Green or Black?

Renewable Energy Policy in Australia

by

Sebastian Crawford and Jeff Angel

Total Environment Centre Inc

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Level 2, 362 Kent Street, Sydney. NSW 2000.
Phone 02 9299 5599
Fax 02 9299 4411

For further information on TEC and its campaigns see:
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About the authors

Sebastian Crawford has worked as a greenhouse and energy activist with Total Environment Centre, Greenpeace and the Nature Conservation Council. He has monitored major greenhouse and energy issues in Australia over the last 5 years and traveled extensively in Europe and USA researching renewable energy technology and policy.

Jeff Angel is Director of the Total Environment Centre based in Sydney. He has been an environmental campaigner since 1973 involved with many natural and urban environmental issues. He has worked on a variety of energy issues including legislative reform of the energy market, greenhouse policies and green building development. In 1999 he edited *Greenprint for Sydney, an environmental strategy for the 21st century.*

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CHAPTER ONE

Introducing the energy story

Most of human history has been powered by renewable energy. Our own muscle power and wood fires provided all the energy required for almost a million years. With the advent of agriculture, harnessed animals hauled goods, provided transport and ploughed fields. About 5000 years ago, people in the lower Mediterranean captured wind energy to propel canoes and rafts. Wind and water wheels appeared in India about 2500 years ago and became common throughout the world to pump water for irrigation, grind grain and drive mechanical devices. Wind power in the form of windmills and sailing ships eventually revolutionised agriculture, transport and world trade.

The ancient Greek and Roman civilisations were completely powered by renewable energy. Evidence exists that solar power, concentrated through mirrors, was used to light fires and heat air to drive early machines. The first century AD saw further refinement in Europe, with water wheels driving all manner of devices. The Dutch reclaimed land from the sea, relying completely on windmill power to drain marshes and swamplands. By the end of the 1700s solar furnaces in southern Europe were smelting metals at temperatures of up to 1,000^{o} Celsius (Sorensen 1991).

Europe switched to fossil fuels in the late 1500s. It was a simple response to the collapse of the primary fuel source – wood. Pressure from commercial growth, population increases, wars and imperial expansion had led to a dramatic decline of Europe's forests. By the 1600s Spain, Portugal and England were forced to transfer most of their shipbuilding activity to outlying colonies in an effort to secure sufficient wood (Ponting 1991). There was little choice but to switch the furnaces of Europe to an alternative fuel, though initially this was resisted. Coal,

the most abundant alternative to wood, produced a foul smell, was dirty and heavy, and the furnace technology was ill equipped to burn it efficiently. Gradually, however, people adapted and improved the technology and efficiency, and the rest is a well-known story. The history of the Industrial Revolution has become synonymous with modernity. So too the history of energy – Europeans unleashed the energy locked away in coal, providing the catalyst for industrialisation.

This version of history fails to encompass the full impact of the switch to coal and oil. When Europeans chose fossilised carbon they set in motion a sequence of events that led to extraordinary environmental and social costs. Four hundred years later these costs are finally being quantified.

Just as four centuries ago Europeans were forced to switch from renewable sources of energy to fossil fuels, the imperative of climate change has triggered a new energy revolution. Over the next few decades a massive industrial and technological shift away from fossil fuels and back towards more sustainable forms of energy will be necessary.

The 21st century will be the age of high-tech renewable energy. In some countries this age has already begun. Governments and industries overseas have embraced the new energy technology and begun to reap the benefits in terms of economic growth, industrial development and jobs. With the right political commitment and policy mix, Australia too could have most of its energy needs met by renewable sources within 50 years, possibly less.[1] Unfortunately, Australia has failed to respond to the renewable energy revolution. We remain locked in an old world mentality that keeps us chained to fossil fuels.

Today, the barriers to renewable energy are no longer poor technology. Many technologies have been well developed for decades. Solar, wind, hydro and energy efficiency are all tried, tested and reliable.

Nor are the barriers economic – solar hot water, wind turbines and ecologically sustainable biomass energy are all cost-effective, as are photovoltaic cells in many locations. With each year the cost-effectiveness of these technologies improves. Despite this, renewable energy remains marginalised in the Australian market by arbitrary pricing policies and legislative mechanisms heavily skewed to favour coal and coal-fired generation.

In Australia today the real barriers to renewable energy are simply institutional: government policies, decision-making structures, legislation and regulation, pricing frameworks and market mechanisms that fail to adequately recognise alternatives to coal.

Having powered industrial society for centuries, coal and oil have become embedded in concepts of development and progress. So much so that the idea of replacing them with 'soft' energy options like solar and wind requires a quantum mental shift. Despite the political and corporate rhetoric, it is an intellectual leap seldom made. Most decision makers in government, industry and the established energy sector continue to predict the future based on assumptions and experiences of the past.

At all levels of government in Australia, there is a clear lack of substantial political commitment to renewable energy. Combined with a powerful coal-based electricity industry protective of its commercial interests, this lack of commitment stands as a key remaining barrier to renewable energy.

Chapter 2 looks at structural barriers within the electricity industry itself and the fact that electricity prices fail to include environmental costs. Despite reforms in the electricity industry, there are still few effective market incentives for green energy. On the contrary, the push for lower electricity prices drives demand for cheaper, more polluting energy.

Chapters 3 and 4 examine a range of other barriers including contradictory policy. The establishment of bodies like the Sustainable Energy Development Authority (SEDA) in NSW (and similar bodies in Victoria and Queensland) and the Australian Greenhouse Office (AGO) in Canberra are a step in the right direction, but there has been little or no meaningful attempt to tackle the huge bureaucratic infrastructures that support our fossil fuel energy system. State and federal energy bureaucracies have yet to integrate sustainable energy into mainstream policy.

Current industry initiatives run by the AGO are voluntary. In its first years following the 1998 Election the Howard Federal Government wound back or abolished most sustainable energy programs. Spending only increased under a deal forced on the Government by opposition parties in exchange for the passage of the goods and services tax legislation in 1999. In NSW, the nation's first sustainable energy development agency (SEDA) has had to fight Treasury each year to

justify continued funding. Yet equivalent funding for coal exploration has not had the same problem.

This book also looks at how renewable energy is perceived by the public. This is important because familiarity with technology is crucial for effective commercialisation. The widespread, yet incorrect, perception that renewable energy is still experimental continues to hinder market transition to new technologies.

At both state and federal government levels there is an unrealistic expectation that the market will deliver commercialisation. This ignores the fact that fossil fuels and the supporting industrial infrastructure have been subsidised and propped up by legislation for more than a century. To expect the market to deliver commercialisation of renewable energy unassisted is simply naive. The current lack of industry support or market incentives, combined with a weak regulatory framework for electricity, underscores virtually all barriers to renewable energy.

In Chapter 5 we examine at how some recent developments in the area of greenhouse gas abatement actually *threaten* future investment in renewable energy. Since the Kyoto Protocol, a significant shift in focus has occurred towards greenhouse emissions offsetting. This allows polluters to write off emissions by trading in pollution permits or carbon sinks (planting trees) instead of installing clean technology. In order to meet reduction commitments, polluters are being given a choice: either invest in new energy technology, or invest in offsetting measures and/or purchase pollution 'credits'. Schemes to generate credits, like tree planting or overseas investment initiatives, directly compete with renewables technology for investment and thereby potentially undermine the transition to a genuinely sustainable energy future.

Finally in Chapter 6 we offer some solutions to the deadlock in Australia. New directions must come from government first and foremost to set the standard for the market and other measures to ensure effective public policy implementation. Then consumer choice will have real potential for effecting change.

CHAPTER TWO

Economic walls

Most of the impediments to renewable energy are well defined. For over a decade environmentalists, politicians and policy analysts have been questioning the lethargic pace of market penetration. Studies and reports are numerous.

A clear picture has emerged – the electricity market is characterised by legislative and regulatory mechanisms biased towards coal. Impediments to renewable energy manifest themselves in a market dominated by discriminatory electricity pricing and a persistent mind-set that energy is cheap and unlimited.

Conquering energy consumption

The squandering of carbon fuels in highly industrial societies has led to the creation of an energy system so wasteful, so convoluted and so inefficient that it borders on the bizarre. The retrieval, transportation and conversion of fossil fuels consume a tremendous amount of energy.

Take the example of domestic hot water. First, oil is drilled from under the earth's surface. It is then refined into diesel fuel, which runs the machines that dig coal rocks from the ground. These are transported by rail and truck, requiring more diesel, to coal-fired generating plants. There, the coal is burnt to produce steam. Steam is converted into electricity, which is then inefficiently distributed over vast distances (incurring considerable waste) to individual houses. There it is converted back into radiant heat and, finally, in this form it heats water. In Australia, more than 70% of households heat water in this fashion[2]. Yet using the sun's rays directly on the roof, the same job can be done cheaper, cleaner, faster and far more efficiently.

Almost every energy cycle in nature utilises energy more efficiently than our industrialised fossil fuel system. The energy used to boil an average electric kettle requires burning a lump of coal as big as a small apple.[3] For the same amount of energy, the human body can power a bicycle

for 45 km[4]. That means the energy a person uses to ride a bike from Bondi Beach to the Sydney Opera House and back, four times over, is equivalent to how much the coal-based electricity system requires to boil a kettle. By any standard that is an astonishingly inefficient use of energy.

Even with current technology, it is still possible to use energy much more efficiently. Research at the Technical University of Denmark shows that all domestic services required by the average household – heating, appliances, hot water and so on – can be delivered using 74% less energy than current consumption levels for the average Australian home.[5] In Germany, houses equipped with the most efficient appliances and design features use only 25% of the electricity of an average urban home (Weizsacker et al. 1997).

Efficiency improvements of this magnitude dramatically alter the cost-effectiveness of sustainable energy technologies.

Using efficiency to change economics

Forty years ago, coal-powered generation produced electricity at the equivalent of 46 cents per kWh in today's prices. Today it can be as low as 4.6 cents per kWh, which represents a tenfold decrease in four decades. Wind turbines today produce electricity at 12 cents or less per kWh. With improving technology and economies of scale, there is no reason to believe the cost of wind generation will not fall in the same way coal generation did. In four decades wind power could cost as little as 1.2 cents per kWh. That is a quarter of the price currently paid for coal-fired electricity.

But why wait till then? Even today's installed wind technology can deliver cost-competitive electricity. Throughout most of Australia retailers offer wind and solar power through Green Power schemes to domestic customers at around 13.95 cents per kWh. The domestic price for coal-generated electricity is around 10.15 cents per kWh. So if customers improve energy efficiency by 37% (that is, use 37% less energy) their power bill will remain the same. SEDA's Energy Smart Homes Project has shown that by installing efficient appliances, insulation, solar hot water and other smart energy options, a 37% reduction in energy is possible and cost-effective.

The Australian energy system, however, has no significant mechanisms or incentives to drive efficiency. Consequently, few customers know or care how much electricity they use. Per head of population, Australians are among the world's most voracious consumers of electricity and the worst carbon dioxide polluters. While the rest of the industrialised world is tackling energy consumption, Australia's response remains woefully inadequate.

At a Federal level the Australian Greenhouse Office (AGO) operates an energy efficiency program for industry and business. Involvement in the 'Greenhouse Challenge Program' remains voluntary, with few meaningful incentives for performance and no compliance mechanisms. After four years of operation only a few hundred of Australia's 890,000 businesses signed on.[6] In NSW, the Sustainable Energy Development Authority has partly compensated for the lack of action at a national level, but there has yet to be deep penetration of the market. SEDA's range of Energy Smart Programs has achieved isolated efficiency improvements of up to 35% in the hotel and liquor industry and up to 40% in the domestic sector.[7]

The poor uptake rate of voluntary programs and the urgency to act on climate change impels the need for a mandatory approach with meaningful compliance incentives.

