A review of the current status of Small Wind in Western Australia and effectiveness of relevant State and Federal policy

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ABSTRACT

This paper reviews results from recent surveys on small wind electricity generating systems facilitated by the Western Australian Local Government Association (WALGA) together with outcomes from a WALGA/Murdoch University Small Scale Wind Workshop and results from an internet search of materials related to Federal, State and International small wind power system policy. The results point to an increase in interest in small wind electricity generation systems in Western Australia (WA) that is reflected in estimates of installed small wind power system capacity based on Renewable Energy Certificates (RECs) created since 2007. However, even with this growth, installed small wind power system capacity pales in comparison to installed small solar PV capacity despite the State of WA having both a strong wind and a strong solar resource. At a Federal level, there is a disparity between incentives given to wind and solar systems and the authors raise concerns with the current calculation of RECs for small wind power systems. At a State level, cost and planning regulations are identified as central barriers to small wind power systems. This paper suggests that improved and dedicated State policy for small wind electricity generating systems can address both of these barriers in WA.

Keywords – small wind turbines, policy, planning regulations, market drivers and barriers, community interest

INTRODUCTION

Both British and American Wind Energy Associations report a recent rapid growth in the deployment of electricity generating small wind turbines (SWTs). In the USA, the largest SWT market in the world, the deployment of units more than doubled from 2005 to 2008 with 17.3 MW of capacity installed in 2008 (AWEA 2009). During the same period, the deployment of SWTs in the UK almost tripled with over 10,000 systems cumulatively installed over the four years and 7.24 MW of capacity added in 2008. 2008 also saw the UK export market double with half of the year's turbine production being sent overseas (BWEA 2009). The number of global SWT designers/manufacturers

recorded growth as well, rising from the 69 reported in 2006 (AWEA 2008) to 219 in 2008 (AWEA 2009). Continued growth in US and UK SWT markets is expected to be driven by a strong wind resource, rising electricity prices, increasing investment, supportive national and state policies, increasing public awareness, economies of scale, and competitive local markets (AWEA 2009; BWEA 2009). While cost and planning regulations still represent the central barriers to global SWT market growth (AWEA 2008), industry growth and SWT penetration in the US and UK indicate that barriers to SWT systems are lowering in the UK and USA on all fronts.

Analysis of the SWT market showing rapid growth in the US and UK led to the question of the extent to which this trend exists in WA. Western Australians enjoy a strong and reliable wind resource across large regions of the State (Coppin et al. 2003; State Government of Western Australia 2003), are experiencing increasing electricity prices, and have access to Federal incentives supporting SWT system deployment in the State (Commonwealth of Australia 2006; Office of the Renewable Energy Regulator 2009c). However, less than 1% of accredited renewable small generation units in the State (Office of the Renewable Energy Regulator 2009a) are powered by wind. The aim of this work is to assess the status of the SWT industry and market in WA and the effectiveness of State and Federal policy on SWTs. The specific objectives of this work can be listed as:

(1) To assess the extent to which the overseas growing community interest in SWTs is present in Western Australia and the capacity of local WA councils to manage requests from their communities regarding SWT systems,
(2) To assess the current status of the SWT market and industry in Western Australia, including the extent to which the overseas trends of significant growth in deployment of SWTs is present in WA,
(3) To examine the level of current planning policy regarding SWT systems in local government in Western Australia, with reference to relevant State and Federal policy,
(4) To investigate barriers to SWT systems in the State with reference to the effect of policies that address barriers in the USA and UK, and
(5) To propose improved and dedicated policy for SWT systems in Western Australia.

METHODS

In order to determine the level of interest in SWT systems, the capacity of local governments to manage community wind enquiries, and the existence of local planning policy, this paper analyses results from a recent online survey on SWT systems facilitated by the Western Australian Local Government Association (WALGA). The results from a separate WALGA-funded survey of local SWT designer/manufacturers and distributors is also considered in determining the state of the SWT market and industry and the level of SWT installations in WA. Outcomes from a WALGA/Murdoch University Small Scale Wind Workshop held in March 2009 together with findings from an internet search of materials relevant to WA, Federal and International SWT policy are then used to inform a discussion of policy in Western Australia. All sources are then used in identifying the need for improved and dedicated State policy on SWTs in WA.

