

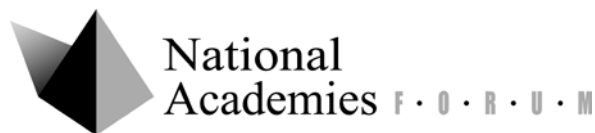


Understanding the Formation of Attitudes to Nuclear Power in Australia

A NATIONAL ACADEMIES FORUM REPORT



Understanding the Formation of Attitudes to Nuclear Power in Australia



THE NATIONAL ACADEMIES FORUM IS THE PEAK ORGANISATION
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- Academy of the Social Sciences in Australia
- Australian Academy of Science
- Australian Academy of Technological Sciences and Engineering
- Australian Academy of the Humanities

UNDERSTANDING THE FORMATION OF ATTITUDES TO NUCLEAR POWER IN AUSTRALIA

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Executive Summary

This study seeks to understand the development of Australian attitudes towards the use of nuclear energy for the large-scale generation of electricity. The topic has become more relevant as Australians are now well aware of the risks attributed to a continued dependence on fossil fuels for the nation's energy demands. Recently there has been a growth in public investment in the new technologies associated with low-emission generation and in developing public education strategies for more efficient use of existing energy supplies. An investment in new technologies means that public acceptance of such technologies will be at the forefront of their development and long term utilisation.

In the past five years, Australia has experienced both the highs and the lows associated with being a global energy resource provider. One of its energy resources that Australia sells to the world is uranium. This study has confirmed that the mining and supply of uranium sets the context within which any discussion about Australia's future energy demands is framed, and within which attitudes to a possible future nuclear power program in this country developed, formed and retained.

The study details how uranium mining and any future use of nuclear power in Australia are inextricably linked – historically, politically and culturally – and how such a link is supported and maintained by media commentary. Australia is a nation that produces uranium but does not use nuclear power and in that respect it is unusual in the context of the developed world. As a result, Australian attitudes to any future that could include nuclear energy continue to be influenced by the current utilisation of our uranium resources by other nations and by the perceived risks associated with such use, at home and overseas.

The role of science, technology and society, and what has been termed the 'social constitution of nuclear power', is reviewed in this study, as are the ways in which decision-making is affected by the perceived risks associated with the adoption of new technologies. This study does not include a large-scale survey of current attitudes to new energy technologies or to nuclear power. It has been designed to undertake critical ground-clearing work about the debate thus far, and has been produced to enable a foundation for further, mature discussion.

On the matter of whether or not Australia should develop a nuclear power program, as well as continue to produce and export uranium, opinion polls reviewed for this study have supported the latter, while not supporting the former. The apparent inconsistency here is not just a reflection of the perceived risks involved in establishing a nuclear power industry (including the vexed question of where any power stations could be sited) but also reflects the fact that for the majority of Australians the issue lacks current salience. This could be due to Australia's perceived good fortune in possessing abundant fossil fuel resources and to the anticipation of a future that includes renewable technologies.

The debate, and those participating in it, forms the structure around which this study has been developed. In adopting a social network/epistemic community (see page 42) conceptual framework, the study has identified six pathways to attitude formation to nuclear power. These are: historical, cultural, political, news media, international and educational. The report describes how the debate has been framed, the influences associated with the pathways to that framing, and the subsequent impact of those influences. Using two case studies, the report charts how the debate intensifies within the national political environment and is then used to establish various political positions on the topic.

The study analyses opinion from current Australian polls and surveys and compares it with opinion from countries that have established nuclear power facilities. Despite there being much media commentary about a ‘renaissance’ of nuclear power programs in countries such as the UK, this study reports on the essential fragility of the necessary social contract for such programs, with a recognised potential for risk magnification associated with any future incidents.

By incorporating some very recent CSIRO Energy Transformed Flagship research and findings from community consultations, the study highlights a continued interest within the Australian community for a low-emission energy future, as well as the potential possible (within deliberative democratic processes) in facilitating the transfer of knowledge about very complex technologies.

Finally, in regard to any future informed debate, this study has brought together a wide range of information sources on the topic, including many multi-media sites, interviews, documentaries and articles, as well as the scholarly literature. Key opinion leaders have been interviewed for their views and an e-survey has been conducted of social networks, focusing on energy technologies and nuclear power. For anyone interested in learning more about the current state of the debate, this study provides a base-line source of information.

In answer to the broad question that was developed for this study, ‘How are Australian attitudes to nuclear power formed?’, the following section provides a brief summary of the six pathways to attitude formation that were identified.

HISTORICAL

Key events were identified as having come to symbolise, in a shorthand manner, the points in history that have contributed to the development of people’s current attitudes to nuclear power in Australia and which continue to be used to frame the arguments, either for or against it. The key events include the testing of military nuclear weapons at Maralinga/Emu Field in the 1950s; the Ranger Uranium Enquiry in the mid 1970s; the decision to restrict the mining of uranium in Australia taken in the early 1980s; the continued testing of nuclear weapons in the South Pacific in the 1980s and 1990s; and the Three Mile Island (1979) and Chernobyl (1986) accidents. These events have become the context within which any current discussions are framed, and to which key references continued to be made, whether the specific and accurate details of such events are known or not and irrespective of the fact that the technology has moved on.

CULTURAL

Symbolic forms (images, films, texts) drawn from popular culture continue to be used by individuals in explaining their support or opposition to nuclear power in Australia. This pathway, which is interlinked with the development of what can be termed a societal ‘environmental consciousness’, can be traced over more than 40 years from the publication of *Silent Spring* (1962) through to various more current television and film media. The use of such symbolic mediators can also be seen as important social markers, as public acceptance of new technologies is often based more on agreed cultural and political values, than on the potential offered by science and technology.

POLITICAL

The study has determined that nuclear power in Australia can best be understood as a political rather than a technological, economic or resource issue. This was also confirmed in discussion with key informants and is supported by an analysis of the international literature. Specifically, the study details how the national relationship with uranium mining shapes the political context, while at the same time individual and personal interaction with nuclear power remains distant. The research has led to a detailed case study of this inter-relationship through an analysis of the context within which the *Uranium Mining*,

Processing and Nuclear Energy Review (UMPNER) was conceived, announced, undertaken, released and debated in 2006-07; the subsequent political responses which highlighted the place of nuclear power on the political platforms of all parties; and the contributions of various opinion leaders in this debate.

NEWS MEDIA

As a mediator of cultural values, and as a medium for the expression of views, attitudes and opinions, the news media act to present, interpret and re-frame events to a mass audience of lay individuals. The media also provide platforms for opinion setters, as well as regularly ‘testing’ public opinion through polling. This pathway highlights how specific events can be presented as ‘dramas’ with various key actors creating a tense atmosphere through the use of carefully chosen language. To explore this in detail, the case study developed for this research analyses a very recent ‘spike’ in media discussion on nuclear power that occurred between May and August 2009, coinciding with a visit to Australia by former US Vice President Al Gore and the lead-up to the Australian Labor Party’s National Conference as well as submissions to the Federal Government’s White Paper on Energy.

INTERNATIONAL INFLUENCES

The global climate change context has raised the issue of future contributions of nuclear power programs in countries with existing nuclear power stations. These debates are often referred to and compared with the Australian context. More specifically, in considering the risks associated with continued greenhouse gas emissions, key international environmental opinion leaders have publicly announced their reconsideration of previously deeply held attitudes against nuclear power. Such ‘conversions’ act to highlight how attitudes are shaped by the testing of individual lay opinions against those held by admired and trusted public figures.

EDUCATIONAL

As a pathway to socialisation more broadly, and to attitude formation more specifically, education is critical at two levels: first, the skills development associated with science, engineering and technology and the place of energy in society; and second, the history and impact of both civilian and military nuclear power. Such skills development needs to be seen as cross-disciplinary. This links to the issue of future teaching of the essential science disciplines associated with nuclear energy, and the related issue of the ageing of the current population of scientists and engineers who have such skills. This pathway also raises the question of the content of curricula on these issues, the resources used in such curricula, in both secondary and tertiary institutions, and whether a science-based education is more or less likely to produce particular attitudes in relation to nuclear power, an aspect well beyond the scope of this study.

KEY INFORMANTS AND SURVEY RESULTS

A summary of findings from the key informants has highlighted the following.

There was general agreement among those interviewed as to:

1. the essentially political nature of the debate in the Australian context, both currently and historically,
2. the importance of the interrelationship between uranium mining and nuclear power, and
3. the requirement for a bi-partisan consensus for any shift in the current position of both major parties to occur.

There was an acknowledgement of an increased media debate, which some respondents viewed as a ‘distraction’ from the more important focus on the role of renewables in a future energy-technology mix, whereas others saw it more as a maturing of the overall climate change debate. The majority of the 13 respondents interviewed were aware of the positions on the issue taken by various media commentators and their institutions. Respondents commented on the breadth of information, not all of it accurate or scientific, that characterised the issue, and on the power of the internet in disseminating such information.

Some respondents were relatively unconcerned about any technological risks associated with nuclear power whereas others were less convinced and cited waste, weapons and national security as unresolved issues. Respondents commented on the special importance of clear scientific communication on this complex topic within its powerful cultural context and political sensitivities, and of the important role played by key leaders in such communication. Although the names of other respondents were strictly withheld, it was evident that most respondents were known to each other, and they referred to each other during their interviews.

With regard to the e-survey, the majority of the 300 respondents were very concerned about future water and energy demands and global warming, issues which they reported were regularly discussed within their networks, in their workplaces and among their families and friends. The majority reported feeling very favourable about nuclear and solar power and favourable about natural gas, hydroelectric and geothermal as technologies that could make a substantial contribution to secure future supplies of energy in Australia. A majority agreed that Australia should increase its nuclear, solar and geothermal capacity 'a lot' in the future; that nuclear power would be an important contributor in the current international and national debate about global climate change; and that this debate had influenced their own thinking on nuclear power more positively or somewhat positively. Respondents stated they were likely to draw useful information on Australia's future energy technology mix from journals, the Internet and the print media. They also found membership of their e-network a useful source of information, and rated scientific organisations and learned academies as highly reliable information sources. When asked to name organisations whose views they valued as reliable sources of information various academies were named first, government laboratories second, and universities third. When naming organisations whose views they would not value, respondents rated environmental NGOs first, political parties second and various combinations of industry alliances third. Finally, on being asked to name specific opinion leaders, both national and international, whose views they would or would not value, the e-survey confirmed a significant 'cross-over' drawn from a small cluster of known individuals.

Finally, the study concluded that:

- Any measurement of attitudes remains essentially problematic, as it involves the measurement of language as well as requiring contemplation and reflection, thus relying on memory.
- An attitude (behaviour) is different from an opinion (verbal expression), and it is only from any subsequent behaviour change that accurate measures of attitude can be concluded.
- Attitude formation is highly dependent on its salience. International research has specifically highlighted salience as a critical determinant in attitudes to nuclear power. Salience is both spatial and temporal, as strong responses to the possible future location of nuclear power facilities demonstrate.
- Attitude formation is a long and complex process which has both gender and intergenerational differences. It draws on individual belief systems and the moral and political domains within which individuals operate, both individually and within groups. This explains why nuclear power continues to provide an example of essentially polarised attitudes.
- The diffusion of new technologies such as nuclear power becomes integrated, adopted or rejected within a social change (political) agenda. The role played by societal groups, their networks and their relationships within institutional infrastructures, is crucial to any technological change being adopted.
- When considering the formation of Australian attitudes to nuclear power, both historic and contemporary, the formation of those attitudes is likely to be affected by a small number of individuals with high social rank, connected through socio-demographic structures by association (i.e. within key groups), who draw on collective action frames in developing and adjusting their arguments according to the audience involved. This framing can be charted through the historical, cultural and media pathways described in detail in the study.

- Risk perceptions remain immediate, dynamic and historically influenced, and in the debate on nuclear power this often becomes a choice between different equally risky alternatives, which are then spatially and temporally dependent.
- Attitudes to nuclear power offer an example of an essential contradiction of views (e.g. the ‘no nuclear now, but we expect it to be important in the future’ response), which links to an ambivalent public relationship with science institutions and a continued apprehension about new technologies when uncertainty about risk remains.
- An understanding of how public opinion is shaped through information processes and expectations that people hold about science and science communication is critical. International research has found that simply giving people more information does not necessarily lead to a greater understanding of the issues or to an acceptance of new technologies. Recent Australian research reviewed for this study has highlighted the value of deliberative democracy processes to help individuals develop their own views in enabled group discussion on complex technological issues.

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Recommendations

This National Academies Forum report highlights that the current gap in evidence regarding the formation of attitudes to the introduction of new technologies more broadly, and the formation of attitudes to nuclear energy technology in particular, is a limiting factor in achieving informed debate in the development of a national energy policy. In addition, the report indicates that a distinction needs to be made between ‘opinions’ and ‘attitudes’.

1 The report highlights the crucial importance of a rigorously established base of community attitudes for any future policy and program development, and highlights the absence in Australia of such a process for gathering of this kind of evidence (similar, for example, to the Eurobarometer in the EU). It recommends:

- With the support of the Australian Research Council, a national, high-quality, longitudinal program of research be established (called for example, the ‘Ozbarometer’) to enable data collection on attitudes towards the many, disparate components relevant to energy and climate change policy.
- As in the European Union, such a program be established as a shared facility among key universities.

2 The report indicates that the current lack of salience for the public of the issue of nuclear energy, and energy technology security in general, can be seen as a barrier to the development of future energy policies. It recommends:

- A program of community-based science education (along the lines of the program established by the former Centre for Low Emissions Technologies) be urgently established to enable a broad and mature national dialogue.
- A scoping study for the potential of a deliberative democracy framework for such an ongoing dialogue be investigated.

3 The report indicates that there is a lack of ongoing, rigorous and robust multidisciplinary dialogue and studies of the place of energy policy and energy technologies within the current debate on national climate change and associated adaptation and mitigation programs. It recommends:

- Such a debate be conducted in Australia, facilitated by the National Academies Forum.
- Such studies be integrated into current developments including, for example, QUESTACON and science communication.
- Interdisciplinary studies be used to create an awareness within science education at the primary and secondary levels as well as within the broader community.

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The project was managed on behalf of the National Academies Forum by the Australian Academy of Technological Sciences and Engineering (ATSE), with Dr Vaughan Beck, ATSE Executive Director – Technical, as Project Manager. ATSE, on behalf of the National Academies Forum, engaged Professor Daniela Stehlik, from Curtin University of Technology, Perth, as the Project Director.

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1 Introduction

1.1 BACKGROUND, CONDUCT AND AIMS OF THE STUDY

Conduct of the study

Each year the Australian Research Council (ARC) invites bids from the four Learned Academies in Australia to propose projects for funding under the Linkage Learned Academies Special Projects (LASP) scheme. These are aimed at utilising the expertise of Fellows of the Academies in broad-ranging topics relevant to Australia.

In March 2008 the National Academies Forum was awarded a grant from the ARC under the LASP scheme to undertake a project entitled 'Understanding the formation of Attitudes to Nuclear power in Australia'. An Expert Reference Group, listed under Acknowledgements, was appointed and first met in July 2008. Professor Daniela Stehlik was appointed Project Director. Professor Stehlik's study commenced in January 2009 and concluded in September 2009. It was overseen by the Expert Reference Group.

Established in 1995, the National Academies Forum is the peak organisation for the four Australian Learned Academies:

- Academy of the Social Sciences in Australia
- Australian Academy of Science
- Australian Academy of Technological Sciences and Engineering
- Australian Academy of the Humanities

The National Academies Forum provides a basis for cooperative activities by the four Academies and a common point of access to the Academies for outside organisations and individuals. It promotes a unified national vision, helping to overcome the difficulties that have often separated science, technology and engineering from the social sciences and the humanities.

Background

There has been a re-opening of the debate regarding nuclear power in Australia in recent times, prompted by the *Uranium Mining, Processing and Nuclear Energy Review* (UMPNER) carried out in 2006 by a taskforce established by the Prime Minister. The final UMPNER report was delivered in December 2006. There were two previous periods of debate on nuclear energy in the 1950s and early 1960s, and then in the 1970s and 1980s. This study centres on understanding why the debates faltered and stalled in the first place and what the determinants will be that influence the nature of the debate in the future. It seeks to analyse the attitudes of numerous sectors of the Australian community towards several key aspects of nuclear power.

The project was planned to concentrate on both historical and contemporary formations of attitudes. Among the groups to be analysed for their influence in shaping the debate were: Federal, state, and local governments; pro- and anti-nuclear lobby groups; professional scientists including physicists, ecologists, engineers; the news media and popular culture; the medical establishment; uranium, hydrocarbon, and renewable energy-source industries; ethicists; economists; and international users. The expectation was that a better understanding of how the debate has been and continues to be shaped would lead to a more effective and productive debate in the future.

Aims of the study

Australia is unusual in the developed world in that it mines and exports uranium but does not permit the domestic use of nuclear energy to generate electricity. The aim of this study therefore was to undertake an analysis of the formation of attitudes in Australia to new technologies, with nuclear power as the essential case. The analysis included a comparison between Australia and certain countries that currently have nuclear power programs – specifically USA, Canada, Europe and UK.

An extensive review of the literature was undertaken about how attitudes are formed and in particular the key factors associated with the formation of attitudes to nuclear power. Attitude formation was considered within a conceptual framework established from social network and epistemic community theory, as well as from diffusion of technology theory. Six convergent pathways to attitude formation – historical, cultural, political, media, educational and international – were determined. Two detailed case studies were prepared which further explored such convergent pathways.

The study included an extensive search for current opinion polling, and for evidence of national or international trends in opinion. This resulted in an extensive literature database, which is available from the National Academies Forum in a searchable form (EndNote® Library). The study has also included an extensive e-survey and interviews with key informants to establish the relationship between science, networks and attitude formation through epistemic communities. Results of the study now provide an important baseline for any future research or analysis.

1.2 SOURCES OF EVIDENCE

Several sources were established to develop an evidence-base. These included: in-depth interviews; focus discussions; an e-survey; content analysis of media articles; and a literature review of secondary sources, including major Government and industry reports, both national and international. These are detailed in the sections and Appendices that follow.

1.2.1 In-depth interviews – key informants

To assess a ‘whole of issue’ perspective as well as to test the network hypothesis, it was agreed to seek in-depth interviews with key individuals, chosen from different epistemic communities and social networks. The purpose of these interviews was to invite key individuals’ reflections on the current debate, and on possible historical, current and future trends. There was no assumption made about the views of these individuals on the issues canvassed prior to the interviews. Interviews were structured around some key questions (see Appendix D); were of approximately one hour’s duration and were conducted by the Project Director, by telephone, in confidence, in the period March to June 2009. Table 1 details the sectors that the 13 interviewees represented.

Table 1 Key Informants by Sector by Gender

Sector	Gender
Energy/Minerals	F (2) M (2)
Medicine/Health	F (1) M (1)
Environment	M
Union	M
Scientific Organisation	M
Political Party	M
Non-Government Sector	F
Government Policy	M (2)
Total	13

The approach to key informants – all senior representatives within their sectors, and well-known Australian public leaders – was made with the goal of forming a synthesis from the perspective of each opinion leader. Each informant’s perspective was then incorporated both in the analysis of the contemporary literature review and in the development of the e-survey instrument. As a ‘snapshot’ of current Australian thinking on the issue of new technologies and attitude formation it was a valuable exercise. Although it would have been useful to have continued such detailed interviewing further, and to have gathered further informants, it was not possible due to time and resource constraints.

Many of the key informants shared epistemic communities and were linked through social networks, as well as through e-networks.

Detailed notes taken during the interviews were then analysed using NVivo (a software package for performing qualitative data analysis) to develop themes and issues. The themes and issues were then used to contribute to the development of the e-survey instrument (see Appendix E).

1.2.2 Focus discussions

Prior to the development of the e-survey instrument, two focus discussions were held, one in South Australia and one in Tasmania, in May and June 2009. The goal of the focus discussions was specifically to enable a ‘member checking’ process of the evidence gathered in the literature review and in the in-depth interviews. The focus discussions broadly followed the in-depth interview questionnaire, and also invited comment on some key historic events in the ‘genealogy’ of nuclear power in Australia.

The 25 participants in the focus discussions were all volunteers, both male and female, and represented a wide age spread above 18 years.

1.2.3 e-Survey

After the focus discussions, the e-survey instrument was finalised in consultation with the Project’s Expert Reference Group. The instrument was prepared with six key areas of information gathering, as follows:

1. Networks
2. Environmental Issues
3. Energy Futures
4. Seeking information about Energy Futures
5. Seeking advice
6. Characteristics of respondents

The survey instrument was prepared using SurveyMonkey computer-assisted analytical software, and permission to release the e-Survey through different networks was sought in early August 2009. A list of these e-networks is at Appendix F. The e-Survey went ‘live’ on 25 August, 2009 and was closed on 21 September, 2009. 300 respondents successfully completed the survey and an overview analysis of the survey findings is provided in section 4.2.

1.2.4 News media content analysis

News media content analysis was not originally identified as a key information source for the study. However, during the study it became apparent that the increased interest in the print and electronic media about issues associated with energy futures for Australia, and specifically, about Australia’s future energy technology mix, needed to be incorporated.

The period of this study (January–September 2009) also coincided with much national interest in the Australian Government’s Energy White Paper and in the development of legislation associated with an Emissions Trading Scheme. It also coincided with the announcement of approval of a new uranium

mine in Western Australia. All these factors contributed to a heightened sense of urgency associated with the debate around the issues. As the report highlights, there was a key period in mid-July 2009 when the national media took up issues associated with the place of nuclear power ‘in the mix’ of any discussion about energy technology solutions to greenhouse gas emissions. The Project Director tracked this discussion, as well as other related discussions throughout the life of the study, and the views aired are incorporated in the discussion that follows.

Media content analysis also includes some international media articles, articles reviewed on some key internet web sites, and some individual blogs, in total accounting for nearly half of the EndNote® Library developed. Several radio programs, and some television programs and documentaries were also reviewed. Wherever possible, references are provided to original sources.

1.2.5 Secondary sources

An extensive literature review was undertaken during the life of the study, with the help of various members of the Expert Reference Group. The literature review also included a search for historical material. The breadth of the database associated with this report (EndNote® Library) demonstrates the extensive review undertaken. Although the focus was nuclear power, other issues reviewed included: uranium mining; waste disposal; health and radiation; nuclear weapons proliferation; climate change and energy demands; reports to various government agencies; population surveys; environmental attitudes and other related aspects. In addition, the search included extensive literature associated with attitude formation theory as well as theoretical material consulted when establishing the conceptual framework.

1.2.6 Case studies

Two case studies on media and political pathways were developed from the evidence gathered. Because of their greater detail they are presented as separate Appendices B and C.

A case study approach provides an opportunity to ‘drill down’ into the evidence and to present a narrative as ‘evidence in practice’. The topics for the two case studies were chosen because of the immediacy of the events (within the past three years) and their contribution to what has become seen as the wider debate – the role of nuclear power within a climate change policy framework.

In building the case studies, a broad-ranging search for evidence also highlighted the quite narrow base of political and media commentary associated with the issues, as well as providing highly topical examples of the concept of how the issues are ‘framed’ depending on the position taken by the commentator/ politician. Although the timeframe of the study did not permit a more detailed examination of these issues, it could provide an important base for future research.

1.3 ETHICS

Ethical clearance for the project was arranged through the Curtin University Human Research Ethics Committee and granted in January 2009. Additional clearance was sought for the e-survey instrument, subsequently granted in July 2009.

Every attempt has been made to ensure that confidentiality of evidence gathered and anonymity is maintained where relevant. No individuals have been identified in the analysis that follows. The names of key informants were not divulged to any other participant or other person involved in the project, including the Expert Reference Group.

1.4 STUDY OUTPUTS

In addition to the final Report, the study has resulted in a searchable EndNote® Library (592 items), with key words and incorporating all the literature searched and analysed for the overall study. An Excel spreadsheet of the e-survey data was also generated.

1.5 STUDY GOVERNANCE

The Project Director worked under the direction of the Expert Reference Group which included members the four Learned Academies. In consultation with the Expert Reference Group the Project Director developed the study conceptual framework and methods; obtained ethical clearance; conducted the literature review; conducted the in-depth interviews with key informants; established and managed the focus discussions; developed and managed the e-survey; undertook the NVivo (data analysis software) and SurveyMonkey analysis; developed the EndNote® Library and prepared and completed the draft report.

1.6 HOW TO READ THIS REPORT

The outputs from the study comprise the body of the Report followed by a series of Appendices. The latter include details of questionnaires; analysis of various polls; background information on the conceptual framework for the study and the associated literature on the subject; two Case Studies on different pathways through which attitudes are influenced; a list of abbreviations and acronyms; and the main list of references.

As noted above, the references are also available as a file in the form of a searchable EndNote® library. Finally, attached to the report is a summary of some related CSIRO studies prepared by CSIRO specifically for inclusion here.

ATTITUDES TO NUCLEAR POWER

2 The Issues in Brief

The purpose of the study was to offer a deeper understanding of how the debate on nuclear power has been shaped in the past, how it might proceed more productively in the future, and why it appears to be different in Australia from some other parts of the world. This section draws together the various components of the study to assist in this deeper understanding. As noted above, a full literature review and case study material can be found in the Appendices.

2.1 ATTITUDES AT HOME AND OVERSEAS

One of the key issues when undertaking a comparison of stated attitudes about nuclear power in different contexts is that Australia does not have nuclear power, whereas the UK, USA, Japan and some 10 other European countries do. As this study makes clear, this offers a challenge in any comparison of attitudes between Australia and other nations. It also creates a barrier to any attempt to build on trends identified overseas (such as that there is a nuclear power ‘renaissance’ or ‘revival’) (Wald 2008) for the Australian context.

It is useful to consider, as Pidgeon et al argue in their most recent UK study, how fragile the social contract around civilian nuclear power remains, despite its longevity in the UK and Europe. Their most recent research concluded that

... the level of support for nuclear renewal would change dramatically if there were to be any further major nuclear accident in any part of the world – and in particular Europe – over the next 5-10 years. The fact that we are more than 20 years since the last major reactor accident at Chernobyl represents both good news for nuclear power’s safety record, but is also its Achilles Heel (Pidgeon et al. 2007:82)

This study finds that any such future incident would be ‘framed’ as being connected to other major events through images which draw on the sub-conscious level of our understanding, and so ‘... these latent concerns can only re-emerge, possibly amplified with considerable force’ (page 83) – a fact which also links it to risk and risk magnification which is discussed in detail in the study.

A further issue of differentiation relates to the commentary made by key overseas environmental opinion leaders about their ‘conversion’ to nuclear power from fossil fuel energy sources. The Pidgeon report briefly outlined such ‘conversions’ on the part of commentators such as Mark Lynas and others. It needs to be emphasised that they are speaking from the context of their own country – the UK or, in the case of Patrick Moore, the USA – and therefore again in the context of an existing nuclear power industry. This context is often ignored when such a case is placed before similar commentators here in Australia and the issue is proposed as being relevant for this country. For the UK commentators, the choice has become a decision about what is more risky (see Ulrich Beck cited further in the report) within a very different environment from that in Australia.

A final point in this section is that, for many Australians, a nuclear power industry remains at the level of an imaginary future, one that culturally becomes tied up with media images, rather than personal experience. Despite the numbers of Australians who regularly travel overseas, it would be fair to comment that, for the majority, how their electricity needs are met in those other countries while they are visiting them is not likely to be a high priority. As a result, Australian travellers are unlikely to seek

out nuclear power stations and learn about them from local people, or meet people who either work at such facilities or live near them.

In other words, unlike those who are polled to comment on nuclear power and their attitudes towards it in countries that do have such power stations, Australians continue to speak from a completely different reality when asked about the issue. The issue lacks the essential salience required, and therefore the debate remains at the level of a future scenario, rather than existing within the context of the present day.

2.2 ATTITUDINAL TRENDS

This study highlights, and the case studies confirm, that Australians are usually asked to give their opinions on nuclear power in two ways: first, in the context of a component of the technology ‘mix’, comparing it with coal, oil, gas or renewables or, second, in the context of a tension associated with political issues, such as an election or climate change. Both case studies track how opinion polling has been undertaken at such key points.

The study has not uncovered any longitudinal analysis of the change in attitude formation to energy technologies in Australia outside such ‘intense’ moments. The ‘climate change debate’, which has certainly added a tension to the issue over the past few years, is often cited as the reason why people are ‘changing their minds’. This links to the point above, which is that in some countries where civilian nuclear power is already a component of the ‘mix’ the study finds that there has been some evidence that on the balance of risk, people are prepared to re-consider their options. It is difficult to conclude from any of the opinion polling done and reported in this study that there is any clearly similar national trend in this country.

Poll results that exist in the public domain are unsuitable for meta-analysis as the questions are never the same and are therefore difficult to compare and contrast. The work undertaken by The Australia Institute in early 2007 to coincide with the release of the UMPNER report did appear to show very little change overall, and certainly little change in relation to gender or generation. It appears that older, well-educated, professional men are more likely to support civilian nuclear power – a fact confirmed by the respondents to the e-survey. Currently there remain some ‘mixed messages’ associated with attitudes held by the Gen X and Gen Y categories of the population. More detailed and specific research, undertaken in a more subtle way than through large-scale binary opinion polls, is urgently needed to enable a more sophisticated understanding between generational cohorts. This would require some longitudinal research with an established base-line, similar to that undertaken for the introduction of other technologies such as the internet or the mobile phone by the Australian Bureau of Statistics (Australian Bureau of Statistics 2007).

CSIRO has for several years been carrying out research into public attitudes towards climate change and energy technologies. Some of that work has been summarised by CSIRO for this report and is attached to the end of the report. It contains a discussion of the issue of transfer opportunities for deliberative technology, based on national workshops on low-emission technologies (LETs) conducted by CSIRO’s Energy Transformed Flagship. Participants were asked to assess their own knowledge (pre-test), then were provided with detailed information and given time to discuss the issues in small groups, before assessing their knowledge again (post-test). At one of the CSIRO workshops, held in Perth in 2008 (not explicitly reported in the attached CSIRO summary), participants self-assessed their knowledge of nuclear power (as one of several LETs) as moderate in a pre-test but higher in a post-test. Following the information session and group discussion, people were then asked how strongly they supported nuclear power, compared with other LETs (Figure 1).

Figure 1 'How strongly do you support the use [of] nuclear energy?'
(Western Australian workshop derived from Ashworth et al. 2009:24)

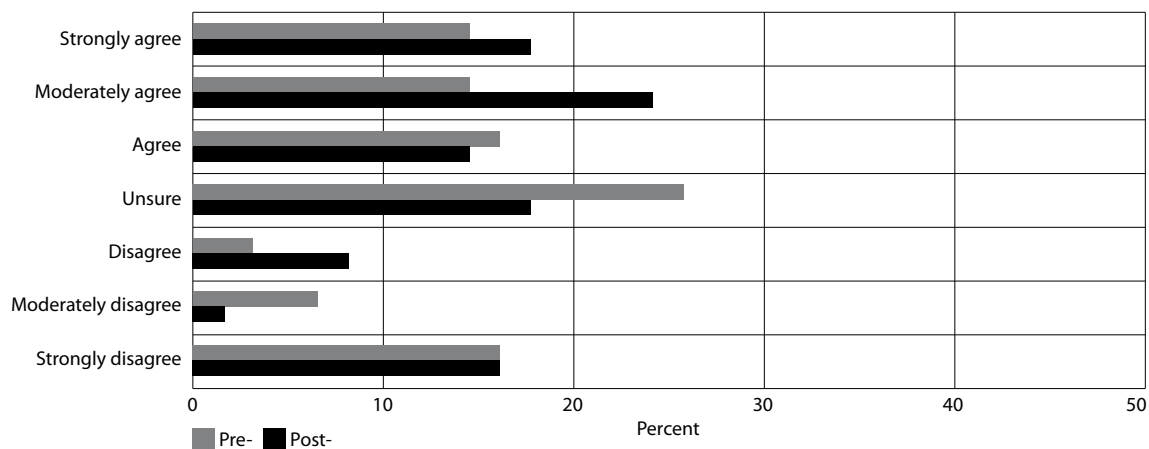


Figure 1 shows that the level of support for nuclear power increased slightly during the workshop from unsure (4.25) closer to agree (4.56). At the start and end of the workshop about one quarter (26 per cent) of participants opposed nuclear power; at the start about a quarter were unsure and 45 per cent were in support. Uncertainty declined to 18 per cent at the end of the workshop and support increased to 56 per cent. However, the workshop analysis concluded that: 'Of all technologies, nuclear elicited the highest level of 'strong' disagreement at 16 per cent, at the beginning and end of the workshop. Conversely, participant feedback provided was positive about nuclear power' (Ashworth et al. 2009:24).

To summarise, the CSIRO workshops demonstrated the importance of dialogue in the exchange of complex scientific information but they also confirmed the consistency of opposition to nuclear power as a future option despite such dialogue, a point which also links to the issue of the diffusion of such new technologies (Roger 1995). The CSIRO workshops also confirmed the interest and enthusiasm among the wider community in such opportunities for dialogue and information sharing.

2.3 OPINION LEADERS, INFORMATION SOURCES AND ATTITUDE FORMATION

The impact of the inter-relationships between the media, public debate and complex science and technology is well understood, and as Garnett reported a decade ago '... the [nuclear power industry] is making clear attempts to address the perceived issues' (Garnett 2000:8). Since that statement, the increasing potency of the electronic media in enabling immediate access to information, as well as immediate connections to like-minded individuals, has both simplified and complicated the 'technology-transfer' process. Although it has become very easy to search for information, such ease makes any analysis of the usefulness of information more complex.

The study reveals that the role of opinion leaders (as well as early adopters) in the formation of attitudes to future energy technology decision-making is critical. In many cases, complex issues are stated in simple terms by such leaders, keen to make their particular points. As is detailed further in this report, e-survey respondents indicate that such opinion leaders/setters cut across the spectrum of pro and contra views on nuclear power. Opinion leaders are individuals with firmly stated public opinions, which are either accepted or rejected by others, depending on their own views and worldviews.

The study focuses on the role of social networks, epistemic communities and the peer influences of opinion leaders in the development and assessment of personal attitudes. The e-survey was designed to explore the role of networks and epistemic communities in the development of attitudes, and respondents were asked about their membership of the network or community (Q2) as well as their involvement in (Q3), the primary purpose of (Q4), and the usefulness of (Q5) the e-network through which they had been invited to participate in the survey. Respondents were also asked how often environmental issues were discussed (Q7) and whether the e-network was a site from which they sought information and how useful such information was (Q17-22).

