
Chapter 10 Conclusion

10.1 Introduction

This research was based on the assumption that if we can understand the types of issues that are relevant to the adoption of renewable energy options at the community level we will be better equipped to introduce renewable energy options on a larger scale and reduce the impacts of climate change. In this chapter, I present a short summary of the research conducted and my main findings. I present these as a response to the research questions outlined in the introduction to this thesis. Thus, I begin with a discussion of the technical and economic analyses conducted for this thesis, and present the most suitable energy options for the communities from a technical and economic perspective. I then summarise the community response to issues relating to the development of energy options by presenting the themes and key concepts that emerged from this research. I go on to present a brief summary of reasons why the communities had not adopted alternative energy options, and summarise the contributions relevant bodies of literature make to expanding upon explanations for why alternative energy options had not been adopted on any significant level by the case study communities. I give recommendations of strategies that can be used to assist in instigating change in the case study communities, and end this thesis with a discussion of avenues that deserve further research.

10.2 Technical and economic findings

The cost of energy on the Islands from imported diesel fuel is high by world standards, and the cost of diesel-generated electricity is particularly high. Technical and economic analyses of energy options undertaken as part of this research combined with findings from previous studies reveal several energy options that are economically attractive and technically feasible.

Increasing the efficiency of electricity production and consumption can produce significant fuel and monetary savings. Upgrading the generators on Lord Howe Island is likely to produce significant fuel savings. There is a range of options available for improving the efficiency of electricity consumption and energy conservation. Existing houses can be retrofitted with energy efficient appliances and lighting, insulation, and measures to increase ventilation and decrease drafts. Typically investments do not require significant capital outlay, and due to the high cost of electricity on the Islands, payback periods can be short. New houses can be designed with solar passive features, incorporating thermal mass, suitable orientation, and glazing that maximises or minimises solar gain according to the season of the year.

The Islands have reliable wind and solar resources, and energy options such as wind and solar photovoltaic systems (with available subsidies) could produce electricity for less than the marginal cost of diesel-fired electricity. Producing from a source for less than the marginal cost of production means they can be integrated into the existing systems with little change to operation procedure and associated impacts on individuals or groups within the communities. Wind and solar photovoltaics are technically mature technologies that are well proven, and they have been widely utilised in remote areas around the world. Wind and solar photovoltaic projects typically require a high capital investment, and if funded on borrowed capital, they are open to fluctuations in interest rates. However, these options do shelter the communities from the price volatility associated with diesel fuel prices.

On Lord Howe Island, using electrically boosted solar water heaters is cheaper than using stored gas or electric hot water heaters. On Norfolk Island, the cost of solar hot water is similar to that of water heated by gas storage units and cheaper than water heated by electric storage units. There appear to be opportunities to reduce the size, number and usage of vehicles on the Islands through the provision of public transport

options and garbage collection services. The use of electric vehicles is an attractive substitute for internal combustion engine driven vehicles if energy is generated from renewable sources.

Other alternative energy options such as biomass, nuclear, geothermal, hydro, wave, ocean current, or tidal energy are not suitable for the Islands due to limitations in resource availability, technical maturity, or economic viability. Energy storage options, besides pumped hydro, are also unattractive for these reasons.

10.3 Community response to energy options

In this research, I elicited responses from members of the community on issues relevant to community level decision-making on energy options through semi-structured, in depth face-to-face interviews and social network surveys. I also collected and analysed documents and made general observations of the communities during field trips.

There were eight main themes on decision-making on energy options that emerged from the data collected in this research. They were: knowledge and understanding of energy options and community debate; perceptions of risk; the lack of cause and effect relationships relating to energy; lack of capacity; disempowerment; communication; cultural values; and population size and social connectivity. Together these themes provide an explanation for why alternative energy options had not been adopted by the case study communities to any significant level. I discuss these themes in turn below.

Among interview participants there appeared to be a good general awareness of energy issues, but little specific knowledge and understanding about specific technologies and energy systems. Those with a greater knowledge and understanding of alternative energy options were generally more in favour of their adoption. The community debate focused almost entirely on the system of electricity supply, and

appeared to consist largely of conflicting statements of opinion rather than mediated or reasoned argument.

Interview participants who appeared to be risk averse on energy issues were generally in favour of established energy options, and those willing to accept risk were generally more in favour of alternative energy options. Participants were concerned about risk on a day-to-day basis relating to the reliability of the electricity production system. They were also concerned about risk on a strategic level relating to longer-term issues such as financial sustainability, fuel availability, maintenance requirements, ease of operation and environmental impacts. Problems with large infrastructure development on the Islands in the past had coloured many interview participant's perceptions of risk.

