RESOURCING A LOW CARBON FUTURE

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ABSTRACT

Climate change is forcing every level of government to look for ways to adapt to impacts and mitigate its effects. Top down policy responses at Federal and State level are evolving and bottom up initiatives at the level of individual businesses and households are beginning to capture public interest. However there is often a gap between these two extremes. This gap is well illustrated by the lack of empirical data in respect of the current energy profile of spatial areas such as local councils and an apparent lack of information on the potential for energy and greenhouse gas reduction across these spatial areas. Using case studies of the City of Playford local government area in South Australia and Manningham City Council in Victoria, this paper addresses the second of these aspects, and seeks to identify the renewable energy resources within their boundaries. It describes techniques for assessing their potential and how, in particular, the solar and wind energy resources might be harnessed, especially in respect of the built environment. The paper concludes by examining the benefits, in terms of greenhouse gas reduction, financial advantages and job creation, which could accrue to the community at large in Playford and in Manningham, should policy be introduced to mandate carbon reduction targets. These benefits may assist local government in meeting environmental, economic and social outcomes which they are increasingly expected to deliver.

INTRODUCTION

The issue of climate change and the need to reduce emissions of greenhouse gases (GHGs) has in recent years become a key area of concern for communities in Australia as it has in most countries. The Intergovernmental Panel on Climate Change (IPCC) reported that the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations and that discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns (IPCC 2007). This human-induced climate change is now accepted by most scientists and governments (Jones *et al.* 2005; G8 Presidency 2005; Lowe 2005; Flannery 2005; Steffen 2006; Garnaut 2008). All levels of government in Australia including local government have made commitments to reduce GHGs. There are examples of carbon trading schemes, legislation to set targets to reduce GHG emissions and various mandatory or voluntary strategies to reduce emissions including improving energy efficiency. Australia is in the process of setting a carbon cap and trade scheme which concentrates primarily on the electricity generation industry in the expectation that dealing with the largest emitters will send price signals to consumers and induce behaviour change across all sectors of society (Department of Climate Change 2008).

The setting of targets is driving the review of available renewable energy sources at all levels (Garnaut 2008). Pressure is being placed on local communities - industry, business and even individual households - to replace fossil fuel based energy sources with renewable energy sources. While renewable energy sources such as solar, wind, biomass, geothermal or waves may be available globally, not all of them are able to be captured for use in all locations. The reasons for this may include: (1) low demand in locations where renewable energy is available; (2) lack of fully developed technology to capture or store the energy; (3) low levels of renewable energy in populated locations; or (4) costly infrastructure required to capture, store or transfer the energy to areas of demand. These factors will influence the forms and amounts of renewable energy that are available and easily accessible by communities.

Energy efficiency measures, unlike energy conservation, aim to reduce energy consumption while at the same time maintaining or increasing the level of useful output or outcome delivered (Productivity Commission 2005). There are expectations of significant gains to be made by using energy more efficiently. For example in March 2008 the Minister for Resources and Energy in the Australian Government stated:

> *'The Australian Bureau of Agricultural and Resource Economics projects that energy efficiency will contribute up to 55% to Australia's emission reduction targets by 2050.'*
>
> (Ferguson 2008)

This paper describes and discusses the results of trialling a method to assess the potential renewable energy resource, the energy reduction potentially achievable through energy efficiency and the associated GHG emissions reduction potentially achievable across a local government area. It uses the City of Playford local government area (Playford LGA) in South Australia and the Manningham City Council (Manningham LGA) in Victoria for this exercise but the authors consider the approach to be applicable to any local government area. At the time of writing this paper, the energy efficiency potential for Manningham LGA had not been completed so has not been included.

METHOD

This section describes the methodology used to assess the renewable energy resources and to calculate the energy efficiency potential for a local government area. (Note that in this paper PJ is petajoules of energy; MJ is megajoules of energy; km is kilometre; sq m is square metre; mm is millimetre; m/s is metres per second; kW is kilowatt, MW is megawatt).