The majority of respondents were from a science-based or industry-based e-network (79.3 per cent), had been a member for at least one year (79.5 per cent) and were somewhat or very involved (55.9 per cent). They found their membership to be useful or very useful (76.0 per cent) with the primary purpose of membership being to get up-to-date information (53.3 per cent) or to enable discussion (30.4 per cent). They reported that the following key environmental issues were regularly discussed: future energy demands (43.0 per cent); global warming (39.5 per cent) and uranium mining (33.8 per cent). For 34.2 per cent the e-network was where they sought information, and that information was both useful (47.7 per cent) and valuable (49.7 per cent) and either most useful (20.7 per cent) or useful (43.1 per cent).

In the key informant interviews and in the e-survey, respondents were also asked to comment on where they sought information to consider the role of nuclear power in the energy technology mix (Q17), how useful such sources were (Q18) and how they would rate such sources (Q19). Respondents highlighted the key role of scholarly journals, the internet and the print media as sources of information they considered both useful and valuable. Least valuable sources were identified as being television and radio programs—an opinion that was largely shared by the key informants.

As the study has highlighted through an extensive review of the literature, attitudes are formed over a long period of time, are established through a variety of influential pathways, and become reinforced/challenged either through the information gathered or when people participate in discussions. It is possible that too much information without the opportunity for such discussion may have a contrary effect to that expected (see further Ashworth et al. 2009; Costa-Font et al. 2008:1276). However not everyone has the time or inclination to undertake detailed study into complex areas of science and technology. Instead, people tend to look to valued others to guide their own thinking. This was the assumption behind the questions to key informants and also behind questions in the e-survey about opinion leaders in the area of energy technology futures and who such valued individuals are within the Australian and international context. In the case of key informants, and those who responded to the e-survey, the names of individuals valued or not valued tended to be the same, thus highlighting the essentially small pool of key individuals who shape the debate within the Australian context, as well as those international figures who are recognised as having a contribution to the national debate here.

Although the ‘now-tarnished image of arrogant experts’ that MacLeod argues characterised the early history of the demand for civil and military nuclear applications in Australia is largely in the past, it is still evident that the science and technology associated with this form of energy technology could be ‘intimidating’ to the general public. Writing in the mid-1990s, MacLeod’s comments still resonate today:

... certain images of ‘otherness’ survive, and resist attempts at eradication. Uranium mining policy, a creature of opportunism on both sides of parliament, continues to produce disquiet. The atom came to Australia as a welcome, if foreign guest, representative of vested interests who promised much and delivered little. It now seems necessary to ask at what price nuclear science and technology will be asked to stay in Australia, or whether, in some sense, some part of it will be asked to leave (MacLeod 1994:312).

The review of web pages associated with the topic of this study demonstrates the ‘on line’ nature of much of this debate. There are active blogs associated with newspaper articles (see for example Brook 2009a); specific web sites dedicated to the issues (see for example www.anawa.org.au or alternatively www.kiwiblog.co.nz/2007/09/the_apec_nuclear_debate.html); and any number of agencies, organisations, institutes, and research centres dedicated to the debate. Such ‘public’ debate is occurring although not in so overt a form as when it is on national television, or in national print media. This debate tends to continue outside the times of tension created by the print media leading up to an election or at other critical political times, although as the literature review highlights the debate can also be called upon at such times.

The debate still remains a largely ‘internal’ one, however, rather than one that extends beyond interest groups/industry/government agencies. For example, it is rarely discussed in the more popular media (except in the form of US cartoons or films such as *The Day After Tomorrow* (2004)). It is not a topic of conversation, for example, in popular magazines, nor has it become a ‘barbecue stopper’ in the sense that it becomes part of the general public conversation. The study has found that the debate remains ‘internal’ in the sense that individuals who interest themselves in the topic, either pro or contra, are all fully aware of each other, and of each other’s positions. Therefore the public dialogue as conducted through the media (see both case studies for examples) remains essentially a dialogue among peers, with any ‘letters to the editor’ tracked during the study also tending to fall into this category, although not everyone identifies themselves as a member of any particular group.

2.4 ENERGY TECHNOLOGIES AND ATTITUDES

The extensive review of the literature undertaken for the study, including the internet sources that have emerged in the last decade, suggests that nuclear power is no longer ‘shrouded in mystery’ and that people do not rely on ‘credulous media’ or ‘ideological agendas’ when making up their minds (Hore-Lacey 1997:1).

The public information available to anyone interested is extensive, with as much or little scientific detail as desired. For someone wishing to make an informed decision regarding nuclear power, there is access to all views, across all countries, and from any number of perspectives. In addition, there are current opportunities (which are likely to increase in the future) to participate in workshops, consultations and forums regarding the future of Australia’s energy technology and the decision-making essential for the challenges ahead.

Research in the United Kingdom has highlighted the fact that public attitudes are more complex than a simplistic risk/risk trade-off like ‘for the sake of climate change, we are prepared to adopt nuclear power’ (Pidgeon et al. 2007). Here again the matter of salience is crucial (Grove-White, Kearnes, MacNaughten et al. 2006). At this point in Australia’s history, it appears clear that nuclear power is simply not salient for the majority of Australians, despite the climate change debate.

This tension is further complicated by the fact that most Australians now agree that climate change means that fossil-fuel dependent economies such as Australia will need to make some significant changes to energy supply and use, but whether we are prepared to adopt nuclear energy remains unclear. In the USA context, Rosa links such tension with another, deeper concern that is also relevant to Australia – the growing mistrust of public institutions (including energy utilities) regarding their promises for a safe, cheap and problem-free future (Rosa 2001). The Australian community would like to be able to trust its public institutions, but many Australians are sceptical about the capacity to deliver on this trust. At the time of writing, the oil spill in the Timor Sea off the north-western Australian coastline is a reminder of the fragility of a reliance on technology, and of the scale of the impact of

such events when they occur (ABC News Online 2009h). The link between risks associated with the adoption of new technologies and the inability of any institution to ensure complete safety remains critical for how attitudes are determined and how issues are framed publically to either support or attempt changes in such attitudes.

A further and very important trend, linked to the 'social constitution of nuclear power' as a technology, was identified in the review of opinion polls conducted in the UK. As Grove-White et al point out, the fragility of this social contract remains underpinned by an ongoing anxiety about the technology itself. They suggest that 'there are ... reasons for believing the technology continues to be capable of igniting substantial opposition at both national and local levels, on issues to which wider opinion would be sensitive' (Grove-White, Kearnes, MacNaughten et al. 2006:245).

As a nation, we remain essentially cautious about adopting a new form of energy technology, despite it being used elsewhere in the world. In line with research undertaken in the United Kingdom, the general Australian public would probably agree that the 'burden of proof' lies both with the industry and with governments in countries with nuclear power (Grove-White, Kearnes, Macnaughten et al. 2006:12). There is no evidence that potentially negative Australian attitudes towards energy technologies are strengthening in the face of climate change. Nonetheless, recent reports from the UK regarding opposition to the building of new power stations must give cause for reflection, particularly in the essentially polarising way in which such issues have been reported (Adam 2009; Monbiot 2009; Wainwright 2009).

The next section takes these issues further by exploring the known attitudes/opinions from various polls/surveys both nationally and internationally to set the context for the study.

3 Present Attitudes – an Analysis

3.1 INTRODUCTION

A further poll on current attitudes was outside the scope of the study, but as an output of the literature review a detailed list of surveys known to have been undertaken recently can now be provided. The surveys include studies conducted in Australia and some overseas countries, primarily Europe but also North America. **It needs to be stressed that because the questions used in different survey instruments cannot be directly compared, the present analysis can only provide immediate ‘snapshot’ rather than a formal comparison of attitudes between countries.**

The large number of surveys undertaken is not surprising as there has been increased interest in the issues such surveys cover, particularly now that governments will be required to develop strategies to reduce greenhouse gas emissions. In many cases therefore, questions on nuclear power/energy are asked in the context of ‘climate change’.

The differences between opinion polls and attitude surveys are discussed in the conceptual framework in Appendix A. It should be noted that such surveys as are represented here have been administered and analysed by a wide range of institutions, including industry, government, universities and market poll companies. The number of respondents for each survey is not always known, but the usual method is to develop a representative sample of the total population to be surveyed. Given the lack of detailed information, it has been necessary to assume that good statistical rigour underlies all surveys reported, but this may not be true. Sources have been identified in full where possible. A summary of all surveys which were identified during the study research, including both national and international surveys by country, can be found in the EndNote® Library created for this study.

3.2 CURRENT AUSTRALIAN OPINIONS

Appendix G presents an analysis of various polls conducted in Australia between March 2006 and January 2009. Results are compared in three graphs showing support for, opposition to, and undecided about nuclear power (Figures G1 to G3).

It can be seen that over the past four years the peak in support established in June 2006 (Morgan Poll) (at the point of the announcement of the UMPNER Review see the case study) has not been reached again. The January 2009 Poll (Essential) shows more support overall than the first Newspoll in May 2006 (Figure G1). In regard to opposition, there was a reduction between May 2006 and January 2009, with a highlight in opposition in February 2007. Figure G3 analyses the significant growth in the numbers of ‘undecided’ – over 10 per cent in the period included.

A survey conducted by the Swinburne National Technology and Society Monitor in 2008 asked about ‘levels of comfort’ with nuclear power plants. 52 per cent reported some degree of discomfort with nuclear power plants, with 26 per cent reporting ‘not at all comfortable’. The survey reported that men were significantly more comfortable with nuclear power plants than women (Swinburne University of Technology 2008:6).

ATTITUDES TO NUCLEAR POWER

A Newspoll survey commissioned by the Australia Institute in 2006 tied in with the UMPNER Review. It probed attitudes to plans to build nuclear power plants in communities. The survey found 66 per cent opposed to building a plant in their local area, 25 per cent supportive and nine per cent undecided. The survey also confirmed that women are more likely to oppose construction, then men (Macintosh 2007b:1). Strongest opposition came from Victoria, Tasmania and Western Australia, with support from South Australia (36 per cent) highest.

Research and community consultations conducted by the Queensland-based Centre for Low Emission Technology on stakeholder perspectives on low emission technologies have included discussion about attitudes to alternative energy technologies. Following surveys conducted in Queensland during 2005, the Centre reported that, although there was general support for the introduction of new technologies, ‘nuclear energy ... received a significant negative response’ (CSIRO Centre for Low Emission Technology 2008:2; 2009:2). Centre researchers compared large group engagement processes across four States, as well as one specifically with young people, which involved the presentation of detailed expert information about various forms of relevant technologies followed by a voting process utilising ‘Digivote’ technologyⁱ. They found that support remained for renewables, rather than for nuclear energy. This is explored further in Table 2. It is noted that ANSTO has also commissioned studies on attitudes to nuclear power; relevant reports are available on request from ANSTO.

Table 2 CSIRO research showing Australian support for a range of energy technologies

	02/08 Youth		03/08 Queensland		06/08 Victoria		11/08 Western Australia		02/09 South Australia	
	Before	After	Before	After	Before	After	Before	After	Before	After
Biofuels	4.0	<u>3.5</u>	4.9	5.0	<u>4.4</u>	<u>4.9</u>	<u>4.6</u>	<u>5.1</u>	<u>4.9</u>	<u>5.2</u>
CCS	3.8	4.4	4.1	4.4	<u>4.2</u>	<u>5.0</u>	4.4	4.6	<u>4.7</u>	<u>5.6</u>
Coal	2.1	2.2	2.9	23.2	3.3	3.8	3.2	3.5	<u>3.2</u>	<u>3.7</u>
Geothermal	5.8	5.6	5.4	5.5	5.1	5.1	5.3	5.0	<u>5.7</u>	<u>6.1</u>
Hydro	<u>5.2</u>	<u>4.8</u>	5.3	5.2	5.0	5.3	<u>5.8</u>	<u>5.1</u>	<u>5.5</u>	<u>5.2</u>
Nat. Gas	4.5	4.5	4.8	4.8	5.0	5.0	4.7	4.6	5.1	5.1
Nuclear	3.3	3.4	<u>2.9</u>	<u>2.9</u>	<u>3.1</u>	<u>3.8</u>	<u>4.2</u>	<u>4.6</u>	3.8	3.9
Oil	2.9	2.5	3.3	3.2	3.4	3.4	3.3	3.5	<u>3.2</u>	<u>3.6</u>
Solar	6.8	6.7	6.5	6.6	6.6	6.7	6.7	6.8	6.7	6.6
Wave/tidal	5.7	5.5	5.8	5.7	5.3	5.6	5.6	5.9	<u>5.8</u>	<u>4.2</u>
Wind	6.2	6.1	6.2	6.3	6.1	6.3	6.3	6.4	6.3	6.5

NB: Significant changes between before and after at $p < 0.05$ are underlined.

Derived from Boughen et al. 2009:n.p.

3.3 INTERNATIONAL COMPARISONS

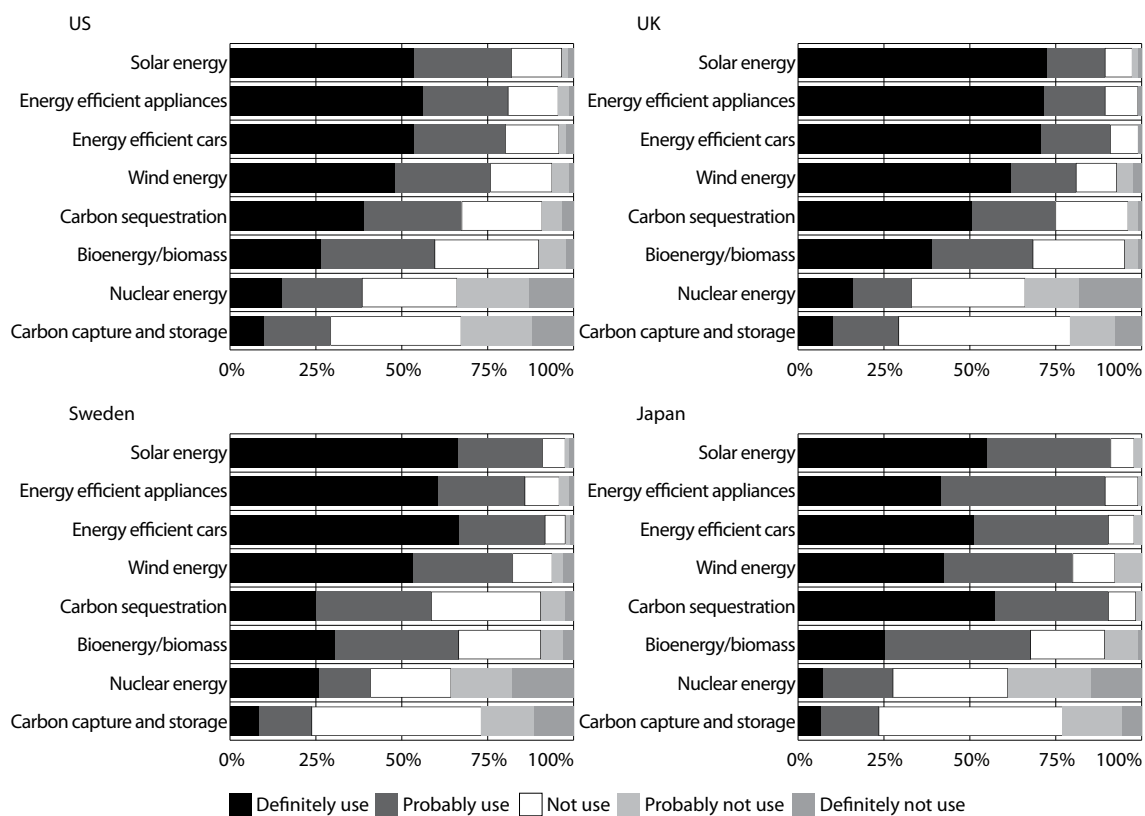
An overview of the International Social Survey Program and two international surveys (1993) and (2000) focusing on environmental questions included questions about nuclear power, so they can provide some material for a comparison. Australia was included in this international snapshot, and the following discussion presents results from Australia, New Zealand, some key European countries, USA and Canada. (Details of figures can be found in Appendix H, Figures H1 to H6).

Australian responses to the question whether ‘nuclear power stations were dangerous for “you and your family”’ could be read to reflect the absence of nuclear power stations in this country. However, the very high response (‘extremely dangerous’) from New Zealand, which also does not have nuclear power, does offer a benchmark comparison. Comments on the statement ‘that some radioactive waste from nuclear

ⁱ At the time of writing, the Energy Transformed Flagship had just released reports detailing all of this research and community consultation see www.csiro.au

power stations will be dangerous for thousands of years' show a similar profile to Great Britain and Canada, with 'definitely/probably true' being in the majority. The question 'how dangerous are nuclear power stations for the environment?' was asked in both 1993 and 2000. There is a distinct difference in the Australian response between the two surveys. In 1993 fewer people were 'extremely' or 'very' concerned. In 2000 the 'extremely' component was significantly higher. Again a comparison with New Zealand shows responses there consistently high in levels of concern in both of the surveys. In Canada the responses were similar in the two surveys. On the question 'within the next five years, how likely is it that an accident at a nuclear power station will cause long-term environmental damage across many countries?', profiles overall were remarkably consistent, with both Italy and Poland expressing 'likely' as their response to a greater degree than other countries.

Figure 2 USA, UK, Sweden and Japan: responses to: 'the following technologies have been proposed to address global warming. If you were responsible for designing a plan to address global warming, which of the following technologies would you use?'



Source: Derived from Reiner et al. 2006:4

Research conducted across four countries prior to 2006 highlights the differences between countries currently using nuclear power for electricity generation, with 'definitely support' strongest in the USA (just over 25 per cent) and overall support at around 40 per cent; Sweden would 'definitely support' at around 12 per cent and 'overall support' at just under 40 per cent; UK would 'definitely support' at around 10 per cent 'and overall support' at under 30 per cent and finally Japan would 'definitely support' at around five per cent and 'overall support' just over 25 per cent. Figure 2 shows how this compares with attitudes to other energy technologies:

Further research at the Centre for Low Emission Technology probed views on similar aspects of alternative forms of energy technologies (see also the Attachment). They reported that nuclear energy had less than 20 per cent support, compared with solar energy at near 80 per cent support and wind

energy at just under 70 per cent support (Boughen 2009:77). In a detailed analysis undertaken for CSIRO, a sample group identified as 'pro-nuclear' in orientation consisted of 26 per cent of a baseline sample of some 2,795 individuals from New South Wales and Queensland in research conducted during 2005 and 2006. The 'pro-nuclear' orientation group were identified as having expressed stronger support for one particular technology in the survey conducted. This group identified as having a high degree of support for the importance of climate change and nuclear energy, reported having a moderate level of knowledge about climate change and LETs (low emission technologies), and reported low level of support for CCS (Carbon Capture and Storage) and a moderately positive attitude toward paying more for electricity. Demographically, members of this group were more likely to be male, 36 to 65 years old, tertiary educated, employed full time or retired, with a household income between \$40,000 and \$79,000 or greater than \$100,000 (Derived from Carr-Cornish et al. 2007).

3.4 A BRIEF INTERNATIONAL REVIEW

Market survey company Ipsos MORI conducted polls in Great Britain between 2004 – 2008 that contained some relevant questions (Ipsos MORI 2007; MORI 2005). In 2007, people were asked: 'How well do you feel you know the nuclear energy industry?', with some 68 per cent responding that they knew 'just a little' or 'almost nothing about'. On the statement 'that nuclear power will be a major contributor to energy supplies in the future', 57 per cent agreed, fewer than in 2005. Overall there was also a reduction in support for a 'mix' of energy sources from 2005. To the question 'how favourable/unfavourable are your overall opinions or impressions of nuclear energy?', in 2005 33 per cent were favourable and 27 per cent unfavourable, with a very high number of 'not known'.

A comparison between attitudes in 2004 and 2005 regarding the building of new nuclear power stations showed an increase from 35 per cent support in 2004 to 41 per cent support in 2005. The 2008 Survey recorded a 40 per cent support for the expansion of the nuclear power sector, with 24 per cent against and the remainder 'not known'. This survey confirmed that 59 per cent of men supported the expansion, but only 30 per cent of women. Overall, however, opposition to nuclear power was at the lowest level recorded, at 19 per cent (Sources: Seed 2006; World Nuclear News 2009). A survey reported in 2005 found that only eight per cent of a UK sample preferred nuclear over renewables, 47 per cent agreed that they had strong opinions about nuclear power, 56 per cent indicated that they had 'mixed feelings' and 67 per cent agreed with the statement: 'I need more information to form a clear opinion' (Poortinga et al. 2006). A BBC Nuclear Power Survey concluded that '33 per cent of men considered nuclear as the most feasible option for the United Kingdom to secure future energy supply, while only 11 per cent of female respondents supported nuclear' (McGowan & Sauter 2005:26).

In England a 2007 study of communities in which nuclear power stations are located identified support for building new stations at two of the sites (50 per cent at Oldbury and 61 per cent at Hinkley Point) (Cardiff University 2008). An opinion poll reported in 2008 found that support for nuclear power had increased by 30 per cent since 2003 and that 33 per cent agreed that nuclear power should replace fossil fuels. Over 50 per cent agreed that the UK should increase its nuclear generating capacity, and respondents were slightly more concerned about rising CO₂ levels than they were about nuclear waste (National Nuclear Laboratory 2008).

A survey of 1100 people in the UK conducted by Accenture in April 2008 and reported by World Nuclear News found a 30 per cent increase in support for nuclear power over the previous five years. There was also 88 per cent support for reducing reliance on fossil fuel-generated electricity in the UK, with 33 per cent agreeing that it could be achieved through nuclear power. Some 85 per cent supported an increase in the use of renewables, despite only 25 per cent agreeing that renewables 'alone could fill the [energy] gap' (National Nuclear Laboratory 2008).

A report to Research Councils UK (the partnership between the seven UK Research councils) of public opinion on energy research identified 34 surveys of various types and from various sources in the period 2002–05, but did not undertake a full meta-analysis because the material was not comparable. However, the research also concluded that ‘nuclear power is not perceived as low carbon technology’, that is to say, the respondents did not consider nuclear power to be one of what they had in mind as ‘low-carbon technologies’ (McGowan & Sauter 2005:9).

The population in Northern Ireland has regularly been asked to comment on social and environmental issues. A survey in 1990 asked ‘how concerned were people of risks associated with nuclear power stations?’. 56 per cent responded ‘very concerned’ with 26 per cent ‘a bit concerned’. Further surveys in 1992 and 1995 found 56 per cent were ‘very concerned about risks from nuclear power’ and in 1995 65 per cent agreed that ‘nuclear power stations were very or extra dangerous’ (Sol Surveys on line 1990).

In a poll seeking a preference between nuclear and wind power, a BBC Scotland Poll showed that 70 per cent of men and 75 per cent of women preferred wind and only 20 per cent of men and 15 per cent of women preferred nuclear (ICM Research for Scotland cited in McGowan & Sauter 2005:26).

In Europe, the Eurobarometerⁱⁱ Survey has been testing opinions since 2005. The 2008 Survey found that overall support for nuclear power production had increased since the previous 2005 survey – 44 per cent in support and 45 per cent opposed. The 2008 Survey also found that citizens in member countries with operational nuclear power plants are considerably more likely to support nuclear energy than those in countries without (International Atomic Energy Agency 2008). However in countries such as Austria and Greece, where there are no nuclear power plants in operation, the majority were against it (International Atomic Energy Agency 2008).

Table 3 ‘Should the government of your country increase or decrease its investment in nuclear power?’ (Europe: derived from Financial Times/Harris Poll (European analysis derived from Harris Interactive 2006)

Country	Increase	Decrease	Same	Not sure
Great Britain	30%	27%	26%	17%
France	19%	36%	30%	15%
Italy	46%	25%	19%	10%
Spain	17%	58%	19%	8%
Germany	19%	54%	21%	7%

In a further Eurobarometer Survey conducted in 2007 and focusing on the issue of safety, most member countries agreed that ‘nuclear energy helps limit global warming’ and that ‘nuclear energy helps decrease dependency on imported fuels’. The same survey found that most member countries perceive nuclear power as more of a risk than an advantage; most have a ‘lukewarm’ attitude to the value of nuclear power and 39 per cent would like to reduce the share of electricity produced by nuclear power (Eurobarometer 2007).

In 2006 a Harris Poll sought opinion from European member states on ‘should the government of your country increase or decrease its investment in nuclear power’, soliciting the opinion in the context of climate change and global warming questions. Table 3 highlights the responses. In the same poll, however, when asked about the construction of a new nuclear power station 100km from their home, 57 per cent of Europeans opposed the idea.

ⁱⁱ Eurobarometer Survey is undertaken by the European Union on all member states regarding questions of interest. It is then published in full on the following web site: http://ec.europa.eu/public_opinion/index_en.htm (Retrieved 20th August, 2009).

ⁱⁱⁱ A new reactor is currently under construction in Finland.

Attitude changes in Italy offer an interesting case example. Following the Chernobyl accident (1986), Italy banned nuclear power by public referendum in 1987. In 2008 it was announced that Italy would build a nuclear power reactor in the next five years, based on supportive results from the above-mentioned 2006 Harris Poll (Harris Interactive 2006).

A recent study in Finlandⁱⁱⁱ (undertaken in the context of the construction of a new reactor in that country) found that ‘most people were more concerned about older plants across the border in Russia than they were about Finnish nuclear power’ (Luoma-aho & Vos 2009:120). In 2005, Energy Attitudes released opinion poll data to show that Finland was more in favour of increasing its share of electricity generation to nuclear power than it had been in any of the previous 24 years of survey analysis, although support between men and women remained polarised (61 per cent men in favour, 23 per cent women) (Finnish Energy Industries 2006:1).

Commenting on Sweden, the IAEA reported in 1991 that ‘nuclear power has gained the highest degree of acceptance by the general public in the regions where the plants are located’ (Wikdahl 1991:31) and that ‘many people considered fossil-fired alternatives were environmentally inferior to nuclear power’ (p.33). Almost two decades later, *The Economist* reported in 2009 that the centre-right government in Sweden was now considering ‘reversing’ its 30-year ban on building new nuclear capacity. The same article stated that 57 per cent of Swedes agreed that it would be possible to replace old nuclear power plants with new ones, and that 70 per cent of Swedes agreed that a new energy plan released by the government was ‘good on the whole’ (*The Economist* 2009). Wikdahl reported that a 2007 survey in Sweden found that about ‘80 per cent of the population were in favour of a final repository in their own municipality’ (Wikdahl 2008:13). *The Times* reported a 2008 poll showing that 48 per cent of Swedes were in favour of building new facilities, with 39 per cent opposed.

World Nuclear News reported on a recent poll in Poland conducted in March 2009 by GfK Polonia, which showed 40 per cent support for the construction of a nuclear power plant and 42 per cent opposing such construction. This was reported as a shift over three months from previous figures of 33 per cent support and 56 per cent opposition (World Nuclear News 2009), a shift attributed to increased concern about reliance on energy security from neighbouring Russia.

Polls from the US offer informative comparisons over the past two decades. A poll in 1999 found 60 per cent opposed to building new plants, 26 per cent in support and 14 per cent undecided (Rosa 2001:2). A Harris Poll taken in 1979 and again in 2008 found that the same majority (67 per cent) consider nuclear power plants that produce electricity area to be safe, but only 49 per cent currently support the building of new plants, up two per cent from 1979 (Harris Interactive 2008). A poll report in 1992 of 500 opinion leaders from government, industry, academia, media and public interest groups found that 72 per cent favoured nuclear energy (Bayne 1992:104). A PEW survey reported in 2008 found that 50 per cent were in favour of promoting more nuclear power, and 43 per cent were opposed. The survey reported a political divide with more Republicans in favour (68 per cent) than Democrats (55 per cent) (Pew Research Centre for the People and the Press 2008:14).

Gallup Polls conducted between 2001 and 2009 have found there has been an increase in the United States ‘strongly’ or ‘somewhat’ in favour of using nuclear energy to provide electricity (46 per cent in 2001 to 59 per cent in 2009). Opposition has reduced from 48 per cent in 2001 to 37 per cent in 2009. On the question ‘would you favour or oppose building more nuclear power plants at this time’ the results showed an increase in favour, (44 per cent in 2009 from 37 per cent in 2001. This confirmed a Fox News Opinion Poll taken in 2008 that found 51 per cent in favour and 41 per cent opposed on the same issue. However

iv At the time of writing this report, the state of Utah has legislated to declare nuclear power ‘renewable’ (see Burr, 2009; Hinkins, 2009).

on the issue of building a facility within 25 miles of their home, 54 per cent and 21 per cent were strongly opposed and somewhat opposed respectively (Ansolabehere 2007:9). This report also pointed out that the 'connection between electricity generation and global warming in the [American] public's opinion remains a remote one' (p.13). On the question of supporting the construction of nuclear power facilities, in response to the rise of energy and gas prices, only 10 per cent chose nuclear power compared with 27 per cent who chose the future development of wind and solar power.

In a poll taken in 2007 on the building of a nuclear plant in the local community, 36 per cent approved and 59 per cent disapproved. The latter figure was an increase in the disapproval rate of some four percentage points since 2001. A CBS News/*New York Times* Poll in 2007 asked whether using nuclear power to generate electricity was mostly a good idea or mostly a bad idea 36 per cent responded 'good' and 58 per cent responded 'bad' (Pollingreport.com 2009). A study conducted by the *Los Angeles Times*/Bloomberg in 2007 asked Americans to select the 'best way for the US to reduce reliance on foreign oil'. Responses to 'more nuclear power plants' came in at six per cent compared with alternative energy sources at 52 per cent (Navin 2007:14). Finally, *Time* magazine reported on an 'industry poll' which had found that 'new reactors were supported by most Americans, including four-fifths of those who live near one' (Grunwald 2009:30). The same report noted that events in the state of Utah had recently put nuclear power back on the legislative agenda (Burr 2009; State of Utah 2009)^{iv}.

An Ipsos-Reid 2006 Survey found that a majority of the residents of Ontario in Canada continue to believe that nuclear power will play the same or larger role in the future. Some 60 per cent supported nuclear energy (Ipsos – Canadian Nuclear Association 2006; World Nuclear News 2009). The survey found that 68 per cent of men supported nuclear power compared with 54 per cent of women. However women showed an increase in support from the previous survey in 2005 of about 14 percentage points. In a national review in January 2006, IPSOS Reid found that 40 per cent of Canadians support nuclear energy, a reduction in support of some 11percentage points since October 1987 (Ipsos – Canadian Nuclear Association 2006:23).

An international poll undertaken by Accenture in November 2008 and reported in *World Nuclear News* in March, 2009 polled 10,508 people in 20 different countries. It concluded that 'sentiment has swung in favour of nuclear energy' with 29 per cent saying they were more supportive (overall) than in previous surveys and 19 per cent saying they were less supportive than three years ago (World Nuclear News 2009).

Finally, two recent polls were reported from New Zealand in early 2008. A poll conducted by the NZ Business Council for Sustainable Development in April 2008 found 19 per cent support for nuclear power as the 'best electricity option for the next 10 years'. A previous poll conducted by Colmar Brunton found that 36 per cent 'believed the Government should consider developing nuclear power stations' with 60 per cent not supporting such development (The New Zealand Herald 2008).

ATTITUDES TO NUCLEAR POWER

4 Key Informant and e-survey Findings

This section reports the two data collection exercises undertaken for this study. First, the findings from the key informant interviews and focus discussions are outlined. Second, a summary of the responses to the e-Survey is provided. Appendix D provides the questions used to frame the interviews and focus discussions. Appendix E shows the e-Survey instrument in full and Appendix F lists the e-networks invited to participate in the e-Survey.

4.1 KEY INFORMANT INTERVIEWS AND FOCUS DISCUSSIONS

The key informants were well-known individuals in prominent positions, who shared epistemic communities and who were linked through social networks and e-networks. Names of the key informants were kept strictly confidential throughout the process, even when, as often occurred, it became clear during an interview that the informant was familiar with others involved in this part of the study.

It should be noted that the key informant interviews were structured for two key purposes: first, to establish the inter-relationships and networks associated with the epistemic communities as discussed further in the Conceptual Framework (see Appendix A) and second, to enable the development of a survey instrument.

There were 13 key informants, and Table 4 details the sectors and gender of those interviewed. Further detail is to be found in Appendix A.

Table 4 Key Informants by Sector by Gender

Sector	Gender
Energy/Minerals	F (2) M (2)
Medicine/Health	F (1) M (1)
Environment	M
Union	M
Scientific Organisation	M
Political Party	M
Non-Government Sector	F
Government Policy	M (2)
Total	13

This section summarises, by themes, the responses of the various respondents to the study from the interviews and focus discussions.

Given the breadth of expertise, experience and attitudes of the key informants, it is not surprising that there was not one 'whole of informant' view. While there was consensus of some issues, on others there was little (if any) agreement. The analysis (using NVivo) identified the following major themes regarding nuclear power and attitude formation:

- Futures
- Leadership
- Risks
- Images
- Communication and education

- Advocacy and advocates
- Historical pathways
- Impact of climate change debate

These themes are discussed in more detail below. The term ‘informant’ is used here specifically to refer to the 13 people interviewed.

4.1.1 Futures

Informants had different predictions as to whether Australia’s future would include nuclear power. Some informants agreed that it ‘will play a major role’, particularly if ‘we take coal out of the equation’ and that Australia should be ‘planning for the long term now, as nuclear power becomes more competitive’. Others suggested that the industry felt ‘grievously misunderstood’ and was using the climate change debate as the ‘last opportunity to create some relevance’ for itself. Some proposed that nuclear power should at least be considered in any discussion about future power generation - ‘why should we choose just one?’ - in other words, as a strategy to reduce risk. Others felt that unless there was a ‘serious setback’ to other options for baseload electricity, such as CCS, it would be ‘unlikely’ for nuclear power to have a role. One informant stressed that the nuclear power debate was ‘lost’ some 30 years ago, despite the fact that ‘in the long run, there is no other way that the world can cope with baseload demand’.

4.1.2 Leadership

Informants agreed on the politics of the nuclear power issue, particularly on the leadership role of government for any ‘national political consensus’. However, because ‘most governments only think three years ahead’ it was clear that there was little positive political ‘will’ and that ‘this [Federal] government is moving in other directions’. One informant pointed to the key leadership role of the Australian public in its regular rejection of the technology. It was suggested that ‘we should give politicians a chance to think further than the next election as [climate change policy] was a big issue with a long time frame’. Another informant pointed to the leadership by governments in other countries, and that when ‘governments say nuclear power is part of the mix ... when they are confident ... people come along with them ... but this is a bit far for the Australian Government’.

