# An Inventory and Forecast of Energy Use and Greenhouse Gas Emissions within the City of Joondalup

## Cities for Climate Protection Programme
## Milestone 1

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## Contents

## Executive Summary

This report presents the findings of Milestone 1 of the Cities for Climate Protection (CCP™) Programme. The programme is operated by the International Council for Environmental Initiatives (ICLEI) and aims to reduce greenhouse gas emissions at the Local Government level. Milestone 1 comprises an inventory and forecast of Greenhouse Gas emissions for activities of both the City of Joondalup Council and the whole Community.

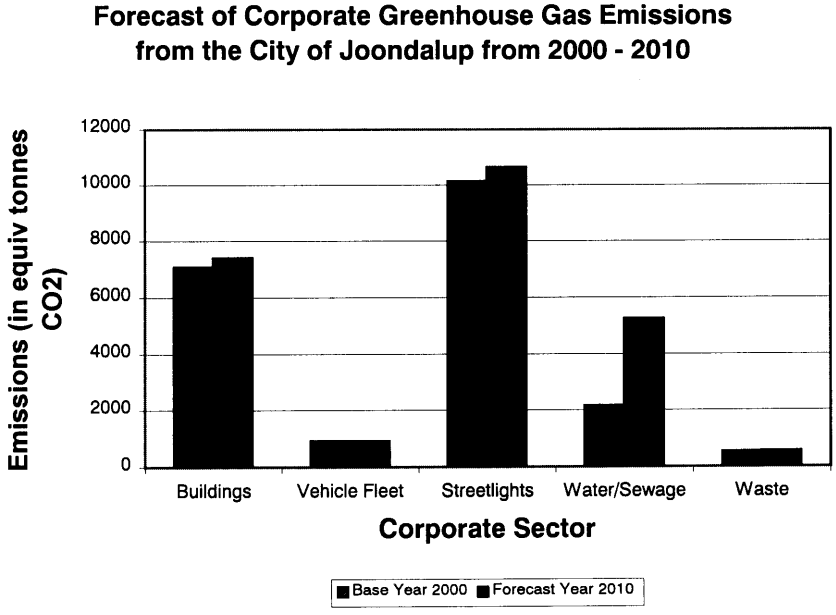
The large population and extensive land area of Joondalup are important factors in the results that have been obtained for this report. When comparisons are made between the Results for the City of Joondalup and those of other Municipalities, the total emissions from the Corporate Sector for the 1999-2000 financial year (20,827 equivalent tonnes of $CO_2$) are higher than both the State and National Averages. On a per capita basis, emissions from the City of Joondalup are 0.15 equivalent tonnes of $CO_2$ per person per year, compared to the W.A. average of 0.125 and the Australian average of 0.08 (ICLEI, 2000a).

In the Community Sector however, the City of Joondalup is lower than the averages at 11 equivalent tonnes of $CO_2$ per person per year compared to State and National averages of 58 and 27 respectively (ICLEI, 2000a). The CCP™ programme and subsequently the results, are divided into two sectors: Corporate for Council activities and Community for all other activities in the Municipality.

## Corporate

### Results

The following chart shows the current greenhouse gas emissions within the City of Joondalup and their projections for the forecast year 2010.



The total costs of energy that was used to result in the emissions for each of these sections is as follows:

| | Base Year Total Cost | Forecast Year Total Cost |
|---|---|---|
| **Buildings** | $806,080 | $850,279 |
| **Vehicle Fleet** | $322,937 | $322,937 |
| **Streetlights** | $1,434,798 | $1,511,891 |
| **Water/Sewage** | $270,034 | $720,579 |
| **Waste** | $71,521 | $75,526 |
| **TOTAL** | **$2,905,370** | **$3,481,211** |

Recommendations

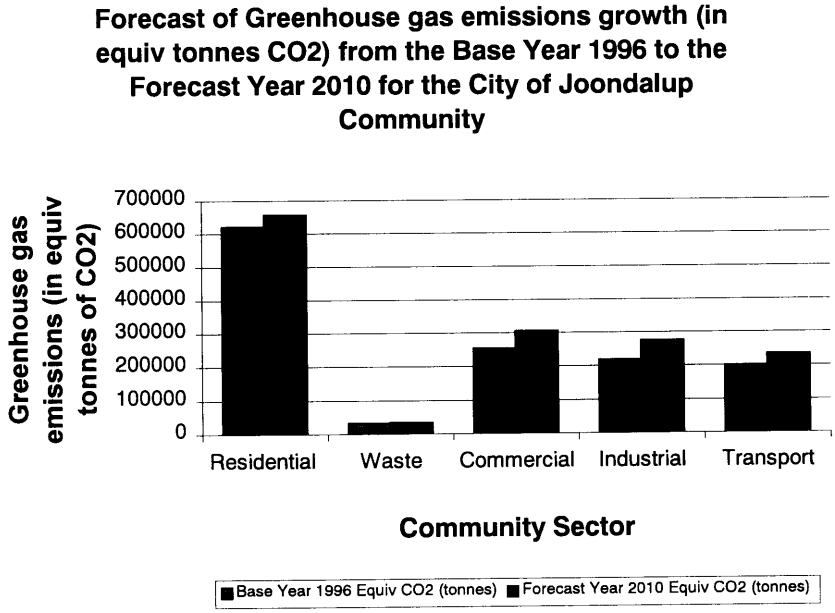
The following table is a list of the recommendations and their benefits for the Corporate Sector in making information more accessible for the future. Recommendations for reducing emissions form part of Milestone 3 of the Programme.

| Action | Benefits |
|---|---|
| **Recommendation 1:** Where buildings are recorded on the Oracle database, add the Western Power and Alinta Gas account numbers near the location code. Do this for all sections. | Avoids confusion, particularly when the building address varies from the meter location. |
| **Recommendation 2:** Start recording units of electricity and gas for bills. Do this for all sections. | Minimises time spent looking through bills.<br>Enables easy indication of energy cost increase. |
| **Recommendation 3:** Record building size and operating hours. | Enables comparisons to be made with other buildings of similar size, operating for similar periods of time. |
| **Recommendation 4:** Maintain a record of all vehicle kilometres traveled and the number of days that the car is used. | Fuel use can be recorded accurately despite fluctuations in fuel prices. |
| **Recommendation 5:** Find out from Western Power if it is possible to receive bills electronically with the number of units included. | Save time in entering the data onto the Oracle database. |
| **Recommendation 6:** Maintain an accurate record of pump activity such as times they are turned on and how long they run for. If a timer is used, this should be kept constant and the days when rain prevents the pumps being needed, this should be noted. | Allows an accurate measure of the amount of electricity used by te pump. |
| **Recommendation 7:** Record the type of waste that is collected by the City into various categories e.g. Paper, food etc. | Accurate percentages and therefore emissions from waste can be recorded. |

## Community

### Results

The following chart shows the current greenhouse gas emissions within the Community of the City of Joondalup from the base year 1996 to forecast year 2010.