There was a lack of cause and effect relationships relating to energy in the case study communities. The short-term observable effects of the system of diesel consumption were bills, local air pollution and noise, and these were relatively easily accommodated by the communities. The longer term delayed impacts of established energy options such as climate change, increases in the cost of living and decreases in the economic competitiveness of the Islands as tourist destinations appeared not to be prominent in the minds of many participants due partly to the absence of observable impacts.

Many participants described shortages of capacity in the communities and their governing bodies to develop alternative energy options and instigate change.

Participants reported busy, complicated, pressured and dysfunctional political environments encompassing a wide range of issues in which the community and governing bodies were involved. In these environments, the fact that the established systems of electricity production were functional meant that they were not viewed as an urgent priority. Many participants believed alternative energy development was an important but not an urgent issue.

Many participants on both Islands appeared to be disempowered on issues relevant to alternative energy development. There were widespread perceptions that the governing bodies on the Islands were dysfunctional, and the long history of investigation of alternative energy options (and many other issues) with little change had convinced many that change was unlikely to occur. Disempowerment manifested itself on both Islands in a lack faith and participation in established structures and process of governance. There was a widely reported disconnect between the communities, regulatory frameworks, and institutions of governance. This was reportedly why few members of the communities were proactive in instigating change on energy options. Some members of the communities had unrealistic expectations of what alternative energy options could offer and were frustrated at the lack of change. This had led to perceptions of injustice and corruption among some members of the community, and appeared to contribute to the establishment of an adversarial relationship between some members of the communities and electricity service staff.

The nature of communication between actors and institutions was a common theme of this research. Participants generally reported effective informal communication among members of the communities, and poor communication between the communities and the governing bodies. On Norfolk Island, participants generally reported poor communication between governing bodies and the community and external institutions such as the Australian Federal Government. On Lord Howe Island, efforts at consultation appeared to be problematic due to a poor understanding of the process by members of the communities, and over consultation. On Norfolk Island, there appeared to be little consultation and few avenues formal communication with governing bodies.

Participants reported conflicting pressures between established cultural values such as independence, resilience, and self-survival and modern pressures to form allegiances

and partnerships with institutions external to the communities. For many participants, these pressures resulted in a tendency resist outside involvement in the affairs of the Islands (from institutions such as consultancies and external governing bodies), a tendency to value local knowledge over that obtained from sources external to the community and also a tendency to accept non-optimal financial decisions if they were seen to preserve the cultural values of the community.

The small size of the populations of the Islands, the long history of the communities on the Islands and their remoteness had resulted in communities with a high level of social connectivity. This appeared to impact on decision-making on alternative energy options in a number of ways. The personalities and interpersonal relationships of those involved in decision-making appeared to influence its outcomes. There was reportedly a general hesitation for decision-makers to make changes because of the close coupling of both institutions with individuals and decisions and their impacts. There was an aversion to action seen to cause social tension and conflict in the communities, and this reportedly resulted in a hesitation or refusal by some to voice their opinions on matters affecting the community if they perceived them to clash with the consensus opinion. Participants were wary of becoming the subject of discussion on active gossip networks or developing a bad reputation within the community. Some participants spoke of social hierarchies on the Island and reported that decision-making processes were restricted to those more established within the communities.

The accounts interview participants gave of their attitudes, opinions, experiences and interpretations relating to the discourse on energy options gave rise to four fundamental concepts underlying individual thinking on energy options. These were relevance, certainty, agency and risk. These concepts appear to underpin the way members of the communities thought about energy options, and assisted in explaining the nature of the community debates, and the outcomes of decision-making on energy

options. Generally speaking, if individuals believed issues relating to energy issues were relevant to their lives and to the communities, they were more likely to become engaged. If they were certain of their knowledge and understanding of energy options they were more likely to be either opposed or in favour of alternative energy development. If they believed they possessed agency and were able to affect decision-making on energy options they were more likely to pursue change. Individuals who perceived alternative energy options to be high risk they were generally not in favour of them, and those who perceived them to be low risk generally supported their development.

10.4 Contributions from relevant literature

From this research, it appeared the communities had not instigated change due to a wide range of issues relating to both the immediate discourse on energy options and the broader social and political contexts in which energy development occurred. The themes and key concepts that arose from this research provide explanations for why alternative energy options had not occurred on any significant level. To build on these explanations, I compared the results of this research with the findings of bodies of literature relevant to community level decision-making on alternative energy options.

