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INTELLIGENT GRID RESEARCH CLUSTER- PROJECT 5

Intelligent Grid Social Impacts

Curtin University

iGrid
intelligent grid
an Australian research collaboration

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1. EXECUTIVE SUMMARY

1.1. Project 5 – Investigating the Social Aspects of IG-DE

Project 5 of the iGrid research cluster focussed on investigating the social aspects and impacts of deploying IG-DE (Intelligent Grid-Distributed Energy) technologies from a variety of energy stakeholders' perspectives. To capture understandings of the issues, impediments and drivers of IG-DE from a diversity of vantage points, the research design incorporated a three stage research process. Stage one involved firstly, case study interviews with key stakeholders in WA's regional communities of Denmark and Walpole located at the edge of the South West Interconnected System (SWIS) electricity grid, to gain their beliefs and understandings of IG-DE and the implications associated with its deployment. This initial phase also involved evaluating Western Power's pilot community engagement process to plan the sustainable energy needs of these two communities which incorporated IG-DE solutions. Stage one culminated with insights about the socio-economic barriers faced by community members and the extent to which institutional collaboration and community activism facilitated the planning and deployment of IG-DE, including community-owned DE initiatives.

Stage two involved an energy attitude survey undertaken with the Small and Medium Enterprises (SMEs) sector in the regional communities of Denmark and Albany to gain their perspective of the issues and impacts implicated with IG-DE deployment. This stage revealed that despite the high levels of pro-environmental values, the economic viability of IG-DE technologies proved to be a major impediment to deployment. Most encouraging however, is that given sufficient economic incentives, SMEs would deploy IG-DE technologies and an energy efficient business practice.

The third stage of the study incorporated two phases. Phase one involved interviews with key energy stakeholders within WA's energy industry network to gain their perspective on the issues, barriers and drivers of an IG-DE transition or their preferred discourse a 'smart grid' transition that includes 'distributed generation' capacity. This phase revealed that while there is majority support for a 'smart grid' transition, economics and lacking energy expertise among policy makers are key impediments facing the industry. In spite of the barriers, there is much optimism that energy technological advancements and consumer demand for IG-DE and other energy efficient technologies would drive policy and regulatory reform.

The second phase of stage three involved an energy stakeholder survey conducted with iGrid Industry forum participants which was held in Perth, WA on March 11, 2010 to gain their perspective on the issues and impacts related to an IG-DE electricity system. While the majority highlighted institutional and economic impediments as significant industry barriers, there was also the conviction that the potential for network efficiency gains and cost savings will lead to policy and industry recognition of its value.

1.2. Overarching Themes of the Study

The central aim of this project involved assessing the implications of deploying IG-DE solutions against human, social, economic, political, cultural and environmental considerations. This study revealed a number of key themes, the most significant involved the high level of acceptance among energy (residential and SMEs) consumers and the network of energy stakeholders that IG-DE or 'smart grid' solutions represents a genuine alternative to a centralized grid supply. However, economic viability is the crucial impediment that must be proven for IG-DE to shift from the discourse of theorised benefits to validated investment opportunity. Also a significant theme, with regard to driving and enabling the transition toward IG-DE is that governments are attributed with

the ultimate responsibility for policy direction, coordination and incentivising all energy stakeholders. The paradox however, is the lack of trust placed in governments' capacity to implement the policies toward an IG-DE vision. While there is desire for government leadership on policy and regulation, there is also the recognition of the need to take personal responsibility, where all sectors of society including community, business and the energy networks drive the vision through both top down and bottom up processes.

While numerous barriers have been identified, the participants of this study overwhelming support the strategic actions of community energy initiatives, institutional facilitation through community engagement processes, including innovative business models such as the roof space rentals, as key enablers for the deployment of IG-DE at the residential and SMEs level. The chief theme emanating from energy stakeholders is that while the industry faces enormous economic pressures in transforming to a smart grid system, it can be enabled by government leadership, policy direction, regulatory reform and collaboration with the energy industry to ensure it can operate as an economically viable sector.

1.3. Key Findings of Stage One – Regional Community Interviews

1.3.1. Environmental Attitudes; Barriers and Drivers

The community interviews revealed that regardless of environmental values and risk perceptions of climate change, there is overall policy support for commercial scale RE sources and small scale DE to enable the transition toward a clean energy economy. While participants react positively to DE technologies, the reality is that only a minority of regional residents can afford to access government subsidies for solar PV. Hence, community acceptance of DE does not necessarily translate to deployment as affordability is the key impediment.

While residents desire energy independence to live sustainably and SMEs are keen to promote green business credentials and/or attain energy security, economic viability is the key impediment. Although higher feed-in tariffs are considered a key economic incentive to increase penetration of solar PV generation, other incentives are also vital to promote deployment among the low income households and SMEs.

With regard to the motivations underlying acceptance of IG-DE, those with strong sustainability values embrace IG-DE because reducing reliance on fossil fuel is the ultimate priority. In contrast, those not concerned about climate change support the development of renewable DE, but oppose community DE projects that are perceived to restrict economic growth of the community. Despite the value orientations, affordability is the key barrier and deployment of IG-DE will be highly dependent on policies and programs that complement government subsidies to incentivise all energy stakeholders. A key recommendation involves utilizing the revenue raised from the proposed Carbon Tax to incentivise IG-DE deployment among disadvantaged energy consumers.

1.3.2. Collaborative Strategies to Drive Consumer Behaviours

A key strategy that has the effect of enabling IG-DE acceptance among regional residents, including low income households is the smart meters pilot initiated by Western Power. To reduce peak energy demands among edge of grid communities, Western Power has deployed a number of Demand Side Management (DSM) strategies at no cost to consumers. Combined with education and training residents are facilitated to reduce energy consumption and electricity costs. Criticisms however, have been levelled at power companies for over emphasizing the benefits of smart meters to consumers when in fact Utilities gain more from the capacity to cut staff (Fyfe, 2010). To build trust, Western Power's Green Town project involves collaborative engagement with

community members as a key driver for IG-DE because consumers are informed about the benefits of energy technological innovation.

1.3.3. Access to Information and Expertise - Influencing Energy Behaviours

Also pertinent is that energy education in isolation is insufficient to influence energy conservation behaviours. As Owens and Driffil (2008) critiqued, while the popular information deficit approach may influence attitudes, it has little or no impact on behaviour, as a multitude of forces are associated with living sustainably (Devine-Wright & Devine-Wright, 2004). Shove and Warde (2001) draw attention to the important influence of cultural norms, routine habits and practices, social networks and the energy technological system that structures patterns of daily life. Early adopters also highlight other economic and technical barriers influencing energy actions. For example, the costs involved with engaging specialist engineering and architectural services to install innovative energy technologies is not a viable option. Energy Utilities are called upon to provide a specialist energy advice service to incentivise businesses to undertake IG-DE including energy efficiency.

1.3.4. Driving Energy Conservation Behaviours

Driving energy conservation behaviours according to respondents involves three sources of influence. While some call for a regulatory force to influence energy conservation behaviours; others believe that holding altruistic values to live sustainably is the key approach. This latter group also advances long term visions for a low carbon society based on balance between idealistic and realistic goals. Hence, strategies for transformational change include consciousness-raising; initiating social norms, social equity, and market and policy incentives to drive green energy investments. For those who are driven by external motivations, emphasis is placed on the social, economic and environmental benefits of energy technological advancements, and policy and economic incentives to motivate all stakeholders.

1.3.5. Institutional Responsibility and Facilitation

While participants support IG-DE technologies, governments are endorsed as responsible for energy security, supply and reliability. While the expectation is that Western Power will play an advocacy role in influencing State energy policy; others advance the contribution of community driven DE initiatives as a key climate change mitigation strategy. The consensus however, is that a supportive energy regulatory and policy context is vital to increase penetration of DE initiatives. Despite these institutional expectations, according to study participants there is a profound lack of confidence in government leadership to tackle climate change issues. Instead trust is placed with bottom up leadership among community and environmental activists playing a key role as advocates for changes at policy and community levels.

Study participants who are indifferent to climate change concerns however, are focussed on the social and economic sustainability of regional communities and advocate for socio-economic visions. Hence, the State government and the energy Utilities are attributed with the ultimate responsibility for energy supply. While not opposed to IG-DE solutions, cynicism is raised by community stakeholders about its impact on economic growth. While socio-economic survival is highlighted as a priority, it also reflects a general distrust with government for devolving state responsibility to the regions particularly resource poor communities.

1.3.6. DE and RE Sources - Drivers and Barriers

With regard to energy sources desired for Australia, there is overwhelming support for renewable energy (RE) sources and a growing minority support for nuclear power. While those who are motivated to address climate change risks are opposed to coal and nuclear power sources, a sub-group who perceive a low risk to modern nuclear facilities endorse it as a viable option to tackle climate change. This perspective however, will need re-visiting in light of Japan's Fukushima nuclear incident in 2011. A third group who are indifferent to climate change and value their geographic and community heritage, are not opposed to coal power sources but are highly resistant to nuclear power plants due to health and waste storage risks. This group is supportive of IG-DE but does not consider it an individual or community responsibility. While there is overall policy support for RE sources to power an IG-DE transition, fossil fuel and nuclear power is more controversial.

1.3.7. Community Interviews - Conclusion and Implications

This first phase identified that while energy supply is the key domain of governments and energy utilities, the community can also play a powerful role in driving the IG-DE transition. While the dominant perspective advances sustainable energy planning that incorporates RE sources and IG-DE solutions, it is driven by a desire to address climate change. The alternative minority perspective reflects those who are indifferent to climate change but desire energy security planning that is not restricted by energy source, particularly if DE threatens socio-economic sustainability. It is vital for Western Power to address community concerns and clarify the potential of IG-DE and the implications for economic growth.

This phase also highlighted that while pro-environmental values predicts support for IG-DE it does not lead necessarily lead to deployment as affordability is the greatest barrier. Despite the steep rises in the cost of electricity, it appears that government subsidies and the feed-in-tariffs are not sufficient to motivate action. On the other hand, for those who can afford to deploy DE, the rising cost of electricity, aspiring a sustainable lifestyle, mitigating greenhouse gas (GHG) emissions are key drivers. While many barriers exist, innovative energy policy and programs are vital to enable an IG-DE transition. Western Power's DSM strategies are a pertinent example of how institutions can incentivise residents toward smart grid solutions.

1.4. Phase 2 – Community Distributed Energy (DE) - Promising Process

The second phase of stage one captured key insights of a community owned DE initiative undertaken by a small group of entrepreneurial environmentalists to build two 800kW wind turbine generators in the regional community of Denmark. While the conceptual process began in 2002 and the proposed development generated enormous community conflict, the Denmark Community Wind Farm (DCWF) gained majority community and Local Council support in 2010 to position the twin turbines on Crown land. Despite experiencing intense negative community reaction, arduous official procedures and paper work including political obstruction, the developers aspired to build the first community owned DE wind farm in Western Australia.

While the political hurdles have subsided, they face further delays as a new application is processed to access government funds. In spite of the obstacles the DCWF developers are optimistic that the remaining fifty per cent will be funded through the sale of community shares. A key recommendation to surmount institutional barriers facing developers of community DE initiatives includes the establishment of supportive regulatory and institutional structures that prioritize community funded DE projects.

While community DE initiatives are considered a key strategy, it does require project developers with the expertise to establish trust as a vital first step. Also essential are public engagement skills to address diverse stakeholders' concerns to avert and deal constructively with political conflict. As Walker et al (2007) highlighted the vagueness and ambiguity of the community RE label becomes problematic when it is politicised into public debate. While community RE projects that are intended to achieve collective outcomes of sustainability is a good investment, Walker et al (2010) guards against simplistic prescriptions of 'what works', as it cannot simply be replicated in any social context. In spite of the reservations, the important benefits of community-owned DE is that it contributes to local income generation, (Walker, 2008) and as Stamford (2004) highlights wind farms are the most profitable forms of RE with proven returns. Given the incentives for community DE, policy attention is vital to lower the barriers by structuring a smoother and speedier institutional process for small-scale DE generators.

1.5. Phase 3 – Community Engagement – Facilitating IG-DE

This phase of the study involved evaluation of Western Power's community engagement approach with edge of grid communities. Most pertinent is that institutional collaboration facilitated a more democratic planning process away from 'centralised expert management', (Nelson et al., 2008) and which proved most conducive to the deployment of IG-DE solutions. While this process led to a number of IG-DE solutions to be undertaken, this power working group must ensure that its decisions are valid and accountable to the larger community. While adopting a *sustainability* framework to assess the decisions made is a crucial deliberative tool, trained facilitators are also vital to monitor power differences between diverse stakeholders to promote the less powerful voices. Inclusive representation can also be assured by undertaking regular feedback with the larger community. While this energy planning group inspired many socio-political and economic benefits for the community, most pertinent is that it motivated Western Power management to drive IG-DE solutions for edge of grid communities.

While Western Power's planning process has been significantly influenced to consider IG-DE solutions for regional communities, it has also evolved with undertakings of social policy programs to incentivise economically disadvantaged residents to engage with DSM energy efficient solutions. While bottom up processes can promote community and institutional change, also vital are top down policy processes to address the socio-economic factors that enhance and impede the successful transition toward IG-DE.

1.6. Key Findings of Stage 2 - SMEs Surveys

1.6.1. Integrating Socio-Economic and Environmental Sustainability

The key theme emanating from the SMEs survey is that environmental and economic sustainability is valued equally. This is attributed to a strong sense of attachment to place, along with a desire for socio-economic and environmental sustainability to be integrated in energy planning and policy. While appealing for broader decision making frameworks to energy planning, the paradox is that the majority support a free market competition. Only a minority are philosophically opposed to a consumerist society. To surmount the socio-economic concerns of highlighted by regional SMEs, strategic policies and programs are vital to enable economically sound investments in IG-DE.

1.6.2. Energy Cultural Worldviews and Responsibility for Actions

SMEs exhibit strong pro-environment beliefs and attitudes and attribute climate change as human caused. However, responsibility for action to address energy and climate change issues is linked to their cultural world views. For example, a cultural perspective characterized as *Hierarchists,* attribute governments as ultimately responsible for climate change and energy policy. In contrast, *Egalitarians* feel a personal moral responsibility to undertake actions to reduce energy usage and GHG emissions. The *Individualists* on the other hand, are either (a) indifferent to climate change and do not feel a personally responsible and/ or (b) prefer to delegate the responsibility to others. In light of the diversity of energy cultural world views, policies and programs must be designed to incentivise all three cultural groups to drive energy conservation and DE actions. While top down regulatory and economic instruments are popular, bottom up processes are crucial to drive long-term behavioural change.

1.6.3. Desired Energy Policy Actions

Support for various energy policy actions also differ according to the SMEs energy cultural world views. For example, while all groups support regulatory and market reforms, the *Hierarchists* and *Egalitarians* favour the Carbon Tax, DE subsidies and green energy investment. Although the *Individualists* oppose the Carbon Tax, they support the Mandatory Renewable Energy Target (MRET) and technological investments such as the Carbon Capture and Storage (CCS). While there is overall support for a multiplicity of government policy actions, it reflects the desire for a top down co-ordinated approach to climate change and energy policy. However, policy support for complementary bottom up strategies, such as community DE projects and eco-village estates are also vital to promote cultural change toward IG-DE.

1.6.4. Attitudes and Responsibility for Energy Actions

The SMEs survey also confirmed that green attitudes and awareness does not necessarily translate into concrete energy conservation actions. For example, despite acknowledging their contribution to GHG emissions, numerous barriers are cited and specifically that energy is low priority compared to other issues impacting SMEs. These reactions however, reflect a desire for institutional action to set strong signals and incentives for a transition toward a low carbon economy that incorporates IG-DE. While all cultural orientations support government direction, *Egalitarians* believe in personal responsibility and collective civic action to influence governments' agenda for climate change and energy policy actions.

1.6.5. Roof Rental Business Model - Promoting on-site DE Options

While SMEs indicate a personal responsibility to engage with on-site DE, deployment is dependent on the economic, regulatory and informational barriers being addressed. One option that facilitates DE deployment involves a business model developed by a local entrepreneur to rent roof spaces to generate electricity from company owned PV panels and micro wind turbines. This business is in transition and the expectation is that Western Power will support this DE business model. While the relentless increases in electricity tariff is not considered an incentive for DE, SMEs do wish for economic (e.g. rebates) and regulatory (e.g. mandatory energy efficient [EE] buildings) incentives to drive deployment of DE and EE solutions. Concern however is expressed that economic incentives would lead to sectoral inequality, as disadvantaged SMEs could not afford access to

rebates. Policy makers are challenged to structure incentives to ensure all energy consumers can access it regardless of socio-economic status.

1.6.6. Policies and Technologies to Reduce GHG Emissions – Trust in Government

Also echoing the community findings, the majority of SMEs favour RE sources over fossil fuels. However, most significant is that nuclear power is identified as more desirable than coal. Japan's Fukushima nuclear disaster is expected to affect the global renaissance for nuclear energy and the accuracy of SMEs' attitudes to nuclear power. While SMEs indicate a desire to address climate change concerns and favour strategies to reduce GHG emissions, there is less certainty about the effectiveness of the Carbon Tax. While some view it as another tax burden to benefit the polluters, others lack trust in governments to use the funds efficiently to subsidize vulnerable groups and reduce GHG emissions. Policy makers face a monumental task to secure public trust that the impacts of a Carbon Tax will be shared fairly. SMEs also lack confidence in both state and national government leadership on matters of climate change and energy policy. While they are undecided about the capacity of governments to deal with sustainability and energy issues, it also reflects a general frustration with the inability of governments to deliver on policy at both federal and state levels.

1.6.7. Information, Educational and Identity

Also highlighted is a key link between SMEs energy awareness, social identify and framing of educational material to promote acceptance of IG-DE technologies and energy conservation behaviours. For example, local social networks are central to SMEs access to information, however, the media and the internet is also influential. To ensure that social identify is not threatened, educational information must be framed to reflect the various cultural orientations. For example, for *Hierarchists* educational information needs to be framed in neutral language, outlining simple, practical IG-DE solutions, focussing on the benefits. The information also needs to be sourced from locally trusted government and industry organizations. Similarly, *Individualists* are not open to environmentalist appeals and communication needs to be framed around techno-centric and economic benefits. The information also needs to be communicated through trusted local radio programs and community newspapers. As *Egalitarians* are more sceptical of media sources, eco-centric and techno-centric appeals that emphasize climate change catastrophe can be accessed through environmental networks. Hence information campaigns need to communicate the message to fit the motivational appeals of a variety of audiences.

1.6.8. Community Differences – Implications for IG-DE Deployment

This study revealed that what works in one community does not necessarily work in another. IG-DE is most salient in the community of Denmark as energy reliability is a major issue. Other characteristics which enabled intrinsically driven energy behaviours include: a small population of approximately 5000; a high proportion of environmental activists and where sustainability is a mainstream value. Also contributing to the prominence of IG-DE is Western Power's community engagement processes to collaborate with key community leaders also facilitated IG-DE visions.

As for the larger regional community of Albany, IG-DE is not a salient issue for a number of reasons. Firstly, energy reliability is not an issue and Verve Energy has invested in the installation of 12 prominent wind turbines in this community. Given that large scale RE is a prominent feature in this community, it is not surprising that small scale DE is not personally compelling for SMEs. There are also a number of government organizations charged with the management of economic and environmental goals for the region which further distances individual responsibility for DE. Although the hike in electricity tariffs is having an impact on residents, economic viability is the key impediment for SMEs.

A comparison between these two SMEs communities revealed that promoting personal responsibility for energy is highly associated with local and institutional leadership and coordination. SMEs tend to operate in isolation without support, hence strong regional leadership, combined with institutional facilitation and social and community networks operating as the conduit for long term change is a vital process for change.

1.7. Conclusions and Recommendations

While SMEs overwhelmingly support pro-environmental strategies to mitigate climate change impacts, they cite numerous impediments in deploying DE and EE. While economics is the greatest barrier, SMEs desire broader sustainability frameworks that integrate socio-economic and environmental impacts to guide policy. The paradox however, is the majority support for free competition. To address the socio-economic impediments, incentives that enable sound economic investments in IG-DE are vital. Despite a call for government leadership on energy policy, there is a lack of trust in governments to execute it effectively. Also important, is that educational and informational campaigns are framed to fit the motivational appeal of diverse energy cultural groups and communicated through a variety of mediums. Promoting personal responsibility for IG-DE engagement among SMES will also require leadership and the supportive structures of institutional and community networks.

1.8. Key Findings of Stage 3 (Phase 1) - Energy Stakeholder Interviews

1.8.1. What constitutes a smart grid road map

In capturing WA' energy stakeholders' perspectives to IG-DE, two dominant views of what constitutes a 'smart grid' (respondents' preferred discourse) road map prevails. The first group endorses the International Energy Agency's (2010) smart grid road map which constitutes the role of four pillars, namely: (a) *Societal*; (b) *Financial*; (c) *Regulatory and Policy* and (d) *Technology* as ideal. While all four pillars are vital, the role of *societal* is deemed as the key driving force to progress smart grid. For example, fundamental to motivating the transition toward a low carbon community involves the contribution of consumer education, financial incentives and regulatory support for IG-DE initiatives. While visionary leadership is vital to enable societal level transformation, the focus is also on enabling grass roots action.

The alternative perspective posits a smart grid road map encompassing three pillars (*financial*; *regulatory and policy* and *technology*) where governments and energy Utilities play a key role in transforming the energy system. Emphasis is placed on government leadership as well as policy and regulatory reform to facilitate market mechanisms to incentivise clean energy solutions through complementary risk/reward measures. While the focus is on top down processes, public education is vital to inform consumers of the benefits of smart grid and distributed generation (DG) technologies. While the two perspectives differ on their emphasis of top down and bottom up processes driving the smart grid transition there is agreement that a complementary approach is more powerful.

1.8.2. Debating the Smart Grid Costs and Benefits

Despite diverse conceptual understandings of a smart grid/DG system, the consensus view is that energy Utilities can pursue a more energy efficient electricity system. More importantly, smart grid enables flexible institutional thinking away from centralized approaches, as a repertoire of smaller scaled DG technological options can be deployed as needed. There is however, greater support for DG technologies such as the Combined Cooling Heat and Power (CCHP) system compared to renewable energy (RE) generation due to network reliability and stability issues. In spite of these concerns, RE sources is desired above fossil fuels.

While the learning curve about smart grid is steadily progressing, most concerning is that key decision makers lack detailed understanding of industry implications and the costs and benefits of adopting this system. While the positive aspects of a smart grid transition have been strongly advocated, the concern is that it will proceed without informed debate of the implications of such a revolutionary change. Stakeholders call for a national debate to clearly define the economic costs and prove the benefits.

1.8.3. Impediments and Issues related to a Smart Grid

The overwhelming consensus is that the economics of a smart grid is the most significant impediment facing the Industry as the magnitude of government funding required is considered untenable. Hence, unless a justifiable business case can be demonstrated to governments and business the aspiration appears idealistic. While most support an integrated bilateral electricity structure, questions are raised about the economic and energy efficiency benefits of smart meters pursued by the Industry. Given that efficiency gains are dependent on consumer behavioural change, doubts are expressed about the risks involved with the massive capital outlay. While modelling studies demonstrate financial benefits of a smart grid, there is a call for applied research to substantiate it, as less costly options are available to deal with critical peak demands. Respondents also identify obsolescence as an important issue requiring investigation to ensure that smart grid offers long term investment returns.

1.8.4. Smart Technologies and Pricing Mechanisms – Consumer Benefits

While consumers' lacking energy knowledge base is considered a key barrier, the suggestion includes consumer engagement, training and education to ensure consumers benefit from the application of smart meters and time of use (TOU) pricing mechanisms. To exploit the timeliness of energy salience, policy makers are also called upon to engage with the public and prove customer benefits from smart grid technologies. While a 'TOU' tariff is a key instrument to influence energy behaviours, concerns are raised about the adverse impacts to disadvantaged groups. A sliding scale tariff similar to the Californian model that penalizes high energy users and protects the minimum lifestyle needs of those on low incomes is considered a more appropriate social policy approach. While it is important to address energy poverty, it needs to be balanced with cost reflective tariffs otherwise the artificially low prices will subsidize extravagant energy users.

1.8.5. Addressing Technical, Network, Policy and Regulatory Barriers

Promoting IG-DE according to stakeholders requires the technical, network and policy and regulatory barriers to be resolved. The recommendations include a standardised approach to grid connection and technical modification to uptake excess generation capacity. Addressing policy and regulatory impediments involve a number of changes, including: (a) market reforms to purchase DE and prioritize DE generation over coal sources; (b) reviewing market rules to deal with liability issues for network damage caused by residential generators and (c) enacting

regulation to oblige Western Power to accommodate all residential solar generation. In summary consistent government policy is vital to ensure that DE can be accommodated on the grid.

1.8.6. Incentivising Stakeholders in the Value Chain

Disaggregation is cited as a major impediment to smart grid, as the energy industry in WA is considered economically unviable within its current disaggregated regulated structure. Also curtailed is the efficient operation of the Utilities, as collaborative strategic planning and collaboration is stifled. There is also a lack of regulatory and financial incentives for Utilities to advance smart grid solutions. To drive energy efficiency and cleaner energy sources respondents advocate for policy and regulatory changes to incentivise stakeholders in the value chain. The proposal includes (a) *revenue decoupling* for energy Retailers; (b) *regulatory reforms* including strategies such as a GHG emission liability to halt the Network Utilities from expanding their transmission lines and (c) incentivising Generators to switch to greener fuel sources. The narrow 'economic rationalist' Economic Regulatory Authority (ERA) approval process is also identified as a key barrier to a smart grid transition and calls are made to expand the frame of reference to include social and environmental cost benefit analyses.

1.8.7. Institutional Barriers within WA

To surmount institutional barriers and promote visionary leadership and consciously considered funding of smart grid solutions, the recommendations include (a) policy makers and government agencies increasing their knowledge base of smart grid technologies and policies to enable effective and timely decisions to be made; (b) raising the staffing and resource capacity of energy agencies to operate strategically with visions that benefit the State; (c) undertake research and development to evaluate the feasibility of smart grid for WA's energy policy context; (d) tackle lack of political will and cultivate visionary leadership on climate change and energy policy as a whole of government approach and (e) develop policy incentives that drive a suite of green generation technologies that is not tied to powerful political lobby groups.

1.8.8. Barriers to Distributed Generation – Cultural, Technological and Economic

Stakeholders highlight some major barriers for distributed generation (DG) which energy Utilities and commercial customers face. Firstly, while Western Power is key advocate for smart grid and DG solutions, they contend with numerous network constraints and have adopted a more cautious approach until the issues are resolved. For commercial customers, the impediments are both economic and cultural. Firstly commercial customers need to embrace cultural change to self fund energy generation plants as a long term business plan. Secondly, systemic change to the regulated energy market structure is also vital to enable commercial customers to deploy DG plants such as CCHP systems, as a fifteen year gas contract is vital for economic viability. A further impediment to small scale DG is that it is economically less attractive to energy Utilities compared to the economies of scale derived from large scale systems.

1.8.9. Impediments to Deployment of Renewable DG Technologies

Although renewable DG technologies are a desirable development, it is considered economically prohibitive for the majority of consumers. While government economic incentives have contributed to the rapid penetration of solar PV, this level of subsidization is considered vital to enable further uptake of DG. While wind power technology has advanced exponentially and small scale wind turbines are a promising DG source, the costs associated with connection, storage and back up and technical equipment to synchronize and protect the grid is considered a major barrier. While wave power is a desirable source, its barriers are that the technology is in its infancy and it is not

yet commercially viable. In spite of these concerns, there is much optimism that Carnegie will surmount the obstacles to demonstrate wave power's commercial applicability.

1.8.10. Most Important Drivers for IG-DE/Smart Grid

Addressing Institutional Barriers

While respondents identify a lack of political will to drive sustainable energy solutions as a key institutional barrier in WA, having a consistent policy and regulatory framework to enable a smart grid transition is also imperative. As the stakeholders highlighted, firstly the power network is not regulated to accommodate all residential solar power on the grid and secondly Retailers are not obliged to purchase its RECs in WA. In view of these issues, the call is for political leadership and coordination to drive a smart grid transition that secures the WA's energy industry's best interests. However, also imperative to address the energy policy vacuum in WA includes policy makers acquiring high level energy expertise to undertake strategic planning and evaluation. Collaboration between energy utilities and consumers contributing their core strengths to drive policy visions is also integral to the process. A smart grid transition is also dependent on consistent leadership and vision at the state and national level.

Drivers for the Consumers and Incentives for DE/DG

While there are a number of incentives driving DG, from a householders' perspective they include rising energy costs, government subsidies and the desire to mitigate climate change impacts. While rising electricity prices is a powerful motivator, other incentives include the higher FIT, RECs, the RE Buyback Scheme and government subsidies. While 'consumer choice' to engage with emerging DG technologies is considered a key driver, incentivising energy conservation must incorporate a balance between reward and penalty. For example, smart meters without cost reflective tariffs would limit energy efficient behavioural change.

Drivers for Industry and Society

While the push to reduce peak energy demand, emissions reduction and energy security are seen as key drivers for smart grid solutions, economic and market incentives are also deemed pivotal in supporting research and development of clean energy sources. The consensus is that government subsidization is germane for all sectors of society to undertake smart grid solutions. While energy Utilities lack funding for research and development of energy innovations, collaboration between energy Utilities, business and research institutions is considered fundamental to prove economically viable IG-DE solutions. While the consensus is that proving economic benefits is the key driver, smart grid is also dependent on institutional cultural change toward an alternative energy system.

1.8.11. Most Promising Process to Drive Smart Grid Solutions

Stakeholders advocate a number of promising processes that facilitate a smart grid transition. Firstly, '*community distributed energy'* is considered a significant bottom up process, as community members drive the community owned energy generation initiatives and also bear the associated costs. Also highlighted is Western Power's pilot *community engagement* process to plan sustainable energy visions with regional communities as a key model to advocate for smart grid solutions. Stakeholders who are driving the smart grid include Land Developers who are demanding energy innovation to build energy efficient commercial buildings and residential eco villages and homes to gain a market edge. The State Government's $30 million LEED (Low Emissions Energy Development) fund for research and development of a variety of RE

technologies is also a key driver for smart grid.

1.8.12. Most Promising Technologies

In terms of technological innovation, the consensus view is that *solar PV* research on solar panel efficiency is expected to prove cost effectiveness in ten to fifteen years. *Wave power* is also considered a promising, as smaller-scale generation studies undertaken by Carnegie is demonstrating economic viability. *Combined Heat and Power* (CHP) and *CCHP* systems are also considered ideal DG solutions, but requires prioritization by policy makers to provide RECs as it reduces carbon output by 40% and up to 60% in some cases. While the *Combined Cycle Gas Turbine* offers great potential, it is currently too complicated for commercial purposes. Smaller scale *wind turbines* are also promising as its size is less distracting and more aesthetically appealing. The potential of *fuel cells* is also advanced, as mass production will render it an economically viable technology.

Curtin University's *Biomass Gasification* project is also identified as a new technological project backed by Federal Government funding. Although the *plug in electric vehicle* (PHEV) is a promising advancement, which faces economic and network impediments but it is expected to play a major role for the smart grid network with its DE storage capacity. The *Home Area Network* (HAN) and *Direct Load Control* capabilities, the simplest and smaller technologies are considered the next significant milestones to be deployed by the energy industry. While there are no silver bullets, many processes and emerging technologies are considered promising but the issue of most concern is the political lobbying by interest groups to promote a narrow repertoire of technologies.

1.8.13. Making Smart Grid Attractive to the Business World

The greatest impediment to a smart grid is that it competes with the much cheaper coal and gas energy source. To be attractive to the business world the expectation is that it will be economically on par with fossil fuel sources. To promote the economic viability of WA's energy industry, the call is for government incentives and a greater educative process to inform the energy sector of economically viable options. On the other hand, the relentless tariff increases is expected to motivate the commercial energy consumers toward DG options as it is an economically viable long term investment.

On the whole respondents found it difficult to ascertain how smart grid could be made more attractive to the business world as there is a paucity of applied research to guide the industry. Nevertheless, energy Utilities are driven to implement smart grid solutions for a variety reasons: (a) to reduce the peak energy demand, (b) avoid paying higher prices during peak times, (c) meeting Renewable Energy Targets (RET) and Renewable Energy Certificates (RECs) liability obligations and (d) offering customer choice for green energy. While the MRET is credited with motivating the development of large scale RE, this policy instrument is considered a constraint to innovative thinking because management is focussed on meeting obligations and sustainable planning is not a priority.

While Utilities target specific smart grid strategies to exploit associated economic and efficiency gains, no clear guidelines exist to determine the most feasible options. Research demonstrating the real costs and benefits of IG-DE to networks and customers is a key enabler. Also of importance is that the industry engages in genuine debate at state and federal levels to determine the costs, benefits and implications of IG-DE for the WA context.

1.8.14. Energy Governance Structure and Sustainability Planning

The consensus view is that WA's energy governance structure is a sound model however delivering transformational change toward a smart grid would require institutional actors with vision and technical expertise to play an immediate policy and regulatory role. There is a strong belief that the energy industry operates under a narrow regulatory framework and the call is to incorporate a triple bottom line approach, particularly to the Energy Regulatory Authority (ERA) process as it focuses too heavily on the economic bottom line. Otherwise long term visions are constrained because the social and environmental gains are excluded. The call is for policy makers to go beyond economic rationalism by adopting a sustainability oriented decision making framework.

1.8.15. Accessing Energy Information

On the whole energy stakeholders rely heavily on networking with other energy Utilities and the energy industry networks at state and national levels to access the latest energy information on IG-DE, but access to research publications is limited. While the majority access internet and media sources, senior management attend national and international conferences. Most favour collaborative relationships with university-based research institutions to be better informed about the latest smart grid energy trends and developments.

1.8.16. Influential Stakeholders – Inclusive Representation

The consensus is that governments at state and federal levels have the most influence over a smart grid policy. Although the WA Government is an influential player, Western Power is considered the lead advocate for smart grid solutions, while Synergy also deploys smart grid options. Other major stakeholders having voice on policy and regulatory issues include the ERA, Office of Energy, Horizon Power, Verve, and Treasury. CSIRO and some Universities are also identified is having influence over smart grid and DG developments. To promote energy policy that does not adversely impact those most disadvantaged, advocates such as WACOSS and ACOSS play a lead role to represent energy poverty issues.

Playing a More Significant Role – Community Stakeholders

With regard to who should be playing a more significant role, many respondents highlighted that as the end use customer is the linchpin in progressing the IG-DE transition, their engagement with decisions that affect their lifestyle is imperative. Hence, customers are seen as a priority and energy Utilities are expected to advocate on their behalf to ensure that their voice is heard at the policy and regulatory levels. Energy stakeholders also desire to play a more significant role in smart grid policy through collaborative efforts in strategic planning and policy development. To promote inclusive representation, energy retailers and consumer advocates are identified as needing to play a more significant role to ensure energy poverty issues are addressed.

Forming Closer Ties - Exclusion of WA Utilities

WA energy stakeholders are concerned that they are excluded from participating at national energy policy development and debates, and the discussions are NEM focussed. While Western Power is invited to national discussions, this impedes engagement, communication and collaboration between the energy Utilities. To include WA in the national energy governance process, forming closer ties with influential federal agencies engaged in energy policy is considered vital. Forming closer ties with research institutions such as CSIRO and major Universities in WA and nationally is also desired to facilitate research and development

opportunities and access to the latest energy expertise.

1.8.17. Conclusions and Recommendations

While respondents have highlighted a number of issues and impediments to a smart grid transition within WA's energy regulated context, there is still much optimism that the process will be driven by visionary leadership stemming from both top down and bottom processes. The path toward an IG-DE transformation is viewed positively as the benefits far outweigh the costs in the long term. The process however needs to be driven by a decision making process that includes some of the following (a) policy makers with knowledge and expertise; (b) research that demonstrates the implications, costs and benefits; (c) sustainability criteria that assesses the economic, social and environmental consequences of the transition; (d) a national debate that clearly defines the economic costs and proven benefits; (e) community engagement with the smart grid technological transition; (f) institutional support for community DE initiatives and (g) a more inclusive energy governance model of participation.

1.9. Key Findings of Stage 3 (Phase 2) Energy Stakeholder Survey

1.9.1. Issues, Drivers and Barriers of IG-DE

The energy stakeholder survey undertaken participants attending the 'iGrid' industry forum held in Perth on March 11, 2010 revealed that while the industry faces economic, policy and regulatory and political impediments to undertake IG-DE, it does not hinder the deployment of viable solutions. While the economic value of IG-DE is considered ambiguous, only a minority think it poses a barrier to the industry. Despite the lack of clarity on costs and benefits, there is optimism that the economic constraints will be conquered with the right policy framework. While the lack of awareness and education is considered a major barrier to IG-DE, only 40% believe that IG-DE is less reliable than grid supply. There is less emphasis placed on the technological impediments, as policy and regulatory uncertainty and a lack of political is considered a greater limitation.

1.9.2. Key Drivers and Enablers of IG-DE

While environmental imperatives to reduce carbon emissions is considered a key driver, other economic enablers include "*promoting cost effectiveness*" and "*creating a fair and predictable investment environment*" as vital to transform the energy industry. Also significant is that 90% of respondents believe that "*network efficiency*", "*cost savings*" and "*peak demand reductions*" are key motivations for the industry to pursue IG-DE. However, the call is for energy networks to incorporate a broader decision making framework to enable recognition of IG-DE as a genuine alternative. Qualitative feedback identifies institutional drivers and enablers that incorporate: "*regulatory reform to promote a triple bottom line approach*"; and "*collaborative (government-private sector) investment arrangement on DE".*

While the deployment of "*smart meters*" combined with "*cost reflective tariffs*" is considered a key driver, regulatory and policy certainty on energy generation and efficiency, and emission reductions including government leadership and coordination are key enablers. Driving the process will require demonstrating the economic viability of IG-DE and establishing the right price signals to enable industry support. Other enabling processes include government leadership and policy direction combined with collaboration between state agencies. Regulatory reform is also considered vital to secure the recognition of Networks and the Regulator for cost savings derived from IG-DE. Also key drivers are the efficient use of scarce commodities and the preparedness of the industry to meet the growing customer demand for IG-DE.

1.9.3. Energy Source and Technology Mix Viable for Australia

With regard to fuel source and technological and strategic approaches considered viable for Australia's electricity system, there is overwhelming support for the deployment of "*solar photovoltaics*" including "*peak demand management"* and "*energy efficiency*". There is also a high level of support for "*electric vehicles*"; "*CHP systems*"; "*solar thermal*" and "*wind power*". Other clean options also favoured include: "*energy storage"*; "*geothermal"*; "*wave power"*, "*centralized gas-fired generation"* and "*micro wind turbines"*. While RE sources and technologies are highly favoured, there is less support for "*micro wind turbines*".

More controversial and expensive sources and technologies are also less favoured, such as: "*carbon capture and storage (CCS)";" fuel cells";* "*nuclear power";" hydro-electric power"* and "*biomass".* Given respondents preferences for economically, socially and environmentally responsible energy sources, it is not surprising that these options are given less support. Qualitative responses identified that there is less support for "*fuel cells*" due to fears that retail gas is too costly to consider it a viable option. Other options desired for Australia include the use of "*super conducting cables"* and "*direct use heat displacement facilities"* or "*low temperature geothermal"*.

Qualitative responses identified that the most promising technology/process in the near term (five to ten years) include the following: (a) the *electric vehicle;* followed by (b) *smart meters* and the *smart grid* infrastructure in parallel with (c) *electricity market reform*, *cost reflective pricing* and *live retail tariffs*. While *energy efficiency, energy conservation* and *energy storage* are important strategies*;* other promising solutions comprise "*geothermal power"," super conducting cables",* and a combination of *"solar and wind power with battery storage".* Also vital to the process is "*incentivising"* all stakeholders toward this goal.

1.9.4. Influential Players in Energy Policy in WA

While respondents attribute Western Power with the greatest influence over policy and regulation in WA, stakeholders believe that the *State Government* and the *Office of Energy* should be playing a greater role. While the *Economic Regulation Authority* (ERA); *Department of Climate Change*; *Verve Energy* and the *Independent Market Operator* (IMO) are attributed as having some influence over policy and regulation, there is less support for these stakeholders to play greater role. On the other hand respondents support a greater role in policy and regulation by *CSIRO*; *Council of Australia Governments* (COAG*)*; *Clean Energy Council* and *Energy Networks Association*. There is however, less support for stakeholders who may be perceived as vested interests groups or lack technical knowledge to contribute to policy and regulation and they include the *Local Government*; *Environmental Groups*; *Local Community Representatives* and *Non-Technical Stakeholders*.

To encourage inclusive representation and ensure policy makers hear a diversity of voices, stakeholders identified the following stakeholders as having a key role to play in policy and regulation: (a) *WACOSS /ACOSS* - advocates for energy poverty; (b) *Department of Resources, Energy and Tourism (*DRET*)* and *Department of Climate Change and Energy Efficiency* (DCCEE); (c) *Office of Renewable Energy Regulator* (ORER); (d) *Customers*- engage for feed-back and (e) *Local business groups*.

1.10. Conclusion and Recommendations from Stage 3

Although the energy stakeholders highlight numerous barriers to an IG-DE transition, there is as much optimism about its potential as the benefits are expected to surmount the impediments. To drive the industry's transformation toward an IG-DE system, emphasis is placed on leadership and collaboration between government, industry and business to facilitate technological advancements that are expected to overcome the economic, institutional and technical constraints.

Although demonstration of economic viability is considered the key driver of IG-DE, also vital is policy direction and collaboration between state and federal government agencies. While economic drivers exist for networks to capitalise on IG-DE, institutional and regulatory recognition of the benefits is central to the goal. Also of significance to enable an IG-DE transition is the extent to which the energy industry is operationally equipped to engage with increasing consumer demand for alternative energy generation solutions as the price of electricity continues to soar. While the technological innovations of a smart grid system that incorporate the features of energy efficiency, energy conservation, small scale generation and energy storage are considered highly promising, market, policy and regulatory incentives are vital to enable the process of change for all energy stakeholders.

While many stakeholders play a significant role in energy policy and regulation, respondents identify the *State Government* and the *Office of Energy* as needing to play a greater role in setting the agenda for an IG-DE transition. Also important is the involvement of a diversity of stakeholder groups to ensure that policy makers respond to all sectoral interests, particularly disadvantaged consumers. There is however less support for Environmentalists and non-technical stakeholders to play a greater role in policy and regulation.

1.11. General Conclusions and Recommendations

This study has identified that residents, SMEs and industry energy stakeholders face numerous obstacles in deploying IG-DE solutions. Although economics is the major barrier, most optimistic is that regardless of environmental orientation, with sufficient government incentives in place IG-DE would be deployed as recognition of the benefits is high. To combat the barriers both top down and bottom up strategies are identified as key enablers for IG-DE or smart grid (preferred discourse of energy stakeholders). To combat the impediments all stakeholders support civil society approaches (un-coerced collective action around shared interests; purposes and values) as political advocacy can drive government action. This study highlighted that bottom up processes are associated with the spread of community acceptance of IG-DE solutions because energy emerges as a salient community issue. Community and institutional collaboration also proved more conducive for informing and influencing people's behaviour towards IG-DE solutions as the process involves face-to-face interactions where trust is high and social identity is not threatened. Visionary community leaders motivated by altruistic norms to live sustainably also enable the emergence of community energy initiatives and alternative business models for the deployment of IG-DE.

An IG-DE road map however, is incomplete without supportive top down processes that include the coordinated actions of all civil society sectors incorporating government, business and community working collaboratively to advocate for change. As already outlined top down processes must incorporate government leadership and coordination of facilitative processes and incentives to achieve economic viability of the energy industry; including regulatory and pricing reform to deliver consistent policy and targets to reduce GHG emissions and promote energy

efficiency. Also vital is that policy makers acquire the knowledge and expertise to drive energy innovation, incentivise all stakeholders and inform consumers of the benefits of IG-DE solutions. The policy and planning process also needs to be driven by holistic visions for sustainable energy where the energy governance framework is transparent and inclusive to ensure that the needs of all sectors are heard, particularly those adversely affected by policy, regulatory, market and pricing reforms.

1.12. Key Proposals to Drive an IG-DE Transition

Following are key recommendations for an IG-DE road map that reflect the perspectives of the multi-sector stakeholders who participated in this study. These proposals are classified according to Dunstan, Langham and Ison's (2009) policy options for DE classified as: (1) Coordination; (2) Facilitation; (3) Incentives; (4) Pricing Reform; (5) Regulatory Reform; (6) Targets and (7) Information.

1.12.1. Coordination

At the policy level all stakeholders demand certainty on the management of climate change, sustainable energy and economic stability. Also important is strong leadership and commitment by all tiers of government to undertake institutional coordination toward a low carbon economy that includes IG-DE solutions. The transition toward IG-DE would also require policy options that cater to all three cultural orientations who favour a mixture of market solutions, taxation, consumer subsidies and energy industry incentives. While affordability is the greatest barrier facing householders and SMEs, social policies are a vital aspect of energy policy to address growing energy poverty issue.

1.12.2. Facilitation

Community engagement by Western Power offers a great potential for IG-DE deployment as the economic, regulatory, and technical barriers can be addressed through institutional facilitation. Collaborating with stakeholders also promotes institutional trust and the salience of IG-DE solutions. However, promoting community acceptance of IG-DE technologies will require an *inclusionary governance process* along with a sustainability framework to balance economic development, social equity and environmental protection.

Bottom up approaches play crucial role in activating problem awareness and attribution of personal responsibility. For example community owned energy generation initiatives offer an important means by which communities can work together to reduce emissions collectively. However, decentralised governance of energy planning also requires all levels of government to work collaboratively on IG-DE solutions otherwise community-owned DE projects face lengthy delays due to regulatory, cultural, technical, economic and political barriers.