### Recommendations

The following table is a list of the recommendations and their benefits for the Community Sector in making information more accessible for the future. Recommendations for reducing emissions form part of Milestone 3 of the Programme in the Local Action Plan.

| Action | Benefits |
|---|---|
| **Recommendation 1:** Investigate the possibility of obtaining energy consumption figures from the three suppliers on an annual basis. For Residential, Commercial and Industrial sub sectors. | Allows changes in consumption to be easily monitored and less contact needs to made with suppliers when information is needed. |
| **Recommendation 2a:** Obtain a copy of the Ministry for Planning's Commercial Land Use Survey when it is available.<br>**Recommendation 2b:** Purchase the software programme Australia on disk to obtain an accurate record of commercial and industrial establishments in the City of Joondalup. | Provides a better indication of land area and number of employees specific to Joondalup for both the Industrial and Commercial subsectors. |

| | |
|---|---|
| **Recommendation 3:** Maintain a list of industrial establishments in the City of Joondalup either by separating them in the rates records or conducting a survey similar to that done by the Ministry for Planning. | Allows a more accurate measure of establishments and size that is more easily attainable. |
| **Recommendation 4:** Investigate the possibility of maintaining emissions figures for Industrial complexes. This is particularly important for heavy industrial complexes, which may release harmful emissions. | Some industrial emissions are difficult to track. This allows problems to be traced. |
| **Recommendation 5:** Investigate the possibility of obtaining public transport use figures for the COJ and compare these to the private transport. Transport (Department of) may be able to provide this information. | Shows areas where the main attention needs to be focused in reducing emissions. |
| **Recommendation 6:** Maintain records of total tonnage of waste at the end of each financial year. Investigate the possibility of finding out the waste composition of the material. | Increases can be more easily monitored and the emissions can be calculated from the type of waste produced. |
| **Recommendation 7:** Investigate the possibility of extracting methane from the Tamala Park landfill site to be used as a source of energy for other activities at COJ or the City of Wanneroo. | Saves money on energy and also reduces emissions of methane into the atmosphere. |

## Conclusion

The City of Joondalup has a significant opportunity to reduce greenhouse gas emissions and therefore cost both at the community and corporate level. By completing Milestone 1 of the Cities for Climate Protection Programme, the first step has already been taken and the continuation into the other Milestones will mean great improvements to the City.

# 1: Introduction

## 1.1: The Cities for Climate Protection Programme

The Cities for Climate Protection (CCP™) Programme is an initiative adopted by the International Council for Local Environmental Initiatives (ICLEI) for Local Governments following the Kyoto Summit in Japan in 1997. The programme is funded by the Australian Greenhouse Office, the lead Commonwealth agency on greenhouse matters and its aim is to reduce greenhouse gas emissions at the local government level (ICLEI and AGO, 1999) while at the same time reducing energy consumption and costs.

There are over 370 councils all over the world participating in the programme with 96 councils currently involved throughout Australia, representing more than 40% of the population. ICLEI's aim is to have 200 councils in Australia as members by the year 2003. The programme is providing an opportunity for Local Governments around the world to work together to make a real difference to the global greenhouse situation.

## 1.2: Milestone One

This report summarises the findings of Milestone 1 of the CCP™ Programme. It is the first of five Milestones that councils commit to on joining the CCP™ programme. The actions of each of these Milestones are summarised in Table 1. Commissioners in 1999 approved the involvement of the City of Joondalup in the programme.

**Table 1: A summary of the Milestone process in the CCP™ programme** Source: ICLEI, 2000a

| | |
|---|---|
| **Milestone 1** | Conduct an emissions inventory of current council and community activity and a forecast of emissions growth in the future |
| **Milestone 2** | Establish an emissions reduction goal that your Council is committed to reducing from the forecast year levels using the base year as a guide |
| **Milestone 3** | Develop a Local Action Plan to document the types of measures that Council will undertake to reduce the total municipal-wide greenhouse gas emissions |
| **Milestone 4** | Implement the Local Action Plan – the visible outcome of the important strategic planning of the previous milestones |
| **Milestone 5** | Monitor and report on the implementation of the Local Action Plan – understanding about the success of implementation is essential |

Milestone 1 forms the basis of action for all of the other Milestones. The audit gives an analysis of the source and quantity of greenhouse gas emissions for a specified baseline year. This allows a greater understanding of the impacts of current activities in the future. With this information and some ideas about the potential increases in population, types of energy use and predicted changes to amounts used, a forecast figure for greenhouse gas emissions can be established (ICLEI, 2000b).

## 2: Background

### 2.1: The Enhanced Greenhouse Effect

The Greenhouse Effect is a natural process of maintaining the earth at a moderate temperature. Greenhouse gases such as Carbon Dioxide ($CO_2$) and Methane ($CH_4$) allow the sun's energy to filter through to the earth but then trap the warmth within the atmosphere similar to the way in which a greenhouse for plants traps warmth from the sun inside the glass. Human actions over the past century in particular, are increasing the concentrations of these gases, predominantly through the burning of fossil fuels, creating the prospect of global climate change (AGO, 1998). This is known as the Enhanced Greenhouse Effect.

Greenhouse gas emissions contribute to the formation of photochemical smog, which is mostly a summer problem in Perth as it requires strong sunlight and relatively high air temperature to reach significant concentrations (DEP, 2000). Smog is usually invisible, except in severe cases when it is seen as a whitish haze and causes eye irritation (DEP, 2000). The brown haze which is often visible in Perth, particularly during winter months, is mostly caused by particulates trapped close to the earth by temperature inversions (DEP, 2000) and usually is a result of incomplete combustion of fossil fuels and is commonly from wood fires and diesel fuel. Both can have serious health implications.

There are positive social and economic, as well as environmental benefits for the whole community in reducing the concentration of these gases. The City of Joondalup is one of 17 Local Governments in Western Australia and 96 Local Governments nationwide who have decided to take up the challenge to reduce their greenhouse gas emissions by participating in the Cities for Climate Protection™ (CCP™) Programme. Potential benefits include:

- Reduced expenditure on energy bills as the amount of energy used may be significantly reduced. This allows funds to then be spent on other projects within the Community
- Significant improvement in the air quality in the region which has subsequent health benefits and may reduce the incidence of respiratory illness
- Opportunity for cooperation with industry and the community at a local, state, national and international level.
- Increased pride amongst community members that their council is improving air quality. Environmental issues, particularly those related to quality of life, are a concern to many residents.
- Recognition for the City of Joondalup as a Local Government participating in a programme that together with other Local Governments can produce a positive global influence

### 2.2: The CCP™ Software

The CCP™ software programme, which is a major part of the Milestone 1 inventory, is divided into two sections; namely Corporate and Community:

**Corporate -** For the purposes of this report, corporate relates to all buildings, facilities and operations, lands, programmes and vehicles owned and operated directly by the City of Joondalup. It is divided into the following sub-sections:

| | |
|---|---|
| Buildings - | Energy use figures for all the buildings or groups of buildings owned and operated by the City of Joondalup. |
| Vehicle Fleet - | Passenger vehicles, trucks and heavy machinery owned by the City of Joondalup. This also includes plant equipment that uses fuel such as lawn mowers and chainsaws. |
| Streetlights – | All streetlights within the City of Joondalup (including those installed and operated by Western Power) and park lights and floodlights owned by the City of Joondalup. |
| Water/Sewage – | Water pumping (bores and reticulation) and sewage facilities operated by the City of Joondalup. This does not include Wastewater Treatment Plants operated by the State Government. |
| Waste – | All waste generated by City of Joondalup activities including greenwaste from parks, public litterbins and rubbish from all buildings owned by City of Joondalup. |

**Community-** For the purposes of this report, community is defined as everything within the bounds of the City that is not directly owned by the City of Joondalup. It is divided into 5 separate sections:

| | |
|---|---|
| Residential - | This includes all private homes within the boundary of the city of Joondalup. Refers to the population of the city that actually resides here (not including those who just work in Joondalup). |
| Commercial - | Any buildings or facilities that are not otherwise classed as residential, industrial or corporate. Consists mostly of retail shops, hospitals, schools and small businesses and services e.g. doctors surgery. |
| Industrial - | Includes light or heavy industry. Examples include agriculture, mechanics and manufacturing. |
| Transportation - | Reports the travel behaviour of people living or working within the boundaries of the City of Joondalup. Looks at types of transport used (private cars, trucks etc.) and distances traveled. |
| Waste- | All waste generated within the City of Joondalup without including corporate waste. Consists mostly of collected private residential bins. |

## 2.3: Choice of Base Year

In order to make an evaluation of the current greenhouse gas emissions within the City of Joondalup and use that information to forecast possible emissions in the future, the CCP™ programme requires the selection of a base year and a forecast year to formulate data for.

**Corporate base year: 1999-2000 financial year**

The 1999-2000 financial year was adopted as the base year for corporate data in the CCP™ software. The choice of the most recent financial year as a base year for the corporate sector was mainly due to the change in administrative structure that occurred following the division of the former City of Wanneroo. The division into the City of Wanneroo and the City of Joondalup, meant that many methods of recording data changed. As a consequence, much of the combined data is no longer accessible.

