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Australian Local Government Responses to Climate Change

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EXECUTIVE SUMMARY

Climate change is a global trend and Australia is no exception. In fact, Australia is one of the most vulnerable countries that will be impacted by climate change due to its unique geographic and sociodemographic characteristics. Local government, at the forefront of combating climate change, is facing a great challenge, as well as great opportunities to adopt adaptation strategies.

This paper conducts an environmental scan of how Australian local government addresses climate change. The main findings of this paper are:

"Community Power" – A Green Energy Buyers' Alliance

"Community Power" is a consumer driven, grass roots movement, designed to mobilize local residents to direct the energy retailer to buy more green power. It works as a collective agreement between local residents and the energy retailer. Local residents will sign up for a mix of green power and traditional power (such as 50% green power and 50% traditional power). Energy retailers are required to buy the same percentage of green power as the resident signed up for (Moreland Foundation, 2007).

Although "Community Power" is still in an earlier stage (1,000 households have signed up for the program), it is very promising for the future, since it connects the dotted line between the end user and the energy provider. With more households signing up with similar programs, energy providers will have to invest more into renewable energy research and production. Therefore, it is a very powerful measure to combat climate change and energy consumption.

Resource Conservation Fund – A Self-Growing Revolving Fund

Some Australian city councils have started interesting experiments in a self-growing fund for climate change and energy conservation. Seed money was invested into small scale, local energy saving projects. The annual savings from the energy bill will be put back into this fund pool to support more projects. This revolving fund has been proved to be very effective in that it has low risk and high yield. Typically this kind of project can save 20% to 50% of annual energy consumption. The input/output ratio is very encouraging (Municipal Association of Victoria, 2007).

Planning is an important tool to managing climate change

Many Australian local governments are good at using planning to proactively manage climate change. For example, some cities have changed their outdoor working hours from 8am to 5pm to 6:30am to 3:30pm. In that way, outdoor workers can avoid the hottest hours and still get the job done (Municipal Association of Victoria, 2007).

Regarding long-term planning, some municipalities have started to update their development plan to reflect the climate change scenario. For example, some cities have

added additional buffer zones on top of the typical Q100 level (the level of the 100year average return interval flood) to manage the sea level rise (Municipal Association of Victoria, 2007).

Public campaigns on climate change are very useful to building momentum

There are a lot of small tips that can help local residents and businesses save energy and address climate change. Public campaigns that distribute this useful information to the targeted population are very important and effective in achieving the results. For example, some cities launched innovative public forums to encourage behavior changes in local communities. Show bags that contain useful information and practical tools to track use of energy have been given to local residents and business (Municipal Association of Victoria, 2007).

In summary, there are a lot of valuable lessons that B.C. and other jurisdiction can learn from Australian local governments to address climate change. With more information becoming available, a more mature and consistent approach can be found for local government to address climate change.

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Background

Climate change is a global trend and Australia is no exception. The Third Assessment Report of the Intergovernmental Panel on Climate Change pointed out that Australia is one of the most vulnerable countries to the affects of climate change (Intergovernmental Panel on Climate Change (IPCC, 2001). This conclusion is based on the geographic and sociodemographic characteristics of Australia (such as current climate pattern, poor soils, vulnerable ecosystems and population concentrated in coastal areas).

As the Australia Bureau of Meteorology points out; Australia is experiencing rapid climate change. Its temperature has increased 1 °C with increased heat waves and decreased frost and cold days since the middle of the 20th century. The rainfall pattern also changed dramatically across different regions. Climate change will affect communities and human behavior in a deep and fundamental way (Bureau of Meteorology, 2007).

Local government as the representative of local communities has a mandate in public safety and health, infrastructure maintenance, emergency response and community planning. It is local government's responsibility to plan for the impact of climate change and take all the necessary adaptation measures to ensure the safety and sustainability of the communities into the future. Local government can do so by making changes to their own activities as well as using their planning powers, spending policies and community and business links to influence households and businesses to change their behaviors.

Purpose of the Paper

This paper will conduct an environmental scan of how Australian local governments prepare for climate change in terms of adding climate change elements into their core functions as well as developing specific adaptation policies and pilot projects in their communities. The focus of the paper is on answering three major research questions:

1. What are Australian local governments doing in anticipation of climate change, i.e. planning for its impact by lessening the negative consequences?

2. Of all possible actions a local government could take, which set would give the greatest return on investment?

3. What actions have already made a difference or are most promising independent of efficiency considerations?

Structure of the Paper

To answer these three questions, this paper starts from a review of Australian local government strategies on climate change in terms of asset management, economic and growth, environment and public health, disaster management and cultural/recreational activities.

