley and you can find yourself at the door of the hottest new club in town. Wander along a crowded laneway and get sidetracked into an arcade and you can find yourself in a grand old building with nine storeys of artists' studios. Walk up the main street and turn into a dimly lit stairwell and you can find yourself kicking back in a deckchair at a rooftop cinema.

Yet it wasn't so many years ago that central Melbourne was being written off as 'an empty, useless city centre'. Its streets were largely deserted after dark, retailers were packing up and moving out to suburban shopping malls and developers were busy swinging a wrecking ball into every heritage building that they could get their hands on.

What changed? And what does any of this have to do with tackling climate change? As it turns out, the rejuvenation of Melbourne's city centre has some vital lessons to offer on how we can remake all of our major cities into better places to get around and live in.

In June 1978, architect Norman Day was an angry man. In a scathing newspaper article for *The Age,* Day declared that his home town had 'an empty, useless city centre', and that 'effective city planning has been almost unknown in Melbourne for at least 30 or 40 years. For Melburnians, that means our city has been progressively destroyed'.

Over the next few years, it became clear that other locals shared Day's anger. In the early 1980s, voters booted out the old state and local governments, replacing them with politicians who promised to revitalise the lifeless capital. What has happened since then proves how

much can be achieved within only a generation, when politicians and bureaucrats have a mandate from voters to knuckle down and work towards a common goal.

In the mid-1980s, the city's council asked Melburnians a simple question: what do you like most about your city? The response was surprisingly consistent, with many singling out the city's easy-to-navigate central grid of streets, its trees and green spaces and its remaining historic buildings. The result was the Grids and Greenery strategy, which set out a vision for remaking central Melbourne.

To achieve its goals, the council mapped out which areas of the CBD needed more protection for heritage reasons, and which were open for greater development. They enforced a set of clear rules, including fixed height limits—similar to those in historic European capitals such as Paris, Prague and Barcelona—to protect the streetscape and reduce overshadowing.

New rules and incentives for developers were also introduced, aimed at making more efficient use of limited space within the CBD, not only by revitalising abandoned laneways but also by requiring new developments to incorporate more shopfronts and public spaces into the ground floor of new buildings.

At the same time, the council also laid out ambitious plans and targets to lure businesses, residents and events back to the city. Along the way, its planners widened footpaths to make more room for pedestrians, planted thousands of trees, put artworks on street corners and created safer bike paths out of the traffic. While the changes have all been gradual, the results speak for themselves.

How has Melbourne changed from being a useless city?

In just over 20 years, Melbourne has gone from having just a handful of outdoor cafes to having more than 700. Once derelict laneways are now jam-packed with tiny restaurants and bars. The number of people walking around town has doubled.

Even the council's seemingly impossible goal of attracting thousands of new residents and businesses back from the suburbs and into the central city has worked, proving more successful than anyone had dared to hope. In the 1980s, only a few hundred residents were scattered around a few pockets of central Melbourne; today, more than 15,000 people live in the city, many of them so that they can be close to work or university, which cuts down on traffic and transport emissions.

There's been a boom in green building, partly inspired by CH2, but also spurred by council policies that have pushed developers to come up with more efficient designs and renovations. Leading architects and developers around town are joining the effort to bring down the city's greenhouse gas emissions, and there are a growing number of renovated and new green buildings popping up around the CBD. Among them are 30 hotels that have benefited from practical advice from the council-run Green Hotels scheme, such as the Holiday Inn on Flinders. The hotel spent $27,000 on more efficient heating and water use; within a year, they had already saved $48,000 on their bills.

For all those reasons, inner Melbourne is now regularly featured in international architecture, design and style magazines as one of the best examples anywhere in the world of how to remake a city.

But as the people involved with remaking inner Melbourne are all too keenly aware, the kind of smart, integrated planning reform that has happened in the CBD is yet to happen in the middle and outer suburbs. Luckily, the lessons learnt in inner Melbourne can help to speed up the process of change across the rest of the city, as well as across Australia.

What rules can help to remake a city?

Whenever local or state governments try to bulldoze their way past residents by declaring, 'we're planning to build more homes in your area, whether you like it or not', it's a guaranteed recipe for disaster. Rather than antagonising ordinary people in that way, there needs to be genuine consultation about plans to remake a city, particularly in areas where more development is proposed.

There are places that have engaged in this kind of public consultation; Western Australia did it a decade ago, when preparing its sustainability strategy; the city councils in Melbourne and Sydney have done a pretty good job in recent years; and, internationally, a few cities, like Vancouver in Canada, have gone to huge efforts to ask people what they really want, and then acted on the findings.

Clear communication is important, especially for cutting through the often mind-numbing jargon of urban planning. For instance, when experts talk about the need for 'greater housing density', many people think it sounds suspiciously like code for giving developers free rein to build endless new apartment towers, without any additional services or benefits for the existing residents. Yet, with the right rules in place,

greater housing density in the right places—clustered in a few areas along existing or new public transport routes—is a crucial part of getting the economies of scale needed to provide more frequent and reliable train, tram and bus services of the kind that people enjoy in similar-sized European cities to ours.

Clear rules help as well. Fixed height limits have been proven to work in giving greater certainty to residents and to investors, cutting down on squabbles over new developments, encouraging more efficient use of space and keeping land prices from being driven to ridiculous heights because of speculative over-bidding by developers.

Higher but fixed height limits are a good idea for busy areas located close to public transport, which are officially known as 'activity centres' and which are essentially like mini-CBDs, because they're small centres where you can go to work, shop and catch public transport.

Creating incentives to set up businesses in those 'activity centres' outside the CBD means bringing more work closer to where people live, which saves time and greenhouse gas emissions from cars being stuck in traffic. It's the kind of integrated solution that both major political parties ought to be supporting, given their claims to being pro-family and pro-business; kids wouldn't have to be in child care for so long and we could all get more work done if we weren't losing so much time commuting.

Just as height controls put a limit on buildings going up, the same kind of rules can help to stop our cities from spreading out even further. Most Australian state governments have agreed that such limits on urban sprawl, known as urban-growth boundaries, are a good idea. Now they just need to enforce them.

In theory, metropolitan Melbourne has a fixed urban-growth boundary. In practice, it's turned into a joke, as the state government keeps moving it further outwards, buckling to pressure from developers who are keen to turn cut-price semi-rural land into new housing estates. It's like someone agreeing with their doctor that they need to urgently lose weight, only to go home and deal with the problem by letting out their belt buckle by another notch. Just as setting sensible goals can help in losing weight in a healthy way, they can help in remaking a city. When urban planners at the City of Melbourne first set ambitious targets to attract more people and business back into the struggling city in the 1980s, many critics said they would never succeed. Overwhelmingly, their targets have been met or even exceeded.

Today, the council is using the same approach for setting greenhouse gas emission goals, aiming to cut emissions by 35 per cent for each

resident, and by 59 per cent for every worker in the city by 2020. It's part of a broader sustainability strategy based on feedback from thousands of local residents, which also includes practical measures such as a plan to upgrade 1200 existing commercial buildings around the city. Once complete, those better buildings are expected to use 40 per cent less energy, save an estimated 383,000 tonnes of greenhouse gas emissions and create more than 3000 local jobs.

