ENERGY POLICY OF DOCTORS FOR THE ENVIRONMENT AUSTRALIA
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Executive Summary

DEA has a deep interest in energy policy because it is the determinant of reduction in greenhouse emissions and climate change presents a significant threat to human health. Climate change will bring to Australia an increased burden of heat stroke, injury from fire and storm, infectious diseases, social disruption and mental illness; in the developing world it will bring famine, water shortage and dislocation of populations. Furthermore many of the widely-proposed solutions for reducing greenhouse gas emissions have significant risks to human health. However, some of the solutions to climate change also are also co-incidentally health promoting – such as active transport options to reduce fossil fuel use.

It is clear that that the risks of uncontrollable climate change are increasing more rapidly than the IPCC reports estimated in part because of humanity's inability to reduce emissions of greenhouse gases. There is urgency to reduce emissions now and this Policy will emphasise actions that can deliver this outcome.

This second edition of DEA's Energy Policy is largely built upon adaptation to the Australian situation of "Healthy Solutions for the Low Carbon Economy. Guidelines for Investors, Insurers and Policy Makers". This document from the Harvard Medical School Center for Health and the Global Environment by Paul Epstein and colleagues was published in July 2008 (1)

DEA supports the view of Professor Garnaut that any short-term pain to the Australian economy will be outweighed by medium to long term benefits of four kinds: (a) the development of valuable, exportable new technologies; (b) reduced dependence on diminishing oil supplies; (c) direct human health benefits such as cleaner air and a less "obesity-generating" environment, and (d) reducing the risk of dangerous climate change.

Our policy is based upon three equally important pillars, all of which will reduce emissions. All of these will reduce emissions now, all are complementary and all can be concurrently introduced and/or expanded as required.

An emission trading scheme is the first pillar of Policy. DEA supports the Australian Government's initiative to introduce an emissions trading scheme (ETS). This must have a target based on science and minimising the risk of dangerously high concentrations of greenhouses gas and resulting climate impacts. The target should be for 80% reduction by 2050, because failure due to modest requirements cannot be entertained for the reasons outlined above. An interim target of 25% by 2020, such as that suggested by Garnaut as being the most desirable (but upon which the Garnaut Review has suggested there should be certain preconditions) would be an appropriate target for Australia. The argument to delay in action till others have taken the plunge is spurious. Australia is lagging behind the European Union, which has been operating a emissions trading scheme now for a number of years. New Zealand is introducing a system. The United States has a number of large regional emissions trading policies being developed as well as legislation underway for a national scheme and both Presidential candidates support stronger actions on emissions abatement.

The second pillar of emissions reduction is energy efficiency and conservation. In this area there are many opportunities to reduce emissions, nearly all of which will result in cost savings. Whilst government has commenced this process the existing regulatory and policy framework falls far short of requirements. We need to rapidly expand the energy efficiency of Australian homes and businesses as well as health care facilities. This requires policies and programs that will overcome the barriers to energy efficiency and both improve minimum energy and greenhouse performance as well as driving improvements across the board through incentives to encourage better practice. Important energy conservation measures include reliable and efficient public transport networks with incentives and encouragement to use these along with disincentives to use cars.

The third pillar of emission reduction is the production of renewable energy. We conclude that renewable energy is a reliable, currently available means of supplying energy and reducing emissions. Renewable energy is decreasing in cost and creates many more jobs per equivalent amount of power than does fossil fuel generation. Australia needs policies to drive a rapid expansion in the deployment of these technologies. Renewable energy needs a strong renewable energy target of at least 20% by 2020 backed up by feed-in tariffs for further support to specific technologies as required. There should also be a supportive and efficient electricity network and land planning regime. An emphasis on renewable energy will develop technological industries that provide Australian leadership and partnerships to the developing countries of the Asia Pacific region.

"Clean" coal technology on a large scale is speculative and may never succeed. In any event its implementation is likely to be too late to prevent several warming thresholds. Figures from the coal industry recognise that clean coal is unlikely to be available for significant deployment for around a decade. Research into clean coal must not be expanded at the expense of greatly expanded funding for renewable technologies. Clearly this "clean coal" research is a political necessity but we point out that coal is an environmental health hazard responsible for much morbidity and mortality worldwide, and the costs of these externalities are also not factored into the price of coal – which is artificially cheap as a result.

The development of nuclear power in Australia cannot be supported. The emissions saving in full life-cycle studies is small. In the short term nuclear energy is unable to supply lower emissions energy due to the length of development of power stations and the long term it is unnecessary as Australia has vast renewable resources to capitalize upon. There are also significant health and security hazards with nuclear power generation .

In making recommendations we indicate that all government decisions should be based on working towards a sustainable society both in this country, the region and in the wider world.

Introduction

Human health is inextricably linked to the environment. Doctors for the Environment Australia's (DEA's) Energy Policy for Australia is based upon principles of social and environmental sustainability.

Climate change is the greatest threat to human health globally. The World Health Organisation (WHO) chose "protecting health from climate change" as the theme for World Health Day on April 7 2008. This theme was selected in recognition that climate change is posing ever growing threats to global public health security. The health consequences for Australia have been reported by DEA in Climate Change Health Check 2020 (2) and by Woodruff and Colleagues (3). Health is inextricably linked to the sustainability of the global society. DEA accepts that sustainable health cannot be achieved by an energy policy alone. Other issues are very important and DEA stresses that a slowing in the rate of global population growth is particularly important to maximise sustainability, through reduction in carbon emissions and consumption of resources; in turn these aims cannot be attained without increased global fairness, and a wider dissemination of education and opportunity.(4)

The emission of greenhouse gases is increasing worldwide and significant reduction must be achieved within the next few decades if serious consequences such as threshold or 'tipping-point' climate events are to be avoided. Most-commonly accepted targets for emissions reduction are in the range of 20-30% by 2020 and 60-80% by 2050. Because of the urgency of this situation emphasis must be given to those measures that can be immediately effective, principally in energy conservation and the expansion of renewable energy.