1.12.3. Incentives

While it is vital that a suite of financial and technological incentives are available for those who can afford it, equally important are schemes that address the needs of those who are financially disadvantaged. Business models such as the "roof space rentals" are well suited. Providing access to free on-site energy consultations for SMEs with an appropriately framed informational appeal can also facilitate energy actions of time and resource poor businesses. To enable the economic viability of the energy industry cost reflective tariffs are considered a key financial incentive.

1.12.4. Pricing Reform

While there is conceptual support for the CPRS there is greater concern that its implementation is fraught with difficulties. Much fear is expressed that the funds generated would not be effectively targeted to incentivise the market and compensate vulnerable residents and businesses. Hence, there is much reluctance about the CPRS due to concerns about its socio-economic impacts. There is however, strong support for the restructuring of the feed-in-tariff to ensure that DE is economically viable for all consumers. There is also a call for the state government to act on the policy of a gross feed-in-tariff.

1.12.5. Regulatory Reform

Community DE developers desire regulatory reform to address institutional and administrative barriers by streamlining the application process to access government funds for renewable DE projects. SMEs also call for regulatory reforms to mandate minimum requirements for energy efficient buildings as there is no incentive for rental premises. Energy stakeholders on the other hand also identified the need to incentivise networks, generators and retailers to pursue IG-DE. This would require policy and regulatory reform to expand the ERA economic justification process for the energy Network; to decouple the retail margins for Retailers and for Generators to switch to greener and cleaner fuels.

1.12.6. Targets

To meet the dual aspirations of the community who desire a reduction of GHG emissions and the energy Utility's need to reduce peak power demands, a program initiated by Western Power has set a community target of a ten per cent reduction in energy usage. This program entitled "beating the peak" facilitates the community residents to reduce their energy usage through a variety of IG-DE and DSM solutions. Energy stakeholders also desire targets to be set for energy efficiency and emissions reductions to drive IG-DE solutions in the Industry.

1.12.7. Information

Climate change beliefs and high environmental values are not necessarily associated with active energy behavioural actions, as economics is the greatest barrier to DE. Where informational barriers exist, it is clear that informational campaigns in isolation will not lead to behavioural change. However, informational campaigns designed to appeal to diverse cultural audiences and accessed from trusted sources can enable engagement. A key Western Power initiative the "Green Town Energy Services Shop" offers energy advice and encourages interaction and engagement with energy technologies and economic incentives.

2. PROJECT AIMS AND GOALS

2.1. Sustainability and Climate Change Mitigation

Since the 1980s, the scientific community has been actively working on detecting climate change and determining how much is attributable to human activities (Karl & Trenberth, 2003). Many studies demonstrate that a concentration of greenhouse gases in the atmosphere is warming the planet in ways that will have profound and unsettling impacts on natural resources, energy use, ecosystems, economic activity, and potentially quality of life (Stott, Stone & Allen, 2004; Turner, Matson, & McCarthy, et al., 2009). What is clear however is that in highlighting the physical impacts, climate change discourse have largely underscored the significance of social impacts. In advocating a just and effective response to climate change, the Australian Greenhouse Office Report on the science and impacts of climate change endorsed that social and environmental impacts be given equal weight along with economic considerations (Pittock, 2006). Otherwise the consequence of failing to integrate all three implications would further disadvantage people with the least capacity to pay and this will further compromise adaptation measures to reduce greenhouse gas (GHG) emissions.

This leads to a strong argument for decision-makers to pursue climate change actions that do not marginalize vulnerable population groups by ensuring that those on low incomes are given assistance to adapt to policies aimed at reducing greenhouse emissions. Promoting an integrated approach to public policy, Pittock (2006) argued that since climate change is only one aspect of a complex arena, it is vital to frame it within the context of other issues affecting the same decision strategies. More pertinently, adaptation to, and mitigation of, climate change are both necessary complementary strategies, so it may be advantageous to consider both in any integrated assessment. As the author elaborated, an integrated decision-making framework not only requires a wider understanding of natural and human systems, but consultation with stakeholders is imperative. As the process is incomplete unless the human element is included whereby stakeholders can identify the most effective and socially just strategies to be adopted (Pittock, 2006). This fits with the pillars of sustainable development that emphasises economic, ecological and human/social dimensions (Robinson & Herbert, 2001; Munasinghe, et al., 2009; Kates, et al, 2005). Decision makers face an arduous task in responding to the potential of climate change impacts. The research objective involved capturing a more inclusive discourse, where social, environmental and economic considerations, including civic participation is part of an integrative decision-making framework to target IG-DE solutions.

2.2. Project Aims and Goals – Intelligent Grid Social Impact

This project evaluates the social aspects and impacts of Intelligent Grid that integrates Distributed Energy (DE) from a variety of perspectives incorporating: (a) interviews with key stakeholders in two regional communities located at the edge of the SWIS grid in the south coast of Western Australia; (b) an energy attitude survey with regional Small and Medium Enterprises (SMEs); and (c) interviews with Perth's energy stakeholders and (d) a survey with Perth's *iGrid* energy conference participants. While phase one involved a micro case study of regional community stakeholders views of the issues, barriers and drivers implicated with deploying IG-DE technologies, phase two involved a macro level view of the issues from the perspectives of regional SMEs and key energy stakeholder representatives.

Other related aims of the study include the following:

- Identifying community beliefs, attitudes, awareness and knowledge base of DE technologies;
- Ascertaining the issues, drivers and barriers to DE technologies in regional communities;
- Understanding the socio-political, economic and cultural dimensions of adaptation utilizing IG-DE solutions;
- Identifying the costs and benefits of DE uptake by Small and Medium Enterprises (SMEs);
- Exploring the level of community acceptance of IG-DE technologies.

While the study comprised of two key phases, phase one involved a micro level case study with regional community stakeholders to capture the issues associated with the deployment of DE technologies and systems within the community. This phase also involved evaluation of Western Power's community engagement pilot to plan the sustainable energy needs of two regional communities on the south coast of WA. Key insights were also gained about the process involved with planning the construction of a small community-owned wind farm in the region.

Phase two, the macro level aspect of the research involved surveys with SMEs in two regional communities differing on a number of demographic and contextual characteristics. While the micro level perspective captured the social context of regional communities implicated with IG-DE developments, the macro level aspect contributed key understandings of the larger socio-political context driving and inhibiting energy policy developments and the smart grid transition process for WA's energy industry. The key objective of the study involved assessing the implications of deploying IG-DE solutions against human, social, economic, political and environmental considerations.

3. LITERATURE REVIEW

3.1. Introduction

The literature reviewed pertains to understandings that are relevant to the environmental, socio-political, economic, cultural and human behavioural aspects of the transition toward an intelligent grid electricity system. This involves exploration of the multi-level factors which enhance and impede the progress of IG-DE solutions within a variety of geographical contexts. This review represents a multi-dimensional perspective of the issues associated with process and outcome of intelligent grid systems that advances decentralized renewable energy generation as solutions to promote energy security and climate change mitigation. By taking a more holistic view of the issues at macro, meso and micro levels of analysis decision makers' strategic responses to the crisis of climate change and energy can be facilitated.

Beginning with key themes emanating from climate change discourse and the motivation driving energy efficient solutions, the focus then turns to understandings related to IG-DE initiatives as a key adaptive response to promote sustainable energy sources and reduce GHG emissions. To understand the issues from a broad perspective the socio-political, technological and human behavioural issues associated with social change toward an 'energy efficient and carbon constrained world' is explored.

3.2. Imperatives for Intelligent Grid-Distributed Energy

Society is highly dependent on a vibrant economy to deliver human health and welfare on a global scale. Vital therefore is that causes of climate change emanating from fossil fuel dependence is tackled by a shift to a low carbon economy. A principal means by which society can greatly reduce carbon emissions is through the development and deployment of renewable forms of energy. One arena where transformation toward sustainable energy is a feasible vision is the electricity sector. Given that scientific and technological advancements offer huge potential for a shift to a low carbon and highly sustainable energy future, the literature pertinent to the issues that underlie societal transition toward intelligent grid systems that incorporate distributed renewable energy is reviewed.

3.3. Behaviour change models – Implications for IG-DE Solutions

If we are serious about promoting the transition in social practice and behaviour that results in a reduced carbon intensive lifestyle then understanding the levers that drive behavioural change is vital. As Jackson stated "consumer behaviour is key to the impact that society has on the environment (2005, p. 5). Reviews of behaviour change theories and strategies reveal a wide range of theories and assumptions (O'Dwyer et al.,1993; Jackson, 2005; Kollmuss & Agyeman, 2002; Shipworth, 2000). These largely differ according to research focus, for example, they are internal (micro-sociological) or external (macro-sociological). Moloney, Horne & Fien (2010) clarified that internal factors influence or shape a person's mind and include features such as awareness, knowledge, values, attitudes, behaviour, rational thought processes, emotional states and entrenched habits. External variables on the other hand are located in the physical, social and discursive environments in which a person lives. While no universally accepted theory of behaviour change exists, it is feasible to identify a range of influences, which can impact on behaviour, depending on the context.

A 'rational choice model' of consumer behaviour however dominates thinking and practice in the area of energy behaviour (Jackson, 2005). This model assumes that human action is the result of a person logically weighing up the costs and benefits of different actions and choosing the option that maximises expected benefits. Jackson outlines three underlying assumptions in this model:(i) individual self-interest is the appropriate framework for understanding human behaviour; (ii)'rational' behaviour is the result of processes of cognitive deliberation; and (iii) consumer preferences are exogenous to the model, i.e. they are taken as given without further elaboration as to their origins or antecedents (2005, p. 7). Logically policy responses focus on the influence of information and pricing signals as key tools in the 'rational choice model' (Moloney et al., 2010).

3.4. Changing behaviour: the fallacy of targeting individuals

Heiskanen et al. (2010) also note that programmes to reduce energy consumption, and to reduce the carbon intensity of our lifestyles, target changing individual behaviour. Hence, behaviour change incentives include economic instruments like grants and rebates, or education and persuasion, e.g. information campaigns (Geller et al., 2006). While some programmes have been quite successful (Geller et al., 2006), many behavioural change programmes have fallen short. A key reason attributed to the meagre outcomes is that programmes appeal to economic or psychological domains of humans and fail to recognize the socially grounded nature of human behaviour (Wilhite et al.,2000; Biggart & Lutzenhiser,2007). Programmes assume the primacy of individuals over the collective behaviour change. Maniates (2002) described this in political economy terms as the "privatisation and individualisation of responsibility for environmental problems" which "shifts blame from state elites and powerful producer groups to amorphous culprits like 'human nature' or 'all of us'" (p. 57). This mode of governance, described as a form of 'ecological modernisation' or 'eco-efficiency' (Bulkeley, et al., 2007), passes responsibility to consumers to purchase more energy-efficient or 'environmentally friendly' goods (Hobson, 2006). Moloney et al. are adamant that limiting behaviour change interventions to moral persuasion, cost incentives or, through energy price increases is a "... mistaken expectation that these will encourage households to reduce consumption—a position openly advocated by 'rational economic' policy agencies" (e.g. Productivity Commission, 2005, p.7616).

Overwhelmingly energy conservation programmes are based on the assumption that individuals have full control over their behaviour and make decisions in isolation, (Lutzenhiser, 1993; Wilhite et al., 2000; Jackson, 2004). In contrast, Heiskanen et al. highlight that individual decisions to save energy in order to conserve common natural resources are framed by social dilemmas (Kollock, 1998): and individual efforts are useless unless others participate. What needs acknowledgement by policy makers is that energy-related behaviour is shaped by conventions and socio-technical infrastructures that are largely beyond individual control (Shove, 2003; Guy, 2006). In accumulation, these problems, together with the invisibility of the consequences of our action, lead to a sense of disempowerment that presents as a major obstacle to low-carbon lifestyles (Thøgersen, 2005).

Gardner and Stern (1996) indicated that there are basically four types of instruments to change behaviour in relation to environmental problems: (a) regulations and incentives; (b) education and awareness-raising; (c) community management of environmental resources; and (d) reference to moral, religious or ethical principles. European societies have almost exclusively relied on the first two instruments to influence energy consumption with limited success. The failure of individualistically oriented instruments is that is that it fails to see human behaviour as embedded in its social context. As Heiskanen et al. clarified infrastructures are central in defining the carbon

intensity of modern lifestyles, they are also central in supporting and maintaining change (Heiskanen et al.) Although individuals can be influenced by information or incentives to curtail energy consumption, it is often short term and rarely survives beyond the change interventions (Kurz, 2002; Abrahamse et al., 2005). To enable lasting change individual learning must be supported by new routines, infrastructures, institutions and networks (Bijker et al., 1986; Rohracher, 2001).

3.5. Transforming toward Low Carbon Communities

The emergence of low-carbon communities is advanced as a partial solution to the programme failures that solely target individual behavioural change (Heiskanen et al.). Much evidence comes from European localities where community groups have transformed themselves into sustainable energy communities or low-carbon communities. Involving practices of engaged citizenry - individuals work collaboratively to transform their energy infrastructure at the local level (Raven et al., 2008). Low-carbon communities according to Wilhite et al. (2000) offer potential solutions to key problems in early energy demand-side management programmes. Low carbon communities is defined by Heiskanen et al. (2010) as “forms of co-operation and collaboration that aim to reduce the carbon intensity of their members’ lifestyles by providing amenable contexts and mechanisms that encourage behaviour change (p. 7586). The literature depicts low carbon communities as geographical local communities (e.g. Peters and Fudge, 2008; Saastamoinen, 2009) that integrate a place-based identity, shared history, shared infrastructure, and political and administrative power (Heiskanen et al.). Although the focus is on place-based communities like cities, municipalities or neighbour- hoods (Hodson and Marvin, 2009). Heiskanen et al (2010) identified other forms of communities, such as: (a) sectoral networks for addressing climate change; (b) NGOs, especially ones that combine a campaigning mission with an aim to provide services for members can be termed ‘interest-based’ and (c) Virtual communities like ‘smart mobs’ (action groups organising via social media technologies, see Rheingold, 2005, p 7589, cited in Heiskanen et al., 2009). A pertinent Australian example of how residents have been facilitated to live a low energy lifestyle by incorporating IG-DE technologies is the Lochiel Park housing development project located in South Australia. The details and key findings of this 7.5 (minimum) star energy rated housing project are reported in Project 6 of the *iGrid* Research Cluster.

Having reviewed over a hundred energy conservation and efficiency behaviour change programmes in Australia, involving micro-sociological and macro-sociological approaches, Moloney, Horne and Fien (2010) have identified a third termed ‘socio-technical’. In this model of transition toward a low carbon community, behaviouristic assumptions are rejected, and the importance of the ‘socio-technical context’ of human behaviour and the need for changes in structural and institutional environment is advanced. The authors however do stress that regardless of the preferred approach, few are working effectively to impact rates of energy use and GHG emissions needed to a degree that will avert destructive climate change. Although they identify a number of exemplary community-based programmes adopting an integrated approach to address both technical and behavioural dimensions in the shift to low carbon communities, most fail to take sufficient account of the systems, standards and norms shaping consumption. Nevertheless, a significant body of research favours a socio-technical framework for understanding the technology–behaviour relationship that encompass the technical, social, economic and political aspects of energy use (Guy, 2006).

Incorporated within the ‘socio-technical’ model is that *practices* (emphasis added) are embedded in a range of socio-technical systems which constitute a diversity of institutions, regulations, infrastructures and technologies. They are also framed and shaped by the norms and values of the societies and contexts in which they take place. Shove (2006), for instance, places the cultural

aspects of domestic consumption practices as central to her analysis. This includes focusing attention on how activities are constructed and reproduced, a concern that is largely ignored by the 'technocratic approach' of demand management strategies adopted by most governments and behaviour change programmes (Shove, 2006, p. 293). It is clear that working together is the key otherwise individuals stand little chance of seriously reducing their carbon emissions.

3.6. Rise of Distributed Community-Based Power Generation

Arguments for community RE are not a new feature of the sustainable energy scene, but extend back to literature on 'soft energy paths' (Lovins, 1977) small-scale development (Schumacher, 1974) and appropriate technology (Dunn, 1978) from the 1970s. Such literatures and idealistic 'manifestos' for change have provided influential guiding principles for grassroots alternative technology activists for over 30 years (Smith, 2006). It is no surprise to learn that conventional thinking that 'a better power station was always a bigger power station farther away' (Patterson, 2007, p. 57) is being challenged. Indeed, a growing trend, also part of a broader concern to promote sustainable communities (ODPM, 2004) is the rapid development of interest in distributed, community-based power generation (DTI, 2006a; Greenpeace, 2007; Patterson, 2007; Scottish Executive, 2007; Rogers et al., 2008), both in rural and urban settings (Kellett, 2007).

It is noted that community energy initiatives which include pertinent examples of renewable DE technologies offer a potential means for reshaping the electrical system in a manner compatible with the goals of climate change mitigation and energy security (Hoffman & High-Pippert, 2010). According to Warren & McFadyen (2009) this growth in interest has stemmed partly from practical, instrumental considerations and partly from neo-communitarian discourses of local participation and empowerment (Walker and Cass, 2007; Walker et al., 2007). However, for many 'edge of grid' communities, the rise of renewable DE is bringing power closer to the people. Internationally growing numbers of individuals and communities are forming new, active and participatory connections with energy generation and supply (Walker and Cass, 2007, p. 464) as they take on 'energy citizenship' (Devine-Wright, 2007) and provide rich examples of how DE can be facilitated through bottom up processes.

A departure from centrally controlled energy policy and planning, the concept of harnessing renewable energy to meet the needs of remote rural communities is reported in several locations around Scotland (Gubbins, 2007; 2008; Hanley & Nevin, 1999; Warren & Lumsden, 2008). Notewothy, is that in spite of the financial and planning hurdles faced by local developers, for small rural communities facing socio-economic challenges, it is claimed that DE such as wind power opens up a potential escape route from a dependency culture (Mackenzie, 2006). A change of development model to community ownership also raises the potential to increase public support for DE initiatives such as small scale wind farms (Warren & McFaden, 2009). Of significance to policy makers is that the community's acceptance of renewable energy developments such as small scale wind farms, are shaped not only by their physical attributes but also by symbolic, affective and socially constructed aspects (Devine-Wright, 2005a). These findings also suggest that within a supportive institutional framework bottom-up projects may be more effective at carbon reduction than conventional top-down corporate developments (Hoffman & High-Pippert, 2010; Kellett, 2007; Sperling Toke, 2005c).

In their review of community renewable energy projects Walker et al. (2010) warn against replication of simplistic prescriptions of 'what works' in one community context to other places. As what is possible in one context may not necessarily translate elsewhere, hence understanding the social context of innovation and technology diffusion is just as important as its technical dimensions (Berkhout, 2002). Walker et al. (2010) points out that a more critical appreciation of

community dynamics is warranted to avoid rose-coloured conceptions of community. Whilst appearing inclusive, communities can also be deeply exclusionary, marginalising those outside their scope of justice (Harvey, 1996; Herbert, 2005; Opotow, 1997). Furthermore, places and communities can be multiple overlapping communities in a place (Jones, 2003) and extended and constructed communities of interest that transcend physical delineations (Delanty,2003; Willmott,1987; Lave and Wenger,1991). Given the diverse nature of communities, there is an inherent policy risk in linking community to renewable energy projects as the extent to which trust and productive social relations are likely to emerge as outcomes of a community RE project is in question (Walker, et al., 2010).

Defining community renewable energy projects however appears flexible, with different groups applying the term to various types of schemes (Walker et al., 2007a). Rogers et al. (2008) defines it as “a rural community energy scheme is installation of one or more renewable energy technologies in or close to a rural community, with input from members of that (geographic) community” (p. 4217). Other criteria are that the scheme must benefit the community—either directly through supply of energy to multiple properties or a community facility, or indirectly e.g. through sale of energy generated to the grid. Community members’ input may be in various forms, for example project initiation, administration, construction, financial support, or decision-making. Having examined the assumptions underlying the promotion of community energy projects Walker and Cass (2007) found that: firstly it is assumed that members of the public are willing to take on the role of participant in local renewable DE developments, finding it more attractive than the role of protestor. It is also assumed that the participation experience may increase individuals’ understanding of sustainable energy issues, leading to their acceptance of alternative low emission DE developments and more active energy conservation actions (Rogers et al., 2008).

3.7. Role of Local Governance in Climate Change and Energy Action

It is postulated that community level initiatives (e.g. DE) hold the potential to ground climate change policy in a much more visible way to the everyday practicalities of energy use than more ‘top- down’ measures have been able to achieve (Gardner and Stern, 1996; CSE, 2007). There is also growing consensus amongst policy makers that locally conceived projects are more likely to address effectively the social, cultural, and economic barriers, which (a) may prevent individuals from recognizing their own contribution to encouraging more sustainable energy use and (b) can serve to prevent citizens from engaging more fully in the wider political debate on sustainable living (Long, 1998; Jordan, 2006; Fudge, Peters & Sinclair, 2010).

Imperative however is good governance underpinned by an informed citizenry, as active participants in a new post-carbon politics (Redclift, 2010). In particular, the community engagement process involves connecting effectively at a political level with the diversity of needs and priorities that underpin a community, is a core challenge for policy-makers. As effective community engagement is principally based on robust ‘social capital’, Ebi and Semenza (2008) suggests increasing community’s level of social capital through encouragement of collective action in climate change and energy. The related concept of social norms and insights from social learning and persuasion theories further suggest that there are benefits to be derived from tapping into the cohesion and motivational drives, which can be discerned in already established social networks and community groups (Petty & Cacioppo, 1986; Halpern et al., 2002; Jackson, 2005). ‘Trust’ and ‘knowledge’, for example, have been seen as crucial to the diffusion of social signals in promoting patterns of behaviour. Disseminating these signals through existing social networks has proven to be expeditious in the past, contributing for example to the achievements of community-based energy conservation projects (Gardner & Stern,1996; Walker & Cass,2007).

3.8. Critical Reflections of Discourse on the Barriers Relevant to DE

To understand what facilitates and impedes the acceptance of community DE solutions that include small scale wind farms less than 30MW, a critical reflection of the "pro" and "anti" discourse is reviewed. As the authors highlight, the literature on public attitudes and reactions to wind farm developments typically assumes that the majority support its development and implicitly (and at times explicitly) positions the opposition as deviant and therefore as less legitimate (Aitken, 2010; Ellis et al., 2007). In Aitken's (2010) critique of the literature the author argues that dichotomous categorisations of supporters and objectors are overly simplistic and of little utility. There is also the temptation to consider opponents to wind energy developments simply in order to overcome them, rather than to learn from them or incorporate their views. More balanced descriptions of public attitudes to wind power developments by Barry et al. (2008), verify that: "*there are not two homogenous and undifferentiated discourses of 'pro' and 'anti' facing one another; but a (not unlimited) variety of pro- and a variety of anti-wind farm discourses, linked together in, and under, what may be termed as a 'discursive coalition*'(p. 92).

Illustrating the multiplicity of motivations, Ellis et al. (2007) identified that while some objectors are most concerned about potential visual impacts, others are motivated by a wider range of reasons, such as local economic concerns. While some objectors are most concerned about long-term impacts others focused on more immediate effects. While some objectors are more sensitive to public perception of their position, some objectors accept that both sides will resort to propaganda, but others see this as a tactic used by the developers alone. Other differences among objectors include engagement with environmental discourse, with some stressing economic rationalism, while others engage in more aesthetic or emotive language (Ellis et al., 2007, p. 530).

Although numerous studies have demonstrated diverse motivations (Devine-Wright & Devine-Wright, 2006; Woods, 2003), opponents are portrayed as ignorant or misinformed as opposition to wind power arises from ignorance of the benefits of the technology (e.g. Ebert, 1999). This seems unlikely as Devine-Wright and Devine-Wright (2006, p. 244) have observed: '*There is now a proliferation of diverse civic organisations openly contesting or supporting the legitimacy of government policy for renewable energy generally and wind energy particularly*'. Ellis et al. (2007) contend that there is no clear relationship between knowledge and acceptance of wind power: "Indeed, many objectors appear extremely well informed about these issues" (p. 520). The fundamental intention for considering public attitudes or reactions to renewable energy appears to be to understand community responses in order to mitigate negative perceptions and opposition in the future and therefore ensure greater rates of planning approval (see for example; Peel & Lloyd,2007; Strachan et al., 2006; Toke, 2002; Wolsink, 2007). Aitken (2010) asserts that the strong, underlying pro-wind power position within the literature can be conceived as being responsible for preventing meaningful understandings of public attitudes and responses towards wind power developments. Furthermore without acknowledging that objectors might have legitimate and valid concerns one can never gain insights into the true nature of the events and people under examination. Although it is vital to understand opposition to wind power, this necessity comes from a need to understand how the planning processes affect and are experienced by members of the public and to understand the social context of renewable energy developments, rather than to uncover ways of manipulating or avoiding potential future opposition.

3.9. Institutional Factors that Enhance and Impede IG-DE

To promote the acceptance of IG-DE solutions, understanding the conditions that influence the diffusion of energy technological innovation is relevant. Wüstenhagen et al. [2007] highlighted that not does it require appropriate economic support (market acceptance) vital, but public support of

those technologies must also be ensured simultaneously, both on a local (community acceptance) and national scale (socio-political acceptance). Sperling, Hvelplund and Vad Mathiesen (2010) linked three integrated sets of factors to the outcomes of Denmark's shift to RE, that is highly relevant to an IG-DE transformation. Firstly, the transition incorporated a financial incentive structure that is economically sound for all stakeholders in the value chain. This involves a reasonable rate of return and enough financial stability in the incentives for investors to ensure a feasible payback time (Mendoca, Lacey & Hvelplund, 2009; Hvelplung, 2006). Secondly, the energy solutions should contribute to local/regional economy and development dynamics. In economic terms ensuring a fair distribution between the costs and benefits is vital. Devising financial incentive structures that encourage local community investment in the project is one example. A good economic basis for local community investment however is insufficient, if implementation is delayed, prevented or otherwise complicated by planning and admission procedures.

The third set of factors, involved establishment of an efficient system of public administration and planning procedures structured to support a smooth administrative handling of power projects. This is also dependent on Local authorities having the necessary tools and incentives to forward the admission process, while concurrently balancing all interests involved. With the "right" planning system in place, local authorities can also support it and create local development. Creating incentives for local development and ownership of DE also helps reduce the likelihood of public conflict, thus contributing to a more efficient local planning process (Warren & McFadyen, 2010). This is considered the most important condition embedded within the framework of energy and public planning policy. As the authors emphasize, a concrete national energy policy that sets long-term development goals for RE that include community DE can be a crucial driving force. Energy and public planning policy are seen as the context for shaping the three elements that determine the diffusion of energy technological innovation such as IG-DE.

3.10. Institutional Trust and Collaboration – IG-DE Solutions

While it is well acknowledged that collaboration among energy stakeholders is a vital ingredient toward IG-DE solutions, promoting intergroup *trust* presents many challenges (Hoffman & High-Pippert, 2010). It has been noted that the sheer scale of the institutions involved in energy (e.g., governments and multinational companies) is daunting (Mumford & Gray, 2010). They form part of the expert systems of global politics, commodity markets (Yergin, 1991) and large scale engineering which are inaccessible to ordinary people. The disparity in terms of power and the impersonal sales interface make the energy companies appear alien to the consumer. As institutions they are isolated from everyday society by both 'expert systems' and 'symbolic tokens' (Giddens, 1991a). To ensure the smooth deployment of alternative energy technologies such as IG-DE, institutions must be trusted, as it is a key attenuator of public risk perception (Kasperson et al., 2003). Engendering trust however, is easier in horizontal networks as it allows free information flow and positive relationships to evolve through affect (i.e. instinctive feeling) (Kasperson et al.,1999). By contrast, hierarchies tend to inhibit information flow because they are asymmetric in relationship and trust is lower.

Examining intergroup disharmony occurring within the UK alternative energy development context, Mumford and Gray (2010) applied Widavsky's (1987) culture theory analysis to classify the social positioning of energy stakeholder groups. Their model predicts cultural behaviour on the basis of two group attributes—the strength of the group boundaries and the degree to which the group is subject to prescriptions and rules imposed from outside the group. While there is *high trust* between the culturally similar hierarchies (a) Government and Regulators and (b) Energy Companies; there is *low trust* between the culturally divergent groups (b) Energy Companies and

(c) Consumers. Similarly while there is *high trust* between the horizontal networks (c) Consumers and (d) NGOs and special interests groups; there is *low trust* between culturally dissimilar groups (a) Government and Regulators and (d) NGOs and special interests groups. The inference from their analysis is that these inter-group tensions are a barrier to public trust in acceptance of alternative energy solutions such as IG-DE.

Elaborating further, it appears that inter-group tensions between institutions reinforce social identities which emphasize cultural discord and undermine public trust. Indeed, any leadership action taken by the conventional energy institutions is likely to be seen as a betrayal of trust by the public while other institutions also lack the capacity to deliver any practical alternative energy solutions. Resulting in a void in coordination where no group can assume the delegated role of introducing alternative energy and consumer expectations are raised with little hope of achievement. In response, Mumford and Gray (2010) suggest that institutions focus on their individual areas of strength and look for ways to collaborate. Also of significance is the shift in consumer expectation and a clearer delegation of accountability for action, to facilitate cooperation which in turn, engenders public trust.

3.11. Critical Elements of Governance and Government

To clarify the role of leadership and coordination of IG-DE transition occurring within communities the critical distinction of government and governance is vital to the project. Thus governance would refer to the modes and manner of governing, government to the institutions and agents charged with governing, and governing to the act of governing itself'' (Jessop, 1998, p.30). In general terms, governance ''refers to: a new process of governing; or a changed condition of ordered rule; or the new method by which society is governed'' (Rhodes, 2007, pp.1246). Several authors (Rhodes, 2007; Stoker, 2002) assert governance is about governing in and through networks. Based on the same literature, Morgues-Faus and Oritz-Miranda (2010) stress the following traits: (i) *governance* involves a certain degree of autonomy from the state, constituting self-governing networks of actors; (ii) but there are interdependent relations or power dependence between organisations in order to achieve goals, contributing to blurring the limits and responsibilities of the actors involved; (iii) these relations are not based on the exertion of power from the *government*, instead the interactions are built upon trust relations and the rules of the game previously agreed by the participants.

3.12. Motivations Underlying Implementation of DE Initiatives

Distributed Energy (DE) has been identified as an early action response to climate change mitigation and has been the focus of research for the Low Emission Distributed Energy Theme of CSIRO's Energy Transformed Flagship. As this project involves a social science perspective of the barriers and incentives towards IG-DE solutions within an Australian community context the studies undertaken by CSIRO's social scientists are reviewed as an analytical model to compare and contrast the narratives emerging from the current study. The first study by Parsons, Ashworth and Gardner (2007) linked three *intrinsic* and three *extrinsic* (emphasis added) motivations driving householders' decisions to implement DE systems. While these participants may fit Rogers' (1995) definition of innovators and early adopters, their experiences can be used to motivate the majority to implement DE initiatives.

As the authors identified 'internal motivations' for implementing DE include the following categories and excerpts: (a) self sufficiency and energy independence "*If something goes wrong [with grid power], we won't be the ones struggling to survive."*; (b) environmental values "*We have a moral obligation to minimise our impact …We wanted to walk as lightly as we could. We wanted to think about the future for everyone."* and (c) catalysing social change. "*[Ecological values] made our decision ... We get a lot more happiness out of living sustainably than out of consumer items.* The following categories and excerpts pertain to 'external motivations': (a) economic factors "*I don't think government rebates influenced us; it was just a bonus." ... "Once the rebate was there, it persuaded me.";* (b) social and societal factors "*My family thought we were doing this crazy, nutty thing… They tried to persuade us to be normal… But we are normal for us; we're not greenies."* and (c) physical and technological factors "*Our intention was to have a practical, comfortable house, but we were really pleased with the designs. As it went up, we said 'Wow!', which we never had intended.".* Problems and issues were also raised about barriers to DE aspirations which include the prohibitive costs of battery storage and grid connection, as well as the inadequate feed in tariffs for those connected to the grid. The authors acknowledged that while motivations are open to fluctuations, it does suggest that government policy can take a leading role by providing cost-effective financial incentives, promoting pro-environmental values, and by working collaboratively with innovators, early adopters and social change agents to transform DE into a mainstream approach to energy systems.

3.12.1. Beliefs and Attitudes toward Climate Change and Energy

A pertinent study undertaken by CSIRO's Energy Transformed Flagship revealed key insights about public beliefs and attitudes toward DE and climate change issues. A social action study by Ashworth, Pisarski and Littleboy (2006), identified that over 90% of the public of Queensland consider climate change to be an important issue. Furthermore the results also revealed that while not all individuals understand the relationship between energy production and GHG emissions, when engaged in discussions with institutional actors they trust, they see it as important and are willing to take individual actions to reduce their own environmental impact. The study concluded that individuals were also willing to pay more for electricity to transition to cleaner energy, if the proceeds were invested in research to proactively address the problem. More recent research however, has highlighted majority public opposition to a carbon tax. While these studies emphasize a change in public energy attitudes, the issues are more complex as the methodological approach in terms of the questions being posed, how it is asked and the socio-political climate underpinning the timing of research are all highly implicated.

According to Gardner et al (2009) the key to gaining positive energy attitudinal change is the methodological approach. Engaging with the public through facilitated workshops where active deliberations of the issues are encouraged, will often lead to more positive attitudes toward new energy technologies. The process of facilitated discussions, along with a steering group with a mix of diverse viewpoints ensured that the process of information dissemination was seen as credible and unbiased. In summary, they identified community engagement as a great opportunity for both governments and industry to communicate more proactively about their efforts in targeting climate change and energy technologies that can enhance acceptance of energy technology innovation such as IG-DE.

A survey of Australian householders undertaken by CSIRO scientists, Carr-Cornish et al (2008) highlighted four public orientations towards DE, categorized as (a) informed environmentalists; (b) balance focused; (c) solution focused, (d) uninformed and (e) sceptical. Individuals categorised as 'informed environmentalists' attributed more positive attitudes towards DE, renewable energy alternatives and reduction in emissions. This group also rate highly the importance of climate

change, including a swift response toward mitigation and adaptation. Additionally, informed environmentalists' hold strong environmental values and beliefs that correspond with a 'high to moderate' practice of environmental behaviours. These respondents perceive themselves as being informed about energy and the environment and scored highly on knowledge about climate change and energy facts. Also of interest is that older males reported being more informed about energy and the environment in the context of DG, while females in the age group 30-49 years reported being more informed in the context of demand management.

The second group categorized as 'Balance Focused' rated highly the importance of climate change issues, including the emissions reduction feature of DG, as well as RE alternatives. In contrast to the 'Informed Environmentalists' they strongly support carbon-capture and storage and were not supportive of a swift response to climate change. While this group tended to report a high potential acceptance of DG, there is a moderate willingness to accept demand management options. Also pertinent is that these individuals valued the environment and economy equally and were moderately informed about climate change and energy. While a moderate level of pro-environmental behaviour was practiced this group favoured reduction of energy consumption. The 'Balance Focused' orientation was mostly reported by females, aged between 20-59 years and living as a couple in a household with one or more children.

The third category with a 'Solution Focused' orientation, were either moderate or unsure in their attitude toward DE. They were also concerned about installation costs and cost saving over time associated with DG. With regard to demand management options, there were concerns about the level of control offered by the technology including safety issues. These respondents considered climate change an important issue and reported positive attitudes toward RE alternatives, CCS and reduction of energy consumption. In contrast to the 'Balance Focused' this group place the economy at a higher priority to the environment and report low to moderate participation in pro-environmental activities. While these respondents were moderately informed about climate change and energy, they perceived themselves to be more knowledgeable about the issues. The 'Solution Focused' orientation was mostly reported by individuals comprising of older males, either retired or on the pension, living in a single person household or as a couple with no children and from a range of educational backgrounds.

Those identified as having a 'Sceptical' orientation appeared less likely to accept distributed energy and similar to the 'Solution Focused' rated installation costs and cost savings as a potential barrier. They were also concerned about the level of control and interruption to electricity associated with demand management. In contrast to other orientations reporting positive attitudes toward renewable energy and carbon-capture and storage, these respondents report positive reactions towards coal instead. Most importantly, climate change was not regarded as an important issue and respondents were not in favour of a swift response to the issue. Furthermore, they echoed pro-economic values, anti-environmental beliefs, were unlikely to have engaged in environmental behaviours and were either unsure or held a negative attitude toward reducing energy consumption. In term of demographics this group comprised mainly of females, between 20-59 years, and employed in a full-time or a part-time/casual position. However, individuals that reported this orientation with regard to demand management were more likely to be males, 60 years or over and retired or on the pension.

A study conducted by CSIRO social scientists Gardner and Ashworth (2007) on Australian householders' energy related attitudes revealed the following relationships to *electricity consumption* (emphasis added): (a) people with lower electricity bills were more likely to intend to reduce electricity consumption; (b) people aged 30-39 were more likely to intend to reduce consumption than were people in younger or older age groups; (c) females were more likely to

intend to reduce consumption and (d) people from households with higher incomes ($150 000 and more per year) were less likely to intend to reduce consumption. As the authors exposed this inverse relationship between electricity consumption and intention to reduce consumption is confronting, as it suggests that households who consume more electricity are least motivated to change their behaviour. This has important implications for programs designed to promote reduced consumption: households specifically targeted to reduce their consumption may be least willing to do so.

Linking psychological predictors with *intention to reduce consumption*, (emphasis added) their study revealed the following significant relationships: (a) people with more pro-environmental beliefs were more likely to intend to reduce consumption; (b) people who reported more pro-environmental behaviours in the past were more likely to intend to reduce consumption; (c) people who valued the economy over the environment were less likely to intend to reduce consumption; (d) people with more positive attitudes towards reduced consumption were more likely to intend to reduce consumption; (e) people who perceived more positive norms about reduced consumption were more likely to intend to reduce consumption; (f) people with higher levels of knowledge tended to polarise, reporting either a very high or very low intention to reduce consumption. People with moderate levels of knowledge reported moderate intention to reduce consumption. As the authors indicated these findings support previous theoretical predictions of energy behavioural change. However, the non-linear relationship between knowledge and intention was unexpected, but is similar to previous findings (Centre for Low Emission Technology, 2006), and may reflect the tendency for people who are better informed to hold more extreme positions about environmental issues.

With regard to *distributed generation technologies* (emphasis added), the study revealed that younger, more educated, working people with children and higher income levels were more likely to accept DG technology. When psychological factors are linked to acceptance of distributed energy the following significant relationships were identified: (a) people with higher levels of knowledge reported higher acceptance; (b) people with more pro-environmental beliefs reported higher acceptance; (c) people who reported more pro-environmental behaviours in the past reported higher acceptance; (d) people who valued the economy over the environment reported lower acceptance; (e) people with more positive attitudes towards reduced consumption were more likely to report higher acceptance; (f) people who perceived more positive norms about consumption were more likely to report higher acceptance.

With regard to acceptance of *distributed energy sources*, solar was most preferred (88.0% of the sample), followed by wind (67.9%), biofuel (46.7%) and natural gas (44.0%). Only a very small proportion of respondents (5.9%) were willing to use a diesel- or petrol-powered generator. The final aspect of the study assessed the importance people placed on nine features of DG technology: (1) cost to install; (2) ease of installation; (3) ease of use; (4) reduction in my carbon emissions; (5) potential exhaust fumes; (6) the generator's energy source; (7) reliability and durability; (8) safety levels; (9) savings over time. While a high utility was placed on safety, reliability/durability and reduction in household emissions, a low utility was placed on ease of use and ease of installation. People who were more prepared to accept DG placed a lower utility on cost to install and a higher utility on reduction in emissions.

3.13. Summary

As the literature review highlights there is overwhelming acceptance of a variety of IG-DE technologies and many are driven to deploy it for a variety internal and external motivations. Nevertheless, studies have shown a disparity between positive environmental attitudes and active energy conservation actions, as stakeholders are constrained by a myriad of factors, including socio-political, economic, regulatory, cultural, technological and informational. Also significant is that the diffusion of energy technological innovation such as a transition toward an IG-DE electricity system requires multi-level drivers and enablers targeted to address the institutional, political, regulatory, cultural, economic, social and psychological impediments, just to name a few. Also integral are strategies that incorporate both top down and bottom up processes to motivate all energy stakeholders to deploy IG-DE solutions. For example, while government policy and incentives are vital to drive the long term cultural change required to engage the participation of all energy stakeholders, also promising are bottom up initiatives such as the low carbon communities, low energy housing developments and community DE initiatives to drive solutions at the community level. While political leadership is imperative to promote IG-DE solutions, the key to community acceptance of strategies to enable a low energy economy will require the formation of trust in government to drive energy and climate change policy that does not adversely affect people and the economy.

4. METHODOLOGY

4.1. Introduction

This section describes the conceptual and methodological approach adopted to understand the social aspects of IG-DE. The objective of the study involves understanding the micro community level and macro socio-political understandings of IG-DE transition occurring in two regional communities within the Western Australian context. This section also entails the conceptual and methodological framework adopted to undertake three phases of data collection, namely: (1) evaluation of Western Power's community engagement approach to plan sustainable energy visions with two edge of grid communities [including support for community DE project]; (2) undertake an energy survey of beliefs and attitudes with Small and Medium Enterprises (SMEs) in two regional communities; and (3) interviews and surveys with Perth's energy stakeholders on the barriers and opportunities toward IG-DE solutions within the Western Australian context.

The methodology adopted facilitated a multi-perspectives view of the drivers and barriers towards IG-DE solutions within the Western Australian energy policy context. The focus of analysis is influenced by the notion of a phronetic approach to social science (Flyvbjerg, 2001) similar to issue oriented research where focus is on context or place based questions in policy debates (Hogwood & Gunn,1984). A qualitative methodological approach is pertinent (Lincoln & Guba, 2000; Sandelowski, 2000) for gaining contextually-grounded understanding at ecological levels of analysis (Broffenbrenner, 1979, Christens & Perkins, 2008; Prilleltensky & Nelson, 2002). This qualitative research design involved a triangulation of four data sources: (a) observational evidence; (b) information from media and previous research, (c) interview and focus group data, and (d) survey information from community informants. As Madill, et al, (2000) pointed out the goal of triangulation within a contextualist epistemology is completeness not convergence. Furthermore, novel perspectives are more likely to emerge within a contextualist paradigm where a triangulation of methodologies is employed (Rossman & Wilson, 1994). Data analysis was guided by grounded theory approaches (Glaser, 1978; Strauss & Corbin, 1994; 1998) in tandem with cultural theory as a heuristic model to make sense of the complexity of discourses and world views underlying the IG-DE policy domain.

4.2. Stage One: Community Engagement Approach to IG-DE Solutions

The research design entailed three stages, where stage one involved the researcher's participation and evaluation of Western Power's community engagement process with two edge of grid regional communities. Dr Costello was invited by Western Power to observe and evaluate the Energy Utility's pilot community engagement project to plan the sustainable energy needs of two communities. The bi-monthly stakeholders' forum organized by Western Power to facilitate community discussions of IG-DE solutions is referred to as the South Coast Power Working Group (SCPWG).

The participants of the SCPWG comprised of community members and stakeholders representing the Shire of Denmark and town of Walpole (Shire of Manjimup). While both communities are edge of grid communities they differ on a number of characteristics. Denmark is situated approximately 420km from the state capital Perth on the south coast of WA with a population of approximately 5000. Denmark is surrounded by a large area of coastline, bush land and wilderness and has a strong history of community participation in achieving high standards of environmental management. Walpole is approximately 413km south of Perth, surrounded by national parks and

state forests and has a smaller population size of around 500. While originally established in the 1930s as a settlement for farmers, timber milling soon followed and is now considered one of the richest dairy and beef farming areas in the state.

4.2.1. Selection of Participants – Stage One

To evaluate the process of community engagement and its impact on the wider community in terms of planning sustainable energy visions, the selection of participants consisted of both a purposeful and snowball sampling techniques (Patton, 1990; Williams & Lewis, 2005). A purposeful sample of twenty (14) participants (from a possible 20) consisted of representatives of the SCPWG who are knowledgeable about both the community engagement process and the factors that enhance and impede IG-DE strategies. To avoid potential bias care was taken to ensure that a diversity of views was canvassed. Using snowball sampling techniques a further sample of twelve (12) participants not involved with the SCPWG structure also participated in interviews. In this phase a cross-section of community participants were selected to elicit a multi-level appreciation of the issues of concern to householders, businesses and institutional actors.

4.2.2. Procedures involving Participants – Data Collection

The participants took part in either (a) a face-to-face, semi-structured open-ended in-depth interview process or (b) a focus group discussion. The interviews and focus group discussions which ranged in duration from one to three hours were tape-recorded and transcribed verbatim. The interviews were conducted in a mutually agreed setting either at a place of business or the Local Shire offices at a time convenient to the participants. The participants were advised of the ethical procedures and that they would be contacted for clarification of issues. The informants represented the diversity of sectors comprising Local Government representatives; business representatives; community leaders involved in climate change and energy issues; key personnel in government and non-government agencies as well as individual and family householders who could contribute to energy related discussions. In keeping with grounded theory process, the researcher ensured development of trust and common ground with participants to enable a deeper reflection by participants (Hall & Callery, 2001).

4.2.3. Questions Posed to Participants

To understand the underlying world views implicated with climate change beliefs, energy attitudes and behaviours including sustainable energy planning, questions posed were as open-ended as possible to ensure ‘authenticity’ (Silverman, 2001, p.13). The lead questions were framed as openly as possible, for example: (1) Can you tell me about the energy issues facing your community; (2) How effective are government and institutional strategies for dealing with energy supply issues? To elicit more specific responses in evaluating the effectiveness of the SCPWG’s planning process, the questions (see Appendix 1 for list of questions) targeted specific insights about the process and outcome of this group’s decision making process.

