



australian network of environmental defender's offices

Submission on the Discussion Papers for the 29 May 2009 National Energy Policy Framework

The Australian Network of Environmental Defender's Offices (ANEDO) consists of nine independently constituted and managed community environmental law centres located in each State and Territory of Australia.

Each EDO is dedicated to protecting the environment in the public interest. EDOs provide legal representation and advice, take an active role in environmental law reform and policy formulation, and offer a significant education program designed to facilitate public participation in environmental decision making.

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EXECUTIVE SUMMARY

Australia's use of fossil fuels, both in terms of our existing energy infrastructure and in terms of export dollars, has underpinned a successful path to high levels of economic development. However, the explosion in energy demand to fuel this prosperity has a price. This price is the environmental impacts associated with the use of fossil fuels to satisfy the majority of our energy demands - with the most significant environmental impact being the increased concentration of greenhouse gases in the atmosphere. Climate change therefore demands that we change the way we produce and consume energy. This will require the development of new technologies, the commercialisation of existing low emission technologies and the more sustainable use of natural resources. The finalisation of a national Energy White Paper will have a key role to play in ensuring that this transition occurs.

The Australian Network of Environmental Defender's Offices Inc (ANEDO) is a network of 9 community legal centres in each state and territory, specialising in public interest environmental law and policy. ANEDO welcomes the opportunity to provide comment on the Discussion Papers for the National Energy Policy Framework 2030.

The factors that drive the successful development and adoption of renewable and low-carbon technologies are complex. Current carbon-intensive energy systems have benefited from long periods of increasing economic returns that has reinforced the dominance of these systems and reduced incentives for the introduction of competing systems.¹ This is particularly the case in Australia where cheap energy from coal creates a greater barrier for investment in other energy technologies than for other nations with cleaner and more diverse energy mixes. Successful technological transformation to more sustainable energy systems cannot therefore be left to market forces alone. Policy and legislative frameworks need to be developed that foster, or at least do not impede, innovation in low carbon energy technologies.

Within this context, this paper addresses a number of specific questions posed by the Discussion Papers that are relevant to the environmental policy focus of ANEDO. Our key recommendations are:

- Renewable energy represents the primary long-term viable solution to climate change and should play a strategic role in energy policy moving forward to 2030 and beyond;
- ANEDO supports the pricing of carbon externalities such as through the Carbon Pollution Reduction Scheme (CPRS). However complementary policies will be

¹ Foxon, T. J. , *Inducing Innovation for a low-carbon future: drivers, barriers, and policy* (The Carbon Trust, July 2003, London), i.

needed to correct market failures that affect the competitiveness of renewables in the marketplace;

- ANEDO supports the introduction of the expanded MRET that will increase the renewables target from 2% to 20% by 2020. However due to problems associated with certificate based trading systems, such as the MRET, ANEDO suggests that feed-in tariff schemes should be reconsidered as a parallel policy to the MRET;
- ANEDO does not support direct or indirect subsidies to fossil fuel producers or consumers. However, where such subsidies exist we submit that assistance should be limited and transitional only and that legislative checkpoints are put in place to validate that such subsidies are warranted on either social or economic grounds;
- Regulatory uncertainty is a major barrier to the development of a renewable energy industry. ANEDO therefore welcomes initiatives such as the development of a set of Government endorsed National Wind Farm Development Guidelines. The provision of such guidelines for all renewable sources, together with defined regulatory processes and institutions will assist renewable energy investors in more accurately quantifying development risk which will lead to more renewable energy projects being undertaken. As a result, the community will be provided with energy generation assets that fulfil environmental, social and economic objectives;
- ANEDO is of the opinion that the energy industry should aim to decrease its water usage in order to avoid having to force tradeoffs between energy, the environment, agriculture and other uses. To enable this, ANEDO submits that moving to renewable energy sources, which are much more water efficient will reduce the consumption of water for production of energy while at the same time reducing greenhouse gas emissions;
- ANEDO submits that the water usage levels of competing energy technologies should be increasingly considered in the assessment of the relative merits of these technologies and that water pricing models are adjusted to adequate price environmental externalities;
- ANEDO submits that investment in Carbon Capture and Storage (CCS) technologies, which is aimed at supporting coal as a viable long term energy technology, should not be made at the expense of the development of a viable renewable energy sector. Given current investment distributions the potential exists for a better weighting of priorities to foster and encourage the development of a renewable energy industry;