Australia's performance on energy efficiency standards for household appliances has been equally abysmal. Mandatory energy performance standards (MEPS) were introduced in California in 1987, and nationally in the US in 1990, contributed to a three fold improvement in the efficiency of the average American refrigerator between 1972 and 1997 (Weizsacker et al. 1997). MEPS did not appear in Australia until 1999, but only for fridges and freezes, leaving all other household appliances exempt.

California experimented with energy efficiency policies for the electricity industry in the late 1970s and early 1980s and experienced both a dramatic increase in wind-generating technology and a stabilisation of electricity consumption. During the 1980s, 12,000 MW of renewable energy – enough to power 5 million homes – was installed (Flavin & Lessen 1992). By the end of the decade overall power consumption had begun to fall. Retailers found helping customers reduce energy consumption was more cost-effective than installing extra generating capacity. This provided incentives for retailers to offer innovative 'energy service packages': providing customers with the same energy

services, yet using less electricity. Such packages included low-energy appliances, solar hot water, efficient water fittings and home insulation. Some retailers ran programs installing free equipment for customers, and still managed to make profits from the resulting 'excess energy' (Weizsacker et al. 1997). Minimum efficiency standards for electricity utilities are now mandatory in half a dozen States across the US.

Here in Australia such energy efficiency initiatives are still in their infancy. The US now spends $4 billion per year, 2% of its electricity budget, on demand-side management (DSM) and energy efficiency (Flavin & Dunn 1997).

In 30 American States it is mandatory for retailers to 'label' their energy. This gives customers information with their energy bill about where the energy is sourced and the environmental cost associated with different types of generation. Since the introduction of this system, the proportion of customers electing to pay more for green electricity (generated from renewables technology) has risen dramatically.[8]

The SEDA Energy Smart Homes Policy has the potential to tackle domestic energy efficiency. Designed for councils to play a more active role in raising awareness of energy issues at a community level, the program has been slowly making gains. At the beginning of 2002, 43 out of 173 councils had fully signed up (including 6 to the basic building envelope and 37 to the more comprehensive level with solar hot water) – equivalent to councils with 47% of development applications. The initiative allows maximum flexibility, minimum cost and no capital risk for councils.

Structural barriers within the electricity industry

A century of coal and coal-fired generation dominating the energy market has meant that administrative structures, regulatory frameworks and market place dynamics have evolved to suit coal. Deregulation has forced retailers to compete with one another for commercial customers, but meaningful competition remains limited. Furthermore, until 2000 retailers supplying the market were obliged by vesting contracts to purchase from existing coal-fired power stations. In this commercial environment it was extremely difficult for new entrants (and non-coal technologies) to compete.

The established coal-based electricity industry and government regulators appear to be in no rush to tackle the problems.

Grid access: locking renewables out

In 1996 a resident of Sydney, Michael Mobbs, installed solar cells on the roof of his suburban home. He installed 18 panels generating up to 2,555 kWh per year, meeting his family's full electricity requirements. In order to maintain constant supply and avoid the high cost of batteries, Michael Mobbs wanted to stay connected to the electricity grid.

In NSW, access to the grid is tightly controlled by the electricity industry. Connection for independent generators (like Mobbs) is an administrative nightmare and can be a process fraught with financial risk. When Mobbs invested in his renewable energy system he discovered his energy retailer, Energy Australia, and the state's transmission company, Transgrid, had no established procedure for connecting small and independent energy generators. He had to invest in the technology and build and install the equipment, before Energy Australia would make any commitment to approve it for connection to the grid. This risk factor deters individuals and small businesses from making the necessary investment in generating technology.

Michael Mobbs took the risk and, once connected, had to negotiate with Energy Australia over a price for his electricity. Originally they offered to pay him 3 cents per kWh for the electricity he sold, while charging him 10 cents for electricity he bought. Not surprisingly, a price discrepancy of this magnitude is a major deterrent. The differential paid for electricity to and from the grid can completely determine the cost-competitiveness of independent generating technology. Selling for 3 cents per kWh and buying for 10 cents per kWh is hardly fair, and is not competitive pricing for solar and wind.

Luckily, through a long process of negotiation Mobbs managed to achieve price parity, buying and selling at the same rate. Nevertheless, pricing for independent grid connection remains a major problem for renewables.

'Feed laws' – facilitating new entrants to the energy market

Experience from overseas offers solutions. In the mid 1970s, Denmark, now the world leader in wind-turbine technology, recognised that facilitating independent installation would be a crucial catalyst to stimulate the commercialisation of renewable energy (Flavin & Dunn 1997). One of the first policy initiatives was to introduce 'feed laws', streamlining access to the grid. Under these laws individual customers could invest in a windmill, connect to the grid and sell electricity to their

retailer, who was legally obliged to pay 90% of the retail price. This provided financial security for investors and by 1992 Denmark had 2,500 turbines installed, owned mostly by farmers and small independent investors (Flavin & Dunn 1997).

Feed laws are now accepted around the world as an effective policy tool to facilitate new entrants to the energy market. Germany, Spain, the Netherlands, Japan, the UK, India, Brazil and 20 states in the US all have feed laws. Most of these have seen explosive growth in renewable energy since their introduction (Lord Marshall Report 1998, Flavin & Dunn 1997).

A completely arbitrary system of negotiation for grid connection and pricing still persists in Australia. The price paid for energy sold into the grid (buy-back rate) depends totally on the negotiating skills of each investor.

Just as deregulating the telecommunications industry required Telstra to open its network to competitors, so too electricity distributors and retailers must be required to streamline administrative and technical access to the grid.

New generating technology embedded within the electricity grid requires the entrance of new players to the energy market. New players display the flexibility and innovative approach necessary to install decentralised technology. The concept of renewable energy is, by its very nature, designed to provide decentralised generation – perhaps eventually moving toward a system where each building generates most of its own power.

Limiting renewables to wind and solar farms installed by large power companies under-utilises renewable energy technology. The physical infrastructure and the corporate culture of the existing electricity industry are not well suited to decentralised renewable energy. For this reason, relying on the established electricity sector to drive the uptake of renewables will mean the existing coal-based energy providers holding the small-scale renewables to ransom.

Green Power

Under the national Green Power program, customers can choose to pay a premium (3-4 cents per kWh) over regular electricity charges (generally about 10 cents per kWh) for electricity generated from renewable sources. The energy retailer must source the amount of electricity the customer uses from renewable generators. Since its introduction in 1997, Green Power has grown to over 60,000 customers

– representing about 1% of the total customer base. Much of the green energy portfolio has been biomass and hydro (less than 2% is solar and wind). For customers, the Green Power program is a good one, providing a simple mechanism to purchase green energy, but Green Power has largely failed to facilitate new entrants to the generation market. Most technology installed is owned and operated by the same generators that operate coal-fired power stations. If we are to fully harness the benefits of renewable energy we must facilitate more decentralised generation.

Electricity pricing

Discriminatory pricing of electricity continues to pose the most blatant barrier to renewable energy. The complete exclusion of environmental and social costs grossly underestimates the benefits of renewable energy. Prices paid for coal-generated electricity in no way incorporate the costs of mining and burning coal. Impacts on human health, ecosystem destruction and global warming are effectively ignored. Such omissions aside, existing pricing mechanisms discriminate against renewables through a range of biased and unquestioned structures.

That both government and industry continue to resist moves to make electricity pricing more genuinely cost-reflective is a demonstration of their reluctance for new players to enter the energy generation market. They are simply guarding their revenue stream and have shown little concern for the consequent impacts on renewable energy or stated commitments to competition.

Cost-reflective electricity pricing

In theory, cost-reflective pricing uses market incentives to deliver better environmental performance. However, this will only occur if all environmental costs and factors are included in the pricing framework. The argument that renewable energy is too expensive relies on the converse reality that fossil fuel energy is too cheap.

If the costs of distribution and transmission (including the building and maintenance of infrastructure) were fully incorporated into the prices paid for electricity, then decentralised renewable energy with no fuel costs, no distribution costs and low transmission costs would be significantly cheaper than coal.

Fossil fuels avoid paying social, health and environmental costs. The bill for these is paid by society at large. As such, coal is effectively subsidised by other areas of the economy. Costs such as resource

depletion and environmental degradation are ignored altogether. They remain unpaid for by the producer, with the consequences borne by taxpayers, local communities and future generations. Yet it is these costs, often classified as 'externalities' that give renewable energy a competitive edge. For this reason they must be included in the pricing framework.

Solar hot water

Solar hot water heaters have been commercially available in Australia for almost forty years. For at least 15 years they have been cost-competitive with gas and electric systems. Payback rates are now about 5 years, providing free hot water for anywhere between 10 to 15 years.[9] Purchase costs have also fallen and, in real terms, a new solar hot water system now costs less than it did five years ago. Solar hot water is now a wise commercial choice.

It is also a good environmental choice. A gas-boosted solar system saves as much greenhouse emission as a family car produces in a year. If every house in NSW had solar hot water, the state would cut greenhouse emissions by almost 10%. Why then, does solar occupy barely 4% of the hot water market? Because electricity retailers have waged a war over hot water. Their marketing strategies have marginalised solar. Both gas and solar have found it almost impossible to compete with extremely cheap off-peak electricity prices, which are available at night for water heating. They are totally unprofitable for the retailers and only possible due to cross-subsidising with higher daytime tariffs.

Anecdotal evidence suggests that once a household connects to gas hot water they often switch to gas home heating as well. For this reason the electricity industry has fought tooth and nail to keep households all electric. Such tactics might be smart marketing, but they have been bad for consumers, worse for the solar industry and catastrophic for greenhouse emissions.

The up-front cost hurdle

The purchase-price hurdle has a personal resonance for us all. Who has not picked up a compact fluorescent light bulb in the hardware store

– $25! For a light bulb! It is a bit of a shock, especially when compared to $1 for a regular incandescent bulb. Even after complete lifecycle assessment reveals the customer actually saves $48 on electricity costs over the bulb's life,[10] $25 is still a significant psychological and financial hurdle. Yet choosing home heating or a hot water system presents a much bigger hurdle than $25. Despite the higher initial outlay, however, consumers generally save money during the life of most energy efficient and renewable energy products.

The basic structures for overcoming initial financial hurdles of this nature are already well established for the purchase of cars, houses, white goods and so forth. The automotive and financial industries have no problem inventing financing options to purchase cars, for instance. The renewables industry is too small at the moment to offer such financial assistance, so responsibility must fall on all levels of government, electricity retailers and lending institutions to develop and promote financing mechanisms. (During 2002 some electricity retailers began offering financing packages for solar hot water).

Consumers also need more information on how long-term payback pricing works. The economics involved in assessing saved energy costs associated with renewable energy technology can be confusing and beyond the ability and patience of the average consumer. There needs to be simple explanations at the point of sale; mandatory energy information provided on packaging; and a much clearer delineation and comparison between a product's purchase costs and its running costs. Yet manufacturers conceal this information, making it extremely difficult for consumers to make informed purchasing decisions.

The current energy star-rating system for large white goods is an inadequate, superficial guide. It does not enable customers to compare the running costs of one model against the purchase cost of another. Yet this information is essential if customers are to make informed decisions.

Energy retailers, tradespeople and retailers selling appliances all need to play a more active role in making the link between energy consumption, energy costs and greenhouse gas emissions.

National Electricity Market

Reforms in the energy market have not stimulated the uptake of renewables. Despite a decade of concern about greenhouse gas emissions and 5 years of reform in the electricity sector, electricity

consumption and greenhouse emissions continue to rise.[11] Notwithstanding the success of Green Power, generation from renewables as a proportion of total electricity fell from a high of 7.5% in 1975 to 5.9% in 1998 (Australian Bureau of Agricultural and Resource Economics 1999).

The National Electricity Market (NEM) allows retailers to buy and sell power between NSW, Victoria and South Australia (Queensland has deferred entry). The new market provides incentives for NSW and South Australian retailers to purchase cheap electricity generated in Victoria from brown coal. Brown coal produces more greenhouse emissions than local NSW black coal or gas generation based in South Australia. Distribution losses associated with these massive and inefficient interstate transmissions are also completely ignored. In this perverse way, the competitive market is promoting worse greenhouse gas emissions and the installation of less renewable energy technology.