Without such government leadership, even those informants who did support a future industry for Australia were less than positive about its likelihood, because change takes a ‘long time’ and ‘there has never been a real consensus’ as ‘even those who [do] support it, feel edgy about it’. One informant suggested that it was vital, in view of the importance of political leadership, to ensure that the ‘facts were presented in a clear, unambiguous way, and then let the democratic process work’. On the issue of political leadership, informants in support of nuclear power stressed the need for a ‘bi-partisan consensus’ as without it, it will ‘not happen’. Another informant suggested that ‘politicians don’t want to talk about it – Liberals have said they won’t bring it up again unless it is bi-partisan because people won’t vote for a pro-nuclear party’. One informant pointed to the lack of a ‘thinking through’ of the issues within the relevant government departments, and as a consequence government bureaucracy has an agenda that is more ‘short term’ than the issue demands. Another informant pointed out that at the Australia 2020 Summit (June 2008) the ‘energy group didn’t discuss nuclear power at all, and were shut down because it wasn’t politically correct to do so’.

4.1.3 Risks

One informant made the following comments on risk: ‘... when it comes to technology, what people worry about is remote, unknowable, regulated by government, run by big business and therefore they are certain to be fatalistic about [nuclear power]’. Some informants were relatively positive about any technological risks (‘there are no impediments, other than waste’) while others were less convinced, for example: ‘There are dangers and costs associated with the nuclear fuel cycle – there are fewer dangers

and costs associated with renewables'. 'Waste, weapons and safety' were critical factors, but also the safety associated with transportation of the ore. Others felt that the stress and investment in renewables to provide future base load was a relatively 'complacent' one considering their known limitations. One informant suggested that 'even coal is better. Sequestration could work if we have enough money to make it work.' Another informant, who had presented much science education material, reported that the 'questions [asked by the public] had changed' over the years. Public interest more recently has focussed on waste disposal, particularly why Australia did not have a 'national waste repository'. One informant suggested that 'nothing in the technology has changed in the last 60 years' and therefore it was not reliable. Another connected the future risk with the current debate this way: 'It's a shameful waste of time [as Australia] pretends to do something and this sets up a false hope. We seem [as a nation] to be looking for something – shying away from cutting back on our energy-hungry lifestyles. We need to be more efficient – but we are trying to avoid doing that – so nuclear power seems to offer a solution'. The risks associated with a response to terrorism and nuclear weapons were raised. 'If Australia goes nuclear then it becomes an incentive to our Asian neighbours. This would up the nuclear ante.' This informant continued: 'The mutually assured destruction (MAD) policy of the Cold War saved [Australia] ... if Indonesia went nuclear then Australia would and I would support this move'. Another pointed to the continued 'fear' of radiation as a risk and factor in decision-making, despite the modelling and strict regulations associated with testing of radiation.

4.1.4 Images

One key informant suggested that the civilian nuclear power industry had come to 'symbolise' the 'western industrialised system' about which most people felt negatively. In that sense, this informant argued, nuclear power and genetically modified organisms (GMOs) represented the 'antithesis' [sic] of modern technological civilisation. This was linked to what another informant termed the images in the 'reservoir buried in our collected unconscious'. The images associated with nuclear power, according to another informant, enabled 'opposition' to be marshalled, regardless of which position was being adopted. Remarking on recent polls that had shown South Australia to be 'more positive' towards nuclear power than other states, one informant pointed to the public education campaigns associated with Maralinga and Olympic Dam.

4.1.5 Science communication and education

There was a general agreement that the science associated with nuclear power, greenhouse gas emissions and climate change more broadly was complex and that 'scientists in general are poor communicators'. One informant suggested that communication about the underlying science should be the responsibility of 'highly skilled communicators' rather than scientists, as the latter often 'come across as elitist'. For one informant, personal experience had highlighted the value of more 'personalised forums' as vehicles for education and information sharing. Another informant pointed out that the last university-based teaching program (at the University of New South Wales) had been shut down over 20 years ago, and therefore Australia was not educating the next generation of scientists in nuclear engineering. Another pointed to the 'continuing disinterest in the reliability of science' and that nuclear power is 'always cited as the reason why people don't trust scientists'. The introduction of 'new technology is always an uphill battle – it is much easier to get the 'fear' across', pointed out another informant. This is also linked to a demand for certainty, particularly by the media, and therefore 'qualified [scientific] views' are of less interest. For another informant, the issue was not 'more education' as 'people do not need their attitudes changed [so] we don't need a public campaign on this'.

4.1.6 Advocacy and advocates

Most informants were keen to highlight that they personally dealt with 'rational facts', rather than with emotion when discussing nuclear power, but some commented that both emotion and 'scare tactics' were used by various groups to get messages across. For example, one informant suggested that particular contra

groups could be considered as ‘one dimensional’ in their message, which often came across as both ‘hysterical and emotional’, to an audience that was on average, more ‘cynical’. Informants generally agreed on the identity of the advocacy groups on both sides of the argument, and on the roles played by these groups. There was some comment made about the role of the media in advocacy, with informants identifying certain media reporters as either ‘pro’ or ‘contra’. For example, one informant suggested that more than 95 per cent of media stories in commercial media were ‘in favour’, while another suggested that the ‘ABC is biased against’ nuclear power. The latter informant also suggested that there were no specific ‘individual contra leaders’ identifiable in Australia, rather ‘they will emerge if there is a strong push towards’ nuclear power. Some informants recognised the pro-nuclear power politicians within both Federal Government and Opposition – ‘Australian Greens remain the only anti-nuclear party’ commented one informant. Another discussed the role of local advocacy, for example, in the case of the waste repository proposal for Tennant Creek.

4.1.7 Historical milestones

There were some critical historical milestones on which the informants reflected when considering the formation of attitudes in Australia. The following section identifies these milestones and some comments made about them.

The Ranger Inquiry (1976) was mentioned by many as a key turning point in Australian government policy and national understanding. As one informant put it, ‘two key findings influenced thinking, first that experts continued to exaggerate [nuclear power’s] potential and second there were unresolved problems associated with waste and safety’. This informant linked the Ranger Inquiry, and the subsequent election of the Hawke Labor Government in 1983, as key factors in the collapse of prospects for a nuclear power industry in Australia.

The Three Mile Island (TMI) accident in the US (1979) created a ‘massive image problem’ and, according to another informant, nuclear power then ‘came to a direct halt’. Another informant recalled that the nuclear disarmament movement against cruise missiles and its link to Australian uranium mining was important in the early 1980s. The Chernobyl accident (1986) subsequently reinforced contra views, despite informants having different perspectives about the accident’s long-term health and safety impacts. For example, one informant suggested that ‘comparing today’s nuclear power reactor with Chernobyl is like comparing a 1948 Holden with today’s model’. Another questioned the ‘evidence’ associated with claims of the numbers of deaths as a result of the accident. Yet another challenged this view, arguing instead that radiation health needed to be considered over decades, and that the WHO was ‘restrained’ in its capacity to speak honestly about findings. Further key historical events cited included the French testing in the south Pacific, the bombing of the *Rainbow Warrior* in New Zealand and the visit of the US submarine *Seadragon* to Hobart in the early 1980s’.

4.1.8 Impact of climate change debate

The final theme is the issue of the impact of the climate change debate on the formation of attitudes to nuclear power. One informant pointed out that there would be ‘no nuclear power’ debate if we did not also have the ‘climate change challenge’, whereas another pointed to the way in which the debate had ‘changed the way [Australians] view the world’. One key informant self-identifying as a ‘strong denier’ of climate change commented that it could be concluded that the ‘vast majority of opinion has been won over’ and as a result ‘all policy is directed towards it’. Another informant suggested that there was a sense of ‘despair’ among some about the available options and therefore ‘more people were open to nuclear power due to the climate change debate’. A further informant thought that the climate change debate has ‘muddied the waters’ and as a result, nuclear power ‘plays a diversionary role from genuine opportunities’. For another informant, the climate change debate had increased the sense of urgency associated with

v <http://ssn584.homestead.com/stein.html> retrieved 19th August, 2009.

needing to find alternative forms of energy, as well as highlighting the threat of ‘environmental refugees, increased tension and increased conflicts’ but concluded that nuclear power is ‘too slow’ to be a solution. One informant suggested that there had not been as much of an impact of the climate change debate on the nuclear power issue as had been promoted – instead, only ‘those educated can see that nuclear power might have a role’. For another informant, a ‘sceptic’, the ‘climate change debate was having an influence ... [however] the crunch will come if policies put a premium on coal usage’.

4.2 ANALYSIS OF E-SURVEY RESULTS

The following section provides an overview of the responses to the e-survey conducted in August/September 2009 as a component of this study. The e-survey questions can be found at Appendix E. The total number of respondents to the survey was more than 380 with the number of valid responses being 300.

Appendices E and F contain explanatory notes about the study and survey, the e-networks invited to participate and the questions asked. Because the survey instrument was sent to a wide variety of e-networks, those who were invited and who then agreed to complete the survey could be considered as ‘self selecting’. Consistent with this premise, it can be seen from the responses detailed below that the respondents did have a particular interest in the issues. It needs noting that this survey was not designed to be representative and therefore should not be interpreted as such.

4.2.1 Demographics (Q.29 - Q.35)

The majority of respondents reported their occupation as ‘professional’ (80.4 per cent) with ‘manager/administrator’ as the next major category (16.7 per cent).

The majority of respondents reported ‘education’ as the industry group that best describes their occupational category (29.9 per cent), with ‘mining’ as second at (25.0 per cent) and agriculture, forestry and fishing at (11.9 per cent).

The majority of respondents lived in a suburb of a capital city (80.6 per cent) and were male (80.1 per cent). The largest age group was 65-74 years (26.3 per cent). Their highest primary or secondary school qualification was year 12 or equivalent at 96.2 per cent and 72.8 per cent held a postgraduate degree.

4.2.2 Networks (Q.1 – Q.5)

The majority of respondents belonged to a science-based network (51.3 per cent) with respondents also from a policy-issues network (13.4 per cent) and an environmental issues network (10.2 per cent). Most had been members of the network in question for more than five years (46.2 per cent) or one to five years (33.3 per cent), and stated that they were ‘somewhat’ involved (39.0 per cent) in the network. The primary purpose of their involvement was to get up-to-date information (53.3 per cent), to enable discussion (30.4 per cent) or to keep in touch with others (26.5 per cent). A majority (51.8 per cent) found their membership to be useful, or very useful (24.2 per cent).

4.2.3 Environmental issues (Q.6 – Q.10)

On the question ‘what national environmental issues concern you the most?’ the majority of respondents were very concerned about future water demands (63.2 per cent) future energy demands (55.9 per cent) and global warming (39.1 per cent). They were somewhat concerned about salinity (49.8 per cent); habitat protection (48.7 per cent) and biodiversity protection (48.2 per cent). A majority of respondents stated that they were unconcerned (40.9 per cent) or somewhat unconcerned about uranium mining (19.6 per cent).

On the question ‘how often are these issues discussed in your network?’ the majority regularly discussed future energy demands (43.0 per cent); often discussed future water demands (34.4 per cent); and rarely

discussed feral animals (31.2 per cent). Uranium mining was discussed regularly by 33.8 per cent of respondents, and often by 30.1 per cent of respondents.

On the question ‘how often are these issues discussed in your workplace?’, the majority regularly discussed global warming (45.9 per cent) or future energy demands (37.5 per cent) but rarely discussed feral animals (28.8 per cent).

On the question ‘how often are these issues discussed among your friends/family?’, the majority regularly discussed global warming (51.6 per cent) or future water demands (42.0 per cent), often discussed future energy demands (45.6 per cent) or uranium mining (27.8 per cent) but rarely discussed feral animals (31.3 per cent).

On the question ‘on considering the current national and international debate about global climate change, has this influenced your opinion about future alternatives for Australia’s energy technology mix?’, the majority responded that they were strongly influenced (41.2 per cent) or somewhat influenced (35.2 per cent).

4.2.4 Energy technology for the future (Q.11 – Q.16)

On the question ‘how favourable or unfavourable do you feel about the following energy sources making a substantial contribution to secure supplies of electricity in Australia in the future?’, the majority of respondents reported feeling very favourable about nuclear power (54.4 per cent) and solar power (37.5 per cent) and favourable about natural gas (46.3 per cent), hydro (46.0 per cent) and geothermal (38.7 per cent). The majority were neutral about biomass (31.3 per cent), unfavourable about oil (33.5 per cent) and very unfavourable about coal (25.4 per cent).

On the question ‘to generate more electricity to meet the country’s needs over the next 25 years, new power plants will have to be built. Companies and government agencies will need to start planning today. How should we meet this demand?’, the majority of respondents indicated that Australia should increase a lot its nuclear capacity (68.9 per cent); solar (53.0 per cent) and geo-thermal (51.4 per cent). It should increase somewhat its biomass (45.4 per cent) wind (42.8 per cent) natural gas (42.6 per cent) and wave/ tidal (41.5 per cent). It should keep its hydro the same (45.8 per cent) and reduce a lot its coal (33.2 per cent) and oil (32.9 per cent).

The last question above was identical to one in previous research conducted in the US by the MIT Center for Advanced Nuclear Energy Systems. Table 5 compares the Australian responses with those from the MIT survey. It should be noted that the MIT survey was conducted nationally in 2007 with a sample size of just over 1,200 and that the e-survey for the MIT study also asked questions about biomass, geothermal and wave/tidal not reported on here.

Table 5 Distribution of preferred energy sources – US/Australia (Australia, 2009/US, 2007)

Energy source	Not use (%)		Reduce a lot (%)		Reduce somewhat (%)		Keep same (%)		Increase somewhat (%)		Increase a lot (%)	
	Aust	US	Aust	US	Aust	US	Aust	US	Aust	US	Aust	US
Coal	9.0	6.6	33.2	22.1	25.2	25.6	18.6	27.0	9.6	11.4	3.7	7.4
Dams/Hydro	1.1	4.0	1.1	2.1	1.8	8.8	45.8	45.1	40.3	27.3	8.5	12.6
Gas	0.3	3.5	1.7	6.8	8.4	19.7	18.9	38.8	42.6	21.4	26.7	9.9
Nuclear	12.5	11.3	0.0	14.1	0.3	13.9	11.8	25.0	68.9	21.4	3.0	14.3
Oil	7.2	6.4	32.9	36.4	28.9	31.3	21.1	18.1	7.9	4.7	0.7	3.1
Solar	0.7	2.7	1.3	3.1	0.3	4.4	6.7	13.1	37.7	25.3	53.0	51.5
Wind	2.1	3.8	1.7	1.6	2.8	3.6	14.5	14.2	42.6	24.0	35.3	52.8

US data derived from Ansolabehere 2007:3
NB: ‘Don’t know’ responses not included.

The responses in Table 5 reveal some remarkable congruence except on the use of coal and nuclear power. Although of interest, such comparisons do need to be seen as guides only, as the mode of selecting and reaching respondents varied between the two surveys.

On the question ‘in considering the current national and international debate about global climate change, what role do you see nuclear power playing?’, the majority of respondents felt that nuclear power would be an important contributor (66.2 per cent) or one alternative among others (22.6 per cent).

On the question ‘in considering the current national and international debate about global climate change, has this influenced your opinion about nuclear power as an option for Australia?’, the majority of respondents felt that the global climate change debate had somewhat influenced (32.9 per cent) or strongly influenced (32.6 per cent) their opinion.

On the question ‘in which way has the current national and international debate about global climate change influenced your opinion about a nuclear power option?’, the majority responded that it had influenced their opinion about nuclear power more positively (49.2 per cent) or somewhat positively (22.3 per cent).

On the question ‘in considering your support or opposition to nuclear power as an energy option for Australia, which of the following reasons would be a factor?’, the majority identified that they had no significant concern about scientific evidence on health effects (65.9 per cent) or radiation leaks (56.3 per cent) or nuclear arms proliferation potential (52.9 per cent). Cost was of some concern (36.4 per cent) as was terrorist attack (34.5 per cent). Waste disposal was ranked highest of the ‘significant concerns’ at 29.7 per cent.

4.2.5 Information Sources (Q.17 – Q.24)

Most respondents sought information about Australia’s future energy technology mix from journals (75.1 per cent), the internet (70.1 per cent) and print media (70.1 per cent). Amongst these three major areas of information sources, respondents found scholarly journals to be most useful at 47.4 per cent, the internet useful at 51.3 per cent and print media useful at 48.1 per cent. When asked to rate these sources the majority identified scholarly journals as most valuable at 52.1 per cent, print media valuable at 51.7 per cent and the internet valuable at 50.8 per cent.

On the question ‘when considering your own views on Australia’s future energy technology mix, how useful is information from...?’, for their network 43.1 per cent found it useful, from work colleagues 52.2 per cent found it useful, from friends 43.4 per cent found not very useful, and from family 46.6 per cent found not very useful.

On the question ‘from which sources do you seek information about the contribution of nuclear power to Australia’s future energy technology mix?’, the majority sought information from journals (73.4 per cent) and internet (68.0 per cent) or print media (58.9 per cent). On the question ‘how useful were these sources?’, the majority found journals highly useful (40.1 per cent), the internet useful (45.6 per cent) and the print media useful (40.1 per cent). On the question ‘how do you rate these sources?’, the majority rated journals as highly valuable (41.1 per cent), the internet as valuable (44.9 per cent) and print media as valuable (41.7 per cent).

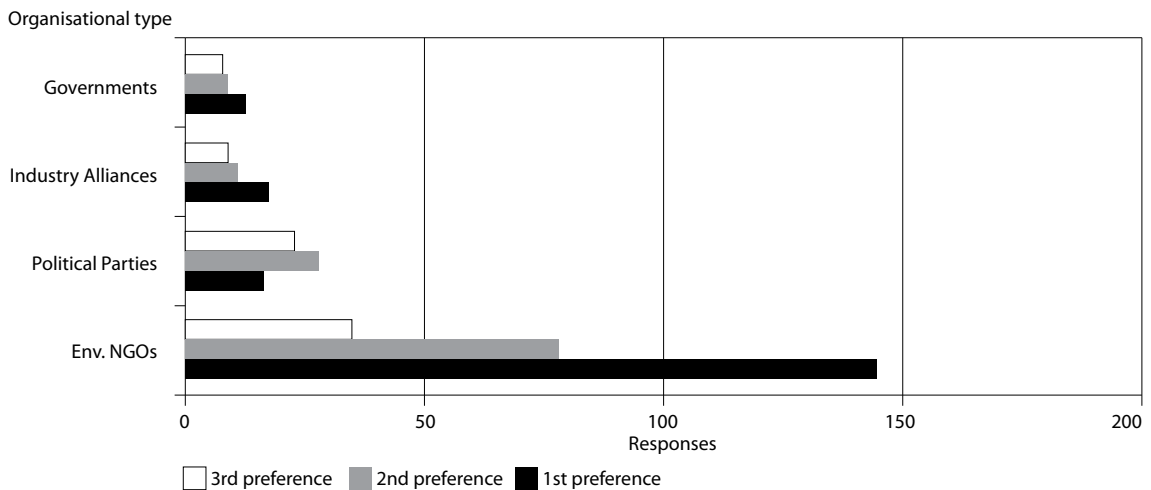
On the question ‘how would you rate the following in terms of their potential to provide advice about Australia’s future energy technology mix and nuclear power?’, the majority rated scientific organisations (54.8 per cent) and learned academies (44.9 per cent) as highly reliable; universities as reliable (51.0 per cent); and Federal governments (45.9 per cent), State governments (45.6 per cent) and energy industry (42.9 per cent) as somewhat reliable. Church organisations (72.2 per cent), peace organisations (69.3 per cent) and local government (67.9 per cent) were rated as not reliable.

4.2.6 Organisations and Individuals (Q.25-Q.28)

On the question: ‘can you name some specific organisations whose views you would value when considering your attitudes to nuclear power?’, the Australian Academy of Technological Sciences and Engineering was the first choice, the Australian Academy of Science was second and various combinations of science alliances, including associations such as The Royal Society, were third.

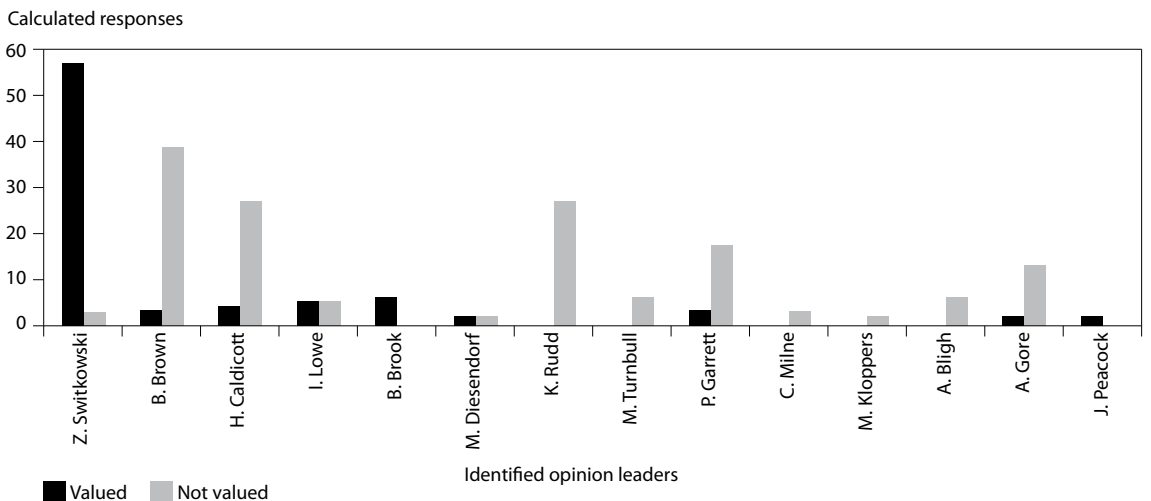
On the question ‘can you name some specific organisations whose views you would not value when considering your attitudes to nuclear power?’, the majority (1st, 2nd and 3rd preferences) for organisations not valued were environmental NGOs, with the following specifically named: Australian Conservation Foundation; Friends of the Earth; WWF (also known as World Wildlife Fund) and Greenpeace, among others. These are analysed in Figure 3 below.

Figure 3 Organisations not valued by preference stated – Q.26 e-survey August–September 2009



The final questions sought opinions on the individuals valued or not valued when considering personal attitudes to nuclear power. Those who were most commonly named included politicians, scientists, political commentators and others (Figure 4). As can be seen, several of these opinion leaders fell into both valued and not valued categories. Those who were nominated only once have not been included in the figure.

Figure 4 Opinion leaders by preference – Q.27 & Q.28 e-survey, August – September 2009



5 Pathways to Attitude Formation

Attitudes change over time, not suddenly – events are long in preparation ... (Hurd 2007:111)

We are well aware that there is still a public acceptance issue with nuclear power and uranium mining (M Angwin, CEO cited in Australian Uranium Association 2009a).

... it is entirely realistic to meet Australia's future energy needs with a mix of clean supply options, completely eliminating the need to go nuclear (Lowe 2007:81).

This section draws on all the evidence gathered to identify the various pathways by which attitudes to nuclear power are formed, held and negotiated. The analysis has been structured according to a number of pathways identified in the formation of attitudes to nuclear power and informed by the conceptual framework adopted for the study.

5.1 HISTORICAL

This analysis does not present a history of nuclear power, as this has already been undertaken by others from a variety of perspectives (see for example: (Birch c2009; Cravens 2007; Dalton 2006; Landsdell 1958; MacLeod 1994; Martin 1980; Parliament of Australia 2006b). It is also not a biographical analysis (i.e. of the contribution of science and of science experts). Both approaches are well beyond the scope of this current study.

Instead, by drawing on literature reviewed and the empirical evidence, this analysis highlights the key historical 'events' that have come to represent the narrative that surrounds the issue of nuclear power in Australia. Such an analysis could be considered a form of a 'history of the present' (Dean 1997:35) as it is concerned with 'that which is taken for granted, assumed to be given, or natural within contemporary social existence'. Drawing on the works of Foucault, Munslow (1997) argues that any written history is a complex 'vehicle for the distribution and use of power' and therefore caution is needed when reading what appears to be a 'tidy' way of 'organising historical data into a narrative' as a 'truthful reality' (13). This links to Foucauldian genealogy, which is an 'attempt to locate historically and analyse the strands of discourse and practices dealing with the subject, knowledge and power (Rabinow 1984:7). The present analysis does not offer a full review of the literature associated with a Foucauldian analysis of historical 'events' or its discussion within historiography (Flynn 1994), but it does enable an understanding of how the historical narratives associated with nuclear power have been organised to suit all arguments, pro and contra, within the discourse. The events highlighted here have come to symbolise, in a shorthand manner, the points in history that have contributed to the development of people's current attitudes.

The proposition that historical pathways can be identified as leading to the development of attitudes towards nuclear power becomes clear, for the purposes of this study, by how common historical narratives are drawn in the literature, and how people involved in the social constitution of nuclear power rely on such events to make their cases in the debate. As this analysis describes, a number of key historical events are commonly invoked to make various critical points in such arguments, and their continued symbolic usage creates an important basis for attitude formation, negotiation and development.

In many cases, these historical events continue to ‘frame’ current debates, despite the decades since their occurrence. This is nowhere more evident than in the use of nuclear bombs during World War II. Although the historical memory of the bombing of Hiroshima and Nagasaki in 1945 may be fading with time, these two events nonetheless continue to exert a powerful symbolic effect on current attitude formation. They form the ‘markers’ from which the historical narratives begin, they provide a key visual of the social and health consequences associated with military nuclear power, and for many analysts and commentators, they remain symbolic of the military potential inherent in maintaining any future civil nuclear power program.

The events of 1945 connect with the history of nuclear power in Australia because the initiatives associated with civil programs in most countries that now have nuclear power emerged from those countries’ military institutions. The testing of weapons in South Australia (Emu Field/Maralinga) and testing off the West Australian coastline on the Monte Bello Islands during the 1950s both underscore the military aspect of nuclear power development at this time. According to Dalton, the decision to invite the British into Australia’s ‘remote places’ was made by Prime Minister Robert Menzies without consulting Cabinet (Dalton 2006:3) and calls at that time from the Women’s League for Peace and Freedom for Labor to oppose the tests were ignored. The fact that these events are still within living memory has been evidenced as recently as January 2009 when media reports of a legal case in Great Britain asserted that the ‘British government deliberately misled Australian officials about the impact of the nuclear blasts’ and as a result, many of the 20,000 Australian servicemen who worked on the British sites had a case to answer about ‘medical defects’ (Thomas, B 2009:4).

During the postwar period, events such as the establishment of the Australian Atomic Energy Commission (1953/54), the development of uranium mines, particularly in the Northern Territory, the building of two research reactors at Lucas Heights, the establishment of a Chair in Nuclear Physics at the ANU, and Australia’s membership on International Atomic Energy Agency, all gave the nation a ‘growing sense of inevitability’(discontents.com.au c2008:105) that both civil and military aspects of nuclear energy were a part of Australia’s future. It was, as Roy McLeod writes, a time of ‘excitement and anticipation – a matter for experts, but one unequivocally in Australia’s interests’ (MacLeod 1994:300). This was seen as supporting Australia’s place in the world and dealing with the Cold War environment, as well as contributing to the development of a large, isolated and underpopulated continent by means of cheap power (Martin 1980:42). An R & D program to develop ‘the industrial use of atomic energy’ was confirmed by the Government in 1953 (Parliament of Australia 2006b:7).

The consideration of the establishment of a nuclear power program in Australia reached its zenith in 1969 with the completion of a feasibility study to build a nuclear power plant at Jervis Bay, New South Wales (see ABC TV *Four Corners* 2002; Lowe 2007; Martin 1980; Parliament of Australia 2006b; The Canberra Times 2006)^{vi}. According to the historical record, the rationale at this time continued to be ‘as much military as industrial’ (Parliament of Australia 2006b:7) but by 1971 all plans were shelved for both political and economic reasons.

In the late 1970s and early 1980s a number of critical events continued to define the historical pathways to current attitude formation. In Australia in the mid 1970s, the Ranger Uranium Environmental Inquiry (Presiding Commissioner R W Fox) became the next key event in the narrative. This Inquiry (Fox 1976; The Gulliver Ranger Dossier 1997; University of Melbourne Indigenous Program 2007; Dalton 2006; Parliament of Australia 1977; Patterson 1976) was established in 1975 by the Whitlam Labor Government (Federal) and the report, commonly known as the Fox Report, was subsequently released by the Fraser Liberal/National Coalition Government. The purpose of the Inquiry was to consider the environmental

vi The re-visiting of the Jervis Bay site came as it was suggested as a possible location during the ‘debate’ at the time of the Switkowski Review (see Canberra Times, 26th May, 2006).

implications of mining uranium deposits (including one at Jabiluka near Kakadu) in the Northern Territory and the Commission undertook wide-ranging consultations over a period of 12 months.

According to Dalton, public awareness of the inter-relationships between uranium mining, 'nuclear disarmament, environmental protection and Aboriginal Land Rights' (Dalton 2006:3) coalesced during the period of this Inquiry, and there was much media interest in the Fox Report (for full details see: The Gulliver Ranger Dossier 1997). The Report's 16 recommendations and findings included a statement linking the 'nuclear power industry [as] unintentionally contributing to an increased risk of nuclear war' (Patterson 1976:2) and it recommended 'against commencement' of further development of uranium mines because '... once it is started, no government will have the strength to resist the pressures for its continuance and even its expansion' (pp182-183 Fox Report cited in Patterson 1976:2). Despite this recommendation, according to Dalton, the Fox Commission had '*legitimised* uranium mining, if only by *default*, through its recommendations for environmental monitoring, supervision of the mine, the payment of royalties, protection of Aborigines from mining impacts, and marketing and safeguarding of uranium' (Dalton 2006:11 stress in original). A political consequence of the Ranger Inquiry was the decision by the ALP to commit to a 'three mines policy' on uranium mining in 1984 (see further below).

In March 1979 an accident occurred at the Three Mile Island nuclear power station near Harrisburg, Pennsylvania, USA. (For two alternative readings, see Caldicott 2006:65-74; Cravens 2007:182-190). Media coverage over the two key days brought the event to Australia where it added to the debate about uranium mining and exporting, and as one key informant commented, it also created a 'massive image problem' for the industry. In the early 1980s the arrival of nuclear powered submarines in Australia kept the issues alive, as did the ongoing French nuclear testing in the South Pacific. The increased concern about Cold War disarmament discussions contributed to maintaining the link between the mining of uranium and its potential to contribute to the manufacture of weapons.

The next major event marked by almost all key informants as well as the literature, and to which reference is still made on a regular basis, was the accident at the Chernobyl reactor in the Ukraine in 1986. Again, the literature regarding this accident and its consequences is formidable, as are the many competing arguments regarding its political, social and health consequences. The subsequent analysis of the impact of the Chernobyl accident once again depends on what perspective is adopted. Although there have been major reports (Kinley 2006; WISE - NIRS 2000) those reports have been rejected by some as having 'obfuscated' the truth (Caldicott 2006:75). Some key informants referred to both sides of this argument. Some informants also noted that in their view the 1959 agreement between the WHO and the IAEA has been a key factor in the inability of the WHO to maintain its 'scientific independence' (Baum n.d.; nonuclear.se 2007).

Post-Chernobyl Europe became divided in its policies regarding for nuclear power, with some countries opposing new reactors (Italy, Netherlands, Greece) and others planning them (France, Germany). Opinion polls taken at the time in the then West Germany showed continued support for existing facilities but rising opposition to plans to build new facilities. This was also reflected in France, where a recent poll found that 53 per cent of respondents would try to move if a power station were built nearby.

The long-term impact of the Chernobyl accident on the formation of attitudes to nuclear power in Australia remains profound. Despite a generation growing up since the accident, the various other kinds of environmental and man-made disasters since the event, the design differences between the Chernobyl reactor and other operational and planned nuclear power stations, and the absence of any comparable accident since 1986, Chernobyl nonetheless remains *the* most potent negative symbol of the nuclear power industry and is most often referred to as an example of what is 'likely to happen' were Australia to adopt nuclear power. Chernobyl appears to have 'shattered the confidence of the public' (Garnett

2000:3). In some cases, its powerful symbolic 'shorthand' needs no further description than its name. Examples of such 'shorthand' taken from a brief review include regular blogs (Margo's Maid 2009), health issues connected to those who visited the site (Seven TV News 2009), vigils remembering the anniversary of the event (Journées Internationales de Mobilisation Contre Le Nucleaire 2009), and the use of the name to denote pro-nuclear ministers (W A Department for Environment and Conservation 2006). Given the longevity of such regular and common representation, Martin's comment in 1993 that 'without the anti-nuclear movement, it is quite possible that Three Mile Island and even Chernobyl would have passed without much notice' (Martin 1993:3) appears, in hindsight, over-optimistic.

In the same decade as the Chernobyl accident, ongoing nuclear testing in the South Pacific by France was also a factor in the establishment of memories associated with nuclear power. Despite the fact that the tests related to the military use of nuclear energy, the link between the two (civil and military) remained a powerful one. US nuclear submarines visited Australia at that time, but in 1984 were banned from visiting New Zealand.

Since the mid-1980s the issue of civilian nuclear power in Australia and any debate regarding its merits or risks has been framed within the larger discussion of uranium mining. This is discussed in further detail below and is traceable in the evidence gathered about the two case studies. Writing in the 1990s, Roy MacLeod took the perspective that it has been a 'chapter of disappointments, accompanied in more recent years by a succession of controversies that have poisoned the well of public confidence' (MacLeod 1994:300).

5.2 CULTURAL

... opposition to nuclear power is still a fascinating and distinctive part of Australian culture^{vii}

The cultural aspects of attitude formation pathways could be dismissed as superficial and therefore as less important in our understanding. In a country which does not have nuclear power, however, individuals often must resort to symbolic cultural mediators to explain their support or opposition.