Renewable Energy Resource Assessment

The methodology adopted for the assessment of renewable energy resources in this study builds on the approach developed in the United Kingdom (UK) (Grant and Kellett, 2002). This approach states that, regardless of the energy source or the type of technology needed to harness it, a common approach requires renewable energy potential to be analysed according to the following criteria:

- The Resource Base – the total quantity of energy or power which physically exists
- The Resource – defined as that part of the resource base which could be utilised under present or future economic circumstances, using existing or modified currently available technology
- The Reserve – that part of the resource which has been proven to exist and which could be exploited cost effectively under prevailing economic circumstances.

The size of the Reserve is determined by the prevailing market price for energy and can be complex to determine when different prices apply, as is the situation in Australia.

Potential Sources of Renewable Energy

The physical characteristics of each local government area (LGA) are the key indicators of its renewable energy potential. Fig. 1 provides a map of the location of the two case study areas and summarises the land use and population in each area.

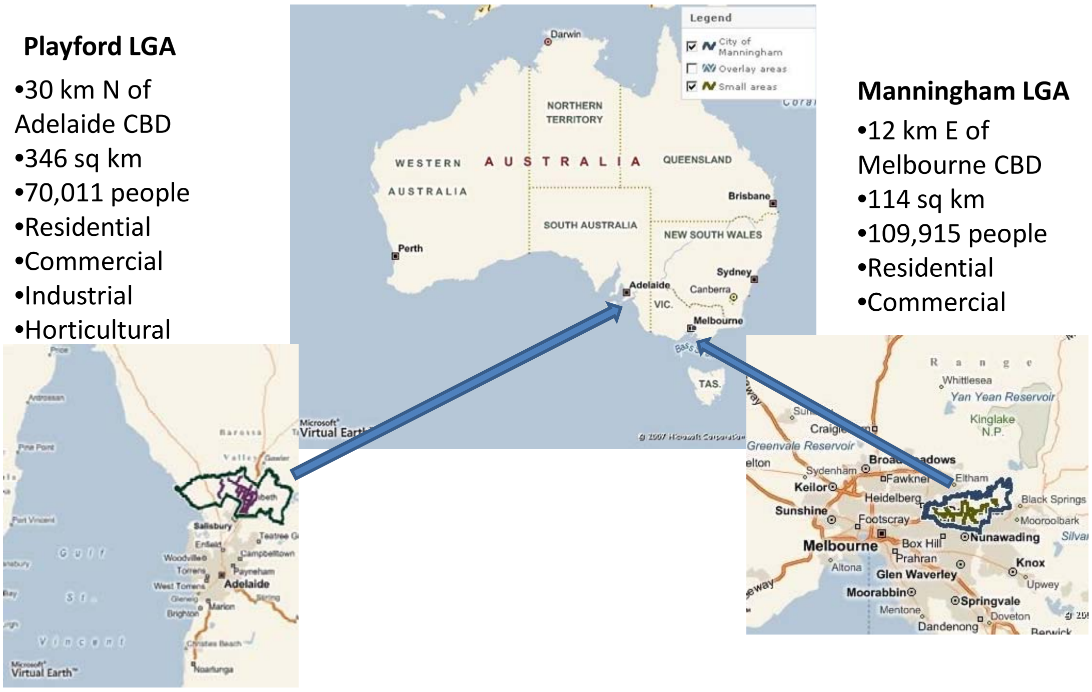
Location of Case Study Areas

Playford LGA

•30 km N of Adelaide CBD
•346 sq km
•70,011 people
•Residential
•Commercial
•Industrial
•Horticultural

Manningham LGA

•12 km E of Melbourne CBD
•114 sq km
•109,915 people
•Residential
•Commercial



Source: http://203.84.234.220/Profile/Playford/Default.aspx?id=120&pg=7&gid=10&type=enum
And http://203.84.234.220/Profile/Manningham/Default.aspx?id=115&pg=101&gid=10&type=enum

Fig. 1. Location map and description of case study areas

In Playford LGA in South Australia, rainfall is low (mean of 428 mm at Edinburgh RAAF Airfield) and there are few continuously flowing water courses. This, together with the generally flat topography, results in the potential for hydro power as a resource being negligible. Similarly the coast of Playford LGA is entirely within the Gulf St. Vincent which is relatively shallow and sheltered, which offers only moderate wave energy, therefore. However information from the Bureau of Meteorology (BOM) predicts reasonably constant mean wind speeds and a relatively high level of insolation (annual mean daily exposure was 17.7 MJ/sq m (BOM 2007)). This, together with the presence of a range of biomass sources, suggests potential for wind, solar and biomass energy developments.