Definitions

It is useful to introduce some definitions to establish the scope and context of the review of SWT systems in this paper. The definition of a "small" wind turbine system varies from country to country and usually hinges on the electrical power production of the turbine used in the system. For the purposes of the SWT policy discussion in this paper, the authors make use of the Australian government's definition of a wind-supplied small generation unit (SGU) as "a device whose energy source is wind and has a kW rating of no more than 10 kW and generates no more than 25 MWh of electricity each year" (Office of the Renewable Energy Regulator 2009c). It should be noted that the AWEA statistics reported in this paper are based on a turbine classification of 100 kW or less (AWEA 2009) while the BWEA statistics cover turbines of 50 kW or less (BWEA 2009). Despite these differences, AWEA and BWEA figures are considered relevant to this discussion as SWT systems of 10 kW or less comprise around 98% of all 50 kW or less wind power systems installed through 2008 in the UK (BWEA 2009) and over 98% of all 100 kW or less wind power systems deployed in 2008 in the US (BWEA 2009).

Considerable diversity of shapes, sizes, orientations, materials, components, and mounting configurations exist among SWTs conforming to the 10kW or less power rating. Four common classifications of SWTs are based on whether the turbine is:

(1) a horizontal-axis wind turbine (HAWT) or a vertical-axis wind turbine (VAWT)

(2) ground-mounted on a tower or pole (pole-mounted) or building-mounted

(3) grid-connected (on-grid) or stand-alone (off-grid)

(4) deployed in an urban environment.

RESULTS

WALGA Local Government survey data

Between December 2008 and March 2009, a survey of WA Local Government, facilitated by WALGA, was carried out by circulating an online questionnaire covering the state of policy, planning regulations, public interest and council knowledge and capacities surrounding SWT systems. It also addressed local council objectives of sustainable and renewable energy in general. 146 local and regional councils were surveyed and 38 responses were received (WALGA 2009d). The results of the survey were a mix of qualitative and quantitative data and were made available to the authors by WALGA for the purposes of analysis. Fig. 1 reflects enquires regarding wind received by local government in 2007 and 2008 while Fig. 2 examines council capacities in terms of SWT enquiries. Tab. 1 presents the nature of enquiries received by the council from the community as well as the councils own interests and concerns related to SWT systems. Tab. 1 was produced from qualitative data and each aspect listed was mentioned at least once by survey respondents. A qualitative measure of reoccurrence in the surveys is denoted in the table by low, medium, and high levels of interest/concern.

Fig. 1 presents total enquiries received by WA councils in 2007 and 2008 along with the share by sector from which enquiries were received. Average values for binned data are used with the error bars calculated from bin widths. Fig 1 shows that the total number of

enquiries from 2007 to 2008 has more than doubled. In each year, approximately half of the enquiries received are from householders. Significant growth in enquiries from wind turbine manufacturers and universities/research institutes is also noted. In 2008, local councils also returned information on the turbine mounting type with which an enquiry dealt. Pole mounted turbines feature in 86% of enquiries in which a turbine mounting system was specified (WALGA 2009d).

Fig. 2 shows that despite the growing interest in SWT systems, councils are not currently adequately prepared to handle enquiries related to SWT system policy, planning regulations, incentives, and applicability in their municipality. The error bars in Fig. 2 reflect, with 95% confidence, the margin of error in extrapolating the results of the sample to the population of 146 councils (Creative Research Systems 2009).