Such symbolic mediators are drawn from popular culture, and are a kind of shorthand to describe events, individuals, disasters and so on. In the past, symbolic mediators have largely been drawn from print media. For many, books such as *Silent Spring* (Carson 1962/2002) began a new awakening of public environmental consciousness. In her introduction to the 2002 Edition, Linda Lear highlights the 'cultural climate' in which the book made its impact and the 'kernel of a social revolution' that it contained (Leer 2002:x). For one commentator, the book became the reason why 'modern societies and classes began to doubt the idea that science and technology constituted progress or contributed to human betterment' (Kershen 1999:4). Perhaps the true impact of a text such as *Silent Spring* is best judged at an historical distance, as its absorption into the cultural framework becomes more obvious with time.

Increasingly, our interaction with global cultural media has become much more immediate and mediated through electronic and visual means. In some instances, art seems to imitate life (BBC television series *The Edge of Darkness* (BBC 1985) is based on events at Sellafield/Windscale). Conversely, an example of life imitating art can be seen in the film *The China Syndrome* directed by James Bridges, which was released in the same year as the Three Mile Island accident (1979)^{viii}.

vii Letter to the Editor The Weekend Australian 12-13 September, 2009 p.15.

viii Further such examples can also be cited: *On the Beach* (1959 Dir: Stanley Kramer) or *Dr Strangelove: or how I learned to stop worrying and love the Bomb* (1964 Dir: Stanley Kubrick).

Interestingly, for some of the key informants to this study as well as some political commentators, the long-running television series *The Simpsons* provided the natural current cultural environment for an immediate ‘take’ on nuclear power^{ix}.

For a number of commentators, as well as some key informants, the public attitude to nuclear power in Australia depends less on the potential offered by science and technology than on cultural and political values. Kershen’s analysis of and conclusions about attitudes to biotechnology and to the ‘contested battleground between contending historical forces and cultural values’ could also be applied to nuclear power:

... the acceptance or rejection of [nuclear power] will not be based on information and understanding. [It] will stand or fall based on the ideological beliefs and the cultural values adopted by individual human beings who, in turn, will shape societal beliefs and values (Kershen 1999:7).

5.3 POLITICAL

The case study developed and discussed further below highlights the political pathway which surrounded the debate on nuclear power called for by Prime Minister John Howard in June 2006, and its place in the lead-up to the Federal Election in late 2007.

In a landmark paper, Costa-Font et al argue that ‘support for nuclear power is likely to vary depending on individuals’ political views’ (Costa-Font et al. 2008:1274). The case study explores this point by providing analysis of survey polling data conducted at the height of the debate, by federal voting intention, and it confirms the point made in the UK research. Political beliefs act as barriers to the adoption of new knowledge (Costa-Font et al. 2008:1285) and the research concludes that:

... despite opportunities for individuals to gain knowledge about the risks of nuclear power generation, attitudes appear driven much more by an instinctive political decision rather than a digestion of information. Some ... form attitudes about nuclear power generation based squarely on their political affiliation and beliefs, which implies that they might be immune to communication policies covering the topic.

Costa-Font et al. appear to conclude that the political pathway to attitude formation is indeed crucial, as is the implied role of the media (in its reporting of the politics of nuclear power) and the historical and cultural contexts within which such political attitude formation is undertaken. It also confirms the view expressed many times in the literature that nuclear power in Australia is best understood as a political rather than a technological, economic or resource issue.

The Australian landscape in regard to nuclear power continues to be shaped by our relationship with uranium mining. Our interaction with nuclear power remains therefore ‘at a distance’ rather than immediate. The issue of nuclear power is also a step beyond the uranium debate, as it becomes caught up in a discussion about enrichment, waste and (as the case study highlights) the location of potential power stations. In that sense, the issue of nuclear power very quickly becomes caught up in a ‘State’s rights’ debate, as individual States have largely refused to have nuclear power stations sited within their borders, particularly as it is economically necessary to build future stations close to existing energy infrastructure (see Duncan 2001; Macintosh 2007a, 2007b; News Online 2007). Lowe suggests the ‘public hostility’ to nuclear reactors as power generators is a ‘crucial political consideration’ (Lowe 2007:39) and he charts the near 30-year history of one site (Caboolture) in Queensland, a community that demonstrated against an enrichment plant proposed in 1983 and again in 2007 (46).

ix A Albanese MP cited from the television series in the debate following the announcement of the Switkowski Review (see Australian Fabians, 2006). A key informant commented on the potential impact of ‘three headed fish’ from *The Simpsons*.

In summarising a poll taken by Accenture of 10,508 individuals in 20 countries during 2008 and commenting on the apparent ‘increasing support’ for nuclear energy, the CEO of Accenture warned that ‘policy makers and generators should not assume that this makes consent easy to achieve or maintain. Government and the energy industry must take note of the continued fragility of popular support for nuclear energy’ (*World Nuclear News* 2009).

The shift in Australia’s attitude to uranium mining, and the pathway to the ‘three mines policy’ has been well documented elsewhere (Dalton 2006). The shift in attitude is linked to an increasing national appreciation of the complexities associated with the Australian environment and of the requirement to increase consultation with traditional indigenous owners (Hamilton 1996) regarding land acquisition and land use change. Over the decade from 1973 to 1983, the ALP changed its position on uranium mining. On its election to federal office, the Hawke Labor Government adopted the existing three mines policy, which restricted uranium mining to three sites: Ranger, Nabarlek and Roxby Downs (SEA Gulliver, p.3). In the past 25 years, this has essentially provided the political framework for any consideration of a nuclear power industry, despite some examples of attempts to raise the issue publicly over the years (see for example Garnett 2000; Kemeny 1989).

The political pathway to attitude formation is further complicated by the integration of nuclear non-proliferation issues associated with the use of Australia’s uranium ore, post-export and post-enrichment. Such issues emerged for the then Prime Minister, John Howard, during a visit to India. It had been reported that Howard would be promoting uranium ore sales, even though India has a nuclear capacity (including a weapons capacity) and has not signed the United Nations Nuclear Non-Proliferation Treaty, which was opened for signature in 1968 and which currently provides guidelines for the sale of nuclear exports^x. Despite reporting that India was anticipating a ‘positive view’ in regard to future exports, the Prime Minister declined the request but would not ‘rule out a policy change in the future’ (ABC TV Lateline 2006b).

For Lowe and other commentators, this ‘great debate’ provided both a distraction and a ‘re-badging’ as well as an example of ‘wedge politics’ against the ALP (Lowe 2007), particularly on the issue of uranium mining. As the case study details, this was defused by the announcement in early 2007 of an abandonment of the ‘no new mines policy’ by ALP Opposition Leader Kevin Rudd, a proposal which had been flagged 12 months earlier by the previous Opposition Leader Kim Beazley.

Where the current political debate stands can be seen by the case study developed in the following media pathway case study with the release by Rio Tinto Ltd of their submission to the Federal Government’s Energy White Paper and the subsequent discussion of the issues raised. It remains a hotly contested issue, one in which individual politicians tend to make their own views clear.

That the issue remains essentially a political one can also be seen in the findings of a review for the APEC Region undertaken in 2004 (before UMPNER or the Prosser Review) by the Asia Pacific Energy Research Centre (APERC). Despite their essentially positive take on the role of nuclear power in the energy technology mix, APERC concluded that, in the APEC Region,

... for nuclear power to have a prominent position in the electricity generation scene, advances have to be made on the most controversial issues. The industry has to prove that investment cost reductions are possible and has to eliminate the public’s skepticism concerning nuclear waste handling by constructing and demonstrating at least one civilian waste repository. On the part of governments, it will entail major responsibilities to ensure the continued safe operation of nuclear facilities, to make the required political decisions to develop and implement

^x see <http://www.nuclearsuppliersgroup.org/Leng/default.htm>.

national waste management strategies, and to promote international action to strengthen nonproliferation controls (Asia Pacific Energy Research Centre 2004:168-169).

At Appendix C a detailed case study has been developed to highlight the ways in which the political context shapes the debate and the responses to it.

5.4 NEWS MEDIA

This pathway has been alluded to previously in relation to both its reporting (journalistic) function and its influence as a mediator of cultural values. In the case of attitude formation, the media act to present, interpret and re-frame events to a mass audience of lay individuals. In the case of complex science, these functions are often criticised as an apparent simplistic reduction to ‘bare facts’, which are then presented as a binary choices (good/bad; black/white).

In the cross-media ownership environment that characterises the Australian landscape, there is a rapid appreciation of the views or ‘angle’ placed on issues being discussed. Media outlets are increasingly cited as being ‘of the right’ or ‘of the left’ as are individual media or political commentators. The reading of such material is then placed within a context of ‘who is speaking’ and from which position they are speaking.

Research in the United States has identified that ‘conflictual events are generally more likely to receive media covering than other events of similar size and form’ (Oliver & Myers 1999:40). This also reflects the relatively adversarial manner in which nuclear power (or indeed uranium mining^{xi}) is reported, and the language that can be adopted in sub-editing, where ‘nuke’ is often used as a shorthand for nuclear, and words used such as ‘heat’, ‘glow’ and ‘meltdown’. This essential ‘drama’ associated with the reporting adds to its news value and as detailed in the case study analysed further below gives an impression that it is a ‘national’, ‘universal’ debate, when as the analysis shows, it is largely one conducted among a closed group, and the ‘debate’ is essentially an internal, controlled one with each actor constructing and then playing out his or her role and so contributing to the drama. This broad drama includes events such as rallies, protests and sit-ins with one recent example in Sydney during the World Nuclear Association meeting in April, 2009. This event was seen as having ‘good coverage’^{xii} in other words, the staged drama had been reported by the media and given the activists/advocates against nuclear power an opportunity to put their case to the public.

Oliver and Myers have identified an interesting trend in such protests, reporting a ‘distinct bias in the news record not only towards larger events ... but toward more established groups who present their concerns in predictable ways in predictable places located downtown, where the reporters are’ (Oliver & Myers 1999:77). That observation is reflected in the strategies associated with the debate in Australia. In the period September 2005 to January 2006, the Tyndall Centre conducted a review of media reporting on Carbon Capture and Storage (CCS) in five English-speaking countries, including Australia. It concluded that the ‘subject of nuclear power attracted a very high level of media attention, particularly in the UK and Australia’ (reported in Ashworth et al. 2007:77)^{xiii}. The case study reported on in the previous section refers to the same period.

The media case study in Appendix B takes up the issues of framing and drama further by focusing on the reporting of very recent events in the overall Australian debate.

xi At the time of writing, such a uranium mining debate is being played out in The West Australian in regard to the Opposition’s position on the opening of future mines in the state.

xii Comment from key informant.

xiii It also concluded that Australia has the most negative reporting on CCS.

5.5 INTERNATIONAL INFLUENCES

The pathway of international influences is a critical one, although at times not recognised as such. It involves not only the historical relationships that Australia has with other western industrialised nations but also the global climate change debate and the increasing media attention given to nuclear power as ‘the answer’ to greenhouse gas emissions. The following brief analysis of the impact of international influences on attitude formation offers an example of the way in which political and media discussions in another country, and reported decision-making by key opinion leaders, influence the debate in this country.

The example is that of the UK and in particular, the apparent shift in attitude among some key environmental opinion leaders as to the role of the nuclear power program in the UK, given the increasing alarm generated by the threat posed by greenhouse gas emissions. It was reported that the challenge of climate change was taken up by the British nuclear power industry in the lead-up to the 2005 UK General Election for the purpose of ‘working together to push nuclear power on the agenda ... the growing interest in climate change and security of energy supply ... meant the time was right’ (B.Wilson (Former UK Energy Minister) cited in *New Statesman* 2005b:1).

At the same time, there was increasing focus on statements by various key environmental opinion leaders as to their ‘rethinking’ of previously stated positions on nuclear power. These leaders included James Lovelock and Patrick Moore, both major figures in the Green movement in the UK, who were both reported to be reflecting differently on energy issues in the context of the greenhouse gas challenges (BBC News 2005a). In a recent report in *The Independent* newspaper, Stephen Tindale (former director, Greenpeace), Lord Chris Smith of Finsbury (chairman of the Environment Agency), Mark Lynas (author of the Royal Society’s science book of the year), and Chris Goodall (a Green Party activist chosen from a lobby favouring nuclear power) argued for nuclear power as an energy solution to climate change (Australian Uranium Association 2009b; *The Independent* 2009).

For Mark Lynas, a key commentator, author regularly published in *The New Statesman* and long-standing Green party member, the issue reduces to a question of degrees of risk (see Beck in *The Guardian* 2008 article). ‘I’m not suggesting that nuclear is a panacea ... But have you considered what five or six degrees of global warming would do to the planet? Something far worse, I assure you’ (*New Statesman* 2005a; *The Sunday Times* 2009). He subsequently reported the reaction to his ‘conversion’ and to the impact that his public discussion had on others. ‘I am still shocked that people ... are too intimidated to speak out. The result of this fear is that the public is dangerously misinformed about nuclear power’ (*The Sunday Times* 2009). For Stephen Tindale ‘it was kind of like a religious conversion ... nuclear power is not ideal but it’s better than climate change’ (cited in *The Independent* 2009:1).

The ‘conversion’ of opinion leaders becomes an important component of the pathway to attitude formation, in which one accepts that attitudes are formed by testing opinions against those of admired and trusted commentators. In that context, the conversion of commentators and opinion leaders such as Lynas, Moore or Tindale *interrupts* the status quo and gives pause for thought and perhaps reviewing one’s position.

As the political pathways case study (Appendix C) describes, such a moment also occurred in the recent Australian context, with comments made by environmental activist Dr Tim Flannery before and during the debate surrounding the UMPNER report expressing support for some uses of nuclear power. The reaction to his comments apparently surprised Dr Flannery and it was reported that he later clarified his view to ensure that there was no confusion as to where he stood on the issue. Such public ‘conversions’ also offer opportunities for alternative views to be re-stated and re-framed (see above) as has been the case in the nuclear industry now regularly citing such ‘converts’ in their own public material.

The international influences are also felt in the way in which Australia's position is reflected to the nation by international opinion. In the BBC News reporting on the decision to conduct the UMPNER Review, the link between Australia's greenhouse gas emissions and the 'international pressure' to reduce such emissions was made (BBC News 2006) as was the fact that the nation held 40 per cent of known uranium reserves and had recently signed an export deal with China.

5.6 EDUCATIONAL

The educational pathway to values formation has long been understood, has been well documented and researched, and is often referred to as the 'hidden curriculum'. In the case of attitude formation to energy technologies in general and to nuclear power technologies in particular, the issue of an educational pathway therefore takes two forms of curriculum:

- (1) the skills development associated with science, engineering and technology education; and
- (2) material taught about the place of energy in society, and the history and impact of both civilian and military nuclear energy.

It is well beyond the scope of this study to explore in detail the nature of the latter curriculum. Despite hopes expressed by some key informants and in some of the literature reviewed for the study, a brief search did not uncover any secondary education curriculum (Western Australia was taken as a case) that specifically stated that an argument either for or against nuclear power should be taught. However, this was by no means a thorough quantitative analysis, which would need to be undertaken in collaboration with State government agencies and specific schools.

What can be said is that teaching associated with nuclear energy technology has now ceased at the last University in Australia that had such a program, the University of New South Wales. This fact has been noted by both UMPNER and the Prosser Review (Australian Government & House of Representatives 2006; Switkowski 2006). It was also noted by key informants to this study as a key reason that there would be a major lag time in any program to establish civilian nuclear power in Australia. Such lack of 'choice' in the study of science and engineering may also contribute to the more general lack of interest in the area of nuclear science or engineering as a career choice. However, this is also beyond the scope of the present study to determine (*The Guardian* 2006; *The Times* 2007). A decade ago, Helen Garnett pointed to realistic assessments that most staff in the nuclear science and engineering sector are in the 50+ age group (Garnett 2000) despite some investment in the US for training and research.

ATTITUDES TO NUCLEAR POWER

6 Conclusion

This study was initiated to enable a deeper understanding of how the debate on nuclear power in Australia has been shaped in the past, and how it might proceed more productively in the future, as well as why the debate seems to be different in Australia from some other parts of the world. In the journey to this understanding, literature has been reviewed that deals with the formation of attitudes, the relationship between attitude and risk, the role of opinion leaders and public debate.

The political, environmental, scientific and technological epistemic communities that participate in this debate are structured through social networks within which individuals obtain information and seek clarification, affirmation and confirmation of their attitudes. The e-survey has highlighted how such epistemic discussions then enhance consensus on future directions.

The study has analysed a large number of opinion polls in Australia and overseas and has found that despite their limitations the polls are reasonably consistent in their findings. If there has been a nuclear 'renaissance' it has been from a fairly low base of support and its future remains essentially fragile as a social contract.

The study has also found that the inter-relationship between uranium mining and civil and military nuclear power remains at the heart of why Australians hold the attitudes they do. The call for a 'full-blooded' debate by the then Prime Minister, John Howard in 2005-06 is now in hindsight seen by many as being more a call for an expansion of uranium mining than a significant step towards civilian nuclear power for Australia. If Australia did not have its uranium resource, the 'debate' might be even more limited and therefore of even less salience.

An analysis of the work undertaken by CSIRO's Energy Transformed Flagship to date would provide a framework for future policy deliberation and consultations. Deliberative decision-making on the scale of that undertaken by CSIRO regarding low-emission technologies offers a structure and process to any future discussions. However any consideration of a future nuclear power program for Australia would only become clearly salient to the formation of attitudes if the more currently acceptable technologies proved to be either economically unviable or technologically more risky.

ATTITUDES TO NUCLEAR POWER

APPENDIX A – Conceptual Framework and Literature Review

1. CONCEPTUAL FRAMEWORK

This section outlines the conceptual framework developed for the study. It has two key sections: the first discusses social network analysis, epistemic communities and innovation diffusion; the second presents the review of literature associated with attitudes to new technologies and what is termed the ‘social constitution’ of civilian nuclear power. Overall, this section gives the conceptual rationale for the data collection instruments developed and for the analysis which is reported in the major section of the report.

1.1 On social network analysis – epistemic communities and innovation diffusion

Social roles and personal identity are critical to an understanding of opinions, attitudes and behaviours. Socio-demographic ‘attributes’ are one of the key generators of social roles (Smith, T 2007:380). They are linked to occupational status, education levels, membership of professional associations, and to other specific relationship ties such as those of family or kinship. Socio-demographic attributes assist in the formation of values that underpin attitudes, and they help to explain why it is ‘easier’ to test for opinions (the verbal expression of an attitude) rather than the attitude itself (the deeply held, and often under-explicated value) (Jones 1982).

The acquisition and personal shaping of worldviews (opinions/attitudes) are strongly affected by the ‘interplay between the structure of the social network in which individuals are embedded and the interactions that take place within it’ (Wu & Huberman 2006:2). Oliver and Myers point out that it is difficult for researchers to understand the diffusion of knowledge across networks, given that there is little objective data ‘on the social relationships and communication processes involved’ (Oliver & Myers 2003:1).

This is relevant when considering Wu and Huberman’s (2006:3) mathematically modelled conclusion ‘that a small number of individuals with high social rank can have a larger effect on opinion than individuals with low rank’. In other words, the formation of Australian attitudes to nuclear power, both historic and contemporary, is likely to be affected by a small number of individuals with high social rank who are connected through socio-demographic structures (i.e. within key groups).

The formation of socio-demographic ‘attributes’ is a different process from that of fad development. As Wu and Huberman point out, ‘fads’ can be considered as those opinions ‘... held by a rather large group of people [which] can become nearly extinct in a very short time, a mechanism which is at the heart of fads’ (2006:3). Therefore this project focuses on the processes associated with attitude formation rather than fads.

Social networks can be understood as ‘dynamic and productive; all are engaged in the mutual enterprise of creating values, both symbolic and economic’ (Potts et al. 2008:170). Social networks are also critically linked to ‘epistemic communities’, whose role is not only to articulate ‘the cause-and-effect relationships

of complex problems' but also (and relevant to this project) to frame 'the issues for collective debate' (Haas 1992).

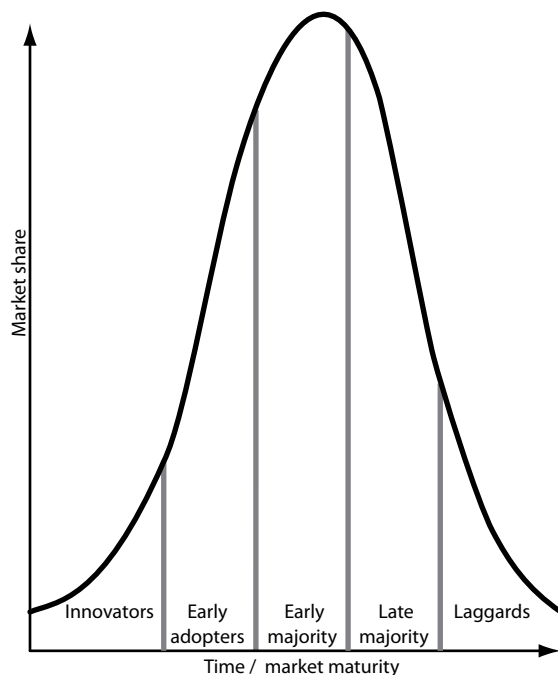
In the context of this study, the epistemic communities are not just scientific communities, but more specifically scientific communities that are bonded by a 'shared belief or faith in the verity and the applicability of particular forms of knowledge or specific truths' (1992:3). This study takes its definition of 'epistemic community' from Haas. Haas suggests that such communities can have the following characteristics:

- a 'shared set of normative and principled beliefs, which provide a value-based rationale for ... social action';
- 'shared causal beliefs ... which then serve as the basis for elucidating the multiple linkages between ... desired outcomes';
- 'shared notions of validity'; and
- 'a common policy enterprise ... to which their professional competence is directed' (1992:3).

From his analysis of Haas, (Boudourides 2004) proposes that 'individuals adjust their opinions on the basis of the perceived quality of the information' they are exposed to as a result of their involvement in a network.

Although this study is not specifically framed within social movement theory (Stern et al. 1993), it is useful to consider the potential for a method called network cartography to clarify how such epistemic communities are mobilised to promote a social change agenda (Dobson 2001). It is within such a social change agenda that new technologies are integrated, adopted or rejected. Because the goal of this study is to understand the historical and contemporary formation of attitudes to nuclear power in Australia, the diffusion model (Roger 1995) can also assist in contextualising the process of change. The diffusion model suggests that change can be considered as a 'wave' passing through society (Robinson, C & Glanznig, A 2003) as outlined in Figure A1 and Table A1.

Figure A1 Diffusion of innovations model



Derived from [http://www.greenplaybook.org/database/rte/image/OverviewDiagram2a\(2\).jpg](http://www.greenplaybook.org/database/rte/image/OverviewDiagram2a(2).jpg)

Table A1 Characteristics of Diffusion Model Segments

Segment	Characteristics
Innovators	Lead the way for others Seek opportunities to 'test' ideas Often invest a great deal of personal time, effort and energy Can often be ideologically driven
Early adopters	Quick to make connections between ideas and opportunities See their investment of resources as more than simply a financial one Open to risks Want real results Like being in front of others
Early majority	Pragmatists who will act only after solid proof Influenced by other pragmatists Not risk takers Like to hear [the] 'industry standard'
Late majority	Conservative pragmatists Dislike risk taking, but not keen to be 'left behind' Will follow the mainstream Often influenced by laggards
Laggards	Sceptics Can often raise critical issues for discussion Support compliance and regulations

Source: Derived from Robinson, L & Glanznig, A 2003:42-43

Within this diffusion model context, the methodological, social network framework adopted draws on and integrates some well-established approaches to understanding how groups in society function. These were then incorporated in the development of the rationale for selection of key informants and the e-networks invited to participate in the e-survey. Within this framework, the contribution of social capital theory to network analysis must be understood as an interactive process, rather than simply as an outcome. Within such an understanding, this study also considered the connections made between ‘micro level social interactions and their potential role as agents of change’ in the development of attitudes (Falk & Kilpatrick 1999:4).

Social capital theory also provides a structure for understanding the inter-relationships within a network cartography, through what (Putnam 2000) and others have called ‘bridging’ activities, those ‘... connected to a diversity of organisations, [that bring] connections to large and loosely coupled networks of high information potential’ (Teorell 2003:49).

Falk & Kilpatrick suggest that as a learning process, this ‘presupposes interactions between the social actors themselves and the contextual tools they employ’ (Falk & Kilpatrick 1999:4) and in this way social networks can be understood to ‘serve to structure the flow of information surrounding an individual’ (Teorell 2003:49) thereby building individual social capital in the process. Networks can also be understood to contribute by ‘linking individuals into a wider context’ and this, according to Boudourides, ‘increases the probability of exposure of the linked individuals to appeals for political action’ (2004:16). Burt suggests that network size, density and hierarchy influence the constraints associated with building social capital. However, Burt also cautions against using social networks as a predictor of change, as ‘social capital is more often a by-product rather than a goal’ (Burt 2000:70).

Importantly, network membership and attitude formation are also gendered, and have intergenerational implications (Stern et al. 1993). Both of these aspects were considered in the analysis that follows.

2. ATTITUDES AND THE SOCIAL CONSTITUTION OF NUCLEAR POWER – A REVIEW OF LITERATURE

Reviewing literature on a topic as broad as this study covers could lead to discussion on topics which, while of interest, do not specifically relate to the question: how do Australians form their attitudes to nuclear power? Nevertheless, as the analysis in section 5 of this report discusses, because there is no one clear ‘pathway’ to such attitude formation, it is important that a breadth of literature is covered to enable the complexity of evidence to be contextualised.

This section is therefore divided into three key sub-sections: the first, a review of the literature regarding the formation of attitudes more broadly, specifically drawing on social psychology literature and, in some cases, on public opinion and marketing literature. The second sub-section reviews the known literature associated with current attitudes to nuclear power specifically, and to climate change and environmental issues more generally. The final, briefer, sub-section focuses on the literature associated with science and technology and the manner in which people generally relate to new forms of technology.

2.1 ATTITUDE FORMATION

2.1.1 Attitudes and language

An influential review of theories of how attitudes are formed, and how they then affect decision-making, stresses the critical point that language ‘lies at the very core ... of attitudinal experience’ (Eiser & van der Pligt 1988:5) (3). Language is central in establishing the urgency or ‘remoteness’ of an issue (Burke 2008). It is through language that we express our attitudes to others and begin to make sense

not only of the world around us, but also of the various factors that help us decide where we stand on issues. As a result

... once we express our feelings and interpretations in the form of statements about objects, people or events ... we are claiming a special relationship with reality – a correspondence between what we feel to be and what really is ((Eiser & van der Pligt 1988:3).

Attitudes therefore involve an evaluation of something or somebody and the ‘naming’ of our attitudes has two consequences, both of which are relevant to this study.

The first consequence is that measuring language through some form of metric is very difficult, and rarely accurate. Therefore any measurement of attitudes is fundamentally problematic in a way that Eiser & van der Pligt believe has not yet been successfully resolved. The second consequence is that how we form our attitudes to an ‘object, people or events’ becomes a matter for reflection and memory. We are therefore likely not to be conscious that we are forming the attitude when we are doing so; rather, we are more likely to recall the process. Such a recall could be relatively faulty, or perhaps influenced by external factors--for example, by objects which by being ‘repeatedly bolstered’ become both intense and extreme, and which need to be supported and validated (Abelson 1959:350). Language is also important when we consider the way in which specific words are used to connote. For example, as Long points out, ‘risk’ has a negative connotation--it not perceived as neutral--whereas ‘safe’ has a positive connotative and is therefore a ‘magic’ word (Long 2006:16).

At this point it is also useful to clarify the difference between ‘attitude’ and ‘opinion’. According to Katz (1960) (cited in Jones, 1982:22) an opinion is the ‘verbal expression of an attitude’ thus linking it to the complexities associated with both language and the measurement of attitude. Jones further suggests that the only true measure of attitude is a subsequent behavioural change (Jones 1982:22). The issue of attitude/opinion is also relevant when considering the value of polls seeking views about nuclear power/ climate change/environmental issues and other matters, as these polls are more likely to be structured to seek *opinion*, rather than to attempt to measure *attitude* (For a review of such UK polls see McGowan & Sauter 2005).

2.1.2 Attitudes and ‘salience’

The relationships between ‘object, people or events’ and attitude formation are also strongly influenced by its/their salience to the person concerned. Eiser and van der Pligt suggest that as

... our view of social issues is selective ... some aspects of the issue are salient to us personally whereas other aspects are not (1988:14)

Language provides the means by which such salience can be attributed, and it is also the means through which others can be persuaded to think the way that we do (16). While the authors caution against the simplistic view that persuasive language is ‘all-powerful’, they nevertheless identify three influences that language has on attitude formation: first, it brings new information for consideration; second, it affords the assertion or suggestion of new possibilities or arguments; and finally it provides a ‘framework for calculation and decision-making, whether of a practical or a moral nature’ (18). This is a crucial point when considering the formation of attitudes to nuclear power in Australia, because a recent meta-analysis of various polls on the topic in the United Kingdom highlighted that

... during the period over which most of these polls were conducted, nuclear power as an issue has lacked ‘salience’ for the public at large, in that people have been responding in a context where there has been little meaningful public or political focus on the issue (Grove-White, Kearnes, Macnaughten et al. 2006:5).

The issue of salience also becomes an important determinant of the value of public polls for measuring attitudes. As the review on energy research for the UK Research Councils highlighted, the ‘extent to which issues acquire salience will in part depend on their ‘proximity’ to the public or parts of the public i.e. how far citizens are directly affected by the issue’ (McGowan & Sauter 2005:3). They conclude that polling may not be useful and that more ‘in-depth’ techniques such as ‘focus groups, citizens’ juries or other deliberative mechanisms’ may be more successful. This issue is discussed in some more detail in section 2.3 of this Appendix.

Eiser and van der Pligt use attitudes to nuclear energy as one of their case studies of attitude formation. They make the critical point that in many cases of attitude formation, nuclear power (or energy/waste/proliferation of weapons) is used as a powerful example of an issue that acts to polarise individuals. They conclude that ‘only a small percentage of the public ... has no opinion’ on either expansion or location of nuclear facilities (Eiser & van der Pligt 1988:162), in contrast to opinion on other issues. In other words, salience is both crucial and variable, because

... people with opposing attitudes towards nuclear energy tend to see different aspects of nuclear energy as salient, and hence, will disagree not only over the likelihood of the various consequences but also over their importance. In other words, each group has its own reasons for holding a particular attitude: the proponents stressing the importance of economic benefits and paying less attention to the various risks, while the opponents attach greater value to environmental and health risks and pay less attention to possible economic benefits (Eiser & van der Pligt 1988:156) (emphasis added).

Salience is also spatial. As discussed further below, many attitude surveys have been undertaken in communities living close to nuclear power stations. Conversely, in communities for which nuclear power is not common or not available at all (such as in Australia), salience has no personal immediacy. Indeed, Seed (2006) (Head of Communications, BNFL) suggests that if ‘issues are too remote then it [becomes] easier to borrow attitudes and adopt them, or simply not to form an opinion at all’ (2006: 2).

2.1.3 Attitudes, belief systems and imagery

To add to an already-complex picture, attitude formation can be a long and complex process, drawing on individual beliefs. Individual beliefs are developed through belief systems, which begin with our early socialisation as human beings, and continue through peer and education socialisation into adulthood (Stern et al. 1995). As a result there is a link between attitude formation and the moral and political domains in which individuals operate. Nuclear power provides an obvious example of such a polarised debate, and it can also be analysed in relation to political preference (Eiser & van der Pligt 1988) as is discussed further below in section 2.1.4. Abelson uses the nuclear example to make this point:

For the antinuclear activist, nuclear power is bad, pollution is bad, natural alternative energy sources are good, conservation is good, concern about hazards to human life is good, and so on. These polarities, which exert a strong organising influence on other concepts with the [belief] system, may have a very dense network of connections ... (Abelson 1979:358)

This also confirms van der Pligt’s view that ‘... people’s attitudes towards nuclear energy are assumed to be a function of beliefs about the possible consequences of its use’ (van der Pligt 1985:90).

Affective imagery (Slovic et al, 1991 cited in Leiserowitz 2005:4) is an important component of such belief systems. Through our learning and our life experiences, we begin to attach certain images (which include ‘sights, sounds, smells, ideas, and words’) to which either a positive or negative affect or ‘feeling state’ is connected. Thus when certain language is used, mental images are roused that are

then associated with any resulting decision-making. Leiserowitz explains that:

... the images the American public associated with the stimulus 'nuclear waste repository' (images such as death, cancer and the mushroom cloud) evoked strong feelings of dread and judgement ... (Leiserowitz 2005:4).

Such mental images are reinforced and bolstered through cultural iconography, expressed in art, multi-media, film and television. They are also utilised to 'frame' associated arguments and publicity (see further in section 2.1.5 below).

2.1.4 Attitudes and peer responses

An important aspect of the current study, since it is founded on a network analysis, is the way in which we assume others (particularly our peers) share our own attitudes. Research by Marks and Miller in 1978, and cited in Eiser and van der Pligt, confirm a 'tendency to see one's own choice as relatively common' and therefore to cast the views of others as 'deviant, or inappropriate' (1988:165). Jones suggests that:

Members seek co validation for their ideas within the group, and they look to the group for knowledge. The group has therefore an effectiveness for influencing the attitudes of its members ... (1982:25).

Attitude formation through group activity can be considered as a process, one that has now become an important 'predictor' of public opinion. It remains a challenge to measure the discussions between friends, co-workers, family members or social network members. Nonetheless, some computer simulation research has attempted to do so (see for example (Novak et al. 1990), despite the difficulties associated with building models that represent systems of such complexity.

The power of groups becomes critical to a broader understanding of attitude formation. For example, research focusing on the siting of new nuclear power stations highlighted that 'people with extremely committed attitudes on an issue engage in little or no information processing' (1988:165) and as a result

... encountering others who disagree with one's own committed opinions presents a continuing challenge to one's conception of social reality. ... One looks for a way of discounting one's opponents' opinions through imputations of stupidity, short-sightedness or bias (Eiser & van der Pligt 1988:167).

A recent paper analysing attitudes to nuclear power in the United Kingdom makes the point that 'support for nuclear power is likely to vary depending on individuals' political views' (Costa-Font et al. 2008:1274) and that such political leanings can then be viewed as the 'anchor' from which these attitudes are adjusted or confirmed.

A similar point could be made about the membership of an epistemic community, and a subsequent membership of a social network as outlined earlier in section 1.1 of this Appendix. Research conducted in the United States on global warming and climate change identified several distinctive 'interpretive communities' that were 'predisposed to attend to fear and socially amplify some risks, while ignoring, discounting or attenuating others' (Leiserowitz 2005:9). Such interpretive communities are also linked to political preference, to gender, to race and to location.