Second, this paper chooses five major climate change elements (decreasing rainfalls, increasing temperatures, sea level rise, cyclones and storms, and droughts) that will influence Australia to examine what action plans have been adopted to adapt to those changes.

Third, this paper summarizes what policy matrix Australian local government has used to address climate change. The policy matrix includes regulation, information, incentives, service delivery and partnership.

At the end of the paper, a tentative answer has been given to the first research question. There is no conclusive evidence at this stage to answer the second and third research questions.

Approach of the Paper

The approach of the paper includes a literature review and case studies. Websites of major Australian cities have been searched. Related state, national climate change agencies and climate change advocacy group websites have also been reviewed. Cases of how Australian local governments address specific climate change elements have been studied and the findings have been reported in this paper.

FINDINGS

As the main body of this paper, the findings part has been broken down into three sections. The first section will take a look at Australian local government strategies in terms of considering climate change in every major aspects of their mandates, namely asset management, economic growth, environment and public health, disaster management and cultural and recreational activities.

The second section will examine what specific technologies or policies Australian local government has adopted to face the challenges of climate change. Five major climate change elements (decreasing rainfalls, increasing temperatures, sea level rise, cyclones and storms, and droughts) that will be witnessed most severely in Australia have been identified and specific adaptation measures will be discussed.

The third section switches to another perspective and discusses what policy tools are available for Australian local government to choose from to respond to climate change. These policy tools have been grouped under regulation, information, incentives, service delivery and partnerships.

Section One: Local Government Climate Change Strategies

As Figure 1 shows, all of the major roles and responsibilities of local government elected mayors and councils will potentially be affected by climate change (Local Government Association of Queensland, 2007). This will include the assets they managed, the service they provided and the policy they developed. It is particularly important for local government to take a proactive role in managing climate change because one of the climate change patterns is that it will vary regionally. This variation will require different local governments to respond differently. The effective solution will depend on different communities' priorities, resources and capabilities.

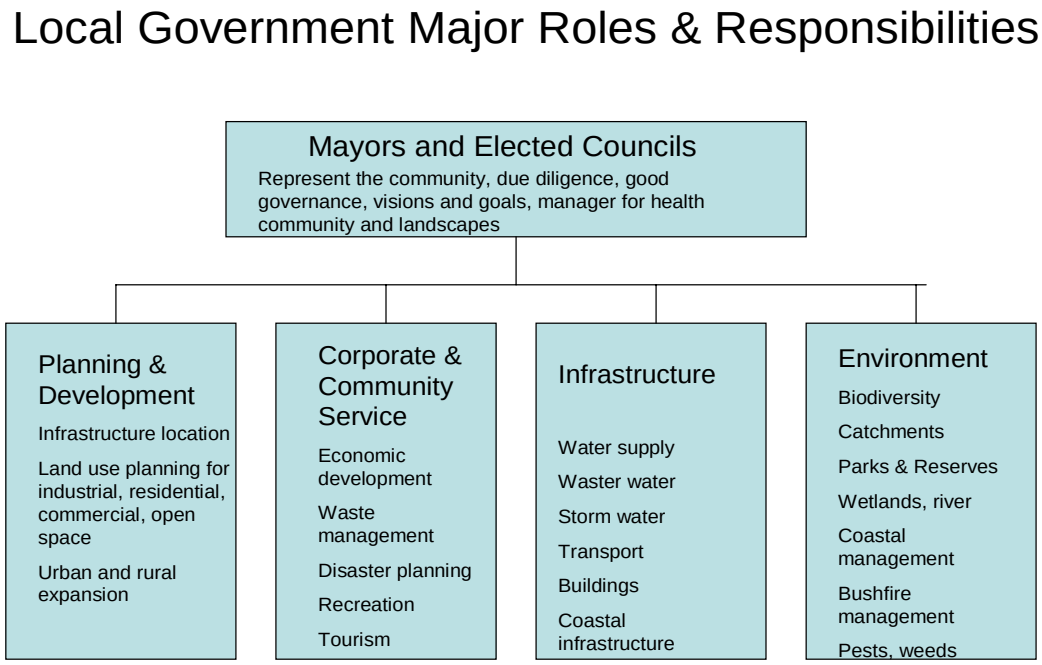

Figure 1 : Local government major roles & responsibilities, adapted from "adapting to climate change – A Queensland local government guide"

Climate Change and Asset Management

Asset management is one of the key mandates of local government. Essential infrastructures such as roads, bridges, water, waste water, and buildings could all be severally damaged in extreme climate events such as storms, floods, winds or droughts. It is local government's responsibility to maintain these infrastructures to a standard that can withstand natural disasters. In the long term, all essential infrastructures should factor in climate change elements. For example, waste water treatment plants should consider the potential reduced volume of waste water and increased nutrition of waste water.