In the background notes for the programme from ICLEI, it is recommended that 1996 be adopted as the base year due to the availability of the census data for that year and the flexibility to compare four consecutive years since then. As a result, most WA councils are using 1996 as their base year. However, the 1999-2000 financial year was chosen as a base year for the City of Joondalup following advice from ICLEI (Bailey, K. pers.comm, 2000) to simplify accessibility to data, due to the difficulties arising from the separation of the former City of Wanneroo. It also allows easy discussion with various staff at the City of Joondalup, as they are more familiar with events that have occurred recently.

**Community base year: 1996 calendar year**

The change in administrative structure from the former City of Wanneroo to the City of Joondalup did not have any significant impact on the community aspect of the study. Population data for Joondalup could readily be derived from Wanneroo data, because Joondalup was already a separate region. It was just renamed from Wanneroo Southwest and Wanneroo Central-Coastal to Joondalup (Appendix 1). The choice of 1996 as a base year was therefore not a difficult decision to make as the availability of the census data that year makes statistics easily accessible. In addition, it allows for a comparison of figures over the years since then.

## 2.4: Forecast Year 2010

The adoption of a forecast year permits an assessment of where, and by how much, greenhouse gases will increase if a "business as usual approach" is taken or if Joondalup does not make any changes to the way energy is used and waste is generated.

Forecasting was completed for both the Corporate and Community Sectors using the year 2010. There are two main reasons for this. The third meeting of the Conference of Parties (COP 3) to the UN Framework Convention on Climate Change was held in Kyoto, Japan in 1997 (ICLEI, 1999). It was at this conference that many nations throughout the world agreed to set a target to reduce greenhouse gas emissions by the year 2010. Australia was one of the signatories to this agreement (ICLEI and AGO, 1999). Secondly, the year 2010 was used by ICLEI as the forecast year in the default

data. Using the same forecast year for the two sectors also allows for an easy comparison between the two.

### 2.5: Default Data

The majority of data used for the Community sector of this report is from the default data provided to CCP™ councils by ICLEI. For each component (residential, commercial etc.), State figures have been obtained for details such as energy use and the number of employees in various industries. This data was then converted to a per capita basis and multiplied by the number of people living in the municipality to form a set of information for each Local Government area. It was recommended (ICLEI, 2000b) that the default data is used only as a bare minimum and wherever possible, figures specific to the municipality should be used.

## 3: Corporate

### 3.1: Results

Data was obtained for the Corporate Section predominantly by searching through past bills for electricity and gas consumption. The results of the corporate section for both the base year and the forecast year are shown in the summary Reports in Appendix 2. The majority of the Greenhouse gas emissions come from the Streetlighting component followed by Buildings and then Water/Sewage as shown in Figure 1.

**Figure 1: Corporate Greenhouse Gas emissions (in equivalent tonnes of CO2) for the City Of Joondalup Base Year 1999-00**

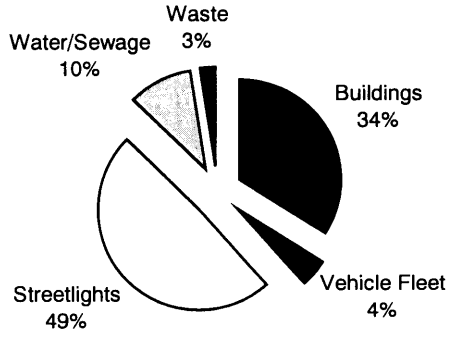


Figure 2 illustrates that the consumption of energy on a cost basis has similar proportions to emissions figures but with the vehicle fleet taking slightly more of the cost and Buildings slightly less. The total energy expenditure for 1999-2000, including electricity, gas, fuel etc. was $2,905,370.

**Figure 2: Corporate Energy Expenditure for the City Of Joondalup Base Year 1999-00**

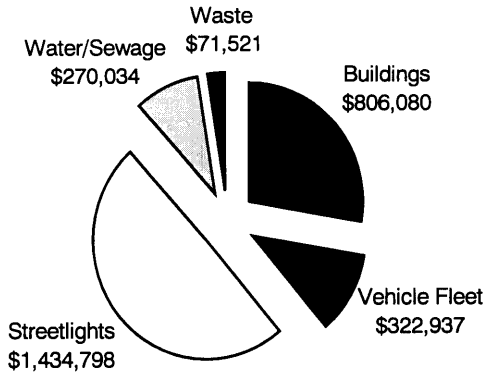



Figure 3 compares the average per capita National and State emissions figures with those of Joondalup and also includes an average annual cost per capita. On this basis, the corporate greenhouse gas emissions for the City of Joondalup are high compared to other municipalities in Western Australia and Australia.

**Figure 3: Joondalup Corporate Greenhouse Gas Emissions and Cost Per Capita compared to State and National Averages**

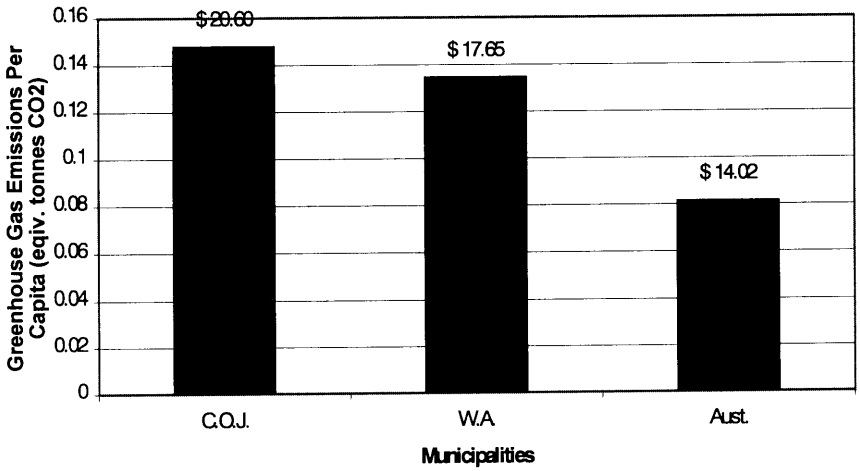


Table 2 shows that electricity was, by far, the highest source of greenhouse gas emissions across all the sub-sectors (Table 2) followed by Petrol, Natural Gas and then Diesel.

**Table 2: Greenhouse Gas emissions, consumption and cost by Energy Source for the Corporate Sector** Source: CCP Software

| | Equiv. CO2 (tonnes) | Equiv. CO2 (%) | Energy (GJ) | Cost ($) |
|---|---|---|---|---|
| **Electricity** | 18,895 | 90.7 | 61,837 | 2,380,110 |
| **Natural Gas** | 481 | 2.3 | 8,910 | 130,802 |
| **Petrol** | 518 | 2.5 | 7,855 | 195,493 |
| **Diesel** | 403 | 1.9 | 5,787 | 127,444 |
| **Paper Products** | 280 | 1.3 | | 17,523 |
| **Food Waste** | 285 | 1.4 | | 19,168 |
| **Plant Debris** | -30 | -0.1 | | 15,520 |
| **Wood/Textiles** | -6 | 0 | | 2,146 |
| **All Other Waste** | 0 | 0 | | 17,165 |
| **TOTAL** | **20,827** | **100** | **84,390** | **2,905,370** |

Table 3 shows a complete summary of all the results for the Corporate Sector including Greenhouse Gas Emissions, Energy Consumption and Total Annual Cost.

**Table 3: Joondalup Corporate Greenhouse Gas Emissions in 2000 Summary Report**
Source: CCP software

| | Equiv. $CO_2$ (tonnes) | Equiv. $CO_2$ (%) | Energy (GJ) | Cost ($) |
|---|---|---|---|---|
| **Buildings** | 7,086 | 34.0 | 30,524 | 806,080 |
| **Vehicle Fleet** | 922 | 4.4 | 13,643 | 322,937 |
| **Streetlights** | 10,135 | 48.7 | 33,169 | 1,434,798 |
| **Water/Sewage** | 2,155 | 10.3 | 7,054 | 270,034 |
| **Waste** | 529 | 2.5 | | 71,521 |
| **TOTAL** | **20,827** | **100.0** | **84,390** | **2,905,370** |

The process of obtaining information differed slightly for each sub-sector and is described below.