The development of the NEM demonstrates the need to stimulate renewables with legislative mechanisms. The NEM has been set up in a way that emphasises the economic bottom line and, because of uncosted externalities, is driving energy markets towards more greenhouse gas emissions, not less. It also supports growth in demand rather than energy conservation. The management of the NEM is overseen by the National Electricity Market Management Company (NEMMCO) and the National Electricity Code Administrator (NECA). Changes to the Code are administered jointly by NECA and the Australian Competition and Consumer Commission (ACCC). These regulatory bodies may be good at economic management, but they are proving ineffective at achieving broad environmental and social goals (Tonkin 1999).[12]

The new NEM has driven electricity prices to the lowest common denominator, promoting the cheapest and most polluting forms of generation. In so doing, the Code has failed to make electricity generators and retailers accountable for their environmental impacts. Given the magnitude of the greenhouse problem, the obvious question that arises is why NEMMCO and NECA have not supported the full and complete inclusion of environmental costs in the pricing structure for electricity.

The existing market is focused on delivering outcomes within short time frames and narrow concepts of economic benefit. These objectives are at odds with long-term ecological and social sustainability.

Contestability

Contestability – where customers can choose an energy retailer – came into force for large industrial customers in October 1996. Different States have different timetables for the rollout of contestability, with various sizes of customers involved. The process for residential customers in NSW and Victoria was completed in 2002. A great deal of faith has been invested in contestability and its ability to deliver greater competition, improved efficiency, reduced prices and better environmental outcomes.

Contestability has indeed delivered reductions in overall electricity prices, especially for large and commercial customers (IPART 1999). It has not, however, led to a reduction in electricity consumption. On the contrary, cheaper prices are driving increased demand and greenhouse emissions.

The national market also gives disproportionate power to generators especially as the current oversupply dwindles. The lack of effective and widespread energy conservation programs has minimised consumer choice. Allan Fels, Chairman of the ACCC states, *the most urgent need is to develop greater demand-side responsiveness. That is, extreme inelasticity of demand simultaneously makes wholesale prices particularly volatile and enables generators to wield strong market power, especially in times of tight supply and demand.*[13] The prime interest of the market is to sell more power, not less to a captured consumer. Thus the consumer does not have the economic choice to conserve power, save the environment and reduce their energy bill.

If free market mechanisms, such as contestability, are unable to deliver better social and environmental outcomes, then it falls on regulators to ensure that energy efficiency and renewable energy technologies are not sidelined in the drive for cheaper prices and growing demand.

CHAPTER THREE

Hidden barriers

Some barriers to sustainable energy are easily identified. Others are less well understood. Fickle consumer confidence, technologies being poorly marketed and lags in public awareness all impede commercialisation. Most of these problems are difficult to quantify, yet their impacts cannot be underestimated.

Public perception

Advertising is a powerful tool. It educates people about new products, innovations, improved performance, lower costs and better value. Rapidly changing technologies, such as computers and telecommunications, rely on advertising as a conduit for consumer knowledge. Through advertising, customers learn about new products and the features and benefits offered by those products. In this way advertising plays an integral part of the commercialisation process.

Yet unlike the marketing success stories associated with computers and telecommunications, the renewable energy industry is too small to fund a multi-million dollar advertising machine. Consumer knowledge about renewable energy is left to word-of-mouth. This presents a major barrier. In small, volatile and rapidly changing markets, technical innovation moves faster than word-of-mouth dissemination.

In the last five years, innovation in the hot water industry has doubled the life expectancy of solar hot water systems. Australia's biggest manufacturer, Solahart, has extended guarantees on its best-performing models from 5 to 12 years. Heat-absorbing efficiency has improved 25% and heat-loss efficiency (insulation) by almost 40%.[14] At the same time, prices have remained stable.

These factors combined have doubled the cost-effectiveness of solar hot water over the last decade. Yet this dramatic improvement has not translated into increased market share. In 1994 solar occupied 4.9% of the hot water market (Australian Bureau of Statistics); five years later

the figure had barely changed.[15] Improvements in technology and cost-effectiveness have gone largely unnoticed by consumers. People might be sold on the idea of solar hot water, but the perception that the technology is expensive and 'still developing' remains strongly entrenched.[16]

Never underestimate a plumber

The Solar Energy Industries Association of Australia (SEIA) maintains that poor product knowledge and lack of experience among tradespeople about renewables technology is a significant impediment for their industry.[17] Local councils have identified the same problem. Leichhardt Council, with a long-established 'going solar' program, continues to have difficulties with residents complaining about the performance of solar hot water. In the vast majority of cases complaints stem from incorrect or poorly installed equipment (such as not installed facing north).[18] The problem is often one of poor understanding of the technology, rather than the technology itself. Not surprisingly, poor performance undermines consumer confidence.

The nature of the building industry is such that tradespeople are generally the first, and sometimes only, point of contact between potential customers and new products. Plumbers often identify faulty hot water systems, provide recommendations on replacements and then install the new system. In an industry where 80% of all installations are replacement, a tradesperson's influence cannot be underestimated. When it comes to renewable energy, tradespeople are salespeople.[19] Despite this TAFE NSW offers *one* course at *one* campus on solar hot water installation for building professionals.

How can Australia realistically expect to establish an industry and improve the energy performance of buildings if building professionals are not being equipped with adequate training, education and technical support?

Far more emphasis needs to be placed on energy use and energy efficiency in technical training for the building industry. As the cost of training is often too high for small and independent business operators, governments must be prepared to fund subsidies to send trade staff on courses. This should be viewed not simply as an investment in renewable energy but an investment in jobs, technical expertise and human capital. The same arguments apply to the training of architects.

Learning from the Olympics

The construction of Sydney's Olympic Village is an excellent example of just how quickly the attitudes and experience of tradespeople can change. The village of Newington has 500 solar-powered houses and is one of the biggest projects of its type in the world. Each house is fitted with solar hot water along with photovoltaic cells generating electricity that also feed into Sydney's electricity grid. By day the houses 'export' electricity, by night they 'import' it.

At the beginning of the project, contractors installing solar systems were sceptical. Installation was slow and required cranes to lift equipment and mount frames onto roof tops. Engineers from BP Solar and Pacific Power collaborated with builders, technicians and architects to streamline the installation process. New demountable frames that could be assembled on the roof and taken in modules up a ladder meant cranes could be eliminated. Within six months, installation time had been reduced by one-third, improving productivity and reducing labour costs.

By the time the first roofs began to generate electricity, one site engineer described the process of learning and collaboration among building professionals as perhaps the single most important legacy of the project. *The change in attitudes towards the technology has been remarkable. This might be the most significant long-term contribution the solar Olympic project makes to the commercialisation of solar technology*.[20]

Decision makers with entrenched attitudes

Resistance to renewable technologies is not restricted to the building industry. The mentality that renewable energy is suitable for niche markets only persists with amazing tenacity at an institutional level within utilities and at all levels of government. That existing energy systems could conceivably be replaced in the coming decades by the sun and the wind remains laughable to some, an anathema to others.

Industry and stakeholder groups defending their own vested interests exploit scepticism and confusion about the technology. The fossil fuel lobby continues to publicly question the viability of renewables, cost-effectiveness, and their ability to meet demand. Misinformation is spread at the highest levels of government and industry.

It is vital for policymakers to recognise this entrenched conservatism. Switching from fossil fuels to sustainable energy will not occur without vision and innovation.

Scientific opinion: sending the wrong messages

Scientists also have an important role to play. The media and politicians often seize upon their views and opinions. Yet this can be problematic. Exciting though their work is, scientists work in the laboratory, not the marketplace. They focus on tomorrow's technology rather than products available in today's market. When scientists become spokespeople for renewable energy, the message conveyed to the public is: "This is interesting technology with exciting potential for the future," rather than the more positive message of "This technology is exciting, affordable and available! Buy it now!"

Politicians and the media need to start consulting with salespeople and consumer advocates on renewable energy. The media need to cover renewables technology from a consumer perspective rather than simply a scientific interest angle.

Local government's vital role

Local government has a crucial role to play in disseminating product and technology information to communities and households. Consumers are wary of claims made by companies with vested commercial interests, so local government is an obvious messenger for advocating sustainable energy.

Some councils have already taken the lead. For six years, Armidale City Council in NSW has offered a range of financing options to assist ratepayers to purchase technology – install roof insulation and solar hot water, and switch to gas heating. Leichhardt Municipal Council (NSW) has introduced planning ordinances requiring all new housing to include solar hot water.

Renewables and the culture of convenience

Consumers make purchasing decisions every day, based not only on price but also on convenience.

This has been well documented in rural Australia, where isolated households have rejected remote area power systems (RAPS) and chosen mains-grid connection despite RAPS being cheaper and more reliable. In some instances, grid connection has been chosen simply because the process itself of researching RAPS is confusing and time consuming.[21] The necessary technology – photovoltaic (PV) solar cells,

diesel generator, wind turbines, batteries and so forth – are all available and reliable. Yet the purchase of a RAPS system requires technical and analytical skills beyond the average consumer. Add to this ongoing issues associated with maintenance, financial risk and lack of service and support, and it becomes clear why people simply revert to the 'easiest' choice – mains-grid connected electricity.

The problem is not one of technology per se, but rather one of marketing and the way the technology is put together for consumers. Most generating technology is not user friendly, requiring professionals to assemble and install it. Manufacturers, distributors and energy retailers need to understand that consumers today expect products that are easy to purchase, install and operate. Until renewable energy is an easy choice for consumers, uptake in the market will remain sluggish.

The fallacy of 'least cost' options (you get what you pay for)

In developing strategies to meet Australia's commitments under the Kyoto Protocol, governments and industry alike have seized upon the idea of 'no regrets' or 'least cost' solutions; that is, meeting emission commitments with the least financial cost. Across the country, corporate environmental planners and government greenhouse policies have adopted no regrets options as a benchmark for best practice.

Yet most environmental impacts, including greenhouse gas emissions, remain outside the confines of the market. As such, when governments and industry implement no regrets options they invariably reduce Australia's greenhouse response to the lowest common financial denominator. Focusing on least cost options as defined by the market ignores the true cost to future generations, other species and ecosystems, and to human health.

Until the full spectrum of environmental impacts is incorporated into the market, adopting a no regrets approach amounts to little more than business as usual.

INSIDE STORY: Sydney CBD Augmentation – a case study in everything that is wrong with the Australian approach

Transgrid (TG) and Energy Australia (EA) are NSW Government owned electricity utilities. Over many decades they have built major powerlines between key centres linked to coal-fired power stations and have sold as much electricity as they can. When their models showed an increasing growth in demand in the inner suburbs and CBD of Sydney, they proposed building more cables to deliver more coal power.

A consultation paper favouring a new powerline at a cost of $180 million was published in January 1999. The scheme involved a new 330 kV cable and substations to ensure a reliable supply of electricity in the summer peak period, to be completed by the end of 2003/4.

The assumptions behind the demand projections included the absence of new generators like cogeneration (a competitor) and 'no new explicit demand management measures' (for example, a big energy conservation program).[22] All alternative options were rejected after application of a 'net public benefit test', which effectively ignored environmental issues such as greenhouse pollution.

The utilities saw their chance to lobby hard inside government after Auckland suffered an extensive loss of power over many weeks in 1998 due to the failure of power cables. EA and TG marshalled their arguments, including the need to increase the reliability of supply to the CBD, a powerhouse of tourism, finance sector, computing and communications economic activity that drives its reputation as a reliable national and international centre.

The opportunity presented by Auckland was not the only asset for the companies. Under Australia's National Electricity Code (NEC), TG and EA were proponent, judge and jury ('joint consultation proponents') of the development. Under the newly competitive electricity system – a regime theoretically intended to improve the efficiency of electricity generation[23] – the utilities investigate, undertake public consultation and then decide what they consider to be the best option for state-based networks. Normally the agreement of their Board and shareholders (in this case NSW Government ministers) is a formality.