While the council still has a long way to go to achieve its goals, its track record means there is some reason for optimism. The City of Melbourne is also far from alone. Many of Australia's city and shire councils have been working to reduce their emissions for years, with more than 180 councils nationwide collectively saving nearly 5 million tonnes of greenhouse gases in 2008 alone. So, while many people are understandably cynical about the lack of political action on climate change, it's often at a grassroots, local government level that the most positive steps have already been adopted.

How much is your vote worth?

A generation ago, few people seriously imagined that dull and dreary inner Melbourne would ever be held up around the world as an example for other cities to follow. Yet it now is—and it only happened because people got angry and demanded change.

What happened in Melbourne is not unique. It was the same story in Perth: its recent rail revival only began because of anger at the closure of the Fremantle train line. It was the same in London: the reinvestment in the Tube, in new buses, new cycling lanes and other new infrastructure only happened after gridlock threatened to shut down the city.

There are a surprising number of other cities where similar patterns have emerged, such as in Vancouver, where it took a proposal in the 1970s to build a freeway through the heart of a bustling community to spark a remarkable public transport revival. Sometimes it takes a crisis to shake us up and make us see the stupidity of old habits. That's why now is the perfect time to start demanding real change from our political leaders.

You don't have to be a long-time political activist to make politicians sit up and take notice of your views. According to leading electoral analyst Antony Green—the man who crunches the numbers for the ABC each election night—swinging voters living in outer suburban

areas have been crucial in deciding the outcome of every federal election since World War II. That's why, when suburban mums and dads start feeling the bite of the VAMPIRE effect—particularly when petrol prices rise sharply—and they go on talkback radio to demand action, governments tend to panic and offer up more quick fixes.

In the 2007 election, some marginal seats were so closely fought that the final result came down to just 27 votes. Despite a still common perception that climate change is something that mainly young, left-leaning voters care about, two separate studies found that swinging voters of all ages nationwide nominated climate change as the key reason why the Howard government had lost their vote. Since then, even in the wake of the global financial crisis, Australians have continued to overwhelmingly say in opinion polls that they want stronger action on climate change than either Labor or the Coalition has promised to date.

Your vote has a dollar value too. Here's how it works: each of your number one votes in the House of Representatives and Senate is currently worth around $2.30. As long as a candidate wins a minimum of 4 per cent of those first preference votes, they get repaid $2.30 per vote they get. The major parties currently bank on the fact that four out of five Australians consistently give their first preference votes to either Labor or the Liberals, which at the last election earned the parties $40 million out of the $49 million in public election funding. We shouldn't let them take us for granted.

Whether you live in an electorate that's never changed hands or in the tightest seat in the country, remember: your vote counts. If you're frustrated with both major parties' performances on climate change, you can register a protest vote that hits them in the hip pocket, simply by looking for better independent or minor party candidates to give your number one votes to. (Your second preference votes can still be valuable in deciding a tight election result, as well as in shaping the make-up of the Senate. So, if you have a preference for a Coalition or Labor government, you can indicate that with your second preference vote when you fill out the House of Representatives ballot paper.)

There are nearly 14 million voters in Australia. What would happen if even a fraction of them realised how badly they are being served by quick-fix state and federal government policies? Just think about some of the huge financial, health and lifestyle costs of short-sighted transport and planning decisions, including losing an average of $750,000 in lifetime savings for every extra car your household needs to run, and losing the equivalent of your annual holidays to being stuck in traffic.

All Australians, no matter where we live, are footing the bills for ill-considered infrastructure spending that is doing very little to give us better cities to live in. That's why it's in all of our interests to shift the political debate, by speaking up in favour of long-term solutions to big problems like urban sprawl and climate change. With that in mind, chapter seven has some tips on more effective ways to have your say.

As we've seen from what has happened in Melbourne, Perth, London and elsewhere, you can't remake a city, its buildings or its transport overnight. But with a clear vision, sensible strategies and the persistence to see the job through, extraordinary changes are possible.

6

Plan B

How emissions trading compares with a carbon tax

Australia doesn't often get a standing ovation at international climate summits. But at the Bali summit in December 2007, the rest of the world had never been so happy to hear from us.

As a senior Australian delegate tried to read a statement announcing that Kevin Rudd had just ratified the Kyoto Protocol in his first act as Australian Prime Minister, hundreds of delegates burst into applause, some standing and raising their clapping hands in delight. Beaming, Indonesia's Environment Minister and president of the UN climate talks, Rachmat Witoelar, declared that he spoke for the 180 nations at the conference in 'giving a sigh of relief' at Australia's new position, before leading another round of rousing applause.

A week later, when Rudd flew to Bali, accompanied by Australia's first Climate Change Minister, Penny Wong, he gave a speech indicating that his government was ready to make a fresh start in working with the world to cut emissions. He told the conference: 'Action to tackle climate change will not be easy. It will require tough choices. And some of these will come at a political price. Unless we act, the long-term costs will threaten the security and the stability of us all.'

Rudd also pledged that Australia would soon set binding greenhouse gas targets for 2020, which he said would be 'real, robust targets … fully cognisant of the science'. He ended his speech with a call to arms to all nations to do their 'fair share'.

'There is no Plan B,' he said. 'There is no other planet that we can escape to. We only have this one. And none of us can do it alone. So let's get it right. The generations of the future will judge us harshly if we fail.'

So far, the government's rhetoric has been a lot more impressive than its actions. Despite arguing that tough action now is better than having regrets later, the Rudd government's main policy aimed at cutting emissions—the Carbon Pollution Reduction Scheme (CPRS)—has ended up being eerily similar to the kind of scheme that former Prime Minister John Howard would approve of. In fact, Howard himself has said just that, declaring in late 2009 that, 'even with the emissions trading system, what Mr Rudd is proposing is not all that different from what I took to the last election.'

How is emissions trading supposed to work?

In theory, emissions trading—often also called a 'cap-and-trade' system—is supposed to be straightforward. The starting point is for the government to decide the amount of greenhouse gas emissions that should be released every year, as part of working towards lower emissions over time. Once they've figured that out, that amount becomes the emissions limit, or 'cap'.

The government then creates millions of permits—effectively licences to emit greenhouse gases—up to this limit. Ideally, all these permits are then sold through auction to the companies producing large amounts of greenhouse gas emissions, such as electricity generators. These companies can choose to reduce their greenhouse gas emissions and so not need to acquire many permits. Or they can keep producing emissions at their usual rate, and choose to buy extra emission permits.

The whole point of it is supposed to be about bringing down emissions by introducing a carbon price into the economy, based on the 'polluter pays' principle: the more you pollute, the more you'll have to pay. Without a carbon price like that built into the economy, there's no financial incentive to burn fewer fossil fuels.

That's the theory. In practice, things haven't proven quite so straightforward.

How has emissions trading worked in practice?

Since 2004, the European Union has been running the world's biggest emissions trading system. There were high hopes that it would be a good example to the world of how to save emissions. Unfortunately, it hasn't quite worked out that way.