2.1.5 Attitudes, opinion leaders and 'framing'

This study is based on the assumption that opinion leaders are a critical component in the process of attitude formation. Within groups and/or networks, there are critical leaders whose role is to set the agenda, enable the argument and develop the rationale for the adoption of certain views. Such opinion leaders are often public figures who are drawn into media debates and who offer leadership in a 'virtual environment'.

In some cases, as Jones points out, identification with an opinion leader goes well beyond any individual analysis of the actual opinions. Because the opinion leader is admired, the follower self-identifies as ‘obedient and faithful’ (Jones, 1982:28). Jones compares this with the follower who has internalised the issue, and no longer feels the need to simply ‘follow the leader’ because the leader’s attitudes have been accepted as ‘conducive to the maximisation of [individual] values’ (28).

According to US research, interpretive communities include opinion leaders from a variety of institutions, including churches, industry, political parties and ‘Washington think tanks’ (Leiserowitz 2005, p.:19). Downey (1986) also details the role of opinion leaders (and ideologies) within anti-nuclear power alliances on the eastern seaboard of the United States in the mid 1970s, charting links between the anti (Vietnam) war movement and other European protests at the time (Downey 1986). Downey concludes that individuals involved in such movements found a sense of identity that resonated with their own views of ‘contemporary society and the position of nuclear power within it’ (371). Thus, the success of an espoused cause is enabled when the cause is congruent with those views.

When considering how attitudes to nuclear power are formed within various contexts – most recently, within a climate change debate – the concept of reality construction, or ‘framing,’ becomes important.

Drawn from the early work of (Goffman 1974) framing describes how individuals make ‘events or occurrences meaningful and therefore able to function to organise experience and guide action’ (Benford & Snow 2000:614). In their review of recent social movement literature, Benford and Snow take the idea of framing further to consider ‘collective action frames’ used by social movements to ‘inspire and legitimate [their] activities and campaigns’ (614). The resulting ‘interactive link’ between political opportunity and collective framing processes is discussed, as is the role of activists (opinion leaders) in developing and adjusting frames according to the audience involved.

Payne argues that the framing of societal issues (such as that of nuclear power) can be viewed as ‘basic building blocks [in] the construction of broadly resonant norms’ and also for indicating ‘appropriate behaviour for that context’ (Payne 2001:39). Payne, however, criticises the ‘shortcomings of frame analysis’ particularly from a human rights and environmental perspective, by arguing that such analysis tends to mask a ‘highly contentious and distorted debate’ (39) and could be better understood ‘in terms of prevailing power structures’ rather than be accepted as a ‘causal explanation of real change’ (54).

Framing is evident in the historical and current literature associated with nuclear power proponents and opponents. For example, Downey describes the critical importance of regular newsletter and technical critiques that were distributed to the members of alliances against the building of new nuclear power stations in the late 1970s in the United States. Their argument became framed and defined ‘in opposition to the atomic-industrial establishment’ (Downey 1986:366) by offering an alternative societal structure and ideology. In this example, framing relied on the affective images discussed earlier. In more recent times, with the development of multi-media and internet, such images are used as symbolic ‘cultural shorthand’, on the assumption that the reader/viewer will understand the implied message^{xiv}.

Consequently, the more recent reframing of the nuclear power issue within an alternative context of global climate change and of increasing demands for energy security raises the question whether there has been any ‘readjustment’ of attitudes as new information is incorporated into surveys. Recent research from the United Kingdom suggests that such a framing may be causing a readjustment of attitudes (see Poortinga et al. 2006:1-2) and there is certainly much media speculation that it is occurring. However, alternative

xiv Two alternative examples are provided: <http://casenergy.org/nuclear-energy/casenergy-classroom/nuclear-and-the-environment/>; and <http://nuclear-news.net/2009/06/26/www-wpcva-com/>

research from the United Kingdom suggests that ‘current perceptions appear to be influenced by pre-existing and latent understandings of both nuclear energy and the nuclear industry’ (Grove-White, Kearnes, MacNaughten et al. 2006:5) which underlines the importance of an historical (genealogical) pathway to the analysis of attitude formation as per section 5.1 of this report. Recent research regarding attitudes to nuclear power in the context of climate change (Pidgeon et al. 2007) are detailed in section 3 of this report.

In their review of previous research on attitudes to nuclear power, Costa-Font et al conclude that factors critical to the maintenance of existing attitudes were lack of detailed information, lack of trust in state ‘protection’, or lack of trust in the technologies associated with operating nuclear power plants, (Costa-Font et al. 2008:1276). However, their UK based research found that, contrary to previously published results, ‘knowledge decreases support for nuclear power generation’ (1284). In other words, they argue that simply giving people more information is not necessarily the pathway to greater acceptance. Instead, they conclude that people give more weight to their underlying political beliefs when making up their minds about nuclear power and are not always influenced by additional information about safety and risk management. The political pathway to attitude formation is discussed in further detail in section 5.3 of this report.

2.2 TOWARDS A ‘SOCIAL CONSTITUTION’ OF CIVIL NUCLEAR POWER

A ‘social constitution’ approach drawn from a recent UK analysis links the development of public attitudes to civil nuclear power with social movements and with the place of technology within wider social relations. Grove-White et al suggest that:

Different technologies bring with them distinctive patterns of relationship with society – through the demands of their particular industrial structures, their regulatory requirements and their perceived social ‘externalities’ in short, they cement and reproduce their own distinctive patterns of *social relations* (Grove-White, Kearnes, MacNaughten et al. 2006:242 emphasis in original)

To explore the social relations of civil nuclear power, including the importance of gender and place, in this section the literature about known attitudes is reviewed and an historical analysis is charted.

2.2.1 A decade of change

Internationally, attitudes towards nuclear power shifted during the 1970s from consistently high levels of support (van der Pligt 1985) to an increasing demand for the involvement of civil society in decision-making about nuclear power. This included not only the siting of new power stations and the location of waste facilities but also the issue of the continued proliferation of nuclear weapons. Van der Pligt (1985) charts this shift as related to three interconnected factors: the 1973/74 energy crisis, the growth of a ‘mature’ environmental movement and increasing media coverage (87).

Some commentators suggest that the coalescence of attitudes towards the peace movement/feminist movement/environmental movement, which included attitudes towards nuclear power, can be seen as a social movement in its own right. It is a movement concerned not so much with technical issues as with the ‘wider social relations in which the particular technology [is] embedded’ (Grove-White, Kearnes, MacNaughten et al. 2006:242). This coalescence of attitudes to nuclear power could be seen as sharing, with other such movements, the aim of a ‘fundamental restructuring of society’ (Stern et al. 1993:323) including the active involvement of ‘influence agents’ (both pro and contra) who ‘frame environmental conditions’ strategically to achieve their objectives (Stern et al. 1995:1631).

Eiser and van der Pligt (1988) provide a useful review of the history of the development of attitudes to nuclear power internationally. They conclude that ‘since the mid-1970s there has been a dramatic

increase in public concern' (151) and they describe how this concern resulted in national debates or national campaigns, such as those in Austria (1976-7) and in the Netherlands (1982-3).

Such public concern also resulted in a number of government inquiries, and alongside these, 'a substantial number of public opinion polls on a variety of nuclear issues' were conducted (p.151). A review of these inquiries identifies a noticeable decline in support for nuclear energy in the United States, even prior to the Three Mile Island accident in 1979 which, until Chernobyl in 1986, was the most 'serious accident in the history of nuclear energy' (Eiser & van der Pligt 1988:151). Writing post-Chernobyl, Eiser and van der Pligt (1988) make the important point that although there had been a 'rebound' in support after the Three Mile Island accident (1979) in the United States, support had still not reached the levels held prior to the accident (152). In the authors' subsequent review of surveys conducted at that time in Europe, they draw a similar conclusion, which was that there was a general decline in public support for civil nuclear power between 1978 and 1982. They stress that the surveys were conducted before the Windscale (now Sellafield) events in the UK early 1980s and before the Chernobyl accident. In other words, Eiser and van der Pligt argue that the decline in public support from the 1980s onwards should not be directly attributed to such accidents/incidents, but that the accidents/incidents aggravated an existing trend.

Research undertaken at the time suggested that during the 1970s and 1980s public attitudes towards the technology associated with nuclear power also shifted, and it began to be understood as an 'unusually *centralising, inflexible* and *security-sensitive* energy technology' (Grove-White, Kearnes, Macnaughten et al. 2006:10) (emphasis in original) which then contributed to what the authors term the 'social constitution of civil nuclear power'.

Recent discussions in the United Kingdom have highlighted the continued 'polarised' nature of the debate in that country. Sir David Wallace^{xv} has noted that the matter is often debated as a 'trade-off between renewable sources of energy and nuclear power' and has called for policy based on 'evidence' and not on 'ideology'. For his debate opponent, Tom Burke^{xvi}, the issue is not only 'socio-political' but also concerns 'private investor' risks, and he makes the call for the 'nuclear chimera' to be 'abandoned' in favour of investment in renewable technologies (for further detail see BBC News 2005b; Burke 2005). For further analysis of attitudes in Europe and North America see Chapter 3 of the main report.

2.2.2 The importance of place

Place is a critical component in any analysis of the formation of attitudes to civil nuclear power. Place is important not just as a consideration of where such civil nuclear power is currently available (i.e. country) but also where such power facilities would be located (i.e. region/town/community). Eiser and van der Pligt (1988) point out that there has been a decline in support for the building of facilities close to where people live, which is commonly referred to as the NIMBY, or the 'not in my backyard,' attitude. They chart a decline of some 20 per cent of support over a period between 1979 and 1983 in the United States (153) (after the Three Mile Island accident but before the Chernobyl accident). Rosa warns against too much stress on the 'building reactor polls', as they have 'no fixed anchor point, since – by definition- the future is just that, an unspecified time later, not now' (Rosa 2001:2).

Decline in support for civilian nuclear power can also be charted in relation to the issue of nuclear waste disposal, and the potential location of such disposal sites (Duncan 2001). Duncan links the relationship between the building of facilities such as nuclear power or waste disposal stations with the concept of 'nuclear blight' and he connects an impact on land and house prices in affected areas (2001:161) with the subsequent general NIMBY response. Chapter 3 of the main report discusses opinion polls conducted in Australia

xv <http://www.newton.ac.uk/history/wallace.html>

xvi <http://www.e3g.org/index.php/about/Tom-Burke/>

following the release of the UMPNER Report, which *inter alia* outlined one scenario where Australia could have 25 nuclear power facilities by 2050. Appendix C is a detailed case study from that period.

Another factor associated with ‘place’ comes out of research undertaken with communities that already have a nuclear power facility. Longitudinal research over five years undertaken by Cardiff University of communities near nuclear power stations in three different locations (Essex, Gloucestershire and Somerset) concludes that ‘local residents were not simply pro- or anti-nuclear power’. Rather, their views were more subtle in a number of ways. Table A2 describes these in more detail.

Table A2 Nuclear power acceptance by types of responses by location

Type	Proportion	Descriptor
Beneficial and Safe	34%	The power station brings benefits for local communities, and there was high trust in plant safety
Threat and Distrust	16%	Risks outweigh benefits; distrust of government and industry; support for renewable
Reluctant Acceptance	38%	Support is highly provisional and potentially subject to change
There is no point worrying	12%	Have few concerns; are critical of authority and reject critics of nuclear power

Source: derived from Cardiff University 2008:2

The research concluded that:

... many remain ambivalent towards nuclear power, and strong mistrust of both the industry and Government is voiced by a further significant minority of residents. Accordingly, any such erosion of local confidence could have adverse consequences for relations between the nuclear industry and local communities, and for the nuclear new build programme as a whole. This clearly argues against complacency about the future (Professor Nick Pigeon, University of Cardiff, 2008:2).

2.2.3 Factoring in gender and inter-generational differences

An important aspect of any analysis of attitude formation to nuclear power is the differentiation between men and women and between generations, in both the process of attitude formation and the attitudes subsequently held.

Gender differences have been analysed in relation to attitudes held about nuclear weapons (Peterson et al. 1990) as well as nuclear power (Brody 1984; Costa-Font et al. 2008). The results have been described as a ‘gender gap’ (Solomon et al. 1989:401) following an analysis of a study to test the Brody hypothesis on gender differences conducted in North Carolina in the mid 1980s, which focussed on opposition to the construction of a new facility some four months post Chernobyl.

In their review of the literature, Solomon et al (1989) identify what has been termed an ‘awareness hypothesis’ in regard to gender analysis. This hypothesis is that women have not been ‘socialised to understand technical and environmental issues’ and as a result, are less likely to support nuclear power (402). A second explanation for the ‘gender gap’ is what has been termed the ‘economic growth’ argument: that men are more likely to be involved in technological innovation, and are therefore more likely to have ‘vested interest in new technologies to aid economic expansion’ (402). A further explanation, and one argued by (Brody 1984), is related to women’s greater ‘concerns about safety issues’ because of ‘their primary responsibility ... for child rearing’ (403). The Solomon et al research tested these hypotheses within what they termed a ‘politicized environment’ and their conclusions supported Brody in that ‘women’s higher safety concerns explains the gender gap in attitudes toward nuclear power’ (412).

Importantly for the current study, Brody also found that women tended to ‘view the energy crisis as a more serious problem than did men, implying a greater perceived need for new sources of energy’

(1984:226). He concluded that when women are ‘provided with convincing evidence of its safety’ they would be more inclined than before to accept nuclear power (227). Conversely, and in support of Brody’s study, the Solomon et al research also found that ‘women are more likely than men to modify their opinion of nuclear power in the face of more negative information’ (1989:412).

An overview of some 30 opinion polls/surveys conducted in the UK between 2002 and 2005 and focusing on energy technologies found that overall men were ‘more supportive’ for nuclear, more aware of renewable energy sources and more likely to support wind power stations and nuclear power stations. Also, there was an ‘overwhelming’ proportion of women favouring additional renewable capacity compared with men (Derived from McGowan & Sauter 2005:26).

In their extensive review of the eco-feminist and environmental behavioural literature and from their own subsequent research (Stern et al. 1993:340) conclude that although women link the consequences of environmental quality to their ‘personal well-being, social welfare, and the health of the biosphere’ there is no gender difference evident between those willing to take political action and those willing to meet higher costs. They conclude that

... women tend to see a world of inherent interconnections, whereas men tend to see a world of clearly separate subjects and objects, with events abstracted from their contexts (340).

This research also recognises the importance of age, life circumstance (i.e. whether or not women are parents) and beliefs about the ‘effects of environmental problems’ (Stern et al. 1993:340). However the concepts of such relationships between gender and environmental risk have been challenged (Freudenburg & Davidson 2007). Conclusions from research undertaken around the issue of nuclear waste disposal indicated that ‘overall differences in attitudes between women and men fall short of standard levels of statistical significance’ (236). Freudenburg and Davidson’s discussion focuses on a number of variables that may have influenced the results, including place, role identity and history. Freudenburg and Davidson call for more nuanced research factoring in the impact of economic concerns that appeared to override any health/safety or risk concerns. Finally, and relevant to the discussion in section 2.3 below, a meta-analysis of risk research by Costa-Font et al found that ‘women appear more risk averse than men ... tend to view nuclear energy risk as higher ...and benefits lower’ (Costa-Font et al. 2008:1277).

On the issue of intergenerational differences in attitudes, in a longitudinal study in Finland, Helve (1993) identified the importance of socialisation of children on the subsequent attitudes of young people. She reported that while ‘for a young person it is not easy to form an opinion about and an attitude towards such environmental questions as ... the question of nuclear power, ... girls tend to have a more critical attitude towards nuclear power than do boys’ (Helve 1993:5).

Intergenerational differences were also identified in a recent Harris Poll undertaken in the US and summarised in Table A3. The question: ‘In general do you favour or oppose the building of more nuclear power plants in the United States’ identified a ‘generation gap’ between support in the baby boomer/mature group and that in the Gen Y group.

Table A3 Building more nuclear power plants now by generation (US)

	Generation				Total %
	Gen Y (18-31 years) %	Gen X (32-43 years) %	Baby Boomers %	Matures (63+) %	
Favour (Net)	35	47	52	63	49
Oppose (Net)	38	35	31	24	32
Not at all sure	27	18	16	11	19

Source: Harris Interactive 2008

Unfortunately, none of the surveys and opinion polls reviewed for this study was available in an analysed intergenerational form. This is research that is still waiting to be undertaken in further detail.

2.3 SCIENCE, TECHNOLOGY AND COMMUNICATING WITH THE RISK SOCIETY

There has been a great deal of interest in the inter-relationships between science, technology and society (STS) since the growth of the science ‘disciplines’ in the early 18th century. Australia now teaches STS as an integrated, multi-disciplinary approach to critical problem solving^{xvii}.

As the report to the UK Parliament highlighted, ‘in common parlance, *scientific* is almost synonymous with *certain*’. The Report concluded that in an increasingly uncertain world facing major challenges, uncertainty lies in a liminal space occupied by risk. It is within this space that science and society can be seen to ‘cross swords’ (United Kingdom Parliament 2000 Chapter 4:1).

Slovic and Weber indicate in their analysis of risk perception and disaster the ‘fact that the word ‘risk’ has so many different meanings often causes problems in communication’. Some such problems stem from the assumption that risk can be quantified objectively (Slovic & Weber 2002:4) or that it can be ‘solved’ (Von Lensa c1998) rather than it being a characteristic of modern societies.

Determining and measuring risk is a highly contested area of research. As the National Academy of Sciences in the United States pointed out in 1980, the frequencies of nuclear accidents, upon which such risk analysis is based, ‘may have been overestimated’ with industry analysts typically arguing that these are ‘incorrect and ... misleadingly presented’. On the other hand nuclear critics argue that the casualty figures are ‘underestimated’ (United States National Academy of Science 1980:8)^{xviii}. For Slovic and Weber, the perceived risks associated with nuclear reactors and fallout from nuclear weapons lie in the ‘dread risk/unknown risk’ category. ‘Risk amplification’ occurs when one additional incident (however minor) magnifies the perceived risk (Slovic & Weber 2002:13). Research undertaken in the UK indicates that ‘where individuals feel that risk extends beyond them to include family member and members of their larger social circle’ more concern is expressed (Costa-Font et al. 2008:1274).

In an attempt to understand how attitudes are formed, Eiser and van der Pligt (p.154) also review the literature associated with risk perception. They conclude that ‘the lay public defines risks in much broader terms than the expert’ when it comes to nuclear power, primarily because the ‘hazard is relatively unknown’ and the ‘conceivable consequences’ are seen to be ‘catastrophic’ (155). Leiserowitz (2005) comments that ‘recent research on risk perception’ has found that public perceptions of risk are ‘influenced not only by scientific and technical descriptions of danger, but also by a variety of psychological and social factors, including personal experience, affect and emotion, imagery, trust, values and world views’ (4). Leiserowitz makes the obvious point that such more subtle dimensions are rarely examined by opinion polls.

Bickerstaff et al (2008) suggest that while ‘risk has become a defining societal discourse’ it nevertheless is used to frame ‘public issues that centre on the potential social, environmental, and cultural implications of scientific research and technological innovation’ in ways that do not then allow for the ‘uncertainty and indeterminacy’ in how people make decisions (Bickerstaff et al. 2008:1313). Their research included testing the risk perceptions associated with nuclear waste disposal. They found that if institutions ‘deploy’ a ‘rhetoric of responsibility while disregarding the causes of the ambivalence which colours many citizens’ attitudes towards responsibility, [this] is likely to have the unintended effect of heightening

xvii For example at Griffith University (<http://www.griffith.edu.au/environment-planning-architecture/urban-research-program/study-employment>)

xviii Such polarised positions are very evident in much of the post-Chernobyl accident analyses and commentary.

scepticism towards institutions’ (p.1327). On the issue of nuclear power, Ulrich Beck (*The Guardian* 2008) suggests that ‘many decisions about large-scale risks are not a matter of choosing between safe and risky alternatives, but between different risky alternatives’. As a pioneer of ‘risk studies’ his view is reported here in full:

In the case of nuclear power, we are witnessing a clash of risk cultures. Thus the Chernobyl experience is perceived differently in Germany and France, Britain and Spain, Ukraine and Russia. For many Europeans the threats posed by climate change now loom much more largely than nuclear power or terrorism. ... The most tenacious, convincing and effective critics of nuclear energy are not the greens: the most influential opponent of the nuclear industry is the nuclear industry itself. Nuclear power is constant, permanent and remains present even when exhausted demonstrators have long since given up. The probability of improbable accidents increases with the number of ‘green’ nuclear plants; each ‘occurrence’ awakens memories of all the others, across the world. For risk is not synonymous with catastrophe. Risk is the anticipation of catastrophe, not just in a specific place but everywhere (*The Guardian* 2008:2 stress added).

This section of the study calls on the ‘social constitution’ of civil nuclear power and draws from recent research conducted in the United Kingdom for the UK Sustainable Development Commission (Grove-White, Kearnes, Macnaughten et al. 2006). This report makes an important and relevant link to the technology of the past and of the future. It concludes that even though nuclear technology has changed a great deal, much of the ‘public scepticism’ (risk averse) towards the technology remains because of the ‘centralisation and inflexibility inherent in the industry’ in the past (10). Accordingly, it is simply too early to speculate whether there will be a change in public opinion just because the technology has changed. Indeed many scholars are occupied with the question of what might constitute an appropriate level of (a) public understanding and (b) trust in science and technology, and how these have been nourished, reinforced and sometimes lost.

In explaining how major long-term technological changes occur within societies, Geels (2002) argues that changes in elements of symbolic meaning play an important part. Thus technology (in this case, nuclear power) does not come about on its own; it is associated with ‘human agency, social structures and organisations’ (Geels 2002:1257). Such technology becomes ‘embedded’ and only then does it work through a series of linked elements, both social and operational. He argues that ‘...radically new technologies have a hard time to break through, because regulations, infrastructure, user practices, maintenance networks are aligned to the existing technology’ (1258). The role of societal groups, their networks and their relationships with institutional infrastructures is also crucial to any change being adopted. He describes in some detail the struggles associated with the acceptance of innovation, primarily a struggle which is not only at the level of ‘lobbying and institutional entrepreneurship’ (Geels & Schot 2007:415) but also at the level of accepted assumptions, symbols and cultural repertoires (415), which then enable active agency. He suggests that, while there is ‘internal logic’ to such technological transition pathways, they should not be viewed as ‘deterministic’ or ‘automatic’. Smith et al extend this argument further by exploring the inter-relationship between power, groups and agency (Smith, A et al. 2005:1504). They suggest that there is a ‘resource interdependency’ in play as no one person ‘has sufficient resources on their own to coordinate responses’. As a result ‘networks of resource-interdependent members’ are established and the

... legitimate authority to push change through or the resources available to build consent, to raise informed dissent, or even to block change, will depend on power relations across the networks actors. [Therefore any change] ... will need to be carried through within networks of actors possessing the wherewithal to adapt the incumbent regime or create alternatives ... ((Smith, A et al. 2005:1508).

An example of such a network of resources activated to mobilise a challenge to the nuclear power industry can be found in Downey’s analysis of the Clamshell Alliance of New England (USA) in the early 1970s.

He describes in detail the process through which the Alliance researched the industry, and then published 'numerous pamphlets and articles detailing virtually every reported worst-case scenario ... [with] all available evidence' to 'better communicate its position to outsiders' (Downey 1986:366). Downey concludes that if '... it were not credible to view the technology as posing unacceptable hazards, then nuclear power could not be an instrument of establishment domination nor provide evidence of the existence of domination' (371).

When discussing the relationships between science and society, the previously-mentioned United Kingdom Parliamentary Report stressed that science 'cannot ignore its social context' (United Kingdom Parliament 2000 Chapter 3:1). The Report referred to a 'crisis of trust' which has permeated both sides of the issue (see also Marshall 2007). On the one hand, while people remain 'deeply uneasy' about technological advances and events (such as the BSE 'fiasco' ^{xix}), a 'climate of deep anxiety' exists among scientists themselves' because of this 'public unease, mistrust and occasional outright hostility' (United Kingdom Parliament 2000 Chapter 1:1). The Report included much analysis from various surveys of attitudes. Overall, it concluded that although public interest in science in the UK remained high, the trust issue can be linked to the fact that the 'relationship between experts and the rest of society is changing' (Chapter 2:5) - a point also discussed further in section 2.3 of this report. A key recommendation from the Report was that 'direct dialogue' between science and the public should no longer be an 'optional add-on', but rather a 'normal and integral part of the process' (Chapter 5:2).

This mistrust of institutions has also been reported in the US, specifically in relation to nuclear power technology. When considering the contradiction in public views (i.e. 'no nuclear now, but we expect it to be important in the future') Rosa (2001) suggests that it is linked to 'past accidents, misrepresentations by the nuclear industry ... and a growing mistrust of many institutions, especially institutions associated with nuclear power ... [that] have made the public apprehensive about the technology' (3).

The contradictory nature of the relationship between people and technology, and those who promote the technology, is also evident in research undertaken by the Pew Centre in its 1999 Millennium Survey. Results of the survey revealed that just 48 per cent of Americans agreed that the development of nuclear energy was a 'change for the better', compared with the computer (87 per cent), the automobile (91 per cent) and the radio (96 per cent) (Pew Research Center for the People and the Press 1999:1). This issue was also discussed in the International Social Survey Program (ISSP) Environment survey conducted in 1993, when Australians were asked to comment on the statement: 'we believe too often in science, and not enough in feelings and faith' with a response of 40.9 per cent reporting they agreed and 8.4 per cent strongly agreed. In this same survey, on a subsequent statement: 'overall, modern science does more harm than good' the majority of Australians (44.2 per cent) disagreed or strongly disagreed (9.8 per cent) (ISSP 1993:8-9). This is an interesting finding, given that Australians have historically been noted for their rapid uptake, assimilation and adaptation of new technologies, from refrigerators to mobile phones, which at least some might see as being connected with 'science'.

For Fisher et al, such ambivalence can be explained by the anxiety associated with the question 'who will control the resulting technology?' which has in turn led to an 'increased questioning of [scientists'] ethics [and] motives' (Fisher et al. 2007:1262). Von Lensa recommends that to be truly successful and sustainable, any future motivation for 'innovation and technological evolution' would be best based on 'the adaptation of reasons that [stem] from the psychological mechanisms for acceptability and from clearly defined reasons for objection and fear' (Von Lensa c1998:244).

A further important issue is the inter-relationship between the science of climate change and the science of nuclear power. As already noted, the resurgence of debate about the potential contribution of nuclear

xix BSE (Bovine spongiform encephalopathy) – sometimes also called 'mad cow' disease.

power towards reducing dependence on fossil fuels and hence reducing greenhouse gas emissions (see as examples Garnett 2000; Hore-Lacey 1997) has also linked the debate to investment in alternative energy and to both green and neo-conservative politics.

Leisorowitz (2005) points out the link to neo-conservative politics in the USA through the connection between neo-conservative goals to ‘undermine totalitarian regimes’ with goals of reducing dependency on Middle East fossil fuels (20). Members of neo-conservative groups also consider climate change a ‘moral and ethical’ dilemma. On the other hand, those identified as ‘alarmists’ (21) in relation to climate change ‘hold extremely negative images that go well beyond scientific assessments of climate change risks’, thus inadvertently providing ‘ammunition to naysayers who in turn claim that global warming is a hoax’ (21).

Involving the public in science debate is a relatively new practice and as Katz et al point out, ‘... in many mainstream scientific research organisations it is still a radical concept’ (Katz et al. 2007:1). Some recent attempts have been made to introduce approaches that place science in its ‘social and political context, and respond to the social and political demands of that context’ (Dickson 2006:2), but overall such undertakings remain a point of negotiation and renegotiation on a case-by-case basis. Communication with the public has tended in the past to be one-way (i.e. science expert to uninformed public) but Dickson and others highlight the urgency to see it as a potential tool for capacity building and empowerment. It is well beyond the scope of this study to comment on the adequacy (or otherwise) of the work so far undertaken in Australia on this issue. However, it could form the basis of future research activities.

What can be broadly termed ‘citizen science’ has recently been taken up in a number of projects by CSIRO (see for example CSIRO Centre for Low Emission Technology 2009; Fisher et al. 2007; Katz et al. 2007). The Energy Transformed Flagship at CSIRO commissioned work by Ashworth et al. to develop deliberative processes across all states so that informed discussion might achieve balanced decision-making about low emission energy technologies (LETs). The workshops conducted by CSIRO were based on research indicating that attitudinal change can occur when ‘cognitive effort is rewarded with the satisfaction of resolving a problem or achieving greater understanding of an issue’ (Ashworth et al. 2009:4). In these workshops the science associated with LETs and their inter-relationships with climate change and energy resources is provided as interactive information, open to debate and question. The effectiveness of this means of transferring technological information was measured in pre-and post-test processes using a digital voting process, known as Digivote^{xx}. Ample time for group discussion was provided, and the interactive workshop was run as a ‘safe space’ environment where all participants felt comfortable seeking responses and making their views known^{xxi}. Findings were that such processes can ‘shift perspectives’, because they provide an important opportunity for complex science to be communicated to an interested public forum in an environment that does not patronise or attempt to compromise views.

An alternative approach to citizen science and community consultation (also undertaken within CSIRO) and described as ‘community value analysis’ (Fisher et al. 2007:1268) is a method which involves some forecasting of potential community concerns. Foreknowledge of such concerns allows ‘scientists and decision-makers’ to be prepared with a response, as it provides a ‘clear insight into the drivers of community attitudes’ thus enabling long term ‘fine tuning’ of the science communication message.

For Katz et al, democratic decision-making in science communication is a matter of good R&D governance. In other words, for Katz and her colleagues, having the scientist involved in a workshop is not enough to achieve effective knowledge transfer. They warn against using ‘public engagement as a

xx See <http://www.bramshaw.com.au/digivote.html> for details.

xxi Professor Stehlik acted as a group facilitator in the Workshop held in Perth in October 2008.

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means of legitimating expert decisions' falling into what Glimell suggests are a kind of 'politics played out on the scientists' home turf' (Glimell, 2004 cited in Katz et al. 2007:11).

Finally, the new 'types of architecture', or ways of organising information required for effective citizen science, should harness new communication technologies including social computing. As Vogel et al suggest, such ways of organising information include 'policy communities, policy stream, advocacy coalitions and epistemic communities' rather than continuing to rely on 'silos of knowledge' (Vogel et al. 2007:351).

APPENDIX B

Case Study: News Media Pathways

INTRODUCTION

To illustrate in detail the processes by which the media influence the formation of attitudes about nuclear power, a case study ‘snapshot’ derived from a variety of sources during July 2009 was undertaken. That month was chosen for two main reasons (1) the Federal Government announced the approval of a new uranium mine, and (2) there were reports of Rio Tinto’s submission to the Federal Government Energy White Paper. The period also coincided with a build-up of several weeks of reporting of various commentaries on the ‘science of climate change’ (see for example Melleuish 2009; Walker 2009).

July 2009 also included an ongoing debate about the proposed Emissions Trading Scheme (ETS) in Federal Parliament as well as the lead up to the ALP National Conference later that month.

Also in that month, former US Vice-President Al Gore visited Australia, creating heightened interest in climate and energy issues, prompting comments from various international experts and putting the issue on the ‘international stage’. In addition, at the height of coverage, the media used several avenues to gauge the public mood through brief opinion polls.

The sub-headings below represent the ‘framing’ underway throughout the period.

Golden opportunities

The following develops the narrative through a chronological analysis, contextualised by a number of factors. First, a decision was made by the Australian Labor Party in 2007 to end its ban on extending uranium mining beyond its then existing ‘three mines’ policy, after which a Liberal/National government was elected in Western Australia and immediately announced support of uranium mining in that state. Second, there were continuing discussions about a site for nuclear waste in the Northern Territory, which had been the subject of a Senate inquiry and associated community consultations in 2008. Third, in May 2009, BHP Billiton released its Environmental Impact Statement on the proposed expansion of its Olympic Dam site (Martin Ferguson, Federal Minister for Energy, as cited in ABC News Online 2009e); the Northern Territory Government gave approval to a joint venture exploration of a uranium deposit south of Alice Springs (ABC News Online 2009a); and BHP Billiton announced it was seeking EIS approval for its uranium mine at Yeelirrie, Western Australia (ABC News Online 2009b). This interest also raised discussion about uranium mining companies as listed on the Australian stock exchange, and on the ‘golden opportunities’ present in the sector, not just for shareholders, but also for the national economy through the creation of jobs (Bromby 2009), which was promoted as a way to ‘dig our way out of this economic slowdown’ (Martin Ferguson, Federal Minister for Energy, cited in ABC News Online 2009b). There was also some continuing discussion about the role of nuclear power and the responses to its perceived potential in combating climate change (Brook 2009a, 2009b).

Changing the way we think

Former US Vice President Al Gore arrived Australia in mid July 2009 to participate in an ‘extensive’ training event for 300 ‘grass roots’ people with the purpose of ‘putting pressure on governments’ and ‘to change the way people think about the climate crisis’ (Al Gore cited in *ABC 7.30 Report* 2009). It was also an event to launch a new initiative, Safe Climate Australia^{xxii}. The visit created an opportunity for protests both for and against action on climate change and for political comments. For example, on the same day, it was reported that climate ‘sceptic’ Senator Steve Fielding (Family First Party) briefly met with Gore (ABC News Online 2009d), and that commentators challenged the Federal Government’s policy of research into ‘clean coal’ as the solution to climate change (*ABC 7.30 Report* 2009). At the same time, Senator Fielding also discussed the climate change debate with Federal Government representatives and subsequently issued a report challenging their views^{xxiii}.

During an ABC *Lateline* interview on 13 July 2009 that included both Gore and Fielding, one commentator suggested that:

We should be scared. We are facing a nightmare scenario. I know people want to feel hopeful and optimistic about [clean coal], but I think we’re beyond feeling hopeful, and the only way to get people to take the necessary action is to scare the pants off them (Clive Hamilton cited in *ABC 7.30 Report* 2009).

A further interview was then conducted with Lord Anthony Giddens, a British sociologist, who suggested, among other things, that the climate change debate would benefit from the ‘greenery’ (green movement) being stripped away (Anthony Giddens cited in *ABC 7.30 Report* 2009) and that the controversy surrounding the subject was understandable, given the relatively abstract nature of the threat.