DEA's Energy Policy endorses the adoption of a series of options for Australia as recommended in the Harvard study (1) to reduce its greenhouse gas emissions.
These include:

- Energy Conservation via green building retrofitting and the implementation of 'green' energy standards for new buildings.
- Adoption of smart city initiatives with efficient public transport, infill redevelopment, higher-density populations and encouragement of green rooftops and greening to reduce heat island effects.
- Encouraging Industry to audit, review and install energy-conserving initiatives.
- Encouragement of individual households and industry to deploy renewable energy technologies via the introduction of "feed-in" tariffs.
- Better focus on distributed renewable sources of energy feeding into State and National power grids; so-called smart grids.
- Forest protection.
- Encouraging best-practice agriculture and shelterbelt plantings.

An ecologically sustainable global society is necessary for sound human health. Climate change is but one of numerous interlinked human-caused phenomena which threaten sustainability and were smouldering away before the accelerant of climate change was tossed onto the fire. All are described in many international studies: desertification, inadequate fresh water and food supplies, deforestation, over-exploitation of natural resources, pollution, international and intergenerational inequality and the abundance of nuclear and other powerful weaponry in an already overpopulated world. In concert, all these activities are leading to world-wide ecological collapse, the Murray Darling river system being an example in Australia.

DEA recognises Australia's interdependence with the rest of the world and sees a need for Australia, as a wealthy and developed country, to play a leadership role in addressing global problems. It should be self-evident that any short-term pain to the Australian economy from leadership over climate change will be outweighed by the long-term benefits. Furthermore, important opportunities exist for coalitions between developed and developing countries, particularly to develop, scale-up and roll-out new carbon-sparing technologies in developing countries.

Investing in a portfolio of greenhouse-sparing and renewable energy technologies is safer and more risk-averse than focusing on one or two 'silver bullet' solutions. Much of the difficulty the world faces in reducing carbon emissions comes about as a result of over reliance on coal for power generation and oil for transportation.

In Australia, unlike in Europe, domestic and industrial energy consumers have been overprotected by low prices, so focus on energy conservation has lagged the rest of the world. Put simply, Australians have had little incentive to conserve energy.

Although state and federal governments have long been aware of the need for energy conservation and for renewable energy development, support for promising technologies has been piecemeal and until now inadequate. DEA maintains that there is a need for Australia to provide greater incentives, using both market and non-market means, leading by example and by providing education, to encourage households and businesses to become more energy-conscious and efficient. Recommended strategies include more energy-efficient buildings, better urban design and much greater investment in public transport. Smaller, fuel-efficient cars using hybrid and other energy-sparing technologies also have a role. While many such developments are now occurring in embryonic form (5) there is an urgent need to convert them in to major programs.

There is also a need to accelerate the installation of wind, solar and other sources of renewable power and to expand research into other renewable energy technologies, not only to reduce carbon emissions, but also to conserve diminishing supplies of oil and gas for future generations.

Professor Garnaut and his teams have examined the scientific background to the reality of climate change and have gauged its negative implications for Australia. Garnaut, as a respected economist, has analysed the economic costs of inaction and outlined the economic benefits and imperatives for tackling greenhouse emissions. The Garnaut recommendations for the introduction of an Emissions Trading Scheme (ETS) were released on July and the government's Green paper followed a few days later.

The nuclear energy debate is significantly misunderstood, particularly in regard to the issue of climate change. DEA concludes that there is no justification for building nuclear power facilities in Australia, and indeed that such a practice would be counter productive.

The biggest objection raised by government and business to investing in sustainable energy policies is the claim that reducing Australian reliance on fossil fuels will result in higher power costs, thus making Australia uncompetitive compared to those industries and countries that continue to be heavy emitters of greenhouse gases. In the short run, this is undeniable. However we are being placed in danger of acquiescing to the most minimal change possible, in which any virtuous no emissions energy supplier is inhibited from competing in the market place because the current fossil fuel-focused system lacks a full and proper accounting of hidden costs, such as greenhouse gas emissions and the health hazards of air pollution. In short the so-called negative externalities of fossil fuel-generated power are hidden from view and therefore excluded from market consideration. Nor should we bow to the threats that energy intensive industries will be driven offshore for the alterative regimes often have unstable power generation and will have increasing difficulties in managing the impacts of climate change.

DEA agrees with Garnaut that any short-term pain to the Australian economy will be outweighed by medium to long term benefits of four kinds: (a) the development of valuable, exportable new technologies; (b) reduced dependence on diminishing oil supplies; (c) direct human health benefits such as cleaner air and a less "obesity-generating" environment, and (d) reducing the risk of dangerous climate change.

DEA also believes that important opportunities exist for coalitions between developed and developing countries, particularly to develop, scale-up and roll-out new fossil fuel-sparing technologies in developing countries.

There is a universal scientific consensus that stabilising climate change requires an enormous effort. The task of researching, developing and commercialising carbon-free primary power technologies on a scale capable of ameliorating the progression of climate change by the mid-twenty-first century has been likened to the challenge of the Manhattan Project and the Apollo space programme. Alarmingly, in the ten years since that analogy appeared in the journal *Nature* (6), carbon dioxide (CO_2) levels have increased from 366 to 382 parts per million (ppm). Lack of progress in establishing the other conditions needed for a sustainable future, such as increased international equity and a dramatic slowing in population growth, is of equal concern. It is in Australia's interest to do what it can to support developing nations in developing sustainable practices.