- ANEDO submits that the development of a renewable energy industry should be complemented by the development of demand management strategies to restrain increases in energy demand;
- ANEDO submits that appropriate subsidies should be introduced to stimulate and encourage the development of a renewable energy industry. However, financial incentives must be accompanied by industry support and training programmes; and
- Government policy has a role to play in energy efficiency technologies such as solar hot water through facilitating the effective co-ordination between manufacturers and consumers. This can be achieved through improving the quality of installers through training and certification programs and ensuring the quality of the installed system through inspection programs and warranty requirements.

DISCUSSION PAPER 2: GOVERNANCE, INSTITUTIONAL, LEGAL AND REGULATORY FRAMEWORKS AND COMMUNITY ENGAGEMENT

3. To what extent is further regulation reform needed to optimise outcomes for Australian energy by 2030? What might the priorities be?

Major Federal Policy Initiatives

The major hurdle facing the development of renewable and low carbon energy technologies is the absence of carbon pricing for traditional fossil fuels such as coal. ANEDO is therefore supportive of mechanisms to price environmental externalities, including carbon, and has already commented extensively on the proposed Carbon Pollution Reduction Scheme (CPRS).²

However a carbon pricing mechanism, such as the CPRS, will be insufficient in itself to correct persistent market and policy failures that inhibit the success of low carbon technologies in the marketplace. Large centralised electricity generating technology, such as that built on coal in Australia, is an example of a technology which has evolved together with an institutional framework to create what Gregory Unruh has termed a “Techno-Institutional Complex”³. Once set up, such systems acquire a momentum which makes them very hard to change. For example in regulated markets like energy, government involvement means that any change will likely meet with resistance from special interest groups. In addition, larger and financially stronger incumbent players have a higher risk tolerance and have access to lower capital costs than new projects financed by independent power producers. Consequently their propensity to invest is substantially higher and this will eventually lead to a more concentrated and less competitive market.⁴ Public policy has an important role in correcting such market failures.

ANEDO is supportive of complementary policies that will mitigate Australia’s dependence on fossil fuels. A major policy initiative is the Mandatory Renewable Energy Target (MRET). Although ANEDO is of the opinion that the proposed MRET target

² ANEDO, *Submission on the Carbon Pollution Reduction Scheme - draft exposure legislation*, <http://www.edo.org.au/policy/090415cprs.pdf> at May 11, 2009.

³ Unruh, G. C., *Understanding carbon lock-in*, (*Energy Policy* 28, 817-830, 2000).

⁴ Kettunen, J., *Electricity Investment Behavior in Response to Climate Policy Risk*, (London Business School, London, 2008), 26.

does not go far enough⁵, we support the introduction of the exposure legislation that will increase the target from 2% to 20% by 2020 as an important first step. ⁶ Issues with certificate based trading systems, such as the MRET, have been highlighted through European experiences with Tradeable Green Certificates (TGCs). An observed issue has been that of the higher levels of risk associated with renewable energy as compared to that of traditional fossil fuel based energy⁷. The higher level of risk associated with renewable energy projects will demand a higher internal rate of return (IRR) from investors. Such a situation favors incumbent providers in the industry who are better positioned to take this risk than smaller innovative firms. This has resulted in a diversion of resources from innovators to incumbents who tended to focus on more moderate innovation rather than the more radical innovation needed to tackle the problem of climate change.⁸ As a result, ANEDO supports the introduction of supplementary mechanisms to drive the adoption of renewables in conjunction with a renewable energy target.