Manningham City Council has some successful experience in achieving energy savings in city buildings. In 2004, it invested $100,000 to install an Eco-Tracker software, which can collect real time energy consumption data and automatically send the data to designated city staff. This has helped the city council identify a couple of energy saving opportunities, such as some fine-tuning of the configuration of heat, ventilation and air-conditioning systems, use of fresh air to replace air conditioning when the outside temperature is below 20 degrees and use of motion sensors to automatically shut off air conditioning when no one is in a room (Municipal Association of Victoria, 2007).

The cost benefit analysis is very encouraging. With a capital cost of $100,000, the estimated annual energy saving is $43,000. Since 1991, the city building has increased its size from 5,000 sq m to 6,200 sq m and the number of staff and activities level has also increased, but the city is still able to achieve energy savings on a 1991 level (Municipal Association of Victoria, 2007).

Climate Change and Economic Growth Management

A local community's continued prosperity depends on economic growth. Climate change can make the community less desirable to live in. Decreased water supply can significantly limit population growth and economic activities. It is crucial for local government to develop some economic policy to guide the local business switch to a sustainable growth model and direction.

Moyne Shire Council has a pilot energy efficiency program, launched at small businesses at Port Fairy. The council successfully convinced 40 small businesses to sign an energy performance contract with an energy service company, who will provide energy audit and energy saving programs to the participated small business. The council received a $40,000 grant from the Victorian Green House Strategy Action Plan and it used part of the money to subsidize the energy audit (small business pay $100 for a $1000 audit) and the energy saving program (Municipal Association of Victoria, 2007).

The energy performance contract guarantees that participating small businesses achieve the expected energy savings. In the event that the saving was not achieved, the contract has a clause to ensure a full refund to participating small businesses. The expected energy

savings range from 20% to 50% of small businesses' annual energy consumptions (Municipal Association of Victoria, 2007).

Climate Change and Environment and Public Health Management

Climate change (temperature increase, storms, etc.) may increase vector-borne diseases, which will jeopardize public health. Natural environment, such as rivers, wetlands, lakes could also be changed due to climate change. As a result, plant, fauna species and ecosystem at large could be in danger over time.

The City of Sydney has developed a comprehensive environment management plan. In that plan, specific targets for energy and emissions, water, waste, plants and animals have been set up. Action plans to achieve these targets are carried out. For example, the city itself has set up a target to reduce the use of water, waste, electricity and increase the use of recycling materials (City of Sydney, 2007).

In terms of public health, one measure Sydney has taken is to adopt a pesticide notification plan. This pesticide notification plan requires the city to notify community members anytime a pesticide is used in city outdoor public spaces. Signs will be placed at noticeable places wherever a pesticide is used. Sensitive places such as schools and hospitals have been registered under a special clause of pesticide regulation. Additional protection will be applied in these sensitive places (City of Sydney, 2007).

Climate Change and Disaster Management

Besides those gradual, long-term climate change impacts such as temperature increase and rainfall decrease, the frequency and intensity of extreme events will also increase. Storms, floods or cyclones can destroy the road network and isolate certain communities. Residents and visitors may be in greater danger during these extreme events. It is local government's responsibility to provide emergency response services to local residents and visitors. Public safety will always remain the top priority for municipalities.

In March 2006, cyclone Larry (category five tropical) affected 20,000 Queenslanders over seven shires and left thousands of them homeless. Victims had to be waiting in the rain for hours before any government relief fund ($50 to $150) could be received. It prompted an emergency service review conducted by all levels of governments. The review pointed out that in the event of something like extreme weather, local communities alone can not face the challenge. A vulnerability mapping of potential high risk areas needed to be done and evacuation plans needed to be updated to reflect the climate change scenario. In the long term, a national early warning system needs to be set up to face the challenge (Queensland Department of Emergency Services, 2007).

One measure that local government can do to help residents in the event of an extreme weather is to provide comprehensive information on how to deal with such a situation.

For example, the Australian capital territory emergency service has a comprehensive website to inform the residents what they should do before the storm, during the storm, and after the storm. It tells residents how to identify the early warning signals, what they can do to seek shelter during the natural disaster and how to find emergency service after the disaster (A.C.T. Emergency Services Agency, 2007).

Climate Change and Cultural/Recreational Activities

Local cultural and recreational activities largely rely on climate. Adverse climate such as heat waves and storms can cause some outdoor cultural/recreational activities to be canceled or rescheduled. Reduced water supply can limit the service municipalities can provide to their residents.