Overview

Climate change and sustainability

There are growing worries that the pace of climate change is accelerating, and that climate change will have a more severe impact than earlier estimates at whatever level CO_2 and other greenhouse gases finally peak. In the forward to a 2006 report, UK Prime Minister Tony Blair warned: "It is clear from the work presented that the risks of climate change may well be greater than we thought" (7) It is also increasingly clear that "peak oil" is looming, and that the price of oil will increase as supplies diminish, thus threatening to undermine the development needed to lift most of the global population from poverty. The comparatively early arrival of peak oil may slightly ameliorate climate change. However, if oil is substituted mainly by coal, rather than low-carbon energy sources (and without making heroic assumptions concerning the success of carbon sequestration) then carbon dioxide concentrations are likely to climb even higher.

The level of CO_2 which signifies "dangerous" climate change is unknown. This depends on the population affected and the definition. It also depends on the "sensitivity" (Climate sensitivity refers to the degree of climate change for a degree of atmospheric change) not only of the climate,(8) but of many other elements of the Earth-social system. (1). Some scientists argue that dangerous climate change is as near as a CO_2 of 450ppm. If the current trajectory of CO_2 emissions continues, then this level might be only 30 years away.

Because CO_2 has an atmospheric lifetime of 100-120 years, its atmospheric concentration will peak roughly 60 years after the year of peak emission. That is, if emissions were to peak in 2020 then atmospheric CO_2 would continue to rise until 2080, but at a slower rate. So reducing emissions may not prevent the concentration of CO_2 exceeding 450 ppm, but simply delay it. However, plausible scenarios also exist whereby the biospheres' CO_2 "sinks" (in the soil, forest, tundra and oceans) start to fail as CO_2 level increases (9-11). If this occurs then the biospheric emission of CO_2 could exceed that from the combustion of fossil fuels, rendering the above calculations irrelevant, and leading to runaway CO_2 accumulation and disastrous climate change. For example, the CO_2 emissions from the Indonesian fires of 1997 (mostly from the burning of peat) have been estimated at 13-40% of the emissions from the burning of fossil fuels globally in the same year (12).The triggering of such positive feedback loops (or tipping points) is likely to cause catastrophic climate change. No one knows at what level of CO_2 accumulation that would occur, but there can be no grounds for complacency. There is a stark need to reduce greenhouse gas emissions.

It has been argued that it is possible, using already-proven energy technologies, to stabilise CO_2 below 560 ppm. (13) These methods and technologies include energy conservation, the redesigning of society to allow more public transport, and an increased use of gas, wind, solar and geothermal energy. More controversially, bio-fuels and carbon sequestration (including smokestack CO_2 capture) may also offer ways to lower greenhouse gas emissions. The most controversial aspect of this study is to replace energy generated by fossil fuels with nuclear energy.

Greenhouse gas emissions in Australia

Australia's National Greenhouse Accounts show that Australia's greenhouse emissions in 2007 were around 585 million tonnes or 106 per cent of 1990 levels. This is an increase of 1.6 per cent from 2006. Both stationary energy (emissions from power generation) and industrial emissions are rising at around 3% a year and transport emissions were increasing at about 1.5% a year until quite recently when the higher fuel prices began to bite. The rapid expansion of timber plantations and reforestation and cessation of most land clearing have enabled the land use sector to continue to lower its emissions (14).

In 2006, Allen Consulting and CSIRO released a study (15) showing that it will cost very much less if Australians reduce greenhouse emissions early rather than waiting until 2020, before which time the climate change problem will be abundantly clear for example from an increase in severe weather events.

The Australian Greenhouse Office has calculated that about one fifth of all greenhouse emissions are generated by householders (approximately 15 tonnes of CO_2 per household per year) of which much (34%) is emitted via individual's transportation expenditures, followed by 26% from the use of various electrical goods of which fridge/freezers are the greatest emitters, 16% from heating water, 11% from heating or cooling the house, 5% from lighting, 5% from waste and 3% from cooking.

Coal and natural gas

Australia has abundant resources of coal – so much so that it is the world's largest coal exporter, by a considerable margin. Coal exports generate $12 billion in foreign exchange each year. The importance of coal in the context of Australia's chronic, serious trade deficit has for many years distorted and delayed recognition by government and elite business of both the danger and business opportunity that climate change represents.

The coal-fired power stations that produce 84% of Australia's stationary power are potent emitters of greenhouse gases. In developed countries, modifications to coal-fired stations have resulted in a ratcheting decline in emissions of sulphurous and nitrogenous gases, and of particulates. These improvements were

achieved without cataclysmic financial results (despite predictions by business of the contrary), using innovative market methods, including a 'cap and trade' market mechanism to lower sulphur emissions. This at least hints that CO2 reductions may be far less painful than is currently envisaged (and opposition by the US to the Kyoto Protocol may be unwarranted.)

However, the exploding economies in poorer countries (such as China, India and Brazil) have been less able and willing to invest in less pollution-intensive coal-fired plants. Many forms of pollution, including of greenhouse gases, are increasing, with an adverse impact on surrounding countries as well as on the health of their own citizens. (16)

Australia also has very large resources of natural gas. In terms of CO_2 and particulate emissions, gas is preferable to coal, being only about half as polluting. Until 'clean coal' (carbon-captured and sequestered) power plants are widely in use or are replaced by renewables, gas should be the preferred fuel for new stationary power plants in Australia.

For similar reasons there is a strong case to convert the national vehicular fleet to run on gas, at least as a transitional stage until fossil fuel dependency can be entirely phased out.