In Manningham LGA in Victoria, the rainfall is higher than South Australia (mean 659 mm at Bundoora climate monitoring station) and some streams may have permanent water. However within Manningham LGA the topography while undulating in parts is still relatively flat and there is minimal opportunity for hydro power. Manningham LGA is also landlocked and therefore wave power is not an option. Fortunately Manningham LGA experiences reasonably constant and high wind speeds (10 to 15 m/s), it has reasonable levels of insolation (annual mean daily solar exposure was 15.1 MJ/sq m at the Bundoora climate monitoring station (BOM 2008)) and has some biomass sources which suggests potential for wind, solar and biomass energy developments.

The potential for wind, biomass and solar energy has been assessed for both Playford and Manningham LGAs.

Wind

The wind resource base was calculated assuming specific turbine types spaced out across the landscape at appropriate separation distances, according to manufacturers' specifications, without regard to obstacles such as existing developments or natural features. The annual average wind speed data was obtained from meteorological weather stations adjacent to the LGA. The wind resource assessment for both the Playford and Manningham LGAs was undertaken using five wind turbines – the Vestas V52, Vestas V39, the Whisper 500, Whisper 200 (1 kW grid connect) and the SWIFT Wind Energy System. Geographic Information System (GIS) software was employed to identify and quantify locations of the Vestas V52 and Vestas V39 wind turbines. For the larger turbines the resource was then estimated by applying a sieve of constraints such as urban development, rivers, forests, communication routes and planning constraints such as protective landscape designations, airport, road and residential buffer zones. The resource for the smaller turbines was determined by assuming that each residential, commercial or industrial parcel could accommodate one wind turbine. The cost per unit of energy produced by each turbine was then determined and compared with retail electricity, with the reserve comprising the energy that could be produced at or below the cost of retail energy.

Biomass

The review of biomass resources for the Playford LGA identified that animal wastes, human wastes, straw, pasture fodder, cereal cropping stubble, forestry residue and wastes and green wastes were being generated. For Manningham LGA, human wastes, green wastes and a small quantity of cereal straw were being generated. The human wastes and green wastes were already being used in both LGAs, leaving the other wastes as potential sources for biomass energy. Technology to process this biomass was identified and costs for generating energy were estimated.

Solar

Solar energy potential for each LGA was calculated using the total area and the annual mean daily solar exposure as measured at the respective climate monitoring stations in or near to each LGA. For Playford this was at the Edinburgh RAAF Airfield adjacent to the south west boundary of the Playford LGA (BOM, 2007). For Manningham LGA the annual mean daily solar exposure was obtained from the US National Renewable Energy Laboratory's calculator (NREL, 2008) and the BOM climate monitoring stations adjacent to the Manningham LGA.

Geographic Information System (GIS) software was employed to identify and quantify a sample of residential North Facing Roof (NFR) facets and all NFR facets of commercial and industrial buildings. Both solar photovoltaic (SPV) and solar hot water (SHW) devices were considered, with an initial estimate of a SHW panel and 1000W of SPV on each available residential roof. Thereafter a further estimate factored in SPV on the remaining NFR facets of all residential, commercial and industrial buildings. The cost per unit of energy produced by each technology was then determined and compared with retail electricity, with the reserve comprising the energy that could be produced at or below the cost of retail energy.

Further information about the development and testing of this methodology is detailed in a working paper for the Carbon Neutral Communities project (Hamilton, 2008).