Betting big on new uranium

On 14 July, the Federal Government, through the Minister for the Environment, Peter Garrett, announced it had approved a new uranium mine in South Australia (Chambers 2009; Fitzgerald 2009; *The Age* 2009b). The reporting focussed heavily on the fact that, prior to entering politics, the Minister had been part of a rock band, Midnight Oil, which had ‘sung against the nuclear industry’ (*The Herald Sun* 2009a); that he had also previously been a President of the Australian Conservation Foundation (ACF), which strongly advocated against the mining of uranium; and that he had previously stood for Parliament as a candidate for the Nuclear Disarmament Party (*The Australian* 2009f).

The link between nuclear power, uranium mining and climate change was subsequently made on that day, when the Prime Minister Kevin Rudd was asked why ‘he didn’t allow a domestic nuclear power industry’ and replied that ‘renewable energy and cleaner-coal technology was the best way for Australia to tackle climate change’ (Prime Minister, Kevin Rudd, cited in *The Herald Sun* 2009a). Responses to the announcement were also made by the Liberal Coalition Shadow Minister for the Environment: ‘The promises Peter Garrett chose to make on uranium mining stand for nothing – and nor does he, any longer’ (Greg Hunt cited in *The Herald Sun* 2009b). Anti-nuclear activist Dr Helen Caldicott also accused Mr Garrett of a ‘descent into moral turpitude’ (Helen Caldicott cited in *The Herald Sun* 2009b). In the same article, it was noted that the Australian Uranium Association ‘welcomed the mine announcement’.

In the days following, the focus remained on the Minister and on his apparent ‘different stand’ regarding uranium mining. Greens Senator Bob Brown suggested that Garrett had ‘lost his way’ and had ‘sacrificed

xxii see <http://www.safeclimateaustralia.org/> (Retrieved 18 August, 2009). See also <http://beyondtalk.net/> a website which responds to the various calls made by Al Gore and others.

xxiii see http://www.stevefielding.com.au/images/uploads/8_Carter-Evans-Franks-Kininmonth_DDR-v_4zzz_-_medium.pdf (Retrieved 18 August 2009).

himself to Labor politics' (*The Sydney Morning Herald* 2009b). Veteran political reporter Laurie Oakes commented that such a reaction to the issue was one which Garrett himself had been 'prepared to wear' and that this was how the 'Westminster System operates' (News Online 2009).

Support did come from Mitch Hooke, CEO of the Minerals Council of Australia, for the 'financial [as well as] environmental benefits' of uranium mining (cited in *The Sydney Morning Herald* 2009b), and from the National Secretary of the Australian Workers' Union, who argued that uranium mining gave 'real economic opportunities ... for Australia' (Howes 2009).

On the same day, during interviews following his meeting with the Prime Minister Kevin Rudd, Gore was further drawn into the discussion, stating that Australia was 'in the line of fire' and that 'no nation is more vulnerable to the impact [of climate change]' (cited in ABC News Online 2009f). Gore also suggested that 'markets should determine the role of nuclear power in the future' and that the 'more serious issue is cost' with a lack of 'accurate cost projections' [for such building] from any 'engineering firm anywhere in the world'^{xxiv} (cited in *The Sydney Morning Herald* 2009a).

Also on 15 July, articles appeared citing Beyond Nuclear Initiative/Friends of the Earth. They linked the uranium mine announcement to the issue of waste disposal, arguing for a repeal of the legislation that enabled a waste repository to be built in the Northern Territory (*Commonwealth Radioactive Waste Management Act*) (*The Sydney Morning Herald* 2009c). On the same day, the Sydney Nuclear Free Coalition organised a protest at the office of Minister for Infrastructure, Anthony Albanese, at his Sydney electoral office (*The Australian* 2009a). Subsequent letters to the Editor of *The Age* from, among others, Dr Jim Green (Friends of the Earth) raised the issue of in-situ leaching and groundwater and environmental protection at the newly approved Four Mile uranium mine (*The Age* 2009a).

Popular scientific opinion

In its editorial on 15 July, headed 'Stop Scaring us Silly' *The Australian* suggested that 'environmental activists' were sabotaging 'climate change solutions,' citing the interviews held previously on *ABC Lateline*, and concluding that the 'debate needs more engineers interested in clean coal and fewer eco-catastrophists'. On the same page, *The Australian* also cited Roland Rudd^{xxv} in The [UK] *Daily Telegraph* (11 July) as saying it was 'hard to enthuse people about the need to combat climate change through fear' (*The Australian* 2009e; 2009i:13). *The Adelaide Advertiser* commented on the issue in its editorial that day and proposed that

... popular scientific opinion has swung towards the view that uranium, and its use to produce nuclear energy, is a vital component in the battle to preserve the world's environment

and, pointing to the 'large potential economic pay-off for South Australia,' suggested that

... to attempt to hold a Federal Government Minister to account because of his actions while a private citizen, is churlish' (*The Advertiser* 2009).

In a subsequent editorial in *The Sydney Morning Herald* on 16 July, it was proposed that the links between Garrett and his 'evolution from uncompromising outsider to compromised insider' could be more usefully viewed as a 'metaphor for a dramatic change in the debate' [and that the] 'world has changed, and carried Garrett with it' (*The Sydney Morning Herald* 2009a). In *The Age*, Associate Editor

xxiv However James Jeffrey does point out that one question that Gore did not answer was: 'whether a country was hypocritical if it refused to embrace nuclear power while selling its uranium to the world' (Jeffrey, 2009:11).

xxv See <http://www.finsbury.com/> retrieved 19th August, 2009.

Shaun Carney reflected on the media response as follows:

The public and media reaction this week should provide food for thought for Kevin Rudd. Garrett's responsibility was to act on advice about the environmental impact of the Four Mile mine, not to make a decision on the merits of uranium mining. That had already been taken by the (South Australian) Rann Government, which wants more mines (Carney 2009).

Also on 16 July, two different links to the issue appeared. The first (health) in *The Age* (and picked up by *The Sydney Morning Herald*) linked the debate to health issues, Chernobyl and the 'threat of nuclear weapons' through the death in Melbourne of a young woman born in Poland through cancer, allegedly 'by the radiation' from the Chernobyl accident (Buttrose 2009). The second (weapons) pointed to a relationship between a director of the company that owned the new Four Mile uranium mine and General Atomics, a 'US weapons and nuclear energy corporation' also chaired by that director (Cubby 2009).

The Australian issued a further editorial on 16 July that drew its heading 'Power and Passion' from a Midnight Oil song. It linked the opening of the mine with nuclear power by strongly endorsing a different energy future:

Amid fears about fossil fuels and climate change, more nations are turning to nuclear power as a clean, greener alternative. ... The Rudd Government is opposed to nuclear power in Australia, but the economics of climate change and carbon reduction should force a rethink. ... Mr Garrett ... has shown a welcome aptitude for putting the national interest first (*The Australian* 2009g).

A reasoned debate about the debate

In *The Herald Sun* on 16 July, journalist Andrew Bolt found a link between the Minister's previous stand and the idea that a 'reasoned' nuclear power debate was 'impossible in this country'. He writes:

So clean is it that nuclear power is in fact our only hope in this cooling world to slash our emissions by whatever the Greens now demand. Yet even this warming-obsessed Government does not dare to consider allowing nuclear power for Australia, even though Garrett is allowing another uranium mine to feed the reactors of America. That's part of Garrett's legacy. That's how he's poisoned the well, making reasoned debate on anything nuclear almost impossible in this country (Bolt 2009).

Bolt rejects what he terms the 'irrational' argument made by Buttrose on the previous day (death by cancer), as an example of the 'unreason' espoused by the 'Garrett generation':

What more evidence does the Garrett generation need to be convinced nuclear power will fry us alive? In this case it's the word of a writer who says a man told him a doctor had told him he was surprised by a cancer (Bolt 2009).

The issues of Minister Garrett, the Federal Government decision on a new uranium mine, and the Minister's previous statements on uranium mining and nuclear issues were still being discussed in opinion pieces in *The Australian* the following week. For journalist Janet Albrechtsen, the 'Garrett saga' highlighted not only the 'particularly unfortunate outgrowth of modern culture: the idealisation of idealism' but also the need to consider the world a 'complex place where good policy depends on ministers having less passion and more rationality' (Albrechtsen 2009). For *The Australian's* Emma Tom, writing the following day and comparing 'Australia's nuclear energy ... with flibbertigibbet brides', the issue was more to do with 'attitudinal turnarounds' and everyone being 'permitted to change our minds' (Tom 2009).

On 22 July, when Matthew Franklin in *The Australian* led with the following front page headline about a submission from mining company Rio Tinto 'PM told nuclear is best hope', the debate shifted more directly

from uranium mining to nuclear power. This article suggested that the timing of the Rio Tinto advice to government was related to Federal Minister for Energy, Martin Ferguson's previous announcement that he 'emphatically rejected the need for nuclear power generation in Australia.' The Rio Tinto advice was that there were 'overly optimistic assumptions on the viability of alternatives' [which] have 'false optimism' which the government must challenge by commissioning new research' (Franklin 2009b). The article continues:

[Rio Tinto's] submission in response to a government White Paper on energy ... warns that Australia must be prepared to consider all energy sources if it is serious about meeting its carbon emissions reduction target of 60 per cent by 2050 (Franklin 2009b).

On the same day, the editorial in *The Australian Financial Review* headed 'Nuclear power a credible option' proposes an 'uncomfortable reality ... that coal – perhaps the chief culprit for global warming – is responsible for more than 80 per cent of our electricity and about a quarter of our emissions' and that the various alternatives such as renewables and carbon capture and storage (CCS) may not yet be proven:

What then? [it asks] ... it makes no sense for Australia to turn a blind eye to a proven source of emissions-free, baseload electricity: nuclear power. ... This debate should begin with the government's energy White Paper, and not wait the best part of two years until after next year's election' (*The Australian Financial Review* 2009).

Climate Change Minister Penny Wong gave the Federal government's response to the Rio Tinto proposal, arguing that 'conventional energy resources, as well as renewable energy resources' were the preferred alternatives (Australian Government Department of Climate Change 2009b; Kerr 2009b). On the same day, ANSTO Chairman Ziggy Switkowski compared renewables to a 'cottage industry of windmills and solar hot water services ... [which] are simply not up to the task of producing baseload electricity, cost-competitively, without major technical challenges' (ABC News Online 2009g), while Senator Bob Brown (Greens) pointed out that while 'Rio Tinto was in the business of promoting nuclear power ... Australians didn't want it. ... Coal and nuclear are both last century. This is a century of renewables' (*The Australian* 2009b).

In the context of climate change

On 23 July, *The Australian* reported on its front page a report prepared by the financial services firm Morgan Stanley to examine the impact of an Emissions Trading Scheme (ETS) on coal generators and to call for further investment in diversification into renewable energy. On the same page, the headline 'New uranium mine enlivens nuclear bid' concerned plans for announcing a new mine in Western Australia, which would prompt an escalation of 'calls for Kevin Rudd to dump his ban on the use of nuclear energy to broaden the nation's energy sources' (Franklin 2009a). This story drew the following comment from Senator Barnaby Joyce (National Party):

... if Mr Rudd believed nuclear energy was evil, he should not be prepared to sell uranium. I don't believe in nuclear weapons, but I do believe in nuclear energy. ... We have got to get our thinking out of the 1950s and into 2009 (Franklin 2009a).

The article suggested that this raised the issue of a 'debate' about nuclear power. One commentator reported that he saw 'a much more rational, data-based discussion about the merits of nuclear power' (Switkowski), while an industry spokesperson argued that there was a 'clear case for a public debate' (M Angwin, Australian Uranium Association). However Senator Brown commented that 'uranium was dangerous to the environment ... political poison' which had cost the Liberal/National coalition an election (Franklin 2009a).

On 23 July the Climate Change Minister, Penny Wong, was asked to clarify her position on the Rio Tinto proposal in a radio interview. Her response in full follows:

Minister: ...I think Australians have made it pretty clear their views on nuclear power domestically. And when you're trying to shift your energy sector over the next 10 or 20 years as Australia is, to try and build a lower carbon energy sector you have to make some choices now. Our view is that the two areas we need to focus on are first, to try and reduce our emissions from coal fire power and second, to invest in renewables. I mean Australia is blessed with an enormous range of renewable energy sources. And we as a government believe that what is much more preferable is to make the investments we need into the renewable energy sector to grow that sector to improve out technology, our innovation, in those sectors, rather than focusing on nuclear power.

Q: We've seen a change, if you like, in the general understanding of what Labor party policy would be on, certainly, uranium mining. [I'm] just wondering if there's any point in time where we might see a change in the swing back to nuclear energy given that there seems to be a, well an ongoing push, certainly it's an ongoing discussion point of the consideration of nuclear energy.

Minister: We've made our position clear, we're opposed to nuclear power domestically. If there's any movement it seems to be on the other side. Mr Turnbull, Mr Robb his shadow minister has been talking about these sorts of possibilities. We've rule out domestic nuclear power in Australia, I think the question is really whether the Opposition will do that (Interview with Martin Corden, ABC 702 Sydney, Australian Government Department of Climate Change 2009a).

In the 'Letters to the Editor' in *The Australian* on 23 July energy discussions continued, with the CEO of the Australian Petroleum Production and Exploration Association arguing that the Rio Tinto rejection of natural gas as an option for future energy security was based on a 'false premise' that had led to 'distortions' in the debate on 'preferred energy sources'. A further letter began 'at last common sense is emerging' pointing to the 'hypocrisy' associated with selling uranium while 'banning its use in Australia'. A letter from New South Wales called the Rio Tinto advocacy as 'a reality check', highlighting the inefficiencies of wind and solar and the 'variable electricity output' which could not provide the base-load necessary. Also from New South Wales, another letter writer, who identified himself as 'formerly active in the anti-nuclear movement', was now providing 'cautious support' to Rio Tinto. He suggested that the 'notion of clean coal being pushed by the Labor Party has far more to do with politics than technological reality'. The final two letters commented on the lack of any other 'perspective or analysis' than that of Rio Tinto, and this was, in fact, a successful public relations exercise on the part of the Company - 'since when did I subscribe to The Aust-Rio-lian?' (*The Australian* 2009c).

On 'green faith'

On the same day, ABC NewsRadio ran an on-line poll with the question: Would nuclear power be acceptable if, as Rio Tinto suggests, it is the key to keeping power bills down? The response was 63.2 per cent no; 36.8 per cent yes (ABC NewsRadio 2009)^{xxvi}.

In the *Australian* on 24 July, Federal Minister for Energy and Resources, Martin Ferguson published an opinion piece 'Humanity can't power progress with green faith' where he wrote, inter alia, that:

As an energy-rich nation with a wide range of options, Australia does not need to pursue a domestic nuclear power industry, yet many nations are not so lucky. For them, a nuclear energy capacity is vital to respond to the challenges of climate change and energy security ... the true environmentalists are those willing to embrace science and technology in the search for safe, environmentally sustainable and affordable ways to deliver uranium,

xxvi A poll was also run that week in *The Australian*, but despite best attempts to retrieve the summary, it was not located. Requests for copies of various polls run in *The West Australian* were also not successful.

LNG, low-emission coal and renewable energy technologies. The world needs all of them for a cleaner energy future (Ferguson 2009).

Responses came from Senator Ian McFarlane, Shadow Minister for Resources, saying that ‘the government must promote debate on nuclear energy’ (Ian McFarlane reported in Franklin 2009c) and from Senator Bob Brown, that ‘Martin Ferguson is a total, 100 per cent lackey of the mining industry. ... Renewable energy including baseload solar, but in particular energy efficiency, is not only ready to take down off the shelf but it’s cheaper and will create more jobs than coal or nuclear’ (Senator Brown cited in Franklin 2009c). A further response also came from journalist Terry McCrann in *The Herald Sun* on 28 July: ‘If we want to have electricity and not emit carbon dioxide, TINA – there is no alternative – to nuclear’ (McCrann 2009).

The front page of *The Australian* on 24 July referred to the ‘odds’ among ‘senior liberals’ on the issue of climate change and ETS (Shanahan 2009). Its editorial that day, ‘Power to the People, whatever the source’, stressed the paper’s support of nuclear power: ‘...alternatives are essential. And nuclear energy is the obvious option. ... Nor should Canberra rule out ever allowing a nuclear power plant at home’ (*The Australian* 2009h). This was also a theme picked up in the Letters to the Editor that day. For example:

... many people voted for Labor on the basis of its opposition to nuclear power ... [its] directions ... were in sharp contrast to the casual attitude of the Howard government ... a strong turn-off for many voters ... there is still no valid reason for Australia to embrace nuclear power ... we need to be very concerned about risk factors, including the safe disposal of waste (M Schilling, Millswood SA cited in *The Australian* 2009d).

Again:

... nuclear power has to be part of the energy mix if we are serious about reducing carbon dioxide in an energy-hungry economy ... we have slipped dangerously behind most other countries in not having people with the skills to develop any kind of nuclear industry in the future ... (R C Warn, Griffith cited in *The Australian* 2009d).

In the subsequent *Weekend Australian* (25–26 July), an opinion piece reported on an interview with Professor Jorg Imberger (UWA) who suggested that nuclear energy technology is ‘ready and commercially viable’ and proposed a solution to the ‘small amount’ of waste disposal in ‘stable, remote geological sites across [WA]’ (cited in Barass 2009). The article concluded by saying: ‘... the next phase of the debate about our nuclear future is about to begin. And Copenhagen will be the starter’s gun’ (Barass 2009).

The month concluded with an interview with Stephanie Cooke, editor of *Uranium Intelligence Weekly*^{xxvii}, about her book *In Mortal Hands*, a history of nuclear development since the 1950s. Here is her comment about the expansion of uranium mining in Australia: ‘... does Australia want to bear the long term consequences of uranium mining and does it want to participate in an industry which ultimately can make the question of proliferation a lot, lot more challenging than it is today?’ (cited in an interview with Peter Cave ABC Radio ABC News Online 2009c). Also, the Labor Party Conference held at the end of the month ‘excluded any reference to a 2007 party resolution’ to repeal the *Radioactive Waste Management Act* which allows the Federal Government the option to ‘establish a waste dump in the Northern Territory’ (Franklin 2009c).

xxvii See <http://www.energyintel.com/about.asp?id=m#Pub104> Retrieved 19th August, 2009.

ATTITUDES TO NUCLEAR POWER

APPENDIX C

Case Study: Political Pathways

A 'full-blooded debate': the Switkowski and Prosser Reviews leading up to the 2007 Federal Election

'I want a full-blooded debate in Australia ... and I want all of the options on the table. I have a very open mind on the development of nuclear energy in my own country' (Prime Minister John Howard speaking in Canada ABC News Online 2006r).

'For John Howard to say that there hasn't been a debate on nuclear energy would suggest that he went to sleep in the 50s and he's just woken up' (Albanese 2006).

INTRODUCTION

In 2005-06 two national reviews of the uranium industry and nuclear energy technologies provided a framework for political debate on the issues. The announcement, conduct, findings and outcomes of the Uranium Mining, Processing and Nuclear Energy Review, UMPNER (Chair: Dr Ziggy Switkowski), and the House of Representatives Standing Committee on Industry and Resources Report on Australia's Uranium (Chair: The Hon Geoff Prosser MP) were reported on in late 2006. These events offer a recent example of the way in which the political debate is shaped in Australia, the complex inter-relationship in that debate between civil nuclear power and uranium mining, and the place of civil nuclear power on the political platforms of all parties.

This case study outlines the contextual conditions within which the UMPNER announcements were made, then continues with a brief chronological outline of the Review processes and the political context in which they were formed and within which they provided their findings. Where available, the case study includes data from public opinion polls taken at the time, and concludes with an outline of the involvement of key opinion leaders in the shaping of the overall debate.

CONTEXT

A useful starting point is a major forum held in Melbourne in 2003. At the Melbourne Climate Change Conference, 'Beyond Kyoto: Economic Impacts and Alternative Strategies', Melbourne, 28 February, 2003 (Institute of Public Affairs 2003:3) the contribution of civil nuclear power to the plans to reduce greenhouse gas emissions was reported as being 'back on the agenda', despite the then (Liberal/Coalition) Minister for the Environment, Dr David Kemp stating that '... nuclear power is off the agenda and will stay off' (cited in ABC News Online 2003:1). At the Conference, Dr Kemp stressed that:

... 'I don't hear any significant change in the community's attitude on nuclear power. I think people feel there are many unanswered questions about it. They're not at all convinced that there are satisfactory ways of dealing with the waste over the longer term. The [Liberal/Coalition] Government has got a very clear view that there is no future for nuclear power in the way that Europe has gone down that track.' (ABC News Online 2003:2)

Alternative views at the Conference were reported from the Australian Uranium Information Centre, and from the Electricity Supply Association of Australia (now the Energy Supply Association of Australia). They provide a snapshot of the disparate views expressed by opinion leaders at that time:

'It has no relevance to current planning, no relevance to any issue that we are addressing. The debate here in Australia is, how do you use cleaner coal?' (K Orchison, ESAA).

'I'm just very curious as to why this Government hasn't got it on the agenda, given that it declares it's serious about reducing greenhouse gas emissions. And the most ready way of doing that is to start replacing coal-fired generation as it becomes old, and clapped out and need replacing, with nuclear power' (Ian Hore-Lacy, UIC).

In the two-year period between this Conference and launch of both Inquiries, there was, on occasion, some relevant discussion about the role of nuclear power in the context of the broad 'climate change debate', usually in the context of greenhouse gas emission technologies (This was also tracked overseas, for example see (Toke 2005)). Two examples demonstrate this. The first, from the left side of the political spectrum from a Worker's Liberty opinion piece in February 2005, where the question was asked: 'should socialists oppose nuclear power out of hand?' and the conclusion was '... we should not' (Thomas, M 2005:1). From the political right was an opinion piece in *The Herald Sun* in March, 2005, which argued that because of the greenhouse gas crisis '... some environmentalists and government are now re-examining the nuclear option' (Mike Nahan in *The Herald Sun* 2005:1).

In June 2005, speaking at the Australian Institute of Energy conference in Sydney, Prime Minister Howard was reported as saying:

'This country has enormous supplies of uranium and it would strike a lot of people as an odd contradiction that we would not allow a debate on nuclear power in Australia yet we would be quite happy under appropriate safeguards to export large amounts of uranium' (cited in ABC News Online 2005b).

This view was supported in September that year by the then Foreign Minister (Alexander Downer) who was reported commenting that:

'... one could comprehend someone not caring about cutting greenhouse gases and being opposed to nuclear energy, but it takes quite a challenge of the intellectual imagination to say you're concerned about greenhouse gases and you're opposed to nuclear energy' (cited in ABC News Online 2005a:1).

In the lead-up to the announcement of the UMPNER review, the key discussion points focussed primarily on the mining of uranium ore and on its sale overseas. There was discussion as to the potential of sales to India and the signing of sale agreements with China (ABC TV *7.30 Report* 2006f; ABC TV *Lateline* 2006b), which was increasing pressure on existing ALP policy regarding expansion of new uranium mining activity (ABC News Online 2006j). In particular, there was a focus on those States that had uranium ore deposits such as Western Australia, where the issue of 'national interests' taking precedent over state interests was first raised by the Prime Minister who suggested that the 'export of uranium' offered one such issue (Prime Minister John Howard cited in ABC TV *WA Stateline* 2006). The mining of uranium ore also raised issues of enrichment and waste disposal and, later, location of any proposed nuclear power stations (ABC News Online 2006e), with the ALP challenging the Prime Minister '... If Mr Howard wants nuclear reactors in Australia, let him name the postcodes' (Leader of Opposition, Mr Kim Beazley cited in ABC News Online 2006b). The then Science Minister, Dr Brendan Nelson, was quoted as stating that 'in terms of high level waste, if it were ever to be produced from an Australian nuclear industry, well that will be a matter for the governments of the day' (cited in Australian Fabians

2006:2), stressing the essentially political nature of the issue. However on the question of the economics of a nuclear power industry, alternative views also continued to be expressed within the Liberal Party (ABC News Online 2006o; ABC TV *7.30 Report* 2006d).

TIMELINES

In March 2005, the House of Representatives Standing Committee on Industry and Resources established a sub-committee (Chair: Hon Geoff Prosser MP^{xxviii}) to inquire ‘into the strategic importance of Australia’s uranium resources’ with a particular focus on ‘... waste management across the nuclear fuel cycle’, health risks, and consultation with Traditional Owners (Australian Government House of Representatives 2006). Public hearings were conducted in three States and both Territories between August 2005 and March 2006. Eighty-seven submissions were received and 93 exhibits, including a number of technical reports. Mr Prosser was a recognised advocate of both uranium mining and nuclear power. ‘If we are going to reduce greenhouse emission targets nuclear energy is the only way to do it and I would have thought it would have been the right thing to do, the responsible thing to do’ (G Prosser cited in ABC TV *WA Stateline* 2006).

The Prosser Review received less overt media attention in comparison with UMPNER review. However, in May 2006, when Prime Minister John Howard called for a ‘full-blooded’ debate focusing on the establishment of a civil nuclear power industry in Australia (ABC News Online 2006s; Macintosh 2007b) the issue again emerged as a political point of differentiation between the major political parties, including the Greens. The Liberal’s coalition partner, the National Party, expressed the need for an ‘open mind’ on the issue of bringing nuclear waste back to Australia (acting Prime Minister, Mark Vaile cited in ABC News Online 2006g), while the ALP stressed that there were ‘many Australians who would be extremely disappointed by a shift in our position and who may [then] consider changing their primary vote [if we do so]’ (Anthony Albanese cited in Australian Fabians 2006:5).

The Prime Minister’s call was then followed up with an announcement on 6 June of a Review focusing on ‘health and safety implications, and the impact on the environment’ (ABC News Online 2006s:1) of uranium mining, but more specifically to ‘undertake an objective, scientific and comprehensive review of uranium mining, value-added processing and the contribution of nuclear energy in Australia in the longer term’ (Switkowski 2006:1). The Chair of the Taskforce to conduct the UMPNER review was named as Dr Ziggy Switkowski. Other members announced included Professor G Dracoulis (ANU) and Professor W McKibbin (ANU/Reserve Bank Board) (Environment News Service 2006; Switkowski 2006). The then Defence Minister, Dr Brendan Nelson, was quoted as Australia needing to have a ‘responsible and mature debate ... about whether there is a place for nuclear power generation’ (cited in ABC TV *7.30 Report* 2006d).

On the following day (7 June) it was announced that Dr Switkowski had temporarily resigned from his position as Chairman of the Board of the Australian Nuclear, Science and Technology Organisation (ANSTO) to Chair the Review, and also that the CEO of the World Wildlife Fund (WWF) Australia, Greg Bourne, had declined an offer to be a member of the Taskforce (ABC News Online 2006v). The UMPNER Inquiry received over 230 submissions, conducted a ‘wide range’ of consultations and commissioned ‘specialist studies’ on various aspects of the nuclear industry ((Switkowski 2006), its purpose being to: ‘... provide a factual base and an analytical framework to encourage informed community discussion.’

xxviii Liberal Member for Forrest, Western Australia.

It therefore transpired that the Prosser Inquiry was concluding its national consultations at the same time that the UMPNER Inquiry began planning its own consultation.

In the lead-up to the release of the UMPNER report, and at the Pacific Basin Nuclear Conference, the Prime Minister and the Minister for Industry and Resources both gave strong support to the need for nuclear power to ‘combat global warming’ and speculated that the first power plant could be built ‘within a decade’ (cited in *The Herald Sun* 2006b:1). This brought then Opposition Leader Kim Beazley into the debate with Labor backing ‘renewable energy as the solution to global warming’. Therefore prior to the release of reports from the Prosser Review and UMPNER, the Opposition ALP was of the opinion that the ‘... line’s very clear’ – ‘John Howard is now very firmly committed to a nuclear future for this nation. We say no, that’s not the modern way. To be about a decent Australian future, you’re about renewables, you’re about solar power, wind power’ (Kim Beazley cited in *The Herald Sun* 2006b:1).

Subsequently, at the Queensland Liberal Party State convention in November 2006, and also prior to the release of either report, the Prime Minister restated his position: ‘Nuclear power is potentially the cleanest and greenest of them all’ (cited in *The Sydney Morning Herald* 2006b:1). ‘I believe that the world attitude to nuclear power is changing and Australia’s attitude to nuclear power is changing’.

Prior to its release for comment on 21 November, 2006, the Draft UMPNER report was reviewed by an ‘expert panel chaired by the Chief Scientist’ (Switkowski 2006:1). The Prosser Inquiry Final Report was released on 4 December 2006. The Final UMPNER report was released in December 2006.

PUBLIC OPINION POLLS

To coincide with the Prime Minister’s announcement, on 7 and 8 June 2006 a Roy Morgan Survey (Roy Morgan Research 2006) was conducted which asked, among other questions, ‘... have you read, seen or heard about the (UMPNER) Inquiry?’

A response of 73 per cent of those Australians surveyed had heard about the Inquiry, with 27 per cent reporting they had not heard about it. Metropolitan area residents reported ‘having heard’ at 76 per cent, while rural residents reported at 68 per cent. Men reported at 78 per cent while women reported at 69 per cent.

Respondents were then asked ‘... do you believe the inquiry into the Australian Uranium Industry should proceed or not?’ 71 per cent agreed that it should proceed, with 22 per cent reporting that it should not proceed (80 per cent of men agreed; 64 per cent of women agreed; 72 per cent of metropolitan Australia agreed; 70 per cent of country Australia agreed).

Table C1 ‘Should the 2006 Inquiry into the Australian uranium industry proceed or not?’ Analysis by federal voting intention

	June 2006	L-NP	ALP	Greens	Indep/Other	No Answer*
Yes, should	71	87	63	59	75	59
No, should not	22	10	27	39	20	30
Can’t say	7	3	10	2	5	11
Total	100	100	100	100	100	100

* Includes all respondents who were undecided on voting intention, plus those ineligible to vote and those aged 14-17 years.

Source: derived from Roy Morgan Research 2006:4

The Roy Morgan Poll offers an immediate example of the differentiation by voting intention of people’s attitudes to nuclear power, and concomitant issues of building power plants and of waste disposal. On

responses regarding approval or disapproval 'of nuclear power plants replacing coal, oil, and gas power plants to reduce greenhouse gas emissions' a total of 49 per cent of respondents approved, 37 per cent disapproved and 14 per cent could not say. Men approved at 60 per cent and women approved at 38 per cent. Men disapproved, at 29 per cent, and women disapproved, at 45 per cent. By State, approval was highest in Queensland and disapproval highest in South Australia/Northern Territory. Responses by Federal voting intention are given in Table C2.

Table C2 'Do you approve or disapprove of nuclear power plants?'
... by Federal voting intention

	June 2006	L-NP	ALP	Greens	Indep/Other	No Answer*
Approve	49	57	39	25	56	61
Disapprove	37	25	48	64	33	29
Can't say	14	18	13	11	11	10
Total	100	100	100	100	100	100

*Includes all respondents who were undecided on voting intention, plus those ineligible to vote and those aged 14-17 years.

Source: derived from Roy Morgan Research 2006:4

A further question was then asked on concern about disposal of nuclear waste. 87 per cent stated that yes, they were concerned; 12 per cent that they were not concerned, and one per cent could not say. Men were concerned at 83 per cent and women at 91 per cent. Men were not concerned at 16 per cent and women not concerned at eight per cent. The State with the highest concern about the disposal of nuclear waste was Western Australia at 94 per cent; the highest not concerned was 21 per cent in South Australia and Northern Territory. The analysis is given in Table C3.

Table C3 'Are you concerned about the disposal of nuclear waste?'
... by Federal voting intentions

	June 2006	L-NP	ALP	Greens	Indep/Other	No Answer*
Yes, concerned	87	85	89	97	91	81
No, not concerned	12	15	10	3	9	17
Can't say	1		1			2
Total	100	100	100	100	100	100

*Includes all respondents who were undecided on voting intention, plus those ineligible to vote and those aged 14-17 years.

Source: derived from Roy Morgan Research 2006:5

THE POLITICAL RESPONSES

Public discussions, including general reactions from all sides of politics as well as challenges to the detail and findings of both reports, continued from June 2006 until well into 2007 and the lead-up to the Federal Election later that year. There were two areas of primary focus: the location of future power stations and the management of waste.

On 8 June, following the announcement of the UMPNER review, the then Federal Treasurer (Peter Costello) stressed that any Australian civil nuclear power would need to be 'competitive and economical' (cited in ABC News Online 2006m:3). Also Prime Minister warned the Labor States that '... not only can [they] change [political parties], but within State governments of the same political persuasion there can be great change' (cited in ABC News Online 2006m:4) and that is 'happening with the Labor Party now, on uranium mining and potentially uranium enrichment'. For the Greens, the members of the Review and the statements from the Government highlighted the 'real agenda', which the Greens claimed to be to enable a 'nuclear enrichment industry and a global nuclear waste dump' (Senator Christine Milne, 14 June The Australian Greens 2006), a view supported by the ALP (ABC News Online 2006i). The

Greens then called for a referendum on the question of whether Australia should enrich uranium (ABC NewsOnline 2006h) and in a further interview Senator Milne gave her view on the inter-relationships between government and business, as follows:

It is very clear to me that this is a push by the nuclear industry for huge amount of public money put into universities, put into skills training, all for the nuclear industry, to the detriment of the renewables, which can provide a solution for climate change (cited in ABC News Online 2006n).

Following the release of the UMPNER report in late November 2006, the Chairman expressed the view that the ‘... community, while not supporting the introduction of nuclear power in Australia yet, at least is more prepared to consider the facts’ (Ziggy Switkowski cited in News.com.au 2006). However, one comment in the report suggesting that the location of nuclear power stations made ‘most sense’ ... ‘close to coal-fired power stations’ (cited in ABC News Online 2006q:2) raised some immediate critical responses.

The Opposition raised the issue of the Federal Government potentially ‘overruling the will of the States’ (ABC News Online 2006q) and political discussion then expanded into a debate about the Federal/State framework (State’s rights), with the Labor States translating the finding of a ‘viable’ nuclear energy industry for Australia by UMPNER to a debate about where such reactors would be built. Overall, there was a rejection of the idea, with South Australian Premier, Mike Rann, for example, announcing his government would legislate to ‘prevent a nuclear power station ever being built in the State’ (cited in The Australian 2006a) and a few days later, an announcement from Queensland that a Bill ‘banning uranium enrichment plants, nuclear power stations and nuclear waste sites’ would be introduced. In addition, this legislation would ‘allow Queenslanders to vote on whether they wanted nuclear facilities if the Federal Government passed its own laws allowing a nuclear industry’ (see comments in ABC TV Lateline 2006c; The Australian 2006b). Also in December, the Senate passed the *Environment and Heritage Legislation Amendment Bill* (Parliament of Australia 2006a), an action that was seen by some commentators not as a coincidence but rather as now making it ‘legal to set up a high-level nuclear waste dump in Australia without resort to public input or transparency’ (Bellingen Institute 2007a:2; 2007b; New Matilda 2007).