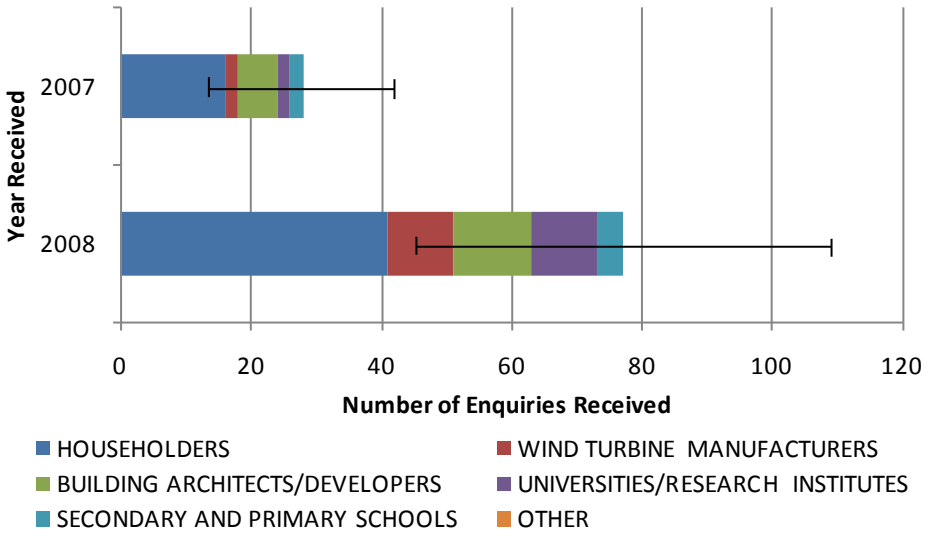

Fig. 1: SWT system related enquiries to WA Local Governments in 2007 and 2008 (WALGA 2009d).

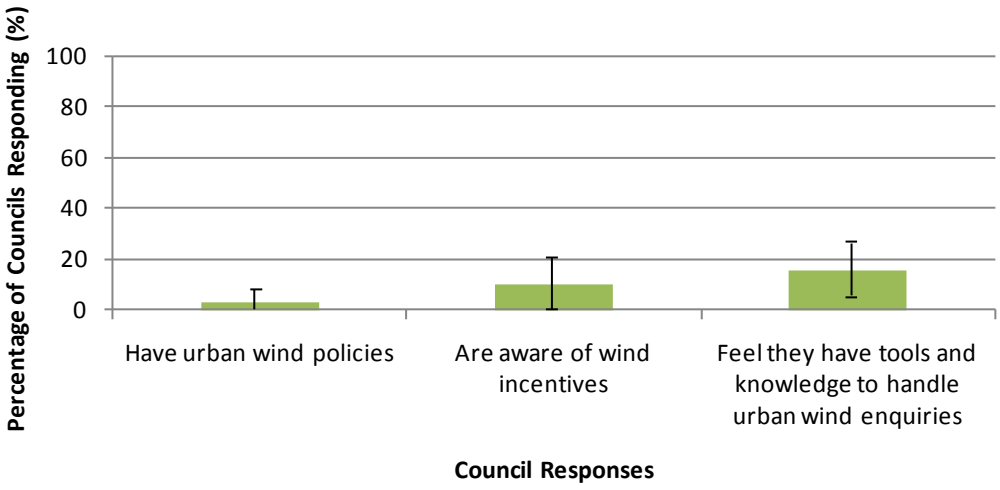

Fig. 2: Council capacities related to SWT system development (WALGA 2009d).

Tab. 1 indicates that the members of the public were mainly interested in obtaining information about planning approval for SWTs as well as general and technical information about SWTs. Councils were also interested in planning approval in terms of assistance with developing planning guidelines but were most interested in costs and the sustainability of SWT projects in terms of the environmental benefits and impact (noise, visual impact and safety).

Tab.1: Aspects related to SWT systems of interest/concern to the public and to local councils. Low, medium, and high denote qualitative recurrence rates (WALGA 2009d).

SWT information requests and areas of concern	Public	Councils
General information	Medium	Medium
Planning requirements	High	High
Technical information and turbine quality	Medium	Medium
Noise impacts	Low	High
Visual impact and amenity	Low	High
Low profile turbines	-	Low
Affect on bird populations	-	Low
Infrastructure for grid connection	-	Low
Aesthetics	-	Medium
Safety (public and structural) and risks	Low	Medium
Turbines on public open space	-	Low
Costs, payback periods, feed in tariffs, grants, funding	Low	High
Climate suitability and environmental benefits	-	High

WALGA designer/manufacturer and distributor survey data

WALGA also funded a separate survey of the WA SWT industry, which was carried out over the same time period between December 2008 and March 2009. The industry survey consisted of interviews with three local designers/manufacturers and an online questionnaire filled out by three of four surveyed distributors (WALGA 2009e, 2009c). All six respondents were primarily focused on the urban SWT market. Questions covered the topics of technology, application, cost, market incentives, and barriers to entry, SWT certification, and government policy.