### 3.1.1: Buildings

A list of buildings owned by the City of Joondalup (COJ) was obtained from the City's Asset Controller and is in the file *v:\Jacinta\Ccp\LIST_OF_BUILDINGS*. Not all of the buildings however were on the list of electricity consumption figures provided by Western Power. The data from Western Power was for all accounts paid for by the COJ for the 1999-2000 financial year. These electricity figures were used as they gave the total units and the total cost for the year. In some cases, a bill included more than one part of a building (e.g. Kiosk and Pool areas of Craigie Leisure Centre are separate on the building list). For these, the Oracle Location Code (Oracle is the City of Joondalup's internal database system) was entered into the software for that building so it would correspond with COJ data records.

Gas figures were sourced from the accounts kept at COJ. The list of cheque numbers for the year was obtained from the Accounts payable business unit at COJ where they are all recorded on the Oracle database and each bill was checked individually as the number of units consumed and the number of days for that bill are not recorded. The Oracle database only records the total cost. The highest energy consuming buildings

are shown in Table 4. Together, these buildings make up almost 25% of the total building energy cost.

**Table 4: The top five energy consuming buildings owned by the City of Joondalup for the Financial Year 1999-2000 (in descending order).**

| Building | Energy Consumed (GJ) | Emissions (tonnes $CO_2$) | Total Annual cost ($) |
|---|---|---|---|
| **C.O.J. Admin. Building** | 13,264 | 3,716 | $361,549 |
| **Craigie Leisure Centre** | 11,634 | 1,701 | $227,143 |
| **Percy Doyle Community Facility** | 1,902 | 552 | $61,094 |
| **Ocean Ridge Community Centre** | 407 | 124 | $18,145 |
| **Fleur Freame Pavilion** | 341 | 96 | $14,335 |
| **TOTAL** | **27,548** | **6,189** | **$682,266** |

Some of the accounts were for meters that incorporated a toilet block, a water pump and park lights. The electricity used for the park lights was mostly included with either the building or the pumps as they only account for a small percentage of total emissions.

### 3.1.2: Vehicle Fleet

A list of the City of Joondalup vehicle fleet was also obtained from the C.O.J. Asset Controller and is in the file *v:\Jacinta\Ccp\fleet vehicles*. Table 5 shows greenhouse gas emissions and cost per vehicle type and also includes the total litres of fuel consumed by each particular vehicle during 1999-2000 based on an average of 85 cents per litre. Figures were only available for the last 7 months of the financial year though due to change in administrative structure after the separation of the former City of Wanneroo. The figures were then extrapolated for the whole year. The total number of kilometres traveled by each vehicle is not recorded for the City of Joondalup. Only the total cost of fuel for the year is recorded. Vehicles have been recorded in the software in sections according to vehicle type (Table 5).

**Table 5: Details of Vehicle Fleet for the City of Joondalup for the 1999-2000 financial year according to Vehicle Type** Source: CCP Software

| Type | Equiv. $CO_2$ (tonnes) | Equiv. $CO_2$ (%) | Energy (GJ) | Cost ($) |
|---|---|---|---|---|
| **Heavy Truck** | 106 | 0.5 | 1,514 | 33,345 |
| **Light Van or Truck** | 462 | 2.2 | 6,871 | 164,853 |
| **Passenger Vehicle** | 162 | 0.8 | 2,453 | 60,969 |
| **Specialised Heavy Equipment** | 62 | 0.3 | 888 | 19,575 |
| **Other** | 131 | 0.6 | 1,917 | 44,194 |
| **TOTALS** | 923 | 4.4 | 13,643 | 322,936 |

The use of 2-stroke or 4-stroke by plant equipment, was recorded as petrol because the 2-stroke is just a combination of petrol and lubricating oil with a petrol to oil ratio of approximately 50:1 or 25:1. The 4-stroke has even less oil in it.

### 3.1.3: Streetlighting

The streetlighting component of this study includes not only the general streetlighting provided by Western Power, but all lights in public areas that are paid for by the City of Joondalup. For example, this includes outdoor lights in parks, at recreation centres (for tennis courts etc.), cycleways and decorative streetlighting, which is quite common throughout the central areas of Joondalup. Traffic Lights are not included as they are paid for by the State Government through Main Roads WA. The City of Joondalup pays a monthly charge of $101,023.25 to Western Power for general streetlighting. This figure multiplied by 12 gives the total yearly cost of streetlights, which comes to $1,212,279. The total cost of all streetlights, inclusive of Western Power lights, is $1,434,798.

The bills that are sent to the City of Joondalup do not include units of electricity used. Electricity usage was obtained separately from Western Power (see Table 6). No figures are available for July and August because they were still part of the accounts for the former City of Wanneroo. The total figure was extrapolated to obtain an annual figure.

**Table 6: Energy Consumption for general streetlighting in the City of Joondalup for 1999-2000.**
Source: Western Power, 2000. File v:\Jacinta\Ccp\COJ streetlights

| Month | Number of Lights | Units Consumed (kWh) |
|---|---|---|
| **Jul-99** | N/A | N/A |
| **Aug-99** | N/A | N/A |
| **Sep-99** | 12996 | 593,698.09 |
| **Oct-99** | 13014 | 594,352.41 |
| **Nov-99** | 13049 | 595,438.47 |
| **Dec-99** | 13049 | 596,671.06 |
| **Jan-00** | 13048 | 595,185.50 |
| **Feb-00** | 13098 | 594,447.48 |
| **Mar-00** | 13096 | 595,807.50 |
| **Apr-00** | 13120 | 598,601.09 |
| **May-00** | 13130 | 602,610.67 |
| **Jun-00** | 13132 | 602,790.34 |
| **TOTALS** | **130,732** | **5,969,602.61** |

N/A = information not available

Some account numbers were missing, from the Western Power list (according to Parks figures) but were obtained from Customer Service at Western Power and are saved in the excel file *v:/Jacinta/WP bills*. Other parks figures (including account numbers) were obtained from the Operations business unit at COJ. These figures include all of the meters that record the units of electricity used in parks into lights only (park lights etc.) and lights/pumps together. An average of 80% of the figure was used to account for the electricity used by water pumps and the remaining was allocated to Park lights. The 80% figure was arrived at using the averages of other councils completing Milestone 1 (Bailey, K. pers.comm, 2000).

### 3.1.4: Water/Sewage

All the electricity data was included in the accounts from Western Power together with the figures for buildings and park lights. The Parks figures from Operations were divided into lights only (park lights etc.) and lights/pumps together. The power of the pumps was calculated by one of the Parks inspectors at the COJ but

unfortunately, due to the failure to record the exact time that the pumps were running each day, it was impossible to calculate the amount of electricity used by the pumps alone. An estimate of 80% of the park figure was suggested by ICLEI (Bailey, K. pers.comm, 2000) as the pump consumes much more electricity than the lights. The Oracle database only records the total cost.

This section also includes water treatment facilities and sewage plants of which there are some in Joondalup such as the Beenyup Waste Water Treatment Plant. There are not, however, any of these facilities that are owned by the City of Joondalup. The majority of water and sewage treatment facilities throughout the State of Western Australia are owned and operated by the State Government through the Water Corporation.

### 3.1.5: Waste

A total waste figure was obtained for the City of Joondalup from Waste Management and Environmental Services and was divided into Community and Corporate waste based on where it came from. For example, the residential and commercial bin tonnage comes under community waste and is recorded as a separate item to the roadside council bins, which are part of the Corporate inventory. Also included in the Corporate inventory for waste is the greenwaste collected from Parks and any waste that is picked up from council operated buildings.

The Waste figures were calculated using data from a report titled *The Development of Options for a Regional Waste Management Strategy for the Mindarie Region* for the 1997-98 financial year. Figures in the report include data for the former City of Wanneroo so these were divided according to population figures and then extrapolated to 1999-2000 figures for the City of Joondalup.