Early in 2007, The Australia Institute released several opinion papers regarding the siting and location of power plants and reported on opinion polls commissioned to seek views on attitudes to living near such facilities. Responses included that it was ‘too early to discuss the location’ (Environment Minister Malcolm Turnbull, Liberal); calls for transparency as to a possible planned business investment in such sites (Natasha Stott Despoja, Australian Democrats); an alleged ‘inner cabal’ of Government and business leaders (Christine Milne, Greens) establishing a company with nuclear interests; calls for urgency to ‘convince the public that nuclear power is the way forward’ (Mal Washer, Liberal, Western Australia); and statements that the Latrobe Valley was ‘not an appropriate location for a nuclear power plant’ (Russell Broadbent, Liberal, Victoria) (ABC News Online 2007i). Other Liberal backbenchers similarly rejected the idea: ‘there won’t be any nuclear reactor in the electorate of Hume’ (Alby Shultz, Liberal, NSW); in the Maranoa region (Bruce Scott, Nationals, Queensland) (ABC News Online 2007d); or in Victoria (Ted Bailleau, Liberal, Victoria) (News Online 2007). The Prime Minister subsequently supported the idea of local ‘binding plebiscites’. Despite the prevailing ‘not in my back yard’ (NIMBY) attitude, he continued to believe that ‘some Australian communities would vote in favour of having a nuclear power station built nearby’ (ABC News Online 2007a).

The debate also put the spotlight on the uranium mining policy of the Australian Labor Party. As early as July 2006, in the middle of the UMPNER review, the ALP Opposition Leader, Kim Beazley had announced he would move to ‘scrap the party’s three mines uranium policy’ (ABC News Online 2006c). The ALP was not unanimous on such a move, which was linked publically with the debate raised by

the Prime Minister (ABC News Online 2006k). However the Beazley announced did represent a differentiation between the parties and enabled the Leader of the Opposition to point out that the 'real debate here is emerging clearer and clearer, and that is between the Australian Labor Party, who does not believe ... there ought to be nuclear power and enrichment in this country, and John Howard who believes there should be' (Kim Beazley cited in ABC TV Lateline 2006a). The debate in early 2007 leading up to the ALP Federal Conference focused on the different views within the ALP as to the future of any expansion of uranium mining, with Peter Garrett reported as opposing any expansion and Chris Evans reported as stating the policy needed to be abandoned (cited in ABC News Online 2007e).

On April 28, 2007, in drawing on the findings of both the Prosser and UMPNER reports, the Prime Minister announced a 'new strategy for the future development of uranium mining and nuclear power in Australia', with relevant Ministers asked to develop the necessary work plans to achieve a pathway to an 'appropriate nuclear energy regulatory regime' (Australian Government, Prime Minister 2007). Just prior to the release of this statement, the ALP announced a decision to remove its prohibition on the development of new uranium mines, a decision which was immediately welcomed by the uranium industry (ABC News Online 2007c; Australian Uranium Association 2007b).

In late May 2007, it was announced that the Northern Land Council had nominated Muckaty Station near Tennant Creek as 'the site for a national nuclear waste facility', an announcement which drew condemnation from other Traditional Owners, and from the NT Labor Government (Northern Territory News 2007c, 2007d). This announcement was followed by a motion passed by the Liberal Party Federal Council in early June 2007 and led by the Federal Liberal Women's Committee (Liberal Party of Australia Federal Women's Committee 2009) 'urging the Government to build a 'worldwide nuclear waste storage in the geotechnically stable and remote areas that Australia has to offer' (cited in Northern Territory News 2007b). This was subsequently rejected by the Federal Industry Minister who stated that the 'Government had no intention of changing the law' (Environment News Service 2007; Northern Territory News 2007b)^{xxix}. At the same time, the Western Australian Labor Government announced plans to introduce legislation to 'ban' nuclear power stations^{xxx} (Perth Environmental Issues 2007).

In June 2007, 12 months after the establishment of the UMPNER review and in the context of the Prime Minister's call for a 'full-blooded debate', the Chairman of the Review reflected on the 'remarkable progress' made. He stated that '... we have come from a position where nuclear power was not an acceptable topic within polite Australian society, to one where many people have an informed view and are open to debate – though not necessarily supportive' (Switkowski 2007:3). He remained pragmatic about the response from the Australian public. 'Australia still needs to come to a shared view about the seriousness of climate change and the implications of global warming... and unless those attitudes change, nuclear power will not be considered as part of the solution' (cited in ABC News Online 2007b).

To conclude this section of the case study, two quotations (cited in ABC TV *7.30 Report* 2006a) serve to summarise the political positions at the end of the period.

... I think we've come a long way. I think the public's interested. I think the public will listen to the debate. I don't think they have the prejudice against nuclear power that Mr Beazley and [Senator] Bob Brown have. I'm open-minded about nuclear power (Prime Minister John Howard – 21 November, 2006).

xxix According to Environment News Service, the full resolution also included the following statement: ... that the Liberal Party 'believes that nuclear power is the most significant component of an immediate response to climate change and calls on the Australian Government to introduce a technical and regulatory scheme, including appropriate environmental and operation safeguards, and any other measures necessary for the development and provision of nuclear power on a market driven basis' (2007).

xxx A subsequent state election in Western Australia in late 2008 and the appointment of a Liberal/National coalition government enabled the announcement of the lifting of the ban on uranium mining in place in that state since 2002.

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If John Howard is re elected, we'll go down an inexorable course for 25 nuclear reactors in this country and tens of thousands of tonnes of nuclear waste. If the Labor Party is elected, we will go down the path of clean coal and renewables, it's as simple as that. There is an absolute divide on future energy needs of this nation ... the question Mr Howard needs to answer is this where will the 25 reactors go? (Leader of the Opposition, Kim Beazley – 21 November, 2006).

By mid 2007, it was clear that a Federal Election would be called by year's end and the political debate surrounding nuclear power became caught up in the strategies associated with achieving or retaining government by both parties and the publicity re-focused on the siting of any future power stations. In September, when the Prime Minister confirmed that he planned to legislate to build 25 nuclear power stations (Australian Labor Party 2007a) by 2050, the ALP launched an interactive website and stated 'the next federal election will be a referendum on nuclear reactors' and any 'talk[ing] down the prospect of a nuclear power plant' by the then Federal Minister for the Environment (Malcolm Turnbull) was 'because he knows it is election day ... just weeks away' (ABC News Online 2007h; Australian Labor Party 2007a, 2007b; Northern Territory News 2007a). The election was called on 14 October, and at the Federal election on 24 November 2007, the Australian Labor Party gained power.

PUBLIC OPINION

A further national survey of opinions about uranium and related matters – including climate change - was undertaken by ANOP for the Australian Uranium Association over the period 2–4 March 2007, to coincide with the release of the UMPNER report and to gauge opinion following the accompanying commentary.

This poll found that 75 per cent of Australians believed that uranium will make either a very big or quite a big contribution to the Australian economy in the future, with 14 per cent not in agreement. 92 per cent held the view that climate change was either a very important (64 per cent) or quite important (28 per cent) problem affecting Australia now. 92 per cent agreed that Australia should be playing either a very big (60 per cent) or quite a big (32 per cent) role in trying to limit the effects of global climate change. Just on half (49 per cent) thought energy from uranium would make either a very big (21 per cent) or quite big (28 per cent) contribution to tackling climate change in 20 years time. There was a majority (51 per cent) support for nuclear power supplying part of Australia's energy needs in the future.

On the question whether nuclear power plants should be built in one's own State, 42 per cent were in agreement, but only 25 per cent in agreement to building nuclear power plants in one's local area. It was reported that 51 per cent were in favour of nuclear power generally and 44 per cent opposed; 42 per cent were in favour of building a nuclear power plant in their own state with 53 per cent opposed; and 25 per cent in favour of a nuclear power plant being built in their local area, with 66 per cent opposed (Derived from ANOP/Newspoll Australian Uranium Association 2007a).

OPINION LEADERS – CONTRIBUTING TO THE DEBATE

The final section of this case study focuses on the same chronological period, spanning the two national reviews leading up to the Federal election, but from a different perspective, that of the involvement of key opinion leaders in the discussion. While this is not presented as a detailed analysis, it does show an overview of the nature of the debate and the roles played by such opinion leaders. Internationally, this period (2005–08) was also important as the climate change issue became a 'hot topic' and political pressure point.

In June 2005 in an opinion piece in *The Age*, Institute of Public Affairs Director Alan Moran argued that economics would determine only a 'niche' role for nuclear power for Australia as it would tax 'coal power out of competitiveness' which would, in turn, 'destroy our cost advantage' (*The Age* 2005a:2). A subsequent report released by a Greenpeace-led coalition in September 2005 challenged the 'Federal Government's view that nuclear power is an environmentally sound energy source for the future' and quoted Professor Richard Broinowski as stating that it '... will never provide a swing fuel of sufficient quantity to make any effect on the greenhouse gas problem that we have' (cited in ABC News Online 2005a:2).

The publication of *The Weather Makers: The History and Future Impact of Climate Change* by Professor Tim Flannery that same year also provided an opportunity to consider the greenhouse gas/nuclear power question (Flannery 2005; *The Age* 2005b). An article by Flannery in August 2005 called for a 'noble act' by Australia to 'switch from coal to nuclear power' as 'our carbon dioxide pollution is devastating the entire world' (cited in Doherty 2006), a point which was later rejected by Greens leader Senator Bob Brown and by Dr Caldicott who pointed out that 'while Dr Flannery was good on climate change, he apparently did not understand the biological implications of radiation' (cited in ABC News Online 2006d). That same month, Director of the Australia Institute, Clive Hamilton, pointed to the relationships between WWF (formerly the World Wildlife Fund), its new Chairman, Robert Purves and the promotion of Tim Flannery's book. 'Alone among Australian environmental advocates, he has declared his support for the development of a nuclear industry. The Prime Minister, John Howard, now regularly buttresses his nuclear push by saying that even some environmentalists 'like Tim Flannery' support nuclear power. ... Flannery is now part of the climate change debate, and whether he likes it or not has become a trump card in Howard's hand' (ABC TV 7.30 Report 2006e in this interview, the Prime Minister names both James Lovelock and Tim Flannery; *The Sydney Morning Herald* 2006a). For the Australian Conservation Foundation, Flannery's view was a 'remedy [which] fails to cure the disease. You cannot solve one monumental environmental problem by embracing another' (*The Herald Sun* 2006a).

In October of 2005, Professor Ian Lowe addressed the National Press Club directly on the topic: 'Is nuclear power part of Australia's global warming solutions?' Lowe (later expanded to a *Quarterly Essay* (see Lowe 2007) concluded that:

...the real motive ... for a debate about nuclear power is to soften up the Australian people to accept a possible expansion of uranium mining [and that] ... the scales are weighted very heavily against nuclear power as a realistic response to global warming. It is too expensive, too risky, too slow and makes too little difference (Australian Conservation Foundation 2005:4-5).

At the announcement of the UMPNER review, the Chairman of the Australian Conservation Foundation (ACF) said that such a review could be a 'waste of time and money' because '... if the inquiry is just about nuclear power it will be a waste of taxpayers' money because nuclear power is too dangerous, too dirty, and too slow to tackle climate change' (Don Henry cited in ABC News Online 2006e). Following the release of the UMPNER Report, the ACF also called on both economics and national security issues to challenge its findings '... an increasingly costly and insecure route that is directly linked to the production of high level radioactive waste and the threat of nuclear weapons and terrorism' (Dave Sweeney cited in ABC News Online 2006f). Also at the release of the Report, Dr Mark Diesendorf stressed the political nature of the whole debate as follows:

Nuclear power is being used in Australia right now politically as a way of distracting attention away from the fact that the present government has failed to deal with the greenhouse problem, it's failed to promote renewable sources of energy, some of which are available now and are actually cheaper than nuclear power and could be installed much, much faster (cited in ABC TV 7.30 Report 2006c)

Following the Prime Minister's announcement of the UMPNER review, the issue of a nuclear power program for Australia was raised with Dr Helen Caldicott and she was asked to comment on the claim that 'some highly credible scientists, eminent scientists, [such as James Lovelock and Tim Flannery] are swayed by the argument'. Dr Caldicott replied that [Lovelock] is 'off the tracks ... he's totally wrong on nuclear power' and on the fact that Flannery was seeing nuclear power as the lesser of evils with regard to greenhouse [gas emissions] – 'you don't replace one evil with another' (cited in ABC TV *7.30 Report* 2006b). At the same time, the Institute for Public Affairs supported the debate as a positive move for rural Australia as it offered a 'reprieve' and 'fewer wind farms' (Jennifer Marohasy cited in *The Land* 2006:1-3).

Relatively early in the UMPNER process, the issue of nuclear fuel 'leasing' and waste disposal developed a regional focus, specifically in the Northern Territory, where there had been discussions for some time about a possible waste disposal facility and about use of Darwin as a port for transporting waste (ABC News Online 2006l:1). In December, 2006, Greenpeace issued comments on the UMPNER report from an 'international panel of experts' which challenged it on various aspects of the findings, specifically on waste disposal, fuel leasing and fuel supply centres (Greenpeace Australia 2006).

On Australia Day 2007, Dr Tim Flannery was named Australian of the Year, a decision which added further weight to his public comments and their reporting in the media. In an article in February 2007, it was stated that he felt his 'reputation' was 'under serious threat'. The article pointed out that 'technically speaking, Flannery is a mammologist [whose] first degree was in English literature, and he is described by supporters and critics alike as a 'public educator whose real strength is writing' (*The Australian* 2007). On May 1st 2007, following the decision by the Federal Government to lift bans on nuclear power and remove 'impediments' to uranium mining and exports (see above) Dr Flannery was reported as stating that 'nuclear power should only be a last resort for tackling global warming' and should only be considered by those countries where they 'already [have] existing nuclear power plants' (ABC News Online 2007f). In a speech to a Sydney business function later that month, Dr Flannery was reported as saying that Australia did not need nuclear power. 'The answer is so resoundingly 'no' it is embarrassing' he was cited as saying, which was then contrasted with his earlier, more supportive comments (Flannery 2005, 2006; *The Sydney Morning Herald* 2007).

The minerals industry was less overt in their contributions to the overall debate. However, as early as April 2006, when discussions of the sale of uranium ore to China were in the media, the SA Chamber of Mines and Energy supported the building of a nuclear power plant in South Australia (ABC News Online 2006u). At the time of the announcement of the UMPNER review, energy consultants from the United States were asked to comment on the need for governments to contribute to the cost of building power stations and on the potential of new technologies (ABC TV *7.30 Report* 2006d). Just prior to the release of the Report, a nuclear energy conference held in Sydney confirmed a 'renewed interest in nuclear power ... a renaissance' (Dr Clarence Hardy cited in ABC News Online 2006p). At this conference, comments were also sought as to the possible location of future nuclear power plants and on the national 'obligation' in helping to dispose of spent fuel (Dr Hardy (ANA) and John Ritch (WNA) reported on in ABC TV *Lateline* 2006d). On the release of the UMPNER report, the uranium industry was reported as 'welcoming' its findings and that 'Australia must start planning to secure nuclear energy' (Martin Blakeman (Newera) cited in ABC News Online 2006a). For the CEO of the Minerals Council of Australia, the opportunity to expand the uranium resources sector and build on the necessary related skills were the critical positives from the report:

We don't have a harmonious and nationally consistent regulatory arrangement and we don't have a very good platform for expanding an industry where we have by far the largest identified uranium resources in the world (Mitch Hooke cited in ABC News Online 2006n).

In January 2007, during a visit to Australia by the UK Special Representative for Climate Change, the question of the 'shift' in the debate in Australia was noted at interview and he was asked to comment on the 'significance' of nuclear power in the climate change debate. 'In some countries, nuclear is clearly a big part of the debate. In other countries it is not ... [and for Australia the issue is rather] ... an effective coal strategy' (John Ashton cited in ABC TV Lateline E3G 2007).

In July, 2007, at the Australian Uranium Conference, Michael Angwin (CEO AUA) stressed the importance of the decision by the ALP to abandon the 'no new mines' policy, and to effectively establish a 'mainstream Australian political opinion' on the matter. Mr Angwin reflected on the importance of the Prosser Review and on the 'bi-partisan way [it has] set the scene for uranium expansion'. In particular, in relation to the discussion about uranium mining and civil nuclear power he argued that it is 'to the advantage of our critics to confuse uranium policy and the nuclear debate. We have to make sure they stay unbundled. ... if a nuclear industry were in Australia's best interests, on its merits, it would need bi-partisan political support and public support and acceptance to be realised' (Australian Uranium Association 2007c). In the same month, the environmental lobby group GetUp launched a petition to seek the Prime Minister's assurance that he was not going into the next election seeking a mandate for nuclear power generation (NPG) in Australia (Bellingin Institute 2007b).

In the final month before the Federal election was called, the *Quarterly Essay* article 'Reaction Time: Climate Change & the Nuclear Option' by Professor Ian Lowe was launched at the Brisbane Writer's Festival on 15 September. In an accompanying article, Professor Lowe summed up the 'debate' as follows: 'It wasn't clear at that point [in mid 2006 when the Prime Minister called for a debate] that things *had* changed a lot, but the Prime Minister set about ensuring that they did' (cited in ABC News Online 2007g:3 (stress in original)).

CONCLUSION

In the period following the debates reviewed above, there was much discussion of global climate change and the forthcoming Copenhagen meeting in December 2009. There were changes of government, federally in December 2007 and in Western Australia in 2008. Some of that debate therefore now reads as 'history'. Nevertheless were the issues to be raised again, the renewed debate would take a decidedly familiar form as is outlined in Appendix B.

Perhaps the one factor in the whole period that could not have been predicted was the decision by the ALP to overturn its long-held policy about the number of uranium mines in Australia. Elsewhere in this Report, the decisions to expand these mines created their own political pathway to attitude formation (Appendix B). The clear separation of political views in taking the uranium mining to the next step – either enrichment or civil nuclear power – acted to clarify the positions from which both parties entered the Federal election in December 2007, and thus confirmed or re-affirmed political decision-making at the individual citizen level.

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APPENDIX D

QUESTIONS FOR KEY INFORMANT INTERVIEWS AND FOCUS DISCUSSIONS

No.	Question
1	On reflection about the current debate on Australia's energy security - what role do you see nuclear power playing?
2	Given the context of climate change - has this influenced your opinion at all?
3	On reflection, what groups (pro and contra) are currently involved in the national debate?
4	How and in what ways do you seek information about the debate?
5	Whom do you typically turn to for help in thinking through such issues?
6	Whose views would you value/not value when considering your attitudes to nuclear energy as a future option?
7	Do you have any views on the historical journey the issue has taken in Australia?.
8	Any other comments?

Table D1 Key informant interview and focus discussion questions.

No.	Question
1	On reflection about the current debate on Australia's energy security, what role do you see nuclear power playing?
2	Given the context of climate change - has this influenced your opinion at all?
3	On reflection, what groups (pro and contra) are currently involved in the national debate?
4	How and in what ways do you seek information about the debate?
5	Whom do you typically turn to for help in thinking through such issues?
6	Whose views would you value/not value when considering your attitudes to nuclear energy as a future option?
7	Do you have any views on the historical journey the issue has taken in Australia?
8	Any other comments?

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APPENDIX E

e-survey instrument

1. Introduction

This survey seeks to understand the formation of attitudes to nuclear power in Australia.

You have been invited to complete the survey because of your membership of an e-network.

It should take no longer than 15 minutes to complete.

This e-survey forms part of a project conducted by the National Academies Forum (NAF) (a peak organisation which consists of the Australian Academy of Science (AAS); Academy of the Social Sciences in Australia (ASSA); Australian Academy of the Humanities (AAH) and the Australian Academy of Technological Science and Engineering (AATSE). For further information see: <http://www.atse.org.au/>

Australia holds 38% of the world's low cost reserves of uranium and produces some 23% of the global output of uranium, however the nation remains divided as to the future inclusion of nuclear energy as an option to meet our rising energy demands.

As a part of the broader project, this survey aims to gain a deeper understanding of how various attitudes from various sectors have been formed; how they have connected or alienated other attitudes from other sectors, and how trends may shape future patterns of national response to the issue of nuclear power.

The project is being managed by Professor Daniela Stehlik, Curtin University of Technology, and directed by an Expert Reference Group that comprises of representatives of the four Academies.

Ethical Clearance for the project has been received from the Human Ethics Research Committee at Curtin University of Technology, Perth (RD01/09).

Further information about the project can be sought from Dr Vaughan Beck at v.beck@atse.org.au.

2. Networks

1. This questionnaire was sent to you via a network membership list. Which of the following best describes the issues focus of this network?

- Health Issues
- Rural Issues
- Environmental Issues
- Science-based
- Industry-based
- Business-based
- Policy Issues
- Career-based

Other (please specify)

2. How long have you been a member of this network?

- Less than 6 months
- 6 - 12 months
- 1 - 5 years
- More than 5 years

3. How involved are you in this network?

- Very Involved
- Somewhat Involved
- Neutral
- Somewhat Uninvolved
- Very Uninvolved

4. What is the primary purpose of your involvement in this network?

- To keep in touch with others
- To get up-to-date information
- To enable discussion
- To seek advice
- To assist in my career goals
- To assist in my employment

Other (please specify)

5. How useful has your membership of this network been to meet this purpose?

- Very useful
- Useful
- Neutral
- Not very useful
- Not useful

3. Environmental Issues

The following seek your responses to questions about current environmental issues.

6. What national environmental issues concern you the most? (one choice only per row)

	Very concerned	Somewhat concerned	Neutral	Somewhat unconcerned	Unconcerned
Future water demands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Biodiversity protection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Habitat protection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Global warming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Urban sprawl	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Future energy demands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Endangered species	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Land use change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Uranium mining	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Salinity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feral animals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. How often are these issues discussed in your network?

	Regularly	Often	Neutral	Rarely	Never
Future water demands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Biodiversity protection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Habitat protection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Global warming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Urban sprawl	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Future energy demands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Endangered species	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Land use change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Uranium mining	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Salinity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feral animals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. How often are these issues discussed in your workplace?

	Regularly	Often	Neutral	Rarely	Never
Future water demands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Biodiversity protection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Habitat protection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Global warming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Urban sprawl	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Future energy demands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Endangered species	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Land use change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Uranium mining	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Salinity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feral animals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. How often are these issues discussed among your friends/family?

	Regularly	Often	Neutral	Rarely	Never
Future water demands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Biodiversity protection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Habitat protection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Global warming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Urban sprawl	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Future energy demands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Endangered species	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Land use change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Uranium mining	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Salinity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feral animals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4. Energy Futures

The following seek your responses to questions about Australia's future energy technology mix.

10. In considering the current national and international debate about global climate change, has this influenced your opinion about future alternatives for Australia's energy technology mix?

Strongly influenced
 Somewhat Influenced
 Neutral
 Little influenced
 Not influenced

11. How favourable or unfavourable do you feel about the following energy sources making a substantial contribution to reliable and secure supplies of electricity in Australia in the future?

	Very favourable	Favourable	Neutral	Unfavourable	Very unfavourable	Don't Know
Biomass (e.g. agricultural, timber, human & animal waste)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hydro	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Natural Gas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nuclear Power	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Oil	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Solar Power	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wind Power	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Geo-thermal (hot rock)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wave Power (tidal/ocean)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify)	<input type="text"/>					

12. To generate more electricity to meet the country's needs over the next 25 years, new power plants will have to be built. Companies and government agencies will need to start planning today. How should we meet this demand? For each power source indicate whether you feel Australia should increase, reduce, or not use at all.

	Not Use	Reduce a Lot	Reduce Somewhat	Keep Same	Increase Somewhat	Increase a Lot	Don't Know
Biomass	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hydro	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Natural Gas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nuclear	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Oil	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Solar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wind	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Geo-Thermal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wave/Tidal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify)

13. In considering the current national and international debate about global climate change, what role do you see nuclear power playing?

- An important contributor
 One alternative among others
 No role
 Undecided

14. In considering the current national and international debate about global climate change, has this influenced your opinion about nuclear power as an option for Australia?

- Strongly influenced
 Somewhat Influenced
 Neutral
 Little influenced
 Not influenced

15. In which way has the current national and international debate about climate change influenced your opinion about a nuclear power option?

- More positively
 Somewhat positively
 Neutral
 Somewhat negatively
 More negatively

16. In considering your support or opposition to nuclear power as an energy option for Australia, which of the following reasons would be a factor? (one choice only per column)

	No significant concern	Of some concern	Of significant concern	Neutral	N/A
Cost	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Too long to construct	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Radiation leaks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Waste disposal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientific evidence on health effects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Terrorist attack	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nuclear arms proliferation potential	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No need because coal supplies are adequate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No net greenhouse benefit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No need because renewables are adequate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify)	<input type="text"/>				

5. Seeking Information about Energy Futures

These questions ask where you seek information and/or advice about energy issues.

17. From the following, where do you seek information about Australia's future energy technology mix?

- | | | |
|---|---|--|
| <input type="checkbox"/> Print media | <input type="checkbox"/> Journals | <input type="checkbox"/> Family members |
| <input type="checkbox"/> Television | <input type="checkbox"/> Internet | <input type="checkbox"/> None of the above |
| <input type="checkbox"/> Local radio | <input type="checkbox"/> This e-network | <input type="checkbox"/> N/A |
| <input type="checkbox"/> National radio | <input type="checkbox"/> Work colleagues | |
| <input type="checkbox"/> Magazines | <input type="checkbox"/> Friends/Neighbours | |

Other (please specify)

18. When considering your own views on Australia's future energy technology mix, how useful is information from the following sources?

	Most useful	Useful	Not very useful	Not at all useful	N/A
The Internet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This e-network	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The print media	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Television programs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scholarly journals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Magazines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Radio programs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify)

19. How would you rate these sources?

	Most valuable	Valuable	Not very valuable	Not at all valuable	N/A
The Internet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This e-network	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The print media	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Television programs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scholarly journals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Magazines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Radio programs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify)

20. When considering your own views on Australia's future energy technology mix, how useful is information from:

	Most useful	Useful	Not very useful	Not at all useful	N/A
From this e-network	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
From your work colleagues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
From your friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
From your family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

21. From which sources do you seek information about the contribution of nuclear power to Australia's future energy technology mix?

- | | | |
|---|--|--|
| <input type="checkbox"/> Print media | <input type="checkbox"/> Journals | <input type="checkbox"/> Family members |
| <input type="checkbox"/> Television | <input type="checkbox"/> From this e-network | <input type="checkbox"/> None of the above |
| <input type="checkbox"/> Local radio | <input type="checkbox"/> Internet | <input type="checkbox"/> N/A |
| <input type="checkbox"/> National radio | <input type="checkbox"/> Work colleagues | |
| <input type="checkbox"/> Magazines | <input type="checkbox"/> Friends/Neighbours | |

Other (please specify)

22. How useful are these information choices when considering the place of nuclear power in Australia's future energy technology mix?

	Highly useful	Useful	Somewhat useful	Not at all useful	N/A
Print media	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Television	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local radio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
National radio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Magazines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Journals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work colleagues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Friends/Neighbours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Family members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify)

23. How would you rate these sources when considering the place of nuclear power in Australia's future energy technology mix?

	Highly valuable	Valuable	Somewhat valuable	Not at all valuable	N/A
Print media	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Television	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local radio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
National radio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Magazines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Journals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work colleagues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Friends/Neighbours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Family members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify)	<input type="text"/>				

6. Seeking advice

This section asks about the individuals/groups that you could consider seeking advice from in regard Australia's future energy technology mix and nuclear power.

24. How would you rate the following in terms of their potential to provide advice about Australia's future energy technology mix and nuclear power?

	Highly reliable	Reliable	Somewhat reliable	Not reliable	Don't Know	N/A
Scientific organisations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Environmental organisations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Health organisations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peace organisations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Church organisations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local government	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
State government	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Federal government	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Universities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Learned academies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Media	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify)

25. Can you name some specific organisations whose views you would value when considering your attitudes to nuclear power? (Need not be limited only to Australia)

- 1
- 2
- 3

26. Can you name some specific organisations whose views you would NOT value when considering your attitudes to nuclear power? (Need not be limited to only to Australia)

- 1
- 2
- 3

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27. Can you name some specific individuals whose views you would value when considering your attitudes to nuclear power? (Need not be limited only to Australia)

1

2

3

28. Can you name some specific individuals whose views you would NOT value when considering your attitudes to nuclear power? (Need not be limited only to Australia)

1

2

3

7. Characteristics

These final questions will enable an analysis by characteristic.

29. Which of the following occupations best describes your own?

- | | | |
|---|---|--|
| <input type="checkbox"/> Manager and/or administrator | <input type="checkbox"/> Clerical and/or service worker | <input type="checkbox"/> None of the above |
| <input type="checkbox"/> Professional | <input type="checkbox"/> Production and/or transport worker | |
| <input type="checkbox"/> Tradesperson and/or related worker | <input type="checkbox"/> Labourers and/or related worker | |

Other (please specify)

30. Which of the following industry groups best describes your own?

- | | | |
|--|---|--|
| <input type="checkbox"/> Agriculture, forestry and fishing | <input type="checkbox"/> Retail trade | <input type="checkbox"/> Government administration and defence |
| <input type="checkbox"/> Mining | <input type="checkbox"/> Accommodation, cafes and restaurants | <input type="checkbox"/> Education |
| <input type="checkbox"/> Manufacturing | <input type="checkbox"/> Transport and storage | <input type="checkbox"/> Health and community services |
| <input type="checkbox"/> Electricity, gas and water supply | <input type="checkbox"/> Communication services | <input type="checkbox"/> Cultural and recreational services |
| <input type="checkbox"/> Construction | <input type="checkbox"/> Finance and insurance | <input type="checkbox"/> Personal and other services |
| <input type="checkbox"/> Wholesale trade | <input type="checkbox"/> Property and business services | <input type="checkbox"/> None of the above |

Other (please specify)

31. How would you describe where you live?

- | | |
|---|--|
| <input type="checkbox"/> A suburb of a capital city | <input type="checkbox"/> A rural area |
| <input type="checkbox"/> A regional town | <input type="checkbox"/> A remote area |

Other (please specify)

32. Are you?

- | | |
|-------------------------------|---------------------------------|
| <input type="checkbox"/> Male | <input type="checkbox"/> Female |
|-------------------------------|---------------------------------|

33. What is your age category?

- | | | |
|--------------------------------------|--|------------------------------------|
| <input type="checkbox"/> 18-24 years | <input type="checkbox"/> 45-54 years | <input type="checkbox"/> 75+ years |
| <input type="checkbox"/> 25-34 years | <input type="checkbox"/> 55 - 64 years | |
| <input type="checkbox"/> 35-44 years | <input type="checkbox"/> 65 - 74 years | |

34. What is the highest primary or secondary school qualification you have completed?

Year 12 or equivalent

Year 10 or equivalent

Year 11 or equivalent

Up to Year 10 or equivalent

35. What is the highest level post-secondary qualification you have completed?

Trade certificate/apprenticeship

Undergraduate Degree

None

Certification I-IV

Graduate Diploma

Advanced Diploma

Postgraduate Degree

Other (please specify)

36. Any further comments?

37. THANK YOU FOR COMPLETING THE SURVEY.

If you would like to receive information about the final report of the project, please enter your contact information below.

Name

Email Address

APPENDIX F

LIST OF NETWORKS INVITED TO PARTICIPATE IN E-SURVEY

Academy of the Social Sciences in Australia

Agri-Food Research Network

ARC Complex Open Systems Research Network

ARC Cultural Research Network

ARC Governance Research Network

ARC Research Network for a Secure Australia

ARC Research Network Future Generation

Australian Academy of Science

Australian Academy of Technological Sciences and Engineering

Australian Academy of the Humanities

Australian Association of Social Workers

Australian Medical Association

Australian Uranium Association

Country Women's Association of Australia

Energy Supply Association of Australia

Environment Institute of Australia and New Zealand

Minerals Council of Australia

National Rural Health Alliance

National Rural Women's Coalition

Solar Energy Society

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APPENDIX G

Analysis of opinion polls – Australia.

These tables have been derived from a variety of sources, including media reporting and on-line reporting. They are discussed in Chapter 3 of the body of this report. The principal sources include: (Australia Institute 2007; Crikey.com.au 2009; Kerr 2009a). The responses are fairly consistent over time. Note the small spike in the support at the time of the announcement of the UMPNER review, which had dropped back by the latest poll conducted in January 2009.