During the review, Transgrid considered a number of options and assessed ten alternatives using two separate costing methods. The first included environmental costs and the second excluded these costs.

When the environment was excluded the least cost option was building more cables linked to distant Hunter Valley coal-fired power stations. When environmental costs (like greenhouse emissions) were included, cogeneration and demand management became cheaper (and were just as reliable).

Debate takes off

A public forum held in February 1999 was a lightning rod for a range of serious concerns. The ACCC and the NSW-based Independent Pricing and Regulatory Tribunal (IPART) presented a joint statement that questioned the decision-making process:

Under these arrangements there must be concerns over the dual roles the networks have in planning and the incentives they may have in expanding their asset base … From a regulator's perspective, we have to be confident that the network investments:

- *are prudent;*
- *are competitively neutral with respect to competitive alternatives such as generation and demand side alternatives; and*
- *are efficient in both their underlying costs and timing.*[24]

The regulators proposed a new regulatory test to judge new investment proposals. The test should, they suggested, include full investigation of all options; an adequate and competitive bidding process; and evidence that network prices have been used to encourage more efficient use of existing capacity, such as by demand management.

Representatives of SEDA also attended the forum. They too were concerned about the capture of the process by the utilities and also outlined a specific program for energy conservation and the use of cogeneration. They claimed demand management, gas-powered air conditioning and small cogeneration was cheaper than building more cables and much more environmentally responsible.[25] Also, a new large cogeneration plant serving an industrial area, just a few kilometres south of the CBD, had already been granted development approval and this could serve the city.

A media release from Total Environment Centre, distributed at the meeting, described the proposal as an 'outrage':

Energy Australia and Transgrid are trying to lock Sydney into decades more dirty coal-fired electricity generation, contrary to state and local

government policies. Criteria used to select the preferred option were those proposed under the new national electricity market codes. This is the first clear evidence of the new national framework undermining NSW's high environmental standards.[26]

The CBD scheme would initially increase annual greenhouse emissions by one million tonnes per annum, rising to two million tonnes by 2007 – making it impossible to achieve the NSW Government's modest greenhouse gas reduction target.

The alternatives – new technology and innovative energy management

The CBD augmentation proposal is intended to serve growing demand and reliability needs based on peak summer demand. There are a number of acceptable ways of resolving the challenge to energy supplies.

Gas-fired air conditioning offers the potential to provide low-cost cooling for large commercial buildings – perfectly suited to the CBD. Commercial ventilation and air conditioning is responsible for 60% of the total CBD load. By reducing electricity demand in summer, gas air conditioning can alleviate the problem of excessive peak seasonal demand.

Cogeneration is even more efficient. This involves the generation of electricity combined with the production of heat for commercial heating or industrial use. Waste heat produced from power generation is recovered and utilised (such as in office-tower basement systems). Excess electricity can be fed into the grid, generating additional revenue. Cogeneration can be used by large power stations providing waste heat to neighbouring facilities; or in office towers and commercial centres, servicing both the buildings' power and heating requirements. During 1999, EA entered into negotiations with the developers of the Botany Cogeneration Plant (being built close to the CBD) about a supply contract. Negotiations were unsuccessful, apparently due to an uncooperative attitude from the utility. There is a strong argument that several cogeneration plants located in the city would provide a more reliable supply of electricity because they do not use one large cable carrying power from remote power stations.

Energy efficiency delivered by SEDA's Smart Energy Business Program is already saving NSW businesses $6.3 million a year in energy bills. The scheme includes CBD firms such as AMP, Mercantile Mutual, Sydney Hilton, Star City Casino and the Renaissance, Nikko and ANA

hotels. SEDA's programs have only scratched the surface. Preliminary estimates for the CBD show a 20% reduction could be achieved in a cost-effective, one to four year time frame. EA has cut energy consumption at its George Street corporate headquarters by 50% (and this included retro-fitting with energy efficient lighting). It is unacceptable that the key electricity utility can save on its own power costs, but not offer the same benefit to its consumers.

Who pays?

The quick payback associated with SEDA's Energy Smart Business Program has demonstrated that many building owners and energy users are willing to meet the capital cost of energy efficient technologies themselves. The cogeneration proposals for Botany and Kurnell have full private sector capital.

Further contributions could be made through electricity pricing structures and IPART's cost-recovery mechanisms that allow Energy Australia and Transgrid to recover demand management investments.

The June 1999 report from IPART recommended, *clear rewards for compliance and clear penalties for failure to comply with environmental standards, including appropriate consideration of alternatives to augmentation in network planning and emission benchmarks*.[27]

IPART's decision at the end of 1999 removed the penalty in the pricing regime that had discouraged measures to reduce the amount of energy sold. This was a major breakthrough in electricity regulation, as it allowed the utilities to recover the costs of demand management just as if they had supplied electricity from new power generators.

Then in March 2000, Energy Australia, Transgrid and the NSW Minister for Energy announced they would be pressing ahead to seek planning permission for the cable works to pump more fossil fuel power into Sydney's CBD. Why?

A change of culture

Clearly the scale of public concern and efforts by regulators to provide incentives for energy conservation were insufficient to convince the power companies. There are a number of possible explanations:

- The environmentally friendly alternatives did not stack up economically or on reliability criteria. However, the final consultant's report found that cogeneration and energy conservation measures were just as reliable as fossil fuel power systems and provided good economic returns.[28]

- Government policy dictates against environmentally responsible outcomes. But this apparently was not the case. As Genia McCaffery, Mayor of North Sydney, wrote: *… in the Herald the Premier wrote with some passion about how he had become convinced global warming due to the greenhouse effect was real. He seemed genuinely concerned. He was still concerned last month, when, in launching a Government energy-efficiency campaign, he apparently chided the media for not taking his concerns seriously. Then last week, the Minister for Energy announced that the Government would spend $180 million – yes, $180 million – on a big cable to meet central Sydney's growing power needs. I am struggling to think of a Government more totally at odds with the rhetoric.*[29]
- The most likely explanation is that the corporate culture of Energy Australia and Transgrid were concreted to the cables solution. In essence, they could not stomach what they perceived as a competing energy source and supply system. Neither the Board nor senior executives had terms of appointment that obliged or gave top priority to achievement of the best possible environmental outcomes.

To arrive at the best outcome requires a convergence of coherent government policy, community views and a reformed corporate culture within the utilities. Unfortunately, on this occasion a deep-seated resistance to change prevailed. Ultimately political pragmatism prevailed and the government formally consented to the augmentation at the end of 2001. On a more positive note a $10million demand management program over 5 years was required in an effort to delay additional works and a major review of demand management policies and regulation, was commissioned. [30]

CHAPTER FOUR

Australia – left behind

Around the world, renewable energy has become big business. The European Union, the undisputed world leader, estimates investment to 2010 will average 3.8 billion euros per annum and create 480,000 new jobs.[31] The Danish wind industry already employs 35,000 people in seven countries.[32]

Meanwhile, the traditional coal-based electricity sector is shedding jobs. In Australia, despite projections of increased generating capacity,[33] employment has declined steeply since 1984. For example, jobs in the NSW electricity sector fell 60% in the 15 years to 1997.[34] The potential to replace jobs lost in the traditional electricity sector with jobs in rapidly growing renewable energy industries is clear. Building a strong renewable energy sector, however, requires long-term commitment from government and industry and a carefully targeted policy approach.

2% Renewables Target – degenerating into high farce

One of the few positive initiatives made by the Australian Government as a result of the Kyoto Conference in 1997 was the Prime Minister's announcement to increase by 2% the amount of electricity generated from renewable sources. Unfortunately, the spirit and intent of the initiative has been completely lost in the implementation.

Lobbying from the fossil fuel industry was strong; consequently, burning woodchips and sawdust in existing coal-fired power plants and new wood-burning plants qualified as renewable energy.

The target originally had the potential to stimulate new technology and send a clear signal to emerging markets that the Government was serious about stimulating wind, solar and genuinely sustainable technologies. Instead, it has confused both the markets and consumers.

The NSW EPA has issued a licence for Liddell Power Station in the Hunter Valley to burn up to 5% 'wood product'. Macquarie Generation,

who operate the plant, have announced an intention to expand the program to other power stations. This could potentially meet NSW obligations under the 2% initiative. A ten-year target could be met overnight without the installation of a single piece of new technology. Between 1995 and 1998, Denmark managed to increase the share of electricity generated from wind sources by 3% (Gipe 1998). In the absence of concerted opposition Australia's 2% target looks set to do little more than provide a new market for an already unsustainable woodchip industry. In the time it took develop the 2% strategy the percentage of renewables as a total proportion of generation fell 0.6% (AGO 1999). With the inclusion of waste wood the 2% will barely result in a 0.5% increase in renewables by 2010.

(see Chapter 5: *Inside Story:* The Biomass Battle)

The international experience

The oil shocks of the 1970s led to a boom in renewable energy in the US. At its peak in the early 1980s, California generated enough solar and wind electricity to supply a city the size of Brisbane. Yet within a decade, the industry had almost entirely collapsed. The American industry has since recovered, but what went wrong in the 1980s?

For more than a decade, American policy focused on government stimulus packages and guaranteed purchasing schemes. This market-led approach was based on an underlying assumption that government grants and large contracts could be used to establish a market for new technologies. Unfortunately, when government money was withdrawn, the fledgling industry was unable to compete financially with conventional nuclear and fossil fuels. American policy failed to tackle the pricing mechanisms and legislative frameworks that structured the electricity industry. The result was an energy market which remained squarely oriented toward fossil fuel and nuclear technologies. This is a situation that continues in many countries today.

The American experience demonstrates that technology alone, no matter how good, is no guarantee of commercial success. Without policy intervention to tackle distortions and barriers that operate within the energy market, renewables remain marginalised.

In contrast to Australia, Europe tried a different approach. Countries like Denmark, Germany and the United Kingdom used a combination of market incentives and legislative requirements to drive the uptake of renewables. The Non Fossil Fuel Obligation in the UK and the Energy

21 Plan in Denmark introduced mandatory requirements for mainstream electricity utilities to invest in new renewable energy technology. At the same time, European countries reduced government support for fossil fuels. Throughout the early 1990s the UK, Denmark, Austria, Germany and Sweden all reduced fossil fuel subsidies. Norway, Denmark, Sweden, Finland, the United Kingdom and the Netherlands also went a step further and introduced new taxes on fossil fuel energy. In April 2001 the UK introduced a climate change levy and established the Carbon Trust that will 'recycle' the levy by investment in alternative energy.

As a result, Europe is establishing a strong, dynamic renewable energy sector. In hindsight, the weaknesses of the US policy approach are now widely recognised (Wolsink 1996, Flavin & Dunn 1997, Moskovitz 2000). In 1999 the International Energy Agency (IEA) published *The Evolving Renewable Energy Market.* In it, the IEA concluded that market initiatives alone have failed to facilitate meaningful uptake of renewables. The IEA determined that renewable energy would not increase its share of total energy supply unless governments take a more prescriptive policy approach.

Experience from Europe and the US shows that policy can be broken into a hierarchy of critical 'primary policy' and less important 'secondary policy'. These include:

Primary

- *Feed laws* that give guaranteed access to the grid for independent generators.
- *Guaranteed purchasing rates* for electricity generated and fed into the grid.
- *Tax incentives* for investment in renewables. This provides incentives for small investors, building owners and landholders to install generating technology.
- *Open and competitive bidding processes* for electricity supply and network support. This allows new generators to enter the market.
- *Binding capacity targets* for renewable energy technologies.
- *Reduced* subsidies and government support for fossil fuel.
- *Integration* of renewable energy policy into mainstream energy policy.

Secondary

This category consists of initiatives that may have a generally positive impact on renewables, but which in the absence of primary policy remain largely ineffective.