ANEDO submits that the most effective way to encourage the production of renewable energy is through a national feed-in tariff. Such a tariff has been introduced in several Australian states and overseas, although it has been shelved federally. As we noted in our previous submission to the Inquiry into the *Renewable Energy (Electricity) Amendment (Feed in Tariff) Bill 2008*, international experience has demonstrated that feed-in-tariff laws have proven the most cost effective mechanism for increasing the use of renewable energy sources in the electricity sector.⁹ Therefore, we strongly believe that when used in conjunction with the proposed MRET scheme, a gross feed-in tariff scheme (which extends beyond 18 months) would provide a significant boost to the industry.¹⁰

Despite the weaknesses of the MRET as an instrument the government seems committed to its current format. Consequently certain factors regarding its design should be considered as they are important drivers of the uptake of renewables. These include the

⁵ ANEDO believes that a target of 25% by 2020 is preferred. Several developed countries have put in place strong renewable energy targets. For example, California has a target of 33% by 2010 and Denmark 28% by 2010.

⁶ ANEDO, *Submission on the Renewable Energy Target scheme – exposure draft legislation 13 February 2009*, <<http://www.edo.org.au/policy/090219ret.pdf>> at May 11, 2009.

⁷ Kildegaard, A., *Green Certificate Markets, The Risk of Over-Investment and the Role of Long-Term Contracts*. (2008).

⁸ Lauber, V. , *Certificate Trading - part of the solution or part of the problem?* (Conference on the Future of GHG Emissions Trading in the EU, 20-21 March 2008).

⁹ ANEDO, above n6.

¹⁰ See ANEDO Submission to the Inquiry into the Renewable Energy (Electricity) Amendment (Feed in Tariff) Bill 2008 – 13 August 2008. Found at http://www.edo.org.au/policy/080801senate_inq_renew_energy_amndts.pdf

rules for the banking of credits and the eligibility period for projects under the scheme.¹¹ If credits created or purchased to meet annual targets can be banked for either sale or surrender in later years of the scheme, especially if the project eligibility period extends to the end of the scheme, there is a strong incentive to invest in as renewable energy to generate credits as *early* as possible. This will have the effect of favouring market-ready technologies as opposed to more immature technologies. Many renewable projects are capital intensive and require 10-15 year in order to obtain a return on investment. This suggests that more certainty about the phase out of the MRET is needed to assist investors as the proposed 2030 phase-out date effectively rules out the profitable participation of late entrants to the market.¹² This is consistent with the findings of the Tambling Report where it was recommended that the scheme be extended out to 2035.¹³

Subsidies for Fossil Fuels

Currently governments in Australia provide substantial financial support for the production and consumption of fossil fuels, through direct payments, favorable tax treatment and other actions. Research from the University of Technology, Sydney identifies total energy and transport subsidies in Australia during 2005-06 of between \$9.3 billion and \$10.1 billion.¹⁴ Such subsidies create an unfair market advantage for fossil fuels over renewables and encourage greater consumption, which leads to increased greenhouse gas emissions. In general ANEDO does not support subsidies or direct assistance to fossil fuel producers or consumers. We also strongly oppose the \$3.9 billion of compensation to coal-fired generators under the Carbon Pollution Reduction Scheme (CPRS). ANEDO is of the view that the operators of these facilities have been aware of the impacts of climate carbon dioxide on the atmosphere and its contribution to climate change for some time, and therefore the inevitability of carbon pricing for several years and these impacts should therefore already have been incorporated into their investment decisions. The allocation of free permits to these generators will reduce the incentive to begin the inevitable transition to forms of energy which produce less or no greenhouse gases.

However, if the Government remains committed to assistance then ANEDO submits this should be transitional and strictly limited in nature. In this regard, ANEDO welcomes the

¹¹ See n6 above.