The City of Melbourne has entered the stage 3a water restriction this April, because last summer it only had an average 40% of the annual rainfall. Under water restriction 3a, no new swimming pool can be filled, house gardens can only be watered every other day and during non-peak hours, only one in every four sports grounds can be watered (with a 25% reduction of water use). Any one violating the 3a water restriction will face a $429 fine (City of Melbourne, 2007).

One way for municipalities to address this issue is to identify and develop new recreational activities that rely less on water, temperature or other climate change elements or move the recreational facilities to a new location that is more resistant to climate change.

Section Two: Climate Change Elements and Action Plans

Cyclones, storms (floods), increasing temperatures, heat waves, decreasing rainfall, sea level rise and droughts have been identified as the most obvious climate change elements that will impact Australia. Before a detailed discussion of each climate change element and its corresponding policy alternatives, it will be better to understand their shared common characters and the important difference among them.

Climate Change Element and their Characters

Climate change element	Specific areas/locations vulnerable?	Nature of the impact	
		Sudden, extreme event	Gradual, long term change
Cyclones	Yes	√	
storms (floods),	Yes	√	
increasing temperatures	No		√
heat waves	No	√	
decreasing rainfall	No		√
sea level rise	Yes		√

Figure 2: Climate change element and its characters, adapted from "adapting to climate change – A Queensland local government guide"

In general, emergency responses will be focused on addressing sudden, extreme climate change events and planning will be mainly used in addressing gradual, long-term changes (Local Government Association of Queensland, 2007).

Decreasing Rainfall

Decreasing rainfall will be one of the most significant climate change elements facing Australia. For example, rainfall has dropped up to 250mm since 1950 in the coast area of Queensland and is projected to decline another 15% by 2030 and 40% by 2070 (Local Government Association of Queensland, 2007).

Besides the total volume decrease, the regional distribution and seasonal distribution will also become more uneven. For example, spring and winter could have less rain fall, southern Australia could get less rainfall and northern Australia could get relatively more rainfall (Commonwealth Scientific and Industrial Research Organization, 2007) This will cause more seasonal water shortages and extreme events such as floods during peak rainfall time.

Decreasing and uneven rainfall may cause water shortage during low rainfall seasons. It may limit the local industrial, agricultural and recreational activities. During low rainfall times, waste water and storm water networks could get blocked due to the low water flow. During peak rainfall times, floods could cause damages to buildings, bridges, roads and other infrastructure. In extreme events, the town could be isolated due to the inaccessibility of roads and other transportation networks.

Adaptation measures to decreasing rainfalls will include developing alternative water supply infrastructures, such as recycling initiatives or desalinations. For example, Gold Coast City has made it compulsory that new buildings must have rainwater tanks as an alternative water source. Existing buildings can also be retrofitted to add rainwater tanks depending on the size of the roof and the cost of plumbing (Local Government Association of Queensland, 2007).

Increasing Temperature

Australia is located at the latitude of the equator. The average temperature ranges from 28ºC along the Kimberley coast in Western Australia to 4ºC in the alpine areas of south eastern Australia. Global warming will put more pressure on the impacts of increasing temperatures. For example, Queensland's annual average temperature could increase by up to 2ºC by 2030 and 6ºC by 2070 (Local Government Association of Queensland, 2007).

Similar to the rainfall change, not only the average temperature will increase significantly, the frequency, severity and duration of extreme events will also increase. For example, heat waves could happen more often and cause a series of consequences. Certain populations, such as construction workers or elderly people, could get dehydrated under heat stress. Outside sports events may have to be canceled. Demand of electricity could jump to an unprecedented level due to the use of air conditioning. Vegetation, wild life and agriculture could be severely damaged by the heat waves and increased bush fires.

One good example of adaptation measures to increasing temperatures is to adjust the working hours. Cook Shire Council adjusted its outdoor workforce working hours from the traditional 8am to 5pm to 6:30am to 3:30am. 40 people who work on roads, bridges and drainages can avoid the heat of the day by the new working hours (Local Government Association of Queensland, 2007).

Other measures to combat increasing temperatures include a review of building codes to reflect the increasing temperature, such as shade, ventilation, insulation and orientation. The same adjustments should be applied to urban green space, street landscape, playground shades and emergency shelters for people to stay out of the heat.

Sea Level Increase

Sea level rise will directly impact the life of coastline communities. IPCC predicted that sea levels will rise between 18cm and 59cm globally. Projection for sea level rise in Queensland, Australia is between 3cm and 17cm by 2030 and between 7cm and 50cm by 2070. Most of Australia's population lives in coastal areas. Sea level rise will become a significant issue for these communities' residential, commercial and industrial activities (Local Government Association of Queensland, 2007).