One of the biggest problems from the outset was that the EU caved into huge lobbying pressure from the biggest polluting industries, especially electricity generators, and gave them their emission permits for free at the start of the scheme. Once the system was up and running, it emerged that many companies had greatly overestimated how much pollution they were generating, and were given millions more permits than they actually needed. Companies flooded the market with spare permits, which sent the price of carbon on the newly-formed carbon market tumbling. From a high in 2006 of €30 for a permit to produce a tonne of carbon dioxide, only a year later the price had crashed to just €1 a tonne.

Two years later, as the recession began to bite in late 2008, companies in Europe started to cut back their production of emissions-intensive products like steel. They found that there was money to be made in doing nothing, reducing their production of goods and then reaping a tidy profit from selling unneeded emission permits. Around €1 billion ($A1.6 billion) worth of emission permits were sold off over just a few months in late 2008 and early 2009. Once again, more permits than anyone expected flooded into the market and their price plummeted, along with the financial incentive to reduce greenhouse gas emissions.

One of the biggest criticisms of the EU cap-and-trade scheme is the windfall profits obtained by some of the largest, most polluting electricity companies—the very ones who should be paying the most for their massive contribution to greenhouse gas pollution. Emissions trading analysts at Point Carbon have estimated that, by 2012, electricity companies in just five European nations could reap as much as €23 billion to €71 billion ($A37 billion to $A113 billion) from selling emissions permits.

The Europeans deserve credit for being the first region in the world to try to set up an international scheme to charge a price for greenhouse gas pollution. However, it was and remains a deeply flawed system. The benefit for other countries, including Australia, is that we can learn from their mistakes, and ensure that whatever scheme we introduce here doesn't make the same mistakes.

Why did Rudd's trading scheme sound so promising?

When the Rudd government was elected at the end of 2007, even cynics thought there was some reason for hope. Voters had given the government a mandate to get on with tackling climate change, and initially Rudd seemed to respond, appointing Australia's first Climate Change Minister, Penny Wong, and making widely applauded speeches overseas. The government wasn't only taking symbolic action, like ratifying Kyoto; behind closed doors, some senior ministers were talking tough with industry as well.

In meetings with chief executives from power, mining, oil and aluminium companies, Wong bluntly declared that the Howard era was over, as were the days of generating greenhouse gas pollution for free. At the same time, Wong was publicly saying that the government was reluctant to compensate coal-fired electricity generation companies for the costs that they would face from an emissions trading scheme. The government was also talking up its ambitions internationally, with Kevin Rudd telling the UN General Assembly in New York that Australia was 'developing the world's most comprehensive emissions trading carbon-pollution reduction scheme to bring down carbon dioxide emissions'.

The most promising sign of all was that, for the first time, an Australian government was talking about the urgent need for big, structural reform of the economy in order to get serious about cutting emissions. For a while, it seemed like the Rudd government really was going to earn its standing ovation at Bali. But, when the plans for the Carbon Pollution Reduction Scheme were finally released, those hopes were dashed.

What happened to the polluter pays principle?

Kevin Rudd can't say he wasn't warned. In 2008, while the federal government was still drafting the rules on how the CPRS might operate, Labor's hand-picked economic adviser Professor Ross Garnaut completed his review on the economics of taking action on climate change. While supporting emissions trading if the scheme was set up right, Garnaut warned repeatedly that there were many ways to get it badly wrong. In particular, he cautioned that over-the-top compensation for a few high-polluting industries, such as the EU had given, could wipe out the financial disincentive for them to keep polluting, while

shifting an unfair share of the costs of cutting emissions onto Australian households and small and medium businesses.

Garnaut also foresaw the danger of politicians being lobbied by big industry making outlandish claims about how they couldn't afford to pay a price for their emissions and would need more time before putting in such a scheme. Cave into all those demands, he said, and the scheme would become a costly mess, which would delay the inevitable need for Australia to become a low-emission economy.

Garnaut was right to be worried.

The mining industry was at the forefront of the lobbying charge, warning that adopting a strong greenhouse target would send Australia back to being 'a candle-lit economy'. Individual companies, such as BlueScope Steel, also made predictions of economic doom, with its chairman declaring that 'the Australian economy will survive the economic downturn, but it may not survive the CPRS'. Tens of thousands of jobs were at risk, Australians were warned, and the only way to save them was with even more industry compensation.

In Canberra, everyone from senior ministers to opposition back-benchers found their diaries filling with meetings with lobbyists, many of whom were former MPs and senior bureaucrats who had worked in Parliament House for years. The overwhelming majority of lobbyists were there representing companies such as ExxonMobil, whose staff later described how they had made repeated presentations to more than 50 or 60 MPs about their concerns.

Just how genuine were those industry claims? When several major investment analyst firms—including Citigroup, JP Morgan and RiskMetrics—took a closer look at the claims, they quickly discovered that many companies that were publicly warning of drastic jobs cuts due to the CPRS were simultaneously telling their shareholders and prospective investors that a carbon price wouldn't have much impact on their bottom line.

Companies that make false or misleading statements to the stock market can be fined hundreds of thousands of dollars and taken to court by Australia's corporate regulators. In contrast, making misleading claims through the media and to politicians can prove very profitable, with the persistent lobbying effort over the CPRS paying off.

At every stage of the CPRS consultation process, the Rudd government has agreed to more generous industry compensation. The principle of having an emissions trading scheme based on the principle of polluter pays has been abandoned, and replaced with a new rule of thumb: the more greenhouse gas emissions a company produces, the more freebies it is entitled to.

How much industry assistance is enough?

For all the criticism from some quarters that the CPRS is too tough on business, the truth is very different. In fact, according to the government's own advisers, if the CPRS were to go ahead as planned it would be the biggest and most expensive government welfare program for industry that Australia has ever seen.

Far from paying even close to their share of the costs of Australia's greenhouse gas pollution, many industries with the highest emissions will initially be given up to 95 per cent of their emission permits for free. Combine that with the plan to cap the price of permits at $10 a tonne in the first year of the scheme, and the result is that some companies would be paying just 50 cents a tonne for their emissions. In the first five years alone, investment analyst company RiskMetrics has estimated that the subsidies for industries like the aluminium sector would be worth more than $16 billion.

While the rate of industry compensation is set to decline very slightly each year, the high-emissions industries have been promised a full review and at least five years advance notice of any change in the levels of assistance to them. That kind of policy certainty is invaluable, but it's rarely offered to other businesses. It's in stark contrast with areas like renewable energy, where large-scale projects continue to be stymied by price fluctuations triggered by constantly changing government policy.

In the meantime, the Rudd government's earlier tough-talking about not compensating coal-fired power stations didn't last either. Under the CPRS, there are now plans to provide billions of dollars' worth of assistance to coal generators too. Much of that money would go to the owners of the highest-emission brown coal–fired power stations, which are precisely the power stations it makes the least economic or environmental sense to keep subsidising.

Like the delay in the proposed starting date, the government's justification for providing these subsidies is that industry needed more time to prepare. That begs the question though—how much more time could industry have been given?