The survey results showed that both manufacturers and designers were interested in the grid-connected residential market, but saw local government and local businesses as their immediate market. This was primarily due to the lack of uniform SWT system planning regulations across the 141 different local councils in WA and the perceived difficulty of navigating the politics that come with SWTs in residential areas. Growing interest of manufacturers in the urban market was reflected by the fact that the focus of all three interviewed local designer/manufacturers was on developing vertical axis SWTs for specific urban situations. Of the three designer/manufacturers, only one had already installed a turbine in a real world test location and was actively pursuing installations in Western Australia and other countries. Of the three distributors, one of the three had installed a turbine in WA and another had an installation pending. Designer/manufacturers were all aiming to make SWT systems competitive with current solar PV pricing (without subsidy) as they recognized that without increased government support SWT systems are not currently cost competitive with solar PV.

WALGA/Murdoch University Small Scale Wind Workshop

The National Small Wind Turbine Centre (NSWTC) and the Institute of Resource Technology (IRT), both based at Murdoch University, collaborated with WALGA to host a "Small Scale Wind Workshop" in March 2009 at the City of Cockburn Council Offices in the Perth metropolitan area. There were approximately 70 attendees including manufacturers, distributors, planners, developers, renewable energy consultants, academics and both local and State government representatives. The workshop consisted of a series of presentations, covering the topics of the global SWT market, the application of mesoscale wind modelling techniques to estimate the wind resource within WA local government boundaries, the results from the WALGA surveys on SWTs, and the connection between policy and innovation (WALGA 2009a). There was also a presentation by stakeholders in the Durack 2 building development – a project that controversially incorporates three Turby urban SWTs into their building design (State Administrative Tribunal 2008). The presentations were followed by Small Group Deliberation on the way forward in the area of policy and planning for SWTs. Some key outcomes of the workshop were agreement that 1) policy related to research grants, certification and accreditation should be implemented at the Federal level, 2) wind profile mapping and broad planning criteria such as design strength and noise should be implemented at a State level, and 3) that establishment of planning guidelines outside those at State level were necessary to incorporate local issues such as location and aesthetics (WALGA 2009b). The March WALGA workshop closed with the "next step" proposal of a Small Wind Task Force to assist in designing broad State policy for SWT systems in WA.

Internet search for relevant State and Federal SWT system policy

The Federal Government of Australia currently assists the development of SWT generation technology through legislation which creates a nationwide renewable energy generation target (RET) and a Renewable Energy Credit (REC) valuation and trading scheme (Office of the Renewable Energy Regulator 2008). Under this system a SWT system is able to create, sell and trade RECs in one or five year deeming periods according to rules specified by the Office of the Renewable Energy Regulator (ORER).

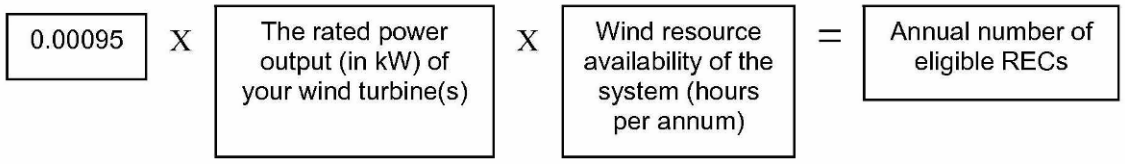

Fig. 3: Australian SWT system REC calculation formula (Office of the Renewable Energy Regulator 2006)

REC creation for SWT systems is based on the rated power output of the system's SWT and the wind resource availability (Office of the Renewable Energy Regulator 2006) as specified in Fig. 3. For systems installed in areas without a proper wind resource assessment, a base annual wind resource of 2000 hours is provided for calculation (Office of the Renewable Energy Regulator 2006). The rated power output of the system's SWT in kW is determined by the SWT manufacturer (Office of the Renewable

Energy Regulator 2006). The five year deeming period REC valuation and up-front sale value of a 1 kW SWT system installed in May 2009 with a 2000 hour/year resource is estimated to pay the REC holder $409AUD (SolarPay.com.au 2008). To date 1264 unique RECs have been created by small generation units (SGU) of wind energy in Australia, with 178 of those RECs being unique and created in Western Australia (Office of the Renewable Energy Regulator 2009a). Assuming a five year deeming period and an average wind resource equal to the base figure of 2000 hours, rearrangement of the formula in Fig. 3 yields an estimate of a total of around 19 kW of SWT capacity installed in Western Australia since 2001.