Sea level rise will particularly change municipalities' planning landscape. Planned future urban expansion areas may not be suitable based on the rapid sea level rise. Salt water intrusion will also degrade the agricultural land and damage the foundation of buildings, bridges and other infrastructures.

Planning is the main adaptation measure municipalities can take to address sea level rise issues. Gold Coast City has added another 27cm buffer on top of the Q100 flood level (the level of the 100year average return interval flood) for new developments. This 27cm buffer was based on CSIRO's projection on sea level rise by 2070 (Local Government Association of Queensland, 2007).

Other adaptation measures include developing alternative water sources to address the salt water intrusion, upgrade design guidelines to strengthen the foundations of buildings and bio-engineering to preserve the ecosystem that will be damaged by the salt water.

Storms and Cyclones

The intensity and frequency of storms/cyclones will increase due to climate change. Storms will cause landslides and flooding, which will significantly damage the roads, bridges, buildings and other infrastructures. Safety of residents and visitors will be in great danger during storms. The damage to the transportation network could isolate the town and disrupt the community life.

One example of adapting measures to storms is to review the building codes. The Australian insurance industry conducted a full review of the building design following an aftermath of the 1999 Sydney hailstorm (the most expensive insurance payout in Australia's history). Some recommendations include upgrading roof material with less brittle ones in the areas with more storms, building coverage for cars to lessen the damage, and training more skilled building workers to speed up the reconstruction after a major storm (Local Government Association of Queensland, 2007).

Other adaptation measures include integrating catchments flood planning with urban drainage planning, expanding the capacity of emergency response teams, and planning buffer zone between waterways to avoid contamination during the storms.

Droughts

Australia is the driest continent and has one of the most variable rainfall climates in the world. Research indicates that severe drought affects some parts of Australia about once every 18 years. The Australian climate of 2002 was characterized by dry and warm conditions. It was the fourth driest year on record, while maximum temperatures across the continent were the warmest on record. (Bureau of Meteorology, 2007).

The Murray-Darling basin in south-eastern Australia yields 40 per cent of the country's agricultural produce. But the two rivers that feed the region are so pitifully low that there will soon be only enough water for drinking supplies. In April 2007, Prime Minister John Howard told the nation's farmers that unless there is significant rainfall in the next six to eight weeks, irrigation will be banned in the principal agricultural area. Crops such as rice, cotton and wine grapes will fail, and citrus, olive and almond trees will die, along with livestock. A ban on irrigation, which would remain in place until May of next year, spells possible ruin for thousands of farmers, after six straight years of drought (The Independent UK, 2007).

The City of Perth is probably the best example of a response to drought. It is expanding its water supply in many ways, including recycling, desalination, groundwater and trading water with irrigators in return for replacing their open channel system with pressurized pipes (Malcolm Turnbull, 2007):

- Recycling, either for indirect potable reuse, or for substitution for potable water (as is proposed in Brisbane where recycled water would be used in power stations).
- Desalination, expensive but like recycling has the great advantage of not being climate dependent.
- Buying water from irrigators often raises intense political and social questions, although it is proceeding in Adelaide and Perth.
- Harvesting more surface water by building new dams and piping it to the city.
- Accessing groundwater, which is really available on a large scale only in Perth.
- Harvesting storm water; the problem here is finding somewhere to store it in an urban environment. This can be done onsite through water tanks although the expense is very high compared to managed aquifer recharge as is being done in Adelaide.

Section Three: Local government policy toolbox for climate change

Local government has a set of policy tools that can be used to address climate change. Right now, most of the municipalities in Australia are still in a research and planning stage, as the below 2006 survey shows (Local Government Association of Queensland, 2007):