Figure G1 Support for nuclear power
Meta-analysis of Australia opinion polls 2006–09

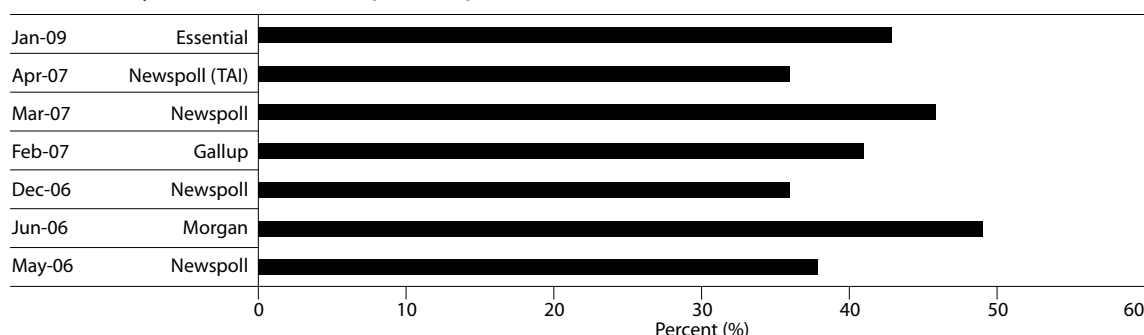


Figure G2 Opposition to nuclear power
Meta-analysis of Australian opinion polls 2006–09

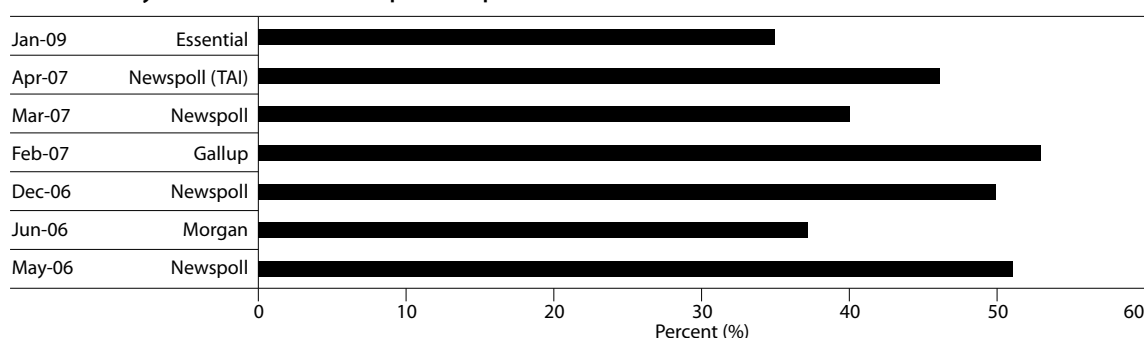
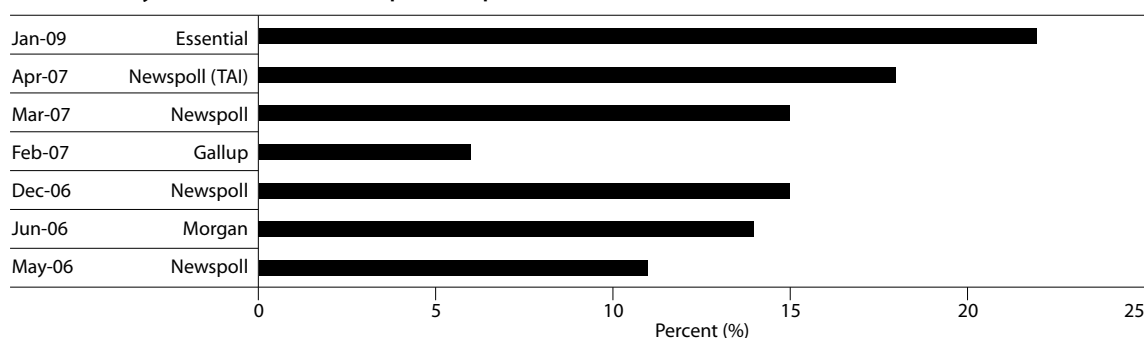


Figure G3 Undecided about nuclear power
Meta-analysis of Australian opinion polls 2006–09



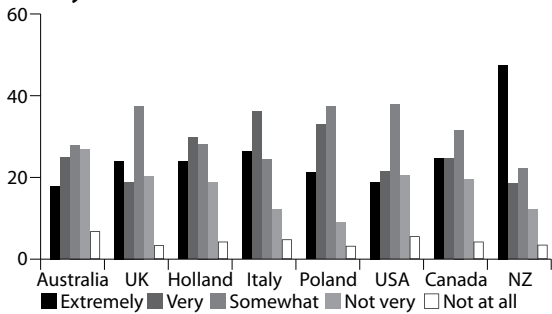
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APPENDIX H

Analysis of Opinion Polls - International

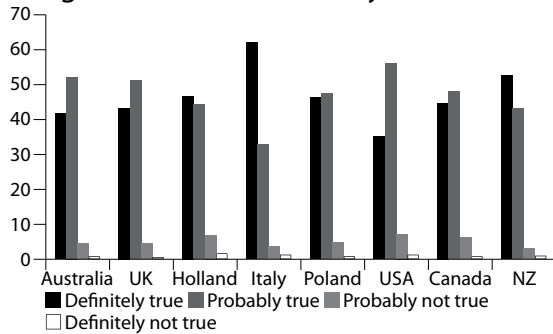
These charts should be read with the discussion in Chapter 3. They present a comparison between Australia and several other industrialised nations, some of which have a long-established nuclear power industry.

Figure H1 'Do you think that nuclear power stations are ... dangerous for you and your family?'



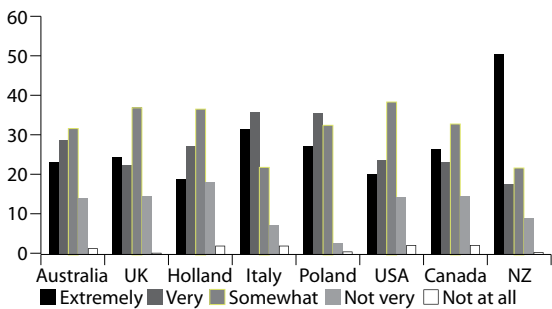
Source: Derived from ISSP Environment 1993:43

Figure H2 'That some radioactive waste from nuclear power stations will be dangerous for thousands of years'



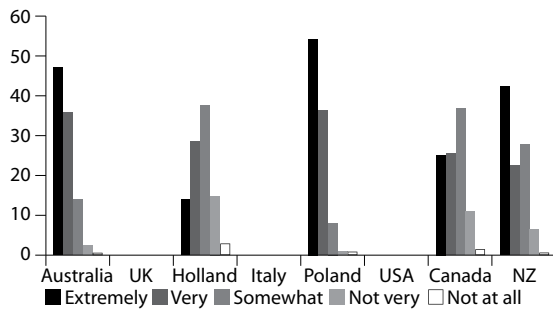
Source: Derived from ISSP Environment 1993:33

Figure H3 'In general do you think that nuclear power stations are ... dangerous for the environment?' (1993)



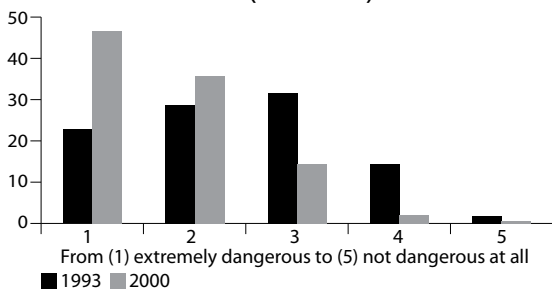
Source: Derived from ISSP Environment 1993:42

Figure H4 In general do you think that nuclear power stations are ... dangerous for the environment? (2000)



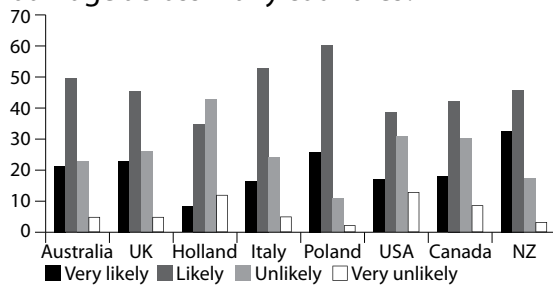
Source: Derived from ISSP Environment 2000:114

Figure H5 'In general do you think that nuclear power stations are dangerous for the environment?' (Australia)



Source: Figures for Australia as derived from ISSP Environment 1993:42 and ISSP Environment 2000:114

Figure H6 'In the next five years, how likely is it that an accident at a nuclear power station will cause long-term environment damage across many countries?'



Source: Derived from ISSP Environment 2000:88

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APPENDIX I

ABBREVIATIONS AND ACRONYMS

ABC	Australian Broadcasting Corporation
ABS	Australian Bureau of Statistics
ACF	Australian Conservation Foundation
ALP	Australian Labor Party
ANA	Australian Nuclear Association
ANSTO	Australia Nuclear Science and Technology Organisation
ANU	Australian National University
APEC	Asia-Pacific Economic Cooperation
BNFL	British Nuclear Fuels Limited
CCS	Carbon Capture and Storage
CEO	Chief Executive Officer
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EIS	Environmental Impact Statement
ESAA	Energy Supply Association of Australia
ETS	Emissions Trading Scheme
IAEA	International Atomic Energy Agency
ISSP	International Social Survey Program
LETs	Low Emission Technologies
NIMBY	'Not In My Backyard'
NZ	New Zealand
PM	Prime Minister
R & D	Research and Development
STS	Science, Technology and Society
TMI	Three Mile Island
UIC	Uranium Information Centre
UK	United Kingdom
US/USA	United States of America
UMPNER	Uranium Mining, Processing and Nuclear Energy Review – Opportunities for Australia (2006).
WHO	World Health Organization
WNA	World Nuclear Association

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APPENDIX J

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Summary of community attitudes toward nuclear and other low emission energy technologies.

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Summary of community attitudes toward nuclear and other low emission energy technologies

In September 2008, Professor Ross Garnaut, described climate change as a diabolical policy challenge and outlined a number of initiatives to address the issue. Low emission energy technologies provide one such opportunity, to endow Australia with a more sustainable energy system. However like any new technology, there may be a social risk to the acceptance of new low emission energy technologies. With a goal to halve greenhouse gas emissions by 2050, CSIRO's Energy Transformed Flagship (ETF) has been researching public attitudes to climate change and energy technologies since 2003. The major findings of this body of research are summarised in this document.

Processes for data collection reported

CSIRO's social research on climate change and energy technologies has used a mix of qualitative and quantitative research processes to gather data around Australian perspectives to low emission energy technologies. Specifically reported in this document are the results of three computer assisted telephone surveys (CATI) conducted in 2005 and 2006 with a random sample of the public from the states of Queensland and New South Wales. The findings from each of these large samples (n=2,700) were consistent and therefore generalisable to the whole of Australia. Reference is drawn to three citizens panels which were conducted as part of the Energy Futures Forum in Perth, New South Wales and Victoria (2005- 2006) and the final set of results tabulated includes the latest research of CSIRO (conducted in 2007 – 2009) when engaging a random sample of the population to participate in a one day large group workshop on the topic of climate change and energy technologies. To date five workshops have been conducted in Brisbane, Melbourne, Perth and Adelaide, and one specifically targeted at the 18 – 25 age group for the general public in the state capital cities.

Rationale for engaging lay public

Early work of the social research program of the Energy Flagship demonstrated that the Australian public has a genuine appetite for more information on the topic of climate change and energy technologies¹. The research also showed the lay public have an excellent propensity for grappling with such a complex issue and identifying a possible way forward for Australia's future energy mix. Using a dialogic approach to engage the public is based on the premise that increased knowledge will lead to more informed decision making and positive attitudes - particularly about new and emerging energy technologies. It also provides a process for accessing the opinions of the Australian public to identify their current issues and concerns with the topic - for both policy makers and technology developers.

Attitudes and knowledge of climate change

All of our research confirms that Australians agree that climate change is an important issue to Australia, particularly for those in the 18 – 25 age groups. However, their self-rated knowledge of climate change is much lower than their strength of opinion about it. The table below summarises the mean responses collected from the Computer Assisted Telephone Interviews (CATI) and large group workshops (LG). The question asked "*How strongly do you agree climate change is an important issue for Australia*", where 1= strongly disagree, 4 = unsure and 7=strongly agree. Respondents were also asked to rate their knowledge about climate change where 1= no knowledge, 4 = moderate knowledge and 7= high knowledge.

¹ Ashworth, P., Pisarski, A. & A. Littleboy. (2006) Social and Economic Integration Program Final Report: Understanding and incorporating stakeholder perspectives to Low Emission Technologies in Queensland. Pullenvale: Centre for Low Emission Technology. November.

Table 1: Australians' attitude and knowledge to climate change

	Jun, 2005		Jun, 2006		Jun,2006		Feb, 2008		Mar, 2008		Jun, 2008		Nov, 2008		Feb, 2009	
	QLD		QLD		NSW		Youth		Brisbane		Melbourne		Perth		Adelaide	
	CATI		CATI		CATI		LG		LG		LG		LG		LG	
	n	Mean	n	Mean	n	Mean	n	Mean	n	Mean	n	Mean	n	Mean	n	Mean
Support	893	6.2	900	6.2	900	5.6	29	7.0	60	6.7	47	6.6	62	6.2	131	6.5
Knowledge	893	4.2	900	4.2	900	4.3	29	4.9	60	4.4	47	4.3	62	4.2	131	4.6

The qualitative components of CSIRO's research confirmed that many Australians still have limited knowledge about the causes of climate change and what can be done for mitigation. For example, many do not understand the difference between the hole in the ozone layer and global warming, or the links between energy consumption and CO₂ emissions etc. When engaged in discussion about the topic, they often become quite concerned and depressed about the enormity of the problem, however through the process of discussion, recognise that there is a role for government, industry and themselves in addressing the issue. The developed versus developing world conundrum also featured heavily but most agree that Australia has a responsibility to develop cleaner options for energy generation that can also be deployed in the developing world.

Support for the range of energy technologies

Overwhelmingly, the Australian general public shows strong support for Australia's energy to be generated from renewable energy forms, in particular solar power, followed by wind. They are less tolerant of fossil fuel based power, although during workshop discussions, their understanding of the need for time to transition from a predominantly coal based power supply to a more sustainable energy system increases. This alone highlights the value in engaging Australians in discussion about the topic. Interestingly, the results from the youth workshop indicate the 18 - 25 age group are far less tolerant of any time for transitioning and would like to see an immediate change to low carbon options that do not involve generating power from fossil fuels, despite the costs involved. Australian's are also reporting a lower tolerance for nuclear energy, although many are indicating an uncertainty about the technology and there was a slight positive shift in some of the workshops as a result of the workshop process and discussion. The following table summarises the range of support for each of the low emission technologies, either through the CATI or from the beginning (without any information) to the end of the day long workshop on the topic.

Table 2: Australians' support for the range of energy technologies? ¹

	Jun, 2005	Jun, 2006	Jun,2006	Feb, 2008	Mar, 2008	Jun, 2008	Nov, 2008	Feb, 2009					
	QLD	QLD	NSW	Youth	Brisbane	Melbourne	Perth	Adelaide					
	CATI	CATI	CATI	LG	LG	LG	LG	LG					
Biofuels	-	-	-	4.2	4.7	4.9	5.0	4.4	4.9	4.6	5.1	4.9	5.2
(CCS)	4.5	4.8	4.7	4.0	4.1	4.1	4.4	4.2	5.0	4.4	4.6	4.7	5.6
Coal	-	-	-	2.3	2.3	2.9	3.2	3.3	3.8	3.2	3.5	3.2	3.7
Geothermal	-	-	-	5.5	5.7	5.4	5.5	5.1	5.1	5.3	5.0	5.7	6.1
Hydro	5.1	5.0	5.1	5.1	4.3	5.3	5.2	5.0	5.3	5.8	5.1	5.5	5.2
Nat. Gas	-	-	-	4.3	4.5	4.8	4.8	5.0	5.0	4.7	4.6	5.1	5.1
Nuclear	3.1	3.5	3.7	2.7	2.4	2.9	2.9	3.1	3.8	4.2	4.6	3.8	3.9
Oil	-	-	-	2.6	2.4	3.3	3.2	3.4	3.4	3.3	3.5	3.2	3.6
Solar	6.0	6.0	6.0	6.7	6.6	6.5	6.6	6.6	6.7	6.7	6.8	6.7	6.6
Wave/tidal	-	-	-	5.7	5.6	5.8	5.7	5.3	5.6	6.0	5.9	5.8	4.2
Wind	5.1	5.2	5.1	6.1	6.2	6.2	6.3	6.1	6.3	6.4	6.4	6.3	6.5

1: Attitude was measured as (1) strongly disagree, (4) unsure, (7) strongly agree

Note: Paired t-tests (p<0.05) were used to identify significant changes between before and after means scores, significant differences between the scores are marked in **bold**.

Knowledge of the range of energy technologies

When asked to rate their knowledge of the range of energy technologies, responses varied considerably. As would be expected, more conventional forms of energy technology that have existed in Australia for some time, received higher self-rated knowledge than energy technologies which are starting to be considered in the

Australian context such as carbon dioxide capture and storage, geothermal, nuclear and wave/tidal. The results from the large group workshop also demonstrate the impact of the process on increasing individual's knowledge on the range of energy technologies. CSIRO is currently analysing a Time 3 survey and conducting follow up interviews to investigate the longitudinal effects of the process on individual knowledge and attitudes – whether these maintained over time. Our earlier research has demonstrated that once engaged in the topic, most individuals continue to research the range of options, make changes to their own energy consumption behaviours and talk to friends and family about what they have learnt.

Table 3: Australian's self-rated knowledge of energy technologies¹

	Jun, 2005 QLD CATI	Jun, 2006 QLD CATI	Jun, 2006 NSW CATI	Feb, 2008 Youth LG	Mar, 2008 Brisbane LG	Jun, 2008 Melbourne LG	Nov, 2008 Perth LG	Feb, 2009 Adelaide LG					
Biofuels (CCS)	-	-	-	4.1	5.0	4.2	4.9	3.3	4.7	3.6	4.7	3.8	5.0
Coal	3.3	3.4	2.0	3.0	4.9	3.2	4.4	2.6	5.1	2.8	4.8	2.9	5.1
Geothermal	-	-	-	4.4	5.5	4.3	5.0	4.1	5.5	4.2	5.0	4.4	5.4
Hydro	-	-	-	3.3	4.9	3.5	4.6	3.1	4.9	3.3	4.7	3.7	5.3
Nat. Gas	4.2	4.2	3.5	3.9	4.7	4.2	4.9	4.1	5.1	4.2	4.9	4.3	5.1
Nuclear	-	-	-	3.8	5.1	4.1	4.8	3.9	5.4	4.2	5.0	4.4	5.2
Oil	3.2	3.6	3.4	3.9	4.9	3.8	4.5	3.6	4.8	3.7	4.7	4.1	4.8
Solar	-	-	-	4.2	4.9	4.2	4.8	4.2	5.3	4.2	4.8	4.4	5.0
Wave/tidal	4.5	4.5	4.3	4.7	5.7	4.8	5.3	4.5	5.6	4.7	5.5	4.9	5.7
Wind	-	-	-	3.2	4.1	3.6	4.4	3.4	4.7	3.6	4.7	3.6	4.8
	3.5	3.7	3.5	3.8	5.2	4.2	5.1	4.2	5.3	4.3	5.2	4.5	5.4

1: Knowledge was measured as (1) no knowledge, (4) moderate knowledge, (7) high knowledge

Note: Paired t-tests ($p < 0.05$) were used to identify significant changes between before and after means scores, significant differences between the scores are marked in **bold**.

Priority ranking of energy technologies

Participants were asked to prioritise how they would allocate funds to the range of energy technologies to accelerate their deployment in Australia. In this instance a low number indicates a higher priority and the results can range from 1 to 10. The results are consistent with individual support in that solar and wind are the most preferred sources of electricity. Coal, nuclear and oil tend to compete for the last position on the hierarchy.

Table 4: Prioritised ranking of preferred energy technologies for deployment in Australia

	2006 QLD		2006 NSW		Feb, 2008 Youth		Mar, 2008 Brisbane		Jun, 2008 Melbourne		Nov, 2008 Perth		Feb, 2009 Adelaide	
	Workshop Before	Workshop After	Workshop Before	Workshop After	LG Before	LG After	LG Before	LG After	LG Before	LG After	LG Before	LG After	LG Before	LG After
Solar	n/a		2.7	3.0	1.7	1.8	2.1	1.9	1.9	2.1	3.0	2.1	2.1	2.5
Wind	n/a		3.2	3.1	2.9	2.4	3.1	3.3	2.6	2.7	2.5	2.8	3.1	3.6
Wave/Tidal	n/a		n/a		4.3	4.6	4.3	4.7	4.4	5.3	4.4	4.1	5.2	6.8
Geothermal	n/a		3.8	5.2	4.2	4.0	4.9	5.2	6.1	6.7	5.5	6.1	4.8	3.8
Nat. Gas	n/a		4.7	4.6	6.6	6.2	6.5	6.0	5.6	6.1	6.6	6.4	5.8	6.0
Hydro	n/a		5.3	5.9	5.6	5.9	5.2	5.3	5.5	5.6	5.1	6.5	5.7	6.3
Biofuels	n/a		4.3	5.2	5.8	5.9	6.2	5.5	7.0	6.4	7.2	6.7	6.7	6.7
CCS	n/a		6.0	4.3	6.5	6.2	6.7	7.0	7.1	5.7	6.9	7.2	6.5	4.3
Coal	n/a		6.7	6.3	9.6	9.6	8.8	8.7	8.6	8.4	9.0	8.6	8.7	8.4
Nuclear	n/a		6.6	7.7	8.7	9.4	8.8	9.1	8.5	8.2	6.9	6.6	7.7	8.3
Oil	n/a		n/a		9.9	9.8	9.2	9.1	8.8	8.8	9.2	8.9	9.1	9.0

Early phone survey results on nuclear

Drilling down into the results from the earlier CATI surveys, the question "Australia should consider using nuclear energy for generating electricity in the future" was the one issue which saw some shifts in opinion between survey

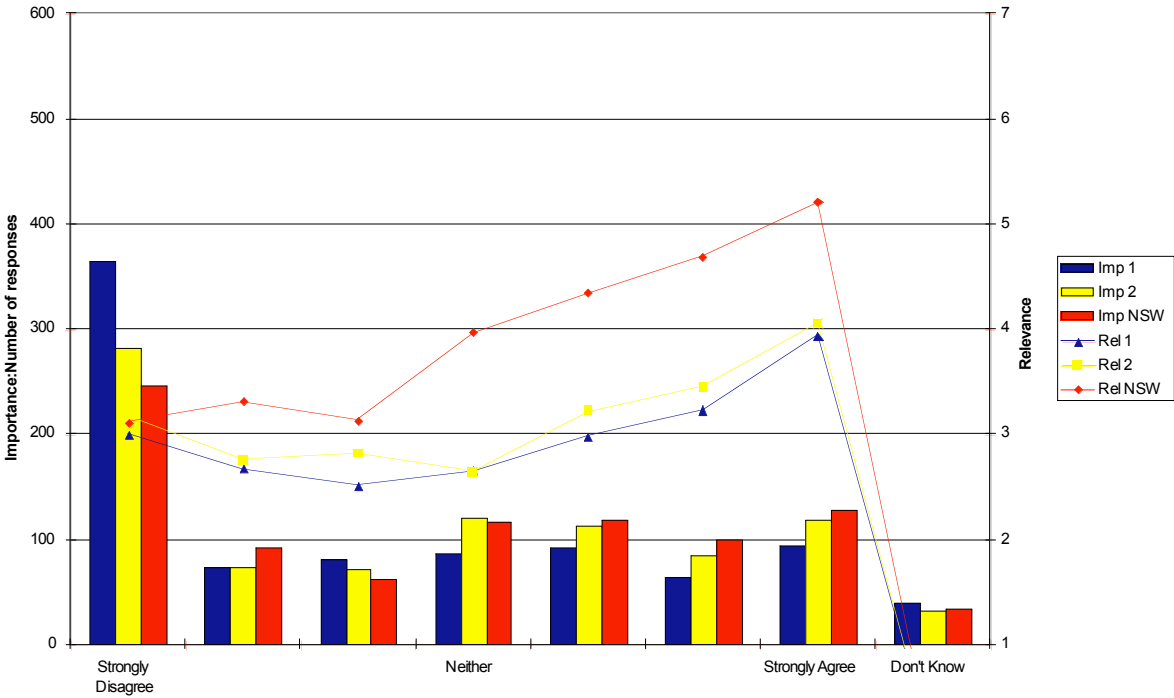
one and two in the Queensland results. The CATI survey was designed and analysed based on the “four degrees of opinion²”. The four degrees help to identify where individuals sit in relation to the issue based on their:

1. Direction: Is the opinion for or against the issue?
2. Degree/extremity: Is the opinion strong or mild
3. Salience: What is the degree of personal interest?
4. Intensity: What is the degree of personal commitment?

Respondents were asked to rate their answers on a seven point scale where 1 is low and 7 is high. The responses to the question on nuclear are summarised in Figure 1 below where direction and strength of opinion is summarised as importance (Imp) and salience was reflected in a question “How relevant is the use of nuclear energy in Australia to you?” and therefore reported as relevance (Rel). The figure reports the results from the first CATI (Imp & Rel 1), second CATI (Imp & Rel 2) and the New South Wales CATI (Imp & Rel NSW).

It shows that in the first survey (2005) respondents were almost two to one against nuclear power with 57.8% disagreeing and 28.1% agreeing. However, by survey two (2006) the numbers were 47.5% disagreeing and 35.5% agreeing. The biggest shifts in opinions seemed to move from being strongly polarised either for or against nuclear into the middle. The results suggest that this may have been a product of the increased media attention nuclear power received when the previous Government made announcements about nuclear energy and the prospect of increasing uranium mining and export in Australia. This coverage appears to have made the population more uncertain about this option, as well as increase its relevance to them. Similarly, in New South Wales (2006) opinions on this topic were strongly polarised. Thirty five people did not know the answer to the question. Of those who did respond, 40.1% agreed while 46.3% of respondents disagreed. Fifty nine participants did not know or refused to answer the question on relevance. However, relevance was positively related to agreement such that people who agreed rated the relevance of nuclear energy higher. Similar to other issues in the survey, people with stronger opinions (both positive and negative) tended to rate their own levels of knowledge higher.

Figure 1: Importance and relevance of nuclear power



² Zaller, J. R. (1982). The nature and origins of mass opinion. New York. Cambridge University Press.

Sub group differences which were significant (at $p < .01$) included gender differences where males reported more agreement, higher levels of knowledge, and higher levels of relevance than females. In addition, people with higher levels of education report higher levels of knowledge and relevance. Participants in the 25-34 year old age group, or 55 years and older group were more likely to agree with nuclear energy than other age groups. When it came to employment types, people employed part-time, unemployed people, and people performing home duties were less likely to agree, and reported lower levels of knowledge than other groups. Participants with higher income levels were more likely to agree, and reported higher levels of relevance.

In New South Wales, a total of 1,634 responses were recorded to the open ended question about what individuals know about nuclear energy (Table 5). The largest single group of responses (40.6%) involved negative reactions including associations with weapons, risk of terrorist attack on nuclear facilities, and many non specific descriptions of “risk” or “danger”. Other common responses mentioned problems with storage of waste (34.4%), the risk of leakage of stored waste (17.9%), positive reactions about the value, utility or safety of nuclear power (12.8%), and responses describing nuclear power as clean or having low emissions (12.3%). A sizable minority of respondents (14.1%) reported no knowledge of nuclear energy. These results reflect similar responses to the Queensland surveys as well.

Table 5: What do you know about nuclear energy?

Open ended comments	Frequency	Percent
Negative reactions – negative images, association with war/weapons, dangerous/hazardous, risk of radiation, possible terrorist target	365	40.6
Waste - Storage of waste, waste has long half-life	310	34.4
Leakage - Possibility of leakage	161	17.9
Positive reactions – a good idea, can be safe, we should use it, good alternative energy source, OK if used/controlled properly, good way to go in the future, not as scary/risky as some people think	115	12.8
Clean – no greenhouse gases, low/no emissions	111	12.3
Efficient – cost effective, low running costs, high energy production	80	8.9
Expensive – high set up costs	38	4.2
Used in other countries	34	3.8
Supply - Australia has abundant supply of uranium	20	2.2
Portability	12	1.3
Legislation	3	0.3
Other - technical descriptions of how power is generated, “used in medical applications”, we have plenty of safer alternatives, “don’t know enough”	258	28.7
Nothing/Don’t know	127	14.1

Note: 2 people refused to answer; frequencies may sum to more than 900 because respondents could provide more than one answer.

Changes in knowledge and opinions of nuclear energy technology

The results show that nuclear energy is one of the energy alternatives Australians are least informed about, this is partly because historically nuclear energy has not played a role in Australia’s energy supply. More recently though, with the Australian Government’s decision to expand uranium mining and the ongoing discussions of mitigation options, nuclear power has begun to gain more prominence in discussions about greenhouse gas mitigation and ways of securing Australia’s energy supply.

Early (2005/6) dialogue with the public on energy technologies facilitated through three, three day Citizen Panel processes conducted in Perth, Melbourne and Newcastle generated technology preference rankings in which nuclear technology was rated lower than coal or oil. As indicated in Table 4, more recent data indicates that it competes with the others for least preferable. This raises questions about whether the heightened discussion and

debate about uranium mining, climate change and the potential role of nuclear power generation in Australian is leading to shift in perceptions.

More conclusive data are available from an analysis of the large group data presented in this paper. These data provide an indication of how people may change their knowledge and opinions of nuclear energy when provided with information and the opportunity to discuss the technology. On average, respondents reported a significant increase in how informed they were of nuclear energy technology by the end of the workshop. That is most respondents finished the process with a medium or moderately high level of knowledge. Findings presented earlier and below show that over half of the respondents initially report to be unsupportive of nuclear or unsure of their support. By the end of the workshop there were either small groups of people reporting a small increase in tolerance for nuclear or overall there was no real change in the group response. However, nuclear was only one of several technologies that was discussed and more often in such a workshop, participants tended to focus on emerging technologies such as carbon dioxide capture and storage and geothermal rather than more established technologies.

When asked to rank the funding priority for energy technologies after the workshops, nuclear energy was repeatedly ranked low, mostly in the bottom three, along with coal and oil. The questions and comments participants raised about nuclear energy technology demonstrate there are mixed sentiments surrounding the technology, including some pleas for government to consider the technology and others to leave it out of the mix. It appears to be a highly emotive topic for many participants.

Table 6: Changes in level of support for nuclear energy technology from the beginning to the end of the workshop

	Feb, 2008 Youth		Mar, 2008		Jun, 2008		Nov, 2008		Feb, 2009	
	Before %	After %	Before %	After %	Before %	After %	Before %	After %	Before %	After %
Strongly disagree	37.9	0.0	39.3	37.7	34.0	14.9	16.1	16.1	16.8	17.6
Moderately disagree	10.3	34.5	11.5	14.8	14.9	12.8	6.5	1.6	11.5	6.9
Disagree	20.7	27.6	4.9	8.2	2.1	12.8	3.2	8.1	6.1	10.7
Unsure	13.8	13.8	16.4	11.5	25.5	23.4	25.8	17.7	29.8	20.6
Agree	13.8	6.9	8.2	14.8	8.5	14.9	16.1	14.5	16.0	24.4
Moderately agree	3.4	17.2	13.1	4.9	8.5	8.5	14.5	24.2	12.2	15.3
Strongly agree	0.0	0.0	4.9	6.6	6.4	10.6	14.5	17.7	6.9	4.6
Missing responses	0.0	0.0	1.6	1.6	0.0	2.1	3.2	0.0	0.8	0.0
Total	100	100	100	100	100	100	100	100	100	100

Most of the comments in relation to nuclear energy acknowledged the challenges including the management of waste and the related stigma from previous nuclear incidents. Overall the findings indicate that even after learning more about nuclear energy the majority of the public still report to be unsupportive or unsure of the technology. Typical comments that arose in the workshops in relation to nuclear included:

- More research into nuclear power options is needed.
- Encourage full use of renewables and nuclear power.
- To government - please reconsider using nuclear energy.
- Nuclear is out.
- Nuclear scares me, so don't do it, but perhaps we should.
- Nuclear sounds like a good idea but there are so many disadvantages as well.
- There is a backlash against nuclear energy because of disasters.
- There is strong disagreement and strong agreement with using nuclear energy.
- If we sell nuclear products we have to buy the waste back.
- Chernobyl is a big issue – was it a conspiracy to spin anti-nuclear?
- Nuclear may be ok, if managed correctly and safe storage of waste (long-term). France is 80% nuclear.

Key themes from the Australian general public

From each of the workshop discussions there are a number of key themes that arise. The most resounding theme is that the Australian general public would like to see a clearly defined path to action for a low carbon energy future for Australia. This includes the wish for the government to implement their proposed 20% renewable target as a way of prioritising renewable energy as part of the mix. The other resounding theme is the need for leadership at all levels of government to address the issue of climate change. Workshop participants recognise that it is not easy and that changes will have to happen over time, however their tolerance for inaction is waning. Education and communication at all levels was also seen as being critical if Australia is going to be successful in changing energy consumption behaviours to capitalise on early wins through energy efficiency.

In relation to nuclear energy it appears that the majority of the public still have relatively low levels of self-rated knowledge about the technology, but despite this their opinions are quite polarised. Given continued discussions about the expansion of uranium mining and also public discussion of nuclear energy as an alternative low emission technology, it appears timely to consider further research to explore public perceptions to nuclear energy in Australia.

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Further reading and information

CSIRO's social research program is extensive and for the purposes of this document we have only presented the results of attitudes towards large scale energy technologies. Under the Intelligent Grid project, which is investigating the value proposition for distributed energy there is a large body of research around the Australian public's willingness to accept distributed generation and demand side management initiatives as a way of managing peak demand and mitigating CO₂ emissions. CSIRO also has an ongoing research projects investigating the effects of information provision and dialogue on informing community attitudes. One significant piece of work is Energymark, a kitchen table approach to the climate change energy dilemma. Below is a list of reference materials which provides more information. Please note the large group process reports for each state are currently being finalised and should be released in the near future.

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Ashworth, P., & J. Gardner. (2006) Social and Economic Integration Program Final Report: Understanding and incorporating stakeholder perspectives to Low Emission Technologies in New South Wales. Pullenvale: Centre for Low Emission Technology. November.

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Littleboy, A., N. Boughen, S. Niemeyer & K. Fisher. (2006) Societal Uptake of Alternative Energy Futures: Final Report. Report No. P2006/784. Brisbane:CSIRO.

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CSIRO (2009). Intelligent Grid: A value proposition for wide scale distributed energy solutions in Australia, 2009, CSIRO report ET/IR 1152. <http://www.csiro.gov.au/resources/Intelligent-Grid-Report.html>

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Gardner, J. & Ashworth, P. (2008). Towards the intelligent grid: A review of the literature (pp. 283-308). In P. Droege (Ed.), **Urban Energy Transition: From fossil fuels to renewable power**. Oxford, UK: Elsevier

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Dowd, A., Carr-Cornish, S., Ashworth, P., & Gardner, J. (2008). Drivers and barriers to alternative energy: Interviews with stakeholders in Castlemaine, Victoria. CSIRO P2008/885.

Gardner, J., & Ashworth, P. (2008). Public attitudes towards electricity alternatives: Results from a survey of Australian householders. CSIRO P2008/944.

Gardner, J., & Ashworth, P. (2007). Attitudes towards electricity alternatives: Results from a survey of Australian organisations. CSIRO2008/1356.

Parsons, R., Ashworth, P., & J. Gardner (2007) Adoption of Distributed Energy: Case Studies of Domestic Consumers. Brisbane: CSIRO. October



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