¹² For all generation technologies the climate change policy risk premium depends on how long there is left for the policy to run. The fewer the number of years remaining until an expected change in policy, the greater the risk premium associated with policy uncertainty. This assumes that there is no visibility at all about future climate policy before the end of the existing policy. The period of 5-15 years into the future is the key period over which a planned new power generation needs to recoup the majority of its investment.

¹³ MRET Review Panel, *Renewable Opportunities, A review of the operation of the Renewable Energy (Electricity) Act 2000*, (Australian Greenhouse Office, Canberra, September 2003), xxvii.

¹⁴ Riedy, C., *Energy and Transport Subsidies in Australia*. (UTS/Greenpeace, Sydney, 2007), iii.

inclusion of provisions under Part 9 Division 4 of the draft CPRS bill that require withholding of assistance if the Authority is satisfied that the provision of free permits constitutes a windfall gain. The ability to withhold assistance in this way ensures that the policy objectives of providing assistance are not undermined.¹⁵

Regulatory Uncertainty

As pointed out in Discussion Paper 2, renewable energy resources, such as wind, are currently managed under a disjointed array of national, state and local government regulatory and planning frameworks, with significant reliance on local government land planning and associated land access provisions. There is an absence of a cohesive and integrated regulatory framework at the Commonwealth and State levels that deals comprehensively with the range of issues required for the effective diffusion of renewables into the marketplace. Key issues include assessment and approval processes, access and property rights, transportation, monitoring and verification, liability and post-closure responsibilities and financial issues. This can pose a challenge to regulators, leading to development delays and increased implementations costs. This high level of regulatory uncertainty does not create positive signals for potential investors.

ANEDO therefore welcomes initiatives such as the development of a set of government endorsed National Wind Farm Development Guidelines. Such guidelines, when complete, should aim to address substantive issues of public concern - including environmental issues - and deliver a high degree of transparency in the planning, location selection, assessment, approval and environmental monitoring of wind farms. The provision of such guidelines for all renewable sources, together with defined regulatory processes and institutions will assist renewable energy investors in more accurately quantifying development risk which will lead to more renewable energy projects being undertaken. As a result, the community will be provided with energy generation assets that fulfil environmental, social and economic objectives. The Wind Farm Development Guidelines should therefore form a blueprint for guidelines for other emerging technologies such as solar and geothermal.

8. Given that the energy industry is expected to increase its need for water to 2030, how might we best manage these impacts on our water resources in the light of our other water management priorities?

Water Consumption and Energy Generation

The issue of water needs and energy production are consistent with issues raised in a recent report by the World Economic Forum in which the authors warn that ‘Energy’s share of

¹⁵ See ANEDO Submission on the Carbon Pollution Reduction Scheme - draft exposure legislation - 14 April 2009. Found at: http://www.edo.org.au/policy/080801senate_inq_renew_energy_amndts.pdf

water is likely to be squeezed in the future in many parts of the world.¹⁶ Increasingly energy producers will become partners in managing the world's water resources, along with agriculture, environmental protection, and urban centres. Nowhere is this problem more pressing than in Australia whose fragile environment and water-intensive energy industry¹⁷ is experiencing a 'trilemma' in trying to provide energy security whilst reducing greenhouse gas emissions in a water constrained environment. To compound this problem the process of acquiring, treating, and delivering water consumes huge amounts of energy. This has led to a vicious cycle as state governments look to water desalination technology to solve water shortage problems, which in turn requires more energy. As has been suggested 'water production will consume all available energy, and energy production will consume all available water.'¹⁸ The effects of this dilemma have already been clearly felt in the marketplace. Specifically, in early 2007, drought constrained hydroelectricity generation in the Snowy region, Tasmania, and Victoria, and the limited availability of water for cooling in some coal-fired generators led to higher spot prices.¹⁹