Fossil fuels and human health

The burning of fossil fuels impacts on health - both directly and indirectly. Climate change resulting from the burning of fossil fuels will increasingly cause health problems including those related to heat stress and loss of ecological services. All coal-fired power stations produce emissions of injurious gases and particulates. Sulphur oxides combine with water vapour in clouds to produce sulphuric acid. This forms acid rain, which is responsible for extensive forest dieback in the northern hemisphere as well as acidification of lakes and rivers that become too acid to sustain animal and plant life.

Apart from health effects resulting from environmental damage, fossil fuel use has other major, direct effects on human health throughout the world. Particulates are inhaled and enter the human body through the lungs to cause both respiratory and cardiac disease. Nitrogen and sulphur oxides are respiratory irritants and predispose to bronchitis. The economic cost of respiratory disease is huge.

Even in developed countries such as the US, there is a significant burden of disease with 23,000 deaths each year being attributed to pollution from power plants (17). Perhaps the most concerning pollutant from coal is vaporised mercury which is accumulating widely in the environment. It persists and accumulates in the aquatic chain rendering exclusively fish-based consumption unsafe for children and pregnant women. All these serious effects on human health are well documented in the medical literature. Improvements in coal power station technology, as practised in Australia, increasingly remove these pollutants. However, much of the coal exported by Australia is used in developing countries without such technology, leading to massive impacts on health and the environment. The world's coal mining industries are responsible for 10,000 accidental deaths per year. (see appendix Coal and Gas)

In assessing the relative costs of fossil versus renewable energy, governments should provide a reasonable estimate of the 'hidden' externality costs of fossil fuels. These health and environmental costs are significant and would certainly make fossil fuels more expensive than renewable energies. Whilst the world continues to use fossil fuels every effort must be made to use clean coal technologies.

Strategies to reduce greenhouse gas emissions

Energy efficiency

Energy efficiency is crucial in emissions abatement. Australia has many opportunities in improving energy efficiency that could be capitalised upon with relative ease, compared to other abatement measures, and in a cost beneficial way. Energy efficiency activities also have the added benefits of improving our energy security by reducing our reliance upon fossil fuels and also for social welfare through helping citizens to reduce their spending on energy and improve the comfort of their homes.

The "low hanging fruit" of improving energy efficiency in Australia has been well documented. Australia's energy efficiency performance has been relatively poor over the past few decades and lags many other OECD countries (Allen Consulting). While this is extremely unfortunate it means that Australia does have access to an arsenal of opportunities with which to make rapid and significant energy and cost savings.

McKinsey and Company have studied Australian abatement opportunities and have modelled the potential volume of abatement and cost per tonne which is as yet untapped. They have concluded that if Australia fully exploited the opportunities available then we could reduce our emissions by 20 per cent by 2020 at no net economic cost. The reason for this is that we have a large volume of abatement available through energy efficiency measures that actually save us significant money. These savings counteract the costs incurred through other forms of abatement such as forest management and land-use changes and renewable energy such as wind and geothermal.

So why - given we have such access to activities generating energy, emissions and cost savings - have we not capitalised upon these? The reason is that there are a variety of barriers to the optimisation of energy efficiency. Again, these have been well documented. Most recently the Allen Consulting Group neatly summarised these barriers in their report to the Western Australian Office of Energy and while we do not wish to provide detailed discussion of these it is important to have a brief overview as these are the reasons for which Australia has neglected its greatest opportunities and by understanding these we are much better equipped to overcome them.

Allen Consulting Group categorised the barriers as "Market failure", "Behavioural, cultural and organisational barriers" and "Other".

Market failures include: *Lack of or imperfect information* leading to opportunities being missed; *Split incentives* - where the person making the decision does not stand to benefit, such as builders choosing not to install solar water heating because it costs more up-front and the house owner reaps the long term benefits, or landlords choosing not to invest in their properties as the tenants reap the benefits; failures also include organisations where the department which covers the capital cost is separate from the department making reaping the ongoing savings; *Adverse selection* where customers are reluctant to pay the higher price-premium of higher efficiency products. Access to certain energy efficient product alternatives can also be a challenge in some places.

Behavioural , organisational and cultural barriers include: *trust in the product and source of information* - that the product will perform as anticipated; *inertia* – creating a bias against energy efficiency because it requires a departure from the status quo and may require extra decision-making; and *organisational limits on individuals decision making or monitoring ability* – this may include unofficial limits resulting from workload and priorities or it may be formalised limits in the role descriptions; also *strict investment criteria* in organisations - such as requiring prohibitively short payback period of less than two years.

Therefore there is a diversity of barriers to energy efficiency, and in particular that incomplete information is only one of many challenges and that education campaigns alone can improve understanding of the opportunities.. Emissions trading will raise the cost of energy and therefore will improve the relative cost effectives and attractiveness of energy efficiency, yet many energy efficiency opportunities are already financially attractive and yet remain unfulfilled as a result of these uptake barriers. Therefore an emissions

trading scheme and education and awareness campaigns must be accompanied by a supportive complementary regulatory and policy measures designed to overcome the barriers.

Many opportunities are available in households, business and industry. Each of these sectors face different barriers and will therefore require some different supporting measures – in other words energy efficiency is not a "one size fits all" policy approach. McKinsey lists some of the opportunities as: improving efficiency of motor systems; commercial and residential heating, ventilation and air-conditioning; car fuel economy; commercial and residential lighting efficiency – i.e. use of fluorescent lamps and light-emitting diodes; residential water heating efficiency; residential stand-by power savings – i.e. turning off appliances or using appliances with minimal stand-by power consumption; and improving appliance efficiency - in particular that of refrigeration.