It's been more than 20 years since Australia set its first greenhouse gas reduction targets. Following the 1988 Toronto climate conference, the federal Hawke government and the state governments of New South Wales, Victoria and Western Australia all supported the target of cutting greenhouse gas emissions by 20 per cent below 1988 levels by 2005. As for charging money for emissions, successive federal governments have been talking about bringing in some form of carbon price since the

mid-1990s, starting with a proposed carbon tax under the then Prime Minister Paul Keating. Although Keating abandoned the plan in 1995, at the time there was talk of a carbon price starting at $1.25 a tonne of carbon dioxide—more than twice the token starting price for the biggest polluters in the CPRS proposed by Kevin Rudd.

In the early years of the Howard government there were also serious discussions of bringing in an emissions trading scheme, with only Howard's personal intervention blocking the scheme in Cabinet. By his last year in office, even Howard was resigned to the inevitability of a carbon price, committing to bring in an emissions trading scheme if his government was re-elected.

More than 20 years of talking about the need to cut emissions. More than 15 years since the first government proposal to bring in a carbon price. More than a decade of talking about emissions trading. That's a lot of warning time. So why are Australians now being expected to subsidise companies that have continued gambling their money on high-emission investments?

In the past, when governments have decided to regulate certain industries, like asbestos or tobacco, they haven't compensated the companies involved—especially when those companies knew that there were significant costs associated with their product that they hadn't been paying for. Yet the only argument you're likely to hear from either the federal government or the opposition over industry compensation is not about how much assistance they need, but which party offers them more.

How is the Carbon Pollution Reduction Scheme designed to let Australia's emissions keep rising?

There is another, more fundamental problem with the Carbon Pollution Reduction Scheme. The entire scheme is based on deliberately misleading greenhouse gas targets—and those targets undermine everything that the Rudd government has said about turning Australia into a low-carbon economy of the future.

In theory, the Rudd government has committed to cutting Australia's emissions by somewhere between 5 and 25 per cent below 2000 levels by 2020—which is equivalent to 4 to 24 per cent below 1990 levels. In practice, the Rudd government's CPRS is likely to achieve something quite different: as the government's own data shows, it would allow Australia's emissions to continue rising for decades to come. That's

because the CPRS includes a huge loophole, allowing businesses to do nothing to cut the emissions they produce in Australia and instead import 100 per cent of their permits to pollute in the form of cheaper international offsets.

With a rule like that in place, the most economically rational short-term choice for many businesses would be to pay for overseas offsets that would allow them to keep burning fossil fuels. As the federal Treasury has forecast, having that kind of unlimited access to international offsets could mean Australia failing to achieve even a 5 per cent cut in emissions here until 2035 or even later.

The Treasury report argued that Australians shouldn't be worried about that though, because paying other countries to cut our emissions on our behalf 'does not compromise the environmental objective' of the CPRS. Climate change is a global problem, so paying someone else to save a tonne of emissions in China, India or Brazil ought to be just as good for the planet as directly saving a tonne of emissions in Australia.

The problem is, that's simply not true.

Why is offsetting an unreliable way to cut global emissions?

There are a number of different international carbon offset schemes, but the biggest and most lucrative market of all is trading in UN-managed Clean Development Mechanism (CDM) credits. Set up under the Kyoto Protocol, the CDM program is designed as a cheaper alternative for companies in industrialised nations to cut emissions overseas rather than at home, by funding low-emissions infrastructure projects in poorer nations. In exchange for funding lower-emission projects, the companies get carbon credits for the resulting emissions savings.

CDM projects can include anything from paying a coal-fired power station to make use of its wasted heat, to upgrading factories and steel mills, to building new hydro-power or wind farms. The most important rule underpinning the credibility of the whole system is to do with what is known as 'additionality'—in other words, that the offset projects can prove that they are additional to what would have happened without the funding.

Companies covered by the European Union's emissions trading scheme have been the biggest buyers of CDM and similar international offsets to date, importing hundreds of millions of tonnes worth of offsets from developing countries. That trade in imported offsets has

allowed a number of European countries to continue increasing their own levels of emissions while claiming to still be on track to meet their Kyoto targets. But it has since emerged that many of those international offsets weren't worth the paper they were printed on.

When two senior Stanford University researchers examined more than 3000 projects that were either applying for or had already been granted $US10 billion ($A11 billion) worth of CDM credits, they concluded that up to two-thirds of the emissions supposedly saved by the projects were not additional at all. They found that many of the projects would have happened anyway; in some cases, construction was already underway before the funding application was even submitted.

There is also the risk of blatant profiteering. In one notorious example, around €4.7 billion ($A7.5 billion) was spent over several years on projects in India, South Korea and China to capture and destroy a particularly potent greenhouse gas called trifluoromethane. Yet the real costs of doing so were estimated at less than €100 million ($A160 million), leaving a tidy €4.6 billion (around $A7.3 billion) to be pocketed by the factory owners and carbon traders involved.

Understaffed and overwhelmed with applications, the UN regulators are forced to rely on third-party verifiers, whose pay cheques come from the developers applying for CDM funding. There is a big push from many countries, including Australia, to expand the coverage of international offset projects to areas such as deforestation. Again, in theory it's not a bad idea. But without proper verification, for all we know we could be trading our money away for emission cuts that only exist on paper.

Is there an alternative to the Carbon Pollution Reduction Scheme?

While emissions trading has proven very successful at making money for some high-polluting industries and financiers involved with carbon trading companies, it has been significantly less successful at achieving genuine, verifiable emissions reductions. Looking at how Australia's emissions trading scheme has been set up, there is no reason to believe that the outcome here would be any different.

The proposed Carbon Pollution Reduction Scheme is horribly complex and riddled with long-term flaws, just like the EU one it was initially modelled on. Rather than reducing emissions, the CPRS risks achieving the precise opposite of what its name promises, thanks

to multi-billion-dollar permit giveaways and countless loopholes such as those allowing companies to buy unreliable overseas offsets. In its current form, the CPRS is not in Australia's long-term economic or environmental interests.

There is a lot of momentum behind the push for emissions trading though, both here and overseas. Many politicians and business people have staked their reputations on bringing it in. Among them are some people who genuinely believe that, in time, a global emissions trading market could be the answer to driving structural changes in our economies. Needless to say, there are also people whose main motivation in backing emissions trading is its potential to make them very rich, irrespective of whether it does anything to slow down climate change.

If Australia and other nations including the US do end up bringing in emissions trading schemes in the next few years, then clearly it will be important to try to close as many of the loopholes and over-the-top subsidy schemes as fast as possible. In the interim, it's not too late for a debate on whether there's a better alternative to the CPRS.

If we did have a federal government that was serious about introducing a carbon price that would encourage industries to switch to lower-emission activities, there is a tried and tested way of doing just that. What we need is a straightforward system that can be brought in quickly. We need a system with fewer loopholes than the proposed CPRS. The simpler the system can be, the easier it is for businesses to comply with. Just as importantly, a simpler system makes it easier for all Australians to see that there's nothing dodgy going on behind the scenes. We need a system where everyone, from individuals to big businesses, can play their part.

That's why we need a carbon tax.

How does a carbon tax work?

Like emissions trading, a carbon tax is all about introducing a price on greenhouse gas pollution. It works by adding a tax on the price of coal, gas and oil, set at a rate based on the carbon intensity of the fuel. For instance, the carbon tax on electricity generated from burning natural gas would be only half as much as for power from burning black coal, because gas produces only half as many emissions.