4.3. Stage Two – SMEs Surveys of Two Regional Communities

Due to a lack of previous research on SMEs energy attitudes and behaviours, the goal of stage two involved gaining SMEs perspectives of climate change and energy issues including the socio-economic and psychological factors that enhance and impede acceptance of DE solutions. Two regional communities the Shire of Denmark and Albany were specifically targeted as research sites to unpack differences in attitudes toward IG-DE technologies between a small 'edge-of-grid' community experiencing energy supply issues with a larger regional city that enjoys energy security. Also pertinent is that the city of Albany is not involved in a community engagement process with Western Power and located on its coastline 80m above the Southern Ocean is the largest wind farm in Australia where 12 turbines generate up to 75% of the city's electricity usage. Only 55km west of Denmark, Albany is located 390km south-east of Perth boasting a population of approximately 35,000. The town is considered a significant tourist destination and is well regarded for its natural beauty and preservation of heritage.

Prior to constructing the SMEs survey, the researcher undertook face-to-face interviews with approximately ten (10) key stakeholder representatives in the Shire of Albany to gain a preliminary understanding energy issues and its acceptance of DE solutions. The purposefully selected sample included management level representatives from the Local Council; South Coast Natural Resource Management (SCNRM) agency; Albany Chamber of Commerce and Industry (ACCI); Albany's University of WA, tourism operators and local environmental organizations to gauge their perspectives to the feasibility of DE solutions for Albany residents and SMEs.

Stage two involved the use of a survey approach to capture a wider representation of the SMEs sector's perspective to energy related issues and to also validate findings emerging from stage one.

4.3.1. Construction of Quantitative Survey

Based on the insights and knowledge gained from the research investigation of stage one including a literature review of previous studies examining environmental beliefs, attitudes and behaviours related to acceptance of IG-DE solutions, a twenty minute survey was constructed by the researcher. The survey consisted of a total of 33 questions separated into seven (7) sections, where section one referred to issues of most concern at local and global levels; section two referred to questions related to environmental, economic and community values; section three related to issues of climate change and energy conservation; section four referred to energy conservation, mix of energy sources and distributed energy options for the regions and Australia as a whole; section five referred to energy policy and educational incentives including access to technological solutions; section six related to levels of awareness and access to information sources, and section seven referred to demographic details of participants (see Appendix B).

4.3.2. Selection of Participants

With the assistance of the Albany Chamber of Commerce and Industry (ACIC) and the Denmark Chamber of Commerce (DCC) a total of 700 surveys were distributed to members to complete the survey either online or by return mail. While a total of 242 survey responses were secured, Albany comprised of 179 responses and Denmark comprised of 63 responses. The response rate for Albany is approximately 31% and Denmark 51% which is considered realistic given that regional SMEs are highly constrained by a lack of time and resources. With only 50 surveys being completed online a clear message had been sent by SMEs that e-technology is not favoured in the regions due to slow internet speeds. A further 100 hard copies of the survey were returned by mail and this was manually entered on the Survey Monkey website. To increase the response rate the

researcher and a research assistant conducted phone surveys and a further 92 responses were manually entered on Survey Monkey. A radio interview was held with the local ABC network to promote the SMEs survey and several informational reminder emails were also sent to the ACIC's and DCC's member distribution list urging them to participate.

4.4. Stage Three – Energy Stakeholder Interviews and Surveys

This phase of the research process was aimed at gaining general impressions of the institutional response underlying WA's energy policy context and the factors that drive and impede the acceptance of IG-DE solutions. As highlighted by Szatow et al (2009) development and deployment of DE technologies and systems is influenced by government policy objectives and subsequent program and regulatory design, but it is a complex process shaped by many layers of stakeholders. To capture the perspectives of energy stake-holders' views towards IG-DE solutions occurring within WA, this phase involved both a survey and interview approach with key representatives of WA's energy stakeholder network.

4.4.1. Energy Stakeholder Survey and Participant Selection

With the assistance of iGrid Cluster researchers, an energy stakeholder survey instrument was constructed to elicit the opinions of WA energy stakeholders. This survey instrument is an adapted version of the original published by CSIRO researchers (Szatow, et al., 2009). This adapted version of the energy stakeholder survey was circulated to the iGrid team for feedback and ethics approval was gained for the final version to be distributed to attendees at the iGrid Industry Forum held in Perth on March 11, 2010. A total of thirty five (35) completed survey responses were collected from forum participants.

4.4.2. Energy Stakeholder Interviews and Participant Selection

To gain more in-depth understandings of the issues influencing acceptance of IG-DE solutions within the Western Australian energy policy context, this phase comprised qualitative interviews with key energy stakeholders. Informants were selected according to the principle of *theoretical sampling* where subsequent data collection is directed by theoretical developments that emerge from the analysis (Punch, 1998). A sample of twelve (12) informants representing Perth's energy stakeholder network participated in face to face interviews. This group of participants were selected on the basis of their knowledge about the phenomenon and *willingness* and *ability* to provide information on the processes involved with IG-DE planning and decision making (Morse, 1991). Data collection ceased when saturation point was reached and no further issues were forthcoming (Glaser & Strauss, 1967). To elicit critical insights about the feasibility of an IG-DE transition for the WA context, a list of fourteen (14) questions (see Appendix C) were posed to participants.

A broad range of key management-level energy stakeholders were identified using both internet searches and snowball sampling techniques. Participants were contacted by phone and email to request their participation and arrange an interview to share their perspectives to the issues. The participants ranged from government representatives and policy makers, regulators, distribution companies, energy consultants, non-government organisations, and academics. Although the informants are broadly representative of Perth's energy stakeholder network, due to resource limitations the participant sample is constrained.

4.5. Data Analysis Framework – Grounded Theory and Cultural Theory

All qualitative interview and survey data was thematically coded according to the principles of grounded theory methodology, described as the process of constant comparison where codes and categories emerge directly from the data (Glaser 1978, 1992). Data is therefore not viewed through a predetermined framework, but rather, data interpretation and category development are driven by conceptual and relational concerns in the data (Glaser, 1978). Conceptual saturation was reached when no new categories could be generated (Glaser, 1978, 1992) and integration and interrelationships of the categories, especially the core categories, forms the basis of the grounded theory process (Strauss & Corbin, 1990). Once the theory is developed, it is compared to previous work as well as other literature and perspectives to validate or point out differences or gaps in current understandings of the phenomena (Pope-Davis, et al., 2002). With the aid of two independent researchers consensus was gained on the interpretive framework that emerged from the data.

4.5.1. Cultural Theory Framework

To guide the interpretation of the interview and survey data sources cultural theory framework proved ideal for analysing the underlying energy discourse, which is the focus of this study. There is growing acknowledgement of the advantages of post-positive approaches to interpret how individuals combine a priori beliefs and multiple sources of information to develop and rationalise their view points on renewable energy (RE) (e.g. Woods, 2003; Haggett & Smith,2004; Szarka, 2004; Haggett & Toke, 2006; Devine-Wright & Devine-Wright, 2006). Cultural theory is also positioned as one of the more durable heuristic devices in the exploration of emerging and complex public perceptions of climate change (Douglas, 1970; Thompson & Rayner,1998; Verweij &Thompson, 2006; Hulme, 2009; Wes, Bailey & Winter, 2010). Cultural theory thus, lends itself to the analysis of worldviews underlying climate change and energy related beliefs and behaviours that have direct implications for policy development on IG-DE solutions.

According to West, et al. (2010) cultural theory is based around two axes, a ‘grid’ and a ‘group’. The ‘group’ dimension reflects the degree to which people are incorporated into communities or other social groupings. The ‘grid’ dimension depicts the social rules and norms informing behaviour in social interactions and ‘gives the answer to the fundamental question ‘‘how should I behave?’’’ (West et al.). As the authors highlighted, these grid and group dimensions offer the basis for four schemas by which the world can be perceived: *individualist*, *hierarchist*, *egalitarian* and *fatalist* (emphasis added). The *individualist* discourses favour competitive markets and believe the environment is tolerant to anthropogenic impacts. This contrasts e*galitarian* discourses which favour social equality and believe nature is fragile to anthropogenic activities. The *hierarchist* discourses allocate particular importance to the role of institutions and regulation in regulating human–environment relations but believe natural systems can withstand some degree of human disturbance. The *fatalist* discourses however believe events are determined principally by fate and so conceives nature as capricious and unmanageable (Schwarz & Thompson, 1990).

Cultural theorists are adamant that for democracy to operate, all three active ideal types must participate in policy decisions (Thompson et al., 1990). This not only contributes to fairer political decisions, but more reliable outcomes results when a balance of opinions is incorporated. Nevertheless, Pendergraft (1998) intimates that conflicts over an agreed policy intervention can still arise from divergent notions of what is real, right and equitable. As the author illustrated, although everyone can agree on a healthy environment, the degree of its health and willingness to bear costs may vary greatly. To understand the context of sustainability and governance of energy and climate change issues the cultural lens through which the world is viewed can be used as a

heuristic device to inform policy responses.

While criticism is levelled at cultural theory for its social stereotyping and neglect of the multiple interactions between lived experiences and personal world views (Sj'oberg, 1996; Boholm,1996a) (see Boholm, 1996a, 1996b; Thompson et al., 1990 for detailed critique), evidence supports its capacity for categorising complex debates into a more coherent form (Milton-Kelly, 2004; Thompson and Rayner, 1998). One of cultural theory's strengths is its potential to encapsulate multiple meanings into smaller sets of super-meanings (Verweij, 2000). Dismissing the issue of stereotyping Milton (1991) stresses that heuristic devices are intended as tools in assisting understanding and comparison which cultural theory does. It is most conducive for capturing snapshots of a controversial debate, to enable: structuring of the multiple and complex ways issues are perceived and exploration of the parameters of debates and assessment of the implications of worldviews for issues like energy policy. Capitalising on the usefulness of cultural theory, this study identifies discourses that are broadly representative of the cultural theory ideal types, and delineates how these might be depicted by different narratives regarding the issues of climate change and IG-DE. The comparative analysis of discourses and narratives are of great utility in exploring policy mechanisms and strategies to encourage a more informed debate about the public utility of IG-DE solutions.

4.6. Issues of Validity

Throughout the study, several strategies were used to ensure rigor in the data analysis process. Peer debriefing (Lincoln & Guba, 1985) is a useful measure in recognizing and eliminating "group think" in the process of data analysis. In qualitative inquiry constructs that emerge from the analysis of multiple judges is considered free from personal researcher bias (Marshall & Rossman, 1995). This study used a collaborative investigative format involving independent researchers and informant verification that ensures that the constructs that emerged are dependable and trustworthy. Trustworthiness is considered high as the categories created emerged directly from the interview data and validity is also enhanced when emergent theory is compared to extant literature to examine similarities and differences (Lincoln & Guba, 1985).

5. ANALYSIS AND RESULTS

5.1. Overview

This section outlines the findings of each phase of the study and it will be presented in a format that reflects the theoretical and conceptual frameworks identified in the literature review and methodology to understand the themes emerging from the qualitative and quantitative phases of the study. This section will firstly focus on Stage One understandings of barriers, opportunities and other themes related to an IG-DE transition including the process involved with community DE initiatives. Stage one concludes with an analysis of the community engagement approach implemented by Western Power to promote sustainable energy planning for two regional communities. This will be followed by Stage Two analyses of SMEs survey with the regional communities of Denmark and Albany and Stage Three involves analyses of interviews and surveys conducted with energy stakeholders to gain their perspective of the issues related to IG-DE within the Western Australian energy policy context.

5.2. Stage One – Community Perspective of Planning for IG-DE Solutions:

Before the evaluation of Western Power's community engagement process is reviewed, this section begins with an analysis of the key themes reflecting the Denmark community participants' perspectives to the issues that underpin planning of sustainable energy visions that incorporate IG-DE solutions. As the SCPWG community forum was held in Denmark and the majority of the participants represented Denmark's visions, the focus of this phase is on Denmark stakeholders' perspective to the issues implicated with IG-DE solutions. A significant factor directing the focus on Denmark's perspective is that Western Power initiated the forum to appease community negativity over the high number of power blackouts experienced during peak periods of consumption, especially during the Easter holiday season when tourism leads to a doubling of the population. Grounded theory analysis in tandem with cultural theory analysis of community interview data revealed five overarching themes: (1) *Energy Reliability and Responsibility for Distributed Energy;* (2) *World Views Underlying Energy Visions*; (3) *DE & RE Sources - Drivers and Barriers*; (4) *Community DE Initiative – Surmounting Hurdles* (5) *Community Engagement and Sustainable Energy Supply.*

5.2.1. Theme 1: Energy Reliability and Responsibility for DE

The overwhelming consensus is that energy reliability is a critical issue facing the Denmark community. While blackouts pose serious economic hardships for the business sector, some householders have experienced being without power for a period of up to 72 hours. A contrary opinion by one participant is that energy reliability is not an issue as they reside in an eco-village where residents have personally invested in solar PV panels to power the needs of the housing estate. While enjoying energy independence, the issue raised is that the choice to export power to the main grid had been curtailed due to the costs of transformers to connect to the grid. Highlighting the concern for SMEs, one participant affirmed that businesses are heavily dependent on a reliable energy supply to ensure viable economic returns, particularly accommodation businesses during the peak tourism season when blackouts are common. Despite a desire to deploy DE, solar PV generation is not considered a feasible option for business owners due to the low economic bottom line of regional SMEs and a lack of subsidies and financial incentives from feed-in-tariffs. While DE is not a feasible option as a business owner, this participant was motivated to access the subsidies to install solar power generation at their residential home.

" ... we still have a reliability issue right now ... blackouts have lead to a loss of medical equipment … current [DE] solutions are not necessarily going to address it ... it depends a lot on the predictions of what the energy consumption increases are ... DE is not a feasible option for business owners ...[excerpts from interviews]

Theme 1.1: Institutional Responsibility and Facilitation

While energy reliability is a serious concern for the majority of participants they attribute Western Power with the responsibility both as an advocate and key influencer on energy policy to facilitate a number of strategic actions. There are two perspectives to institutional responsibility for actions, those who identify with (a) green energy visions and those who identify with (b) socio-economic visions. For the majority of participants who identify with sustainable green energy visions they highlight key strategies aimed at climate change mitigation by reducing GHG emissions. At the regional community level the desire is for the development of locally generated renewable energy sources of power (e.g. community DE initiatives) to halt the augmentation of power lines delivering coal fired power. At the individual level the aspiration is for a greater array of financial and policy incentives to promote solar power generation among householders including demand management behavioural changes to reduce energy consumption and GHG emissions. From this perspective, there is also a lack of trust in institutions to lead the charge and address climate change issues and therefore community coalitions of sustainability oriented activists feel it is their obligation to advance their cause through education, awareness and political advocacy to promote change at the policy and community level.

"... there is a long standing suspicion about big institutions ... their record of communicating with the community/people has been terrible ... Corporations are not set up to be altruistic. So if they don't engage very well and they are not altruistic there is very genuine reason why people might be suspicious about their motivations and who is actually going to be left to pick up the pieces" [excerpts from interviews].

For the minority of participants who present a socio-economic perspective to the issues of energy security, they attribute the state government and the energy Utilities with the ultimate responsibility for energy supply to promote the social sustainability and economic viability of regional communities. There is also the perception that locally generated renewable energy will limit the power that is available for developers and other entrepreneurial activity which will ultimately jeopardize economic growth of the Shire. To cope with the dual challenges of future population growth and economic growth the view is that the government and power utilities are best positioned to respond to the increasing demands for electricity.

From this perspective if augmentation of power lines are required to keep pace with development and growth of communities then that is what is desired. The vision involves socio-economic needs as the main concern for regional communities as it is ultimately up to Governments and Energy Utilities to pursue development of energy technology mix required for the state. From this perspective the socio-economic viability of regional communities is about survival, concern about climate change issues and the reduction of GHG emissions is not part of the regional frame of reference. There is also great distrust in government and its institutions that adequate resources will be accessible to regional communities. Hence, the underlying concern is that devolution of state responsibility for energy reliability to the regional or community level would relieve institutional responsibility to the regions and create additional resource pressures for the local governance structures.

"... There are plenty of technical innovations, all we need is the Utilities and Government on board – Governments create policy areas and set boundaries for everybody but they are all short term and not long term solutions. Give a business person money he will do something to make a profit – government hands out money they don't make any profits ... can we trust them (governments) to spend tax dollars efficiently ..." [interview excerpt].

5.2.2. Theme 2: World Views Underlying Energy Visions;

" ... we are heading for disaster it is already too late and governments lack commitment ... we live in a geographically perfect place, the community is diverse, friendly ... permaculture is the only thing that will save the planet, it's about cycles always in ecological balance ... ... stop preaching to the converted ... target the young - it is only when children live with recycling and energy conservation then it will become automatic ... economic barriers need to be addressed to promote solar power" [interview excerpt].

While the majority of participants are highly knowledgeable about climate change issues and DE options there are three cultural perspectives that underlie visions for energy sustainability. Most significant is that all participants exhibit strong environmental values including attachment to geographic place and community shared as a core defining feature of this community. Most prominent however is that environmental values and risk perceptions of global warming can be linked to divergent emphasis on the attribution of responsibility for influencing energy related behaviours. While the *green oriented* perspective can be associated with risk perception of climate change impacts as a core external motivational force for adopting DE solutions, for many of these participants, sustainability values is an intrinsic motivational drive guiding their purposefully chosen ecologically balanced lifestyle. Within this cultural perspective there are two major views about how energy behaviours should be influenced. For those professing extreme risk perceptions of climate change impacts, the imperative is for policy makers to use regulatory force to increase RE power sources and DE solutions which also avoids community conflicts over the location of wind farms.

A contrasting stance among those holding strong environmental values with a diminished urgency about climate change risks is to offer a pragmatic approach to influence energy behaviours and ultimately social change. The reason underlying the pragmatic approach to behavioural change is that while Australians are the highest per capita energy consumers, Australia only contributes one percent of GHG emissions and it is not going to change the global context. Therefore the vision is for a long term cultural change towards a low carbon society. This perspective postures the adoption of balance between the idealistic and a realistic position of what can be achieved by humans to live an environmentally sustainable lifestyle. While the goal is the integration of energy efficient behavioural changes with low emission energy technologies there is greater recognition that long term behavioural changes comes from transformation that is not too rapid and onerous. Hence the goals are holistic and targets enduring changes that result from empowering processes involving consciousness raising, the inculcation of energy efficient social norms in the younger generation, paying due regard to both intergenerational and intra-generational justice, advancement of social equity for those least able to afford to energy efficient technologies including market and policy incentives to promote viable markets for green energy solutions.

The third perspective represents the participants who have invested in DE solutions such as solar power generation but are not necessarily intrinsically motivated by environmental concerns or climate change risk perceptions. From this viewpoint, emphasis is placed on external policy and economic incentives as important driving forces to promote energy efficient behaviours. One

example which motivated members of the business sector to adopt energy efficiency and DE solutions is the ability of SMEs to market its green business image. From this stance external motivation is the key and deployment of DE solutions is dependent on government and energy utilities' policy incentives to ease the burden on the economic bottom line.

5.2.3. Theme 3: DE and RE Sources - Drivers and Barriers

" ... to produce enough power from nuclear it would be 30 years – way too late – beauty of wind is quick ... wave still not proven technology still at testing stage ... would prefer government to put money to wave and geothermal than carbon capture and storage ... Clean coal is an oxymoron ..."[interview excerpt].

While there is overwhelming support for the development of RE sources including the deployment of low emission DE sources and other energy efficient technologies (e.g. solar PV, wind turbines, wave, biomass, gas, hydro, geothermal, electric vehicles, retro-fitting) there is also a growing minority support for nuclear power. Three perspectives can be linked to the differing attitudes toward coal and nuclear energy. The first group identified with a green orientation and perceiving climate change risks are totally opposed to coal and nuclear power sources. There is however a subgroup within the first group who perceive a low risk to modern nuclear facilities and endorse nuclear energy as a viable option to tackle climate change. Japan's Fukushima nuclear incident may influence this view. A third narrative emerging from the data reflects those who value their geographic and community heritage but do not perceive climate change risks. While they are not opposed to coal fired power there is greater resistance to nuclear power plants due to perceptions of associated health and waste storage risks. While development of RE sources and deployment of DE technologies is not seen as an individual or community responsibility, there is a willingness to deploy economically viable DE.

While there is overall policy support for RE, it appears that the main drivers for DE are associated with those possessing high environmental values with climate change risk perceptions. While the majority are both intrinsically and externally motivated to deploy DE generation (mainly solar PV) the greatest barrier for regional householders and SMEs is economic as the disposable income is low and the feed-in-tariff is insufficient to make it a viable investment.

With regard to electric vehicles the narratives reflect a similar pattern, those with strong environmental values and climate change risk perceptions emphatically endorse it as a desirable technological innovation. Nevertheless, affordability is flagged as the key impediment for the majority of regional residents. Those not perceiving climate change risks however, are indifferent to the electric vehicle and point out the irony that it would be charged with coal power from the main grid. From this perspective acceptance of electric vehicles is dependent on economic viability and suitability for long distance country driving.

With regard to access to information and awareness about DE technologies, participants have links to environmental agencies and can easily access the more general literature. However, most desire detailed knowledge and access to energy specialists to provide technical advice on the best options. As one participant highlighted, installing a solar space heating system required expensive specialist services such as engineers and architects to position it into the building. From this perspective, for those wishing to deploy innovative energy efficient technologies the barriers are numerous, including access to information, energy technical expertise and economic viability.

"There is no one stop shop to go to for information on all the technologies. We are having to do those evaluations of things ourselves … we just can't go to Western Power and say can we please have access to a consultant to help us go through what the options are and their feasibility for the peak situations that we have down here …"[interview excerpt].

5.2.4. Theme 4: Community DE Initiative – Surmounting Hurdles

"In May 2008 the shire council voted to approve access to the wind farm site, and support the endeavours of Denmark Community Wind farm Inc … In November 2009 council voted to support excision … Western Power supports the project, as part of its ongoing program to improve the local electricity supply" [interview excerpt].

A major theme which emerged as a central issue for the participants and the community as a whole is the proposed development of the Denmark Community Wind Farm Inc (DCWF) comprising of two 800kW wind turbines - a community DE initiative instigated by a small group of entrepreneurial environmentalists. While there is majority support for its development, its positioning on Crown owned coastline has sparked heated community conflict. While the inspiration for this initiative can be linked to concerns over (a) climate change impacts, (b) power from fossil fuels, (c) energy security and a desire to involve the whole community in the empowering benefits of owning its own RE generation company. This initiative represents a key strategy supported by Western Power as a viable alternative to augmentation of power lines. Nevertheless the transition from concept development to progression of approval for fifty percent (50%) Commonwealth government funding has been a long and arduous journey. Developers will seek funding for the remaining fifty percent (50%) of the costs of the project through the sale of shares to the community.

While the application process began in 2005 the barriers have been numerous involving intense community disputes over the coastal positioning of the twin turbines and concerted efforts by key Politicians to obstruct its construction due to strong community opposition and its location on crown land. While community conflict has abated, community tension is still high among those opposed to the potential loss of privacy, visual and aesthetics, including spoiling of amenities and disruptions from noise and rising tourist numbers. Regulatory hurdles from the Shire and the State has now ceased as the State has excised crown land for private use and approval has been granted by the Local Council for the development of the DCWF. While it has taken approximately six years to reach this stage of concept approval, there are more hurdles to overcome.

While the DCWF developers received confirmation in 2009 for a Commonwealth grant to fund fifty percent (50%) of the costs of the twin turbines, this figure was based on a 2006 estimates that is inadequate for 2010. As the costs have risen by ten to twenty percent and additional funds are required to connect to the grid the developers now face a new economic barrier. There is no option other than to start again with a new application process with current costing to construct the DCWF. Although the grant application process may take up to two years to progress to funding stage, there is also a waiting period of two years for delivery of the wind turbines. A protocol requirement by ENERCON, the wind turbine manufacturers is that an order will only be processed when the DCWF Inc obtains an active connection agreement with Western Power.

" The catch 22 with this grant is its not designed to be difficult but it is difficult ... to get the grant money we have to progress the project to the point of excision – excised from the A class reserve for the purpose of a wind energy facility – we need $300 000 bridging money to get us to excision and assuming that the Minister will accept our upgraded application that then becomes the trigger point to getting our capital costs money and along the track we have also got to go out to the community, prepare a prospectus for around $80 000 to get the other half of the money that we

need for the total amount of what we have no idea ...” [interview excerpt].

In spite of the enormous political, regulatory, institutional and economic obstacles along with the grant application approval delays, the DCWF developers are confident that they will be successful with their upgraded Commonwealth grant application and in securing community funds for the project costs. In spite of the hurdles, the executive members of this future community owned power generator are driven by a vision to build the first community owned RE power plant in Western Australia. Their passion and tenacity to surmount all the barriers to deploy community DE is staggering. Their concern for the environment and the socio-economic benefits that this project will generate for this regional community is also a key motivational force.

The developers and stakeholders desire more supportive institutional structures to promote community driven renewable DE projects as it is environmentally benign and it is also an ideal alternative to constructing expensive power line augmentation. While there is majority support for the DCWF, concerns are raised that economic sustainability is a delicate balance and community DE might constrain energy intensive commercial developments. Also raised is the fear that governments and energy Utilities are attempting devolve responsibility for energy reliability and security to the community level.

5.2.5. Theme 5: Community Engagement and Sustainable Energy Supply

“The power working group was really provoked, initiated, recruited really from the community and it was them coming to Western Power and said you have to have a more innovative approach that building more infrastructure ...” [interview excerpt].

There is a diversity of perspectives pertaining to Western Power’s motivation for instigating community engagement processes to deal with energy issues and plan the solutions toward energy reliability. Nevertheless, the consensus view is that the representatives of the SCPWG persuaded the energy Utility to take more innovative approaches to energy generation and efficiency. This included solutions to increase RE sources, DE technologies as well as demand side management (DSM) strategies to reduce energy consumption and GHG emissions. Although the goal for the majority of the representatives was inherently about mitigating climate change, for Western Power the strategic direction targeted the reduction of peak power consumption and cost savings achieved through DE and DSM strategies. From the participants’ perspectives the twin goals of the community representatives and the energy Utility were being pursued through the community engagement process.

In terms of power and influence, community interviews revealed that the Denmark representatives felt empowered to shape the strategic direction of their community’s sustainable energy vision. In contrast representatives of the Walpole community were frustrated by their inability to influence the direction of their vision for energy reliability. While a number of factors impeded the successful engagement of the Walpole representatives, it must firstly be noted that this ‘*power working group*’ assembled by Western Power officers largely comprised of green oriented social activists from the community of Denmark who worked tirelessly to steer the sustainable energy agenda to act on climate change. As a result the forums largely focused on solutions identified by the Denmark community to address green energy visions. While all representatives supported green strategies it was not motivated solely by environmental concerns. For a small group of representatives not subscribing to green politics, it was a pragmatic decision supported on the premise that it was economically viable and advantageous to a green business image.

Sub-Theme 5.1: The Green Agenda – Power and Issues of Representation

While this power working-group pursued feasibility planning for a green energy solution to meet the future needs of these two edge-of-grid communities, the procedural process did not meet the needs of the Walpole representatives. For example, during forum deliberations the Walpole community representatives verbalized high levels of agitation over the low priority given to their energy solutions. Although these criticisms were acknowledged, the facilitation and procedural process was not able to address the uneven power dynamics.

In terms of the effectiveness of the community engagement process, it is perceived more positively by the Denmark representatives as the Western Power officers played a positive role and function in changing the power relationship between institution and community. The bold move taken by the energy Utility to incorporate local expertise into the planning process and advocate for community needs represents a major cultural shift in governance relations and Denmark representatives acknowledged this as a significant achievement. They were equally satisfied with facilitation as it provided ample opportunities for them to participate in informed discussions. However, this positive perception can also be attributed to the utility Officers inexperience with facilitation that allowed the more experienced Denmark representatives possessing high level energy expertise to steer the deliberation process.

Given that the uneven power dynamics was not explicitly addressed, the process of community engagement has drawn mixed responses. For the highly engaged members of the SCPWG, the process is evaluated as positive as it involved open dialogue and reasoned discussion that influenced others, particularly the decision makers. In contrast, for the less engaged members, participation was a frustrating experience, as management by a skilled and neutral facilitator was lacking.

Sub-Theme 5.2: Validity of Decision Making - Procedural Issues

Even with the best intentions, the community engagement pilot revealed that the energy Utility officers were in the early stages of the learning curve with both IG-DE solutions and the process of community engagement. While the SCPWG's strategies reflect the community's principled commitment toward green energy innovation, several procedural changes were implemented to enhance accountability and promote a more inclusive representation of community interests. In this vein Reid (2009) draws attention to the value of ecological frameworks to guide us in addressing complex governance and sustainability problems. A pertinent example where a community initiative meets multiple sustainability goals involves incorporating the promotion of energy conservation and reduction of utility bills for low-income home owners (Reid, 2009).

There is little doubt that the deliberative process was highly constrained by the energy Utility's regulatory, economic and statutory requirements and this precluded the wider consideration of community impacts. To promote a more integrative community engagement process, adopting a sustainability framework that promotes balance between economic development, social equity and environmental protection based on inclusionary governance is considered a vital tool (Agyeman & Evans, 2004; Szarka, 2004). Furthermore, a socially responsible decision making framework leads to substantive goals that is representative and accountable to the larger community as well as meeting sustainability aspirations (Kolk, 2008; Reid, 2009).

Sub-Theme 5.3: Community Awareness and Institutional Change

In spite of the limitations, a number of key positive outcomes have emerged. The engagement by Western Power officers at the local community level is a powerful symbol of institutional change toward more democratic local governance processes. A greater level of trust has also emerged between the Utility officers and the community, as engagement has engendered positive working relationships. Also highly valued is the easy access, SCPWG members have to Utility officials to voice community concerns. The energy forums have opened the channels of communication between the energy Utility and the community and this in turn has led to a reduction in negative community attitude toward Western Power's responsiveness to energy reliability issues. Geiselhart (2004) and O'Hara (2004) confirm that public trust is related more to reputation and experiences derived from direct forms of participation and engagement.

A significant outcome of community engagement processes is that it has sparked many other community initiatives to promote awareness, education and easy access to information and advice about DMS strategies and deployment of DE. Key community leaders have also been proactive in promoting a community-wide approach to climate change mitigation. This has also involved intense lobbying of state politicians to reduce regulatory and institutional barriers to deploy Renewable DE and increase funding for DSM strategies (e.g. piloting of smart meters). The SCPWG has also enabled cultural transformation of mindsets in energy institutions to adopt IG-DE solutions. This community engagement process has enabled this power working group to use its human, social and political capital to promote change at individual, community and higher societal levels toward a more environmentally benign electricity system.

5.2.6. Summary – Stage One

Community interviews revealed that while energy supply is considered the key domain of governments and energy utilities, the community also plays a powerful role in driving IG-DE the adoption of solutions. While pro-environmental values predict support and early adoption of IG-DE technologies, it does not necessarily lead to mass deployment as affordability is the key impediment. While many barriers exist, Western Power's DSM strategies are a pertinent example of how institutions can incentivise residents toward smart grid solutions. Phase two also highlighted the role of community DE in facilitating the development of DE, however, governments must play a more proactive role in eliminating the institutional barriers to streamline the grant application process. Community engagement by Western Power also highlighted that IG-DE solutions are enabled when Energy Utilities and community activists advocate for solutions alternative to a centralized grid supply. While community engagement is a powerful facilitator of change for IG-DE, the deliberative process must be facilitated by trained experts to ensure decisions are accountable and reflect diverse community aspirations.

5.3. Key Findings of Stage Two: SMEs Survey

5.3.1. Defining SMEs

According to Australian Bureau of Statistics (ABS), a small business is defined as one which employs less than 20 people, and a medium business as one which employs between 20 and 199 people. Small to medium sized businesses (SMEs) make up 95% of all businesses in Australia. SMEs can be characterised as heterogeneous, resource poor both financially and in time, are a disparate group and do not think as a collective but are a vital component of Australia's economy (Walker, Redmond & Goeft, 2007). Also of relevance is that they often work in isolation and are not necessarily connected to industry groups or associations, unless required to do so for registration purposes (Condon, 2004). Working in isolation also makes it easier for them to ignore

the individual impact they may be making on the environment, however, collectively they make an enormous impact on the ecological footprint of society, both on their immediate local environment as well as in a global sense (Hillary, 2000; Stokes, Chen & Revell, 2007). From this perspective understanding SMEs beliefs and attitudes including the drivers and barriers implicated with the deployment of DE solutions and related energy efficient practices is vital to promote the 'business case' that will change current management practices. The regional SMEs of Denmark and Albany located on the edge of the SWIS electricity grid are appropriate sites for understanding the issues associated with IG-DE solutions. As these communities differ in population size, socio-political and economic characteristics including energy reliability issues, the comparison between these two communities will provide a more nuanced understanding of what motivates SMEs energy related behaviours.

5.3.2. SMEs World Views

The SMEs survey analysis has been informed by qualitative data collected in the previous research stages and thematic and cultures theory analysis has been applied to understand the world views underpinning SMEs' energy attitudes, beliefs and behaviours. While categorisation of discourse allows a simpler understanding of SMEs energy attitudes and behaviours it is not meant to stereotype the respondents but to recognize that a multiplicity of worldviews exist and this analytic process will assist in the development of more flexible IG-DE policy solutions.

5.3.3. SMEs Perceptions of Energy Reliability Issues:

Of note is that the communities of Albany and Denmark experience divergent energy reliability issues. While Albany residents are accustomed to a secure electricity supply direct from the main grid, Denmark on the other hand receives its power from a 132/22 kV transmission line connected to the Albany substation more than 50km away. It is therefore not surprising that Denmark experiences frequency of blackouts during peak energy periods. The SMEs survey confirms this perception and while the majority of Denmark SMEs (66% strongly agree and 24% agree) think that energy reliability is a major issue fewer Albany SMEs (14% strongly agree and 30% agree) think it is a major issue for their community. In spite of these major differences to energy reliability issues it appears that the SMEs sector in both communities share similar views about climate change, the environment and the management of energy issues.

5.3.4. Climate Change Beliefs and Attribution of Responsibility

Applying a cultures theory framework the SMEs energy consumers' worldviews can be categorised into three (1) *Hierarchists*; (2) *Egalitarians* and (3) *Individualists*. The fourth orientation the *fatalists* was not represented in this study as a salient cultural disposition. From a cultural perspective the *Hierarchists* represents the largest group and responses tend to convey little sense of individual responsibility for energy issues. Furthermore, the discourse suggests that climate change mitigation and development of RE options are government responsibilities. Examples of this discourse are (support for survey statements): *"Australian businesses will be disadvantaged if overseas economies do not regulate carbon emissions"; and "financial incentives are vital to take up energy efficiency and solar power generation"*.

The *Egalitarians* represent the second largest group and the discourse reflects a fundamental belief in taking personal responsibility for climate change mitigation and deployment of DE. Examples of this discourse are: "*acting on climate change is a moral choice to protect the planet*"; and "*we must change our behaviour to protect future generations, we must act now to reduce our carbon emissions*".

The *Individualists* represent a minority group and the discourse tends to indicate an absence of personal responsibility and/or a desire to delegate responsibility to others to address climate change. Examples of this discourse are: "*there is no point subscribing to green energy because you don't know if it is RE or coal fired*"; "*it is not practical to pursue energy efficient operations if other businesses don't do the same*"; "*the big polluters (Corporations and industry) should be mainly responsible for protecting the environment*"; and "*government is responsible for delivering a secure and reliable energy supply*".

5.3.5. SMEs Demographic Representation

The demographic statistics reveal a fairly even representation of SMEs for both Albany and Denmark on a number of characteristics. Figure 1 below portrays the gender distribution for the two communities where Denmark's sample comprises 45.8% female and 54.2% male, while Albany's sample is 44.4% female and 55.6% male.

Figure 1: Albany and Denmark – Gender

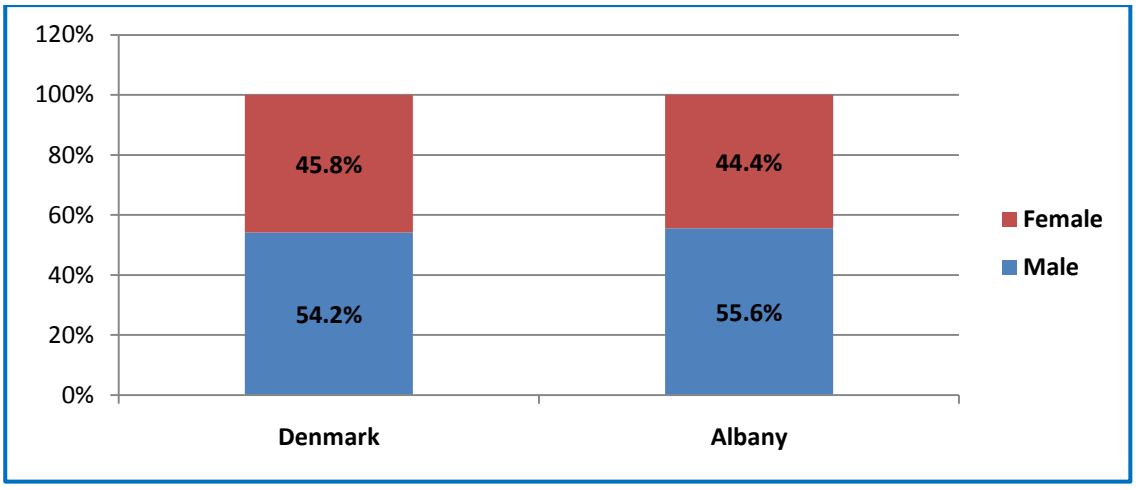
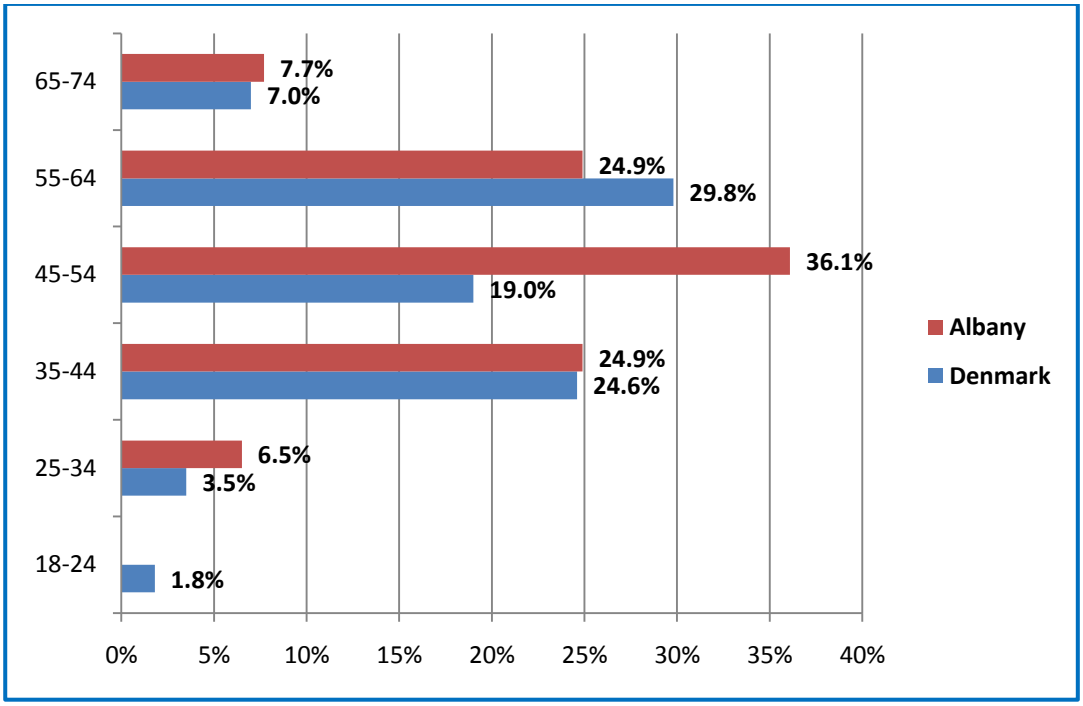


Figure 2 below illustrates a representative sample of SMEs based on age distribution, where a larger sample is drawn from the age groups 35-44; 45-54 and 55-64, fitting with expectation for respondents holding management positions.

Figure 2: Albany and Denmark - Age Spread of SMEs



Fugure 3 below illustrates the spread of business ownership models which largely comprise of sole proprietorships, family businesses and business partnerships. The implications are that regardless of environmental values, the majority of regional SMEs will face economic barriers in the deployment of IG-DE technologies.

Figure 3: SMEs Business Ownership

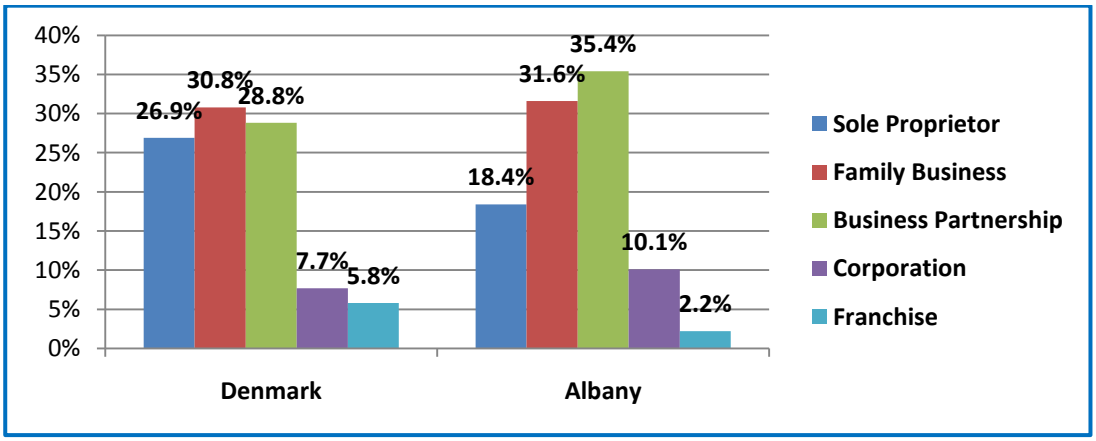
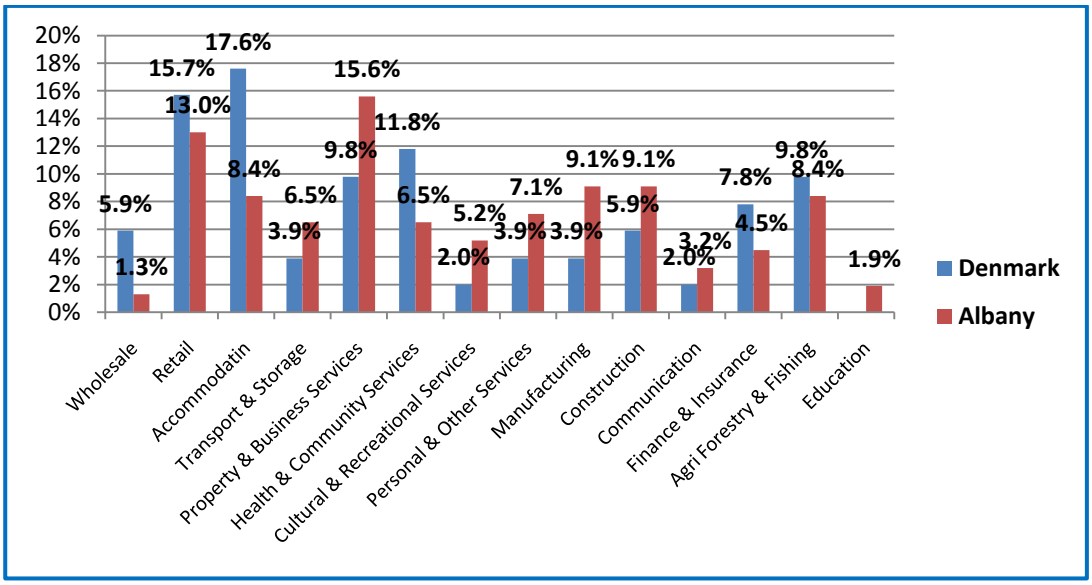


Figure 4 depicts a fairly even spread of SMEs by the industry sectors and reflects the representation of the industry group in the regions identified by ABS data, where retail, accommodation and agri-forestry and fishing sectors dominate.