Energy Efficiency Assessment

The method that was used to assess the energy efficiency potential for a local government area involves: estimating the energy use for each of the residential, commercial, industrial and transport sectors for the local government area; estimating the trend in energy use over a time period (in this instance 2006 to 2010); calculating the percentage energy efficiency improvement expected based on the range and average of studies undertaken in Australia and the particular State (for Playford LGA this is South Australia an for Manningham this is Victoria); and calculating the net energy use after projected increases and decreases due to efficiency over time. The estimate of the energy used by sectors in Playford LGA and Manningham LGA was obtained from a previous study undertaken by Hamilton *et al* (2008). The trends in energy efficiency and energy use across sectors were obtained from analysing and summarising various studies (Lee & Denlay 2002, Productivity Commission 2005, Cuevas-Cubria & Riwoe 2006, Spoehr *et al.* 2006, AGO 2007, Pears 2007a, Pears 2007b, Cousins *et al.* 2007, Apelbaum Consulting Group 2008, DTEI 2008, EES 2008, Hatfield-Dodds & Denniss 2008).

RESULTS

This section presents the results of the renewable energy resource assessment for wind, biomass and solar energy sources for the Playford and Manningham LGAs and presents the potential for energy reduction estimated for energy efficiency across the residential, commercial, industrial and transport sectors of Playford LGA.

Renewable Energy Resource Assessment

The results are presented firstly for Playford LGA and then for Manningham LGA.

Playford LGA Wind

The Vestas V52 turbine provides the largest resource base estimate at 32.1 PJ per annum. Restrictive planning policies, most notably a 15km exclusion zone around the Edinburgh Airfield (Royal Australian Air Force base) reduce this potential to just three turbines. A second resource estimate, which significantly reduces the 15km exclusion zone, but maintains other planning constraints, suggests a resource estimate of 542 turbines producing 3.4 PJ per annum of energy. The cost of wind derived power from the larger wind turbines in the study is price competitive with grid supplied electricity in South Australia, so all of the resource can be included in the reserve estimation.

The potential renewable energy from small turbines constructed on residential or business properties was estimated to be up to 0.24 PJ per annum. The electricity produced, however, is not as cost effective as with the larger machines and thus falls outside of the reserve estimate.

Playford LGA Biomass

Biomass sources in Playford LGA consisted of municipal solid waste from domestic premises, biosolids from domestic wastewater, green waste collected from households and from tree trimming as part of council operations, animal wastes from grazing or intensive farming activities, cereal cropping residues, straw crops and forestry residues, Several of the statistics required for the estimation of the biomass resource were difficult to obtain. Most of the biomass was already being collected and used for energy or other purposes. A combination of the fact that much of the biomass resource is currently utilised and several of the technologies used to extract energy from biomass are not currently cost effective, suggests that there is a sharp difference between the resource base, resource and reserve quantities. Whilst the resource base is around 2.7 PJ per annum, the resource is much smaller at 0.063 PJ per annum and the reserve less again at 0.013 PJ per annum.

Playford LGA Solar

The solar resource base was calculated to be 2,235.3 PJ per annum of which only 11.9 PJ per annum falls on NFR facets of buildings (0.5%). The resource calculation reduces this figure substantially since it considers only those areas such as suitably oriented rooftops which are capable of mounting solar collectors. The resource estimate suggests that 1.55 PJ of solar energy is technically extractable in Playford LGA using current proven technology. Estimation of the reserve requires this technical estimate to be set in the context of current energy prices. Solar hot water (SHW) is competitive with conventional fuels such as gas and electricity, but solar photovoltaics (SPV) generally is not. Only a small proportion of SPV which is heavily price discounted using the Origin Energy Solar Cities scheme, which at the time of writing is active in some northern Adelaide suburbs, falls within the reserve calculation. Thus the total available solar reserve is currently 0.6 PJ.

Summary Playford LGA Renewable Energy Resources

The potential renewable energy resources and reserves for Playford LGA are summarised in Table 1. In Table 2 the greenhouse gas (carbon) emissions associated with the renewable resource and reserve have been summarised.