Australian state and federal governments have introduced some policies and programs which have begun to successfully target certain sectors and groups of technologies. Examples of past successes have included the NSW and ACT Greenhouse gas Abatement Scheme, various state and federal solar water rebate schemes, improvements in state building regulations for new houses such as BASIX in NSW and 5 star in Victoria, the Australian Building Greenhouse Rating – a voluntary rating scheme for commercial buildings and tenancies. However these policies need to be built upon, preferably in a co-ordinated national response and many more will be needed. In the past the state by state approach has created unwarranted costs for both business and Government. Governments should be more willing to wisely recognise and implement successful schemes trialled in other jurisdictions, rather than constantly reinventing the wheel. In the 2008 federal budget $1 billion was allocated for measures to help put Australian homes and communities on the energy efficiency fast track (5). This is a good start and the Government will need to ensure it supports well targeted programs and that these in turn are backed-up by the necessary regulations.

DEA calls for the following:

- The expansion of the planned Victorian and NSW Energy Efficiency Target schemes to a **National Energy Efficiency Target Scheme** with eligibility for both the residential and commercial sector
- Rapid up-scaling of the roll-out and upgrade of the **Minimum Energy Performance Standards** for all commonly used appliances so that they lead minimum performance in the market, rather than follow
- Continuation and expansion of **Energy Labelling** to new appliances and development of
- **Mandatory measuring and disclosure of greenhouse and energy performance of buildings** – including commercial buildings and residences - upon sale or lease
- Modification of the **Energy Efficiency Opportunities** program to mandate that large energy users perform efficiency upgrades with a three year of less payback period (as is currently being investigated by the Council of Australian Governments)
- An **Energy Efficiency Action Fund** – funded by the Australian Government's proposed Climate Change Action Fund – for industrial energy efficiency project with long payback periods. Such a fund should be non-competitive and have clear eligibility guidelines to reduce the cost for both industry in scheme involvement.
- Far more robust minimum energy performance standards in all **state building codes**.
- **Household rebates for fittings/appliances** as necessary to support the roll-out of technologies which are not supported through the National Energy Efficiency Target. In particular, incentives for low-income households and for landlords may play an important role.
- **Ongoing public education** of the available opportunities, actions and supporting government programs.

Together these measures raise the standards for minimum energy and greenhouse performance through regulations. They also raise the "ceiling" – that is, they encourage better practice across the board by providing incentives for business and individuals to do more than the minimum though providing incentives to go further.

The Australian Government has indicated an intention to pursue some of these actions, including a Greenhouse and Energy Minimum Standards, fast-tracking new standards, continually reviewing standards, accelerating the introduction of the 1 watt standard for stand-by power and improving the current six-start Energy Rating Label. We endorse this approach and encourage the Government to prioritise these activities.

As mentioned above, these measures will, if designed carefully will have enormous greenhouse savings and economic benefit as well as other positive spin-offs such as improving the thermal comfort of households and buildings.

Renewable energy

Centralised energy supply
Two key arguments characterise the debate about global energy policy. The one most-commonly argued by fossil fuel and nuclear proponents is for the continuation of the development of large, centralised power sources with which to supply interconnected national power grids. This is despite several key problems with these:

- **Emissions intensity of coal-fired power.** In particular, Victoria's brown coal-fired electricity is the most emissions polluting in the world.
- **The high cost of electricity networks.** Electricity networks are very expensive to build and maintain, with billions of dollars spent each year in building new poles and wires and upgrading these to meet growing demand.
- **Network inefficiency.** There is significant power loss along the network. Power loss of up to 10% occurs along long transmission lines.
- **Security concerns.** A recent explosion at Varanus Island off Western Australia demonstrated the vulnerability of a system dependent on only few sites for a large proportion of power needs, to accidents or misadventure. The explosion cut that State's gas supplies for months by a third at enormous cost to local industry and indirectly to the Nation. More recently, it has been recognised that centralised power stations represent tempting and vulnerable terrorist targets.

Diversified energy supply from renewable sources
There is a strong case for a diversified energy supply, which would include many small to medium sized, widely-dispersed, renewable energy power sources

Renewable sources can cost-effectively and safely contribute significantly more energy to Australia, while reducing emissions and improving energy security.

- **Renewable energy is available now –** There are an array of technologies which are already being deployed and which can contribute much more energy to Australia without the need for technological breakthroughs.
- **Renewable energy is reliable** – A diversified and distributed network of energy generation can reliably meet Australia's energy needs without the need for storage. Intermittency of resources such as wind and solar is not a problem when combined with a variety of other sources such as hydro power and gas-fired power generation which are both "fast start-up" technologies. Countries such as Denmark have effectively incorporated 20% of wind generation into their electricity grid.
- **Renewable energy is decreasing in cost** – As renewable energy technologies are deployed, learning-by-doing ensures that their costs are continually be reduced. Solar PV in particular is currently on a steep learning curve.
- **Renewable energy is employment intensive –** Renewable energy technologies provide many more jobs per MW installed capacity than gas or coal-fired generation.
- **Distributed renewable energy supports regional areas -** Distributed energy resources are a positive for social welfare and health as they tend to distribute employment opportunities to regional and rural centres. This will help to transition some to a more sustainable future.. Such

support is integral in addressing the burden of stress, depression and suicide which is increasingly prevalent in these communities.

Renewable energy sources already operating in Australia include: hydro and wind power, bagasse (i.e. sugar cane waste), landfill and sewage methane, other biomass resources including black liquor, wood and agricultural wastes, solar photovoltaic, wave and geothermal energy (18)

In 2004-05 Australia sourced nearly 8% of its power from renewable sources (ABARE). This was dominated by large-scale hydro which accounted for 85% of renewable power production followed by wind and then bagasse. Unfortunately, despite the threat of peak oil to our energy security the threat of climate change to our quality of life, renewable energy's share of power generation has fallen progressively over the last 15 years from 11.5% in 1987/88 to the current 8-9%.