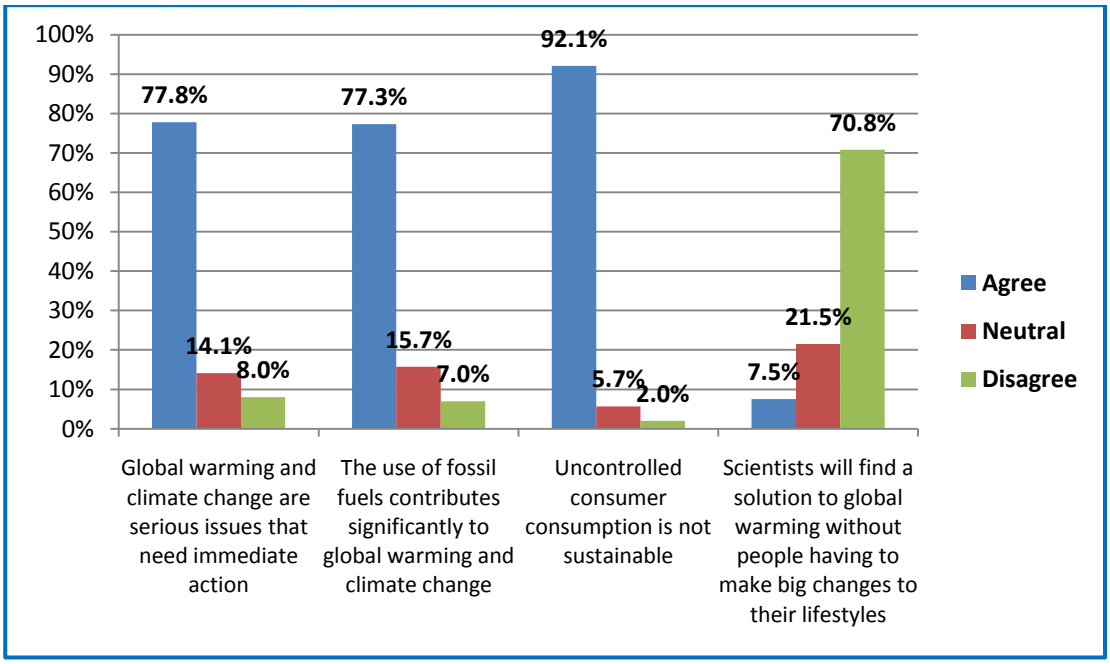
Figure 4: Chart 4: SMEs by Industry Sector



5.3.6. SMEs Environmental Orientation

While the two regional SMEs communities differ on a number of characteristics no significant differences in energy attitudes and behaviours were found. However, where differences are significant these themes are discussed in the latter sections. As illustrated in Chart 5 the majority of SMEs are highly supportive of environmentally friendly beliefs and attitudes and indicate high levels of awareness of the cause and impact of climate change. This contrasts with a minority of SMEs who hold either neutral or negative attitudes towards climate change and that it is human induced. There is also strong agreement among the majority of SMEs that science is not the solution and that big lifestyle changes are needed to live harmoniously with the environment.

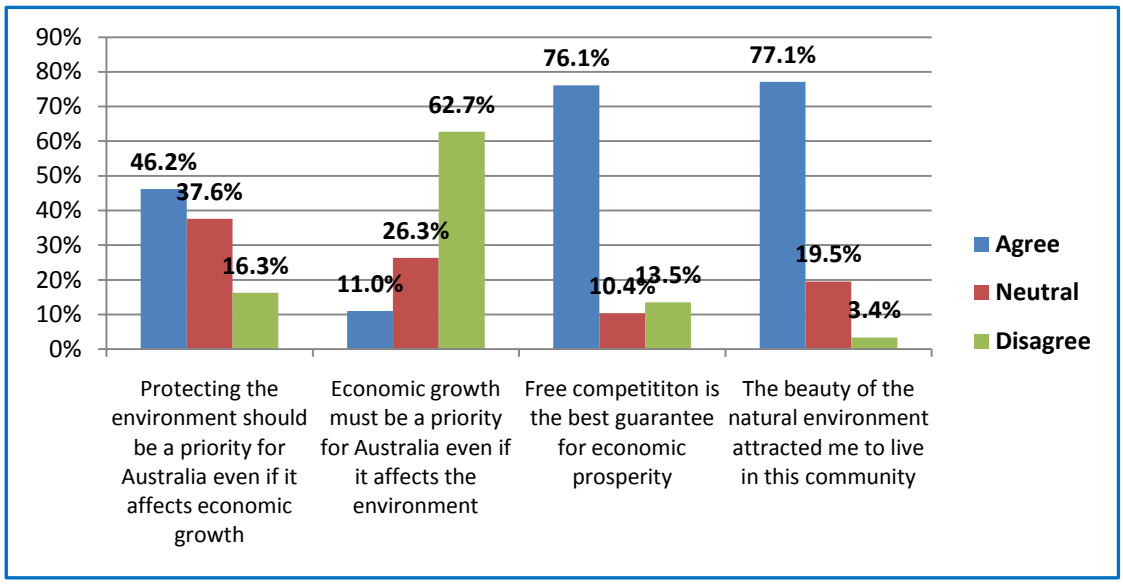
Figure 5: SMEs Environmental Attitudes



5.3.7. Theme 1: Economic and Environmental Sustainability

The SMEs position the state of the environment on a par with economic sustainability and support integration of economic and environmental issues with energy management decisions. Confirming this premise, Figure 6 below indicates that only 11% of SMEs think that economic considerations should take priority over the environment, while only 16.3% disagree that the environment should take priority.

Figure 6: Attitudes to Economy and Environment



The responses indicate that the majority of SMEs perceive environmental concerns and economic sustainability as an integrated issue. As Figure 6 above illustrates less than half of SMEs (46.2%) think that the environment should take priority over the economy and 63% don't believe that economic growth should take priority over the environment. SMEs are averse to prioritizing either the environment or the economy and desire decision making to be driven by broader sustainability visions.

While emulating sustainability values, the paradox is that the majority of SMEs (76.1%) support the notion that *free competition* is best for economic prosperity. Only a minority of SMEs (13.5%) are philosophically opposed to a consumerist society. These responses however are in keeping with regional SMEs value systems where the environment and the economy are equally important issues. As the survey responses highlight regional communities show a strong sense of attachment to place (77.1% support) and are attracted to living the regional lifestyle despite the lower profit margins.

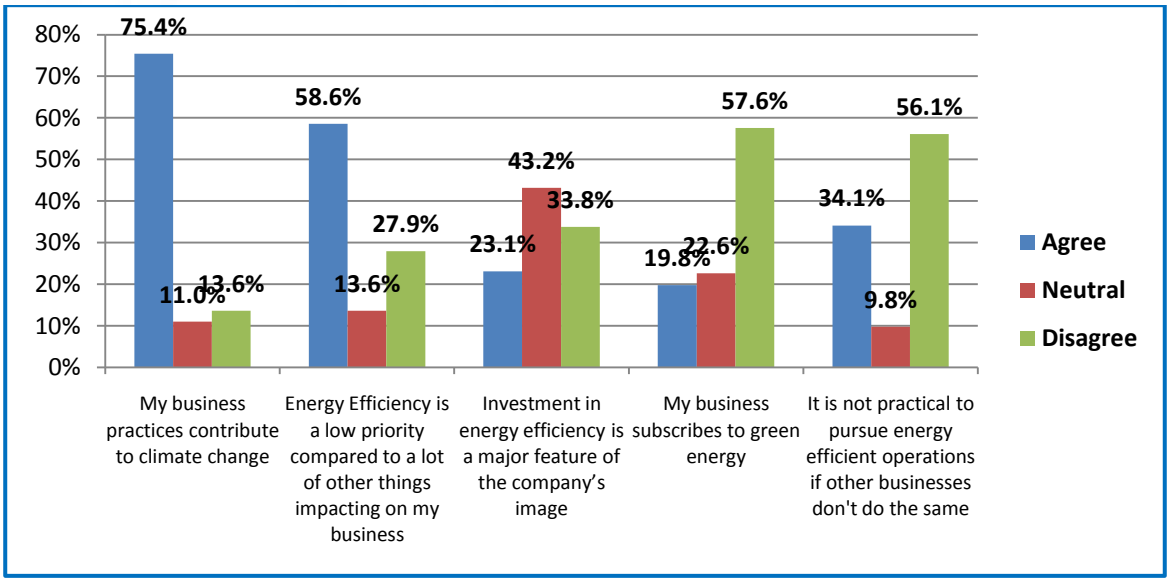
Theme 1.1: Energy Policy Actions – Economic and Environmental Sustainability

While all three energy cultures support regulatory and market reforms to address energy and climate change issues, the *Hierarchists* and *Egalitarians* support the CPRS, RE subsidies and green energy investment. However, unlike the *Hierarchists* who support capitalist growth, *Egalitarians* desire cultural change to reduce consumer consumption and increase investments in an alternative green economy. *Individualists* on the other hand who are highly distrustful of governments propensity to increase taxes, are opposed to a CPRS but support RE targets and technological developments such as CCS. The excerpt below reflects the lack of trust in government leadership*: "SMEs are the backbone of the economy and there is little assistance to make a viable living ... governments are too busy playing politics to take effective action ... bilateral commitment from all parties in needed so they can feel comfortable making decisions good or bad. I'm not going to hold my breath, death would be 99.9% assured".*

5.3.8. Theme 2: Awareness and Behavioural Actions

Echoing numerous research findings, green attitudes and awareness do not necessarily translate into concrete actions (Jackson, 2005; Owens & Driffill, 2008). As figure 7 below indicates, while many SMEs (75.4%) take responsibility for GHG emissions they do not necessarily take actions to address it. For example, although some SMEs (23.1%) invest in energy efficiency, for 58.6 per cent of SMEs the key barrier is that energy conservation is a low priority compared to other issues impacting on business. Energy efficiency and DE is also not considered a prudent investment if other SMEs don't do the same. These contradictions are also confirmed by the Eurobarometers' (2008) environmental attitude survey which found that people with high environmental values are not necessarily undertaking energy conservation actions. While many undertake 'passive' energy behaviours like recycling, they refrain from 'active' behaviours such as using the car less or buying environmentally friendly products. While the lack of active energy behaviours could be viewed as indifference to energy conservation, there are other considerations that explain the incongruence between attitudes and behaviours discussed below.

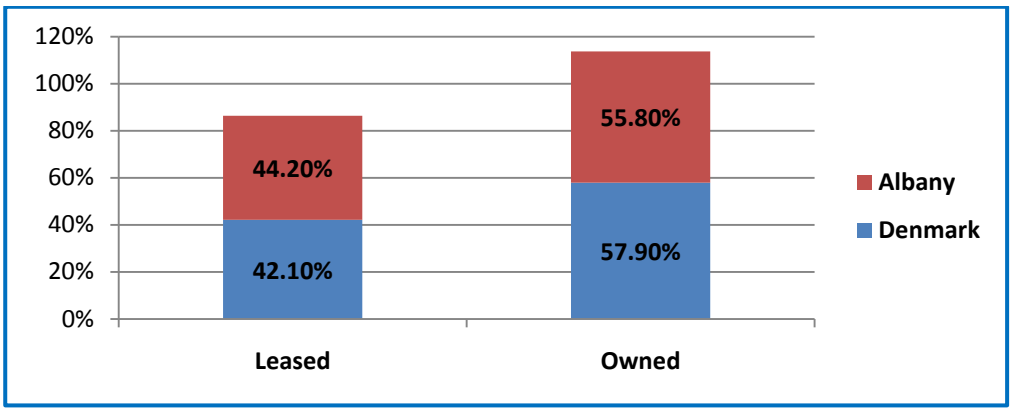
Figure 7: Green Energy Behaviours



5.3.9. Theme 3: Barriers to Energy Behaviours and Attribution of Responsibility

While the SMEs' response to the more active forms of green energy actions is not inspiring, many factors may hinder it. For example, many business premises are leased; (see figure 8 below) some businesses are mobile; and for others energy use is low and there is little incentive to pursue DE options. The implications are that energy policy needs to be designed to incentivise SMEs to undertake DE and other EE practices as a social responsibility.

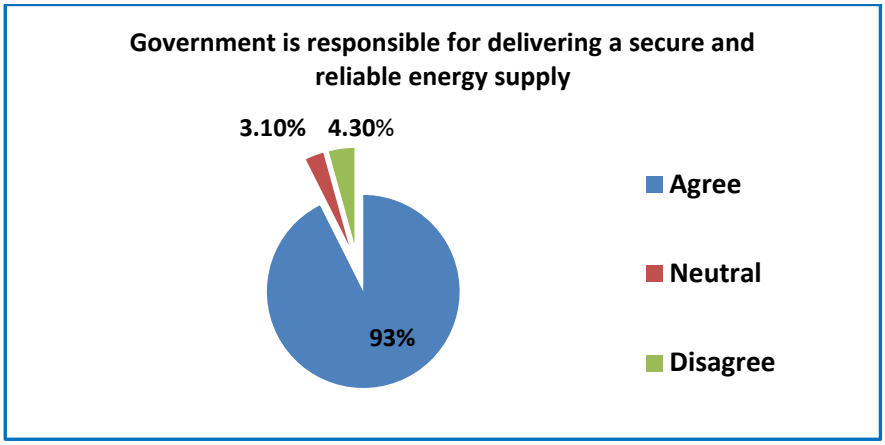
Figure 8: Business Premises



While SMEs cite numerous limitations to undertake active energy behaviours, others are either altruistically motivated to adopt EE business practices or are economically motivated by the advantages of a green business identity. For the majority who don't pursue EE and DE actions, affordability and the low priority of EE compared to other more pressing business concerns is cited as a major barrier to organizational change. While it is tempting to categorise this group as sceptical due to their pro-economic values and anti-climate change beliefs (e.g. Carr-Cornish et al.,

2008), the respondents may also reflect a more pragmatic attitude to the attribution of responsibility for climate change mitigation. For example, while many SMEs feel morally responsible to undertake climate change mitigation, they also feel powerless to change without institutional facilitation. As the responses in Figure 9 below indicate 92.5% of SMEs believe that energy security and reliability is a government responsibility.

Figure 9: Government Responsibility

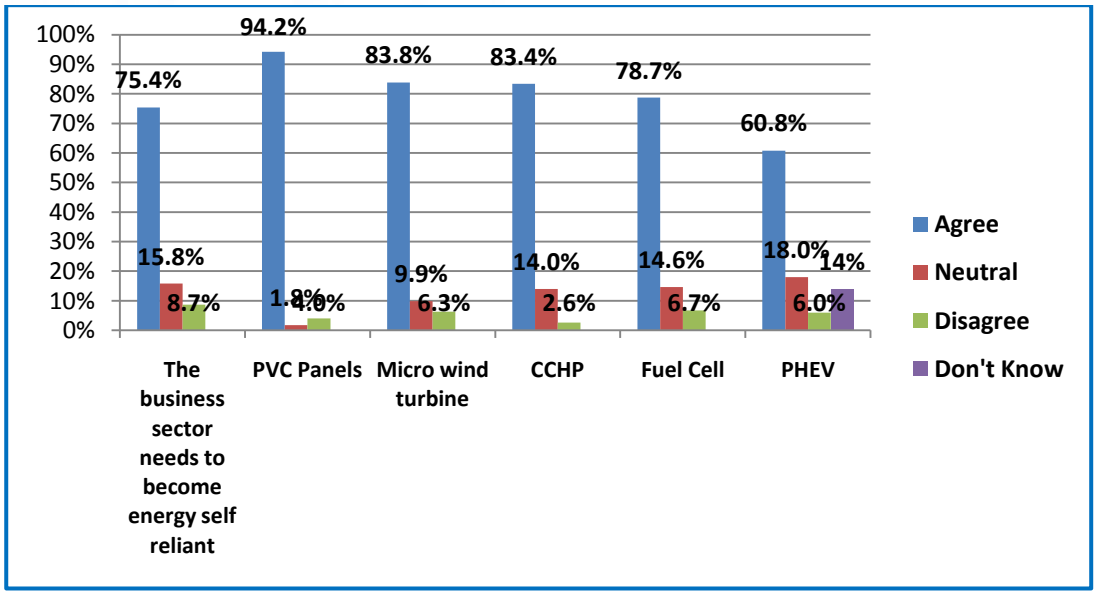


As governments are attributed with responsibility for energy issues, it is understandable that SMEs are reluctant to take more active energy actions as they are dependent on governments to take the lead in providing strong signals and the incentives to facilitate change in the business sector. Also of relevance is that while all three cultural orientations desire institutional coordination for energy policy, the *Hiearchists* and *Individualists* are more reliant on institutional leadership to incentivize green energy behaviour. For the *Egalitarians,* individual responsibility is fundamental along with civic action to influence the governments' agenda for climate change and energy policy actions.

5.3.10. Theme 4: SMEs On-Site Acceptance of DE Solutions

While the majority desire institutional coordination to drive viable energy technological solutions, the SMEs also support the development of a suite of technologies and attribute personal responsibility to engage with on-site DE generation, as indicated in Chart 10.

Figure 10: Acceptance of DE Solutions



While there are high levels of acceptance for the proven technologies there is more caution toward the less familiar energy technologies. For example while 75.4% of SMEs want to energy self reliance, they are willing to deploy the popular technologies such as solar panels (84.2%) and micro wind turbines (83.8%) on business premises. There is also a high level of support for the CCHP system (83.4%) and Fuel Cells (78.7%). While there is moderate support (60.8%) for PHEVs, these responses signify a general acceptance of DE technologies and the signs are optimistic for DE deployment among SMEs as long as the economic, regulatory and informational barriers are addressed.

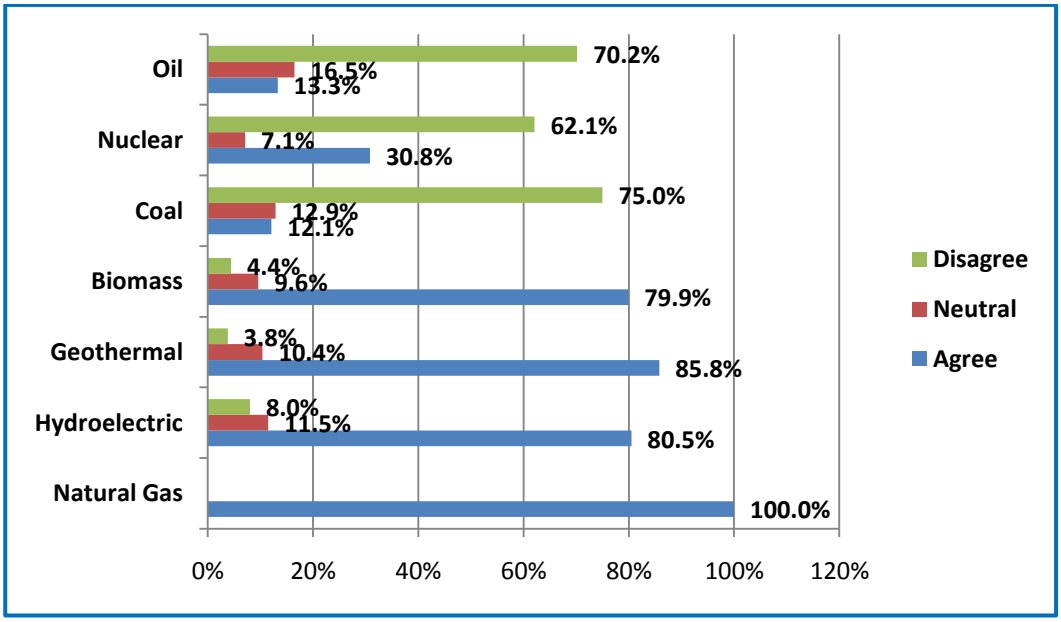
5.3.11. Theme 5: Sources of energy mix desired for Australia

With regard to sources of energy mix desired for Australia, predictably the majority of SMEs favour RE sources over fossil fuels (see Chart 11 below). The minority who support coal sources however, rationalize that it is reliable, abundant and cheap. The surprising element is that nuclear power is desired above coal. While these attitudes reflect the global renaissance for nuclear energy sources (existing prior to the 2011 Fukushima incident), its development is supported under the strict criteria that safety, storage and disposal and economic concerns are addressed. The supporters highlight that all options have been exhausted, there is little choice but to pursue nuclear sources.

An excerpt highlights the rationale for nuclear sources, given the dire consequences of climate change: "... nuclear has a definite place, we know all the dangers they can be managed ... coal power stations have created enormous health problems and disastrous impacts for the planet yet people worry about a little Chernobly disaster – it is a drop in the ocean compared to the health consequences of coal ... it is [nuclear impacts] more visible and it is immediate and you can see it and quantify it well ... as for the health problems with coal they occur over generations ...".

While there is minority support for nuclear power, all three cultural orientations are associated with supporting its development as a future option provided it is safe and economically viable. Although it is expected that Japan's Fukushima nuclear incident has affected public attitude toward nuclear power. For the majority of SMEs however the general stigma toward nuclear power persists as there is a high perception of risk linked with dangerous waste disposal issues and the hazards posed to human health.

Figure 11: Energy Technology Mix Desired for Australia

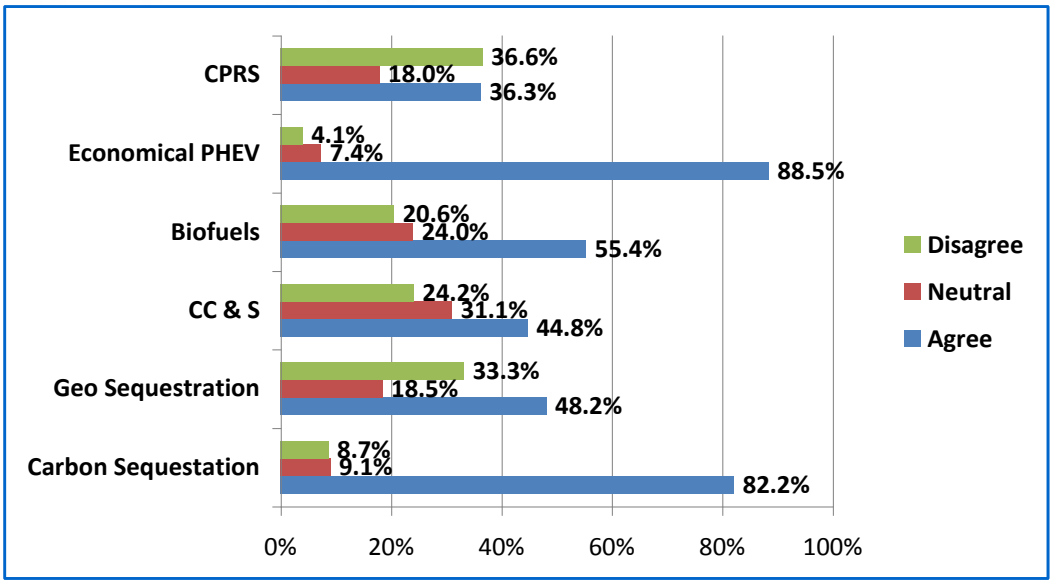


5.3.12. Theme 6: Reducing Carbon Emissions - Policies and Technologies

In general the majority of SMEs reflect a sophisticated understanding of the issues related to the various technologies and there is majority support for strategies that are least detrimental to the environment, economy and humans. With regard to the CPRS however, SMEs appear to be confused about the impacts and the costs and benefits of this policy. For example, SMEs responses (36.3% agree; 18% neutral; 36.6% disagree) as shown in Chart 12 below, not only reflect a lack of knowledge about CPRS but there is a real concern with debates which portray it as vital for climate change mitigation on the one hand, yet it will lead to price hikes and subsidize the big polluters. On the whole SMEs are confused and cautious about the advantages of a policy that appears to be another tax burden that affects all sectors of the community particularly Australia's economy.

In contrast there is overwhelming support for Carbon Sequestration (82.2%) as SMEs are familiar with this scheme. There is however a spread of responses (33.3% support; 18.5% neutral; 48.2% disagreement) to Geo-Sequestration as many SMEs are not familiar with this technology and it is also less relevant to SMEs in this region. Another technological advancement that elicits a split of responses is CCS, with 44.8% in support, 31.1% neutral and 24.2% disapprove of CC and S as it is linked to support of the coal industry.

Figure 12: Carbon Reduction Solutions



On the whole the SMEs are familiar with the concept of a PHEV in terms of reducing reliance on fossil fuels however there is less in-depth knowledge about its intelligent grid capabilities. Nevertheless there is overwhelming support for this technology (88.5% agreement) as long as it is economically feasible.

Given regional SMEs awareness of the debates around the production of bio-fuels, it is not surprising that responses are spread with a 55.4% support for the production of this energy source. Some of the concerns raised include competition with agricultural land, the debates about a global food crisis and the hikes in food prices that are associated with bio-fuel plantation. In general SMEs tend to favour energy sources and technologies that they are knowledgeable about, that are affordable, where there is clarity about the benefits and are less associated with socio-political and environmental controversies.

5.3.13. Theme 7: Barriers to DE Solutions

While SMEs are generally accepting of a wide variety of DE technologies, there are economic and informational barriers to deployment. As the responses below highlight the barriers to deployment of DE include economic considerations such as an inadequate feed-in-tariff (90.6% agreement) and lacking government subsidies (90.5%). Other issues of concern include the high costs of grid connection (88.7%) and the lack of information available to decide the best technological options (84.2%). While a minority of SMEs have been motivated by altruism and economic advantages to deploy DE, for the majority there appears to be little option but to rely on grid supply till economic and informational barriers are addressed. There is nevertheless overwhelmingly consensus that investment in DE represents an economic potential for the regions.

Figure 13: Barriers to DE Options

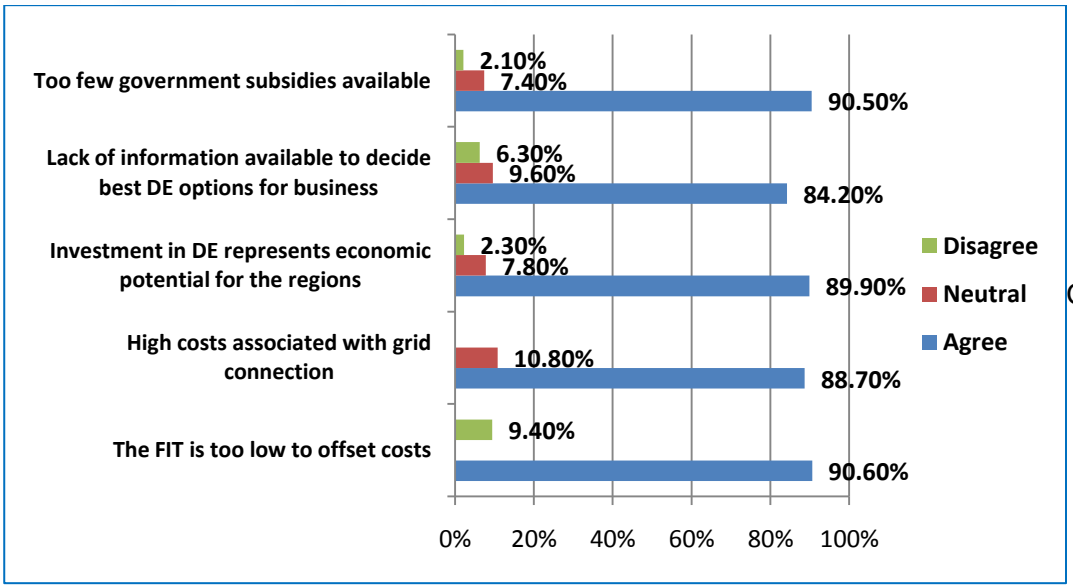


Chart 13:

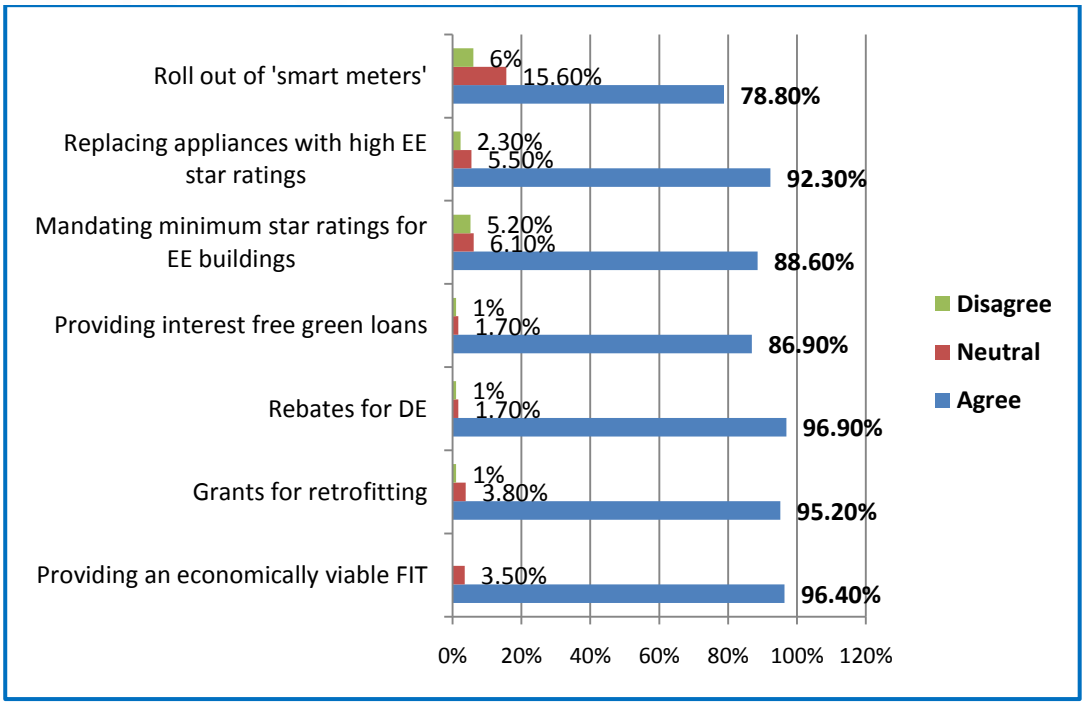
5.3.14. Theme 8: Local Business Solutions – Incentives for DE Deployment

To promote DE among residents and SMEs unable to afford the capital outlay of DE technologies, a niche business has emerged. A local entrepreneur with previous energy utility experience has developed a business model that involves renting roof spaces from residents and SMEs to generate electricity from company-owned solar panels combined with micro wind turbines. While the company generates income from grid power supply, participants also benefit from access to cheaper RE. While the business venture is in transition from concept to deployment stage, a number of residents and SMEs have committed to this scheme and institutional negotiations are continuing with Western Power facilitating the process to enable the success of this type of DE business model.

5.3.15. Theme 9: Incentives to Facilitate DE/DSM Solutions and Social Equity

SMEs believe that incentives are crucial for the sector to deploy DE solutions and support initiatives that motivate organizational and management change toward EE. SMEs overwhelming support a more economically viable FIT (96.4%); including access to rebates for DE (96.9%); grants for retrofitting (96.9%) and other economic and technological incentives as outlined in Chart 15 below. There is also majority support for regulatory incentives (88.6%) to mandate the minimum star EE rating for commercial premises. Given the high rate of SMEs who lease premises, this strategy would assist businesses to become more energy efficient.

Figure 14: Incentives for DE Solutions

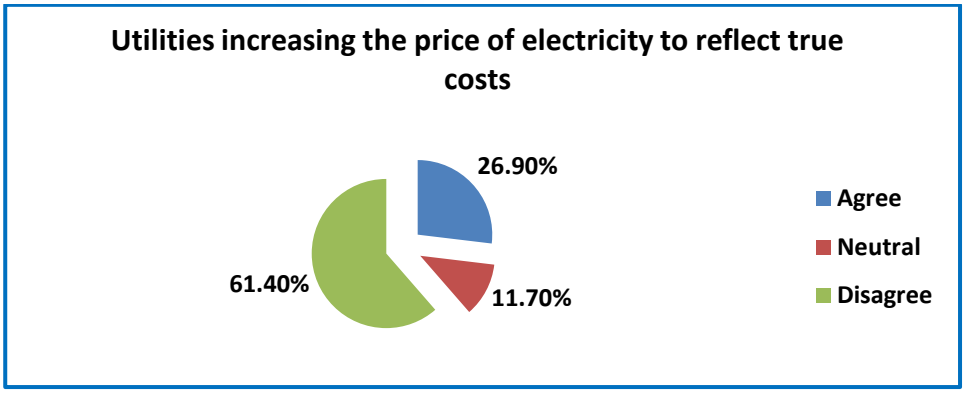


SMEs highly favour economic and regulatory incentives including initiatives such as the smart meters program (78.8%). Most inspiring however, is that regardless of environmental and cultural worldviews, if sufficient incentives are available SMEs are willing to adopt DE and DSM options. While financial incentives are vital for the deployment of DE and EE, social justice concerns are raised about the potential for inequality as financially disadvantaged SMEs are least able to access the grants and rebates. Policy makers face a great challenge in ensuring that financial incentives are accessible by low socio-economic energy consumers.

5.3.16. Theme 10: Cost Reflective Energy Pricing – Cause for Concern

One incentive posing a deleterious impact on the business sector is the relentless electricity tariff increases transpiring in Western Australia. Although energy consumers are reeling from the price hikes, a State Government report 'Energy2031' predicts the average electricity bill to increase by more than 60 per cent from $963 in 2008-09 to $1547 in 2012-13. While higher electricity prices will lead to a reduction in energy usage, the concern is that economic disadvantage will curtail the deployment of other more EE strategies. It is not surprising that only 26.9% of SMEs support increases in electricity prices as a key driver to promote DE and other energy conservation practices (see Chart 15 below).

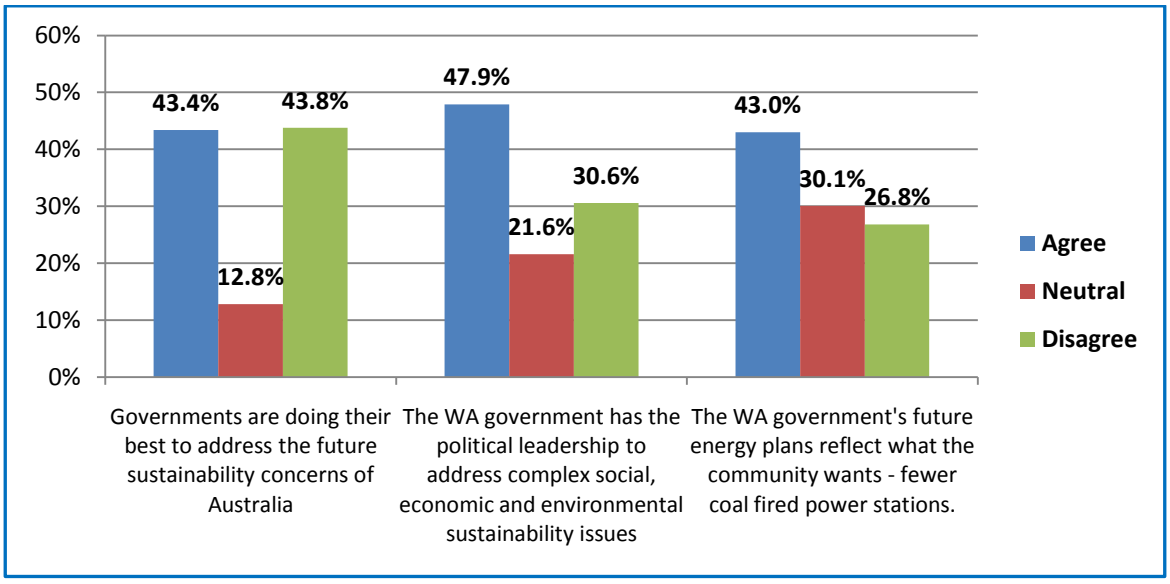
Figure 15: Increasing Cost of Electricity



5.3.17. Theme 11: Trust in Government – Climate Change and Energy Policy

SMEs response to trust in government leadership is mixed and there is a split between positive and negative views toward both national and state governments' capacity to act on sustainability and energy policy issues. While 43.8% of SMEs disagree and 43.4% agree that governments on the whole are doing their best to address both sustainability and energy issues, 12.8% are neutral (see Chart 16 below). Responses are again split to the statement that the *"WA government has the political leadership to address complex issues of social, economic and environmental sustainability".* Where 47.9% of SMEs agree with this view, 21.6% disagree and 21.6% are neutral.

Figure 16: Trust in Government

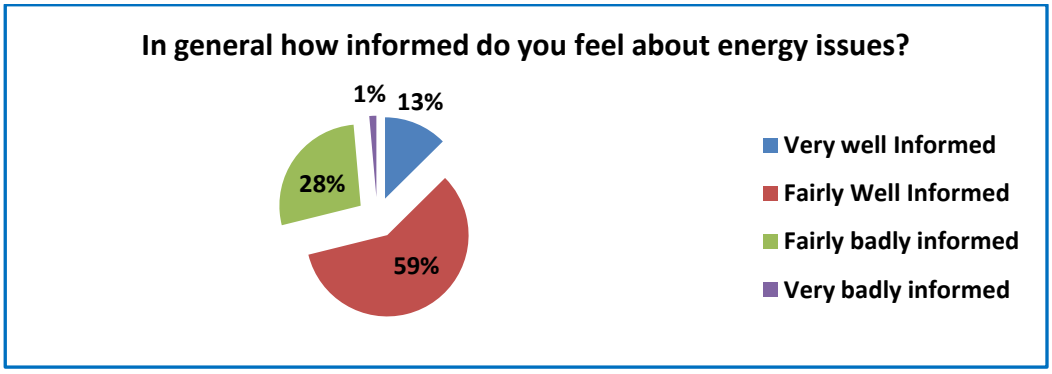


To the statement that the "*WA government's future energy plans reflect what the community wants – fewer coal fired power stations"*, the responses understandably is mixed, as the statement could be interpreted in a number of ways. For example it is plausible that 47.9% agree that this is government energy policy*;* while 26.8% may disagree that this policy is actually being implemented or that they don't actually support this policy. Given the high level of neutral responses (30.1%) it is conceivable that SMEs are not sure what the energy policy status is in WA.

While many of these responses may reflect political allegiances, on the whole the mixed responses most likely reflect general community frustration and confusion with state and federal governments' policy and action on climate change and energy. Within the WA context for example, while the state government has committed to the expansion of RE it has also approved three new and two refurbished coal fired power plants. These policy decisions have stirred much public debate in the media and energy commentators have highlighted the glaring vacuum in climate change policy to reduce GHG emissions despite community desire for certainty on these issues. Given the lack of leadership at both national and state policy levels to push the green energy agenda it is not surprising that SMEs are confused over the incongruent signals to plan for an energy constrained economy.

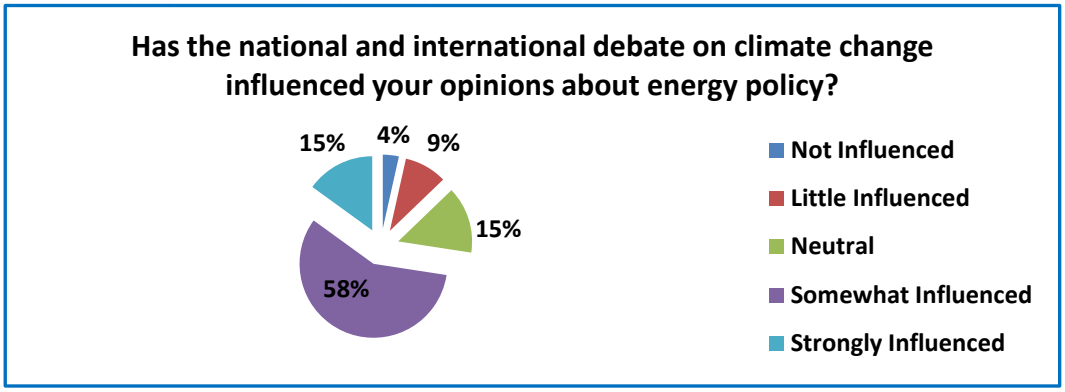
5.3.18. Theme 12: Information, Educational and Identity

Figure 17: SMEs Awareness



Thematic analysis revealed a link between SMEs awareness of energy technology, social identify and framing of educational material to promote deployment of DE technologies and energy conservation actions. With regard to SMEs energy awareness, 71.2% report being informed about energy issues, while 28.9% believe they are badly informed. In relation to influence, the majority of SMEs (72.5%) indicate that their opinion about future energy alternatives is influenced by national and international debates on climate change, while 9.3% are little influenced and 3.5% are not influenced. As Chart 17 and 18 below reveals, the majority of SMEs are knowledgeable about energy issues and are influenced by media debates.

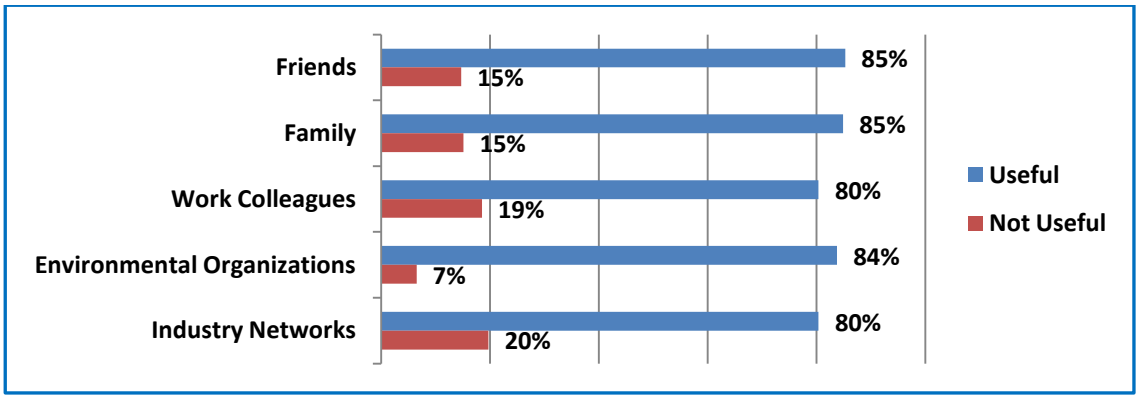
Figure 18: Influenced by Debate



Influential Source of Information

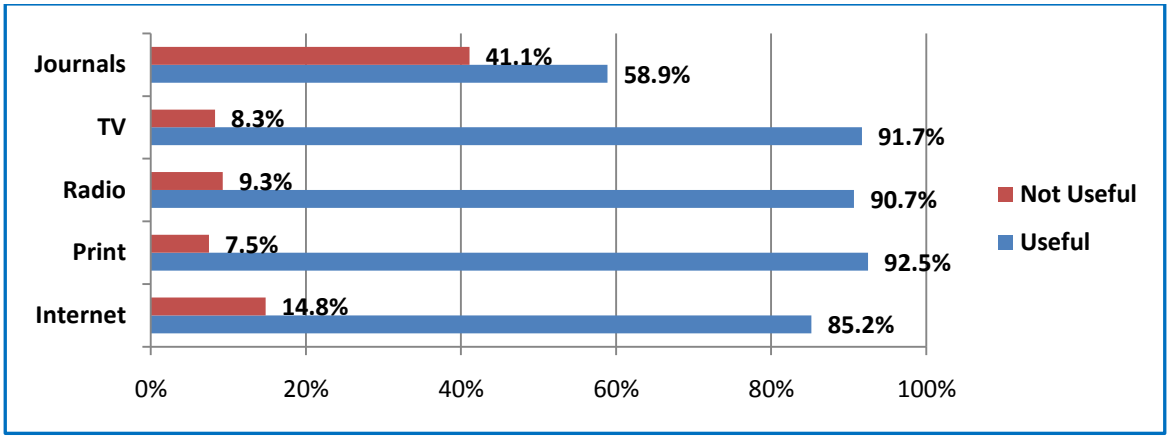
Given that the media can influence energy attitudes, knowing where SMEs source energy information can facilitate development of communication appeals to target public educational campaigns. As figure 19 below illustrates SMEs access energy information from a wide source of social and community networks, however, the media and the internet are important sources, although scholarly journals are accessed by fewer respondents. These responses are in keeping with place-bound communities where local social networks play a fundamental role in dissemination of information.

Figure 19: Source of Information - Social and Community Networks



As Figure 20 portrays, SMEs identify a wide range of media sources as useful for accessing information on energy issues, but they rely less on scientific journals.

Figure 20: Media Sources of Information



Cultural Theory Perspective – Accessing Sources of Information

While SMEs gain information from both community and media sources, trusting the source and the focus of communication appeals is linked to community social identity. For example, *Hierarchists* are more open to educational information that is framed to provide simple practical solutions to energy issues. The motivation for change for this orientation is linked to economic incentives and energy savings flowing from DE solutions. Educational campaigns must also avoid using climate change appeals that emphasize the gravity posed to humans, as this orientation is not responsive environmental discourses. There is a stigma attached to an environmentalist identity and information needs to be framed in neutral language that focuses on the benefits and sourced from locally trusted people and organizations. Even though 83.8% of respondents identify environmental organizations as a good source of energy information, this does not imply that SMEs will access this source. *Hierarchists* are more comfortable accessing information from local government, community and industry sources where trust is established and social identity is not threatened.

Individualists are also more sceptical of climate change discourse and are not open to environmentalist appeals. In terms of sourcing information, they are more trusting of local radio programs and community newspapers including local government and industry networks. Behaviour change for this orientation would come from an appeal that is framed around techno-centric and economic incentives such as the advantages of EE and green energy business image.

Egalitarians on the other hand, are more sceptical of media sources, but trust climate change science and source information from environmental organizations, scholarly journals and the internet. As they are already converted, eco-centric and techno-centric appeals that emphasize climate change catastrophe is a strong motivator for change. Many *egalitarians* tend to have strong links to local environmental organizations and practice environmental sustainability. In this region green oriented activists actively promote energy educational campaigns and facilitate community-level behavioural change. Local environmental organizations however, would need to communicate the message to fit the motivational appeals of a variety of audiences.

5.3.19. Salience of Energy Issues – Motivational Differences: Albany and Denmark

While no significant differences in environmental and energy attitudes and behaviours between Albany and Denmark SMEs have been found, there are clear differences between the two communities' in terms of the salience of energy conservation actions. For example, key environmental activists in Denmark are actively engaged in role modelling energy conservation actions and the community benefits from the increased levels of awareness and knowledge about environmentally sustainable energy technologies and actions. There are also numerous examples of active energy behaviours being modelled and some of the initiatives include (a) community stakeholders engaging with Western Power to plan sustainable energy; (b) environmental activists constructing architecturally designed EE buildings; (c) entrepreneurial DE plans to construct a small scaled community owned wind farm and (d) volunteers engaging with the public to promote energy conservation actions.