Tab.1: Potential renewable energy resource base, resource and reserve for Playford LGA

Renewable Energy Source	**Resource Base** **PJ per annum**	**Resource** **PJ per annum**	**Reserve** **PJ per annum**
Vestas V52 Wind Turbines	32.2	3.08	3.08
Whisper 500 Wind Turbines	3.69	0.6	0
Biomass	2.7	0.06	0.01
Total Solar on Buildings (NFR facets)	11.9	1.55	0.6

Tab. 2. Summary of estimates of renewable resource and reserve and estimates of carbon emissions potentially able to be displaced for Playford LGA

Renewable Resource	**Resource PJ per annum**	**GHG emissions displaced Mt CO2-e/yr**	**Reserve PJ per annum**	**GHG emissions displaced Mt CO2-e/yr**
Solar PV	0.95	0.229	0.008	0.002
SHW	0.6	0.143 (0.031*)	0.6	0.143 (0.031*)
Wind	3.7	0.885	3.1	0.740
Biomass	0.06	0.015	0.013	0.003
Total	**5.3**	**1.272** **(1.16*)**	**3.7**	**0.888** **(0.776*)**

*if gas is displaced by renewable energy.

Manningham LGA Wind

The excellent wind resource in Manningham LGA resulted in similar resource base estimates for both the Vestas V39 and V52 turbines. These were 41.2 PJ per annum and 40.0 PJ per annum respectively. Similar constraints with regard to airfields were present in Manningham as for Playford LGA, but for Manningham LGA the exclusion zones were 30 km. Approximately two thirds of the Manningham LGA fell within the 30 km zone around the Melbourne Tullamarine, Essendon or Moorabbin Airports. Even disregarding these exclusion zones, no sites for medium to large wind turbines could be located within the Manningham LGA following the filtering of proximity to residential dwellings, roads and conservation areas. Therefore the contribution of the medium and large turbines to the potential wind resource is nil.

There was a potential resource base of up to 5.16 PJ per annum from small wind turbines placed evenly across the Manningham LGA. When placed one on each dwelling and on commercial and industrial buildings, this provides a potential resource of 4.37 PJ per annum. Comparing the cost to current retail electricity prices, all of this resource is economical and is a reserve.

Manningham LGA Biomass

Biomass sources potentially available in Manningham LGA were a small area of land for cereal crops (crop residues and straw), municipal wastes, green wastes and biosolids from domestic wastewater. Together these total a small resource base of 0.69 PJ per annum, of which more than two thirds was already being used leaving a resource of 0.2 PJ per annum. The reserve which is currently able to be economically produced was much less at 0.01 PJ per annum.

Manningham LGA Solar

The solar resource base for Manningham was calculated to be 649.9 PJ per annum, of which 22.13 PJ per annum was calculated to fall on north facing roof (NFR) facets. The resource which could be harnessed using current technology of solar hot water and solar PV was estimated to be 3.13 PJ per annum. Use of the solar resource for heating water was economical resulting in an estimated reserve of 0.93 PJ per annum.

Summary Manningham LGA Renewable Resource Assessment

The renewable energy resource assessment for Manningham has been summarised and presented as Table 3. In Table 4 the estimated carbon emissions potentially displaced by the renewable resource and reserve have been summarised.

Tab.3: Potential renewable energy resource base, resource and reserve for Manningham LGA

Renewable Energy Source	**Resource Base PJ per annum**	**Resource PJ per annum**	**Reserve PJ per annum**
Vestas V52 Wind Turbines	40.0	0	0
Whisper 500 Wind Turbines	5.16	4.37	4.37
Biomass	0.69	0.2	0.01
Total Solar on Buildings (NFR facets)	22.13	3.13	0.93

Tab. 4. Summary of estimates of renewable resource and reserve and estimates of carbon emissions potentially able to be displaced for Manningham LGA

Renewable Resource	**Resource PJ per annum**	**GHG emissions displaced Mt CO2-e/yr**	**Reserve PJ per annum**	**GHG emissions displaced Mt CO2-e/yr**
Solar PV	2.2	0.758	0	0
SHW	0.9	0.310 (0.047*)	0.9	0.310 (0.047*)
Wind	4.4	1.515	4.4	1.515
Biomass	0.2	0.069	0.001	<0.001
Total	**8.05**	**2.652 (2.389*)**	**5.3**	**1.825 (1.562*)**

*if gas is displaced by renewable energy.