The social acceptance literature is based on a wide body of empirical evidence, and focuses on factors and processes that affect the social acceptance of renewable energy technologies. This literature can assist in explaining non-adoption and inform decision makers on how best to introduce new energy options. Based on this literature, those with a good knowledge and understanding of energy options are more likely to support new energy projects. In the case study communities, low levels of knowledge and understanding are likely to have hindered efforts to introduce new technologies. Based on the literature, those interested in introducing alternative energy options on the Islands should focus on ways to increase knowledge and understanding and educate the communities on relevant issues such as economic aspects of different

energy options and the ways in which the new systems would affect their lives and require changes in behaviour. Experience in locations where the landscape is highly valued by local communities shows that energy systems that impact on these values are unlikely to receive local support. This builds on evidence gathered in this study of the concern some community members had regarding the impact of energy options such as wind turbines on aesthetics and the environmental qualities of the Islands. Those interested in implementing new energy projects should address these concerns and minimise potential impacts.

The social acceptance literature informs us that energy options that deliver local social and financial benefits and options that are perceived to be equitable and fair are more likely to be accepted by local communities. There was evidence gathered in this research that some members of the communities were not convinced of the benefits of introducing alternative energy systems, and did not believe that the outcomes of development would be fair and equitable. This adds to explanations for non-adoption. The literature informs us that local communities are generally more accepting of projects that are planned in an open and transparent manner and they have an institutionalised role to play in the planning and development processes. The efforts to introduce alternative energy options in the communities documented in the history of investigation of alternatives did not appear to focus on such factors. Experience in other locations has shown that public meetings and consultation documents are not the best way of communicating with local communities, and developing relationships through networks of local contacts is more effective. Similarly, there was little evidence of this approach being taken with the case study communities. Non-adoption of systems of micro-generation in the case studies was explained in part by high capital costs, servicing costs and bureaucratic burden, and the social acceptance literature informs us efforts to reduce these factors through systems of financing and better organisation assist at increasing levels of acceptance and adoption.

There is evidence in the social acceptance literature that models of energy development such as cooperatively owned wind farms or solar systems or domestically owned systems of micro generation are successful due to their ability to deliver local benefits and engage communities in energy issues. These appear to be solutions that are appropriate for the case study communities.

The literature on barrier models makes a contribution to this research by providing a way to conceptualise and order the evidence gathered. The reasons for non-adoption in the case study communities were grouped and ordered according to institutional, technological, economic, information, financial, cultural, legal, participation and consultation and political barriers. Whilst this may be a useful way of understanding the nature of a particular scenario, conflicting evidence gathered in this study suggests that these barriers were not fundamental explanators of why the case study communities had not adopted alternatives on any significant level.

The technology transfer literature on point-to-point transfer from commercialisation to adoption and use makes a contribution through its focus on the roles and responsibilities of key actors and institutions. Analysis of the relationships between these actors and institutions provides a context in which the outcomes of decision-making on energy options can be interpreted. This is an approach incorporated and developed in the knowledge systems approach. Approaches to technology transfer that emphasise the active, contextual and multi-directional nature of the process appear to be suited to the case study communities. These are places where there are complicated and busy social and political landscapes, and where transfer attempts characterised by a more linear approach from active donors to passive receivers have failed. The appropriate technology literature associated with technology transfer builds upon the social acceptance literature, delivering the message that to be considered

appropriate, new technology should provide social, economic and environmental benefits to areas where it is introduced.

Literature written from the perspective of social constructivism was useful in interpreting the research results and building on explanations for why the case study communities had not adopted alternative energy options. Results from this research supported three key findings of literature based in social constructivism. These are that technical and economic factors are important in decision-making on alternative energy, but alone do not shape the development of energy options. Secondly, the social and political context of a social group shape its values and norms, and these in turn influence the meaning given to technological artefacts and their development. Thus, there needs to be greater acknowledgement of the social context in which technology development occurs to understand decision-making and its outcomes. The influence of social environments is usually greater and more complicated than that assumed by traditional models of technology transfer or diffusion of innovations. Thirdly, technical change is an inherently social phenomenon. The process of technical change in relation to energy options is socially constructed. The decision to adopt or reject new energy technologies and ideas is made by actors and these actors operate within local, culturally and temporally specific environments. They are active social agents rather than passive recipients of science based research findings.