Fig.4 presents estimated annual deployment of SWT capacity in WA and Australia since 2001, based on a five year deeming period for small wind REC creation and a conservative 2000 hour annual wind resource. The figure suggests that SWT capacity in WA has been increasing since 2007 with June of 2009 figures already surpassing 2008 installations. The ORER REC database for wind SGU also shows that only 17% of wind SGU RECs deemed in Australia between 2001 and 2003 have been re-deemed following completion of the first five year deeming period (Office of the Renewable Energy Regulator 2009a). The reason for the low re-deeming rate on systems usually designed to last at least 10 if not 25 years (The Carbon Trust 2008) is not further pursued in this paper but leads to questions of SWT system maintenance and robustness as well as REC re-deeming procedures. Wind SGU REC creation can be compared to a cumulative 885,105 RECs deemed for nationwide solar PV SGU of which 136,910 were deemed in Western Australia (Office of the Renewable Energy Regulator 2009b).

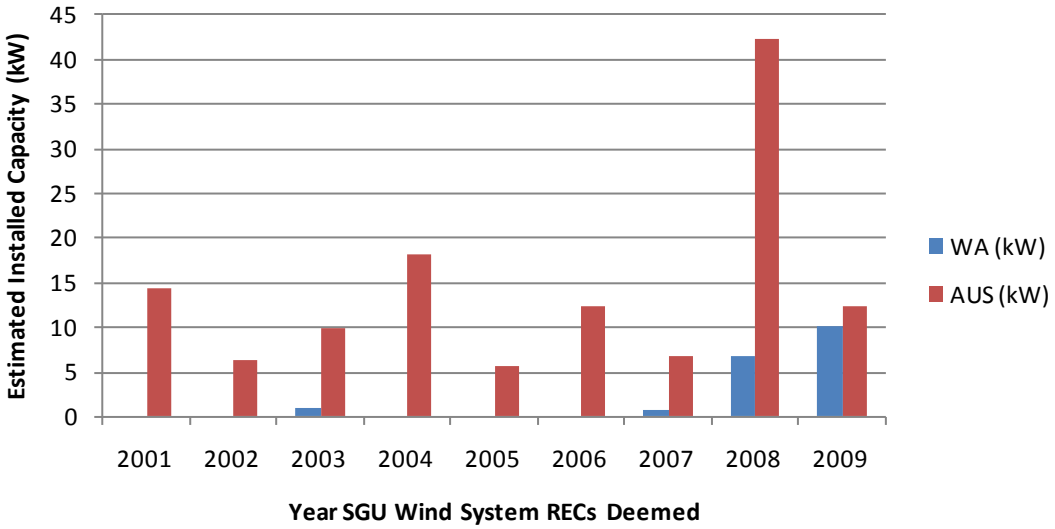

Fig. 4: Estimated kW of SWT capacity installed in WA and Australia (Office of the Renewable Energy Regulator 2009a)

The excess of solar SGU is not surprising in the sunny State of WA, but even with recent growth in the PV market the comparatively low number of SWT RECs deemed in a State with a solid wind resource is surprising.

The Federal Government also currently supports SWT systems through the National Solar Schools Program which allows for up to $30,000AUD to be spent on school

renewable energy and efficiency measures and can include a SWT. An additional $20,000AUD is available if a solar PV system of over 2 kW is included in renewable energy and efficiency measures (Department of the Environment 2008). Federal Government support also extends to SWT research and development as in August 2008, the Federal government announced funding of $1.05 million for a National Small Wind Turbine Centre (NSWTC) to be operated by the Research Institute of Sustainable Energy (RISE), based at Murdoch University in Perth, Western Australia. The aim of the NSWTC is to support the development of the SWT industry in Australia by providing services in the areas of Testing, Standards and Labelling, Professional Development and Training and Research (Murdoch University 2009).