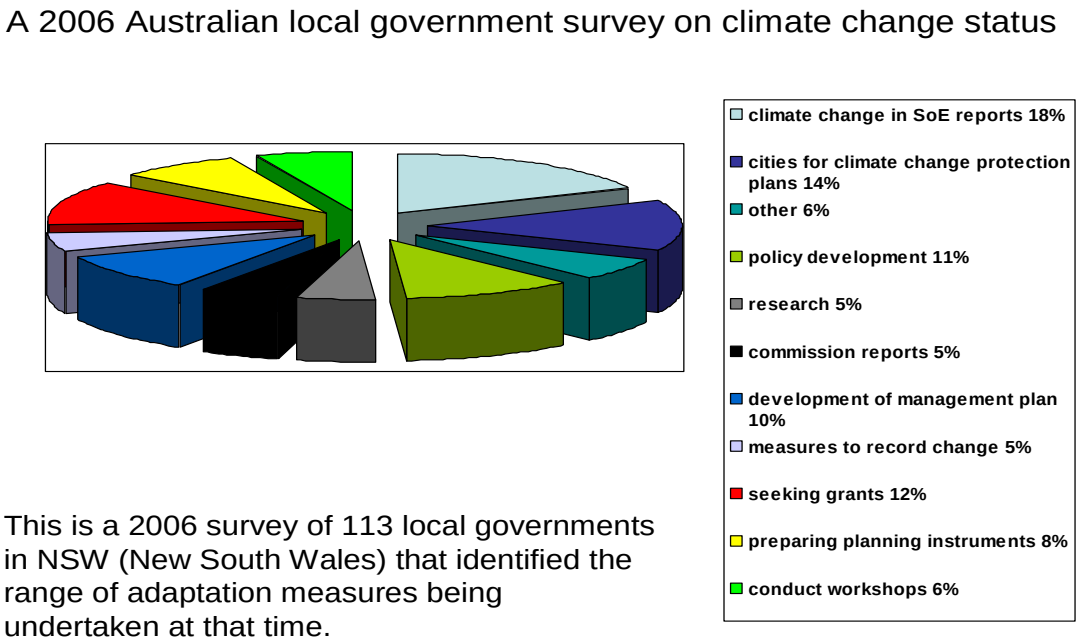

Figure 3: A 2006 Australian local government survey on climate change profile, adapted from "adapting to climate change – A Queensland local government guide"

Regulation and Policy Guidelines

Regulations and policy guidelines are some of the most powerful tools local government can use to change the behavior of residents or businesses. In doing so, it will set strict rules for residents or business to follow. The 3a water restriction mentioned earlier is an example. The $429 fine poses a barrier for those people who do not follow the rules (City of Melbourne, 2007).

Sustainable Housing Code – A Local Green Building Code

Although there are some existing green building rating systems (such as the Australian Building Greenhouse Rating Scheme that focuses on office building ratings), local government can also develop its own rating system that is most suitable for the local environment. One good example is that Brisbane City Council has developed a sustainable housing code to guide the development of local housing and apartments (City of Brisbane, 2007).

This sustainable housing code is developed based on a 2002 local housing survey. 300 houses were randomly selected during the survey and 50 of them were audited by engineers for the energy efficiency level. The survey found half of the houses were not meeting the local council requirements and particularly, the hot water systems that were responsible for 38% of the household energy use were overlooked by current building codes.

Key elements of the sustainable housing code include:

- Hot water systems must be gas, solar, or heat pumps (i.e. no electric storage)
- Showers must have flows of less than 9 liters per minute
- Buildings must achieve a set level of points from a range of alternatives addressing energy efficiency, water conservation, design appropriate for Queensland's sub-tropical climate, as well as safety and security

This sustainable housing code applies to all new homes, town homes, apartments and other residential buildings. It is expected that new homes that follow this code will save 3 tons of greenhouse gas emission and 30,000 liter of water per year (City of Brisbane, 2007).

Information

Another policy alternative local government can use to address climate change is information. Knowledge is power. Conducting research on climate change can identify high priority areas and find effective ways to its impacts. Education forums and seminars are very effective ways to raise the awareness of climate change and engage community members in adaptation strategies and actions. Once the general public know there is some

easy way to combat climate change, they will take those actions at their home or their business.

"Your Community, Your Future" – Public Forum on Climate Change and Energy Saving

Mornington Peninsular Shire Council hosted 14 sessions of the "Your community, your future" public forum in 2006. The forums were broken into two parts. The first part was a general discussion on a sustainable community topic. The second part was dedicated to specific local community issues, such as infrastructure and planning. Participants also got the opportunity to ask questions after the brief presentations (Municipal Association of Victoria, 2007).

To attract more people to these public forums, each participant was given a show bag which included a brochure on climate change and energy saving information, an energy efficient light bulb, show timer and thermometer to monitor the home's temperature. These show bags cost around $20 each. A total of 650 show bags were given away over the fourteen sessions (Municipal Association of Victoria, 2007).

Not only residents can benefit from the information on how to prepare for climate change and save energy, local businesses will also benefit from such efforts, particularly when it is customized to fit their needs.

Farm Emissions and Efficiency Project (FEEP)

Corangamite Shire Council developed the Farm Emissions & Efficiency Project (FEEP) to help farms reduce greenhouse gas emissions and save energy. This project was funded under the Community Action Fund through the Department of Sustainability and Environment (DSE) (Municipal Association of Victoria, 2007).