The knowledge systems approach draws from the social constructivist paradigm, and is an approach I used to further build on explanations for why the communities had not adopted alternative energy options. There was evidence in the results of this research that participants had poor perceptions of the salience, credibility and legitimacy of information in the knowledge systems. The knowledge systems approach informs us that information is likely to be less influential if it is perceived in these ways. Further to this, there was evidence that there had been poor communication and translation of

information between institutions, and few attempts at mediating between them on problematic issues. The knowledge systems literature informs us that a failure to perform these functions of boundary management results in gaps between knowledge and action and in this case, the non-adoption of alternative energy options.

10.5 Instigating change

Based on the knowledge systems literature, I made a series of recommendations that are likely to assist in developing alternative energy options in the case studies. I recommended the communities each establish a boundary organisation based around the appointment of an energy officer. The role of these organisations is to attempt to bridge gaps between experts and decision makers. To do this, they perform the functions of boundary management (communication, translation and mediation), and to improve perceptions of the salience, credibility and legitimacy of information in the knowledge system. The literature informs us this can assist in reconciling competing interests, conceptual gaps, different approaches and different expectations between existing institutions.

On Lord Howe Island, there is a reasonable likelihood that funds could be leveraged from the New South Wales State Government to establish a boundary organisation due to the significance of the natural systems, and the history of funding projects that may impact on them. On Norfolk Island funds would most likely need to be sourced internally. A way to minimise the likelihood that the organisation is entangled in the existing political landscape would be to train members of the communities as local experts to act as energy officers. Boundary institutions would also need to maintain a degree of political and institutional autonomy, and they should be planned with long time scales to allow for change to occur.

10.6 Recommendations for further research

The scope of this research was broad, and there are opportunities for further research in several areas. Much of this research focussed on perceptions of issues relating to energy development from members of the communities. It is likely that actors in institutions external to the communities would have different perspectives on the same set of issues and events, and there would be value in exploring these perspectives to broaden the context of decision-making on energy options.

There are opportunities for more focussed research into the individual themes uncovered in this research. For example, there are likely to be useful findings from research on the ways actors' knowledge and understanding of energy options or perceptions of risk impact on decision-making on energy options. Similarly, effects on the decision-making process from the nature of communication between actors and institutions or the cultural values of members of the communities are likely to be interesting research topics. These themes could be compared with experience of communities in other contexts to broaden the context of this knowledge.

There is scope for additional research into the appropriateness of different models of ownership of energy options on the Islands. Models of ownership such as co-operatives or government owned systems distributed through the community could be appropriate for the communities and these options deserve further research.

The interaction between macro and micro level politics and how this affects energy development is an area deserving further research. Over time it would be interesting to research if and possibly how political stances on renewable energy from State and Federal governments affect development at the local level. It would be useful to compare the findings of this research with research in other small communities to

explore possible relationships between size, population, geography, governance, history and other factors on decision-making on energy options.

A greater focus on the knowledge systems approach in the context of energy development is an area worth researching. One could more thoroughly investigate perceptions of information and functions of boundary management in the case study communities or in other contexts. How to prevent boundary organisations from becoming entangled in existing political landscapes is an avenue of research worth pursuing. There is likely to be benefit in further research into the experiences of those involved with boundary organisations that have assisted in increasing the adoption of renewable energy options. One example of a boundary organisation that appears to have successfully performed the functions of boundary management in relation to the development of renewable energy systems is the Samsø EnergiAkademi in Denmark.

The marketing of solar hot water heaters to Island residents in the 1970s and 80s was an area of interest to me in this research. I was keen to find out how solar hot water heaters had become so successful for a period of time, and why acceptance of some forms of renewables existed, while other forms appeared to be rejected. Determining why and how solar hot water heaters were previously adopted could lead to finding ways of encouraging adoption of other forms of energy technology. However, during interviews on Norfolk Island most participants made few comments about the history of solar water heater adoption. It appeared the younger participants were not familiar with events that had taken place during this period. During questioning, older participants made few comments apart from descriptions of how solar hot water heaters became more popular on the Island. It is unlikely that this information has disappeared and thus could possibly be uncovered by more specific research in this area.

There was evidence in this research that social networks in the communities influenced the discourse on energy options, and yet the response rates from the social network surveys were insufficient to arrive at conclusive findings. This is an area deserving of further research, and better quantitative social network data could inform a range of research avenues such as the influence of informal communication on the development of energy options. Establishing trust with the communities would be essential to pursuing this line of research.

Finally, there are opportunities for further research comparing the findings of this research with community level decision-making on energy options in developing nations.