Energy Efficiency Assessment for Playford LGA

Using the average of estimates of efficiency from various studies across the residential, industrial, commercial and transport sectors in Australia, an average energy efficiency improvement of 1.4% per annum is potentially readily achievable. A review of projections for energy use across sectors estimates an increase in energy use ranges from 1.3 to 1.8% per annum, effectively negating this efficiency improvement. The estimated energy demand for various sectors in Playford LGA in 2006 (from Hamilton *et al*. 2008), the projected estimate of total energy use by sector for Playford LGA in 2010 together with the estimate of the potential energy saved in each sector through energy efficiency initiatives is summarised in Table 5. At the time of writing this paper, the energy efficiency potential for Manningham LGA had not been completed so has not be included.

Tab. 5:. Estimates of energy use in Playford LGA in 2010 with and without efficiency improvements

Sector	Estimated energy use in 2006* PJ per annum	Estimated energy use in 2010 PJ per annum	Estimated energy use in 2010 after efficiencies PJ per annum
Residential -Electricity -Gas	1.24 0.52 0.53	1.32 – 1.53	1.175 – 1.48
Commercial	0.57	0.63	0.61
Industrial	4.59	4.85	4.67
Transport (including Transport and Storage Industry)	3.38	3.50	3.27

*Source: Hamilton *et al.* (2008)

DISCUSSION

From the analysis undertaken in this study a number of key points can be highlighted. Firstly the renewable resource available within both the Playford and Manningham LGAs is significant in terms of the impact that it could have on the demand for conventionally generated electricity. In a previous paper, see Hamilton *et al.* (2008), the current energy baseline for both the Playford and Manningham LGAs was assessed. The average energy demand for Playford LGA was 10.30 PJ per annum including transport energy. For Manningham LGA the average energy demand was 13.0 PJ per annum including transport energy. Comparing the estimated non-renewable energy demand to the estimated available renewable energy resource of 5.3 PJ per annum for Playford LGA, it is clear that there is potential to displace slightly more than 50% of the total non-renewable energy demand with renewable energy. In addition the reserve of 3.7 PJ per annum, more than two thirds of this renewable energy resource, could be generated economically under current circumstances. For Manningham LGA, the resource of 8.05 PJ per annum has the potential to displace slightly more than 60% of the total non-renewable energy demand with renewable energy while 5.3 PJ per annum is currently economical.

Secondly it is clear that the renewable resource is significant in terms of the contribution to carbon reduction and the overall carbon footprint of the area, were it to be fully exploited. In a previous paper (Hamilton *et al.* 2008), the carbon emissions baseline for both the Playford and Manningham LGAs was assessed. For Playford LGA the estimated average total carbon emissions were 1.07 Mt CO2-e per annum, while for Manningham LGA the estimated average total carbon emissions were 1.54 Mt CO2-e per annum. Using the estimates of greenhouse gas emissions potentially able to be displaced by using renewable energy in Tables 2 and 4, it is clear that the carbon emissions displaced exceed the carbon emissions generated for both Playford and Manningham LGAs. A renewable energy contribution of around 50% of current baseline energy demand in each area has the potential to displace more carbon dioxide than is currently produced in both Playford and Manningham. This apparently anomalous result stems from the fact that most of the renewable technologies discussed above result in an output of electricity, which is very inefficiently produced by burning fossil fuels. The high level of direct coal burn by industry in Playford determined from pro-rata state fuel consumption for industry and the very high contribution of transport in Manningham, both of which result in lower CO2-e outputs than is the case when burning fossil fuel to produce electricity, account for these results. Note that whilst renewable energy could displace more carbon emissions than is currently produced, this is largely with electricity and therefore does not immediately address the carbon emissions related to transport fuel use. If more electricity was generated from renewable sources than is currently estimated to be used in each LGA, there would be potential to feed electricity back into the grid or use the excess to power electric vehicles. The latter scenario would reduce the transport related carbon emissions if the use of fossil fuels in vehicles subsequently reduced.