Participating farms received free guidelines on how to calculate and reduce green house gas emissions and energy consumption. A spreadsheet was provided to record the original green house gas emission/energy consumption and the reduced greenhouse gas emission/energy consumption after taking the recommended measures. These measures are designed to increase the efficiency of the farming system, so by following the advice, farmers not only contributed to the environment, but also saved money due to an improved farming operation.

Within a six months period, the council recorded that 55 farmers had saved 262 tons of CO2, which is 50 tons more than the original target set by the council. Communities across the region are asking how to implement this project in their communities. This proves that non-mandatory guidelines can also achieve their purpose (Municipal Association of Victoria, 2007).

Incentives

Although local government usually doesn't have much fiscal capacity to introduce financial incentives to address climate change, there are some small steps local government can take to encourage climate change friendly behaviors.

Revolving Resource Conservation Fund

Nilliumbik Shire Council established a revolving resource conservation fund to pay for small energy efficiency projects, such as new technologies in conservation of electricity, water, and waste water fuel consumption. Current projects focus mainly on energy savings on buildings. Future projects will expand to street lighting, city fleets and other areas (Municipal Association of Victoria, 2007).

Since 2004/2005, the council has contributed $60,000 to this revolving fund. In the fiscal year 2007, the council is spending $50,000 on energy saving projects and expected to have a saving of $30,000 each year after the projects completion. The annual energy savings will be calculated and returned to the revolving fund to support more energy saving initiatives (Municipal Association of Victoria, 2007).

Community Power – Green Energy Buyers Alliance

Another interesting practice in Australia is "community power", a community/local government program set up to make it easier and more affordable for residents to sign up to Green Power. It is a partnership program, established by the City of Darebin, the City of Melbourne and the City of Banyule with the support of the Moreland Energy Foundation (Moreland Foundation, 2007).

The program works as a buyers' group. When participating residents sign up for a percentage of Green Power (such as 50% green power, 50% conventional power), the local energy retailer agrees to purchase the same amount of Green Power as the residents requested from accredited renewable energy generators (such as solar power or wind power). By choosing Green Power, there is no change in how residents get electricity at home, but it changes the source of energy by choosing more renewable power than traditional power (such as coal) (Moreland Foundation, 2007).

As the Community Power website points out: "Community Power is one of Australia's largest community-based greenhouse gas reduction projects. The 1,000 households already with Community Power are saving around 6,000 tones of greenhouse gas pollution a year. That is the equivalent to removing the greenhouse gas emissions of more than 1,300 average cars (Moreland Foundation, 2007).

Service Delivery

Leading by example is always a good way to promote good courses. Local government provides lots of services to its residents and business. By adopting climate change technologies and polices themselves, local residents and businesses can look at the city as a role model and follow its lead.

For example, public transit can save energy, reduce green house gas emissions and have a very positive impact on climate change. Municipalities as the service provider of public transit have the opportunity to promote public transportation within their communities.

Integrated Travel Plan – A Behavior Change Program

Darebin City Council is a pilot in promoting sustainable transport. In 2000, it developed "Going places: The Darebin integrated travel plan". This integrated travel plan mainly consists of two parts. The first part is internal practice, which set out a target to reduce city staff car drivers to 70% of staff by 2005 and 50% of staff by 2007 (Municipal Association of Victoria, 2007).

The second part of the integrated travel plan is to improve public transit and change people's behavior in taking public transit. The target is to let residents take two less drive alone trips per week. The council provided a range of incentives, such as weekly random prizes, member only events, shopping discount cards, and an online community for members. To date, there are 316 residents who signed up for this program. The estimated saving is 19,441 kg of green house gas and 6,403 liters of petrol (Municipal Association of Victoria, 2007).

Partnerships

Climate change has a profound impact on local communities. Yet, local communities alone can not face the challenge. There are a lot of things municipalities either can not do (out of their jurisdiction) or can not afford to do (lack the fiscal capabilities). Regional alliances and liaisons between different levels of governments are the two most common partnerships local government can pursue to address climate change.

International Climate Change Partnerships – "Cities For Climate Protection" Australia

ICLEI - Local Governments for Sustainability is an international association of local governments and national and regional local government organizations that have made a commitment to sustainable development. Founded in 1990, ICLEI has more than 500 local government memberships. In Australia, the "cities for climate change protection (CCP)" is a program jointly delivered by ICLEI and the Australia Green House Office. To date, there are 221 councils that participated in the CCP program representing 82% of

Australia's population (International Council for Local Environmental Initiatives(ICLEI), 2007).