ANEDO is of the opinion that the energy industry should aim to decrease its water usage and improve water efficiency as a key first step. A primary driver in reducing the water dependency of energy production is the choice of fuel stock. Coal-fired power generation as is undertaken in Australia demands large volumes of freshwater from rivers and lakes for cooling purposes whilst simultaneously emitting greenhouse gases and contributing to climate change which will lead to a reduction in water availability in many catchments throughout Australia. A re-examining of coal-fired power generation in this light clearly reaffirms that case for renewables. The water consumption of wind and solar is negligible compared to those of either nuclear or coal. Wind generated electricity uses less than 1/600 as much water per unit of electricity produced as does nuclear, and approximately 1/500 as much as coal.²⁰ ANEDO is of the opinion that moving to renewable energy sources will help ease the competition for limited water resources whilst at the same time reducing greenhouse gas emissions. It is therefore suggested that the water consumption levels of competing energy technologies play an increasing important role in the debate over the relative merits of these technologies.

¹⁶ World Economic Forum/Cambridge Energy Research Associates, *Energy Vision Update 2009 Thirsty Energy: Water and Energy in the 21st Century*.

¹⁷ Approximately sixty five percent of the generating capacity in the National Electricity Market (NEM) is currently dependent on freshwater for energy (hydro-electric) or cooling (coal or gas fired generation).

Source: Australian Government National Water Commission <<http://www.nwc.gov.au/www/html/433-water-management-and-the-electricity-generation-sector.asp>> at May 2009.

¹⁸ Kris De Decker, *Water eats energy: desalination*, (November 07, 2007),

<<http://www.lowtechmagazine.com/2007/11/water-eats-ener.html>> at May 15 2009.

¹⁹ Australian Government – Department of Resources Energy and Tourism, *Energy in Australia 2009*, <http://www.abare.gov.au/publications_html/energy/energy_09/auEnergy09.pdf> at May 15, 2009

²⁰ American Wind Energy Association estimate <<http://www.awea.org/faq/water.html>> at May 15, 2009.

Pricing and Allocation Considerations

ANEDO submits that where water is used in the production of energy, regardless of the mode of energy production, it is important that it is adequately priced to reflect environmental, economic and social costs. That is, externalities must be built into water pricing to reflect the full lifecycle cost of water usage. Water, as an environmental externality, is no different from carbon in this respect. External costs to be factored into water pricing could include changes in aquatic and terrestrial ecology and impacts on water quality.²¹ Unless such externalities are reflected in water pricing, then the consumption of water will be above the socially and environmentally optimum level.

Finally ANEDO, as documented in a previous submissions to the *Water Amendment Bill 2008 (Cth)*²², highlights the issue of ‘trigger points’ where an ‘emergency response’²³ will be required to address situations where water quality becomes too poor, or water salinity too high to meet ‘Critical Human Water Needs’.²⁴ The allocation of water to communities or indeed to electricity in times of drought may be able to stave off economic and social downturn in the short term. However such actions may simultaneously deplete natural water systems over the long term which in turn has the potential to increase the prevalence of areas succumbing to future ‘trigger points’. It is important therefore that decision makers ensure environmental consequences are taken into account before water is allocated to consumers, including energy producers, in order to reduce the likelihood of ‘trigger points’ being reached and subsequent ‘emergency responses’ needing to be introduced.

DISCUSSION PAPER 5: MAXIMISING THE VALUE OF TECHNOLOGY IN THE ENERGY SECTOR

- 1. What does the Australian community want the energy technology mix to deliver in 2030? Consideration could be given to the following:*
 - *Conventional technologies*
 - *New and emerging technologies*
 - *Energy storage systems*

²¹ K Hussey & S. Dovers (eds.) *Managing water for Australia- the social and institutional challenge* CSIRO Publishing at 78.a

²² ANEDO, Submission to the Senate Rural and Regional Affairs and Transport Committee Inquiry into the *Water Amendment Bill 2008*, (November 2008), <http://www.apb.gov.au/senate/Committee/rrat_ctte/water_amendment/submissions/sub02.pdf> at May 15, 2009.