The added cost of using fossil fuels would inevitably be passed on, meaning price rises for things including petrol, electricity and groceries.

As consumers, the prospect of even the smallest price rise is never welcome. But the fact is that, unless you believe that climate change isn't a problem at all, it's inevitable that we will eventually have to address the hidden costs of greenhouse gas emissions. That means the real question is how to make that economic change fair and effective.

A key advantage of a carbon tax is that it's a more transparent solution than emissions trading, because it's easier to see exactly what tax rate everyone is paying. Because a carbon tax would apply right across the economy, it would also drive change in critical areas such as energy efficiency and better buildings, which we know can deliver the biggest, quickest, most cost-effective reductions in our emissions now and over the next decade. Doing that would begin the transition away from outdated, unnecessarily energy-intensive ways of doing things. It's the catalyst we've been waiting for to kick-start many of the climate solutions outlined throughout this book, and in the process finally get Australia moving towards being a low carbon economy.

With a carbon tax, the big greenhouse gas polluters would pay the most—rather than getting the biggest subsidies—while companies that are more innovative in finding ways to reduce their reliance on fossil fuels will gain a competitive edge, because they'll be able to charge a lower price for their products. It's a crucial difference between a straightforward carbon tax and a more convoluted emissions trading scheme: everyone pays a fairer share of the costs of cutting emissions.

Who backs a carbon tax?

Another advantage of a tax over trading is certainty. Because the price is more stable than under an emissions trading scheme, the government gets a more dependable income stream that can be reinvested in retraining people for jobs in new lower-emissions industries, for more ambitious national programs for energy efficiency to improve homes and businesses, or for carefully targeted rebates to low-income households.

For business, a tax offers more certainty and control over their costs, enabling them to plan ahead instead of not knowing whether the price of permits to pollute under an emissions trading scheme might spike up or down, as has happened in the EU. As staff from the International Monetary Fund wrote in late 2009, that kind of unstable carbon price is still slowing down investment in renewable energy. Boom–bust investment cycles are a disaster for companies deciding whether to

spend money on infrastructure that takes years to build and then will be operating for decades to come.

There's nothing new or radical about the idea of carbon taxes. Over the past 20 years, around half a dozen European countries, including Denmark, Finland, Britain and Ireland, have brought in various types of carbon taxes. More recently, other countries that have either given in-principle backing to a carbon tax, or else are in the process of bringing one in, include China, Japan and Indonesia.

One of the first to act was Sweden, which introduced a carbon tax in 1991 that has since been gradually increased. That economic reform started a shift in how Swedes did business and heated their homes, helping them achieve something that many said was impossible: shrinking the nation's carbon footprint without shrinking the economy. In stark contrast with most other countries, Sweden's greenhouse gas emissions have fallen by more than 7 per cent below 1990 levels, while its Gross Domestic Product has grown by more than 40 per cent.

Continuing to push for further improvements, in 2007 the Swedish parliament decided to modify the tax to reduce emissions by another 4 per cent, at the same time as integrating with the EU trading scheme. The Swedish environment minister, Andreas Carlgren, has highlighted just how successful the tax has been, noting that, without it, the country's emissions would have been 20 per cent higher today.

What are the potential problems with a carbon tax?

A carbon tax is not a fail-safe solution. Like emissions trading, a tax can also be badly undermined in all sorts of ways. For example, if the tax is set too low, or the industry and household compensation for its introduction is too high, there would similarly be little incentive for anyone to change. Another common concern is that a carbon tax could hurt business and affect jobs. One solution with broad support is to use some of the money raised to reduce other taxes, such as income tax and payroll tax. That means that there is still a price being charged for greenhouse gas emissions, sending an economic signal to drive change, but in the meantime the costs of employing people would actually fall.

For all the exaggerated claims about paying $100 for a steak, the difference in most Australians' household bills before and after introducing either a carbon tax or an emissions trading scheme would be far less than the scaremongering suggests. The only householders who

are genuinely expected to need compensation to avoid disproportionate price hikes are a relatively small number of low-income people, or people living in areas with high transport costs. Paying hefty compensation to virtually all households, as the Rudd government has proposed, is about politics rather than economics.

Crucially, in many cases, price increases for consumers and businesses can be avoided entirely by changing wasteful habits, as practical energy-saving programmes here in Australia, California and elsewhere have proven time and time again. Often it can be done with the simplest solutions, such as insulating homes, planting trees to provide external shade, and changing personal or work practices to make more productive use of energy, water and other resources.

As for how to practically bring in a carbon tax, a recent study for the conservative Centre for Independent Studies outlined one way to get started, with a tax of $30 per tonne of greenhouse gas emissions on energy use alone raising around $13 billion a year. Those funds could be used to support emissions-saving projects, from small-scale community and business grants through to investing in sorely needed public transport infrastructure.

A tax is a simpler, more effective, faster solution for cutting emissions. That's why so many people and major financial institutions—from renowned economists like Jeffrey Sachs and Nobel laureate Joseph Stiglitz to world-leading scientists like NASA's James Hansen—back a tax over trading.

Why is one little word so hard to say?

There is only one obvious reason why most politicians prefer to talk up the option of emissions trading ahead of a carbon tax. It's the dreaded t-word: tax.

The most ridiculous thing about the emissions-trading-versus-tax debate is that trading in emissions permits is really just another form of government tax. Although more convoluted than a tax, a trading scheme like the CPRS still raises money by charging a price on greenhouse gas emissions, which is collected by the government in the form of permits.

Understanding the CPRS in any detail involves learning a dictionary full of jargon in order to decipher the significance of SAIs and EITEs being allocated AEUs while also being allowed to surrender CERs, ERUs and RMUs. (Translated, that basically says that high-emission

industries will get permits to pollute for free, while being able to buy cheap international offsets.)

'Tax' has as few letters as all those acronyms, but it's a word that most politicians find much harder to say. While any new tax is hard to sell, politicians who are convinced that it's the right thing to do—which, for all his faults, John Howard did with the GST—have braved opposition to make their case and succeeded. Similarly, if politicians were convinced that Australians really wanted fast, effective cuts in our emissions, then more of them would be making the case for a carbon tax.

Talking about a tax is a lot tougher and requires more political leadership than pushing through a deeply flawed, poorly understood emissions trading scheme. It's the kind of leadership that Kevin Rudd has told the world we need, when he said at the Bali climate talks it was time to make 'tough, politically hard choices'. He hasn't delivered on that promise since and he needs to be held accountable for that.

We also need to demand better from the federal opposition, because without even some bipartisan agreement on the need for action, any government will struggle to bring in a carbon price. In the past few years, the Liberal party has changed its position on carbon pricing even more often than it's changed leaders. First John Howard was anti-ETS; then he was for it. His successor Brendan Nelson was anti-ETS; then Malcolm Turnbull was for it. Tony Abbott was half-heartedly pro-ETS, but then switched sides, declaring he was not only anti-ETS but anti–carbon tax too. If the Liberals ever want to be taken seriously on climate change, they need to come up with a more consistent, economically credible policy—fast.