The weight of rubbish from street litterbins was 1948 tonnes in 1997/98 (BSD Consultants, 1999, p.1). The total number of bins collected for that year was 129,000 (BSD Consultants, 1999, p.3). This equates to an average of 15.1 kg per bin. The fact that this was for Wanneroo and Joondalup bins combined was negligible. It was assumed that the amount and type of waste does not differ markedly between the two cities.

The number of bins currently within the City of Joondalup is maintained on the daily bin check sheet in the Operations unit. For 1999-2000, this was 1456 bins emptied per week or 75,712 per year. Multiplying this figure by the 15.1 kg per bin gives a total corporate waste of 1,143,251.2 kg or 1,143.25 tonnes. At a cost of 68.8 cents per bin for collection (1999-2000 budget figures), the collection fee comes to $52,089.86. Tipping fees are $17 per tonne (1999-2000 budget) so the tipping cost for 1,143 tonnes is $19,431.

The total haulage and tipping costs are therefore:
$19431 + $52,089.86 = $71,520.86

In order to estimate the emissions produced by the waste, it was necessary to break the waste down into various types. As no waste classification survey for the City of Joondalup has been conducted, a State based average was used (see Table 7). The percentages here are the same as for the community percentages. This, however, is an

assumption that would be more accurately defined through a waste classification survey.

**Table 7: Breakdown of Waste into various types for the State of Western Australia** Source: Ho, 1992

| Waste Type | Waste Share |
|---|---|
| **Paper products** | 24.5% |
| **Food waste** | 26.8% |
| **Plant debris** | 21.7% |
| **Wood/textiles** | 3.0% |
| **Other** | 24.0% |

## 3.2: Discussion

Streetlighting contributes to almost half of the total emissions and total energy expenditure for the City of Joondalup. This is mostly due to the large land area within the City that requires lighting. Unfortunately, this may be an area that is difficult to deal with as all lighting control (i.e. types of lights) is vested with Western Power. Lighting that is installed and operated by the City of Joondalup can be controlled, however and should be maintained for maximum energy efficiency to reduce costs and greenhouse gas emissions.

The buildings component makes up the second highest consuming sector. This is understandable considering the size and location of the City of Joondalup. There are many community facilities available, which is indicative of the City of Joondalup's efforts to keep most of the activities of residents close to Joondalup due to the distance from the Perth City Centre. Leisure Centres, in particular, consume a great deal of energy and the City of Joondalup is already investigating the possibility of using waste biogas from the Beenyup Waste Water Treatment Plant to heat the pools at the Craigie Leisure Centre. This may drastically reduce energy costs and greenhouse gas emissions.

On the basis of cost, Fleet Vehicles are the 3$^{rd}$ highest energy users, but from the emissions perspective, the Water/Sewage sub-sector is the third highest consumer. The reason for the difference is due to the difference in energy type. While electricity does not actually release any emissions when it is used, there are significant $CO_2$ emissions released at the fossil fuel power plants where it is generated through the use of coal, oil and natural gas (ICLEI, 2000b). There are also other emissions related to fuel use in vehicles but these are not related to greenhouse gases. For example, diesel fuel emits much higher quantities of particulates that petrol. These contribute to haze but not to smog, which is a result of greenhouse gases. Greenhouse gas emissions from vehicles can be reduced by the conversion of vehicles to the use of Liquefied Petroleum Gas (LPG) rather than other fuels.

## 3.3: Recommendations

Several difficulties arose in the collection of data for this report. Many of them were due to a lack of information since the division of the former City of Wanneroo into the current City of Wanneroo and the City of Joondalup. In addition, difficulties arose due to a limit in the amount and type of information that is recorded by the City of Joondalup. This section is primarily a list of problems and their possible solutions.

The details of how these problems will be dealt with will go into more detail in the Local Action Plan as part of Milestone 3.

3.3.1: Buildings

***Problem 1:*** *There were many inconsistencies between the names of various buildings and parks according to the names that they were given on the Western Power bill. For example, Kallaroo Hall is also known as Rob Baddock Community Facility. The Accounts section have it listed as Kallaroo Hall but on the buildings list, it is Rob Baddock Community Hall. This makes matching the bill to a building very difficult; especially if the meter for the building is at a different address to the actual building as is often the case.*

**Recommendation 1:** Where buildings are recorded on the Oracle database, add the Western Power and Alinta Gas account numbers near the location code to avoid confusion when trying to track the data. This will also apply to bills for the streetlighting and Water/Sewage components.

***Problem 2:*** *The Oracle database records the total amount of money spent on an account for the year but does not record the number of days or the total amount of electricity units consumed during that period. This makes it very difficult to determine the total greenhouse gas emissions produced as each bill needs to be looked at individually to record the units and number of days. It also does not give any indication of whether or not electricity and gas consumption have increased, as it may have simply been the cost per unit that increased.*

**Recommendation 2:** Record units of electricity and gas on the Oracle database to provide for a convenient and readily accessible record of energy consumption. This will also give a better indication of when energy use is increasing. As for buildings, this also applies to bills for all of the sub-sectors.

***Problem 3:*** *There does not appear to be any record of building floor area and operating hours of each building. It is therefore difficult to compare the energy use between buildings on a size base. For example, the consumption of energy at the City of Joondalup Administration Building is seven times that of the Percy Doyle Community Facility, but does that mean that the administration building wastes a great deal of energy or is it because the administration building is seven times the size? Additionally, there is no indication of changes that occur such as renovations and additions to buildings and how they affect the energy consumption.*

**Recommendation 3:** Record the size and operating hours of buildings in Joondalup from original plans or any changes that occur. This will enable comparisons to be made with other buildings of similar size, operating for similar periods of time.

3.3.2: Vehicle Fleet

***Problem 4:*** *Currently only the total cost of fuel used each year is recorded by the City of Joondalup. The cost of fuel is continuously changing and each vehicle has different fuel efficiency. The cost of fuel only is not a good indicator of the fuel consumption and does not take kilometres into consideration.*

**Recommendation 4:** Keep an accurate log of the kilometres traveled by each vehicle to develop a more accurate indication of the amount of fuel used.

3.3.3: Streetlighting

***Problem 5:*** *Western Power electricity bills do not include a number of units consumed for the time period of that particular bill. This makes it very difficult to record the actual electricity used and Western Power could easily increase the bill at any time despite not having an increase in the number of lights. Newcastle City Council advised that their electric company provides bills electronically and they include the number of units consumed.*

**Recommendation 5: Request that Western Power forward bills electronically, if possible, with the number of units included. This will also save time in entering the data onto the Oracle database.**

3.3.4: Water/Sewage

***Problem 6:*** *The division of parks figures into the electricity consumed by pumps and that consumed by lights, proved very difficult as they are all measured on the same meter. Even if it is not possible to provide different meters for each, keeping an accurate record of the pump activity can separate the figures. Although the information regarding the power of the pumps is accessible, the information is useless if no one knows how long the pumps run for every day.*

**Recommendation 6: Maintain an accurate record of pump activity to enable the electricity used by pumps to be separated from that used by lights in the parks figures.**

3.3.5: Waste

***Problem 7:*** *There isn't any information currently available on the breakdown of waste into various types except on a State basis. If a waste composition survey were done for Joondalup, it would be possible to calculate greenhouse gas emissions more directly.*

**Recommendation 7: Record the type of waste that is collected by the City into various categories e.g. Paper, food etc. so a percentage of each can be calculated.**

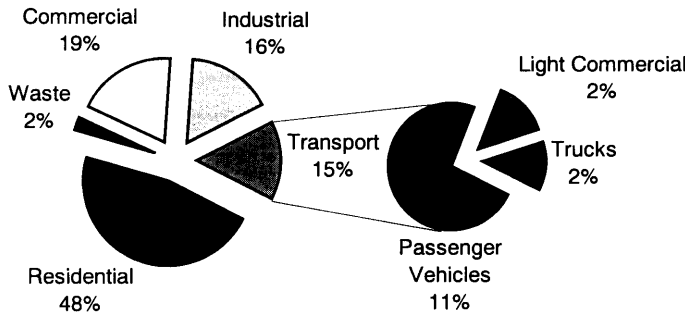
## 4: Community

### 4.1: Results

As previously mentioned, the Community sector deals with all activities occurring within the City of Joondalup that are not directly owned and operated by the City itself. It is divided into five subsections, which primarily used information from the default data. The highest producer of greenhouse gas emissions in this sector is the

residential area, followed by commercial and then industrial (see figure 4). A more detailed itemisation of these emissions can be seen in Appendix 3.