This community is unique in that environmental conservation is a mainstream value and key social change agents work tirelessly to push the sustainability agenda including climate change mitigation strategies to reduce GHG emissions through DE and DSM. Given the level of active energy actions observed as a cultural norm it is not surprising to find that energy is a salient issue in this community. Nevertheless, while community acceptance for DE and DSM solutions is high, deployment is heavily dependent on the economic, regulatory, informational and educational barriers being addressed at the policy level.

Other key factors have also enabled engagement with DE and DSM solutions. Firstly, Western Power's community engagement has enabled community stakeholders to voice their desire for DE and DSM initiates. In response Western Power's Green Town project which targets peak energy demand issues met both community and institutional goals. The Green Town project incorporated numerous strategies including public educational programs; EE strategies such as CFL replacements; free replacement of inefficient hot water systems and stoves; fuel switching to greener alternatives; load control and smart metering trials. These publicised initiatives enabled greater awareness and access to information and to Western Power officials to discuss EE and DE options. As a small community, key community leaders and Western Power officers were able to tap into established social capital networks and motivational drives (Ebi & Semenza, 2008) to disseminate energy conservation actions.

Albany on the other hand is a larger community, more politically conservative and energy reliability is not an issue. Given the diversity of community constituents, environmental organization have less influence over energy actions. Other factors limiting the motivational drive to pursue energy conservation is that local government agencies play a strong role in planning the economic and environmental strategies for this region. Given the level of regional government support it is not surprising that energy conservation initiatives are at the more passive level. A State Energy Development Office (SEDO) project undertaken in Albany in 2009 reported that residents and SMEs were reluctant to undertake free energy audits. While the participants' unwillingness may be interpreted as apathy, it may reflect a threat to cultural identity when dealing with environmental organizations. The importance of involving a variety of organizations in recruitment and delivery of energy programs is vital to gain diverse participation.

While the more altruistically and technologically motivated SMEs have deployed solar generation on business premises, there is no dedicated group promoting DE solutions. While key industry representatives such as the CCI promote Green Advantage actions, DE is not the focus. Also limiting of salience of DE is that this Shire boasts a highly visible wind farm and is pilot testing wave technology. Given the focus on large-scale energy generation, it is not surprising that the motivational drive of residents and SMEs to undertake DE may be limited. Also constraining IG-DE solutions is that Western Power is not engaged with this community to facilitate more active energy conservation action.

A study commissioned by the Swan Catchment Council (2008) with 200 Light Industrial Albany SMEs' revealed that while businesses are concerned about the impacts of their environmental practices, their actions toward sustainable business practices is low. Despite the lack of action, they believe that all sectors of society incorporating individuals, community and government are responsible for the environment. While SMEs want to adopt more sustainable environmental practices, cost is the major barrier. The SMEs identified that the best methods for change include: (a) education 33%; (b) financial support (33%); (c) self management/industry driven (20%) and (d) Laws and Enforcement (12%).

A comparison between the community's energy actions confirm that when personal responsibility for energy is not a salient issue and when institutional leadership and coordination is lacking, SMEs have no option but to operate in isolation where IG-DE options are constrained through a lack of support. Pursuing IG-DE solutions therefore is highlight dependent on multi-sector stakeholder collaboration combined with community engagement/deliberative governance processes as a vital step to promote community level visioning and change. Emerging strongly from this study is that deployment of IG-DE is facilitated with community level approaches when combined with institutional facilitation where strong social capital networks operate as the conduit to promote long term collective behavioural change. Also noteworthy is that advocacy by the *iGrid* team members has elevated the focus of IG-DE among key agencies involved in strategic planning the socio-economic and environmental futures of this region. While strong regional leadership is a key facilitating process, also vital is state and federal leadership, and policies on energy and climate change that incentivises the path towards IG-DE solutions.

5.3.20. Summary – SMEs Survey

While SMEs overwhelmingly support pro-environmental strategies to mitigate climate change impacts, they cite numerous impediments in deploying DE and EE. While economics is the greatest barrier, SMEs desire broader sustainability frameworks to guide policies that address energy and climate change issues. While supporting a free market, government coordination is called for to provide the incentives to drive sound economic investments for IG-DE. While there is an appeal for government leadership to drive energy policy, there is a profound lack of trust in governments to execute it effectively. To encourage personal responsibility toward IG-DE solutions, SMES require leadership and the supportive structures of institutional and regional community networks to facilitate the transition.

5.4. Key Findings Stage 3 [Phase 1] - Energy Stakeholder Interviews

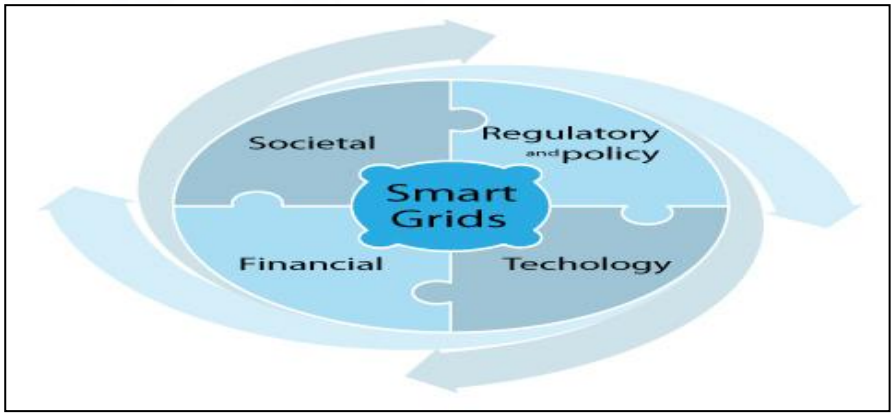
5.4.1. Overview of Results and Analyses

Perth Energy stakeholders responded to a list of questions (see Appendix D) to capture their conceptual understandings of IG-DE, including the issues, barriers and drivers implicated with policy development and transition toward IG-DE within the WA context. Firstly it must be noted that these participants represent an exclusive population group and the themes reflect the personal perspective of those involved with policy and regulation within the energy stakeholder network and not that of the organization. In keeping with a cultural and thematic analytic approach taken by this study the stakeholder analysis revealed two dominant perspectives that underlie their smart grid frame of reference.

While the perspectives do not necessarily fit the distinct (i) hierarchist; (ii) individualist and (iii) egalitarian cultural domains, it is dependent on the frame of reference adopted toward smart grid transition. As distinguished by the International Energy Agency (IAE), the roadmap towards a smart grids (see Figure 1 below) constitutes of four pillars (a) Societal; (b) Financial; (c) Regulatory and Policy and (d) Technology. While there are two dominant perspectives to what constitutes a smart grid transition, the first group perceives it as involving all four pillars and “Society” is identified as the key force driving the transition. From this perspective, targeting educational and financial incentives, including community energy initiatives to facilitate bottom up processes toward a greener economy and community is highly recommended. While there is recognition that visionary leadership is equally vital to enable societal level transition, the focus is on enabling action at the grass roots level.

For those viewing a smart grid transition as involving three pillars (Financial; Regulatory and Policy and Technology), governments and energy Utilities are attributed with playing a key role in the change process. From this perspective the recommendations emphasize government leadership as well as policy and regulatory reforms to facilitate appropriate market mechanisms through which both supportive and punitive measures motivate change toward a smart grid energy system. While the focus is on top down processes, emphasis is also placed on public education as a vital tool to promote community benefits from IG-DE technologies. While the perspectives differ in their emphasis, with regard to a smart grid transition being driven as either a top down or bottom up process, there is consensus that a complementary approach is more powerful. Following are the key themes outlining their assessment of the issues, the impediments and the drivers toward IG-DE.

Figure 21: IEA Smart Grid Road Roadmap, 2010.



5.4.2. Energy Discourse and Conceptual Understandings of IG-DE

Energy stakeholders referred to the conceptual understandings and the issues related to intelligent grid (IG) and distributed energy (DE) as separate entities. While many referred to a smart grid as the enabling technological infrastructure, the software along with consumer engagement to promote a more EE grid system. Others referred to smart grid as a decision making tool for management that promotes flexible institutional thinking away from traditional centralized approaches. Hence, rather than limiting solutions to the traditional mindset of poles and wires, the view is that smart grids offers potential for incorporating a repertoire of DG technological options at various locations to respond to growing energy demands. For one participant smart grids is about making efficient use of capital.

While the majority of stakeholders considered DE as encompassing smart grid communications and control mechanism, distributed generation (DG) as it is more often referred to, is generally discussed in terms of the smaller scale energy generation technologies located where it is needed. While no concern is expressed about the incorporation of DG technologies such as CCHP, there is greater concern about the impact of renewable energy (RE) sources as it is considered a barrier to reliability and stability of the networks.

It is noteworthy that energy stakeholders preferred the substitute discourse of smart grid and DG in their response to questions posed about IG-DE. While respondents referred to institutional, regulatory, economic, technical and consumer barriers, the aspect that the majority highlighted is that stakeholders lacked a detailed understanding of industry implications and the costs and benefits of IG/smart grid approaches. While there is strong support for the benefits proposed to flow from a smart grid transition, there is an equally passionate call for a detailed assessment of the costs and implications involved with such a revolutionary change to the electricity system. This excerpt demonstrates the lack of debate and evidence around smart grid "*what frightens me is that there is a massive debate on the National Broadband Network ... In our [energy utility] industry there is no debate and people are just going headlong and I call it a juggernaut and its confusing me because the benefits have been proposed but no one has proven those benefits as yet or that they exist and no one can define clearly the costs*...".

5.4.3. Impediments and Issues related to Intelligent Grids

Economic Barrier

The consensus is that the most significant impediment to a smart grid transition is economic, as it is extremely difficult for stakeholders to justify the costs involved with a major transformation of WA's electricity system. While most refer to the Californian smart grid transition as the exemplary model which Australia should follow, the distinction highlighted is that it has been funded by a stimulus package involving millions in expenditure. With government funding commitment of this magnitude, smart grid can be expected to be economically feasible. The concern is that while Australian energy utilities are pursuing US based smart grid innovations, it is independent of government economic support. Criticisms are also levelled at IG-DE policy and program objectives proposed by energy utilities for lacking clarity in terms of the costs and benefits associated with a transition within the Australian energy policy and market context. Attracting funds for a smart grid transition is a difficult challenge, as developing a cost effective business case is a significant impediment to the industry. Unless a solid, transparent and justifiable business case can be surmounted the transition will be very difficult.

Obsolescence of Technologies

While it is convincing to mount an argument that fifty year old networks should be replaced with smart grid innovations, caution is emphasized that the longevity of smart grid products cannot be predicted. For example, it may reach obsolescence in two, three or five years, but the traditional networks last for more than twenty to thirty years. The pace of technological innovation transpiring across the computer, internet and air conditioning industry indicate that the pace of technological change and obsolescence is unpredictable. It is therefore imperative for policy makers to evaluate the costs and benefits including the economics of replacing traditional networks with new network operations that may have a limited life span.

Critical Perspective of Smart Meters

While the majority highlight the benefits of smart grid, this excerpt presents a critical evaluation of smart meters: "… people generally express the idea of smart meters when they talk about smart grid … I think of smart grid as very much of an integrated, bilateral electricity structure and I don't believe that necessarily entails smart meters at all and I am personally not of the view that smart meters will deliver the economic basis that which they are alleged to usually be installed to do. It also includes behaviour change, education, knowledge to even begin the process ...". Questions are posed about the evidence that exists to demonstrate that the massive expenditure associated with smart meter installation would be funded without Utilities having to increase tariffs.

While theoretical evidence indicates that the benefits of smart meters will exceed the costs, some respondents are not convinced. As this excerpt demonstrates: "… *I have not seen a single indication of that anywhere in the world – I have seen plenty of cost benefit analysis that theorise that but none that actually demonstrates it to be real …*". While there is industry understanding that smart meters will lead to a 5 per cent reduction in energy consumption and load shift by up to 15 per cent that result from using power at night, the view is that no evidence exists to support it. Some question the use of theorized benefits to justify the installation of smart meters which could pose a financial risk to the Utilities. As one excerpt indicated: " *… what happens once they're installed and you find that people actually don't change their behaviour and you have just spent $500 per household installing meters and infrastructure that will not pay for itself...*".

In evaluating the Californian smart meter deployment where critical peak pricing is approximately six times higher than the base tariff, the view expressed is that this is unnecessary to motivate reductions in energy use. Given that critical peak periods only occur a few times during the year in WA, the suggestion is that a public response approach would be more efficient. As this excerpt reveals: "… *you would probably get a better outcome … just telling people to please turn off your air conditioner, to reduce energy use through various strategies or we are going to charge you a very high tariff tomorrow from 2pm to 4pm* …". Hence, smart meters are not necessarily the only option to reduce energy consumption.

Consumer Energy Knowledge - Education and Acceptance

Also a key impediment is that energy consumers and policy makers have a limited understanding and engagement with energy technological developments. While consumers can benefit from smart meters that incorporate a time-of-use (TOU) pricing mechanism, it will take time and education to enable the public to benefit from the new tariff structure. While the price hikes have made energy as a salient issue, the view is that policy makers have failed to realize that the end-use customer is the linchpin to a successful transition. Unless customers are engaged with the products and benefit from its application the success of smart grid technologies will be limited. Success is dependent on customers changing their behaviours however policy makers have failed to inform the public of the benefits.

Time of Use (TOU) Tariffs and Energy Poverty

While most agree that TOU tariffs are the key to influence energy behaviours there is equal concern that fairness must be incorporated to protect the lower socio-economic groups. Many recommend a sliding scale tariff to target those who live an energy intensive lifestyle and the Californian tariff model is recommended as an option. As this excerpt outlines: *"... you get penalised as you go up the high usage tariff ... where the average price is X and the lower energy usage would equal X – 1 and higher energy usage would equal X + 2 times and so on ... this would benefit the low energy users and the lower socio-economic groups would not be penalised ..."*.

To assist those adversely impacted by the higher tariffs many also advocate social policy approaches to enable the reduction of energy consumption. This includes offering economically disadvantaged consumers EE options such as replacing energy inefficient appliances, cheaper fuel sources, retrofitting and other incentives. The general agreement however is that energy tariffs must be cost reflective otherwise the artificially low prices will be subsidizing high energy users. As this excerpt indicates: *"... It is a huge balancing act to put up prices and have the right mechanisms to ensure energy guzzlers don't get it subsidized from tax payers and protecting the minimum lifestyle needed for those on low incomes..."*.

One participant warned that consumers have to pay for the smart grid infrastructure and if the benefits are not forthcoming their protests would curtail the initiatives. Consumers also need protection from possible exploitation by Utilities who charge customers for smart meters and fail to educate them sufficiently to leverage the best outcomes. Care is needed to ensure that customers benefit from smart grid otherwise the Ombudsman and the Regulator will terminate these initiatives. These concerns are raised because the view is that the energy industry appears to be too focussed on the network intelligence aspects of smart grid to the neglect of consumer benefit. As one participant highlighted: "... *the dominant discourse of smart grid is a one sided top down perspective that fails to appreciate that success is dependent on end use customers accruing benefits from energy behavioural changes* ...".

Technical, Network, Policy and Regulatory Barriers

Stakeholders also highlight other barriers categorised as (a) technical; (b) the network and (c) policy and regulatory. Technical refers to the lack of a standardised approach to the connection of power generators, which can incur considerable costs to both the energy Utilities and customers. The standards and the technical issues around grid connections are therefore considered a major problem for the industry. As one participant highlighted the network has also been designed for centralized delivery of power, hence much technical modification is required to deal with the uptake of excess generation capacity. This excerpt highlights the network issues: "*… the grid is already starting to experience some of these issues but we do not know what the solution is right now …*".

As for the policy and regulatory issues the view is that the current market system is not set up for the purchase of DE and current market rules are not appropriate for the residential generators. For example, there is the possibility for liability issues to arise when damage is caused to the network through the process of a dual flow grid system. Hence, policy and regulatory responses are vital to assign responsibility for costs incurred. An impediment to DE uptake from a policy point of view also is that while there is a growing penetration of PV power, Western Power is not regulated to ensure that the grid can accommodate all the solar power that is generated by householders. Ultimately the issue is about ensuring that there is consistent government policy to ensure that DE can be accommodated on the grid.

Selection Process of Generation Source: Free Market Issues

Another regulatory and policy issue impeding greater uptake of cleaner energy sources is that the current market mechanism is not set up to prioritize RE sources. As this excerpt demonstrates: "*... there is nothing driving the selection of the appropriate new energy generation coming onto our grid system... Renewables are constrained because it is left to the free market ...*". As there is a lack of government policy to push RE sources, it is deemed unlikely that WA will meet the 20% MRET obligation. Many recommend Germany's regulated approach where RE generators have automatic priority access to the network. This contrasts WA's quasi-market approach that lacks coordinated planning and the issues are managed through an ad hoc process. As Western Power's approach and economics drive the selection process of energy source, coal fired power is given preference. As this excerpt highlights, coal is not considered a suitable fuel mix: *"... apart from being the worst fuel, it is the worst in terms of mixing with Renewables – if we want a Hybrid RE penetration you don't go with coal its very inflexible- it's all the wrong technology..."*.

Incentivise Stakeholders in Value Chain – Revenue Decoupling

Stakeholders identified that in a disaggregated environment there is a clear lack of regulatory and financial incentives for Utilities to adopt IG-DE solutions. As this excerpt demonstrates: " *... at this point there is no incentive for us to sell less – there is no incentive for Western Power to stop building bigger networks ... you need to change the regulated network and the regulatory environment – where if we spend this money – we need to be able to get some of that returned because the return does not necessarily go to the people spending the money ...*". To address the barriers, policy and regulatory changes are needed to incentivise the various stakeholders in the value chain. An example highlighted is that Retailers are dependent on the revenue generated from selling power, however they are financially penalised for EE gains, as mechanisms do not exist in WA to recoup the loss of revenue. The recommendation is to follow California's decoupling policy by decoupling the sales in kilowatt hours to the revenue forgone in energy efficiency. Generators are also not incentivised to switch to greener cleaner fuels. To redress the energy sustainability and smart grid barriers the recommendation is for governments to provide Utilities

with incentives to recoup financial losses that result from generating cleaner energy sources and promoting energy efficiencies.

While Western Power is considered the lead agency to drive EE the incentives appear to be non-existent. As this excerpt demonstrates: *"... they are a regulated business, understaffed, under-skilled, under resourced, staid and any time they want to do anything and spend money it gets knocked back by the ERA and Treasury ... there is no incentive to do something..."*. The issue is that without a GHG emission liability it is very difficult to justify the funding of EE strategies. Although Western Power is motivated to target EE to address the peak load issues the view is that they are severely constrained by the ERA process that demands economics as its first priority.

The ERA process is viewed as an impediment to a smart grid, as the requirement to prove economic benefits to the exclusion of social and environmental benefits is considered onerous and narrow. Nevertheless, there is a level of optimism that despite the impediments it can be achieved: " *... I can't see past the economic benefits of what we have to prove, it is a regulatory requirement, it is the ERA criteria and also internally we are getting a lot smarter and we are a lot better now at knowing what the Regulator is going to ask us and what we need to demonstrate – its not the regulator now – it is the internal process that has stepped up the economics criteria as part of the procedures..."*.

Disaggregation and Strategic Planning

Disaggregation is considered a key impediment to smart grid solutions because strategic planning and collaboration between the networks is stifled. As this excerpt signifies: " ... *when it was Western Power together and SECWA there was central planning about the destiny … but now that we have split up there is no overall plan just the free market – so you end up with imbalances - too much of the wrong generation, certain generation, shortage of it sometimes, so it's much harder to actually take it down the RE path ...".* Disaggregation has resulted in an inefficient use of capital and resources, as this excerpt portrays: "*... its driven costs up enormously ... even the technical rules for the connection to the grid ...you can only change it once every 3 years and it's a really torturous process to get it changed and as a result they drive some silly solutions ...".* Also acknowledged is Western Power's frustration with the ERA approval processes to achieve things that seem obvious to the industry.

Also emphasized, is that the efficient operation and the economic viability of the energy industry is curtailed under the current disaggregated structural environment. As one participant highlighted, the expectation of disaggregation has been exaggerated: "... *the belief that somehow you could take one organization and chop it up into four bite size pieces and thereby create an environment where the benefits of competition were available to be harnessed or captured was an unrealistic expectation in the first place ...so how you create real competition by changing the market dynamic in this way mystifies me*...."

A dominant perspective is that the energy industry is not economically viable. Furthermore, one of the misconceptions of changing the dynamics of the market structure is that it would lead to reductions in energy prices. As one respondent noted, "*this does not eventuate even in true competition, unless there is some margin of savings to be passed on in the first place*". Given that the energy sector was a heavily subsidized industry prior to disaggregation, competition is not feasible when there is insufficient profit to be made in the value chains. As this excerpt elaborates: *"... you need some head-room above the total cost to attract some players ... at our starting point the margin was two percent that is not enough to entice anybody...*". A competitive market is also hindered as the public would not tolerate the substantial rises in tariffs needed to attract new

businesses to compete in WA. Until a sufficient head room can be created in the industry, competition and economic viability is impeded.

Technological Push toward RE Sources

While RE sources is a desired source, the strong push toward RE sources is also identified as a barrier toward smart grid, as this excerpt highlights: *"… one of the problems with RE at the moment I think is everyone is supportive of them – but they are simply more expensive and somebody has to pay for them…"*. While the inducement toward technologies such as solar PV and wind turbines is strong, it is considered at the expense of other more feasible options. The call is for policy makers to consider a suite of alternatives that is more feasible from a triple bottom line perspective, as RE on the whole is not economically viable. In comparison to RE sources, technologies such as CHP and CCHP are considered more economically viable in terms of traditional generation. An appeal is made for decision making approaches that incorporate objective research, cost benefit analyses and feasibility of the most appropriate source and technology instead of responding to powerful lobby groups.

Policy Makers Learning Curve

Also a key barrier is that if policy makers are not sufficiently knowledgeable about the concepts, the costs and benefits, as well as the impacts to the WA energy context, then funds would not be forthcoming. To promote a smart grid transition, the recommendation includes government agencies increasing their energy expertise to undertake effective and timely decisions at the policy level. As one participant highlighted *"... government can't be lost ... they need to understand at least the strategic aspects and how they want it to affect and not affect the state...we can't be bringing things to them as we do now ... and they say Oh No you can't do this because we don't understand it – and we waste another year as they try to understand it ..."*.

While stakeholders are highly supportive of WA's energy governance structure, there is concern about aspects of the process that impede timely decisions being made. For example, while the expectation is for the Office of Energy to provide government with information on energy policy options, the department is under undue pressure to undertake the task due to staffing and resourcing issues. As this excerpt reveals: "... *the vast majority of staff are relatively new, junior ... private enterprise has poached their experienced people to help drive policy ... energy Utilities have also taken their staff ... because they are so inexperienced they are grappling to deal with so many issues on their plate...*". To facilitate a transition toward smart grid, government agencies need to secure the expertise and resources vital to focus on strategic directions that drive the energy visions beneficial to the State.

Evaluating the Costs and Benefits of Smart Grid

A minority narrative emerging from the interviews is the concern that policy makers will follow the Californian smart grid trend without evaluating WA's unique energy system which is islanded from the Eastern States' networks. As one representative argued, "*it would be a mistake to think that WA can deploy the initiatives undertaken by California, as the process has been driven by a different set of conditions*". While the dominant discourse favours WA following the Californian smart grid model, the alternative view is that a number of socio-economic factors need consideration. Firstly the state of California has undertaken smart grid initiatives since the 1960's and it is also a service based economy which contrasts Australia's resource based economy. Also contextually different is that California does not generate energy within the state and it is rated the eight largest world economy where residents enjoy a high standard of living. In such a strong

economy imposing a mandatory five star EE rating for televisions is feasible. However, in WA where the cost of living continues to rise, these are less favourable options. Hence, gaining a contextual understanding of why it works in California and whether it can be replicated in WA's socio-economic energy policy context needs evaluation.

Climate Change and Energy Policy Vacuum

The consensus view is that a lack of Climate Change and Energy Policy is a key barrier to a smart grid transition as change must be driven from the top. The majority view is that climate change is not a salient issue for WA and a whole of government approach toward energy conservation is largely non-existent. This is attributed to a lack of political will as the WA government does not take climate change seriously. Most respondents acknowledged that regardless of climate change beliefs there is public willingness to implement EE for a variety of economic and altruistic reasons. However, stakeholders believe that it will take public pressure through elections to force government action rather than through visionary leadership. As this excerpt portrays: "*... I think our governments tend to be too cautious about introducing things – it all has to be very consultative and takes years to finally come to a conclusion that it is a good idea and it has lost years of opportunity...".* The lack of political will is also attributed to the strong coal lobby, the plentiful coal reserves and climate change dissenters who are a significant threat to a green energy transition.

Political Determination – Sustainable Energy Solutions

For many stakeholders the key barriers in WA are politics and the policy and regulatory framework underpinning the energy industry. As one participant highlighted it is the dominance of a free market ideology that undermines political determination toward sustainable energy solutions. As this excerpt demonstrates: *"... they are more business aligned, they are getting the alarmist position of why we can't do anything, why we have to keep on doing the coal way, carbon sequestration etc ...".* In terms of energy policy the criticism levelled at the government's Energy Directions paper is that it fails to reflect long term planning which is considered vital to move the industry forward. With regard to WA's regulatory framework many stakeholders emphasize that it lacks an accountability mechanism to firstly ensure that Western Power's networks can accommodate all the generated residential solar power. Secondly, the concern is that WA lacks the formal mechanisms to obligate Synergy to purchase its RECs in WA as they can purchase it from the Eastern States. These issues remain unchallenged and the view is that political leadership and coordination is vital to ensure the best interests for WA and the smart grid transition.

MRET Policy and Limitations to Energy Vision

While Utilities collaborate on research and development trials of new technologies, under the ACT it can only be undertaken if it is commercially proven. Hence there is no long term indication about where the Corporations are headed with regard to smart grid-DG technologies and the criteria that is necessary to pursue it. Nevertheless, the MRET is credited with motivating the development of large quantities of RE and on the whole it appears that policy drives the dominant vision. The negative aspect of this type of process is that it constrains innovative thinking. As this excerpt aptly demonstrates: *"...When you have to focus on policy I think people get busy meeting an obligation rather than looking at what can we do ... You should probably be doing both –you should be meeting your obligation but you should also be focussing on the future. In the past we had to justify RE on the fuel savings – GHG wasn't even a consideration back then – and also resource conservation was a big thing – we needed to conserve our fossil fuels because it wasn't*

going to last forever. Now the resource conservation side hardly features …".

Barriers to Distributed Generation – Cultural, Technological and Economic

Western Power is considered an influential player in the energy policy network and leads the policy push toward smart grids. Western Power has also publicly acknowledged the economic benefits of a smart grid in their submission to the government's Energy Directions paper. In contrast others believe that Western Power is also a barrier to DG as their actions reflect a limited commitment to DG solutions. A number of respondents highlighted that despite the public declarations, at the ground level engineers and management still view DG as creating numerous problems for the network and are reluctant to change. One participant noted that Western Power is on a steep learning curve with smart grid technologies and therefore their immediate response is to be cautious. The general expectation is that given sufficient time Western Power will eventually overcome the problems. The reason for this belief is revealed in this excerpt: " *... it will be resolved because a sufficient portfolio of DG across the network is simpler ... it would make their network more stable and probably allow them to defer costs...*".

Other factors which lead Western Power to take a cautious approach and to set artificial limits to the DG load is the limited access they have to funds and resources to undertake modelling research. As real solutions are needed, the recommendation is for Western Power to undertake modelling research to facilitate a rational basis to decisions about what DG load the grid can handle. While some believe that cultural change is the barrier others believe it is the practical limitations, as immense technological modifications are needed to operate a dual flow electricity system. This excerpt demonstrates an optimism for change: "*... it is not impossible to get Western Power over that curve to the point when they embrace rather than the current softer, unspoken issues approach that make them go slow, treading lightly, more conservative rather than with gusto...*".

A further barrier to DE uptake is that householders are misinformed about the economic benefits of solar power generation. As one respondent highlighted while a 1.5kW solar generation system will provide a household approximately 25 to 30 per cent of their annual power, advertisements mislead consumers about the profits made from selling excess power. Synergy's statistics on the REBS scheme showed that just 17 per cent of the energy it produced was actually exported to the grid. Furthermore, under the REBS scheme householders pay more for using their own renewable energy and would be better off buying RE from Synergy because it's cheaper (Sonti, 2010). There is concern that clarity of information is lacking and the benefits of DE must be accurately portrayed.

Cultural Change to Business Planning

Respondents highlight that the barriers to DG for the business sector are both economic and cultural, as determining how the DG plant is financed is a critical issue. While the Energy Retailers have seen a growing interest among commercial customers for opportunities to install CHP and CCHP, determining how the various parties pay for the DG initiatives need detailed examination. As one participant established "... *commercial customers can benefit from CHP or CCHP but cultural change is needed in the energy industry and the customers in terms of how this is financed* ...". It is noted that acceptance of DG among the business sector will require much cultural change from currently purchasing electricity off the grid to long range economic planning to finance their own generation plant. As this excerpt illustrates to install a CCHP system: " ... *you need a 15 year gas contract to make it all work [economically viable] ... so you need a whole systemic change in the way organizations and people look at how they secure their power supply...*". A further impediment to small-scale DG is that it is not an economically attractive investment for network

businesses. For example it is economically more viable for Verve to build one 200MW custom built generation plant than 20 small-scale 20MW power plants.

Costs and Benefits of Renewable Technologies

There is general agreement that RE sources are economically prohibitive for the majority of consumers. Although solar technology is now well advanced and people are familiar with its operation, costs are still a barrier. The rapid penetration is attributed to government subsidies and increased feed-in-tariffs (FIT) and as long as governments continue to support this policy then Australia can expect to see a significant penetration. Small-scale *wind turbines* are also associated with several impediments, including the intermittent nature of wind requiring expensive storage and back up technologies, and expensive grid connection. The intermittent change of wind velocity also requires expensive technical equipment to synchronize and protect the grid. Also problematic with RE sources, as one respondent highlighted: *"in Western Australia back up supply tends to be either coal or gas and as this reduces its green credentials customers are less likely to subscribe to it*". Nevertheless, the positives are that wind power technology is progressing at a pace where fewer turbines are needed to generate larger amounts of wind power.

As for wave power the impediments are that the technology is relatively new, it is unproven and not yet commercially viable. Nevertheless, developers like Carnegie are demonstrating its feasibility, improving the aesthetics of the buoys and safety to sea vessels. The expectation is that Carnegie will demonstrate the viability of wave technology and attract early adopter investments. In time wave and solar energy will be similar placed where costs will be the main determining factor. The key advantage for Australian coastal cities is that transmission and distribution connection including associated costs will not be an impediment.

5.4.4. Most Important Drivers toward IG-DE

Leadership and Vision - Sustainability

While stakeholders highlight that the capacity for energy Utilities to reduce the costs of power line augmentation is a key motivator for change, the majority view is that it takes leadership and vision at the national and state government level to promote the transition toward smart grid. As this excerpt highlights: "…*The governments really need to lead those sorts of charges and that's why it has been such a success in places like California ... it has come from the top down…*" The Californian energy policy model is used extensively to demonstrate the kind of leadership and vision that is vital to set long term goals and to promote energy conservation in line with smart grid solutions. As one respondent highlighted the state needs to be more proactive about sustainability as the core of the issue but at the moment WA appears to be in a policy vacuum.

The consensus view is that governments need to take the lead role in driving the Smart grid vision. While the Office of Energy made a promising start with the State Government Strategic Energy Initiative issues paper "Energy 2030" the view is that it has since grounded to a halt and direction once again appears to be lacking. Also vital to drive the smart grid transition is for policy makers to become conversant with the trends emerging in energy policy and to undertake strategic planning and evaluation of the impacts for WA's context. Developing policy and planning future energy initiatives also requires the collaborative engagement of all the energy Utilities and the consumer base applying their core strengths to drive the policy visions.

Drivers for the Consumers: Economic Incentives and Choice

The incentives driving householders' motivation to adopt DE solutions include rising energy costs, government subsidies and the desire to mitigate climate change impacts. However, for the vast majority of people the single key driver is rising costs of energy, as this excerpt highlights: *"... especially here in WA where over last two years we've seen a fifty percent increases in energy prices ... while it has come from quite a low base its hitting people in the hip pocket ..."*. As WA can expect a sustained growth in electricity prices to exceed the CPI for at least the next decade, solar PV penetration is expected to rise as consumers attempt to reduce energy consumption.

Also driving a greater penetration of solar PV is the revised higher FIT for household customers, including the RECs, REBS and government subsidies. Consumers are also demanding choice and that is a key enabler toward smart grid solutions. The emerging development of electric vehicles is also considered a key enabler of smart grid as it will facilitate people to engage with DG capabilities. Customer choice is however, considered the key enabler to a smart grid as people will have the tools to load shift and save costs.

Economic Benefits of Smart Grid

The ultimate driver of change is that all sectors of society, the energy industry, business and consumers will see the economic benefits of smart grid and DG. For example, if customers demand flexible alternatives and the economics of smart grid is proven then Western Power would deploy DG to the system rather than just transmit. The consensus view is that a smart grid transition is highly dependent on Western Power management embracing cultural change, and assured of network benefits, such as cost deferrals and more efficient and reliable operations.

Facilitating Smart Grid: Energy Security, Research and Development

While some believe that the push toward emissions reduction and energy security are key drivers for a smart grid, others believe that financial and market incentives to promote the research and development of clean energy sources is also vital. Hence, subsidization is considered the key to influence the vast majority of society to get on board the clean energy route. Subsidization of green energy developments is also expected to lead to lower costs of the technology and broader access.

Allowing energy Utilities to move into more research and development arenas is also considered a key driver of smart grid. As this excerpt indicates: *"... I would form a much closer relationship with CSIRO and Universities ... invest a small amount of money for some promising kinds of research and development ... if you don't stay close enough ... you are not aware and you cannot take them into consideration as part of your overall strategy ..."*. As Utilities are government owned, accessing funds to undertake research and development to drive particular technologies will be curtailed. Synergy is expected to play a lead role in driving smart grid technologies.

Balanced Approach to Behavioural Change: IG Technologies

Most respondents believe that the best incentive to change consumer behaviour is to incorporate a balance between reward and punishment. The optimal strategy recommended for promoting effective engagement with smart meter technologies is the compulsory inclusion of TOU tariffs. As they highlight, when energy consumption is cost reflective then the choice is with the consumer to pay the higher costs during peak times. To avoid adverse consequences however, education and training is vital to empower consumers to make informed choices that best reflect their lifestyle and budget.

Identifying and Prioritizing Policy/Regulatory Issues

A range of responses were articulated about how major policy and regulatory issues are identified and prioritised in the organization. For one major energy stakeholder, policy and regulatory issues are identified when new concepts and products emerge in the market and they are assessed as possible solutions. The government also approaches the Utilities for energy policy solutions and during the planning and discussion process potential regulatory issues emerge for prioritization by government. With regard to smart grid matters a specialist Strategy group has been formed to provide leadership on the policy and regulatory implications. This group also provides advice to governments about market and regulatory requirements when new energy policy outcomes are being deliberated for impacts.

For other respondents, the policy and regulatory issues are also highlighted when the market and consumers ask for new products to undertake EE. Prioritization of specific issues also occurs when governments impose a particular policy regime and the business focus needs to be change to meet the regulatory requirements. The response also is that since Western Power has been afforded a greater voice to advocate on smart grid and DG issues its management team is working more proactively with government and energy agencies to prioritize specific solutions. For other stakeholders, such as advocacy groups they respond to policy and regulatory issues by providing submissions to government and energy agencies on the impacts posed to key sectors of the community.

Forming Policies and Regulations:

The majority of participants are involved in specialist strategist groups to identify and address policy and regulatory issues as they emerge. While many belong to a dedicated Energy Strategy Group there is regular consultation and collaboration with other sections of the organization particularly those dealing with the market and trading issues as well as the more specialised technical issues. In general prioritization of particular technologies revolves around what the impacts are for the Corporation and the customer. For other participants policy and regulatory issues are identified if it affects their operations and there is basic monitoring of GHG emissions and Renewable energy policy but there is less of a tendency to drive any changes. As this excerpt demonstrates: "... *it is certainly an organization that intends to have a direction but there is no intention to influence renewable policy or whatever ... we respond to calls for submissions...*" Some stakeholders also identified a political element to the decision making process as there is a clear division between those supporting fossil fuel and RE sources. If the gatekeepers are proponents of fossil fuel then the green options are ignored. On the whole most respondents are actively engaged in specialist energy strategy groups and policy and regulatory issues including prioritization of solutions are identified during regular forum discussions.

Advocating for Specific Technologies – Governance Process

While it is technically possible to advocate for particularly technologies, it is unlikely as energy Corporations are predominantly government owned. Apart from surmounting the process of a corporate hierarchical structure, the advocate would also need to gain the full support of the government, the Office of Energy and the Minister's advisors. This type of governance structure is less flexible and is not ideal to advocate for particular energy technologies. The governance structure of private organizations is considered more ideal for a senior executive for example to gain access to funds and resources to advocate for technologies that are economically viable.

This excerpt demonstrates the impediments associated with operating as a government regulated Utility, as subsidization of energy efficiency investments is deterred: " ...*We are happy to buy energy from anyone but there is a certain market price that we are willing to pay ... and while we are government owned we operate as a private company and government does not give us any money but we give them a dividend of 75% which no other private company does – so we can't afford to be overly generous by saying that we would like to get this [particular technology] off the ground and pay you a certain amount of money ...what entrepreneurs need to understand is that they want a sustainable product - if they are not getting the market rate then it is not going to be sustainable ...*".

5.4.5. Most Promising Process or Technology

Community Energy and Community Engagement:

Community energy is identified as a promising process as it can play a significant role in facilitating a smart grid, as community members are leading the charge and are willing to bear the costs associated with developing local energy generation plants. Western Power who is engaging with regional communities to plan a sustainable energy vision is considered a key enabling process for smart grid acceptance. This deliberative process which has attracted participants with high level energy expertise has generated numerous ideas and solutions most appropriate for the regional community level. Western Power officers highlight that management views this process as more credible because the economically justified initiatives have been driven by the community.

One participant identified that a promising process to support the smart grid path in WA is the State Government's LEED (Low Emissions Energy Development) Fund which supports technological development to cut GHG emissions from the energy sector. Investments of $30 million have been provided for research and development of biodiesel, geothermal, solar and wave power sources. The expectations overall is that solar will be leading the technological advancements, however the need to be informed is also highlighted by this excerpt: *"... incredible strides have been made in photovoltaics ... in film and even spray-on PVs ... how credible this is you don't know unless you are part of that mosaic of experts ... we are a couple of steps away from some of these research collaboratives ... we are totally reliant on the internet, the press and published research which is too late ..."*.

Bottom up Processes: Land Developers

Some participants believe that a promising bottom up process is that Land Developers are pushing for smart grid technologies as there is a growing demand for the construction of EE commercial buildings and residential homes. Developers are seeking advice from Western Power and Engineering Consultants on how best to build EE demonstration sites that include a suite of EE and power generation technologies. The report is that Land Developers are now more vocal about what they expect from Western Power and are pursuing EE and DE technological developments to gain market edge.

Solar PV Technological Progress

The consensus view is that most promising is the technological innovation emerging with PV solar research where current efficiency with most home sized solar panels at 15% is expected to progress significantly on that figure. Hence the expectation is that the performance characteristics of PV panels will continue to improve and the production costs will fall sufficiently to be cost effective. The realization is that until it is cost effective PV solar will continue to need high levels of subsidization through RECs and a high FIT to encourage penetration. The expectation is that PV

technologies will become truly competitive in ten to fifteen years.

Wave Power Developments:

In terms of wave technology the Carnegie wave power developments is identified as a promising source that will highly beneficial to WA and Australia due to the significant wave and tidal patterns. Australia is geographically well placed for wave power and the additional advantage is that wave produces base load energy. Other benefits include the easier access to network connections as it can be connected on the coast line at Fremantle and Kwinana. Wave is also significant to WA as the generation process can also produce clean water. Smaller scale generation studies are demonstrating that it is economically viable and the expectation is that as the uptake of the wave technology grows it will prove to be an economically viable generation source.

Cogeneration and Tri-generation Technologies

CHP and CCHP systems are also identified as the ideal DG solution as it is a well advanced DE generation plant. As this excerpt portrays: *"... a lot of the equipment is pre-packaged now – it is not difficult to install, operate and most of all it will automatically set frequency controls. .."*. This DE technology is described as the most efficient electricity generation plant that needs prioritization by policy makers. One advocate highlighted that CHP and CCHP represents a golden opportunity for governments to provide RECs as it reduces carbon output by 40% and up to 60% in some cases.

Gas Turbine

The Combined Cycle Gas Turbine plant which is currently operating in Kwinana, WA is also identified as most promising. It is proposed that this system is the most efficient electricity generation plant that the world has in application today. However, the process of operation is considered too complicated for commercial purposes.

Micro Wind Turbines

Smaller scale wind turbines are also predicted to be a promising technology. Its size makes it less distracting and noise reduction can be engineered to make it more environmentally friendly and aesthetically pleasing.

Fuel Cells

Also offering real promise are fuel cells and with mass production characteristics the cost are expected to lower and be economical viable for small commercial enterprises and eventually residential consumers. While it is not economically viable for small scale use at this stage it is expected to eventuate.

Biomass Gasification Project

The Curtin University's Biomass Gasification project is also identified as a promising new technological development. This project has received $2.4 million Federal Government funds and it is now in the final stages of development. This venture is described as an award-winning project and an example of where Western Australia is leading the world in the development of RE technologies.

Plug-in Hybrid Electric Vehicles (PHEV)

While the PHEV is identified as a promising technological advancement, the transition is considered an immense undertaking for the energy Utilities. Although PHEVs are considered inevitable it is considered too costly. While the PHEV is expected to play a major role for the smart grid network with its DE storage, one participant is highly concerned about the impacts: *"... it is actually the worst thing for the network because you've got all these loads charging into the network all at the same time ... but fortunately it is so well discussed that we are aware of it but we don't have the answer ... but at least it is out in the open ... it gives us time to look at the issues and the solutions ...".*

Home Area Network (HAN)

The Home Area Network (HAN) (In Home Display) and Direct Load Control capabilities, the simplest and smaller technologies are considered the next significant milestone to be deployed by the energy industry. The conclusive remark is that while there are no silver bullets, there are many processes and emerging technologies that are considered promising but the issue of most concern is the political lobbying by green groups that promote a narrower repertoire of technologies. As this excerpt portrays: *"... they push photovoltaics ... and you start paying out, e.g. in New South Wales fifty cents feed in tariff - somebody has to pay for that – so these types of DG are coming at an enormous cost to tax payers who are not necessarily benefiting equally particularly those that can't afford to self generate..."*.

5.4.6. Making IG-DE Attractive to the Business World

The consensus view is that the key impediment to DE is that it competes with the much cheaper coal and gas sources. Therefore DE options will be attractive to the business world when costs compete with current energy sources. As one stakeholder highlighted " *... take the climate change aspect out of it you are going to pay something like $120/mega watt hour for a wind farm as opposed to $60/mega watt hour for coal ... we can't justify doing that because the customer base out there cannot withstand those costs*...". As viable profits are vital for the energy industry, cost effectiveness is the key. The recommendations include government subsidies and a greater educative process to inform the sector of the options and improve the economics of DE. On the positive side, the relentless tariff increases in power is expected to motivate businesses to look more realistically at DG, particularly if they take a long term view of the costs. It will however, require cultural change to incorporate DG in the business plan. Energy is becoming a salient issue for Australian businesses and they are increasing their knowledge about DG options.

Motivations to Pursue IG-DE

In general respondents found it difficult to articulate how smart grid and DG capabilities can be made more attractive to the business world. As they highlighted *"... there are no business plans or information available on how it should work, how it is suppose to save money and what it actually does. It also depends on who will benefit from it ...*" While the energy Utilities are motivated by regulatory, policy, economic and energy efficiency imperatives to pursue smart grid and DG solutions, the key is that it leads to gains in revenue and cost savings.

Cost Benefit Analysis of Smart Grid-DG

The consensus view is that policy makers need to be knowledgeable about smart grid-DG and demonstrate the costs and benefits to the networks and customers. While it is tempting to embrace smart grid technologies, the redundancies in the network need to be evaluated. As this excerpt

highlights: *"... this means a lot of copper and a lot of poles and wires ... given that the current network is available 99.95% times of the year, are customers really upset about that .05% reliability ... if they are upset are they prepared to pay $300 per year to fix it ... those are the types of answers we need to have..."*. To make smart grid-DG attractive to the business world, the process needs to begin with genuine debate about the costs and benefits including implications of IG-DE for the WA context. The recommendation is to also include the Federal government in the debate as they are the major funding body.

5.4.7. Effectiveness of Energy Governance Structure

In terms of the effectiveness of the current energy governance structure in WA to promote smart grid-DG, the majority view is that it is sound, but it needs to be complemented with more powerful voices and technical influence. As one respondent highlighted the energy industry is more dynamic and technological change is transformational, it is therefore imperative that decision makers have the energy expertise to play an immediate policy and regulatory role. The electricity industry is dependent on sound energy policy decisions. Otherwise the transition toward an efficient and effective electricity system will be impeded. Although the visions need to be driven from the top, key players in the energy governance structure must also play a major facilitative role to enable government priorities to emerge from strategic planning.

Sustainability Planning

The effectiveness of the governance structure can also be enhanced if the regulatory framework is expanded to incorporate a triple bottom line approach to the Economic Regulatory Authority (ERA) process which focuses too heavily on economics. Recommendations include long term visions that incorporate economic, social and environmental considerations into strategic planning. The suggestion is for governments to take risks with short term economic pain by undertaking strategies that benefit the community and the energy networks in the long term. Legislators are also called upon to play a leading role to enable a broader focus to energy policy planning by changing the rules to support the conservation imperatives of society. While the salience of energy conservation has faded, it appears that policy makers are relying solely on pricing mechanisms as the main policy instrument to reduce energy consumption. This is considered too narrow and the recommendation is for policy makers to have visions that go beyond an economic rationalist approach that penalizes the most disadvantaged.