The long-term consequences of going ahead with a flawed CPRS or no carbon price at all are serious. But it's not too late to change, and go for a carbon tax. That's why it is worth reminding ourselves and our current Prime Minister of what he has said in the past about climate change, because it remains as true today as it was then: 'There is no other planet that we can escape to. We only have this one. And none of us can do it alone. So let's get it right. The generations of the future will judge us harshly if we fail.'

Conclusion

To screw, or not to screw?

How much difference light bulbs really make

Over the past six chapters, we've looked into the economics of climate change, some of the key solutions to saving emissions through smarter consumption, energy, transport and buildings, and why a carbon tax would be more effective than emissions trading.

But what about the questions that provoked the writing of this book in the first place: is changing light bulbs as useful as it's always made out to be? And is Australia really doing the right thing by banning old-fashioned globes? The answers to those questions are revealing, particularly for what they demonstrate about the power of collective and individual action.

Can changing light bulbs really change the globe?

As it turns out, there are good reasons why so many people go on about the need to change our light bulbs. When the International Energy Agency did a study on how much electricity is used around the world for lighting, even their experts were surprised by what they found:

the amount of electricity going to waste each year through inefficient lighting was more than all the electricity produced by all the world's 440 nuclear power plants.

Worldwide, about 20 per cent of electricity is used for lighting, and it's only a slightly lower figure in Australia. By being smarter about the way we light our buildings and streets, there is potential to save nearly a billion tonnes of carbon dioxide emissions globally, as well as a staggering $122 billion on electricity a year by 2020.

By now, you won't be surprised to hear that Australia has among the highest per-person rates of energy consumption for lighting in the world, using an average of 62 megalumen-hours of electricity a year. That's the equivalent to every one of us leaving a dozen ceiling lights on all day and night, all year round. In the process, Australians spend more than $2.5 billion a year on lighting, which accounts for about 25 million tonnes of our national greenhouse gas emissions.

How can we start reducing those greenhouse gas emissions and the financial costs of lighting, without ending up living in the dark?

The obvious first step is to make the switch away from traditional incandescent bulbs, which have hardly changed in their basic design since they were first invented well over a century ago. Incandescents are so inefficiently designed that 90 per cent of the energy they use goes into heating the globe, rather than producing light, so it would be more accurate to call them mini-heaters than lights. That's why they get so hot to touch, and why they waste so much electricity.

But despite all the government advertising campaigns singling out the humble incandescent globe as terrible energy guzzlers, they don't entirely deserve their reputation as greenhouse enemy number one.

Why are incandescent globes being singled out?

For all the focus on old-fashioned globes, we ought to be paying more attention to another, much faster-growing source of emissions from lighting in Australia: halogen lights. While halogens can be ideal for providing a narrow beam of bright light above a desk or to highlight a picture hanging on a wall, they're a really bad choice for lighting entire rooms. That's because you need so many of them to provide the equivalent of just one compact fluorescent, or even an incandescent globe. Yet, as we saw in chapter five, they've become a standard fitting in many Australian homes, not because they're an efficient option but mainly because they've become a handy little earner for designers, builders and electricians.

While a lot of people assume they don't use much energy because they're labelled as low voltage, a standard halogen downlight and the transformer fitted with each one will use 10 per cent more power than an old 60 watt incandescent light bulb. That's why lighting a home with halogens requires far more electricity than lighting one with old-fashioned incandescents, let alone using much more efficient types of lights, such as compact fluorescents. According to one estimate, halogens alone are responsible for around 2000 gigawatt hours of electricity consumption a year in Australia, generating about 2 million tonnes of greenhouse gas emissions in the process. That's the equivalent of 300,000 households' entire electricity needs.

Halogen lamps also generate so much heat—up to 370 degrees Celsius—that the only safe way to install them in a ceiling is by cutting out large chunks of insulation around each one, because otherwise the insulation can smoulder and start a fire. That undermines the whole purpose of ceiling insulation: when you cut so many holes in it, you end up paying far more for your heating and cooling, which results in higher bills for everyone because of the need for extra power generation, transmission and distribution. For such small lights, halogens are having a surprisingly big knock-on effect on our electricity use.

To seriously reduce our emissions from lighting, we also need to think beyond the home front and address the massive amount of lighting used in shopping centres, office blocks and public spaces. Most importantly, we need to do more than simply change individual bulbs—and that means changing the laws to improve lighting standards. In a moment, we'll take a look at just how useful Australia's new ban on old bulbs is likely to be. First, though, there is an interesting back-story to be told about why the Howard government suddenly saw the light on energy efficiency.

What's the real story behind Australia's light-bulb ban?

Surrounded by primary school children on one side and a posse of cameras and reporters on the other, Malcolm Turnbull was having a great day. At the time, Turnbull was the relatively new federal Environment Minister and a rising star in the Howard government. That morning, 20 February 2007, his office had announced that Australia planned to become the first country in the world to ban the sale of incandescent light bulbs.

The reaction to that news went beyond the wildest dreams of any politician. International as well as national media organisations

clamoured for footage of Turnbull explaining to schoolchildren that old globes got too hot to touch because they produced so much excess heat, whereas more energy-efficient compact fluorescents stayed nice and cool. It was a good news story that almost no one wanted to criticise, with even long-time environmental critics of the Howard government lining up to support the bulb ban.

But one environmentalist was livid.

Jon Dee is best known to most Australians as the co-founder of Planet Ark who, along with tennis player Pat Cash and a host of other celebrities, has run campaigns promoting recycling and reducing plastic bag use. In 2006, he decided to start a new campaign to ban inefficient lights and pitched the idea of a three-year phase-out of old-fashioned bulbs to Turnbull's predecessor as Environment Minister. But following a government reshuffle and what seemed to be a lack of interest from the new minister, Dee decided to go it alone.

Instead, in late 2006 he joined forces with Australia's biggest light-bulb supplier, Philips, with a plan to voluntarily stop the sale of incandescent bulbs as the first step towards what they hoped would be a national phase-out. Just as they were getting ready to go public, Channel 10 decided to put on a Sunday night television special on climate change in March 2007—and suddenly they had a prime-time platform from which to launch their Ban the Bulb campaign.

Called *Cool Aid*, the television special hosted by Sandra Sully was set to feature a who's who of environmentalists, Hollywood actors, sports stars and politicians, including Turnbull. Dee was another invited guest and he was ready to launch the Ban the Bulb campaign live on national television.

In mid-February, just a few weeks before *Cool Aid* went to air, the show's executive producer gave Turnbull a full briefing on what would be on the program, including the Ban the Bulb announcement.

Dee, meanwhile, was just beginning to relax. With most of the hard work of setting up the campaign out of the way, he began ringing and emailing a few journalists around the country to let them in on his plans, lining up interviews to follow on from his television appearance. He didn't know it at the time, but all that work was about to go to waste.

On the evening of Monday 19 February, Turnbull's media advisers contacted a handful of reporters writing for major metropolitan newspapers, offering them what is known by journalists as a 'drop'—when one or a few selected media outlets are given advance details of an imminent government announcement.

Those kind of drops happen all the time. For the journalists involved, it means gaining a slight edge on their rivals on a breaking story. For the government, it's an attempt at media management. If the government can start the day with prominent newspaper headlines, it's likely to drum up prominent coverage on the radio; combine the two and they can usually bet on a prominent run on the television news that night.