Forms of renewable energy

Hydro

Using water and gravity to turn turbines is Australia's most well utilised renewable energy source. Unfortunately, dams do have some detrimental environmental effects, such as loss of ecology caused by reduced water flow and the inundation of fertile land. In Australia, rainfall in the southern two-thirds of the country is in decline as a result of climate change (this decline is best documented for Western Australia). Dams also have high capital costs, and a limited life-span. Generally speaking Australia has capitalised on this resource and its ability to further develop hydro-power is limited.

Wind

Between 1-2% of Australia's power is currently derived from wind. This compares unfavourably with a much larger and increasing market share in Europe. For instance 20% of power generation in Denmark is sourced from wind. Wind power generation can be effectively combined with other generation technologies to supply a significant share of power generation. There is enormous potential for more wind power generation in Australia – indeed there are thousands of megawatts of wind projects in development, awaiting a supportive policy framework.

Solar Photovoltaic

The federal government provides up to $8,000 rebates for individual households to install grid-connected solar photovoltaic (solar PV) power systems if the family income is less than $100,000 per year before tax. There are also grants for installing renewable energy systems in remote areas. Despite these initiatives, the quantum of Australia's power derived from solar energy is very small. Australia is one of the sunniest countries in the world and there is potential for a great increase in the proportion of Australia's power to be generated from the sun.

Worldwide the take-up of solar PV has been growing very rapidly, on the back of robust stable "gross" feed-in tariff policies which ensure that owners of solar PV systems are paid a premium rate for the electricity they generate .The cost of solar PV is rapidly improving with the European Commission reporting that solar PV systems are now more than 60% cheaper than they were in 1990. Furthermore they predict that the cost is likely to fall a further 50 per cent between 2005 and 2020.

Solar thermal power generation

Solar thermal power plants convert solar energy to heat, using a system of mirrors or lenses focused on absorbers. This heat is then converted to electricity using turbines - either steam or gas. The European Solar Thermal Industry Association produced an excellent summary of these technologies and their potential in a report for Greenpeace in September 2005 (19) Already-installed plants are producing power at about twice the cost of conventional coal-fired generators. Concentrating solar thermal technology in California has been delivering electricity there for two decades. Now advanced solar thermal electric options are dropping in price and some companies are introducing thermal storage to match power demand. Solar thermal power could not only replace most fossil-fueled electricity generation in the US, but could replace petroleum-based transportation by providing renewable electricity for plug-in electric vehicles. This is not only technically but also economically feasible - and not just for the US but for China and India

as well. (20) Spain now has a solar tower that takes reflected heat from the sun from angled ground-based mirrors that powers 6000 homes. A planned larger tower will supply enough electricity to drive the power needs of the 600,000 residents of Seville. This technology stores enough heat for when the sun does not shine and can provide 24 hour power..

Australia, with its abundance of suitable sites for solar could be a leader in an industry that is set to dominate the 21st century. Otherwise, the future may consist of importation of technology that it could well have developed locally and exported.

Solar water heating

Heat pumps
A more diffuse utilisation of solar thermal technology that can be used to both heat and cool individual houses and workplaces. It has been estimated that these individual solar thermal applications might eventually reduce demand on national power grids by up to 10% or more.

Biomass
Bagasse, or sugar cane waste, has been used in cogeneration (combined heat and power) plants in Australia for many decades now. Bagasse, as a waste product, is a 'good' biofuel, as are other fibrous and cellulitic products which would otherwise be burned for their disposal. Globally, the development of biomass-fuelled power has been intense. The cleanest and most efficient way of utilising these fuel sources is in combined-cycle gasification systems in which the emitted gases can be cleaned and/or 'captured'. The more sophisticated the plant, the more costly the power. Although research into biomass crops is proceeding (switch grass is one possibility), there remains a long-term risk of environmental damage from soil degradation and competition for food-producing arable land. Recent rises in global food prices have been blamed in part on the increasing switching to biomass crops.

Other sources
Methane is a potent greenhouse gas with a greenhouse warming potential 21 times that of carbon. Capturing and using methane as a fuel source from gas that would otherwise be vented into the atmosphere from waste dumps or coal mines is environmentally sound. Methane is becoming more commonly utilised in Australia and elsewhere.

Geothermal: Geothermal power can be utilised wherever steam from the Earth's heat comes to the surface. It is the biggest source of Iceland's power and produces about 7% of New Zealand's. Elsewhere, including in Australia where several clean power companies are already drilling, hot fractured-rock geothermal heat will be used to generate steam from water injected into hot rocks deep in the Earth's crust. Other applications include the use of the stability of ground temperatures at only a few metres depth to assist domestic heating and cooling.

Tidal power: As with geothermal power, there are places in the world where tidal flows are strong enough to drive turbines without major environmental impact, and tides are being used to generate clean power. Each proposed application requires careful environmental evaluation because the potential to cause sedimentation or to kill mangroves, other coastal vegetation and to deplete fish stocks is very real. Because tidal flow is so reliable, there is much potential for research into better ways of harnessing tidal power without such severe environmental problems, using hydroplanes and other devices.

Wave power: Waves are another source of 'free' power from which it should be possible to generate clean energy in a cost-effective manner. Many devices are being trialled and are producing energy from small-scale installations. This technology is still in the process of being commercialised.