5.4.8. Key Information Sources on Smart Grid-DE

To access the latest energy information, stakeholders rely heavily on networking with other energy Utilities and the energy industry networks as access to research publications is limited. While the majority source the internet for the latest information, senior management rely on national and international energy conferences to be informed about on energy policy and technology trends. Table 1 below lists the information sources identified by the respondents.

Table 1: Smart Grid Information Sources

Internet Sources: US Energy Organizations; Department of Energy; California Energy Commission; EPRI Data; UK Cogeneration Europe – publicly available research data Australia: Department of Climate Change; Department of Resources, Energy and Tourism; Energy Utility and Industry Websites
Government Departments and Institutions: Office of Energy; CSIRO; Curtin University
Media International; National and State News sources; Trade Magazines
Forums and Conferences International, National and State Energy Research and Industry Forums
Commercial Customers Engineering firms; Hospitals; Land Developers

5.4.9. Influential Stakeholders – IG-DE Policy and Regulation

With regard to influence over energy policy and regulation, the respondents identified those perceived as having voice and power over the policy and decision making process. While governments both state and federal attributed with the most influence over energy policy, within the WA context, most identify Western Power with the most influential voice over smart grid-DG. While some believe that Western Power takes a cautionary approach, others believe that the Corporation leads the process. As this excerpt reveals: *" ... I think that Western Power has the most influence as it has to rely on the Office of Energy's radar ... Renewables have been on the radar but I don't think DG generally has been prominent – at the moment I would say Western Power, although Synergy has done quite an extensive amount of DG ..."*. A variety of other energy stakeholders attributed with influence over policy and regulatory issues as well as the smart grid direction include the ERA, Office of Energy, Horizon, Verve and Synergy. Research organizations such as CSIRO and Universities are also identified as having influence on smart grid but not as

much with DG, although it is conceded that the whole concept of smart grid incorporates some level of integrated DG.

Stakeholders identified as having influence over smart grid policy is listed below in Table 2. Although the State Government is identified as an influential stakeholder, because of its lack of vision and direction, by default Western Power has taken the lead to explore the smart grid-DG options.

Table 2: Influential Stakeholders - Energy Governance

Western Australian	State Government; Energy Ministers Office; Office of Energy; ERA (Economic Regulatory Authority), Treasury
Federal Level	Department of Climate Change; Department of Industry and Resources; Electricity Networks Association (ENA).
Nationally	Electricity Regulators: Office of NEM "takes a policeman approach as opposed to making policy and their voice is heard". The Energy Ombudsman; Electricity Retailers Association of Australia; Electricity Suppliers Association of Australia
Energy Poverty Advocates	WACOSS; (ACOSS and associated federal and state bodies).

5.4.10. Playing a More Significant Role in Policy and Regulation

With regard to who should be playing a more significant role, many respondents highlighted that as the end use customer is the linchpin in progressing the smart grid transition, it is imperative that consumers play a more significant role in decisions that affect their lifestyle. A significant point highlighted is the need to include the voice of those who are affected by the decisions made by those in power. As this excerpt illustrates, energy stakeholders need to be seen from broader decision making frameworks to develop socially just policies: *"... the energy stakeholders facilitate not only business and commercial enterprise but it also facilitates lifestyle, hence every member of the community should be represented as part of the stakeholder engagement network ..."*

Customers are also regarded as a top priority and the Retail networks believe it is their responsibility to advocate on their behalf to ensure that their voice is heard at the policy and regulatory level. Synergy Power is also identified as needing to play a more significant role in strategic planning and policy development of smart grid-DG solutions. Other groups including the retailers and consumers' advocates are also identified as needing to play a more significant role in policy and regulation to address the diversity of issues. As captured by this excerpt: *"energy poverty is becoming a significant issue and they* [WACOSS*] would be significant players in driving policy in the future"*. The Electricity Retailers Association of Australia is also identified as needing to play a greater role in policy and regulation as the dominant discourse suggests that smart grid is a distribution transmission network related initiative and it does not impact on them - this should be challenged.

Other organizations such as the WA Chamber of Commerce and Industry and Chamber of Minerals and Energy WA are playing an increasing role in policy and regulation because energy has been a salient issue in Western Australia for a relatively short period of five years. As energy issues become relevant the involvement of more diverse stakeholders is expected to increase. While the energy utilities want to collaborate and play a greater role in policy and planning, it is difficult for Corporations like Synergy and Western Power to advocate to government for particular energy systems as they are not independent. It is also not possible for management to participate on debates that involve criticizing government policy as it would be in conflict.

5.4.11. Forming Closer Ties - Exclusion of WA

The respondents' highlight that WA energy stakeholders are excluded from national energy policy development and debates, as this excerpt illustrates: *" ... often they hold workshops and discussion forums and we are not invited ... the issues are NEM focussed and WA is forgotten when it comes to policy making and debates ..."* Organizers fail to recall that WA Utilities are disaggregated and only Western Power is invited. This poses barriers to engagement, communication and collaboration for the energy Utilities as a whole. To enable engagement with the broader energy stakeholder community, forming closer ties with influential Federal government agencies leading the charge on energy policy; including research institutions (e.g. CSIRO, major Universities) is desired to facilitate opportunities for research and development and access to latest energy expertise.

5.4.12. Questions that needed to be asked

Consumer Engagement and Collaboration

In terms of what question needed to be asked by the researcher, the response identified the issue of how consumers fit into the transition toward smart grid. To address this, the first suggestion included the role of customer education to inform them about the technologies being created to assist them. This is highlighted due to concerns raised over the distribution of smart meters to householders without adequate training. The second aspect of how consumers fit with a smart grid transition, highlighted whether they should be playing a greater role in policy and regulation. While some believe that the public is not sufficiently knowledgeable to participate at that level. Others advocate for community engagement processes to involve the public in energy visions. The suggestion also included the role of energy Retailers who are well trained in customer relations to collaborate with Western Power in undertaking public participation in strategic planning.

5.5. Conclusions and Recommendations

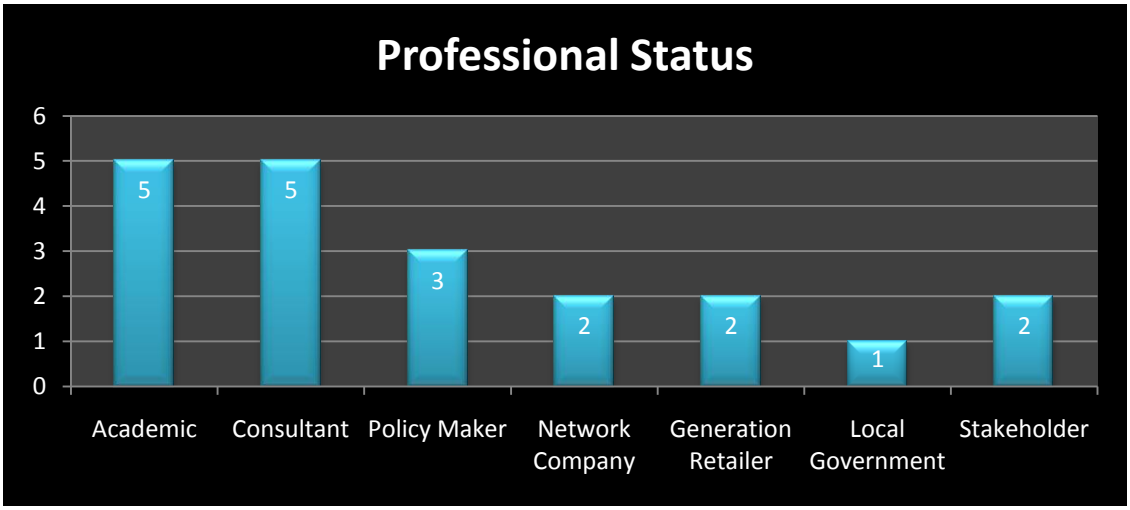
Although the energy stakeholders highlight numerous barriers to a smart grid transition, there is as much optimism about its potential as the benefits are expected to surmount the impediments. To drive the industry's transformation toward a smart grid system, emphasis is placed on leadership, high level energy expertise, sound applied research evaluation and collaboration between government, industry and business to drive technological advancements that are economically viable. While economic drivers exist for networks to capitalise on smart grid, institutional and regulatory recognition of the benefits is central to the goal. Also essential are market, policy and regulatory incentives including broader governance frameworks to promote planning that benefits the industry, consumers and the state in the long term. While many powerful stakeholders influence energy policy and regulation, advocacy groups are identified as needing to play a greater role to voice the needs of disadvantaged consumers.

5.6. Key Findings of Stage 3 [Phase 2] – Energy Stakeholder Survey

5.6.1. Overview of Results and Analyses

This stage represents the key findings emerging from an energy stakeholder survey undertaken at the Intelligent Grid Industry Forum held in Perth on March 11, 2010. A total of twenty (20) participants completed the surveys that sought their perspective to the issues, drivers and barriers associated with an IG-DE transition. A breakdown of the participants' professional status is shown in the Table (3) below. While the respondents are not a representative sample of the energy stakeholder network, it does reflect a general perspective of energy stakeholders' understandings of IG-DE issues pertinent to the industry.

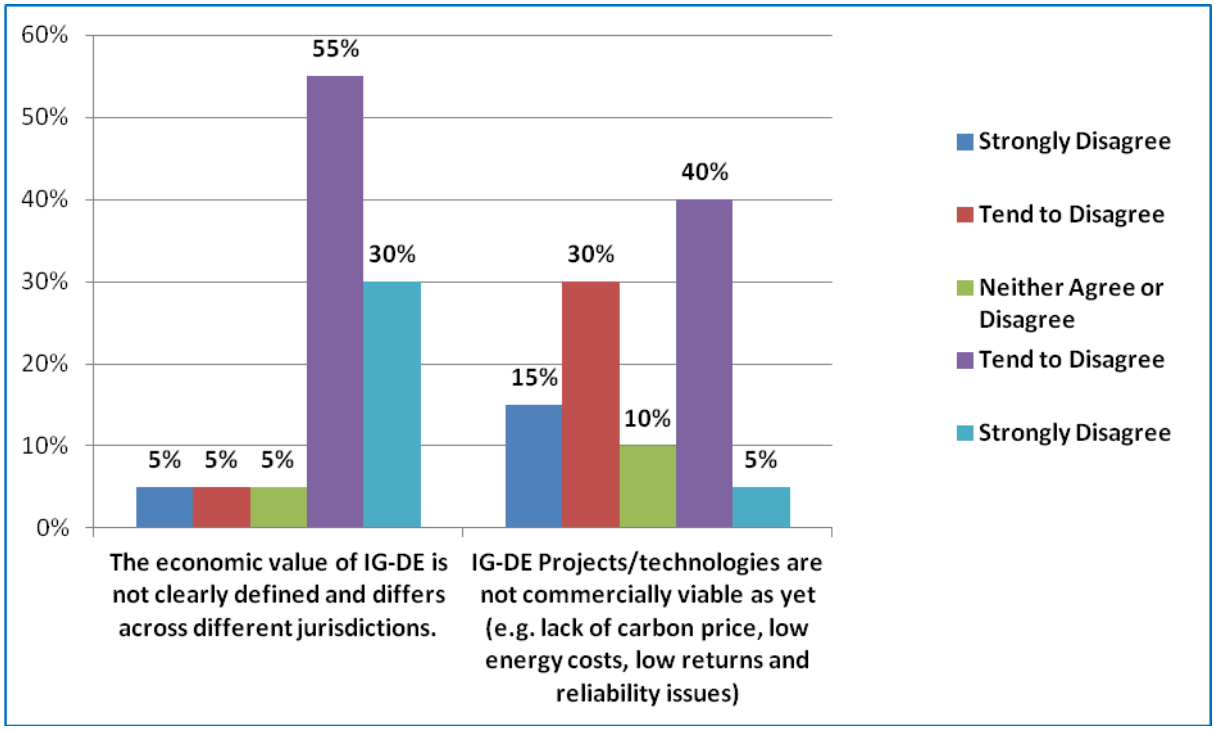
Table 3: Professional Status of Energy Stakeholders



5.6.2. Barriers and Impediments to IG-DE

While the consensus is that specific economic, policy, regulatory and political issues impede IG-DE, it does not necessarily curtail its deployment. For example as Table 4 below depicts, with regard to economic barriers, 85 per cent agree that "*the economic value of IG-DE is not clearly defined and differs across different jurisdictions*". In spite of these concerns, respondents are divided over the statement that "*IG-DE projects/technologies are not commercially viable as yet*" poses a barrier to the industry. To elaborate, 45 per cent believe commercial viability is a barrier; while 45 per cent do not believe it is a barrier and 10 percent 'neither agree or disagree' that it is a barrier. While there is agreement that the economic value of IG-DE lacks clarity, there is optimism that economic viability is not necessarily a barrier to deployment.

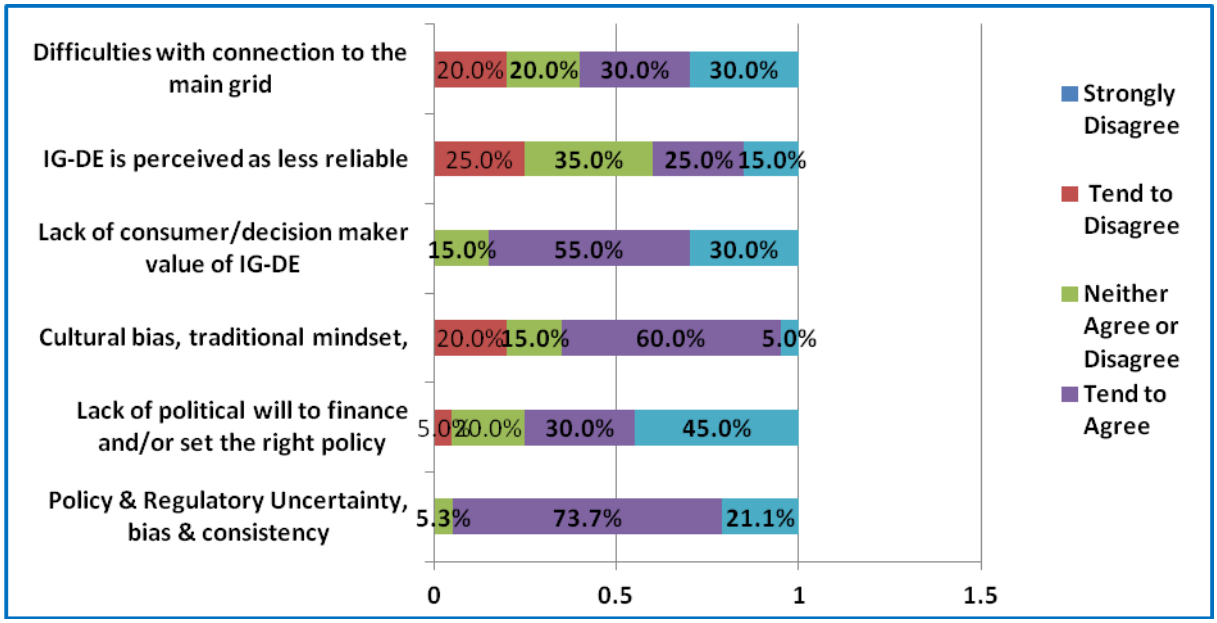
Figure 22: Economic Constraints



5.6.3. Institutional, Technological and Technical Barriers

Figure 23 below also indicates that while 85 per cent believe that lack of awareness and education is a barrier, there is less certainty about the technological impediments to IG-DE. For example, only 40 percent agree with the statement that "*IG-DE is less reliable than grid supply*". Most respondents emphasize "*policy and regulatory uncertainty*" (94.8% agreement); "*lack of political will to finance and/or set the right policy*" (75% agreement); "*lack of consumer/decision maker value of IG-DE*" (85% agreement) as greater limitations to IG-DE compared to cultural and technical impediments, such as "*cultural bias, traditional mind set*" (65% agreement) and "*difficulties with connection to the grid*" (60% agreement).

Figure 23: Institutional, Technological and Technical Barriers



Stakeholders' Qualitative Responses

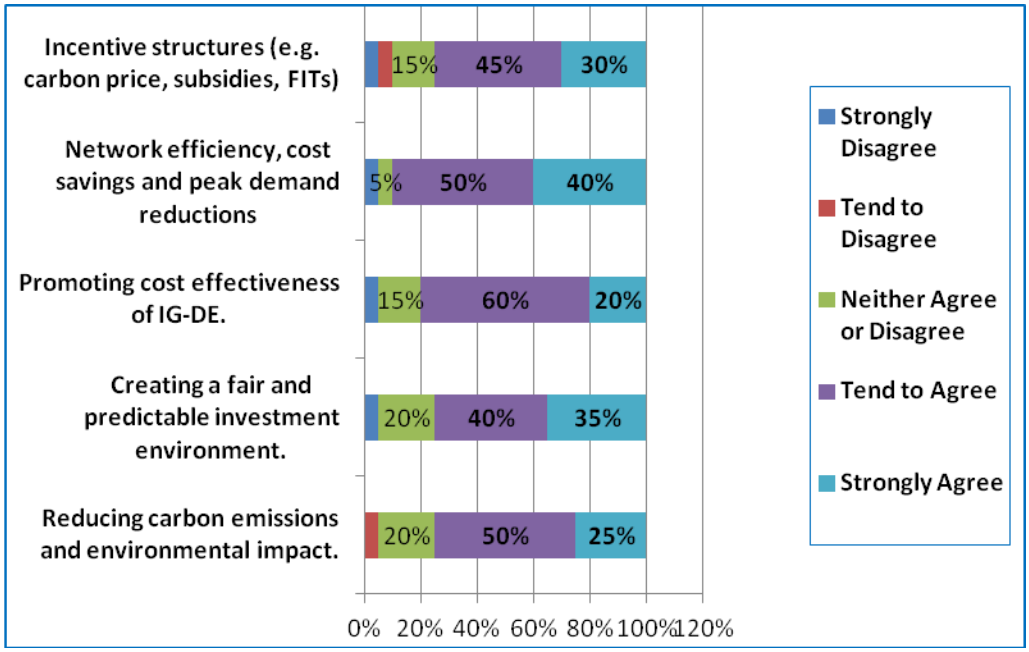
Stakeholders also indicated a number of other barriers and impediments to IG-DE as identified by the following qualitative excerpts:

- Lack of clear governance arrangements with respect to re-regulated markets;
- Lack of incentives for Retailers and Generators to pursue IG-DE;
- Connection of mid range (greater than 1mw) generation – there is no clean pathway to connect to the grid and proponents are given conflicting information;
- Energy prices are not cost reflective;
- Uncertainty over carbon pricing;
- National and International Technical Standards need to keep pace

5.6.4. Key Drivers and Enablers of IG-DE

Participants also indicate a high level of agreement that an IG-DE transition is associated with the following environmental, institutional and market drivers. Figure 24 below illustrates that while environmental concerns are a key driver of IG-DE it is also enabled by other economic and market incentives. For example, while 75 per cent believe that reducing carbon emissions and environmental impact is a key motivation; 80 per cent also identify cost effectiveness as a key enabler and 75 per cent link market incentives such as "*creating a fair and predictable investment environment*" and 90 per cent agree that "*network efficiency, cost savings and peak demand reductions*" are key drivers to transform the energy industry.

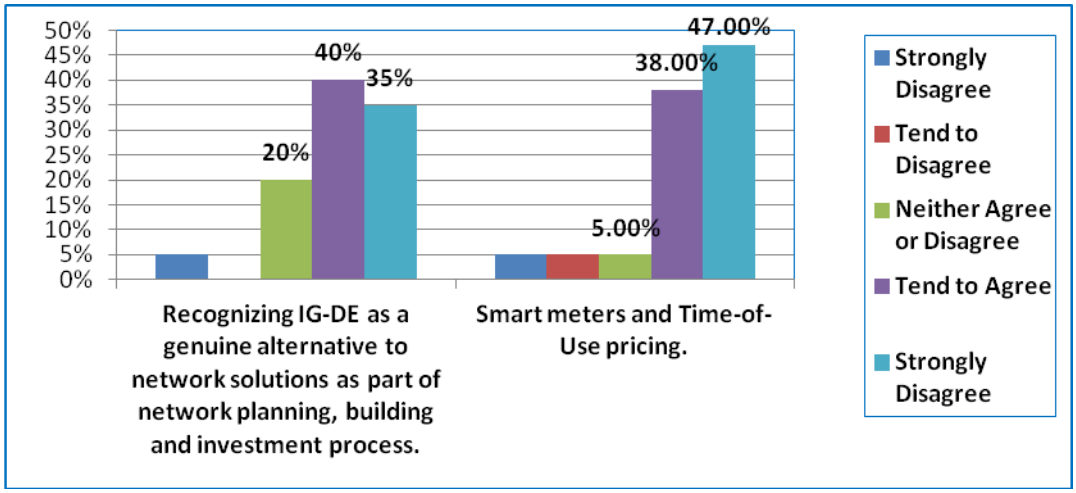
Figure 24: Environmental and Economic Drivers



Energy Network Incentives

There is also consensus that broader decision making frameworks, innovative technology along with cost reflective pricing are key enablers for networks to pursue IG-DE solutions. As Figure 25 below indicates 75 per cent believe that a key driver of network transformation is linked to management "*recognizing IG-DE as a genuine alternative to network solutions as part of network planning, building and investment process*". Also important, 85 per cent agree that a key driver of IG-DE is the capacity of the energy utilities to deploy technologies such as smart meters in combination with cost reflective tariffs.

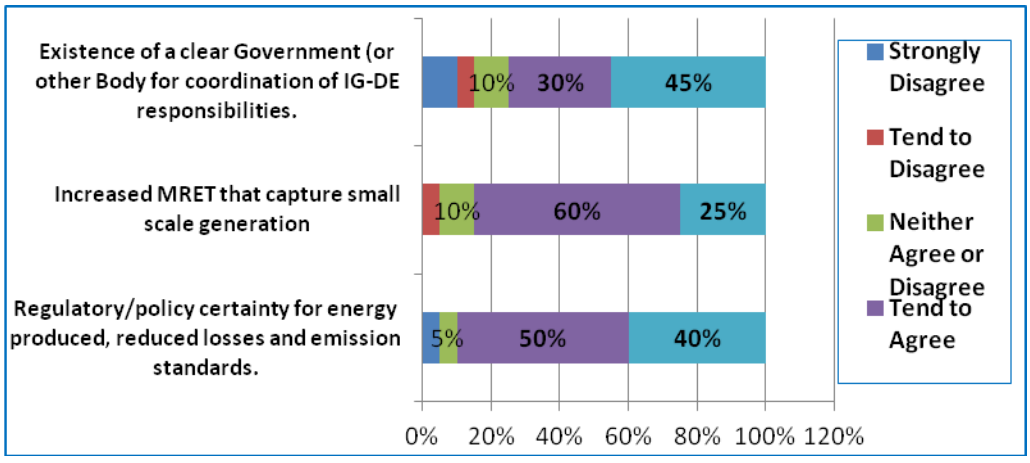
Figure 25: Network Drivers



Regulatory and Policy Structures

The consensus is that an IG-DE transition is highly dependent on key regulatory and policy structures including government leadership and coordination. For example, as Figure 26 below highlights, 95 per cent of respondents believe that a key driver of IG-DE is linked to "*increased MRET that capture small scale generation*"; while 90% of respondents are in support of "*regulatory/policy certainty for energy produced, reduced losses and emission standards*" as vital, 75 per cent think that the "*existence of a clear Government (or other Body) for coordination of IG-DE responsibilities*" will also progress the transformation. There is clear support for regulatory and policy certainty as key enablers of the energy industry's transition toward IG-DE.

Figure 26: Regulatory and Policy Drivers



Stakeholders' Qualitative Responses – Other Drivers and Enablers

A number of other institutional, educational and technological drivers and enablers of IG-DE are also highlighted, as reflected in the following excerpts:

- Regulatory reform to promote a triple bottom line approach to include IG-DE considerations;
- Collaborative (government-private sector) investment arrangement on DE;
- Energy generation mix must be explained - reasons for future vision must be clear;
- Raising public awareness on energy conservation;
- Good coverage – improving reliability
- Electric vehicles will accelerate peak overload growth;
- Innovative technical developments.

5.6.5. Qualitative Responses – Single Most Important Driver for IG-DE

The following institutional, economic, market, policy and regulatory, network and environmental drivers for IG-DE are also identified:

Economics: proving economic viability over centralized approach;

Streamline and evaluate the benefits across generators, networks, distributors and customers to highlight the real value of IG-DE;

Policy/Regulatory: State and Federal policy direction and leadership;

Having a collaborative approach between state agencies (in particular) for addressing planning functions for the state/country.

Pricing and cost transparency are critical for sustainable decision making;

Achieving customer buy-in will become a key enabler for IG-DE solutions overall. From a customer perspective, the current state of increasing electricity prices is going to force people to look to alternative energy solutions to either generate their own electricity or reduce their consumption. The industry needs to be equipped to meet customer demand when this time comes.

Market Signals: Getting the price signals right but at present price signals are distorted, muted or absent altogether and incentives by the network to invest in IG-DE may not be captured by network/recognised by regulator.

Real time of use pricing (once cost reflectivity is achieved)

Network Incentives*:* Reductions in peak loads without significant capital investment;

Deferred requirement for network investment;

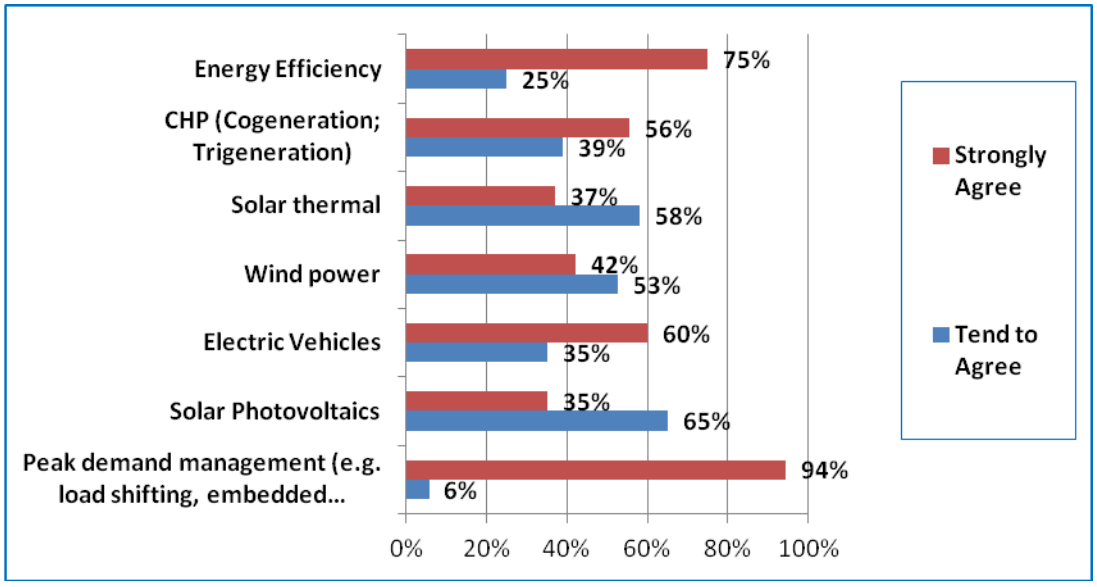
Efficiency of energy distribution and capital expenditure;

Environmental Drivers*:* Efficient use of scarce commodities

5.6.6. Energy Source and Technology Mix for Australia

There is overwhelming support for RE sources including a variety of technological solutions as a viable option for Australia's electricity system. Figure 27 below illustrates strong support for the following technologies and strategies: (a) 100 per cent support for "*peak demand management*"; "*solar photovoltaics*" and "*energy efficiency*"; as well as (b) 95 per cent support for the development and deployment of the following energy generation technologies and source including: "*electric vehicles"*; "*CHP"*; "*solar thermal"* and "*wind power*".

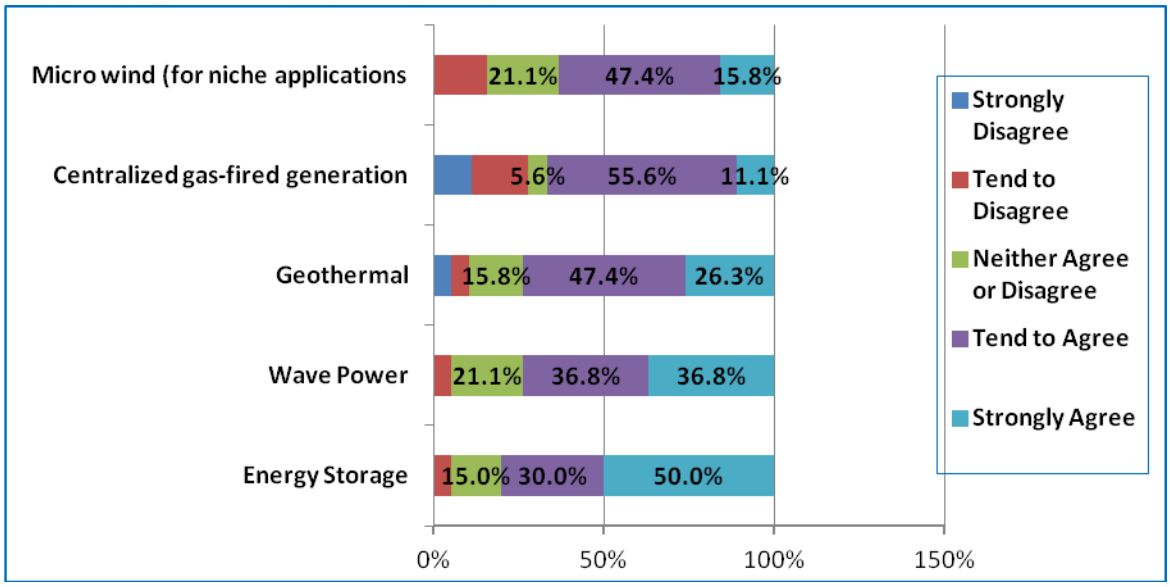
Figure 27: Highly Favoured Energy Sources and Technologies



Other Favoured Sources and Technology Mix

Participants also favour the following energy source and technological solutions. As Figure 28 depicts, there is: (a) 80 per cent support for "*energy storage*"; (b) 73.7 per cent support for "*geothermal*"; (c) 73.6 per cent support for "*wave power*"; (d) 66.7 per cent support for "*centralized gas-fired generation*" and (e) 63.2 per cent support for "*micro wind turbines"*. While RE sources and technologies are favoured, there is less support for *micro wind turbines* compared to *large scale wind power*. Given the emphasis on economic barriers, these results most likely reflect concerns over cost effectiveness of small scale wind turbines as a viable option.

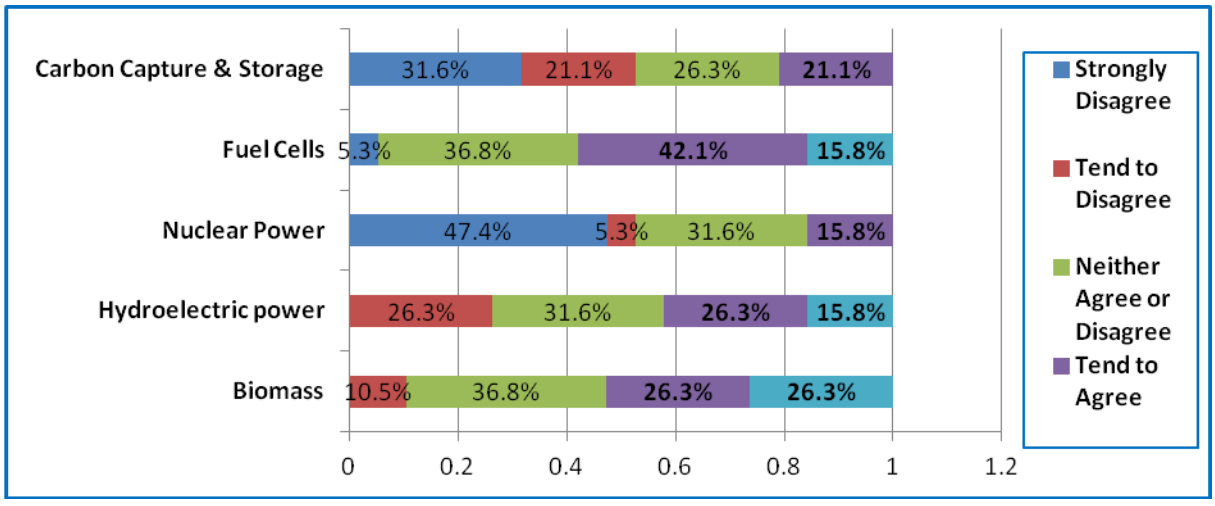
Figure 28: Other Favoured Energy Source and Technologies



Least Favoured Source and Technologies

Figure 29 below highlights the respondents' perspective of the least favoured and most controversial sources and technologies. With regard to *CCS*: 47.4 per cent support it as a viable option; 42.7 reject it and 21.1 per cent are neutral. For *fuel cells*: 57.9 per cent support it; 5.3 per cent reject it and 36.8 per cent are neutral. As for *nuclear power*: 15.8 per cent favour it; 52.7 per cent reject it and 31.6 percent are neutral to the option. For *hydroelectric power*: 42.1 per cent support its development; 36.3 percent reject it and 31.6 per cent have a neutral opinion. As for *biomass*: 52.6 per cent support it; 10.5 per cent reject it and 36.8 per cent are neutral about its use. Given respondents preferences for RE sources which are viewed as more economically, socially and environmentally feasible, it is not surprising that the other sources are considered a more conflictive option for Australia.

Figure 29: Contentious Sources and Technologies



Stakeholders' Qualitative Responses

Respondents also highlighted the following issues and options for energy source and technology mix viable for Australia:

- Retail gas is too expensive for fuel cells;
- Direct use heat displacement facilities (or low temperature geothermal);
- Super conducting cables.

5.6.7. Stakeholder's Qualitative Responses: Most promising Technology/Process

The stakeholders' response to what is the technology/process that is most promising in the near term five to ten years revealed the following:

- The most popular technology is the "*electric vehicle*" with the proviso that network issues need to be addressed;
- The energy trend identified is the "*smart meter*" and the "*smart grid*" infrastructure as the building block for energy technologies; in combination with "*electricity market reform*"; "*cost reflective pricing*" and "*live retail tariffs*" that convey the full cost of electricity delivery at that time.

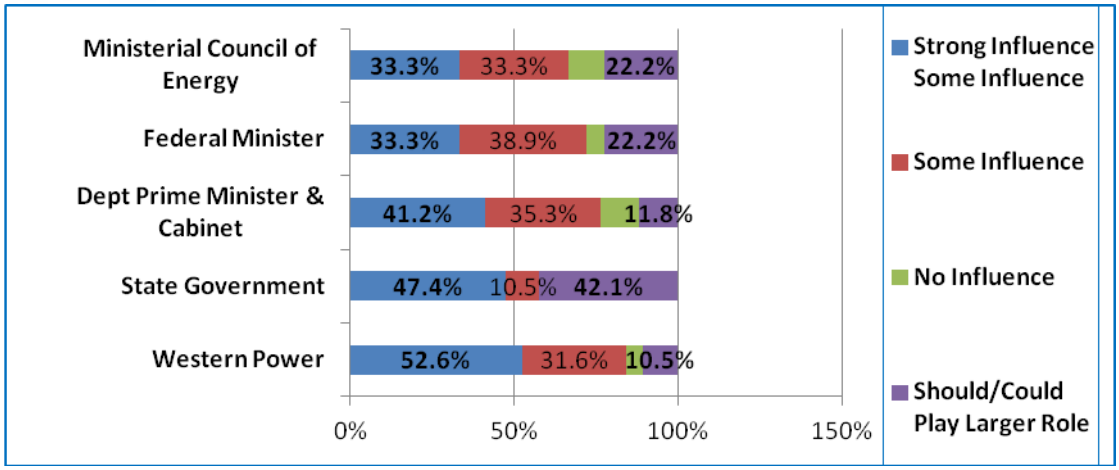
Other popular technologies or process considered most promising include the following:

- Solar thermal, solar storage and energy efficiency;
- Energy efficiency; energy conservation and energy storage;
- Geothermal and super conducting cables;
- Solar and wind combination with battery storage and time shift dispatch and load shifting;
- Incentivising all stakeholder

5.6.8. Influential Players in Energy Policy in WA

The respondents highlighted the following influential stakeholders as well as those who should be playing a greater role over IG-DE policy decisions. As figure 30 below indicates the stakeholders considered influential players over policy and regulation include: (a) Western Power; (b) the State Government; (c) Department of the Prime Minister and Cabinet; (d) Ministerial Council of Energy (MCE) and (e) the Federal Minister. However, while "*Western Power"* is attributed with having influence (52.6%), the respondents indicate that it is the "*State Government*" (42.1%) that needs to play a greater role in policy and regulation in WA.

Figure 30: Stakeholders Needing to Play a Greater Role

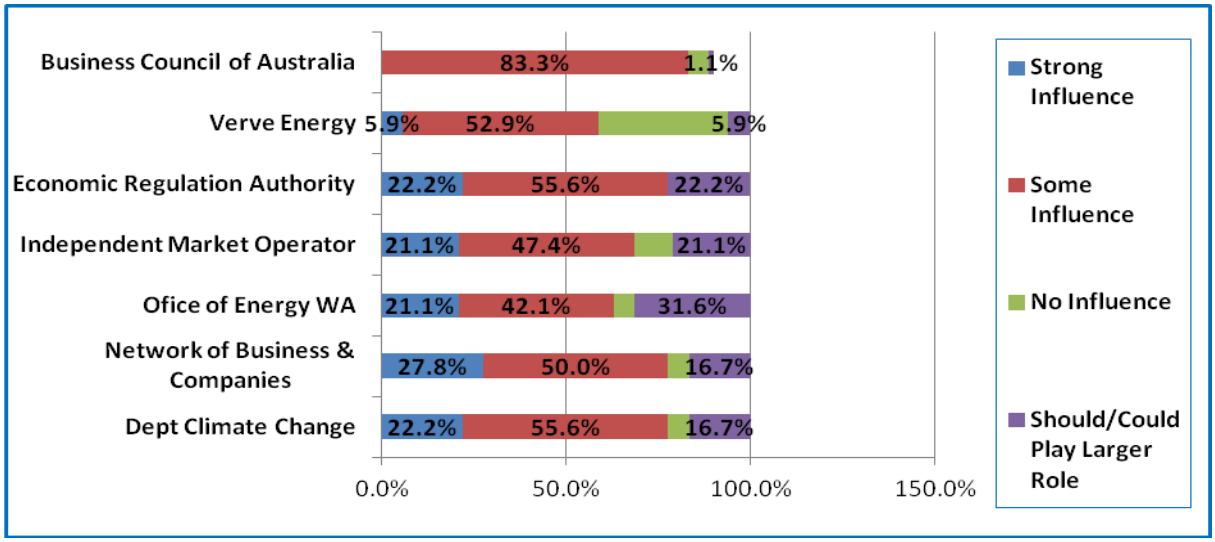


5.6.9. *Other Influential Players in the Energy Network*

Figure 31 below illustrates that while 77.8 per cent attribute the "*ERA"* with some level of influence over energy regulation and policy, only 10.5 per cent believe they should play a greater role. Similarly 58.8 per cent attribute "*Verve Energy"* with influence and only 5.9 per cent think they should play a greater role. With regard to the "*IMO*", while 68.5 per cent attribute them as having influence, only 21.1 per cent believe they should play a greater role. As for the "*Network of Business and Companies*", 77.6 per cent attribute them with having influence and only 16.7 per cent believe they should play a greater role in policy and regulation.

Most pertinent however, is that while the "*Business Council of Australia*" is attributed with having influence by 83.3 percent of the respondents and the "*Office of Energy*" is attributed with having some influence by 42.1% of respondents, the majority of respondents (31.6%) believe that the "*Office of Energy"* needs to play a greater role in policy and regulation. It appears that respondents desire government leadership as they attribute the "*Office of Energy*" and the "*State Government*" as needing to take a leading role in energy policy and regulation in WA.

Figure 31: Players with Some Influence



Qualitative Responses – Other Influential Stakeholders

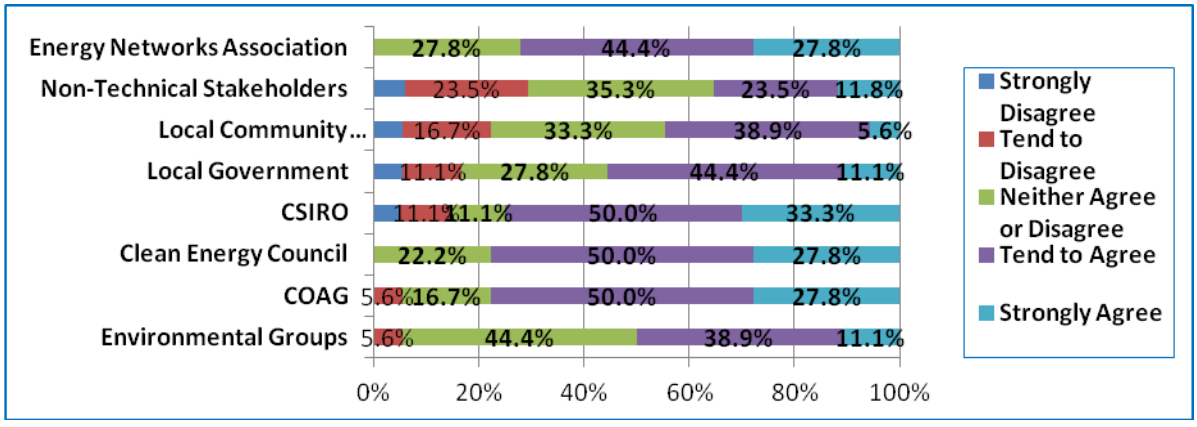
Participants also identified the following stakeholders having influence over energy policy and regulation.

- Energy Retailers; Synergy; Horizon Power
- Consumer Advocates: WACOSS
- Consumers: communities; residential customers; project developers
- Local government
- Contractors; Land Developers
- Universities should be helping to set the agenda
- State Planning Bodies

5.6.10. Stakeholders Who Should Play a More Significant Role

With regard to who should play a more significant role, the involvement of the following stakeholders is supported: (a) *CSIRO* – 83.3 per cent; (b) *Council of Australia Governments* (COAG) – 77.8 per cent; (c) *Clean Energy Council* - 77.8 per cent and (d) *Energy Networks Association* – 72.2 per cent. There is however, less support for stakeholders who are perceived as vested interest groups or lacking the technical knowledge to contribute to policy and regulation. For example as figure 32 below highlights, there is less support for a greater role to be played by the following stakeholders: (a) *Local Government;* (b) *Environmental Groups*; (c) *Local Community Representatives* and (d) *Non-Technical Stakeholders.*

Figure 32: Playing a More Significant Role



Qualitative Responses – Stakeholders who should play a more significant Role

Respondents identified the following stakeholders who should play a more significant role to ensure that the diversity of voices are represented, particularly those adversely impacted by an IG-DE transformation.

- WACOSS /ACOSS are advocates for energy poverty and consumers which need to be factored in by policy makers;
- DRET, DCCEE – Office of Renewable Energy Regulator;
- Customer feed-back should be passed on to Retailer, Network, Generator and Regulators;
- State Planning Bodies;
- Local business groups.

5.7. Conclusions

Although the energy stakeholders highlight a number of economic, market, institutional, political, policy and regulatory, cultural, knowledge, technological and technical barriers, there is also much optimism about the advancement of IG-DE as the benefits outweigh the impediments. This supports the findings of the previous two research stages which highlight that despite the economic barriers to IG-DE deployment, strategies are called for to enhance its economic viability. Survey respondents also identify numerous drivers and enablers that will facilitate the energy industry's transformation process and much emphasis is placed on leadership, coordination and collaboration among government, industry and stakeholders to promote the technological advancements and developments that is expected to overcome the economic, institutional and technical barriers that constrain its deployment.

6. DISCUSSION AND RECOMMENDATIONS

6.1. Overview

This section highlights the main findings emerging from the three research stages, where each phase provides a different perspective to the issues, the barriers and the drivers toward an IG-DE transition. Following are the discussion of the key issues and the implications that have emerged from this multi-perspectivist study. By integrating the various energy stakeholders' perspectives, a more holistic view of the issues implicated with an IG-DE transition with the Western Australian context at the macro, meso and micro levels of analysis is facilitated.

6.1.1. Community Motivations, Attitudes, Barriers and Facilitators

The community interviews revealed that regardless of environmental values and risk perceptions of climate change, there is overall policy support for both commercial scale RE sources and small scale Renewable DE, including IG technologies to facilitate the transition toward a clean energy economy. While participants react positively toward the development and deployment of IG-DE technologies, the reality is that only a minority of regional residents can afford to access government subsidies to install for example solar PV generation. Hence, community acceptance of IG-DE technological solutions does not necessarily mean it will lead to deployment, as residents and SMEs face numerous impediments. For example, while an eco-village privately funded solar PV generation, they were prohibited from connecting to the grid due to transformer and connection costs. This is considered a significant barrier to DE deployment and institutional solutions are vital to enable a greater penetration of DE for regional communities. While many regional residents desire DE solutions for a variety of motivations, economic viability is rated a critical barrier. Those living in rented accommodation are also frustrated by the lack of incentives available to landlords to deploy DE. While increasing the feed-in tariff is viewed as a key incentive for owner occupied households and business premises to undertake solar PV generation, urgent attention is needed to incentivise property investors.