**Figure 4: Community Greenhouse gas emissions (in equiv tonnes $CO_2$) for the City of Joondalup Base Year 1996**




The associated costs of energy for the Community sector are not documented, as the corporate sector is paid for by Joondalup and therefore has more influence. As in the corporate sector, electricity was, by far, the largest source of emissions (Table 8).

**Table 8: Community Greenhouse Gas emissions and Consumption according to Source for Base Year 1996** Source: CCP Software

| | Equiv. CO2 (tonnes) | Equiv. CO2 (%) | Energy (GJ) |
|---|---|---|---|
| Electricity | 955,884 | 72.6 | 3,128,333 |
| Natural Gas | 47,408 | 3.6 | 877,922 |
| Heating Oil | 147 | 0 | 2,103 |
| Fuel Oil | 2,498 | 0.2 | 33,947 |
| Petrol | 139,472 | 10.6 | 2,113,208 |
| Diesel | 80,531 | 6.1 | 1,155,401 |
| LPG | 22,674 | 1.7 | 354,279 |
| Brown Coal | 1,651 | 0.1 | 18,694 |
| Black Coal | 23,189 | 1.8 | 257,656 |
| Coal Briquettes | 480 | 0 | 4,569 |
| Coke | 11,923 | 0.9 | 99,772 |
| Kerosene | 11 | 0 | 162 |
| Paper Products | 16,536 | 1.3 | |
| Food Waste | 16,823 | 1.3 | |
| Plant Debris | -1,758 | -0.1 | |
| Wood/Textiles | -364 | 0 | |
| **TOTAL** | **1,317,104** | **100** | **8,046,046** |

**Figure 5: City of Joondalup Community Greenhouse Gas Emissions Per Capita compared to State and National Averages for Base Year 1996**

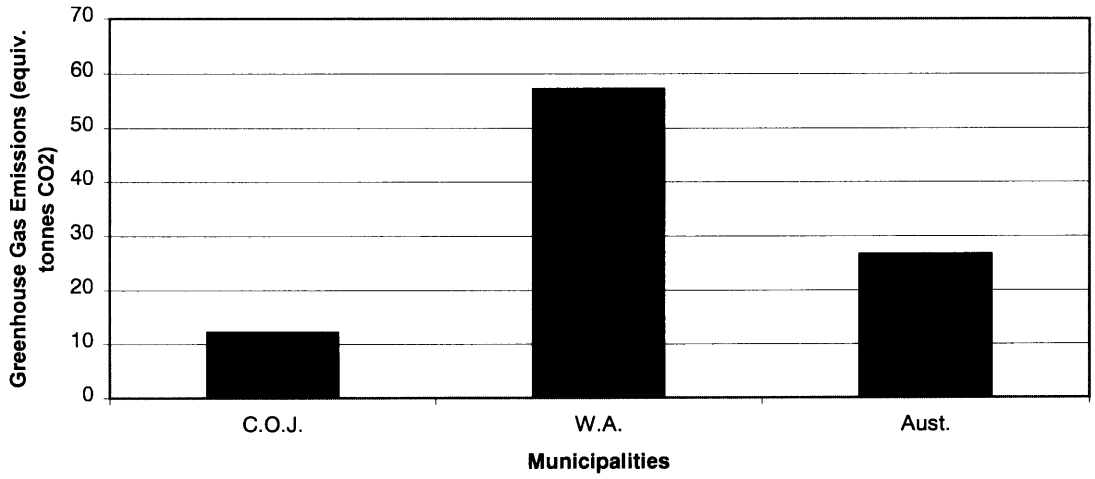



Figure 5 shows a comparison between the emissions per capita for average State and National Municipality figures. Note that Joondalup is quite low, which is mainly due to the lack of heavy industry in the City.

4.1.1: Residential

For this section, actual natural gas figures were obtained from Alinta Gas on a postcode basis. Alinta Gas provided gas consumption figures for all the residences in each postcode area (Table 9). For those postcodes, which are not completely within the City of Joondalup, the relevant percentage was calculated. The total number of units was equivalent to 212,730,212.4 kWh costing a total of $11,199,306.65 from 38,199 customers.

**Table 9: Alinta Gas Residential gas consumption figures according to postcodes**
Source: Alinta Gas, 2000

| Postcode | % Of Postcode in C.O.J. | Consumption (kWh) | Total Annual Sales ($) | Number of customers |
|---|---|---|---|---|
| **6020** | 30 | 10,110,680 | $519,665.03 | 1792 |
| **6023** | 100 | 27,236,080 | $1,336,523.50 | 4509 |
| **6024** | 100 | 22,446,901 | $1,188,530.51 | 4269 |
| **6025** | 100 | 41,313,778 | $2,186,349.56 | 8141 |
| **6026** | 85 | 33,236,346 | $1,777,618.14 | 5627 |
| **6027** | 100 | 59,439,233 | $3,156,385.74 | 10946 |
| **6028** | 100 | 17,530,119 | $959,574.97 | 2639 |
| **6065** | 10 | 1,417,076 | $74,659.19 | 276 |
| **TOTALS** | | **212,730,212.4** | **$11,199,306.65** | **38,199** |

Electricity figures for COJ were provided by ICLEI based on Western Power data for 1997-98. Based on a population of 141,036 for 1996 and 147,021 at 31/12/99 (City of Joondalup, 2000), a population of 144,030 was calculated for the financial year 1997/98 (halfway between the other two figures). The Western Power data was then extrapolated to 1996 figures by dividing the data by 144,030 and multiplying it by 141,036.

The default data figure provided by ICLEI was used for the LPG as Kleenheat could not provide it for confidentiality reasons and no figure was entered for Heating Oil as none is used in Western Australia. The summary of default data information for the Community Sector is in Appendix 4.

### 4.1.2: Commercial

The gas figure from Alinta Gas is given as a total for Commercial + Industrial. Using the default data figures, a percentage of gas use for Commercial compared to Industrial was used and then the consumption was calculated for each, using these percentages. i.e. The default data for the base year 1996 had natural gas as 241,388 GJ (33.27%) for the commercial sector and 483,991 GJ (66.73%) for the industrial sector. The Alinta gas total of 112,166 GJ was divided according to these percentages, to give a commercial gas use figure of 37317 GJ.

Electricity figures for 97/98 were provided by Western Power. Then, based on the same method used for the residential sector (population figures), the data was extrapolated back to 1996 figures. The default data was used for all other energy sources and for the indicator inputs.

### 4.1.3: Industrial

Electricity and Gas figures were both obtained in the same way as they were for the Commercial sub-sector arriving at a total electricity consumption of 448,784 GJ and gas consumption of 74,848.37 GJ. Table 10 shows the total gas consumption for Commercial and Industrial establishments in the City of Joondalup. The default data was used for all other energy sources (Appendix 4).

**Table10: Alinta Gas Commercial and Industrial gas consumption for establishments within the City of Joondalup for base year 1996** Source: Ralph Bailey, Alinta Gas

| Postcode | % Of Postcode in C.O.J. | Consumption (kWh) | Total Annual Sales ($) | Number of customers |
|---|---|---|---|---|
| **6020** | 30 | 1,066,222 | $65,608.18 | 18 |
| **6023** | 100 | 1,472,110 | $87,326.84 | 36 |
| **6024** | 100 | 4,362,628 | $179,225.60 | 37 |
| **6025** | 100 | 13,048,210 | $502,795.87 | 60 |
| **6026** | 85 | 2,676,211 | $153,754.70 | 34 |
| **6027** | 100 | 7,697,188 | $478,226.47 | 103 |
| **6028** | 100 | 226,662 | $14,058.05 | 12 |
| **6065** | 10 | 610,857 | $43,205.68 | 9 |
| **TOTALS** | | **31,160,088** | **$1,524,201.39** | **309** |

An Industrial Land Use Survey prepared by the Ministry for Planning in 1997 provided a clearer representation of the industrial establishments in Joondalup, but this was not used due to discrepancies in the definitions of industrial and commercial establishments. This information is provided, however, in Appendix 5.