- *Direct loans and one-off installation grants* to existing energy market operators.
- *Public awareness campaigns* highlighting the environmental benefits of renewable energy.
- *Greenpower purchasing schemes*, giving customers the choice to pay extra for green energy. This completely contradicts the polluter pays principle. It is coal-generated electricity that should cost more.
- *Energy efficiency initiatives* – which provide only an indirect stimulus to renewable energy.

Carbon taxes have emerged in recent years and are in a category of their own. Too recent to yet qualify as core policy, they have nevertheless emerged as powerful policy tools, helping to internalise the environmental costs associated with burning coal.

How does Australia rate?

Primary policy	Australia
Electricity market liberalisation	Yes; but energy and network service markets have yet to achieve a balance
Feed laws	X
Guaranteed purchasing agreement for grid-connected renewables	X (some individual retailers have limited offers on specified technology)
Integration of renewable energy policy into mainstream policy	X
Legislated renewable energy targets	Yes; small 2% renewables target, but includes some unsustainable technologies
Competitive bidding process	Yes; but very limited
Reduced subsidies for fossil fuels	X (Coal-generated electricity still heavily subsidised and the GST disadvantages solar which was previously not taxed)
Tax incentives	X (Tax incentives still geared towards fossil fuel investment)

Secondary policy	
Public education campaigns	Yes
Energy efficiency programs	X (Voluntary only)
Loans and one-off investment grants	Yes; but very limited
Greenpower	Yes; national (originated in NSW; obliges retailer to offer green electricity strategies)
New policy	
Energy tax on carbon fuels	X

While some parts of Australia are well advanced with energy market liberalisation, we have yet to implement most of the primary policies necessary to build a strong renewable energy industry.[35] To date, policy has focused on the secondary area. This has resulted in a poor rate of renewables uptake.

Selected countries with incentives to encourage the use of renewable energy in the domestic sector

Country	Power source	Incentive
Australia	most renewables	20% rebate for PV in NSW, and up to $7,500 for RAPS in Qld. New electricity retailer subsidies. Up to $400 million in Federal funding on grants
Germany	solar	65% capital subsidy and guaranteed pricing policy for grid-connected systems
Netherlands	renewable	Tax exemptions for electricity generated from renewable sources
Sweden	most renewables	Subsidies and accelerated tax depreciation
Japan	solar	50% subsidy, guaranteed pricing policy for grid-connected systems
India	most renewables	Tax incentives, some direct government subsidies
USA	solar	1 million solar roofs program

Effective tax rates on energy products in progressive countries

Country	Tax	Coal ($/1000KG)	Electricity ($ per kWh)
Sweden	Carbon	0.89	0.00
	Energy	0.60	0.29
Finland	Carbon	0.74	0.11
Netherlands	Carbon	-	0.08
	Energy	0.19	0.00
Denmark	Carbon	0.58	0.26

Countries with feed laws and guaranteed purchasing rates

Country	Feed laws	Guaranteed purchasing
Brazil	Yes	No
Denmark	Yes	Yes
Germany	Yes	Yes
India	Yes	Yes
Italy	Yes	Yes
Japan	Yes	Yes
Luxembourg	Yes	Yes
Netherlands	Yes	Yes
Spain	Yes	Yes
UK	No	No
Australia	No	No

* Some individual electricity retailers offer purchasing agreements for some technologies (such as PV solar), but Australia is a long way behind the unified 'parity pricing' policy adopted in many European countries and some states of the US.

CHAPTER FIVE

Wrong way, go back!

In the current climate of political inertia, Australia's energy policy continues to prop up old fossil fuel technology. Policy is centred around simple projections based on the experience and trends of the past. There is no clear vision or strategy to develop a new energy system and industries based on new technology.

In 1995, the International Energy Agency, working collaboratively with ABARE and the Australian Coal Board, projected Australia's future coal production would grow until at least 2050, with constraints coming only from: *the pace of productivity improvements, reform of workplace practices and industrial relations, and the rate and cost of developing new mines*.[36]

The complete omission of any concern about greenhouse pollution is alarming, and demonstrates that the fundamental imperatives of climate change have yet to be integrated into mainstream energy policy in Australia. This reduces bodies like SEDA to the status of a minor stakeholder.

Can't see the renewables for the trees

At the Kyoto Conference and subsequent Bonn meeting in 2001, the Australian Government lobbied hard to include a wide range of offsetting measures to enable countries to meet greenhouse emission commitments. Countries will now be permitted to count activities like investments in developing nations (clean development mechanisms) or in carbon sinks (planting trees). These have the potential to threaten investment in renewables.

Sinks

Scientists do not yet fully understand how carbon sequestration by trees works. In 1997 the United Nation's chief scientific body on climate change, the Intergovernmental Panel on Climate Change (IPCC), reported at Kyoto that meaningful negotiations and commitments on sinks were not possible due to the lack of credible scientific data.[37] Doubts continue to be voiced.

This has not stopped the fossil fuel industry or federal and state governments in Australia from pushing ahead. A recent policy document from the NSW Government claims:

Because expanded forest plantations can help to offset the emissions resulting from fossil fuel use, they are becoming an increasingly attractive investment for industry.[38]

The Federal Government's National Greenhouse Strategy (1998) states:

A key new measure in the National Greenhouse Strategy is the Bush for Greenhouse Program. This program aims to enhance Australia's sinks by encouraging greater private investment in revegetation … it will provide a low-risk environment for industry and government to learn about the costs and benefits associated with sequestering carbon.

In mid-1998 two electricity generators in NSW signed agreements with State Forests to provide trees for carbon sinks. In 1999 NSW passed legislation allowing electricity companies to meet greenhouse gas reduction obligations by planting trees.

Trees have become hostage to the power industry's approach to greenhouse programs. In concert with forestry agencies they are promoting tree plantations as storehouses for the carbon dioxide emitted by burning of fossil fuels in order to enhance their image and obtain carbon credits. The biomass becomes a proxy for dirty fuels.

This is a high-risk strategy for a number of reasons:

- Compared with a tonne of carbon in the ground in fossil fuel deposits, a tonne of carbon stored in a tree is very vulnerable to a host of factors including bushfire, drought, pests, diseases and storms, most of which will increase in frequency and/or intensity as climate change increases. Trees are also vulnerable to changes of land ownership, management and government policy changes.
- Trees as sinks are subject to the international negotiations on climate change. Agreement has been very controversial on the extent and type of sinks which can be included. The negotiations in turn are informed by scientific findings of the IPCC and doubt is growing. Recent scientific studies by the IPCC suggest that as temperatures rise due to global warming, the planted and older forests may release carbon, becoming net sources rather than sinks.[39] It has been claimed that the benefits of growing trees in

terms of $C0_2$ absorption may have peaked and, having reached saturation, respiration rates from the trees and soil will increase.

- The difficulty of measuring carbon absorption and losses adds to the risk of investing in trees as carbon sinks. Despite much effort going into this area, the National Greenhouse Gas Inventory figures for past land-use change and forestry keep changing, so there are shifting benchmarks.

However, these problems have not yet dampened the enthusiasm of the stock market, financial service firms and forest agencies for carbon sinks. Big polluters, financial markets and commodity traders are rapidly developing an emissions trading capacity, in which carbon sinks will play a big role.

Sinks may have the potential to sequester CO_2 from the atmosphere, but they will never be a substitute for the only sustainable solution: stop the burning of coal and switch to renewable energy. Sinks best serve the interests of those who continue to emit CO_2, rather than those moving to non-emitting technology.

There is little argument against planting trees per se. Creating mechanisms for tree planting in order to continue burning carbon fuels, however, is questionable. As long as polluters are given the choice between investing in sinks schemes (and continue polluting), or investing in new technology (and make genuine pollution reductions), renewable energy and energy efficiency will be forced to compete with sinks for investment.

Emissions trading

Similar, although less clearly defined, dangers emerge with emissions trading. At a purely theoretical level, emissions trading offers incentives for polluters to reduce emissions, with those who achieve reductions permitted to sell the resulting pollution 'credits'. While emissions trading allows companies to make a choice between buying pollution 'rights' or investing in renewable energy technologies, it too has the potential to undermine renewables. A 1998 paper by the Sydney Futures Exchange stated:

The most significant development in greenhouse policy since Kyoto has been the rapid growth of interest in emissions trading. Unlike other greenhouse policies … emissions trading has the potential to galvanise private sector entrepreneurial skills.[40]

Emissions trading will only reduce emissions if it takes place in a tightly regulated framework where the objectives and compliance mechanisms are clearly set.[41] Legally binding emissions caps will be essential, along with penalties for non-compliance. The number of tradeable credits within the marketplace should also be strictly limited and reduced over time. The inclusion of sinks in any emissions trading scheme will undermine the uptake of renewable energy.

Consumer choice

With all the attempts to improve the acceptability of fossil fuels the role of the consumer will become crucial. Will an environmentally aware consumer be satisfied with buying electricity generated from wood or municipal waste or reject it in favour of environmentally sustainable energy? (See below "Inside Story: The Biomass Battle").

The advent of the National Electricity Market and the right of the consumer to choose their electricity supplier may give much more control to the consumer. Domestic consumers will be able to decide not only their supplier, but also the type of power and associated packages (such as linkages with other utility supplies and benefits). Inevitably the environmental acceptability of the energy source will come into play for many consumers. This partly explains the biomass industry's attempts to clothe its fuel source in environmentally green terms.

The ability to exercise effective choice will largely depend on the available information, in particular independent assessment of suppliers (as opposed to retailer marketing strategies) and technical issues such as metering (current domestic meter systems inhibit flexibility of choice). In regard to information, there is a great deal of scope for credible sectors in the community to recommend suppliers based on social and environmental criteria.

Nationally environment groups have established a consumer information campaign on native forest energy with a website, postcards and investigation of electricity generators and suppliers,[42] and the Australian Consumers Association has joined the effort. Those using unsustainable or environmentally damaging energy sources will be exposed.

Signs of utility sensitivity have emerged with a split apparent in the bioenergy lobby. Potential consumers are already sceptical. A national opinion poll (Roy Morgan, March 2001) found just 8% of people thought

energy from native forests was renewable and only 6.5% supported the schemes. Governments are critically examining fuel source policies.

The mobilisation of consumer power will be an interesting development for social change movements. In 2002 a broad alliance emerged seeking to influence the choices of consumers and thereby the practices of major electricity corporations under the name Green Electricity Watch. Its first report appeared in February 2002 and can be viewed at www.tec.nccnsw.org.au

INSIDE STORY : The Biomass Battle

Governments and electricity generators eager to be perceived as taking action on greenhouse abatement have begun enthusiastically embracing biomass energy as a replacement for coal. Millions of dollars are being spent on feasibility studies, resource inventories, national conferences, pilot plants and attempts to seek international accreditation. The claimed benefits require close scrutiny, however, and there are significant environmental dangers. Furthermore, because biomass apparently offers a cheap and convenient solution, a large amount of funds that could be directed into genuine green energy technologies are being diverted.

Biomass energy – what is it?

Biomass is a broad term referring to any organic material that can be used through bio-organic processes to generate energy, whether electricity, heat or liquid fuel such as ethanol. The most common forms of fuels are wood, agricultural residues, municipal waste and animal manure. Energy can be obtained through processes such as:

- *Combustion* – burning which can be used directly as heat or in the production of steam and electricity.
- *Gasification* – direct conversion to gas that can be burnt, sometimes used in electricity generation.
- *Digestion* – biological breakdown such as in pig farms producing biogas, or the production of methane in rubbish tips.
- *Fermentation* – bacteria or yeast used to produce liquid fuels like alcohol.
- *Pyrolisis* – the heating of a biomass feedstock in the absence of oxygen.

Is it green energy?

With the passage of the *Commonwealth Renewable Energy (Electricity) Act 2001* (which sets a target of 2% of additional renewable energy capacity by 2010), interest in bioenergy skyrocketed. Industry analysts expect biomass could account for up to half of the required 9,500 GWh of new generation capacity.[43]

Biomass energy could be a legitimate sustainable energy source – at least in the transition to energy sources that do not release CO_2 – as long as the fuel is sourced in a genuinely sustainable manner and does not minimise the rapid adoption of green energy solutions, like wind, solar or energy conservation. These solutions are preferable because they result in an immediate and sustainable cut in greenhouse emissions.