²³ Section 86F, *Water Act Amendment Bill 2008*.

²⁴ Included in this submission is a request for clarification on the definition of ‘Critical Human Water Need’.

- *Demand reduction and energy efficiency*
- *Synergies between technologies*
- *The cost of maturing each technology and their timing*

Policy Objective

In ANEDO's opinion renewable energy represents the primary long-term viable solution to climate change and should thus play a strategic role in energy policy moving forward to 2030 and beyond. Up to this point renewable energy has been a largely under-utilised resource in Australia despite the fact we have a greater resource capacity than most other nations from which to establish a viable renewable energy industry. ANEDO submits therefore that it is important that renewable energy sources should progressively displace coal and oil towards 2030 and beyond. Such a shift should be supported by strong energy efficiency measures.

Energy Mix

Forecasting a potential energy mix for 2030 is difficult due to the fact that many renewable and carbon capture technologies, such as geothermal and Carbon Capture and Storage (CSS), are not ready for mass market adoption. Consideration therefore needs to be placed on the process of allocation and prioritisation for support and funding of these technologies. When allocating resources to new technology development there is a balance between the desire to provide technology-neutral support in order to avoid distorting the selection of technologies and the competing desire to concentrate resources on the areas that show the most promise. While government policy which sets a carbon price attempts to be a technology-neutral policy, technology specific policy, such as Australia's massive investments in CCS²⁵ are a clear attempt to 'pick a winner'. ANEDO submits that this bias towards CCS technology is symptomatic of Australia's overdependence on coal²⁶. Investments aimed at perpetuating this regime should not be made at the expense of the development of a renewable energy sector. The fear is that a singular focus on CCS

²⁵ Investments include Carbon Capture and Storage Flagship Program: \$2billion, the National Low Emissions Coal Fund (NLECI): \$500 million over 8 years to support the National Low Emissions Coal Initiative, the Low Emissions Technology Demonstration Fund (LETDF): \$410 Million over 10 years to support industry-lead projects to demonstrate technologies with the potential to deliver large scale GHG reductions in the energy sector, The Global Carbon Capture and Storage Initiative, and a proposal to fund up to \$100 million per annum towards a new Global CCS Institute, Support for range of CCS related projects with key international partners, including China, through the Asia-Pacific Partnership on Clean Development and Climate, and the world's largest research and geosequestration demonstration project, the Cooperative Research Centre for Greenhouse Gas Technologies Otway Project in Western Victoria. (C02CRC).

²⁶ ANEDDO, Submission to the Inquiry into the Offshore Petroleum Amendment (Greenhouse Gas Storage) Bill 2008 & 3 related Bills 15th August 2008. < http://www.edo.org.au/policy/080812_ggstorage_senate.htm > at May 15, 2009.

encourages a 'business as usual' approach for the energy industry with the ongoing environmental consequences likely to be passed on to future generations.

Consideration should be given to how much bias is based on the technological merits of the technology and how much is based on effective lobbying from incumbents. One only need look at the breakdown of allocations under the Low Emissions Technology Demonstration Fund (LETDF) where four of the five existing projects support fossil fuel production or consumption, with total funding of \$335 million. Only one of the projects supports renewable energy, with funding of \$75 million. That is, fossil fuels receive 82 per cent of the total funds allocated under the LETDF to date.²⁷ This trend has continued in the 2009-10 federal budget where the Renewable Energy Fund was increased to \$1.5 billion up from \$135 million whilst an additional \$2billion of new funds was placed in CCS under the Carbon Capture and Storage Flagships Program.²⁸

The potential exists for a better weighting of priorities to encourage the development of renewable energy. This would imply significant funding into research and development of renewable sources of energy beyond solar to include wind and tidal energy. Additionally, it is important that in the case that CCS technology turns out not to deliver the promised capacity for emissions reduction a clear exit strategy must be defined in order to avoid a situation where continued investments are made based on pressure from special interests rather than on the future potential of the technology itself.