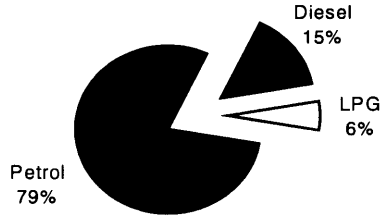
### 4.1.4: Transportation

This subsector provides an estimate of the total travel and type of travel by people in the City of Joondalup. The Annual Vehicle Kilometres Traveled (VKT) by people in

the City of Joondalup was calculated by entering C.O.J. road data into the software. The road data includes the total kilometres of each type of road for 2000 and the Average Annual Daily Traffic (AADT) for 1996 (file *v:\Jacinta\Ccp\Traffic*). The road length figures were extrapolated back to 1996 figures using an average of 12km of road added per year as suggested by Asset management at the C.O.J. These were entered to give a total VKT of 686 million km. This is much less than the default value figure of 1,418 million, which suggests that on a per capita basis, Joondalup residents do not travel as far by private vehicle as the average for Western Australia. The energy consumption for private transport within the City of Joondalup equates to 21.04 GJ per capita.

The total VKT was also broken down into different fuel types and the percentages are indicated in figure 6.

**Figure 6: Total Annual VKT (millions) for City of Joondalup Community according to fuel type for the base year 1996.**




A survey was conducted by Transport in March 2000 to calculate the driver behaviour of people within different areas of the Perth Metropolitan area, including the City of Joondalup. The results of this survey are in Appendix 6. This data was not used as it was for a different base year and did not include Trucks or Light Commercial Vehicles.

4.1.5: Waste

This subsector includes waste from all non-government (non-corporate) activities and uses information from the report *The Development of Options for a Regional Waste Management Plan for the Mindarie Region, 1999*. The percentage breakdown for waste is the same as that for corporate (table 7). Community waste incorporates domestic rubbish collections, commercial waste and industrial (non-hazardous) waste and for the City of Joondalup for 1996, the total waste was 68,873 tonnes. This equates to almost half a tonne per person per year. See Appendix 7 for calculations.

Waste from the City of Joondalup is currently disposed of at the Tamala Park landfill site within the City of Wanneroo. This site has been used for at least ten years (Elliott, R. pers.comm, 2000) and there are currently no landfill sites within the City of Joondalup. Methane extraction is therefore not an immediate option for the City of

Joondalup as methane is only produced for approximately ten years after a landfill site has closed (Bailey, K. pers.comm, 2000).

## 4.2: Discussion

Community emissions were highest for the residential subsector in the City of Joondalup. This is most likely due to the very high number of residents, particularly in comparison to the occurrence of industry and commercial establishments in the City. Although actual figures were used for electricity and gas use, the default figures formed a basis for most of the other data. These figures may not be very accurate due to the fact that they are simply a State average based on population in the municipality and do not take into consideration factors such as facilities available and distance from the CBD.

The presence of the train line in the City of Joondalup is an important factor in reducing emissions from the transport sector and this is also an area where improvements can most easily be made. Encouraging the use of public transport within Joondalup may have a significant impact on emissions. The consumption of fuel per capita for private transport is increasing worldwide as vehicle dependence increases (Newman and Kenworthy, 1999). In 1999, the average fuel consumption in Australia was estimated to be 33.6 GJ per capita compared to 55.8 GJ in the United States and 17.2 GJ in Europe (Newman and Kenworthy, 1999). The figure is much lower for the City of Joondalup (22.04 GJ in 1996) and the reasons for this may be investigated at a later stage.

Other reductions may also be made by incentives within industrial and commercial sectors to reduce greenhouse gas emissions or use more energy efficient appliances. These types of options will be investigated more thoroughly in the Local Action Plan, which is the basis for Milestone 3 of the CCP$^{TM}$ Programme.

## 4.3: Recommendations

The Recommendation section (as for the Corporate Sector) is a suggestion of actions, which may be taken in order to improve data collection and the accessibility of information regarding energy consumption. Individual processes that form part of these recommendations are the sole purpose of Milestone 3 (The Local Action Plan) so they will not be discussed here. Once again, the Recommendations are divided into different subsectors.

### 4.3.1: Residential

***Problem 1:*** *Residential energy use figures were difficult to obtain from the energy providers. Alinta Gas readily provided natural gas consumption data but the Western Power information had to be paid for by ICLEI and the LPG figure was not available at all as Kleenheat Gas would not release any information for confidentiality reasons.*

**Recommendation 1:** Investigate the possibility of obtaining energy consumption figures from the three suppliers on an annual basis to monitor changes in this sub-sector as well as the commercial and industrial sub-sectors.

4.3.2: Commercial

***Problem 2:*** *The number of Commercial businesses in the City of Joondalup proved very difficult to determine. A report is soon to be released from the Ministry for Planning titled 'Commercial Land Use Survey: Perth Metropolitan Region 1997' but it was not available for this report. The survey may also provide information on floor area and number of employees for each commercial establishment. Alternatively, a computer software programme titled Australia on Disk (Donahee, T. pers.comm, 2000) is also available with up to date lists of Commercial and Industrial Establishments according to Local Government area.*

**Recommendation 2a: Obtain a copy of the Ministry for Planning's Commercial Land Use Survey when it is available.**
**Recommendation 2b: Purchase the software programme Australia on disk to obtain an accurate record of commercial and industrial establishments in the City of Joondalup.**

4.3.3: Industrial

***Problem 3:*** *The 'Industrial Land Use Survey: Perth Metropolitan Region 1997' provided very important information for this sector based on floor area and number of employees. Unfortunately, it related only to the Joondalup Industrial complex and did not include all of the smaller industrial areas or individual establishments in other suburbs within the City of Joondalup. In addition, the rates section of COJ could not provide a record of the Industrial establishments within the City without providing a list of every ratepayer and looking through the list individually.*

**Recommendation 3: Maintain a list of industrial establishments in the City of Joondalup either by separating them in the rates records or by conducting a survey similar to the Industrial Land Use Establishments, 1997 report completed by the Ministry for Planning.**

***Problem 4:*** *Emissions from industrial and commercial complexes are not available on a Local Government Scale. They can only be obtained currently on a per capita basis for State figures.*

**Recommendation 4: Investigate the possibility of maintaining emissions figures for Industrial complexes. This is particularly important for heavy industrial complexes, which may release harmful emissions.**

4.3.4: Transportation

***Problem 5:*** *Public transport is not included in the Community Inventory as it is provided by the State Government rather than the municipality. This therefore, does not give any indication of the number of people who prefer public transport to private.*

**Recommendation 5: Investigate the possibility of obtaining public transport use figures for the COJ and compare these to the private transport. The Department of Transport may be able to provide this information.**

4.3.5: Waste

***Problem 6:*** *The amount of waste produced by the City of Joondalup was easy to obtain due to the summary produced at the end of the financial year. The waste composition however was very difficult to attain so once again, State based averages were used.*

**Recommendation 6: Maintain records of total tonnage of waste at the end of each financial year. Investigate the possibility of conducting a waste composition survey.**

***Problem 7:*** *There are currently no landfill sites within the City of Joondalup as the Tamala Park site is shared with the City of Wanneroo. No methane is being extracted from this site.*