Unless biomass is assessed for sustainability using full lifecycle analysis, it runs the risk of being just as environmentally damaging as coal. There is no benefit in switching to biomass energy if specific crop production destroys native ecosystems, reduces biodiversity, pollutes wetlands and waterways with fertiliser and chemical runoff, exacerbates salinity problems and undermines the transition to genuine sustainable energy technologies.

It is claimed by biomass supporters that it is greenhouse neutral because the CO_2 released when it is burnt is taken up by the next crop. However, this is not guaranteed, as another crop may not be planted (due to drought or loss of market) or could fail or burn down (for example a plantation forest). The logic also relies on the total area of vegetation remaining constant or increasing. This is not the case; land clearing and the destruction of forests, replaced by less carbon-intensive agricultural crops, continues all over the world including Australia.

Further questions need to be asked about alternative uses of the biomass and the funds being used to support biomass. A number of proposals intend to use municipal waste (including garden, vegetable and paper refuse), but much of this material could be used to make compost for new forests or landscaping, rather than being burnt. A sustainability test for municipal waste to energy is essential so there is maximum recycling first (saving significant energy in the manufacturing process) and the residue only is used for electricity production.

There is also the risk that consumers will become confused with the various labels for energy, such as ‘Green Power’ and ‘sustainable energy’ or ‘renewable energy’ – and inadvertently support weak

greenhouse solutions. For instance, Business Victoria in its prospectus for a native forest wood-waste project described it as green power, whereas in fact the National Green Power program will not accredit the project. The situation is further confused by the Commonwealth Government's 2% renewable energy target that is intended to include biomass from burning native forests; this is not sustainable.

The controversy over biomass labelling may undermine the credibility of efforts to install and sell genuine green energy and achieve maximum and immediate greenhouse gas reductions.

The biomass lobby

None of the critical issues have been satisfactorily resolved yet the biomass industry is fast gathering speed. Already a strong alliance exists between the power industry, resource extraction industries and their government agency supporters.

The chief body is Bioenergy Australia. It was founded in July 1997 by a number of Commonwealth Government energy research and rural resource bodies and Environment Australia. Its members now include: Pacific Power, Australian Greenhouse Office, CSIRO Divisions of Energy Technology and Forestry and Forest Products, State Forests of NSW, Waste Service of NSW, Western Power Corporation, Sustainable Energy Development Authority, Macquarie Generation and Northern Sydney Waste Board. Annual membership is $5000, well beyond the resources of community and environmental organisations.

The group is concerned with, "all aspects of biomass, from production through to utilisation, and its work embraces technical, commercial, economic, societal, policy and market issues."[44] It identifies 'key issues and drivers' as including:

- the requirement for renewable energy is supported by legislation in NSW and increasingly in other jurisdictions;
- 'green' energy attracts premium pricing;
- co-firing biomass with coal provides a low-risk bioenergy opportunity;
- a number of technical and institutional barriers exist which presently inhibit the broad adoption of biomass energy and fuels in Australia;
- Australia has a substantial biomass resource; and
- increasing concern for the global environment.

Some Bioenergy Australia members, such as Macquarie Generation and State Forests of NSW, have been amongst the first to embark on biomass energy programs, using their insider influence in the NSW Government to prompt policy and legislative changes to drive the uptake of unsustainable biomass energy.

Burning forests for electricity

There is a big push by electricity generators and the timber industry to intensify extraction from native forests to supply biomass energy. In May 1999, government, industry and research groups involved in the timber industry met in Victoria to discuss intensive management of native forests to increase yields. Bioenergy featured in the discussion. A year later the NSW Hardwood Timber Industry Development Strategy found:

The more prospective options for utilisation of pulpwood and other residues in NSW appear to be narrowed to bioenergy and other carbon-related products. Following the outcomes of the United Nations Climate Change Conference in Kyoto, and the Commonwealth Government requirement for 2% of energy production to be generated from renewable resources, there is a commercial incentive for the forest industry to support bioenergy facilities.[45]

There are also gains for government-owned forest agencies. According to the NSW Treasurer:

I believe that as long as the biomass sources are 'sustainably harvested' and conservation objectives are maintained, they could be utilised to both environmental and economic advantage. Restricting their use could prevent State Forests achieving their commercial targets as laid out in their Statement of Financial performance with little or no environmental gain in return.[46]

All of the following have been classified as forest residues or waste:

- residues left in the forest after logging (branches, stumps, crowns)
- any trees not suitable for sawlogs, such as pulpwood (currently used for woodchips in papermaking)
- silvicultural thinnings (trees, big and small, and undergrowth removed to promote the growth of sawlogs)
- bark and leaves.[47]

A whole new market for woodchips

Can native forests be used for electricity with little or no environmental harm?

Burning native forests for electricity creates greenhouse emissions, just like burning coal. Leaving the forest material to decay allows it to be absorbed into the soil and food chain and this material – including branches, stumps and litter – also provides valuable habitat for considerable biodiversity including threatened species.

Electricity generators in NSW have begun substituting coal with sawdust and woodchips from native forests (called 'co-firing'). This ploy is intended to maintain the market position of coal-fired power stations through distortion of environmental policies. While the burning of timber releases carbon in the same way as coal, burning wood, it is argued, enables the industry to reduce their greenhouse emissions. This is because the carbon-accounting methodology only counts the emissions from coal and not from wood. The result is that as long as wood replaces coal, greenhouse emissions fall (at least on paper) regardless of the quantity of wood burnt. A recent report (Barnes 2001) found that the combination of inefficient wood power stations, the very large release of carbon held in native forests and the time needed for enough new forest to grow back have made native forest power more greenhouse intensive than coal for more than a century, just at the time when we need to reduce greenhouse emissions.

When the woodchipping industry began in the 1970s, politicians and the forestry sector claimed it was simply a mechanism to utilise the 'waste' from logging. Within a decade, hundreds of thousands of hectares of Australia's forest had been clearfelled and woodchipped. Some of the nation's most significant wilderness areas in Tasmania, Western Australia and NSW have been lost forever to the woodchip industry. Forestry biomass could become an even greater threat, feeding power stations in all regions.

For example, in 1999 NSW produced approximately 500,000 tonnes of woodchips for paper production. Under licences issued by the EPA, Macquarie Generation's Liddell and Bayswater power plants could consume up to 450,000 tonnes of woodchips every year. The trend has spread nationwide with up to a dozen plants – which would consume millions of tonnes of woodchips each year – proposed for rural regions.

There is no comfort given by the Federal Government's controversial Regional Forest Agreements (RFAs), which removed the ceiling on woodchip harvests from RFA regions and were heavily criticised for

their inadequate conservation results. Native forests are still grossly under-protected. Nevertheless, the Federal Government has automatically included these forests as biomass sources in its 2% renewables legislation.

CHAPTER SIX

Setting a new course

Energy policy in Australia is currently oriented towards short-term economic and political outcomes. At a federal level, the National Greenhouse Strategy (NGS) favours those programs that are economically profitable. While it remains a 'response' strategy in all but name the NGS ignores the political and legislative challenges necessary to facilitate a transition away from fossil fuels and towards renewable energy. This transition will not occur on its own. It requires a clear recognition from governments that renewable energy can provide more jobs and more economic growth in the 21st century than coal. Energy policy in Australia has yet to reflect this.

A new focus in energy policy is needed for Australia if renewable energy is to gain a foothold. Chief among these is energy market and generation liberalisation. Fossil fuel technology has produced a global energy system based on large centralised generation. Yet renewable technologies are better suited to small, independent or 'embedded' generation. For this reason, the existing energy system is relatively hostile to new technology. Nowhere in the world have renewables established themselves without an open and competitive energy market. Yet, at the same time, market liberalisation on its own has not led to widespread renewables commercialisation.[48] Establishing a viable renewables industry has required prescriptive policy that targets the establishment of embedded generation.

Wind-turbine, solar-thermal and photovoltaic technologies are all mature and ready for immediate uptake in the Australian energy market. Getting them established in a hostile market, however, will take time and financial and regulatory support. Germany and Denmark have developed strong industrial bases around renewables technology. In both cases, early government assistance in the form of tax incentives to stimulate investment, guaranteed buying rates for renewable electricity,

sizeable industry development grants, and low or no sales tax for renewables technology were vital policy tools to establish industries.

Taxes and financial incentives

In Australia, policy remains piecemeal and patchy. Federal investment in renewable energy focuses on installing 'showcase' technology rather than supporting R&D or establishing a viable industry. The total level of federal support for the renewables industry is up to $350 million over 5 years. Despite a range of programs including the Renewable Energy Commercialisation Program ($55m), Photovoltaic Rebate Program ($31m) and Renewable Remote Power Generation Program ($265), a major criticism from the renewable energy industry has been that current federal policy fails to recognise the need for ongoing research and development.[49]

Australia has no tax incentives or rebate schemes for generation technology and has introduced a GST on renewables. For most sustainable energy technology this increased the total tax burden, making it more expensive compared to conventional energy.

Impact of the GST

Despite claims of being a 'new' tax, the GST is actually more of the same in the energy field. Fossil fuels have received major tax concessions and renewable energy will be taxed more.

Under the GST the cost of diesel in rural Australia fell by up to 50%[50]. This will have a major impact on the cost-effectiveness of solar and wind technology for RAPS. The impact on solar hot water may be even greater. The replacement of a targeted 12.5% wholesale sales tax with a flat-rate 10% GST will make solar systems more expensive and electric systems cheaper. Turton and Hamilton (1999) predicted an increase of at least 4% in the cost of solar hot water systems under such a GST. Electric hot water systems on the other hand would fall in price by approximately 2.5%. Furthermore, the cost of electricity for commercial customers is eventually expected to fall by 3.1% under the GST. Changes of this magnitude have a dramatic impact on the cost-effectiveness of solar hot water heaters.

The effectiveness of a $400 million 'compensation' package negotiated by the Democrats remains to be seen, but the mere fact that renewables need additional compensation under a 'new' tax system, demonstrates the extent to which the system is still focused on supporting non-renewable fuels.

In the 1980s Denmark had a 30% tax rebate to help establish a wind-turbine industry. As the industry matured, this was gradually reduced to allow sufficient time for companies to adapt to a competitive market. Denmark now has a $1 billion a year industry, has become the world's biggest wind technology exporter, and has been able to wind back most industry support (Mitchell 1998). The Netherlands, a country of comparable population and economic size to Australia, budgeted $550 million to stimulate renewables for 1998–2001 (Mitchell 1998). This commitment is almost ten times the size of Australia's.[51] The European Union is expected to spend $300 billion supporting renewable energy between 2000 and 2010 (Mitchell 1998).

What renewables in Australia require is a substantial program of sustained assistance aimed at commercialisation and the building of industrial infrastructure to provide economic growth and jobs.

Tax incentives work best where taxes are high, in countries like Denmark and Sweden. Companies and individuals with money to invest are usually those that pay high taxes. Following the 30% tax concession on wind power, Denmark saw private investors install 2,500 turbines in the 12 years to 1992 (Flavin & Dunn 1997).

Most of these were embedded grid-connected systems installed by farmers (Wolsink 1996). Australia too has relatively high taxes. Rather than cut taxes, offering tax concessions for renewables could give the industry a major boost.

Effective regulatory frameworks

All markets need laws and regulations – without them there would be severe social and environmental consequences. Describing reform of the electricity industry as 'deregulation' is a misnomer. It suggests that the market is somehow unregulated, but of course the energy market is highly regulated. The critical issue is the nature and extent of regulation.

Just as markets need laws and legislation to make them operate effectively, society needs government policies and regulatory controls to ensure markets serve the broad spectrum of social and environmental concerns.