A prominent finding related to energy orientation is that strong sustainability values are highly associated with acceptance of RE sources and IG-DE solutions because the priority is to reduce reliance on fossil fuels. This contrasts with the views of those not perceiving climate change risks, as they are more discerning about the type of IG-DE solutions they support. For example, they are less supportive of wind turbines and less familiar technologies (e.g. PHEV, Fuel Cell, CCHP system) because the priority is about ensuring the socio-economic sustainability of the community. Despite the positive environmental value orientations, affordability is still flagged as the most significant barrier to IG-DE deployment for the majority of regional residents. To combat the economic barriers, policies and programs to incentivise those unable to access the subsidies for DE generation is vital. Using the revenue raised from the proposed CPRS to incentivise IG-DE solutions among the low socio-economic groups is proposed.

6.1.2. Collaborative Strategies to Drive Consumer Benefits of Smart Meters:

A key initiative identified in this study to enable IG-DE solutions among low income households is the smart meters pilot initiated by Western Power. In their attempt to reduce peak energy demands with edge of grid communities Western Power has undertaken a number of DSM strategies at no cost to consumers. The strategy involves initial deployment of smart meters without TOU tariffs to enable familiarisation with In-Home-Display and avert the adverse controversies that it is associated with higher electricity prices. These concerns reflect a University of Melbourne report which found that Victoria's smart meters roll out combined with TOU tariffs is likely to unfairly impact people who use more power during the day, including pensioners, stay-at-home parents, the sick, disabled and carers (Fyfe, 2010). By delaying the introduction of TOU tariffs and providing adequate education and training, the hope is that consumers would effectively utilise load shifting to save on costs. In spite of the strategic considerations, criticisms have been levelled at power companies, as it appears that smarts meters benefit the Utilities more than the customer as they no longer require staff to read meters or connect and disconnect power to homes (Fyfe, 2010). To attempt to combat issues of trust Western Power's Green Town project involving collaborative engagement between energy utilities and the community is expected to deliver a smoother transition toward an IG-DE system as energy consumers are being informed about how they will benefit from energy technological advancement. Ensuring that consumers actually benefit from technological change is a key imperative to promote public acceptance of IG-DE.

6.1.3. Influencing Energy Behaviours

Community interviews revealed that energy information benefitted those already committed to undertaking energy conservation because it is a salient issue. Hence, energy education in isolation appears insufficient to influence energy actions toward IG-DE. Owens and Driffil (2008) confirm that the information deficit approach may influence attitudes on issues like energy and the environment, but it often has little or no impact on behaviour. Promoting IG-DE will therefore require multi-facetted solutions, as behaviour is influenced in complex ways by a range of factors such as price, awareness, trust and commitment, including a sense of moral obligation (Devine-Wright & Devine-Wright, 2004).

To motivate energy actions, the call also includes government leadership to institute the cultural change and energy infrastructure toward an IG-DE goal. The literature also draws attention to the important influence of cultural norms, routine habits and practices, social networks, fashion (e.g. domestic lighting) and the energy technological system (e.g. washing machines) which structure patterns of daily life (Shove & Warde, 2001). Rather than solely focussing on individual level change the appeal is for more holistic solutions that also target the socio-economic and political structures that influence human behaviour. The dominant perspective emerging from the community interviews is that while it is desirable for people to live energy sustainable lives, it is also equally important that governments are accountable for energy security and supply including access to power that is affordable by those most disadvantaged in society.

6.1.4. Barriers to IG-DE - Specialist Information Sources

The lack of access to energy technology specialists also influences energy behaviours. For example while residents can source IG-DE information, access to specialist technical knowledge is lacking. While some desire objective evaluative information on the best IG-DE solutions, others also require affordable specialist energy expertise to undertake innovative EE solutions. Early adopters of innovative IG-DE solutions face numerous impediments including informational, technical and economic. To resolve these issues, calls are made for energy Utilities to provide a specialist energy advice service to incentivise residents and SMEs to deploy IG-DE solutions.

6.1.5. Approaches to Drive Energy Conservation Behaviours

This first stage revealed three major perspectives to drive energy conservation behaviours. Those perceiving extreme risk perceptions of climate change call for regulatory force to surmount community opposition, particularly over wind farm developments. Those who are altruistically motivated to live sustainably advance a more pragmatic approach, as there is less concern with Australia's small contribution to GHG emissions. Instead a long term vision for a low carbon society is proposed, based on holistic strategies that incorporate empowering processes such as consciousness raising, inculcation of energy efficient social norms, social equity, and market and policy incentives to drive green energy investments. A third perspective representing those who are externally motivated to benefit from energy technological advancement, place emphasis on policy and economic incentives. For example green energy technologies provide a significant advantage to SMEs who market their green business credentials. From this perspective deployment of IG-DE solutions is dependent on government and energy utilities' policy incentives to ease the burden on the economic bottom line.

6.1.6. Institutional Responsibility and Facilitation

While participants are accepting of IG-DE technologies, governments are attributed with the ultimate responsibility for energy reliability and supply. Those involved with the SCPWG community engagement forums also expect Western Power to play an advocacy role to influence energy policy. Those associated with green energy visions support large-scale RE developments, DE deployment and community energy initiatives as a key climate change mitigation strategy. However, the consensus is that a supportive energy regulatory and policy context is vital to increase penetration of DE including DSM initiatives. There is however, a profound lack of confidence in government to take the leadership on climate change issues. Instead there is reassuring confidence that bottom up leadership among community and environmental activists will play the lead role in advocating for changes at policy and community levels.

A second perspective reflecting those who are indifferent to climate change are more anxious about the social and economic sustainability of regional communities and advocate for socio-economic visions. From this perspective the state government and the energy Utilities are attributed with the ultimate responsibility for energy supply. While they are not opposed to IG-DE solutions, there is suspicion that DE will limit commercial developments reliant on high power demands. Given these concerns it is not surprising that socio-economic survival takes priority as climate change is not part of the regional frame of reference. These concerns also reflect a general distrust in government for devolving state responsibility to the regions that further threaten resource poor communities. To enable acceptance of IG-DE solutions, Western Power and policy makers must clarify the socio-economic concerns raised including devolution of responsibility to the community level.

6.1.7. DE and RE Sources - Drivers and Barriers

There is overwhelming support for RE sources and the deployment of DE and EE, incorporating solutions such as: solar PV, micro wind turbines, biomass, gas, hydro, geothermal, PHEV, and retro-fitting. While it is interesting to note a growing minority support for nuclear power, the three energy cultural orientations can be linked to attitudes toward coal and nuclear energy sources. For example, those perceiving climate change risks are opposed to coal and nuclear power sources, however, a sub-group who perceive a low risk to modern nuclear facilities endorse it as a viable option to tackle climate change. A third narrative represents those who are neutral to climate change concerns but place a high value to their geographic and community heritage. While this group is not opposed to coal fired power there is greater resistance to nuclear power plants due to the associated health and waste storage risks. While they are willing to deploy economically viable IG-DE solutions, it is not considered an individual or community responsibility. While there is overall policy support for RE sources, it appears that the main drivers for IG-DE are associated with high environmental values and perceptions of climate change risk. While participants are both intrinsically (e.g. environmental values) and externally motivated (e.g. combat rising electricity costs) to deploy DE generation (mainly solar PV) affordability is the biggest barrier for regional householders and businesses as the disposable income is low and the FIT is insufficient to make it a viable investment. It is clear that policy and regulatory incentives are vital to drive IG-DE solutions for regional communities.

6.2. Conclusion and Implications

This first phase of the study identified that while energy reliability is a key issue for the community, two core cultural perspectives underlie their aspiration for energy security. While the dominant perspective advances sustainable energy planning that incorporates RE sourced IG-DE solutions, it is motivated by concerns over climate change. The alternative minority perspective reflects those disinterested in climate change but desire energy security planning that is not restricted by energy source particularly if IG-DE solutions threaten social and economic sustainability. To address community concerns that IG-DE solutions will halt entrepreneurial activity as energy is finite, it is vital for Western Power to clarify the potential of IG-DE solutions and the implications for economic growth.

The phase also highlighted that participants are highly knowledgeable about IG-DE and this is linked to the influential environmentalists who have actively promoted green awareness and education. They are also politically active in support of IG-DE solutions at the regulatory level. While those with pro-environmental values support the IG-DE path it will not necessarily lead to uptake, as affordability is a key barrier. Hence, despite the steep rises in the cost of electricity, it appears that government subsidies and the current FIT is not a sufficient incentive. Nevertheless, for those who can afford to access the subsidies, the rising cost of electricity, aspiring toward a sustainable lifestyle, mitigating GHG emissions are key incentives to deploy DE.

While pro-environmental values are associated with supportive attitudes toward IG-DE solutions it is clear that many barriers exist and policies and programs are vital to incentivise the transition for residents and SMEs constrained by costs and other issues. The Green Town initiative undertaken by Western Power to promote DSM strategies including the smart meter roll out is a pertinent example of how institutions can incentivise residents toward EE and IG-DE solutions.

6.3. Community DE Initiatives – A Promising Process

This regional community proved to be a model for sustainable living and a promising case study for promoting the transition toward IG-DE. Key community leaders and environmental activists played a key role in advocating for IG-DE and DSM. Their dedication toward energy sustainability is clearly reflected by the entrepreneurial development of a community DE initiative. Despite facing numerous institutional hurdles, the developers of the DCWF are motivated to continue the quest to develop the first community owned wind farm, driven by altruism and climate change concerns. To support the development of community DE, it is imperative to institute more supportive institutional and regulatory structures that prioritize community driven and funded Renewable DE projects, as it is an ideal collective strategy to promote IG-DE.

To ensure community acceptance of DE initiatives, gaining trust from all sectors of the community is a vital first step. Walker et al (2007) also emphasize guarding against simplistic prescriptions of 'what works' and the notion that community DE projects can simply be replicated from place to place. As what is possible in one context, may not be elsewhere and in this sense understanding the social context of innovation and technology diffusion is just as important as its technical dimensions (Berkhout, 2002). Nevertheless, purposefully supporting community driven DE projects intended to achieve collective outcomes is considered a good investment. More importantly Hoffman & High-Pippert (2005) emphasized that if community RE empowers people to take action through participatory means then the: " … *accumulative outcomes of supporting more intensively participatory projects may be to create a far more positive social context for larger-scale transition towards a distributed and sustainable energy system*" (Walker, et al., 2010, p. 2663).

6.4. Process of Community Engagement

A significant and positive outcome of Western Power's community engagement approach is that its planning process can be judged as more democratic than centralised expert management (Nelson et al., 2008). While this power working group facilitated significant IG-DE solutions, more inclusive representation is vital to ensure its decisions are valid and accountable to the larger community. To improve the deliberative process facilitators with expertise to facilitate an egalitarian structure is also vital. While community feedback is vital to engage with diverse community stakeholders about an IG-DE transition, most significant is that this community engagement process has been embraced in the spirit of mutual social learning and has inspired many socio-political and economic gains. To promote inclusivity of perspectives, adopting a sustainability framework to assess the broader social, economic, environmental and governance concerns and impacts of decisions made is also recommended. Community engagement facilitated cultural change at the institutional level to respond to community aspirations. In view of the achievements, community engagement offers much promise for a path toward IG-DE solutions that can deliver a reliable and secure energy supply that does not compromise the planet.

6.4.1. Conclusions and Recommendations

While Western Power's community engagement process is a work in progress, it has significantly influenced the energy Utility's planning process to consider IG-DE solutions for regional communities. Most significant however, is that this process has led to social policy initiatives undertaken by Western Power to incentivise economically disadvantaged residents to engage with DSM solutions. As many social theorists argue, imperative is the integration of the moral and civic contribution of 'civil society' through community engagement, as it is vital to sustain institutions' effectiveness in ensuring social justice and equity for all (Pandey, 2009; Stubbs & Cocklin, 2008). Hence, social scientists can play a key role in enabling deliberative engagement as a catalyst for

social change to promote IG-DE solutions. While this study has shown that bottom up processes can promote community and institutional change, also critical are the top down policy responses to address the socio-economic factors that enhance and impede the successful transition toward IG-DE. Also important is a just process toward a sustainable energy future where decisions are evaluated against contextual considerations: such as culture, politics, geographic location, landscape and other sustainability considerations (Benecke, 2008; Lowe & Lloyd, 2001; Nelson et al., 2008). Otherwise we are gullible to the uncritical acceptance of the ideology of sustainability and democracy.

6.5. Stage 2 - SMEs Surveys of Two Regional Communities

6.5.1. Planning for Economic and Environmental Sustainability

This phase revealed that SMEs position the state of the environment on a par with economic sustainability due to their strong sense of attachment to place. Hence regional SMEs reflect a propensity to view economic and environmental sustainability as an integrated set of planning issues. While desiring holistic approaches to policy and planning, the paradox is that the majority support free competition and only a minority are philosophically opposed to the growth of a consumerist society. In light of SMEs focus on the socio-economic sustainability of regional communities, strategic policy approaches are required to incentivize the sector to surmount their economic survival concerns.

6.5.2. Environmental Beliefs and Attribution of Responsibility

While the majority of SMEs indicated high environmental values and climate change awareness, there is a diversity of response for taking responsibility for climate change and energy conservation actions. For example, while the *Hierarchists'* attribute governments with responsibility for climate change and energy issues; *Egalitarians* believe it is a personal moral responsibility and the Individualists believe it is not a personal responsibility and/or want to delegate it to others. In view of the diversity of world views, a variety of policies and programs are needed to incentivise all three cultural groups to undertake IG-DE and conservation actions.

6.5.3. Energy Policy Actions – Economic and Environmental Sustainability

A significant theme is that support for a variety of energy policy actions differ according to the energy cultural perspective. For example, while all three energy cultures support regulatory and market reforms, *Hierarchists* and *Egalitarians* support the CPRS, DE subsidies and green energy investment, and *Individualists* are opposed to a CPRS but support the MRET and technological investments such as the CC and S. While *Hierarchists* support capitalist growth, *Egalitarians* desire cultural change toward a green economy. Firstly, it is not surprising that the three cultural world views reflect support for the spectrum of politically affiliated policy actions. However, what is significant is that these strategies reflect a top down co-ordinated approach to climate change and energy policy desired by all cultural groups and which supports IG-DE solutions. Also requiring policy support are bottom-up strategies, such eco-villages and community driven DE to promote cultural change toward energy conservation at the community level.

6.5.4. Attitudes and Energy Actions - Barriers and Incentives

The result that SMEs green attitudes and awareness do not necessarily translate into concrete actions, also replicates previous social psychological findings, of a paradox that pro-environmental attitudes are not reflected in significant shifts in behaviour (Heiskanen et al., 2010; Wilhite et al., 2000). Given the complexity of attitudes, behaviours and the relationship between the two (Jackson, 2005) these findings are not unexpected. For example, while SMEs acknowledge their contribution to GHG emissions, numerous barriers to energy actions are cited. While this may appear as indifference, it actually signals a desire for institutional coordination on to act on climate change and energy issues. SMEs therefore attribute government with the responsibility to provide strong signals and incentives for more active energy behaviours. While all three cultural orientations support institutional coordination to facilitate green energy behaviours, *Egalitarians* attribute personal responsibility and collective civic action to influence governments' agenda for climate change and energy policy actions. It is however optimistic to note that the majority of SMEs indicate a personal responsibility to engage with on-site DE and are accepting of a variety of DE technologies, but deployment is dependent on economic, regulatory and informational barriers being addressed.

6.5.5. Barriers and Incentives to DE Solutions – Social Equity Issues

While SMEs desire to be energy self reliant they face numerous economic and informational barriers and strategies are needed to ensure that DE is affordable and access to evaluative technological information to make informed choices is facilitated. To address these economic barriers business models such as roof space rentals to generate electricity from company owned PV panels and micro wind turbines require institutional support.

The majority of SMEs are not in favour of punitive incentives (e.g. increasing energy tariffs) as it would pose a deleterious economic impact on the sector. In contrast a minority of SMEs support tariff increases as a key driver for DE. SMEs however do favour economic (e.g. rebates) and regulatory (e.g. mandatory EE buildings) incentives to drive DE and EE solutions. Given the high rate of SMEs who lease premises, regulatory mechanisms are considered vital to promote EE business practices. Most significant however, is that regardless of environmental and cultural worldviews, given sufficient economic incentives SMEs are willing to deploy DE and DSM options. Concern however, is raised that financial incentives would lead to sectoral inequality, as disadvantaged SMEs would not be able to access the subsidies. Addressing social inequity is a key concern and policy makers are challenged to structure the incentives fairly to enable access to low socio-economic groups.

6.5.6. Sources of energy mix – Policies and Technologies to Reduce Emissions

While there is majority support for RE sources over fossil fuels, there is minority support for coal power, based on the rationalisation that it is reliable, abundant and cheap. Nuclear power is also identified as more desirable than coal, however, Japan's Fukushima nuclear disaster has slowed the global renaissance for nuclear energy and a similar shift is expected in Australia. In general SMEs reflect sophisticated understandings of the issues and support policies and technologies that are least detrimental to the environment, economy and humans.

The CPRS is a topic of intense public debate and SMEs reflect similar confusion about its impacts including the costs and benefits of this scheme. Despite their concerns about climate change impacts, greater concern is focussed on the economic impacts of a CPRS. On the whole SMEs are cautious about the advantages of this policy, and the perception is that it is another tax burden that will benefit the polluters. There is also a lack of confidence that governments would use the funds effectively to compensate the disadvantaged and reduce GHG emissions. Policy makers face a monumental task in clarifying the impacts of CPRS to the public as their appeals must address the concerns of all cultural groups. The overall theme suggests that SMEs favour energy sources, policies and technologies that they are knowledgeable about; that is economically viable; where there is clarity about the benefits and it is less associated with social, political and environmental controversies.

6.5.7. Trust in Government Leadership – Climate Change and Energy Policy

SMEs are distrustful of both state and national government leadership on matters of climate change and energy policy. While the SMEs are undecided about the capacity of governments to deal with sustainability and energy issues, it is partially related to political allegiance but it also reflects a general frustration with the inability of governments to deliver on policy. The federal government's track record on climate change policy and the state government's lacking leadership on climate change and energy policy does not send a strong signal to SMEs to plan for an energy constrained economy. Hence, while there is conceptual support for the CPRS, there is great concern that the funds generated will be wasted and the public will suffer the economic, environmental and social consequences.

6.5.8. Information, Educational and Identity

This stage revealed that awareness of energy technology, social identify and framing of educational material is a key consideration when promoting acceptance of IG-DE and energy conservation behaviours. Firstly, while SMEs display a high level awareness about climate change and energy, their attitudes are also influenced by media debates. Secondly, although local social networks play a key role in the dissemination of information, the media and the internet are also important sources. Most significant however, is that energy information must be framed to reflect the significance of each cultural group. For example *Hierarchists* are receptive to neutral appeals that highlight the benefits of simple, practical IG-DE solutions, sourced from locally trusted government and industry organizations, as social identity is not threatened. *Individualists* are also not responsive to environmentalist appeals and are receptive to information sourced from local radio programs and community newspapers.

Egalitarians are more sceptical of media sources and will respond to eco-centric and techno-centric appeals validated by trusted scientific sources. Promoting behavioural change would therefore require communication to fit the motivational appeals of a variety of audiences. Liesbeth et al. (2010) also highlighted that promoting more sustainable and environmentally friendly energy consumption is associated with stressing the possibilities to overcome these problems rather than stressing the gravity of environmental problems.

6.5.9. Community Differences – Implications for IG-DE Deployment

What this study has revealed is that what may work in one community may not necessarily work in another as the social context must be understood. For example, the community comparisons revealed it is important that energy reliability and energy conservation is a salient issue for the community and that key community leaders are actively involved in modelling sustainable living and energy conservation behaviours. While a minority are motivated by altruistic values, acceptance and deployment of IG-DE and DSM solutions can be promoted with community engagement processes, institutional facilitation and by tapping into the community's established social capital networks, and motivational drives (Ebi & Semenza, 2008).

In larger communities like Albany where energy reliability is not an issue and where large scale energy generation and regional government infrastructure is highly visible, there is less motivation for SMEs to engage with IG-DE solutions. Where institutional facilitation and government incentives are lacking, IG-DE is further constrained as it is not a viable investment. Although rises in electricity tariffs are having an impact on the profit margin, it further erodes SMEs capacity to invest in IG-DE solutions. While SMEs are willing to change their environmental practices, economic assistance is considered vital to promote IG-DE.

When personal responsibility for energy is not high and coordination is absent SMEs have little option but to operate in isolation. Promoting active behavioural changes of both residents and SMEs toward IG-DE will require community level approaches which combine institutional facilitation with social and community networks operating as the conduit for long term change. While strong regional leadership is the key, it is also dependent on state and federal policies on energy and climate change providing the motivational drive to incentivise IG-DE solutions.

6.6. Conclusion and Recommendations

This stage revealed that SMEs face numerous obstacles to the deployment of IG-DE solutions and that economics is the major barrier. Most optimistic however, is that regardless of environmental orientation, with sufficient economic incentives SMEs are willing to deploy IG-DE and EE solutions. The literature highlights that SMEs largely operate on a survival management culture rather than a strategic management culture, therefore long-term operational changes are difficult to action (Sten et al., 2007). Promoting DE would require cultural change and models of community engagement that demonstrates the economic business case.

While many barriers remain, a civil society approach (un-coerced collective action around shared interests, purposes and values) offers great potential for combating the barriers. Civil society facilitates political advocacy and promotes community acceptance of IG-DE solutions because the issues are salient to the community. It is also conducive to inform and influence people's behaviour towards IG-DE as the process can involve face-to-face interactions where trust is high and social identity is not threatened. An IG-DE road map will require the coordinated actions of all civil society sectors incorporating government, business and community working collaboratively to advocate for change. It will require coordination, facilitation; incentives; pricing reform; regulatory reform; targets; and information as the basis for planning an integrated approach to IG-DE that incorporate visions for sustainable energy.

6.7. Stage 3 [Phase 1] – Energy Stakeholder Interviews

6.7.1. What constitutes a smart grid road map

This phase revealed two dominant perspectives to what constitutes a smart grid road map. For those endorsing the role of all four pillars (Smart Grid Road Map, IAE, 2010): (a) *Societal*; (b) *Financial*; (c) *Regulatory and Policy* and (d) *Technology*, discern *societal* as the key driving force to progress the smart grid transition. Hence, educational and financial incentives, including bottom up processes such as community DE is considered vital to promote a green economy and low carbon community. While visionary leadership is the key to enable societal level transformation, the focus is on enabling action at the grass roots level.

Those advancing the role of three pillars: (a) financial; (b) regulatory and (c) policy and technology, attribute governments and energy Utilities as playing the key role in the transformation process. Hence, government leadership and policy and regulatory reform to invigorate market mechanisms, is the key to incentivise clean energy solutions. While top down processes are central, public education is also vital. While each perspective emphasizes either top down or bottom up processes to drive the smart grid transition, there is agreement that a complementary approach is more powerful.

6.7.2. Cost/Benefit Analysis of Smart Grid

Despite the diverse conceptual understandings of IG-DE, the consensus view is that smart grid incorporates an enabling technological infrastructure, including the software and consumer engagement to promote a more energy efficient grid system. A key advantage is that flexible institutional thinking away from traditional centralized approaches is enabled as the potential for incorporating a repertoire of DG technological options is possible. As RE generation is associated with network reliability and stability issues, there is more support for DG technologies such as the CCHP systems. Nevertheless, RE sources is considered more desirable than fossil fuel, as the expectation is that network impediments will be addressed in due course.

While respondents identified the typical institutional, regulatory, economic, technical and consumer barriers to smart grid, of most concern is that policy makers lack detailed understanding of industry implications. While there is a strong advocacy for a smart grid in WA, the fear is that unquestioning support without objective assessment will severely impact the industry. The call is for a national debate around smart grid solutions to clearly define the economic costs and to prove the benefits.

6.7.3. Impediments and Related Issues

Clarity of Economic Cost Benefit Analysis

Economics is highlighted as the most significant impediment to a smart grid transition, as it is difficult for proponents to justify the costs involved with a major transformation of WA's electricity system. While the stimulus funded Californian smart grid vision is endorsed as the exemplary model for Australia, the impediment is that the magnitude of government funding required would be untenable. Hence, Australian energy utilities pursing US based smart grid innovations would need to act independently of government economic support. Until a solid transparent and justifiable business case can be demonstrated to governments and business the smart grid transition is considered a difficult ambition.

Obsolescence of Technologies

Also highlighted is that the longevity of smart grid innovations in terms of its infrastructure and products cannot be predicted. The concern is that obsolescence may be reached in a few years compared to the long term investment returns of traditional networks. Given the speed of technological change the view is that energy policy makers have a vested interest to research the costs and benefits of replacing traditional networks with new network operations that may have a limited life span.

Smart Meters and Energy Efficiency Research Claims

While many support the transition toward an integrated bilateral electricity structure, reservations are held about the associated economic and energy efficiency gains resulting from smart meter programs. While reduced consumption is dependent on consumer behaviour change, there is doubt that the massive expenditure is viable without increasing tariffs. While modelling studies demonstrate financial benefits, applied research to substantiate it is non-existent. Hence there is resistance to the theorized benefits to justify the installation of smart meters as it could pose a financial risk to the Utilities if energy reduction is not forthcoming. Given that less costly options exist to deal with critical peak periods the economics of smart meters is considered unproven.

Enabling Smart Technologies – Consumer Engagement

A key barrier is that the general population has a limited understanding of the energy grid and the emerging technological advances. To enable consumer engagement and benefit from the smart meters program, the recommendation is to incorporate time of use (TOU) pricing mechanisms with ample training and education. While the relentless price hikes have made energy a salient issue, the appraisal is that policy makers have failed to realize that the end use customer is the linchpin to a successful smart grid transition. Hence, the call is to engage with the public and prove how consumers can derive EE and economic benefits from smart grid technologies.

Energy Poverty and Balancing TOU Tariffs

While a ‘TOU’ tariff is a key instrument to influence energy behaviours there is equal concern about fairness to protect the disadvantaged groups. Many recommend a sliding scale tariff similar to the Californian model which targets the high energy consumers while it also protects the minimum lifestyle needs of those on low incomes. Social policy approaches are vital to facilitate reduction of energy consumption among those vulnerable to energy poverty. This includes options such as replacement of energy inefficient appliances, cheaper fuel sources, retrofitting and other incentives. Energy poverty must be balanced with cost reflective tariffs otherwise the artificially low prices will subsidize the high energy consumers.

6.7.4. Technical, Network, Policy and Regulatory Barriers

To address the technical, network and policy and regulatory barriers, the recommendations include a standardised approach to grid connection and technical modification to uptake excess generation capacity. To target policy and regulatory impediments a number of strategies are advanced: (a) market reforms to purchase DE and prioritize RE generation over coal sources; (b) reviewing market rules to deal with liability issues for network damage caused by residential generators and (c) enacting regulation to oblige Western Power to accommodate all residential solar generation. In summary consistent government policy is vital to ensure that DE can be accommodated on the grid.

6.7.5. Disaggregation and Incentivising Stakeholders in the Value Chain

While disaggregation is advanced as a major impediment to a smart grid system, recommendations to address it include: (a) improving the economically viability of the industry; (b) facilitating institutional planning and collaboration; and (c) clarifying the regulatory and financial incentives for Utilities to advance smart grid solutions. Other policy and regulatory reforms to incentivize stakeholders in the value chain include: (a) *revenue decoupling* for energy Retailers; (b) setting GHG emission liability to halt the Network Utilities from expanding their transmission lines; (c) incentivising Generators to switch to greener fuel sources. Facilitating a smart grid transition would also require regulatory reform to the ERA approval process to expand the frame of reference beyond economics, to also include social and environmental cost benefit analyses.

6.7.6. Addressing Institutional Barriers within WA

To address institutional barriers, a number of changes are proposed to enable visionary leadership and consciously considered funding of smart grid solutions. The recommendations include (a) policy makers and government agencies becoming knowledgeable about smart grid energy technologies and policies to enable effective and timely decisions to be made; (b) addressing staffing and resource issues to enable leading government agencies to become more operationally focussed and more strategic in outlook to drive the energy visions that are beneficial for the State; (c) undertake research and development to carefully evaluate the most feasible smart grid initiatives for the WA's energy policy context; (d) address lack of political will and cultivate visionary leadership on climate change and energy policy as a whole of government approach; and (e) promote policies that incentivise the deployment of a suite of green generation technologies that is based on cost benefit feasibility rather than powerful political lobby groups.

6.7.7. Barriers to DG – Cultural, Technological and Economic

A number of recommendations are highlighted to address institutional, informational, cultural, economics and energy source barriers. While Western Power is a key advocate for smart grid and DG solutions, they face numerous network constraints. Nevertheless, cultural change is expected to occur when the network issues are resolved, when DG is proved to be simpler and more economic. Consumers also need to be better informed of the economic benefits DG to enable genuine engagement. Commercial customers are also expected to embrace cultural change to fund generation plants as part of their long term business plan when it is accompanied by regulatory reform to the energy market structure. To promote the economic viability of small scale DG, network incentives are essential.

6.7.8. Costs and Benefits of Renewable Technologies

While RE sources is desired above coal, it is economically prohibitive for the majority of consumers. Although the rapid penetration of solar PV has been enabled by government subsidies and a high FIT, small scale wind turbines face numerous barriers. The costs associated with expensive storage, back up technologies, grid connection and technical equipment to synchronize and protect the grid are key impediments. Nevertheless, wind technology has advanced exponentially and fewer turbines are needed to generate more power. Wave power also faces a number of impediments, the technology is in its early stages, it is unproven and it is not commercially viable as yet. There is however, much optimism that Carnegie will demonstrate its commercial applicability.

6.7.9. Most Important Drivers toward IG-DE

Institutional Barriers – Leadership, Vision and Direction

A key barrier towards smart grid for WA is highlighted as politics and the policy and regulatory framework underpinning the energy industry. While the lack of political determination to drive sustainable energy solutions is considered a key barrier, there are also calls for consistency to the policy and regulatory framework. The recommendations include: (a) regulatory reform to ensure that the power network can accommodate all the residential solar power and (b) obligating Retailers to purchase its RECs in WA. Political leadership and coordination is vital to ensure the best interests for WA and the smart grid transition.

A key motivator for a smart grid transition is the capacity for networks to reduce infrastructure costs. In spite of the economic appeal of a smart grid, leadership and vision at national and state government levels is vital to drive it. While WA's energy policy issues paper "Energy 2030" is a welcome start, it will require policy makers with the energy expertise to undertake strategic planning and evaluation of the impacts to WA's energy context. Planning energy initiatives also requires the collaborative engagement of all the energy Utilities and consumers applying their core strengths to drive the policy visions.

Facilitating a Clean Energy Market: Energy Security, Research and Development

While the push to reduce peak energy demand, emissions reduction and energy security are seen as key drivers for smart grid solutions, economic and market incentives are also vital to promote the research and development of clean energy sources. The consensus is that subsidization is germane for all sectors of society to embrace the green energy path. To address the lack of funds available to energy Utilities to undertake research and development of energy innovations, collaboration between energy Utilities, business and research institutions is considered pivotal to prove economically viable IG-DE solutions. While the consensus is that proving economic benefits is the key driver, smart grid is also dependent on institutional cultural change.

6.7.10. Identifying and Prioritizing Policy/Regulatory Issues

In response to how major energy policy and regulatory issues are identified and prioritised within the energy industry, for the majority who belong to a dedicated Energy Strategy Group, energy related issues and solutions are discussed as a result of new government policy; when new concepts and products emerge in the market and when consumers request new energy efficiency products. Others however, rely on advocacy groups to highlight the policy and regulatory implications to the industry and consumers. On the whole the process involves consultation and collaboration in-house and with external stakeholders to identify the impacts for the Corporation and the customer. Some however highlight in-house political obstacles to IG-DE as there is a clear division between those supporting fossil fuel and RE sources. To overcome the politics, calls are made for more objective multi-criteria decision making processes.

6.7.11. Most Promising Process or Technology

In response to what is the most promising process or technology emerging in the industry, a number of strategies and technological developments are identified. In terms of a promising process, *community energy* is identified as playing a significant role in facilitating IG-DE solutions as community members drive the community owned energy generation initiatives and bear the associated costs. Western Power's pilot *community engagement* process is also identified as a key planning model to advocate for smart grid and community DE solutions. Also pushing the smart

grid agenda are Land Developers demanding the latest technologies to build EE commercial buildings and residential estates to gain a market edge. Also promising to support the smart grid path is the State Government's $30 million LEED fund to support research and development of a variety of energy sources including of biodiesel, geothermal, solar and wave power.

Most Promising Technologies

In terms of technological innovation, the consensus view is that *solar PV* research on solar panel efficiency and cost effectiveness is expected to progress significantly. The probability is that subsidies would not be needed in ten to fifteen years. *Wave power* is also highlighted as a promising RE source as smaller scale generation studies undertaken by Carnegie are demonstrating economic viability. *CHP* and *CCHP* generation is also identified as the ideal DG solution as it is technologically well advanced and efficient but requires prioritization by policy makers to provide RECs as it reduces carbon output by 40% and up to 60% in some cases.

While WA's *Combined Cycle Gas Turbine* plant is identified as most promising, the process of operation is considered too complicated for commercial purposes. Smaller scale *wind turbines* are also predicted as promising as it is less distracting, aesthetically pleasing and noise reduction can be engineered to be environmentally friendly. Also offering real promise are *fuel cells* which is expected to be economically feasible for small commercial enterprises and eventually residential consumers. Curtin University's *Biomass Gasification* project is also identified as a promising world leading development of RE technologies.

Although the PHEV is a promising technological advancement, the transition is considered problematic for the energy network. While it is currently not economically viable, it plays a major role for the smart grid network with its DE storage capacity. The *Home Area Network* (HAN) and *Direct Load Control* capabilities, the simplest and smaller technologies are considered significant milestones for the energy industry. While no silver bullets exist, many processes and emerging technologies are promising, however political lobbying by interest groups to promote a narrow repertoire of technologies is concerning.

6.7.12. Making IG-DE Attractive to the Business World

The key theme is that DG will be attractive to the business world when it is economically competitive to fossil fuel sources. To ensure that the energy industry is economically viable, recommendations include government incentives and a greater educative process to inform the sector of the options that are economically feasible. Currently the relentless increase in electricity tariffs is expected to motivate the commercial energy consumers toward DG as it is economically viable as a long term investment but it requires cultural change.

On the whole respondents found it very difficult to ascertain how IG-DE can be made more attractive to the business world as there is a paucity of applied research to guide the industry. Nevertheless, energy Utilities implement IG-DE solutions for a variety motivations including: (a) to reduce the peak energy demand, (b) avoid paying higher prices during peak times, (c) meeting RET and RECs liability obligations and (d) offering customers choice of green energy. While the MRET is credited with motivating the development of large scale RE, this type of policy instrument constrains innovative thinking because management is focussed on meeting obligations and future planning is not a priority.

While Utilities target specific IG-DE strategies to exploit associated economic and efficiency gains, no clear guidelines exist about how it can be made more attractive. The key step to make it attractive to the business world involves policy makers understanding and demonstrating the real costs and benefits to the networks and ensuring that customers benefit from the technological advances. Most important however is that the process must begin with genuine debate at state and federal levels about the costs and benefits including implications of smart grid for the WA context.

6.7.13. Energy Governance Structure and Sustainability Planning

The consensus is that WA's energy governance structure is a sound model however delivering transformational change toward a smart grid requires institutional actors with vision and technical expertise to play an immediate policy and regulatory role. There is a strong belief that the energy industry operates under a narrow regulatory framework and the call is to incorporate a triple bottom line approach, particularly to the ERA process as it focuses to heavily on the economic bottom line. Under the ERA regime long term visions are constrained because social and environmental gains are excluded. The call is for policy makers to go beyond economic rationalism by adopting a sustainability decision making framework.

6.7.14. Key Information Sources

On the whole energy stakeholders rely heavily on networking activities, conferences, the internet and media sources to access the latest information on smart grid and DG technology, access to research publications is limited. While there is some interaction with climate change and resource management government agencies, there is less contact with university based research institutions. Commercial customers and engineering consultants are also important sources for knowledge on the latest energy related technologies. Strategies are needed to promote dissemination of technological knowledge among energy stakeholders.

6.7.15. Influential Stakeholders – Inclusive Representation

While state and federal governments are attributed with the most influence over the energy policy, Western Power is considered the lead advocate for smart grid and DG solutions. Other major stakeholders, such as the ERA, Office of Energy, Horizon, Verve, Synergy and Treasury also have voice over policy and regulatory issues in WA. Although CSIRO and Universities are also identified as influential leaders, WACOSS and ACOSS are highlighted as playing a lead advocacy role to represent energy poverty issues to ensure that energy policy is linked to social policy measures.

6.7.16. Playing a More Significant Role – Community Stakeholders

With regard to playing a more significant role, customers are highlighted as the key players in progressing toward a smart grid transition. It is therefore imperative for consumers to be engaged with energy decisions that affect their lifestyle. As customer needs are a top priority, Utilities also need to advocate on their behalf to ensure that their voice is heard at the policy and regulatory levels. Despite the political impediments, all energy Utilities desire collaboration and playing a more significant role in strategic planning and policy development of smart grid and DG solutions. Retailers and consumers' advocates also need to play a role in regulation and policy to address issues of inequity. The Electricity Retailers Association of Australia is also identified as a key stakeholder that needs to be involved in policy and regulation development. The Chamber of Commerce and Industry and Chamber of Minerals and Energy WA are also identified as playing an increasing role in policy and regulation.

6.7.17. Forming Closer Ties - Exclusion of WA

Respondents express the view that WA energy stakeholders are generally excluded from national energy policy development and debates as the majority of the Utilities are not invited and the issues are NEM focussed. This exclusion impedes engagement, communication and collaboration among all the energy Utilities. To ensure that WA is included in the national energy governance process, forming closer ties with some of the influential federal government departments leading the charge on energy policy is considered vital. Forming closer ties with research institutions such as CSIRO and major Universities in WA and nationally would also facilitate research and development opportunities and access to the latest energy knowledge.

6.7.18. Conclusions

While respondents have highlighted a number of issues and impediments to a smart grid transition within WA's energy regulated context, there is still much optimism that the process will be driven by visionary leadership stemming from both top down and bottom processes and that the path towards transformation is promising as the benefits far outweigh the costs in the long term. The process however needs to be driven by a decision making process that includes some of the following (a) policy makers with knowledge and expertise; (b) research that demonstrates the implications, costs and benefits; (c) sustainability criteria that assesses the economic, social and environmental consequences of the transition; (d) a national debate that clearly defines the economic costs and proven benefits and (e) community engagement with the smart grid technological transition.

6.8. Stage 3 [Phase 2] – Energy Stakeholder Surveys

6.8.1. Issues, Drivers and Barriers of IG-DE

While numerous economic, policy and regulatory and political barriers presents a challenge to an IG-DE transition, it will not impede the industry's deployment of viable solutions. For example, while there is consensus (85 per cent) that: "*the economic value of IG-DE is not clearly defined and differs across different jurisdictions*", only 45 five per cent think that the issue of commercial viability poses a barrier to the industry. Hence, while the majority believe that the economic value of IG-DE is ambiguous, there is optimism that the economic constraints will be conquered with the right policy framework. While awareness and education is considered a barrier to IG-DE, only a minority (40 per cent) believe that: "*IG-DE is less reliable than grid supply*". The majority of respondents place less emphasis on the technological impediments and highlight policy and regulatory uncertainty and lack of political will as a greater limitation to IG-DE. As this excerpt echoes: "*... lack of clear governance arrangements … lack of incentives for retailers and generators … energy prices are not cost reflective ...*"

6.8.2. Key Drivers and Enablers of IG-DE

While environmental imperatives to reduce GHG emissions, is a key driver for IG-DE, economic enablers, such as: "*promoting cost effectiveness*" and "*creating a fair and predictable investment environment*" is considered vital to transform the energy industry. The majority also highlight that "*network efficiency*", "*cost savings*" and "*peak demand reductions*" are a key motivational force for the industry to pursue IG-DE solutions. Other key drivers toward an IG-DE transition include the deployment of technological advancements such as "*smart meters*" combined with "*cost reflective tariffs*". However, the recommendation is for energy networks to incorporate broader decision making frameworks where IG-DE is recognized as a genuine alternative. The IG-DE process is

also highly dependent on regulatory and policy certainty on energy generation and efficiency, and emission reductions including government leadership and coordination. Qualitative quotes also demonstrate a call for institutional drivers and enablers that incorporate: "*regulatory reform to promote a triple bottom line approach*"; and "*collaborative (government-private sector) investment arrangement on DE".*

Qualitative Responses - Single Most Important Driver for IG-DE

The single most important driver for IG-DE involves institutional and regulatory reforms. While proving the economic viability of IG-DE and establishing the right price signals is a central theme, government leadership and policy direction combined with collaboration between state agencies is also considered vital to the process. Although the capacity for networks to defer infrastructure investment is considered a key driver, the concern is that IG-DE may not be captured by the network and/or recognized by the Regulator. Also considered a driver of IG-DE is the rising cost of electricity which will motivate customers to seek alternative energy generation solutions. From this perspective achieving customer buy-in is considered a key driver and the industry needs to be equipped to meet growing customer demands. The efficient use of scarce commodities is also considered an important driver for policy makers.

6.8.3. Energy Source and Technology Mix for Australia

With regard to fuel source, technological and strategic approaches viable for Australia's electricity system, there is overwhelming support for the deployment of "*solar photovoltaics*" including "*peak demand management"* and "*energy efficiency*". While there is higher levels of support for the development and deployment of "PHEVs"; "*CHP systems*"; "*solar thermal*" and "*wind power*", there is also mid to high level support for: "*energy storage"*; "*geothermal"*; "*wave power"*, "*centralized gas-fired generation"* and "*micro wind turbines"*. While RE sources and technologies are highly favoured, there is less support for micro wind turbines. In general there is less support for the more controversial and expensive sources and technologies, which include: "CCS*";" fuel cells";* "*nuclear power";" hydroelectric power"* and "*biomass".* Given respondents preferences for sources and technologies that are economically, socially and environmentally responsible it is not surprising to find these options are considered more conflictive for Australia.

The qualitative responses reveal less support for "*fuel cells*" because retail gas is expensive making it economically not viable. Other options desired for Australia, include the use of "*super conducting cables"* and "*direct use heat displacement facilities"* or "*low temperature geothermal"*.

6.8.4. Qualitative Responses: Most promising Technology/Process

The most promising technology/process in the near term (five to ten years) include the following: (a) the *PHEV* as the most popular choice; followed by (b) *smart meters* and the *smart grid* infrastructure in parallel with (c) *electricity market reform*, *cost reflective pricing* and *live retail tariffs*. While *energy efficiency, energy conservation* and *energy storage* are important strategies*;* other promising solutions comprise "*geothermal power"," super conducting cables",* and a combination of *"solar and wind power with battery storage".* Also vital to the process is "*incentivising"* all stakeholders toward this goal.

6.8.5. Influential Players in Energy Policy in WA

With regard to who has influence and who should be playing a larger role over policy and regulation, respondents highlighted that: (a) Western Power; (b) the State Government; (c) Department of the Prime Minister and Cabinet; (d) Ministerial Council of Energy (MCE) and the Federal Minister have a strong influence. However, while Western Power is attributed with having greater influence, stakeholders believe that it is the State Government that needs to play a greater role in policy and regulation in WA.

With regard to other key players, while the majority identify the "*Business Council of Australia*" as having some level of influence over policy and regulation, the view is that the "*Office of Energy*" should be playing a greater role. While the *ERA*, *Department of Climate Change*; *Verve Energy* and the *Independent Market Operator* (IMO) are attributed with having some influence over policy and regulation, there is less support for these stakeholders to play greater role.

Qualitative responses also reveal the following as having influence in policy and regulation: (a) *Synergy* and *Horizon Power*; (b) consumer advocates, *WACOSS*; (c) *consumers*, *contractors* and *project/land developers*; (d) *Local Government*; (e) *Universities* assisting in setting the agenda and (f) *State Planning Bodies*.

6.8.6. Stakeholders Who Should Play a More Significant Role

With regard to who should play a more significant role in energy policy and regulation, the following stakeholders are identified as enabling deployment of technological innovation: (a) *CSIRO*; (b) *Council of Australia Governments* (COAG*)*; (c) *Clean Energy Council* and (d) *Energy Networks Association*. There is however, less support for those perceived as vested interest groups or lacking technical knowledge. For example, the following stakeholders are viewed less favourably: (a) *Local Government*; (b) *Environmental Groups*; (c) *Local Community Representatives* and (d) *Non-Technical Stakeholders*.

Qualitative responses highlight the following stakeholders needing to play a more significant role to ensure a diversity of voices are heard by policy makers: (a) *WACOSS /ACOSS;* (b) *Department of Resources, Energy and Tourism (*DRET*)* and *Department of Climate Change and Energy Efficiency* (DCCEE); (c) *Office of Renewable Energy Regulator* (ORER); (d) *Customer feed-back* passed on to Retailers, Networks, Generators and Regulators; (e) *State Planning Bodies* and (f) *Local business groups*.

6.8.7. Conclusion

Although the energy stakeholders highlight a number of economic, market, institutional, political, policy and regulatory, cultural, educational, technological and technical barriers, confidence is high about the advancement of IG-DE, as the benefits outweigh the impediments. Respondents also identified a number of drivers and enablers that facilitate the energy industry's transformation process. However, much emphasis is placed on leadership, and collaboration between government, industry, business and research institutions to promote the technological advancements and developments that will overcome the economic, institutional and technical barriers.