Solar and wind electrolysis: The hydrogen to power hydrogen fuel cells (see below) can come from by-products of petroleum refining and be generated in nuclear power stations – and both industries are extolling their hydrogen-producing credentials. However, the 'cleanest' source of hydrogen is water from which hydrogen can be released by electrolysis. Research is underway to use solar and wind energy to provide the electrolysis of water; the ultimate in clean fuels and energy conversion and storage

Support for Emerging technologies

The investment banking industry is very rapidly recognising the potential for renewable energy. Goldman Sachs announced a $US 1 billion investment in 'clean' energy over the next three years, and the Carlyle Group have made a similar statement of intent. Climate Change Capital, a merchant bank focusing on low-carbon energy solutions was formed with three staff in 2003. It now employs 60 people. Opportunities such as these are currently by-passing Australia. Firm targets for renewable energy will greatly enhance industry developments.

More analysts are studying the greenhouse gas emission strategies of major companies, particularly their intentions for the future, advising that investors steer clear of recalcitrant companies. There are suggestions that companies that wilfully ignore their greenhouse gas responsibilities may leave themselves open to being sued for culpable behaviour and lack of care (21)– as have tobacco companies when they continued to deny that smoking causes death and disease.

Micro generation (the production of heat and/or electricity on a small-scale from a low carbon source) could have a promising future. In 2006 the United Kingdom (UK) government launched its Micro generation Strategy (22) and a study commissioned via the 'Energy Saving Trust' suggested that by 2050, micro generation could provide 30–40% of the UK's electricity needs and help reduce household carbon emissions by 15% per annum.

The Australian government has recognised the potential for technological advances to reduce greenhouse gas emissions and has participated in the setting up of the AP6 Partnership (Australia, the US, India China, South Korea and Japan) to invest in and exchange new technologies. $100 million has been committed to the AP6 initiative. The British government has recently announced a 1 billion Pound partnership to invest in 'clean' energy technologies (500 million Pounds government money and 500 million Pounds industry investment).

It is not easy, from readily available information, to establish how much Australian government money is being directed towards the various emerging renewable energy technologies, although it appears there has been a particularly focused investment in supporting the 'clean coal' option. If the Australian government supplied 'feed-in' tariffs, as in Germany, from the proceeds of issuing carbon permits in a Garnaut-recommended Emissions Trading Scheme, multiple sources of renewable energy technologies could contribute the required 80% of Australia's energy needs by 2050.

Cleaner coal

It is encouraging that Australia's coal industry, the source of $12 billion a year in exports and the generator of 84% of Australia's stationary power, has stated that it "recognises that greenhouse gas emissions have to be cut significantly" in launching its $300 million COAL21 Fund to research 'clean coal' options.

However, cleaner coal technology is speculative and even if successful the time scale is unlikely to assist the urgent control of green house emissions. DEA notes in the review by the Institute of Science in Society that in 2005 in response to President Bush's February 2003 call for a programme to demonstrate "the world's first near-zero-emissions coal-fired power plan, a public-private partnership FutureGen Alliance, which included industry giants such as Rio Tinto, American Electric Power Service Corp, Anglo American, BHP Billiton, and China's largest coal-based power company, China Huaneng Group, was launched as a $950-million initiative for integrated gasification combined cycle (IGCC) technology to produce hydrogen and electricity while providing capture and storage of CO2. In January 2008, the US Department of Energy withdrew support from the project, citing soaring cost, then $1.8 billion. By the end of 2007, at least 11

carbon capture and storage (CCS) projects were scrapped in the UK, Canada and Norway. An Australian CCS coal-fired power generation plant Kwinana was also dropped. (23)

In Australia, CCS would lead, at best, to a 9 percent emissions reduction in 2030 and a cumulative reduction from 2005 to 2030 of only 2.4 percent, partly due to the lack of suitable carbon storage facility. A recent study commissioned by the German federal government confirms that compared with renewable energy options such as wind and solar, CCS will increase CO2 emissions 10 to 40 fold and raise the cost of electricity by 100 percent
.
This pessimistic view has to be balanced against a call on governments in 2008 by the UK's Royal Society and science academies from other industrialised nations and five other countries including China and India to set an agreed timetable for fitting power stations with CCS by next year to avoid "dangerous and irreversible" climate change. And it has to be balanced by almost universal government enthusiasm for the future of clean coal. Unfortunately it has to be recognised that governments have a vested interest in the success from the venture because of jobs and re-election. They cannot be regarded as free from conflict of interest

Alternative transport fuels

Transport is a major cause of greenhouse as well as particulate emissions. In Australia, about 15% of all CO_2 emissions come from transport, but for individual Australian households, this amounts to 34 % of all their emissions. The cost of petrol and/or diesel has a major impact on household budgets. The instability of global oil production has lead to a rapidly-increasing focus on biofuels either in the form of ethanol or biodiesel. In 2003, Brazil mandated that all cars be engineered to run on 75% petrol and 25% ethanol and since then the country has saved $129 billion on imported fuel.

This focus has been intensified by the recognition that oil is not an inexhaustible resource and at some point, possibly within five years, there will be a peak in oil extraction. Biofuels are no panacea because there are high energy costs of seeding, harvesting, spraying and fertilising in their production which itself cause greenhouse emissions. They are not without environmental harm including soil exhaustion. The major existing sources of biofuel (corn, sugar and canola) are also potential food sources for feeding nations in which hunger is a recurrent reality. In particular, prices of sugar and canola have risen quite sharply with increasing biofuel production. The ISIS Energy Report, "Which Energy 2006?"(24) pays particular attention to the place of waste streams and algae as sources of biodiesel and biogas using various micro-organisms to break down wastes, including plastics. Biofuels are likely to become increasingly important, especially if there are substantial technological breakthroughs.