Governance

The above discussion raises the question as to how such funding and policies will be coordinated. Professor Garnaut²⁹ proposes the possibility of a new specialist research body focused on low-emission technology, to elevate, coordinate and target Australia's efforts. One key role of such an organisation would be to attempt to better align innovations with investors and markets, particularly on an International scale. As low emissions technologies are a public good technology, the market alone will not contribute sufficient investment in research and development, therefore development in Australia will suffer if there is insufficient government investment and the international markets for these technologies are not explored or developed.

²⁷ Riedy, C., *Energy and Transport Subsidies in Australia*. (UTS/Greenpeace, Sydney, 2007), 16.

²⁸ Australian Government Department of Climate Change, *Climate Change Budget Overview 2009-2010*, <http://www.climatechange.gov.au/budget/0910/pubs/ccbo_200910.pdf> at May 15, 2009.

²⁹ Garnaut, R., *The Garnaut Climate Change Review: Final Report*. (Cambridge University Press, 2008), 430.

The CPRS White paper public policy position 18.3 suggests the formation of a Stakeholder Consultative Committee, comprising of business, environmental and community stakeholders, to provide advice on detailed design and implementation of activities under the Climate Change Action Fund (CCAF) and on the operational aspects of the regulation of the CPRS. The Committee will not have a decision making role, but will advise Ministers in relation to applications and proposals received under each of the streams of the CCAF. Such a structure opens up the possibility of political influence. The evaluation of alternative governance structures, such as an independent statutory authority, might be able to provide more focused support to technology initiatives.

Demand Management

Regardless of the energy portfolio mix in 2030, ANEDO submits that the development of a renewable energy industry should be complemented by demand management strategies and energy efficiency measures to restrain increases in energy demand. Over the past thirty years energy consumption in Australia has more than doubled from approximately 2700 peta-joules to more than 5500 peta-joules in 2006.³⁰ Incentives that encourage households and businesses to reduce their energy use and that fund research into energy efficiency programmes will play an important role in controlling the burgeoning increase in electricity use in Australia.

Support for the Renewable Energy Industry

One important mechanism for facilitating the development of Australia's renewable energy industry is to provide subsidies for the installation of energy efficient technologies, such as solar hot water heaters. However, the provision of such subsidies will likely be insufficient unless it is accompanied by industry support and training programmes. Indeed, experience in Californian solar hot water subsidy programs has shown that installation booms that follow the introduction of subsidies have affected the reputation of solar hot water as a technology through poor warranty and support of the products after they enter the market. This has been due to an unsustainable installation and support industry.³¹

Installers are a key piece in the innovation chain in that they sit between the end consumer and the technology provider. In the installation process, knowledge flows from the manufacturers through the installers and to the end-users. In order to increasing the pace of innovation and adoption of energy efficient technologies we also need effective flow of knowledge in the other direction, so that installers and end-users can help inform manufacturers and inventors about ways to improve their products. Various approaches,

³⁰ ABARE, *Energy Update 2006* at <<http://www.abare.gov.au/>> .

³¹ Taylor, M. , *Beyond technology-push and demand-pull: Lessons from California's solar policy*. (Energy Economics 30 Issue 6 , 2829–2854, November 2008), 2840.

requiring some level of government co-ordination, are available to facilitate these feedback loops such as improving the quality of installers through training and certification programs; and insuring the quality of the installed system through inspection programs and warranty requirements. This example and other case studies also suggest the need for tailored approaches to low emission technology diffusion policy, undertaken with private sector involvement in both research planning, funding and technology commercialisation, to avoid the mistakes such as those experienced in California.³² Such policies are noticeably absent from the governments current energy efficiency plans.

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³² Marlay, R. C., & Koske, B. H., *Technology Policy for energy and climate change: Lessons from a retrospective of thirty years on research, development, and demonstration experiences*. (French Center on the United States at the Institut Francais de Relations Internationales Paris, 2005), 23.