The assumption that markets will, of their own accord, deliver better environmental outcomes is not borne out by five hundred years of capitalist history. Nowhere in the world has electricity market liberalisation, on its own, delivered more renewable energy (David

Moskovitz 1999). Stimulating renewables must be incorporated into the regulatory framework.

A ray of light appeared in Australia with the announcement by the NSW Government in early 2002, that it would legislate to mandate greenhouse reduction benchmarks and impose penalties for failure to reach the target.[52] The previous voluntary system had failed over several years with almost all retailers breaching the benchmarks every year. While the reduction levels are moderate, it is a regulatory move of international note and is likely to lead to significant job creation. A greenhouse labeling scheme on energy bills was also announced.

Jobs in green energy

Even though greenhouse emissions from energy have been increasing, jobs in the traditional coal and electricity sectors have been in steep decline since 1984. This trend has been sharpest in NSW where jobs between 1991 and 1998 (ABS) declined by 10% or 1,437 jobs. This contrasts sharply with the 25% growth of the emerging sustainable energy industries. Growth in this sector now rivals the IT sector (but will stall if not further supported).

Studies from Europe and America show sustainable energy industries provide a significantly higher number of jobs than traditional coal industries.

Jobs created per installed MW of electricity capacity[53]

Coal	2-3 excluding production of coal
Energy efficiency	3
Biomass	6–10 based on agriculture biomass not forest biomass
Wind	12 – 16
Solar	12

Note: all figures include indirect jobs in related industries

Using the lower job numbers and assuming an equal contribution of installed renewable energy types and efficiency capacity, each 1,000MW could create 8,250 jobs.

Reforming the system

We have argued that the regulatory system is failing. It is often the case the levers that influence the many decisions made by the private and public sectors lead to a course of action contrary to the intent of public policy objectives. The challenge presented by the greenhouse effect – to develop renewable energy and better energy efficiency – runs counter to established energy practice and policy. Only sweeping change in energy decision making will lead to significant improvements. At times, the process may be bumpy, and persistent pressure and guidance by leading-edge companies and the community will be essential as reforms are debated through our democratic system.

Australia needs a green energy vision so that renewables are not at the margin. The following regulatory, financial and educational measures are necessary to bring renewable energy to the fore.

National renewables target

- *Augment the minimal national 9,500GWh renewables target by 2010, to a 20% increase, and restrict eligibility to genuine renewable technologies and demand management.* This is equivalent to the European Union target – and is a doubling of current capacity by 2010.[54] All fossil fuel by-products, biomass co-firing in coal-fired power stations, and unsustainable biomass should be excluded.[55]

Electricity retailers

Governments should establish:

- *Legally enforceable greenhouse emission caps for electricity retailers, including penalties to provide meaningful incentives for compliance.*
- *Mandatory energy 'labelling'.* All energy retailers should provide customers with information that shows where energy is sourced. In the US this has provided a powerful marketing incentive for Geenpower, and helped make the exercise of consumer choice in competitive markets more effective.
- *Mandatory demand management strategies.* Retailers should be required by law to offer energy efficiency services to all customers. This could be in the form of information, audits, subsidy packages and installation

services. Innovative practices can return revenue (by payback) whilst also assisting consumers to install energy efficiency measures, which will in turn assist customers to control rises in their power bills.

Electricity distributors and generators

- *Should be required to adopt embedded generation where cheaper (after broad social, environmental and economic analysis) than network options.* Embedded generation such as cogeneration units and solar plants on rooftops are closer to the point of use and more reliable than power delivered by cables hundreds of kilometres long. At present, retailers and the national market are biased against embedded generation.
- *Should transfer energy demand and infrastructure planning to an independent agency.* While there have been some improvements in this system in recent times with utility-sponsored forums and annual assessments, the problem is lack of credibility and green energy culture, with those proposing the new infrastructure also being the judge and jury.

National electricity code

- *Environmental costs and benefits, including greenhouse gas mitigation, should be considered in all electricity infrastructure planning.* National regulators have been grappling with this, but have decided that network planning is not the appropriate forum to deal with environmental policy issues; therefore only the narrow view of costs to the utility of meeting environmental requirements is generally considered (ACCC 1999). Moreover, the limited analysis of environmental issues and demand management alternatives lacks credibility and independence.

Energy efficiency

- *National Mandatory Energy Performance Standards (MEPS) for all major household electrical appliances.* In order for the market to operate effectively, regulators should require producers to provide easy-to-understand information for consumers and establish benchmarks to promote industry development.

- *Energy efficiency standards for industry.* Similarly, industry energy standards can improve not only greenhouse emissions but also the economic bottom line, that is, profitability.
- *Increased government funding for R&D of energy efficiency and green energy technology.* By reversing the imbalance between funding for conventional and green energy technologies, commercialisation will occur much faster.
- *National energy efficiency standards for all new building developments and new housing.* The key instrument is the Building Code of Australia that has broad application, but energy reform of it has been very slow. It has been left to groups like SEDA to enrol councils in the Energy Smart Homes Policy in an ad hoc process.

Planning

- *Integrate renewable energy more fully into traditional energy planning.* This requires the development of scenarios to compete with fossil fuel options. To date the approach has suffered from the proponent/judge/jury conflict. Planning for fossil fuel power by utilities takes precedence because it is familiar and they are incapable of objectively embracing green energy directions. It is common for a network augmentation report to observe that demand management is 'unsure' or 'untested', thus reducing its attractiveness. An independent network planner is required.
- *Environmental and social costs of fossil fuel need to be integrated more fully into planning models.*
- *Ensure SEDA-type organisations are funded over the long term.* There needs to be a persistent effort to change industry and government views and encourage green consumer responses.

Independent generation

- *Federal feed laws and guaranteed buy-back rates for small grid-connected embedded generation.* It is inequitable to require small green generators to negotiate with giant

utilities. Feed laws and proper buy-back rates will create a level playing field.

- *Streamline administrative procedures for connection to the grid.* Similarly, the electricity utilities throw 'practicality' and 'insurance' obstacles in the way of actual connection by small generators to the grid. This is slowly being overcome, but is not advertised or applied widely.

Customer service and marketing

- *Increase training and education for installers of renewable technologies and make renewables and energy efficiency information a standard part of training for building professionals.* New technologies often fail to penetrate markets because they are not sold at the coalface. A broad program will lead to quicker results than allowing new skills to be incrementally obtained. Training will engender greater confidence and knowledge in architects who design the buildings and tradespeople who install the equipment.
- *Establish a free, national phone information service to provide impartial green energy information and advice to consumers.* Consumers are rightly sceptical of green claims made by private companies. In order to maintain the credibility of renewable energy an independent source of information is vital.
- *Require all appliances to be sold with energy consumption information explained in monetary terms.* The existing star energy rating system is inadequate. It is difficult for a purchaser to convert energy data into real life financial information. It should be simple to answer the question, 'how much more will it cost me to operate this appliance over a year, or over its life time?'
- *Encourage retailers to offer long-range lease/buy schemes on residential solar hot water.* Financing packages should involve payback rates similar to average hot-water energy bills. It is necessary to overcome the up-front cost barrier for solar hot water systems, even though solar offers very significant savings over the life of the system.

Building and infrastructure

- *Requirement for all new housing to have solar or heat-pump hot water (where viable) incorporated into the development application process.* By providing a growing market share, the economies of scale will improve and thus the price per unit will decrease.
- *Government at all levels should become a 'model consumer'*. The size of the government purchasing dollar and demonstration capacity of green building can be a major stimulus to the renewables industry.
- *Restrict cash-rebate programs to replacement of hot water systems by solar, and to domestic customers only.* Developers should be required to install this technology as part of the cost of a new house.

Pricing system

- *Remove off-peak electricity rates for hot water.* While this price system seeks to better utilise coal-fired electricity plant production in non-peak periods, it unfairly disadvantages renewables as environmental costs are not included.
- *Include the full cost of transmission in generation prices.* Because the full cost of transmission is not assessed, renewable energy plants close to actual demand are disadvantaged since they pay a fee as if they were a long-distance plant. Allowing distributors to recover the cost of embedded generation on the same basis as network augmentation would help, since embedded generation is effectively subsidising the main network system.
- *Introduce a renewable energy levy of approximately ½ cent per kWh for all customers, with exemptions for Green Power customers.* The revenue raised could be used to help fund green initiatives.

Tax rebates and subsidies

- *Introduce tax deductions and credits for investment in renewable technologies and allow accelerated depreciation on investments in renewables technology.* Virtually all major industries in Australia have begun life (and often continue) under a tax-friendly, subsidy regime in

recognition of their social and economic benefits. The renewable energy market should be no exception, as it too can provide major employment, industry development and (unlike some established industries) environmental benefits.

APPENDIX A

Alternative technologies

Solar

Solar energy is a generic term used to describe two distinctly different technologies. Photovoltaic cells (PVs) convert the sun's rays directly to electricity. Solar thermal technology – like that used in solar hot water heaters – generates heat rather than electricity. PVs are more highly engineered and significantly more expensive. Technological innovations have also begun to create hybrid thermal/PV systems, capable of producing both heat and electricity.

Photovoltaics potential

Leaps in photovoltaic R&D have dramatically improved the cost-effectiveness of solar energy. Between 1980 and 1999, the average cost of PV-generated electricity fell from over $1.50 per kWh to between 50 and 80 cents per kWh.[56] The International Energy Agency has predicted this will fall by half again over the next decade.[57] New solar hybrid technology promises to reduce this further, already generating electricity supplying the Spanish and Californian grids[58] for as little as 20 cents (US) per kWh.[59]

In 1998, total world PV capacity exceeded 600 MW.[60] Average market growth for PV through the 1990s was 17% per annum, and the industry is expected to continue growing at a minimum of 10% per annum to 2010.[61]

The ten largest photovoltaic manufacturers in 1999 had a turnover of approximately $US1 billion.[62] The market is dominated by Kyocera (Japan), Siemens (Germany) and BPSolarex (USA). 83% of all PV installation occurs in the home countries of these companies.[63] Australia has one small manufacturing plant (BPSolarex), but has been at the cutting edge of solar research and development for many years.

Innovations in PV technology have produced thin films which can be applied directly to building materials like roof tiles, walls and windows. While average conversion efficiency for these new thin films (approximately 10%) is not as good as traditional PV cells (approximately 15%), the new technology is much cheaper to manufacture and install, offering the potential to reduce the overall cost-efficiency of solar electricity.

Solar thermal potential

Solar hot water can reduce domestic electricity consumption by up to one-third. China is the world leader in solar hot water manufacture, producing 400,000 units per annum, mostly for a domestic market.[64] Second comes Japan, producing 100,000 units per year. Australia is a significant producer at 35,000 units per year, of which approximately 50% are exported. After a slump in the late 80s and early 90s, the solar hot water market in Australia is currently growing at 10% per annum.[65]

Wind

Wind is the fastest growing energy technology in the world today.[66] Despite an early lead by the US, the industry is now dominated by Europe – nine of the ten largest manufactures of wind turbines are European.

Installed global capacity in 1998 increased 26.8%, bringing the combined total to 10,000 MW. This is greater than the entire electricity generating capacity of Victoria. Of the 2,035 MW installed in 1998, 1,640 MW were installed in Europe.

Eighty percent of the world's installed capacity is limited to five countries: Germany, Denmark, India, USA and Spain in order of capacity.[67]

By 2010, the EU estimates 40,000 MW of wind power will be installed in member countries. This is equivalent to Australia's total electricity generating capacity[68].

Generating almost 10% of its electricity from wind, Denmark is the leader in wind R&D, manufacturing output, export growth and jobs. At times of high wind and weak demand, wind supplies up to 35% of electricity feeding into the Jutland Peninsula grid (mainland Denmark)[69]. In some Danish towns, 90% of electricity is supplied by wind turbines.[70]

Biomass

Wood has been burnt for centuries as a biomass fuel. Today, 14% of the world's heat energy comes from biomass, mostly from burning wood fuel in the developing world.[71] Increasingly industrialised countries are turning to biomass as a source of renewable energy. New technologies using anaerobic digestion, gasification, fermentation and liquefaction processes are being developed.