Hydrogen-fuelled vehicles are a promising transport solution, especially if the hydrogen can be economically and reliably produced by electrolysis of water using solar power, or, as addressed in the ISIS Report, from an experimental anaerobic, bioelectrochemically-assisted fuel cell capable of producing hydrogen from sugar. Realistically, if they become feasible, these vehicles may be 20 to 30 years away from commercial production.

The global love affair with individual vehicles for self-transportation will ensure that massive research monies continue to be spent on the endeavour to develop 'clean'-powered vehicles. In the near-term, various US sources are promoting plug-in hybrid electric vehicles (PHEVs), which use rechargeable batteries and hybrid technology. The promoters say that the electricity required to charge these vehicles' batteries can be derived from wind, sun or other renewable energy sources.

Policy and regulatory support for renewable energy

Many European countries have set themselves targets to generate significant proportions of their power from renewable sources. The UK is aiming for 20% by 2020 and 50% by 2050. Despite the widespread controversy about Australia's agreement to export uranium to China, that country expects only 5 % of its power to be derived from nuclear energy by 2020 compared to 15% by wind.

Australia's new expanded Renewable Energy Target (RET) will aim for 20% of the nation's power to be generated by renewable energy sources by 2020. This will complement the Carbon Pollution Reduction Scheme (CPRS) proposed by the Federal Government, ensuring that renewable energy is deployed in Australia but only has a modest impact on the price of electricity. In doing this the RET will ensure a lowest-cost path to meeting our emissions reduction targets. Over time, as the Australian carbon price increases with more lower and more challenging emissions targets, the CPRS will be high enough to provide support for renewable energy and the RET will no longer be needed and will naturally fade out.

It is clear that the potential for increasing the proportion of Australia's power generation from existing renewable technologies is very large. There is a great need for Australia to implement a broad clear strategy to ensure strong and immediate growth in the renewable energy sector in Australia. Such a strategy should include:

- A higher renewable energy target of greater than 20 % by 2020
- **Feed-in tariffs –** Implementation of feed-in tariffs as necessary to give extra support to specific technologies – for example solar PV
- **Network planning** - Planning for the electricity network should be undertaken to ensure a successful incorporation of a much larger share of intermittent technologies such as wind generation. One very important aspect of this is addressing barriers to connection to the network which are faced in disproportionate costs and obligations on small project proponents – often in regional areas that serve to most benefit from the project.
- **Supportive and efficient planning regulations –** Local, state and federal planning regulations should ensure a robust but efficient processes are in place to minimise unnecessary delays in the project development phase. One aspect of this is amending the Environment Protection and Biodiversity Conservation Act to take climate change into account.
- **Amendments to tax law** – Examples such as accelerated depreciation of assets such as solar panels would support businesses installing solar PV.

Nuclear power

Recognition of the reality and potential severity of climate change has stimulated the mining and nuclear energy sectors – both globally and within Australia – to call for increased use of uranium and other nuclear fuels to replace and to complement the combustion of carbon-releasing fossil fuels, especially coal, in order to generate electricity. (25-27) Reliance on nuclear power cannot successfully ameliorate climate change and the true costs of nuclear power are poorly understood. In the final analysis, even if it were entirely safe and had no security risks, nuclear power is just another extractive industry and sources of high grade uranium will at some stage become exhausted. Eventually generation of the world's power will have to come from renewable sources. Arguing about the feasibility and adoptability of a rapid expansion of nuclear power is a distraction from focusing upon and achieving the renewable energy reality.

Doctors for the Environment Australia's first Energy Policy adopted in 2006 set out in detail the scientific arguments for and against the adoption of various nuclear energy scenarios. This is available on request.

Conclusion

Dangerous climate change is closer every day. As it nears the capacity of humanity to rescue itself from its predicament shrinks. Reducing greenhouse gas emissions is vital to achieve sustainability. However, climate change is but one of numerous interlinked problems which threaten sustainability, including international and intergenerational inequality, resentment, and the frightening abundance of powerful weapons.

A rational energy policy should seek to prevent dangerous climate change, and should also seek to preserve stocks of dense energy sources, such as fossil and nuclear fuel. DEA believes that Australians should vigorously and actively contribute to the development of a combination of greenhouse-sparing energy technologies, such as energy conservation, and the deployment of wind, solar and geothermal energy technologies. We believe we can and should develop regional leadership in these fields.

Australian leadership regarding climate change and energy policy, albeit belated, is vital for the Asia Pacific region. Together with Singapore, Japan and New Zealand we clearly form part of the wealthiest and most fortunate group of nations in this area. But as a major financial beneficiary of coal exports we bear extra responsibility for global climate change. Although this exporting role may once have been largely innocent of knowledge of atmospheric harm, this ignorance has changed to one of culpability and possibly of eventual legal liability. We need to develop positive leadership. Persisting with our negative example of selfishness and indifference is instead likely to fuel deep resentment. In addition to coal, Australia possesses great resources of science, technology and solar energy. If we could genuinely harness these resources in the pursuit of regional and global public good then it is likely that the Australian people would benefit materially and psychologically. The positive example we could set would be inspiring to many people, both within and without Australia, and is likely to generate goodwill for Australia, and to reduce our attraction to terrorists. Most importantly, Australian leadership will help reduce the risk of runaway global climate change, a threat increasingly recognised as both real and forbidding.

A sustainable global society cannot be achieved by an energy policy alone. DEA stresses that a slowing in the rate of global population growth is particularly important to maximise sustainability, and that this cannot be attained without increased global fairness, and a wider dissemination of education and opportunity.

Doctors for the Environment Australia support the development of an energy policy based upon the above.

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