While proving the economic viability of IG-DE is regarded as the single most important driver for IG-DE, government leadership and policy direction including collaboration between state and federal agencies is considered vital to the process. Although economic drivers exist for networks to capitalise on IG-DE, institutional and regulatory recognition of the benefits is central to the goal. A key driver for IG-DE is the preparedness of the energy industry to engage with commercial and residential consumers seeking alternative energy generation solutions driven by rising electricity tariffs.

With regard to promising technologies, while the PHEV is considered a promising advancement, also vital to the transformation are the *smart meters* and the *smart grid* infrastructure. Although *energy efficiency, energy conservation* and *energy storage* are elements of the IG-DE package, other features include market, policy and regulatory incentives to enable the process of change for all energy stakeholders.

While governments and associated energy stakeholder groups are attributed with having influence over energy policy and regulation, respondents want a greater role to be played specifically by the State Government and the Office of Energy to set the agenda for an IG-DE transition. On the whole respondents believe that diverse stakeholder voices including consumer advocates need to be heard by policy makers. However there is less support for vested interest groups such as Environmentalists and other non-technical stakeholders to play a greater role in policy and regulation.

7. INTEGRATED CONCLUSION AND RECOMMENDATIONS

Integrating the findings of the three research stages have emerged with recommendations that fit the framework developed by Dunstan, Langham & Ison (2009) for policy options to promote the transition towards DE. Following are recommendations for an IG-DE road map that reflect the themes highlighted by the multi-sector stakeholders who participated in this study. The policy palette by Dunstan et al. (2009) comprise of seven categories: (1) Coordination; (2) Facilitation; (3) Incentives; (4) Pricing Reform; (5) Regulatory Reform; (6) Targets; and (7) Information. These categories are used more broadly to capture the strategies desired by the stakeholders to facilitate the path towards IG-DE including visions for sustainable energy.

7.1.1. Coordination

At the policy level, the key theme is the desire for certainty on the management of climate change, sustainable energy and economic stability. The stakeholders also appeal for strong leadership and commitment by all tiers of government to undertake institutional coordination toward a low carbon economy that includes IG-DE solutions. Based on this study, it is clear that the transition toward IG-DE would require policy options that cater to all three cultural orientations who favour a mixture of market solutions, taxation and subsidies. Most importantly however is the acknowledgement that affordability is the greatest barrier facing householders and SMEs, as current subsidies and the feed-in-tariff is not economically viable. Also important is social policy that complements energy policy to promote equity among energy consumers, as government assistance is vital to address growing energy poverty issues.

7.1.2. Facilitation

In terms of facilitation community engagement by energy Utilities offers a greater potential for IG-DE deployment as the economic, regulatory, and technical barriers can be addressed through institutional facilitation. This study also revealed that engaging with stakeholders at the community level promotes both institutional trust and the salience of IG-DE solutions. However, promoting community acceptance of IG-DE technologies will require an *inclusionary governance process* along with a sustainability framework to balance economic development, social equity and environmental protection.

Bottom-up approaches also play crucial role in activating problem awareness and attribution of personal responsibility. For example community owned DE offer an important means by which communities can work together to reduce emissions collectively. A strong civic culture enhances the capacity for behavioural change by activating altruistic moral norms. Obviously there are limitations to a decentralised governance approach to promote IG-DE solutions however it does offer the capacity to work within a sustainability framework that addresses local needs for environmental protection, economic development and social equity.

Decentralised governance of energy planning also requires all levels of government to work collaboratively on IG-DE solutions otherwise projects like the community-owned DE face lengthy delays due to regulatory, cultural, technical, economic and political barriers. Gaining trust and working collaboratively with of the Local Government and the community is also vital for salience and advocacy of IG-DE solutions at the local level.

7.1.3. Incentives

While it is vital for a suite of financial and technological incentives to be available for those able to afford DE, equally important are schemes that address the needs of those who are financially disadvantaged. Business initiatives such as the “roof space rentals” are well suited. One significant barrier faced by many regional SMEs is they are time and resource poor. Even if they desire IG-DE solutions they are limited by staff and resources to undertake the action. It would be feasible through a range of government and energy Utility programs to secure the resources of local environmental and industry organizations to provide free on-site energy consultations to SMEs. It is important to note that cultural orientation in terms of energy attitudes is an important characteristic. As community engagement processes must ensure that the right informational appeal is used to facilitate energy actions of diverse cultural orientations.

While some SMEs are altruistically motivated to adopt DE solutions, many are capitalizing on sustainability initiatives to increase value to the business and their reputation. Apart from the Chamber of Commerce and Industry, the Small Business Development Corporation (SBDC) also represents a key organization to advocate for IG-DE solutions as they report an increase interest in green practices among the SMEs sector. The drivers toward an environmental shift can also be attributed to the increasing pressure from supply chain partners and consumers for green credentials. In fact many large corporations now require supply-chain partners to adopt ecologically sound practices, so the pressure will be on for SMEs to comply. In view of these incentives it is prudent to facilitate access to energy consultants that can assist them toward DE solutions.

7.1.4. Pricing Reform

While there is conceptual support for the Carbon Pollution Reduction Scheme there is a lack of trust in government to effectively utilise the funds to address climate change and energy issues. There is overall support by stakeholders to restructure the feed-in-tariff to ensure that DE is economically viable and there is also some level of support for a gross feed-in-tariff.

7.1.5. Regulatory Reform

While economic drivers exist for networks to capitalise on smart grid, institutional and regulatory recognition of the benefits is considered vital. Also essential are market, policy and regulatory incentives including broader governance frameworks to promote planning that benefits the industry, consumers and the state in the long term.

Community energy developers also desire regulatory reform to address institutional and administrative barriers by streamlining the application process to access government funds to begin the implementation phase of the community DE initiative.

Many SMEs who rent premises also call for regulatory reforms to mandate minimum requirements for energy efficient buildings.

7.1.6. Targets

To meet the twin demands of the community who want a focus on reduction of GHG emissions and the energy Utility’s focus on reducing the peak power demand a program initiated by Western Power has set a community target of a 10 per cent reduction in energy usage. This program entitled “beating the peak” facilitates the community residents to reduce their energy usage through a variety of IG-DE and DSM solutions.

7.1.7. Information

This study has shown that climate change beliefs and high environmental values are not associated with active energy behavioural actions. While economics is identified as the greatest barrier to DE, informational barriers also exist as many SMEs are unsure about the most appropriate way to reduce GHG emissions. The process of information dissemination however, needs critical analysis. While a public informational campaign in isolation is not expected to change behaviour, strategies can be adopted to increase motivation for energy behavioural change.

For example accessing information about the technological benefits and economic incentives needs to be expanded to ensure that diverse identity groups can acquire this information from their own trusted community networks.

While environmental organizations play a lead role in devising educational campaigns that appeal to all three cultural orientations, the expectation is that this information will be promoted by community and industry groups where social identify is not threatened. Another key initiative launched by Western Power to address information barriers is the one stop “Green Town Energy Services Shop” which offers energy advice to the community. These types of processes which involve a two-way flow of knowledge are held to be more fruitful than top-down communication which treats the public as passive recipients (Hoffman & Pippert, 2010).

8. REFERENCES

Abrahamse, W., Steg, L., Vlek, C., Rothengatter, T. (2005). A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology, 25*, 273–291.

Agyeman, J. & Evans, B. (2004). 'Just sustainability': the emerging discourse of environmental justice in Britain? *The Geographical Journal, 170(2)*, 155-164.

Aitken, M. (2010). Why we still don't understand the social aspects of wind power: A critique of key assumptions within the literature. *Energy Policy, 38*, 1834–1841.

Ashworth, P., Pisarski, A. Littleboy, A. (2006). *Understanding and Incorporating Stakeholder Perspectives to Low Emission Technologies in Queensland*. Final Report, November, Centre for Low Emission Technology, CSIRO.

Barry, J., Ellis, G., Robinson, C. (2008). Cool rationalities and hot air: a rhetorical approach to understanding debates on renewable energy. *Global Environmental Politics, 8*(2), 67–98.

Berkhout, F., 2002. Technological regimes, path dependency and the environment. *Global Environmental Change, 12*, 1–4.

Biggart, N.W., Lutzenhiser, L. (2007). Economic sociology and the social problem of energy inefficiency. *American Behavioral Scientist, 50*, 1070–1087.

Bijker, W.E., Hughes, T.P., Pinch, T.J. (1986). *The Social Construction of Technological Systems*. MIT Press, Cambridge, M.A.

Boholm, A., 1996a. A critique of cultural theory. *Ethnos, 61,*(1), 64–84.

Boholm, A., 1996b. Risk perception and social anthropology: critique of cultural theory. *Ethnos, 68*(2), 159–178.

Broffenbrenner, U. (1979). *The Ecology of Human Development*. Cambridge, MA: Harvard University Press.

Bulkeley, H., Watson, M., Hudson, R. (2007). Modes of governing municipal waste. *Environment and Planning A,39*, 2733–2753.

Calderon, E. J. (2000). An applied method for the assessment of sustainability of urban pilot projects. *Environmental Impact Assessment Review, 20,* 289-298.

Carr-Cornish, S., Ashworth, P. Gardner, J. & Fraser, S. (2008). *A Self-Organised Map (SOM) Analysis of Distributed Energy Acceptance*. Report Prepared for: The Intelligent Grid Project, P2008/819, CSIRO.

Carson, L. (2009). Deliberative public participation and hexachlorobenzene stockpiles. *Journal of Environmental Management 90*, 1636–1643.

Carson, L., Hartz-Karp, J. (2005). Adapting and combining deliberative designs: juries, polls, and forums. In: Gastil, J., Levine, P. (Eds.), *The Deliberative Democracy Handbook: Strategies for Effective Civic Engagement in the 21st Century*. Jossey-Bass, San Francisco, CA, pp. 120–138.

Stokes, D., Chen, H. & Revell, A. (2007). *Small businesses and the environment: turning over a new leaf?* A Report for the Workspace Group PLC March 2007. Kingston University: Surrey

UK.

Christens, B. & Perkins, D.D. (2008). Transdisciplinary, Multilevel Action Research to Enhance Ecological and Psychopolitical Validity. *Journal of Community Psychology, 36*(2), 214-231.

Condon, L. 2004. Sustainability and small to medium sized enterprises- How to engage them. *Australian Journal of Environmental Education, 20*, (1), 57-67.

Delanty, G. (2003). *Community*. Routledge, London.

Devine-Wright, P. (2007). Energy citizenship: psychological aspects of evaluation in sustainable energy technologies. In: Murphy, J. (Ed.), *Framing the Present, Shaping the Future: Contemporary Governance of Sustainable Technologies*. Earthscan, London, pp. 63-86.

Devine-Wright, H., Devine-Wright, P. (2006). Prospects for smart metering in the UK. In: Jamasb, T., Pollitt, M., Nuttall, W. (Eds.), *Future Electricity Technologies and Systems*. Cambridge University Press, Cambridge.

Devine-Wright, P. (2005a). Beyond NIMBYism: towards an integrated framework for understanding public perceptions of wind energy. *Wind Energy, 8*(2), 125-140.

Devine-Wright, H., Devine-Wright, P. (2004). From demand side management to demand side participation: towards an environmental psychology of sustain- able electricity system evolution. *Journal of Applied Psychology 6*(3–4), 167–177.

Douglas, M. (1970). *Natural Symbols*. Routledge, London.

DTI. (2006a). Our Energy Challenge: Securing Clan Affordable Energy for the Long Term. UK Department of Trade and Industry, London.

Dunstan, C., Langham, E. & Ison, N. (2009). *20 Policy Options for Developing Distributed Energy*. Working Paper 4.2 (Version 1). *iGrid*Project 4, Institute for Sustainable Futures, University of Technology, Sydney.

Ebert, P.R. (1999). *"Stakeholder Management" Ignore it and your wind farm may never happen*. In: Proceedings of the 1999 Australian Wind Energy Conference, pp. 44–50. Available at /http://www.daws.com.au/Downloads/Papers.htmlS

Ebi, K.L.,Semenza.,J.C. (2008). Community-based adaptation to the health impacts of climate change. *American Journal of Preventative Medicine, 35*(5), 501–507.

Ellis, G., Barry, J. & Robinson, C. (2007). Many ways to say 'no', different ways to say 'yes': applying Q-Methodology to understand public acceptance of wind farm proposals. *Journal of Environmental Planning and Management, 50*(4), 517–551. Energy4All. http://www.energy4all.co.uk/.

Eurobarometer. (2008). *Attitudes of European citizens towards the environment*. Special Eubarometer 295/Wave 68.2, TNS – Opinion & Social, March, European Commission.

Flyvbjerg, B. (2001). Making Social Science Matter: Why Social Enquiry Fails and How it can Succeed again. Cambridge University Press, Cambridge, pp. 57–60

Fyfe, M. (2010). *New smart meters not so smart*. The Age, May 23, accessed from: http://www.theage.com.au/victoria/new-smart-meters-not-so-smart-20100522-w31c.html

Fudge, S., Peters, M., & Sinclair, P. (2010). Mobilising community action towards a low carbon future: Opportunities and challenges for local government in the UK. *Energy Policy, 38*, 7596–7603.

Gardner, J., Dowd, A., Mason, C. & Ashworth, P. (2009). *A framework for stakeholder engagement on climate change adaptation*. Climate National Adaptation National Research Flagship: Working Paper No. 3, CSIRO. http://www.csiro.au/resources/CAF-working-papers.html.

Gardner J, Ashworth P. 2007. Public Attitudes Towards Electricity Alternatives: Results from a Survey of Australian Households. CSIRO. P2008/944.

Gardner, G., Stern, P.C. (1996). *Environmental Problems and Human Behavior*. Pearson Custom Publishing, Boston, MA.

Gardner, J. & Ashworth, P. (2007). Public Attitudes toward Electricity Alternatives: Results from a Survey of Australian Householders. P2008/944, October, CSIRO.

Geiselhart, K. (2004). Digital Government and Citizen Participation Internationally. Pavlichev, A. and Garson, G. D. (Eds.) *Digital Government: Principles and Best Practises*. Hershey: Idea Group Publishing.

Geller, H., Harrington, P., Rosenfeld, A.H., Tanishima, S., Unander, F. (2006). Policies for increasing energy efficiency: thirty years of experience in OECD countries. *Energy Policy, 34*, 556–773.

Giddens, A. (1991). *Modernity and Self Identity*. Polity Press, Cambridge

Glaser, B.G. (1998). *Doing Grounded Theory: Issues and Discussions.* Mill Valley, CA: Sociology Press.

Glaser, B.G. (1992). Basics of Grounded Theory Analysis: Emergence versus forcing. Mill Valley, CA: Sociology Press.

Glaser, B.G. (1978). Theoretical sensitivity: Advances in the Methodology of Grounded Theory. Mill Valley, CA: Sociology Press.

Glaser, B.G., Strauss, A.L. (1967). *The Discovery of Grounded Theory*. Aldine, Chicago.

Greenpeace. (2007). Decentralising Scottish Energy: Cleaner, Cheaper More Secure Energy for the 21st Century. Greenpeace, London.

Gubbins, N. (2007) Community energy in practice. *Local Economy, 22*(1), 80–84.

Gubbins, N. (2008). Community ownership models for renewable energy projects. In: Conference presentation, '*Practical Solutions to Scotland's Renewable Energy Challenges*', Edinburgh, 29-1-2008.

Guy, S. (2006). Designing urban knowledge: competing perspectives on energy and buildings. *Environment and Planning C: Government and Policy, 24*, 645–659.

Haggett, C., Smith, J., (2004). 'Tilting at Windmills? *Using discourse analysis to understand the attitude–behaviour gap in renewable energy conflicts*. Paper given at the British Sociological Association Conference, York, 22–24, March.

Haggett,C.,Toke,D. (2006). Crossing the great divide—using multi-method analysis to understand opposition to wind farms. *Public Administration, 84*(1), 103–120.

Hall, W.A. & Callery, P. (2001). Pearls, Pith, and Provocation, Enhancing the Rigor of Grounded Theory: Incorporating Reflexivity and Relationality. *Qualitative Health Research, 11*(2), 257-272.

Halpern, D., Aldridge, S. and Fitzpatrick, S. (2002). *Social Capital: a discussion paper*.

Performance and Innovation Unit, London.

Hanley, N. & Nevin, C. (1999). 'Appraising Renewable Energy Developments in Remote Communities: the case of the North Assynt Estate, Scotland'. *Energy Policy, 27*, 527-547.

Harvey, D. (1996). Justice, Nature and the Geography of Difference. Blackwell, Oxford.

Heiskanen, E., Johnson, M., Robinson, S., Vadovics, E. & Saastamoinen, M. (2010). Low-carbon communities as a context for individual behavioural change. *Energy Policy, 38*, 7586-7595.

Herbert, S. (2005). The trap door of community. *Annals of the Association of American Geographers 95*(4), 850–865.

Hillary R. (2000). Small and Medium-Sized Enterprises and the Environment. Greenleaf: Sheffield.

Hodson, M., Marvin, S. (2009). Cities mediating technological transitions: under- standing visions, intermediation and consequences. *Technology Analysis and Strategic Management, 21*(4), 515–534.

Hoffman, S.M. & High-Pippert, A. (2010). From private lives to collective action: Recruitment and participation incentives for a community energy program. *Energy Policy, 38,* 7567-7574. Collective Action

Hogwood, B.W. & Gunn, L.A. (1984) *Policy analysis for the real world*. Oxford, Oxford University Press.

Hulme, M. (2009). *Why We Disagree on Climate Change*. Cambridge University Press, Cambridge.

Hvelplund, F. (2006). Renewable energy and the need for local energy markets. *Energy, 31*(13), 2293-302.

International Energy Agency (IAE). (2010). *Roadmap towards a Smart Grid*. Retrieved December , 2010, http://blog.iaee.org/?p=1008

Jackson, T. (2005). Motivating sustainable consumption: a review of evidence on consumer behaviour and behavioural change. Report to the Sustainable Development Research Network. University of Surrey, Centre for Environmental Strategy, Guildford, Surrey, UK.

Jackson, T. (2005). *Motivating Sustainable Consumption: A Review of Evidence on Consumer Behaviour and Behavioural Change*. A Report to the Sustainable Development Research Network, Sponsored by Defra UK.

Jessop, B. (1998). The Rise of Governance and the Risks of Failure: The Case of Economic Development'. *International Social Science Journal, 155*, 29-46.

Jordan, A. (2006). The environmental case for Europe: Britain's European environmental policy. UEA: EDM Working, 2006–2011.

Karl, T.R., & Trenberth. K E. (2003). Modern Climate Change. *Science* 302 (5651), 1719-1723.

Kasperson, J.K., Kasperson, R.E., Pidgeon, N., Slovic, P. (2003). The social amplification of risk: assessing fifteen years of research. In: Pidgeon, N., Kasperson, R.E., Slovic, P. (Eds.), *The Social Amplification of Risk*. Cambridge University Press, Cambridge.

Kasperson, R.E., Golding, D., Kasperson, J.K. (1999). Risk trust and democratic theory. In: Cvetkovich, G., Lofstedt, E. (Eds.), *Social Trust and the Management of Risk*. Earthscan, London.

Kates, R.W. Parris, T.M. & Leiserowitz, A.A. (2005). What is sustainable development?: Goals, indicators, values and practice. *Environment, Science and Policy for Sustainable Development,* 47, 8-21.

Kellett, J. (2007). Community-based energy policy: a practical approach to carbon reduction. *Journal of Environmental Planning and Management, 50*(3), 381–396.

Kolk, A. (2008). Sustainability, Accountability and Corporate Governance: Exploring Multinationals' Reporting Practices. *Business Strategy and the Environment, 18*, 1-15.

Kollock, P. (1998). Social dilemmas: the anatomy of cooperation. *American Review of Sociology, 24*, 183–214.

Kollmuss, A. & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behaviour?. *Environmental Education Research, 8*(3), 239–260.

Kurz, T. (2002). The Psychology of Environmentally Sustainable Behaviour: Fitting Together Pieces of the Puzzle. *Analysis of Social Issues and Public Policy, 2*(1), 257–258.

Lave, J. & Wenger, E. (1991). *Situated Learning and Legitimate Peripheral Participation*. Cambridge University Press, New York.

Lincoln, Y.S. & Guba, E.G. (2000). Paradigmatic controversies, contradictions and emerging confluences. In N.K. Denzin & Y.S. Lincoln (Eds.), *Handbook of qualitative research* (2nd Ed.). New Delhi: Sage.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry.* Beverly Hills, CA: Sage Publications.

Long, T. (1998). The environmental lobby. In: Ward, P., Ward, S. (Eds.), *British Environmental Policy and Europe*. Routledge, London.

Lovins, A. (1977). *Soft Energy Paths*. Penguin, Harmondsworth, UK.

Lutzenhiser, L. (1993). Social and behavioral aspects of energy use. *Annual Review of Energy and the Environment, 18*, 247–289.

Mackenzie, A.F.D. (2006). Aworking land: crofting communities, place and the politics of the possible in post-Land Reform Scotland. *Transactions of the Institute of British Geographers, 31*(3), 383–398.

Madill, A., Jordan, A. & Shirley, C. (2000). Objectivity and reliability in qualitative analysis: Realist, contextualist and radical constructionist epistemologies. *British Journal of Psychology*, 91, 1-20.

Maniates, M. (2002). Individualisation: plant a tree, buy a bike, save the world?. In: Thomas Princen, Michael Maniates, Ken Conca (Eds.), *Confronting Consumption*. MIT Press, Cambridge.

Marshall, C. and Rossman, G. B. (1995). *Designing Qualitative Research*. London: Sage.

McIntyre, J. (2004). Facilitating Critical Systemic Praxis (CSP) by Means of Experiential Learning and Conceptual Tools. *Systems Research and Behavioural Science, 21,* 37-61.

McGuirk, P.M. (2001). Situating communicative planning theory: context, power, and knowledge. *Environment and Planning A, 33*, 195–217.

Mendoca, M., Lacey, S. & Hvelplund, F. (2009). Stability, participation and transparency in renewable energy policy: lessons from Denmark and the United States. *Policy and Society,*

27, 379-398.

Milton, K. (1991). Interpreting environmental policy: a social scientific approach. *Journal of Law and Society, 18*(1), 4–17.

Milton-Kelly, E. (2004). No great breakthroughs have ever been achieved by taking things seriously: a festschrift for Michael Thompson, Marco Verweij and Steven Ney. *Innovation: The European Journal of Social Science, 17*(1), 1–37.

Moloney, S., Horne, R.E. & Fien, J. (2010). Transitioning to low carbon communities—from behaviour change to systemic change: Lessons from Australia. *Energy Policy, 38*, 7614–7623.

Moragues-Faus, A.M. & Ortiz-Miranda, D. (2010). Local mobilisation against wind farm developments in Spanish rural areas: New actors in the regulation arena. *Energy Policy, 38*, 4232–4240.

Morse, J.M. (1991) Strategies for Sampling. In J.M. Morse (ed.) *Qualitative Nursing Research: A Contemporary Dialogue*. Sage: California (pp. 127-145).

Mumford, J. & Gray, D. (2010). Consumer engagement in alternative energy - Can the regulators and suppliers be trusted? *Energy Policy*, (in press). www.elsevier.com/locate/enpol

Munasinghe, M. (2009). *Sustainable Development in Practice: Sustainomics Methodology and Applications.* Cambridge: Cambridge University Press.

Nelson, R., Howden, M. & Smith, M.S. (2008). Using adaptive governance to rethink the way science supports Australian drought policy. *Environmental Science & Policy, 11*, 588-601.

ODPM. (Office of the Deputy Prime Minister). (2004). *Planning Policy Statement: Renewable Energy*. TSO, London.

O'Dwyer,W.,Leeming,F.,Cobern,M.,Porter,B.,Jackson,J.M. (1993). Criticalreview of behavioural interventions to preserve the environment research since the 1980s. *Environment and Behaviour, 25*(3), 275–321.

O'Hara, K. (2004). *Trust – From Socrates to Spin*. Cambridge: Icon Books.

O'Neill, J. (1997). "Value Pluralism, Incommensurability and Institutions." In *Valuing Nature?: Ethics, Economics and the Environment.* J. Foster (Ed). New York: Routledge.

Opotow, S. (1997) What's fair?: justice issues in the affirmative action debate. *American Behavioral Scientist, 41*(2), 232–245.

O'Riordan, T., Jordan, A. (1999). Institutions, climate change and cultural theory: towards a common analytical framework. *Global Environmental Change, 9*(2), 81–93.

Owens, S. & Driffill, L. (2008). How to change attitudes and behaviours in the context of energy. *Energy Policy, 36*, 4412-4418.

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

Patterson, W. (2007). Keeping the Lights on: Towards Sustainable Electricity. Earthscan, London.

Patton, M.Q. (1990). Humanistic psychology and humanistic research. *Person-Centred Review, 5,* 191-202.

Peel, D., Lloyd, M.G. (2007). Positive planning for wind-turbines in an urban context. Local Environment: *The International Journal of Justice and Sustainability, 12*(4), 343–354.

Pendergraft, C. (1998). Human dimensions of climate change: cultural theory and collective action. *Climatic Change, 39*(4), 643–666.

Petty, R. & Cacioppo, J. (1986). Communication and Persuasion: Central and Peripheral Routes to Attitude Change. Springer-Verlag, New York.

Potts, T. (2010).The natural advantage of regions: linking sustainability, innovation, and regional development in Australia. *Journal of Cleaner Production, 18*, 713–725.

Peters, M., Fudge, S. & Sinclair, P. (2010). Mobilising community action towards a low-carbon future: Opportunities and challenges for local government in the UK. *Energy Policy, 38*, 7596–7603.

Peters, M.,Fudge,S. (2008). Motivating individual carbon reduction through local government-led community initiatives in the UK proceedings: sustainable consumption and production: framework for action, 10th–11th March, Brussels, Belgium. Conference of the Sustainable Consumption Research Exchange (SCORE!) Network, supported by the EU's 6th Framework Programme. Online at:/http://www.score-network.org/files/24121_CF2_session_3-4.pdf#page=20S.

Pittock, A. B. (2006). "Are Scientists Underestimating Climate Change?". EOS, *Transactions American Geophysical Union,* 87, 34, 340-341.

Pittock, A.B. (Ed.). (2003). *Climate Change: An Australian Guide to Science and Potential Impacts.* Prepared for the Australian Greenhouse Office: Canberra, ACT. Retrieved March 30, 2008, http://www.greenhouse.gov.au/science /guide/index.html

Pope-Davis, D.B., Toporek, R.L., Ortega-Villalobos, L., Ligiéro, D.P., Brittan-Powell, C.S., Liu, W.M., Bashshur, M.R., Codrington, J.N. & Liang, C.T.H. (2002). Client Perspectives of Multicultural Counseling Competence: A Qualitative Examination. *The Counselling Psychologist, 30*(3), 355-393.

Prilleltensky, I. & Nelson, G. (2002). Doing psychology critically: Making a difference in diverse

settings. Basingstoke: Palgrave Macmillan.

Productivity Commission. (2005). *The Private Cost Effectiveness of Improving Energy Efficiency*. Productivity Commission, Melbourne, p. 7616.

Punch, K.F. (1998). Introduction to Social Research: Qualitative and Quantitative Approaches, London: Sage.

Redclift, M. (2010). Review comment. In: Peters, M., Fudge, S., Jackson, T. (Eds.), *Low Carbon Communities: Imaginative Approaches to Combating Climate Change Locally*. Edward Elgar, Cheltenham, in press, anticipated publication date July 2010

Reid, R. (2009). The Moral Imperative for Sustainable Communities. *Public Management, 91*(4), 27-31.

Rhodes, R.A.W. (2007). *Understanding Governance*. Open University Press, Buckingham.

Robinson, J. & Herbert, D. (2001). Integrating climate change and sustainable development. *International Journal of Global Environmental Issues,* **1**(2), 130-148.

Rogers, J.C., Simmons, E.A., Convery, I. & Weatherall, A. (2008). Public perceptions of opportunities for community-based renewable energy projects. *Energy Policy, 36*, 4217–4226.

Rogers, E.M. (1995). *Diffusion of innovations*. (4th Ed). Free Press: New York.

Rohracher, H. (2001). Managing the technological transition to sustainable construction of buildings: a socio-technical perspective. *Technology Analysis & Strategic Management, 13*, 137–150.

Rossman, G.B. & Wilson, B.L. (1994). "Numbers and words revisited: being 'shamelessly eclectic'." *Quality and Quantity*, *28*, 315-327.

Saastamoinen, M. (2009). *Samsø—renewable energy island programme, Denmark*. Case study for WP2 (Analysis of success factors, underlying models and methods of target group interaction) of the ECFP7 project CHANGING BEHAVIOUR (contract213217). Online at: /http://www.energychange.infoS Case studies.

Sandelowski, M. (2000). Focus on Research Methods: Combining Qualitative and Quantitative Sampling, Data Collection, and Analysis Techniques in Mixed-Method Studies. *Research in Nursing & Health, 23*, 246-255.

Schumacher, E.F. (1974). Small is Beautiful: A Study of Economics as if People Mattered. Sphere, London.

Schwarz, M., Thompson, M. (1990). *Divided we Stand: Redefining Politics, Technology and Social Choice*. Harvester Wheatsheaf, Hemel Hempstead.

Shipworth, M. (2000). *Motivating Home Energy Action: A handbook of what works.* Prepared for the Australian Greenhouse Office, Australian Greenhouse Office, Canberra.

Shove, E. (2006). Chapter 20 efficiency and consumption: technology and practice. In: Jackson, T. (Ed.), *The Earthscan Reader in Sustainable Consumption*. Earthscan, UK and USA, pp. 293.

Shove, E. (2003). Converging conventions of comfort, cleanliness and convenience. *Journal of Consumer Policy, 26*, 395–418.

Shove, E., Warde, A. (2001). Inconspicuous consumption: the sociology of consumption, lifestyles and the environment. In: Dunlap, R., Buttel, F., Dickens, P., Gijswijt, A. (Eds.), *Sociological Theory and the Environment: Classical Foundations, Contemporary Insights*. Rowman and Littlefield, Lanham, MD, p. 230–241.

Silverman, D. (2001). Interpreting qualitative data : methods for analysing talk, text, and interaction. (2nd Ed.), London: Sage Publications.

Sjöberg, L. (2000). Factors in risk perception. *Risk Analysis, 20*(1):1-11.

Smith, A. (2006). Niche based approaches to sustainable development: radical activists versus strategic managers. In: Voss, J.P., Bauknecht, D., Kemp, R. (Eds.), *Reflexive Governance for Sustainable Development*. Edward Elgar, Cheltenham.

Sperling, K., Hvelplund, F. & Vad Mathiesen, B. (2010). Evaluation of wind power planning in Denmark: Towards an integrated perspective. *Energy, 35*, 5443-5454.

Stamford,M. (2004). *Community ownership: the best way forward for UK wind power*. M.Sc. Dissertation, University of East Anglia, Norwich. /http://www. uea.ac.uk/env/all/teaching/eiaams/pdf_dissertations/2004/Stamford_Mike.pdfS.

Stott, P.A. Stone, D.A. & Allen, M.R. (2004). Human Contribution to the European Heatwave of 2003. *Nature,* 432*,* 610-614.

Stoker, G. (2002). Life is a lottery: new Labour's strategy for the reform of devolved governance. *Public Administration, 80*(3), 417–434.

Stokes, D., Chen, H. & Revell, A. (2007). *Small businesses and the environment: turning over a new leaf?* A Report for the Workspace Group PLC March 2007. Kingston University: Surrey UK.

Strachan, P.A., Lal, D. & von Malmborg, F. (2006). The evolving UK wind energy industry: critical policy and management aspects of the emerging research agenda. *European Environment 16*, 1–18.

Strauss, A., Corbin, J. (1998). *Basics of qualitative research: techniques and procedures for developing grounded theory.* (2nd Ed.) Sage Publications, Thousand Oaks, London, New Delhi.

Strauss, A. & Corbin, J. (1994). Grounded theory methodology: An overview. In N. Denzin & Y. Lincoln (Eds.), *Handbook of qualitative research* (pp. 273-285). Thousand Oaks, CA: Sage.

Strauss, A. & Corbin, J. (1990). Basics of Qualitative Research: Grounded Theory, Procedures and Techniques. Thousand Oaks, CA: Sage.

Swan Catchment Council. (2008) *Regional Light Industry Survey, Albany WA*. Great Southern Employment Development Committee Inc, Great Southern Area Consultative Committee WA Inc.

Swofford, J. & Slattery, M. (2010). Public attitudes of wind energy in Texas: Local communities in close proximity to wind farms and their effect on decision-making. *Energy Policy, 38*, 2508–2519.

Szarka, J. (2004). Wind power, discourse coalitions and climate change: breaking the stalemate? *European Environment, 14*(6), 317–330.

Szatow, A., Ashworth, P., Dowd, A.M., Rodriguez, S. & van Kasteren, Y. (2009). *Distributed Energy and its stakeholders: Making sense of the distributed energy landscape in Australia*. National Research Flagships, CSIRO Publications, August.

Thøgersen, J. (2005). How may consumer policy empower consumers for sustainable lifestyles?. *Journal of Consumer Policy, 28*, 143–177.

Thompson, M., Ellis, A. & Wildavsky, A. (1990). *Cultural Theory*. Westfield Press, Oxford.

Thompson, M., Rayner, S. (1998). Risk and governance part 1: the discourse of climate change. *Government and Opposition, 33*(2), 139–166.

Toke, D. (2005c). Community wind power in Europe and in the UK. *Wind Engineering, 29*, 301-308.

Toke, D. (2002). Wind power in the UK and Denmark: can rational choice help explain different outcomes? *Environmental Politics, 11*(4), 83-100.

Turner, B.L., Matson, P.A. & Mccarthy, J.J., et al. (2009). *Illustrating the coupled human-environment system for vulnerability analysis: Three case studies*. Proceedings of the National Academy of Sciences of the United States of America, Vol 100, No. 14, 8080-8085.

Valentine, S. (2010). Braking wind in Australia: A critical evaluation of the renewable energy target. *Energy Policy, 38*, 3668–3675.

Verweij, M., Thompson, M. (2006). Clumsy Solutions for a Complex World: Governance, Politics and Plural Perceptions. Palgrave Macmillan, Basingstoke, UK.

Walker, G. (2008). What are the barriers and incentives for community-owned means of energy

production and use? *Energy Policy, 36*(12), 4401–4405.

Walker, G. & Cass, N. (2007). Carbon reduction 'the public' and renewable energy: engaging with socio-technical configurations. *Area, 39*(4), 458–469.

Walker, G., Devine-Wright, P., Hunter, S., High, H. & Evans, B. (2010). Trust and community: Exploring the meanings, contexts and dynamics of community renewable energy. *Energy Policy, 38*, 2655–2663.

Walker, B., Redmond J. & Goeft, U. (2007). *Bellevue Sustainable Industry Project*. Small & Medium Enterprises Research Centre, ECU and the Swan Catchment Council, August.

Walker, G., Hunter, S., Devine-Wright, P., Evans, B. & Fay, H. (2007a). Harnessing community energies: explaining and evaluating community-based localism in renewable energy policy in the UK. *Global Environmental Politics 7*, 64–82.

Warren, C.R. & McFadyen, M. (2010). Does community ownership affect public attitudes to wind energy? A case study from south-west Scotland. *Land Use Policy, 27*, :204-217.

Warren, C.R. & McFadyen, M. (2009). Does community ownership affect public attitudes to wind energy? A case study from south-west Scotland. *Land Use Policy*, 26, (in press).

Warren, C.R. & Lumsden, C. (2008). Familiarity breeds content? Public perceptions of wind power in the Scottish Borders. In: Galbraith, C.A., Baxter, J.M. (Eds.), *Energy and the Natural Heritage*. TSO Scotland, Edinburgh, pp. 259–264.

West, J., Bailey, I. & Winter, M. (2010). Renewable Energy Policy and Public Perceptions of Renewable Energy: A Cultural Theory Approach. *Energy Policy, 38*, 5739–5748.

Widavsky, A. (1987). Choosing preferences by constructing institutions: a culture theory of preference formation. *American Political Science Review,81*(1), 3–21.

Wilhite, H., Shove, E., Lutzenhiser, L., Kempton, W. (2000). The legacy of twenty years of energy demand management: we know more about individual behaviour but next to nothing about demand. In: Jochem, E. (Ed.), *Society, Behaviour, and Climate Change Mitigation*. Kluwer Academic Publishers, Dordrecht, pp. 109–126.

Williams, W. & Lewis, D. (2005). Convergent interviewing: a tool for strategic investigation. *Strategic Change, 14,* 219-229.

Willmott, P. (1987). *Friendship Networks and Social Support*. Policy Studies Institute, London.

Wolsink M. (2007). Wind power implementation: the nature of public attitudes: equity and fairness instead of backyard motives. *Renewable and Sustainable Energy Reviews, 11*,1188-207.

Woods, M. (2003). Conflicting environmental visions of the rural; windfarm development in Mid-Wales'. *Sociologia Ruralis, 43*(3), 271–288.

Wüstenhagen, R., Wolsink, M. & Bürer, M.J. (2007). Social acceptance of renewable energy innovation: an introduction to the concept. *Energy Policy, 35*(5), 2683–2691.

Yergin, D. (1991). *The Prize*. Simon & Schulster, Sydney.

9. APPENDIX A

Curtin University – *iGrid* Research Cluster Project 5

9.1.1. Community Engagement Evaluation – SCPWG Committee

What do you think are the ***main aims and goals*** of Western Power's community engagement process? Response:
How would you describe the ***level of community input*** with regard to planning the energy visions of the Denmark and Walpole community? Response:
3. What do you think about the ***level of community influence*** over the types of strategies and technologies targeted to promote local visions for energy generation and reduction of greenhouse gas emissions? Response:
4. What are your thoughts about the **Denmark Community Wind Farm** as a strategy for a local community energy generation project? Response:
5. With regard to the **Green Town Project**, what are your thoughts about the process and outcomes associated with the following strategies: (a) Appliance Survey: Response: (b) CFL (Compact Fluorescent Light Bulbs) Replacements: Response (c) Community Education/Forums: Response

(d) **Beat the Peak** – Community Education Strategy

Response:

6.What are your thoughts about the following strategies:

(a) Setting and Measuring the ***10% Energy Reduction Target*** for the Denmark community?

Response:

(b) The proposed offer of free ***replacement of household appliances*** with more **energy efficient** Hot Water Systems and Stoves?

Response:

(c) Proposed ***fuel switching*** program:

Response:

(d) Smart metering trials:

Response:

(e) ***Load control project***: (residents pre-select appliances that are remotely switched off during peak periods).

Response:

7. Do you have ***any recommendations*** to improve the community engagement process to plan for future energy sustainability?

Response:

8.What are your thoughts about the usefulness of the ***SCPWG network*** to advance other community initiatives: e.g. Compilation of a Directory with energy efficiency funding, resources and local suppliers.

Response:

9. **Anything else** you will like to add: Response:

SECTION 2 - PLEASE RATE THE FOLLOWING ACTIVITIES

1=Poor; 2=Satisfactory; 3=Neutral; 4=Good; 5=Excellent

Place number next to statement:

Statements
1.Relevant information is provided by Western Power to committee members to make informed decisions:
2.Western Power listens to the needs and aspirations of committee members:
3.This committee is set up to represent the wishes of the community:
4.Western Power facilitates the following: Community is ***encouraged*** in planning energy strategies- Provides access to ***experts*** in the field of energy- Provides access to ***technological*** expertise- Provides assistance for ***funding*** of energy projects- Provide access to ***external networks*** and resources- Reports ***decisions*** of SCPWG to committee members- Reports ***decisions*** of SCPWG to other relevant community stakeholders-
5.The SCPWG meetings are **structured** to provide opportunities for good levels of Information sharing- informed discussion of the issues- representative decision-making- feedback and follow-up-
6.The meetings are well facilitated by an ***independent*** facilitator -

10. APPENDIX B

See Separate File Attachment for Appendix B.

11. APPENDIX C

(Energy Stakeholder Interview Questions -adapted from CSIRO Report by Szatow, et al., 2009 – with permission)

Distributed Energy (DE) involves generation of electricity where it is needed using a variety of low emission energy sources (e.g. solar panels, wind power, wave power) and it also involves the adoption of Energy efficiency technologies and practices to reduce energy usage. [other related concepts – Intelligent Grid; Smart Grid]

1. What do you see as the key impediments or barriers to DE overall?

2. What do you see is the single most important driver for DE?

3. What do you see are the key enablers for DE overall?

4. How are major policy/regulatory issues identified and prioritised in your department? If you are not in a government department, how do you perceive these to be identified and prioritised?

5. How does the department/government (if external) go about forming policies/regulations to address the issues identified? If you are not in a government department, how do you perceive these to be formed?

6. What do you see as the **technology**/**process** that is **most promising** in the near term (5 – 10 years)?

7. What is it that you need to see to make DE attractive to your business/world?

8. Who are the key contacts or information sources you rely on to gain information about DE?

9. Which people, governments departments/agencies or businesses that you know, have the **most influence** over policies/regulations/ decision making affecting DE?

10. Who (individuals and/or organisations) would you like to see **play a more significant role** in regulation and policy development around DE?

11. Who would you like to establish **closer ties with** in order for you to address the issues highlighted in the interview?

12. Is there a question you thought I would have asked but I have not?

13. Is there anyone else/any other organisation that you have not mentioned that you think is imperative to informing our research?

14. What is the ideal decision-making structure to promote a transition toward smart-grid solutions.

12. APPENDIX D

Perth Forum Participants Survey – Drivers and Barriers to IG-DE

Please select the category that best describes your professional status.

☐ Academic ☐ Consultant ☐ Generation Retailer

☐ Local Government ☐ Market Operator ☐ Network Company

☐ NGO ☐ Peak Body (Please state) _____

☐ Policy Maker ☐ Regulator ☐ Stakeholder_____

☐ Other (Please state) _____

1. Please select ☑ your level of agreement that the following are impediments or barriers to IG-DE solutions overall.

Statements	Strongly Disagree	Tend to Disagree	Neither Agree or Disagree	Tend to Agree	Strongly Agree
1. The value of IG-DE is not clearly defined and differs across different jurisdictions, regulatory compliance requirements also change.					
2.IG-DE Projects/technologies are not commercially viable as yet. (e.g. lack of carbon price, low energy costs, low returns and reliability issues).					
3.Policy and regulatory uncertainty, bias and consistency.					
4.Lack of political will to finance and/or set the right policy.					
5.Cultural bias, traditional mindset, lack of industry knowledge, skills and understanding of IG-DE					

alternatives.					
6.Lack of consumer/decision-maker awareness, education and understanding of the value of IG/DE and the issues it faces.					
7.IG-DE is perceived as less reliable than grid supply.					
8.Difficulties with connection to the main grid (unnecessary and complex compliance requirements by networks).					

12.1.

Other impediments (Please state): ----------

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2. Please select ☑ your level of agreement that the following are key drivers or enablers for IG-DE solutions overall.

Statements	Strongly Disagree	Tend to Disagree	Neither Agree or Disagree	Tend to Agree	Strongly Agree
1.Reducing carbon emissions and environmental impact.					
2.Regulatory/policy certainty for energy produced, reduced losses and emission standards.					
3.Creating a fair and predictable investment environment.					
4.Promoting Cost effectiveness (either by reducing costs of existing technology or increasing cost of centralised energy).					

5.Network efficiency and cost savings (e.g. emission reductions and peak demand reductions).					
6.Increased Mandatory Renewable Energy Targets (MRET) that captures small scale generation.					
7. Recognizing IG-DE as a genuine alternative to network solutions as part of network planning, building and investment process.					
8.Resolving connection issues (grid connection process/costs, managing power quality, safety, etc)					
9.Incentive structures (e.g. Carbon Price; Subsidies, Feed in Tariffs).					
10.Smart Meters (real time price signals).					

Other drivers or enablers (Please state):

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3. What do you see is the single most important driver for IG-DE solutions?

Please select ☑ your level of agreement that the following energy source and technology mix is a viable option in Australia?

Statements	Strongly Disagree	Tend to Disagree	Neither Agree or Disagree	Tend to Agree	Strongly Agree
1.Solar power (PV/Thermal)					
2.Biomass					
3.Wave power					
4.Wind Farm					
5.Micro wind (for niche applications)					
6.Hydroelectric power					
7.Fuel cells					
8.Geothermal					
9.Electric Vehicles					
10.Coal with carbon capture & storage					
11.Nuclear Power					

Other options (Please state)

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5. What do you see as the technology/process that is most promising in the near term (5 – 10 years)?

Please select ☑ your level of agreement that the following people, governments,

departments/agencies or businesses have central influence over policies/regulations/decision making affecting IG-DE in Western Australia?

Stakeholders	Strong Influence	Some Influence	No Influence	Not Applicable
State Government				
Department of Climate Change				
Network of Business and Companies				
Department of the Prime Minister and Cabinet				
Federal Ministers (e.g. Penny Wong)				
Office of Energy, Western Australia				
Independent Market Operator (IMO)				
Economic Regulation Authority of WA (ERA)				
Western Power				
Ministerial Council of Energy (MCE)				
Verve Energy				
Business Council of Australia (BCA)				

Other Influential Stakeholders: (Please state)

Please select ☑ your level of agreement that the following (individuals and/or organisations) should play a more significant role in regulation and policy development around IG-DE?

Stakeholders	Strongly Disagree	Tend to Disagree	Neither Agree or Disagree	Tend to Agree	Strongly Agree
Environmental Groups					
Council of Australian Governments (COAG)					
Clean Energy Council (CEC)					
Australian Greenhouse Office (AGO)					
CSIRO					
Local Government					
Local Community Representatives					
Non-Technical Stakeholders					
Energy Networks Association (ENA)					

12.2.

Other individuals and organizations: (Please state)

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8. Any further Comments?