In terms of support for SWTs at a State level, direct support comes via funds from the Sustainable Energy Development Office (SEDO). SEDO was established in 2001 to fill the "vital role of accelerating the adoption of renewable energy and energy-efficient strategies across all sectors of the community" (SEDO n.d.-a). The Federal government's Renewable Remote Power Generation Program for off-grid areas is administered in WA by SEDO. SWTs are one of the renewable technologies which are eligible for rebates under this Program (Department of the Environment 2009). SEDO also offer funding through a competitive R&D Grants Program. In 2007, SEDO awarded $34,000 AUD to a local SWT inventor to assist in turbine development (SEDO n.d.-b). This was followed by a subsequent award for the inventor in 2008 to complete the final stage of research and development on the turbine. The State Government also supported a 2008 wind feasibility study on the roof of the Melville council building in WA (Whale et al. 2008). Indirect support by the State government for SWT systems manifests through support for WA renewable energy demonstration sites (some of which incorporate SWTs), the creation of basic literature mentioning the inclusion of SWTs in remote area power systems in WA (SEDO n.d.-c) and the reform of the State electricity market in 2003 to allow for competition from all State energy sources and increased choice for electricity purchasers (Office of Energy 2003). In summary, State policies and activities create a mildly supportive atmosphere for SWTs in WA, but do not significantly enhance Federal Government policies on SWT systems.

DISCUSSION

The extent to which growth in interest in SWT systems in WA resulted in an increase in installations in the State was not explicit from the findings of the WALGA-funded surveys. Results from the REC registry in Fig. 4, however show a sharp increase in the deeming of unique accredited SWT RECs between 2007 and 2008. The rapid growth in SWT installations in WA between 2007 and 2008 is consistent with a rapid growth in SWT installations in Australia shown during the same time span and might be said to reflect trends occurring in the global market. Western Australia shares some of the same local SWT market drivers present in the US and UK; a strong wind resource, the recent increases in WA electricity tariffs[†], growing awareness of the connection between anthropogenic climate change and human activity (Australian Bureau of Meteorology

[†] Announced officially in February 2009 (Office of Energy 2009) but which are rumoured to increase by more than 70% over the next 6 to 8 years (ABC News 2008)

2009), supportive Federal policy and growing awareness of SWT technology all exist in WA. However, even with similarities in market drivers, there is still nearly twice as much SWT capacity installed per person in the US and nearly four times as much in the UK (AWEA 2009; BWEA 2009).

A look at the relative states of the two central barriers, cost and planning regulations, to SWT systems in all three locations can shed light on differences in per capita installed SWT capacity and inform discussion on improved SWT policy in WA. Through September 2008, there was no uniform policy supporting SWTs across the USA (AWEA 2009), yet SWT system deployment grew. This can be attributed to individual US States choosing to support SWT and micro-generation technologies through the adoption of renewable energy education measures, feed-in tariffs, and a variety of rebate programs rewarding residents choosing to pursue clean energy technologies (AWEA 2008).

In the UK, SWT development is currently supported by the UK government's 2006 Microgeneration Strategy, the 2006 Low Carbon Buildings Programme (Allen et al. 2008), and a policy pursuing a 20% renewable energy target for national energy production by 2020 (Burton and Hubacek 2007). Such policies have provided direct subsidies for SWT systems and lowered prices for SWT systems through the stimulation of competition and investment in the industry. Having said that, the annual deployment of SWTs *decreased* slightly from 3787 units in 2007 compared to 3453 in 2008. In particular the proportion of building-mounted turbines decreased from 27% in 2007 to 19% in 2008 (BWEA 2009). A look at concurrent SWT related activity in the UK suggest that the market might have been influenced by the initial results from the Warwick Microwind Trial Project (Encraft 2009), which were unfavourable towards building-mounted SWTs.

The BWEA, however, attribute the slight downturn in annual units deployed to delays in the introduction of the UK government's General Permitted Development Orders (GDPO); policy which aims to streamline planning for SWT systems. The GDPO was originally planned to come into effect in April 2008 and its delay has led to many consumers adopting a "wait and see" attitude before installing a SWT. The UK expects marked increases in deployment of SWTs in 2010 due to the introduction of the GDPO policy together with Feed-in-Tariff policy to address both planning and cost barriers. The BWEA predict that the number of SWT systems installed in 2010 will be approximately 3.5 times the number installed in 2008, with 80% in the capacity range 0-1.5 kW, 75% grid-connected and 54% building mounted i.e. predominately system designs for the residential and small-business sector.