Emerging policy on carbon reduction in Australia takes a top down approach, nationally identifying key emitters, which will be subjected to a carbon cap and trade mechanism. The intention is that the increased cost of emission reduction will be passed down the supply chain, thereby altering market perceptions and consumer behaviour. Investment in renewable energy technologies by utilities, industrial and commercial organisations and householders would all follow. Mechanisms such as Renewable Energy Credits (RECs) created by the recently increased Mandatory Renewable Energy Targets (MRET), (Commonwealth of Australia 2008), will also drive electricity generators towards provision of an increasingly greater supply of electricity derived from renewables. However, the tendency which has been noted so far has been towards the development of large scale wind farms and solar generating plant. Opportunities which take advantage of distributed generation with small scale solar and wind are less in evidence so far, despite the very favourable insolation regime in South Australia and the wind resource in Victoria. Spatial target setting has the potential to kick start these sorts of developments and potentially could combine effectively with top down sectoral cap and trade initiatives.

As with the estimation of baseline demand and GHG emissions, better data is needed in order to further this approach. In particular, local government should consider the potential of local energy resource and infrastructure plans. These would be a mechanism to identify the available resource within a given spatial area, publicise the potential to organisations of all scales and inform householders of their potential resource. Such estimates need to be set in the context of both carbon and financial cost savings, so the reserve estimate is a crucial aspect of this work. Changing attitudes to planning policy and changing energy costs can increase and decrease the reserve estimate. Thus a public debate about the degree of restriction on the location and operation of wind farms, for example, is a necessary prerequisite of plan formulation. As the public become increasingly aware of the need to reduce carbon emissions and the environmental and financial costs involved, it will wish to be party to prioritisation of planning constraints. This is particularly the case for wind farms, individual wind turbines and facilities for converting biomass to energy such as municipal waste incinerators where the public is likely to have strong opinions about the potential impacts and decisions regarding location. Leclerq and Morgans (2008) reported that noise emissions were the most widely publicised challenge facing the uptake of wind energy. Other issues which have been raised as barriers to community acceptance of wind energy relate to visual amenity, shading, flickering and electromagnetic interference from the wind turbine generators (Gipe 1995, Finlay-Jones & Kouzmin 2004). Barriers to establishing biomass to energy facilities include adverse public reaction to potential impacts related to emissions such as odours, particulates and toxic organics (Dresner & Gilbert, 1999) and issues of fairness and equity (Wolsink, 2007).

In addition to the challenges posed for local government planners already highlighted, local government faces significant barriers to support households to install renewable energy technology where properties are rented rather than owned. While the tenant may be keen, the landlord may not wish to invest in the property. Another challenge is also posed by the energy efficiency assessment for Playford LGA which indicates that there is little prospect of significant reduction in energy use in the short term due to energy efficiency as the increased demand for energy over time matches the expected energy efficiency improvements.

There are, however, economic and social benefits resulting from the potential for employment in installation of renewable energy technology. Hamilton (2008) analysed the potential employment opportunity for the Playford LGA and identified 32 jobs over 5 years in retrofitting solar hot water and 1000W solar PV on all dwellings while installing 50 Vestas V52 turbines (42 MW total) across Playford LGA would result in a benefit of $76,500,000 and create 21 to 33 jobs as well as provide the energy for the residential sector of Playford LGA. Local government would need to make decisions in light of foregoing these types of socioeconomic benefits.

CONCLUSIONS

This study has presented a method to assess the potential renewable energy which could be harnessed within a local government area. The results of the assessment show that for the two cases studied, a significant amount of energy could potentially be produced from wind and solar resources within each LGA and that a high proportion of this resource could be generated economically under current circumstances. The potential for displacement of current carbon emissions is also possible if the full resource is realised. While the limitations of this paper do not allow further exploration of some of the issues raised, a number of significant challenges for local government have been identified for further exploration. The authors consider that the method outlined in this study is applicable to any local government area provided sufficient information is available.

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Cathryn Hamilton has more than 20 years experience in the South Australian Government, mainly in natural resources management and environmental protection roles including 8 years as Manager of Environmental Management at the South Australian Water Corporation. In 2007, Cathryn completed a Masters in Urban and Regional Planning from the University of South Australia and is currently undertaking her PhD at the School of Natural and Built Environments at the University of South Australia with a scholarship funded by the ARC Linkage Project - *Carbon Neutral Communities – Making the Transition*. This project is being undertaken in conjunction with RMIT University in Melbourne and various industry partners including local government in both South Australia and Victoria. Cathryn’s PhD focuses on local government initiatives to support carbon neutral households.