That's exactly how the 'Turnbull bans bulbs' story played out. Early on 20 February, Dee got a call from talkback radio, wanting his reaction to the story on the front page of the *Sydney Morning Herald* that 'The federal Environment Minister, Malcolm Turnbull, is expected today to announce a commitment to phase-out incandescent light bulbs by 2009–10, a world first by a national government…' It was the best day of news coverage to do with climate change that the Howard government had enjoyed in years.

As Dee tells his part of the story, there was one final twist in the Ban the Bulb saga. Later that year, not long after the 2007 election, Dee was in Canberra when he ran into a senior Coalition adviser. Comparing notes on the Howard government's legacy, the adviser said that the only decent thing the former government had done on the environment was to ban incandescent light bulbs, adding: 'And we nicked that idea from you'.

How did Australia change global opinion by banning old bulbs?

While Australia's bulb ban was brought in at least partly as a political stunt, it's a pretty good policy. The switch to more efficient lights has the potential to save around $1.3 billion a year on annual household electricity bills in Australia through reduced electricity demand. If that saving is achieved, it would reduce our national greenhouse gas emissions by several million tonnes a year.

However, the biggest impact of the policy has been its international ripple effect. Within hours of Turnbull's announcement of the ban-the-bulbs policy, the news was being flashed around the world via the internet and foreign news wires, generating headlines everywhere from the BBC to the *Hindustan Times*.

At the time, a handful of South American countries led by Cuba had already switched to more efficient bulbs, while California was in the middle of debating a proposed 'How Many Legislators Does it Take to Change a Light Bulb' Act to ban the sale of incandescents.

But Australia was the first major industrialised country to bring in a national ban, and the worldwide attention it generated proved to be a tipping point that persuaded other countries to follow our lead.

Around the world, environmentalists and energy experts had been campaigning for years to ban the bulb, with little success. Australia's decision to ban bulbs changed all that by establishing an international precedent that they could point to, and ask why their governments weren't doing the same.

Suddenly, banning bulbs became all the rage. Only two months later, Canada announced it would ban the sale of inefficient light bulbs by 2012. Having dithered about it for years, the European Union finally agreed to act, too, bringing in a similar Europe-wide phase-out by 2012. Meanwhile, California's light bulb-bill was passed, but was soon gazumped by a national energy bill that effectively banned the sale of most incandescent globes by the end of 2013. Others, including Argentina, South Africa and the Philippines, have since joined the list.

Even the world's biggest light-bulb maker is now getting in on the act: China produces about 70 per cent of the world's light bulbs, and while it hasn't gone quite as far as to bring in a bulb ban, in late 2007 it announced plans to replace all its old incandescents within a decade. With so many countries now making the switch to more efficient lighting, China doesn't plan to get left in the dark.

At the moment, incandescent bulbs alone consume about 7 per cent of the world's electricity. A global switch to more energy-efficient lights such as compact fluorescents has the potential to avoid the need to use nearly all of that electricity, and save around 500 million tonnes of greenhouse gas emissions.

It just goes to show that even a small nation like ours really can change the globe.

What's the brightest way to light a room and tackle climate change?

There's one big problem with all this talk of changing light bulbs: better bulbs alone are not really the best lighting solution. In fact, the very best way to light a gloomy room and save emissions is not with an incandescent globe or a halogen or a compact fluorescent, or even the latest light-emitting diodes (LEDs), which are expected to become far more affordable and widely used in the next few years.

The best zero-emission lighting solution of all is one that we're still neglecting to make enough use of here in Australia. It's sunlight.

Generations ago, when electric lights and air conditioning weren't an option, people had no choice about building their homes to try to make the most of natural light and fresh air. Since then, the blessing of abundant fossil fuel energy in Australia has fooled us into having a complacent, 'lucky country' attitude, so that we have ignored opportunities to save energy, such as by turning down lights when the sun is shining.

Even the busiest factory using power to operate 24 hours a day can make those kind of savings, as shown at Coca-Cola's Western Australian bottling plant in Kewdale. A decade ago, the company decided to run an energy-saving lighting project at the plant. During the day when there was plenty of sunlight streaming in, all but a few lights in the plant were switched off before gradually coming back on again as the light dimmed. Before long, its WA operation was costing around $45,000 a year less to run, while also saving more than 400 tonnes of greenhouse gas emissions annually. Since then, Coca-Cola has updated the lighting systems at its other Australian plants to make better use of natural light, and its lighting bills have dropped by more than a third.

Similar results can be achieved in office blocks and in homes, as we saw in chapter five. Common-sense designs to maximise natural light and fresh air can save energy, greenhouse gas emissions, and create healthier environments where people feel and work better. Making the change to better technology alone is rarely the best solution. What's more important is a willingness to reconsider current ways of doing things. Better thinking is always a smarter solution than simply screwing in better light bulbs.

There's plenty we can all choose to change within our homes, businesses and communities. But we can't expect people to make lower-emission choices in their daily lives unless there are better choices available to them, like having a fast train to catch rather than flying or driving.

Luckily, there are some signs that a few politicians understand the need for much bigger change.

Who else says 'screw light bulbs'?

Despite the daily blizzard of news stories in the lead-up to the 2008 US election, there were a few things that we didn't find out about Barack

Obama until after he had been elected as president. One of them was that Obama had his own 'screw light bulbs' moment.

In *A Long Time Coming*, a behind-the-scenes book about the Obama campaign, the aspiring president and his advisers were tape-recorded while preparing for an upcoming television debate. Expressing his frustration at having to give three-second sound-bite answers about complex issues like climate change, Obama declared:

> I don't consider this [televised debate] to be a good format for me, which makes me more cautious. I often find myself trapped by the questions and thinking to myself, 'You know, this is a stupid question'… So when Brian Williams is asking me about what's a personal thing that you've done [on climate change], and I say, you know, 'Well, I planted a bunch of trees.' And he says, 'I'm talking about personal.' What I'm thinking in my head is, 'Well, the truth is, Brian, we can't solve global warming because I f---ing changed light bulbs in my house. It's because of something collective.'

Obama isn't the only politician who knows that we need much more ambitious solutions to climate change beyond anything he has been able to persuade the US Congress to do so far. The same is true here: there are politicians from across the political spectrum who privately think Australia could do more to cut emissions but who are unwilling to say so until they believe there's enough public support for tougher action.

There is an old anecdote about former US president, Franklin Delano Roosevelt, who led his country through the turbulent years of the Great Depression and World War II, which shows the importance of such public support. At a dinner party in the 1930s, Roosevelt was introduced to a well-known African American civil rights leader, A. Philip Randolph, and asked him for his opinions about 'the plight of the Negro people'. Randolph gave a long, passionate speech and, when he finished, Roosevelt replied, 'I agree with everything that you've said, including my capacity to be able to right many of these wrongs…But I would ask one thing of you, Mr Randolph—and that is go out and make me do it.'

Obama and Roosevelt were both right. On the one hand, we need political leaders who recognise that we can't address climate change simply by individually changing light bulbs. On the other, it's unrealistic to expect those political leaders to take bolder action without us, the voters, telling them exactly what we want.

How can you cast a vote for change on any day of the week?