In some instances biomass is the most cost-effective renewable energy source. For this reason it is expected to overtake solar and wind in the coming decade.[72] A number of environmental concerns remain, including 'upstream' environmental impacts from such things as chemical residues and/or genetic modification of biomass crops.

In countries with substantial forest industries such as Sweden, Canada and Australia, concerns remain about the sustainability of using forestry products (such as native forest woodchips) as a biomass fuel source.

There is also a growing demand to use municipal waste as a feedstock in power stations. However, much of this material could be composted or recycled as a

replacement for virgin materials. Careful analysis is required to ensure the highest value use occurs.

Until these issues are resolved, a question mark hangs over the long-term role of biomass technology as a genuine sustainable energy source.

Energy efficiency

Energy efficiency does *not* mean sitting in the dark or going without heating. It refers to technical innovation in the way we use energy to provide the same services using less energy. Approaches to help reduce electricity consumption include solar hot water heaters, compact fluorescent light bulbs, 5-star energy rated electrical appliances, ceiling and under-floor insulation, AAA-rated showerheads and draught seals on doors and windows. Reduced consumption means reduced energy costs and reduced greenhouse pollution. Lower energy bills offset the cost of installing new technology.

Per capita electricity consumption in Denmark and Germany is almost half that of the US and Australia. Studies have shown that the US could meet its Kyoto target of a 7% reduction in greenhouse emissions by 2010 simply by improving energy efficiency.[73] In the process, American consumers would save US$43 billion in energy costs and the manufacture and installation of new technology would provide 900,000 new jobs.[74]

Programs undertaken by SEDA in NSW have shown that office towers in Sydney's CBD can cost-competitively reduce energy consumption by 25%.[75] The National Home Energy Rating System (NatHERS) is a software program developed to improve the energy efficiency of homes, yet less than 6% of Australian homes are NatHERS rated. Unfortunately, cheap energy costs have allowed Australians to become excessively wasteful in the way we use electricity. This means the opportunity to improve energy efficiency, and in the process improve the competitiveness of the Australian economy, is huge.

Micro-hydro

Approximately 19% of the world's electricity is generated from hydro sources. Only 3% of this total is environmentally sustainable small hydro. Micro-hydro does not require large dams and instead uses naturally flowing water to drive electricity generators. Thus micro-hydro avoids the adverse environmental impacts associated with damming rivers.

Europe has 9,705 MW of installed micro-hydro capacity. The EU has a target to install 14,000 MW by 2010,[76] which represents an increase in capacity of 44% for the coming decade. Norway generates almost 100% and Austria almost 70% of their electricity from conventional large-dam hydro. 72% of Europe's micro-hydro is installed in Italy, France, Spain and Germany. Micro-hydro industries in Europe provide 10,000 jobs.[77]

Australia has some production of micro-hydro equipment, but most of this is exported.

Geothermal

Geothermal energy was first developed in Italy in 1904.[78] The technology is mature and relatively simple. Water pumped down shafts into hot bedrock is superheated by the earth's heat. Steam returning to the surface is used as thermal heat or to drive electricity turbines.

Today, Japan and Switzerland lead the world in geothermal technology. Global capacity is split equally between electricity generation and heat production. Japan has almost 70% of the world market worth approximately US$1 billion per annum. Indonesia, the Philippines and Central America have all installed significant geothermal capacity in recent years.[79]

There have been geothermal applications in Australia, but only for specific developments (for instance to run air-conditioning plants for office and apartment blocks). NSW has sufficient geothermal reserves in the Hunter Valley to meet electricity demand for at least 50 years.[80]

Tidal and wave power

The world currently has six operating tidal-power stations. Only one, in Brittany, France, is a large commercially viable plant of 240MW. The second largest is a 20MW demonstration plant in Canada, and the remaining four are research projects in Russia and China.[81]

Denmark, Norway, Japan, USA, Australia and a number of other countries are experimenting with wave power, though no commercially viable plants are yet in operation.[82] A proposal to build a 48MW plant in Derby, northern Western Australia, is currently being considered, although environmental concerns regarding damming of estuarine wetlands have made the proposal controversial.

Cogeneration

Cogeneration, or 'cogen' as it is commonly called, involves the production of heat and electricity for commercial heating or industrial purposes. Waste heat from industrial processes is used for power generation and excess electricity can be fed into the grid. Because the electricity generated is often used within the industrial process, cogen reduces transmission losses and improves efficiency.

Cogen is not considered a renewable energy source but is generally considered under the broad umbrella of sustainable energy as it improves energy efficiency. By international comparison, cogeneration in Australia is under-utilised, comprising only 4.8% of total generating capacity.[83] In the Netherlands cogen is 30% of total Dutch energy use, in Sweden 25% and China 12%.

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[1] This prediction relies on expected technological improvements and a slight rise in energy prices, but not beyond that deemed politically and electorally acceptable (Dovers 1994).

[2] Gas occupies the vast majority of the remainder, with solar about 3-4%.

[3] Based on figures provided by Dr Manfred Lenzen (University of Sydney, *pers. comm.*). Boiling 1.5 litres of water requires approximately 1MJ of electricity (Australian average). In NSW it takes 3.76 MJ of coal to produce 1 MJ of electricity for your kitchen. 3.5 MJ of primary coal is about 130 grams, which is a lump about 5-6 cm in diameter.

[4] 3.5 MJ of human body energy is approximately what it takes to ride a bicycle 45 km at 9 km/h (without hills!) (Lenzen, University of Sydney, *pers.comm.*).

[5] Based on figures obtained form Weizsacker et al. (1997); pp 29-33 on Danish research. NSW energy consumption from the NSW Ministry of Energy & Utilities (1999 & 2000).

[6] Greenhouse Challenge figures from the AGO and business figures from the Australian Chamber of Commerce.

[7] Precious, SEDA, *pers. comm*., 2000.

[8] Lecture by David Moskovitz *(*9 February 2000).

[9] Reddi, Solahart, *pers.comm.* 1999

[10] Gavin Gilchrist (1994) discusses the economics of old incandescent versus fluoro bulbs in *The Big Switch*, pp 16-17.

[11] Total electricity consumption is rising faster than the introduction of renewables. Consequently, generation from renewables as a proportion of total generation is falling.

[12] Tonkin (1999) argues that the way governments prioritise decision making undermines the process of long-term sustainability. While ESD is standard rhetoric at all levels of government, the economic bottom line usually overrides issues of environmental concern. In this way, the environmental benefits of renewable energy are often overlooked by the economic imperatives of an energy system focused on coal and short-term economic profits.

[13] Fels, Allan (2002)

[14] Reddi, Solahart, *pers. comm*.

[15] Total SHW sales grew in the early to mid 1980s. This growth was in response to the energy shocks of the 1970s that stimulated both consumer and government interest in new technology. From the mid-1980s to the early 1990s sales slumped. Since 1993 sales have begun to steadily improve, albeit slowly. Last year Solahart sold 12,000 systems nationwide, which represents approximately 75-80% of total solar hot water sales. Anecdotal evidence from SEDA's hot water project, and Solahart's national sales office, indicate that sales are continuing to improve. Despite this, solar occupies only 2.2% of all hot water sales in NSW.

[16] These issues were raised at a CIPSE workshop of representatives from a range of renewable energy industries. Some industries were more affected by the problem than others. Solar hot water representatives in particular perceived a widespread perception in the community that solar technology is not yet economical, despite the fact that the technology has been economically viable for more than a decade. Industry workshop held 2 December 1998.
[17] Neill, SEIA, *pers. comm*.
[18] Eckstein, Leichhardt Municipal Council, *pers. comm*.
[19] Quite by chance, while writing this book (in Sydney) Sebastian Crawdford's gas hot water system failed. When he inquired about replacing it with solar the plumber informed him that solar was only economically viable in Darwin – and not to bother with the technology!
[20] Quote from BP Solar engineer Tom Davenport, at a discussion with BP Solar, Pacific Power and Energy Australia. Olympic site, 12 November 1998.
[21] Neill, SEIA, *pers. comm.*
[22] Transgrid 1999, p 16.
[23] For instance, the deferral of investment in structures such as powerlines and power stations by use of surplus power-station capacity and energy conservation.
[24] Joint statement by the ACCC-IPART (5 February 1999). "Transgrid-Energy Australia CBD augmentation".
[25] Dunstan, Chris (5 February 1999). "Demand Management and Distributed Generation". SEDA.
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[27] Overview of Report, p 5.
[28] National Economic Research Associates 2000.
[29] McCaffery 2000.
[30] See www.ipart.nsw.gov.au for discussion papers.
[31] Marshall 1998.
[32] http://www.windpower.dk
[3333] National capacity between 1997 and 2010 is predicted to increase by 10,000 MW. Source: DPIE 1997b.
[34] "Electricity Australia's fiftieth issue a timely pointer to change", in DPIE op. cit.
[35] The WorldWatch Institute, one of the world's leading think tanks on environment and energy policy, rates Australia at the bottom of industrial nations in terms of policies to address climate change (Flavin & Dunn 1997).
[36] International Energy Agency 1995, p 199.
[37] Mike Young, energy consultant, also noted the impossibility of constructing an effective emissions-trading scheme including sinks when the unknown factors are still so numerous (at an emissions trading seminar at the NSW Department of Energy, 3 November 1998).
[38] NSW Environment Protection Authority 1998.
[39] Pearce 1999.
[40] Sydney Futures Exchange 1998.
[41] The main reason for the failure of numerous pollution credit schemes in the United States has been the lack of a tight regulatory framework. Indeed, the only scheme to have successfully achieved emission reductions has been the SO_2 scheme (Lecture by Mike Young 1998).
[42] See www.colongwilderness.org.au

[43] Roarty 2000.
[44] Biomass Taskforce 1998.
[45] Department of Information Technology and Management 2000, p 45.
[46] Letter to Total Environment Centre, 24 November 1999.
[47] Enecon Pty Ltd 1999.
[48] *Pers. comm.*, Moskovitz, David. Director of the Regulatory Assistance Program, 9 February 2000.
[49] This problem was discussed at a renewable energy industry workshop at the Annual Climate Action Network Australia Conference in Canberra, 17-19 September 1999
[50] When subsidies and the rebates under the Diesel and Alternative Fuel Grants Scheme are taken into account.
[51] Figures from Australian Conservation Foundation 1997.
[52] The benchmarks aim for 5% below 1989/90 levels or 7.27t CO_2-e per capita by 2006/7. See www.doe.nsw.gov.au
[53] Coal figures are derived from Ministry of Energy and Utilities capacity and total employment from ESAA 1999. Biomass, energy efficiency and wind figures are all European. Wind figures from Vassilakis & Zibetta 1997. The solar figures are Australian from Lawley 1998.
[54] The 2% target is added to the existing 10% hydro and a few other sources. However, the national 2% or 9,500 GWh target coverts into 0.5% increase on current use of renewables when increased consumption is taken into account.
[55] For an analysis of the NSW portfolio see: www.nccnsw.org.au/member/tec/context/jeffangel.pdf
[56] International Energy Agency 1999a, and Ellis & Crawford-Smith 1999.
[57] IEA 1999a, op. cit.
[58] ibid.
[59] ibid.
[60] Ellis & Crawford-Smith 1999, op. cit.
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[62] http://www-solar.mck.ncsu.edu
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[64] Flavin & Dunn 1997.
[65] Brian Morris, Solahart, *pers. comm*. 22 December 1999.
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[68] Australia's main grid capacity in 1999 was approximately 38,000 MW. Source: ESAA 1999.
[69] Greenpeace, op. cit.
[70] ibid.
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[72] International Energy Agency, ibid.
[73] Bernow, S, Cory K, Dougherty, W, et al (1999).
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[75] SEDA's Building Greenhouse Star Rating scheme.
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