A recent report on the feasibility of urban SWTs in Melbourne stated that in general, without economic support from the Australian government, the Australian urban SWT market is not currently commercially viable (Webb 2007). Reported wind SGU capacity in WA as gathered from the ORER registry and survey results from the local SWT industry reflect the same situation in Western Australia. The situation is exacerbated by the lack of State policy and uniform local planning policies on SWTs, evidenced by the WALGA Local Government survey and referenced in the WALGA local SWT industry surveys as translating directly into the SWT industry's reluctance to enter the residential market. In addition, Fig. 2 shows that, in the main, local WA Governments do not currently have the capacity to address community SWT system enquiries or formulate

planning policy on small wind systems. Tab. 1 further illustrates the need for a range of information on SWTs addressing areas of strong concern to local councils and the public such as SWT noise, planning requirements, visual amenity, financing, and environmental appropriateness.

Growth of the SWT market will continue to be marginal at best if State policy fails to address local planning issues when Federal policy support for the SWT industry in WA and Australia is strengthened as expected in July 2009. Further support comes in the form of the revised REC system for SGU under the new Solar Credits scheme (Department of Climate Change 2009). This system is expected to increase the subsidies fivefold for the first 1.5 kW of SWT capacity. There are currently however, issues in the REC valuation method of Fig. 3. Firstly, the rated power of the SWT depends on the rated wind speed, which is set by the turbine manufacturer. There are no standards that relate to the rated wind speed that a manufacturer must choose, making it easy for unscrupulous manufacturers to manipulate the system (Gipe 2000). Secondly, an accurate wind resource availability figure is crucial and the default value of 2000 hours cannot be relied upon, particularly for urban SWT installations where capacity factors have proved to be very low (Encraft 2009). Unfortunately without revisions in the REC valuation method (e.g. linking REC creation with actual turbine energy creation) or the introduction of uniform and well considered SWT system planning regulations in WA to deal with REC valuation problem areas, the outlook for SWT deployment and market growth in WA may actually get worse as perceptions suffer from underperforming and ill conceived wind installations.

This paper recognizes that comparing the situation in a single Australian State with the situation in two entire nations will yield only partial results. Additional limitations include the low response rate of the WALGA Local Government survey which led to margins of error on the order of up to 15-18% for yes/no type questions (Creative Research Systems 2009), the bias of that survey towards urban SWTs and not SWTs in general, and a survey of SWT distributors representing minority stakeholders in the wind SGU installed in WA. The results of this paper must be considered in the light of these limitations.

CONCLUSION AND RECOMMENDATIONS

While solar hot water systems are a common sight and solar PV systems are becoming an increasingly common sight in the Perth metropolitan region, SWT system visibility is comparatively non-existent. This is not only due to the lack of a comparative Federal subsidy for SWT systems, but also to the lack of a unified State policy framework and planning guidelines for SWTs across Local Western Australian Government borders. Both represent central barriers to SWT systems in WA. Additional barriers include a lack of easily accessible and appropriately targeted SWT information and knowledge in the state as well as unresolved issues surrounding wind resource assessment and turbine standards in current and proposed Federal legislation. While the State Government may not be able or willing to directly address the cost barrier to SWT systems in WA, as shown by recent disarray over the proposed State feed in tariff (Energy Matters 2009), well considered and coordinated State policy on SWTs can address remaining barriers to SWT market growth in the State.

Improved SWT policy in WA could be centred on the formation of the Small Wind Task Force (SWTF) proposed at the WALGA/MU Workshop and informed by the work of the NSWTC. The SWTF would envision, design and implement a supportive policy framework for SWTs in WA and provide local governments with a set of base planning guidelines they can adapt to their local council conditions and regulations. SWTF formulation of State policy addressing issues around turbine standards, wind resource assessment, and targeted and appropriate information, can be coordinated to draw from NSWTC advancements in these areas. A set of clear guidelines for SWT installation across WA would support both the SWT industry and consumers. As in the US and UK flow on effects from the stimulation of the SWT industry can create drivers such as competition and economies of scale in the SWT market. Such drivers work to address the cost barrier. On a wider playing field it is hoped that SWT system policy development in WA coupled with similar movements in other States might stimulate further policy development and support for SWTs at a Federal level.

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