Every year, our federal, state and even local governments spend millions of dollars on media monitoring and opinion polls. Media monitoring has become a huge growth industry, with politicians and their advisers paying to receive regular, often daily, reports summarising the hottest topics on talkback radio and the letters pages of the newspapers. They do it because they're paranoid about being seen as out of touch with the public, in the way that John Howard was caught out on climate change in the 2007 federal election.

Your tax dollars are being spent on all this media monitoring. So isn't it worth making sure they hear from you too?

If a talkback show is talking about traffic jams or high petrol prices, don't be afraid to ring in and say you'd rather see long-term investment in public transport services, not just more quick-fix solutions that keep making the problems worse. You can do the same thing in the letters to the editor pages of newspapers, as well as through shows such as *Sunrise* and *60 Minutes* that encourage viewer feedback.

You might be surprised to learn just how much your actions can help shape what appears in the news. In Australia and overseas, mainstream news media outlets have been forced to cut back their budgets to cope with falling advertising revenues. One of the few positives to emerge from that trend is that every local news organisation is redoubling its efforts to give the audience what they want.

For instance, when you're reading the news on the internet, everything you do is turned into readership statistics. Which stories you click on, how long you spend reading them, which issues you keep coming back to time and again—all that information is collated into a top stories online list for news editors each day. It's one of several ways that they know which issues people are most interested in. Just as importantly, that information is closely scrutinised by advertisers too, because they're all about targeting their ads to their ideal customers.

So if you and enough other people click on news about the latest Hollywood sex scandal, don't complain if you see more gossip and entertainment news on the site in future. Alternatively, the more often you click on articles about issues that you wish got more coverage, the more likely it is that those stories will keep getting a prominent run in future. With every click you make, you're casting a vote for the kind of news that you think really matters.

The growing interest in climate change and what can be done about it has already made a difference. In the past few years, most news websites have set up dedicated environment or climate change sections, largely in response to reader demand. The increased public demand for climate news has helped it go from being an issue that not so long ago was buried down at the end of the news bulletin, to often leading the news, even on commercial television and radio. That's a huge change. Chances are you have been part of making that happen.

What are our tips for smarter solutions to tackle climate change?

So how can you help support smarter solutions to climate change? Here are 10 tips on how to take effective personal and political action.

1. Boost business leadership
If you own or work for a small business, check out initiatives like Grow Me The Money and see if there's anything like it in your local area. Even if you don't, you can always mention it to someone who does. And if you work for a big company, ask what it's doing to save on energy, water, waste and other resources. In taking any of those actions, you'll be helping to build business leadership from the ground up.

2. Do something super
Money talks—so what's your money saying about you? Australians have $1 trillion invested in superannuation funds that own huge stakes in everything from city skyscrapers to mines and power generators. It's in our interests for that money to be invested wisely. By switching to a sustainable super fund, you'll be joining a growing number of individuals and institutions supporting more responsible business practices, as well as reducing your long-term financial exposure to rising carbon costs.

3. Choose quality over quantity
With neuroscientists, psychologists and surveillance experts on their side, marketers are good at encouraging us to buy more than we really want or need. But we can all learn to become smarter shoppers—and if we do, our consumption choices can help cut emissions both here and overseas. Buy less stuff and enjoy it more, by opting for quality over quantity.

4. Weigh up what you eat
The old saying that 'we are what we eat' is true. A significant contributor to rising emissions is due to our consumption of meat and dairy products. We can all make an immediate difference by thinking more about what we eat. It can be as simple as starting with a few meat-free days a week. It's also worth buying fruit and vegetables in season, so that you're getting fresh Australian produce, rather than fruit that's flown halfway around the world.

5. Protect yourself from rising bills
To keep your bills low even as prices rise, get an audit of your home's energy and water use. Doing so will show you how to save money, such as by identifying appliances around your home that are munching through power, helping you decide if it's worth investing in more energy-efficient appliances. You can also make use of federal government grants and rebates, detailed at <http://livinggreener.gov.au/>

6. Demand higher standards
To drive long-lasting economic change, Australia needs to develop stronger industry regulation. Other countries have higher minimum standards on everything from building design to fuel efficiency for cars. Without clear signals to business that we are shifting gear, Australia's companies are going to find it even harder to compete internationally. Our standards have been too low for too long, and it's already costing us dearly. Demand better.

7. Beware of the VAMPIRE
Areas without decent public transport are the most vulnerable to rising global oil prices. At the same time, the infrastructure costs of unchecked urban sprawl are becoming increasingly expensive. If you're considering moving home, think about how much your daily commute will cost you as fuel prices rise. If you already live in an area poorly served by public transport, remember what happened with the Fremantle and Mandurah train lines: when politicians see votes in better public transport, big changes are possible.

8. Make your vote count
No matter where you live, your vote counts. The upcoming federal election is a chance to make the next government take climate change more seriously, as well as being a chance to make sure we have a Senate

that will closely scrutinise climate policies. Show that you know your vote has a dollar value: vote 1 for candidates promising stronger action on climate change.

9. Support an effective carbon price
In its current form, the Carbon Pollution Reduction Scheme is expected to allow Australia's greenhouse gas emissions to keep rising for decades to come, rather than living up to its name. It's not too late to opt for a simpler, fairer and more effective carbon tax.

10. Help direct the news
If you think the media is not paying enough attention to issues you care about, do something about it. Call a talkback show. Write a letter to the editor. Click on the online stories that you want to see more of. By doing that, you're casting a vote for the kind of news that you think really matters, and sending a message to our media-monitoring politicians about the actions you want them to take.

As we've seen throughout this book, there are countless people and places around the world showing how smarter thinking, proven technology and effective regulation can cut emissions in ways that leave us better off than before.

Renewable energy and energy-saving solutions introduced in countries like Germany, states like California and small towns like Woking have inspired other places to follow their lead. Super-fast trains in Japan and France have led to fast train networks being built in Asia, Europe, North and South America and Africa. Revitalised train and bus networks in places as diverse as London and Delhi have shown that more people will switch to public transport when offered better services. Just like Australia's light-bulb ban, these examples show that what begins as a simple idea in one small corner of the world has the capacity to go global.

There are also a growing number of businesses quietly getting on with the job of reducing their carbon liability: from cake shops to kebab shops, from commercial printers to boutique hotels, and from banks to transport companies.

Internationally, the same can be said for individuals like Chinese-born Australian 'Sun King', Zhengrong Shi, through to the multi-trillion-dollar superannuation sector, which is recognising the need to invest for the long-term. The shift to a low-carbon global economy has already begun. Australia can either get on board, or get left behind.

Climate change is only one of the problems we face in Australia today. Fortunately, many of the most cost-effective ways to cut emissions are smart solutions to other problems too. We can create healthier, more productive workplaces; more comfortable, energy-efficient homes; and better connected cities, where we waste less time commuting, giving us more time to do what we love.

There are countless choices we can make, individually and collectively, to reduce our emissions and improve our quality of life. The good news is that we can start making these choices right now.

NOTES

Many of the sources of information for this book were interviews. A list of people consulted in the course of our research can be found in the Acknowledgements.

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Currency exchange rates are from January 2010.

Chapter 1: Climate champions

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