The key of the CCP program is a strategic milestone framework (specific examples are discussed in climate change elements, local government strategies and other parts of the paper):

Milestone 1

Establish an inventory and forecast for key sources of greenhouse emissions for council and community at Milestone 1.

Milestone 2

Set an emissions reduction goal at Milestone 2.

Milestone 3

Develop and adopt a local greenhouse action plan to achieve emission reductions at Milestone 3.

Milestone 4

Implement the local greenhouse gas action plan and quantify benefits at Milestone 4.

Milestone 5

Monitor and report on greenhouse gas emissions, and implement actions as a continuous improvement cycle at Milestone 5

Besides the five milestones, there is a CCP-plus that focuses on advanced greenhouse reduction initiatives through a suite of CCP Plus actions, such as advancing action projects, organizational reviews and planning & review.

This CCP program works as an umbrella organization. Lots of specific climate change projects happened under its framework, such as those examples discussed in this paper. It serves as a roadmap for local councils to measure their progresses (International Council for Local Environmental Initiatives, 2007).

National Climate Change Coordination Agency - Australia Green House Office

At the national level, the Australia Green House Office (AGO) is an agency dedicated to greenhouse matters and climate change at large. It provides funding and a range of other services to support local governments in climate change. The national adaptation network is one of its key mandates. The framework provides research and funding support to the most vulnerable sectors under climate change, such as agriculture, biodiversity, fishery,

forestry, settlements and infrastructures, coastal, water resources, tourism and health (Australia Green House Office, 2007).

State Climate Change Coordination Agency – Queensland Climate Change Center of Excellence (QCCCE)

At the state level, there are also lots of similar agencies that coordinate climate change policies. For example, the Queensland Climate Change Center of Excellence (QCCCE) provides science and policy advice on climate change modeling and its impacts on the community, economy and environment. Since its establishment in March 2007, it has developed Climate Smart Adaptation 2007-12. This is an action plan, focusing on a number of priorities, such as water planning and service, agriculture, human settlement, natural environment and landscapes, emergency services and human health, tourism, business and industry, finance and insurance (Queensland Climate Change Center of Excellence (QCCCE), 2007).

Local Level Climate Change Partnerships – The West Port Greenhouse Alliance

At the municipal level, local councils are taking steps to form regional alliance to address the climate change profile. The West Port Greenhouse Alliance is such an initiative. This alliance's membership comprises five councils in the region: City of Casey; Cardinia Shire Council; Bass Coast Shire Council; Frankston City Council; and Mornington Peninsula Shire Council. Some funding support was secured through the Department of Sustainability and Environment (DSE) (Western Port Greenhouse Alliance, 2007).

The purpose of the alliance is to develop a regional framework to coordinate local councils' efforts on reducing greenhouse gas and energy savings. Some key projects include:

Effects of Climate Change on Human Settlements

This project is mainly focused on the impacts of climate change on low lying coastal areas in terms of sea level rise, storms and other climate change elements. Planning policy adjustment on regional housing and accommodation will be studied.

Agricultural Emissions

This project is mainly focused on identifying main sources of agricultural emissions and studying ways to reduce them. Agriculture is still one of the main businesses in the region.

Energy Efficient Street Lighting

This project will introduce new energy efficient street lighting in all five local councils.

Carbon Sinks

This project is still a pilot project. Studies will be carried out on how to develop multi-benefit carbon sinks to offset the greenhouse gas emissions.

Community Education

This project will target schools and homes to reduce greenhouse gas and save energy through public campaigns on energy saving tips.

The alliance has gained support from the five local council members. They have all agreed to contribute more to the funding of the alliance. Now the alliance has three staff members and carries out a wide range of greenhouse reduction and energy saving projects in the whole region (Western Port Greenhouse Alliance, 2007).

CONCLUSION

In summary, Australian local government's response to climate change is positive yet embryonic. Most of the action is still in either the research or small scale pilot project stage. Nevertheless, a broad range of policy alternatives, such as information, policy guidelines, incentives, service delivery and partnerships have been tried out in different communities.

Most of the actions Australian local government is taking in anticipation of climate change are research/information and small scale pilot projects. Current experience shows that conducting public campaigns to raise the awareness of climate change and disseminate practical, easy to follow tips to the general public has the greatest return. As some cases in this paper revealed, simply starting to track the consumption of energy is a good start to push people to think about ways to save energy.

There are a lot of valuable lessons that B.C. and other jurisdiction can learn from Australian local government to address climate change. With more information becoming available, a more mature and consistent approach can be found for local government to combat climate change. Until then, measures to address climate change will remain largely in the "trial and error" stage. Only time can tell which measure is the most effective one to help local communities achieve a green and sustainable growth.

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