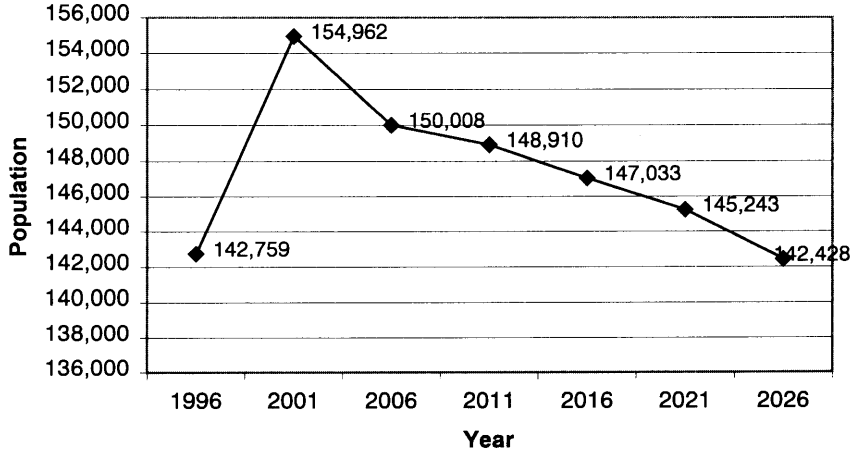
**Recommendation 7: Investigate the possibility of extracting methane from the Tamala Park landfill site to be used as a source of energy for other activities at COJ or the City of Wanneroo.**

## 5: Forecast to 2010

### 5.1: Population Change

Most of the extrapolations for the base year data and the projections for the forecast section have been based on the population of Joondalup at various times. Figure 5 illustrates the estimated population growth from the ABS (Australian Bureau of Statistics) census data in 1996 to a projection for the next 30 years. This is only a general guide and may not be very accurate due to the extent of time that has been estimated. The estimated population of the City of Joondalup on 31 December 1999 was 147,021 – clearly below the projection in Figure 5. The actual population will not be known until the next census to be conducted in 2001.

**Figure 7: Population Projections for the City Of Joondalup from 1996 - 2026**



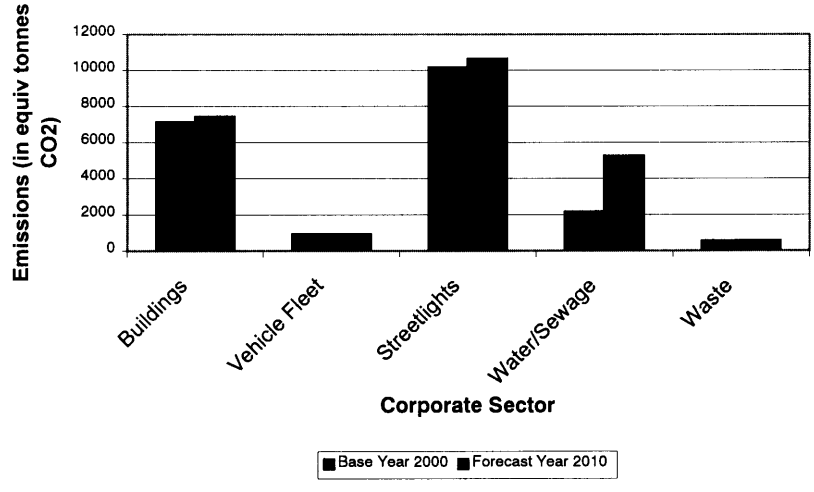
The above projection shows that after increasing for a while, the population of the City of Joondalup is expected to decrease. This simplified population estimates as the population for the forecast year is not expected to be very much higher than the base year. The Corporate and Community Sectors do differ quite markedly though and have therefore been projected separately.

## 5.2: Corporate Forecast

In order to complete the Corporate Forecast, an estimate was needed of the expected increase in infrastructure and services within the City of Joondalup. The *2000-2001 Five-Year Capital Works Programme* document gave a good indication of the changes likely to occur over the next five years. These included: the construction of a new Performing Arts Facility; installation of reticulation at many parks and on median strips; extension of roads and therefore streetlighting; and additional car parking facilities.

As actual figures were not available to forecast growth over the following 5 years (2005 – 2010), the Structure Plan was used along with population growth projections. Current population at the year 2001 is estimated to be 154,962 and in 2011 it is estimated to be 142,428 (City of Joondalup, 2000a). This is a decrease by 12,534 people or 9%. As the same time difference is used (2001 - 2011 instead of 2000 - 2010), the same percentage of population decrease was also used. Figure 8 shows the emissions forecast for the Corporate Sector.

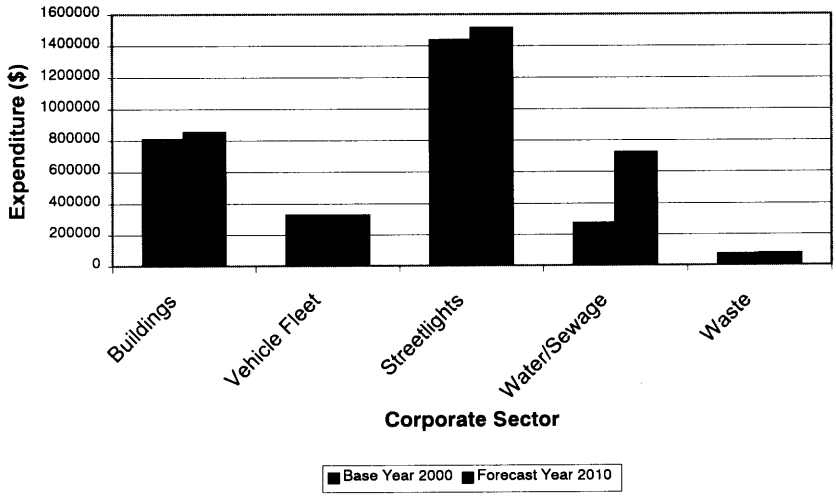
**Figure 8: Forecast of Corporate Greenhouse Gas Emissions from the City of Joondalup from 2000 - 2010**




For example, in the Building subsector, it was assumed that there would be roughly the same growth in the number of buildings over the 5 years from 2005 - 2010 as there was from 2000 – 2005. The increase in electricity used for buildings in 2005 was extrapolated based on population and excludes the Joondalup Performing Arts facility as another building of this size is very unlikely to be built. i.e. Additional Buildings for the next five years will increase electricity costs by an estimated $13,193 (COJ, 2000b). This figure multiplied by 0.91 (for the expected population

decrease from 2005 – 2010) is equal to $12,005.63 and this equates to 76049.61 kWh. Expenditure is likely to increase over all of the subsectors (see Figure 9).

**Figure 9: Forecast of Corporate Energy Expenditure by the City of Joondalup from 2000 - 2010**



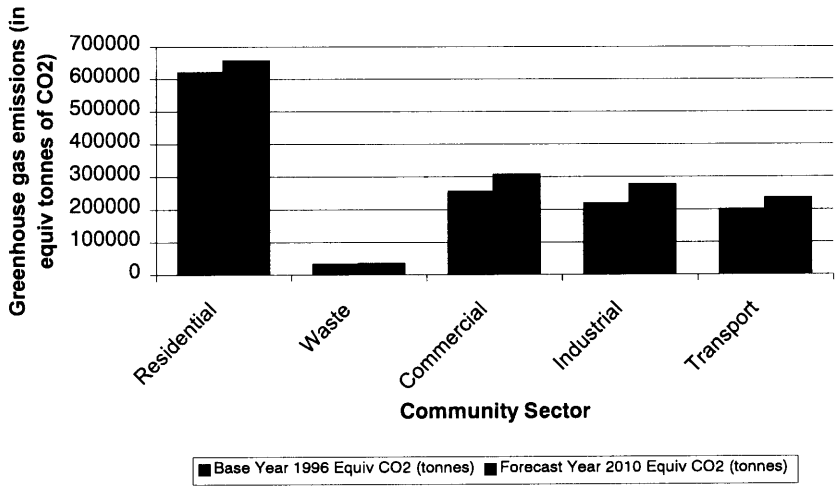

## 5.3: Community Forecast

The community forecast was completed in a similar manner to the corporate forecast (see figure 10) aside from not having a structure plan to go by. Projections were predominantly estimated using population growth statistics and the default data that was provided by ICLEI.

In the residential, commercial and industrial subsectors, the actual electricity and gas figures for 1996 were already available so these were simply entered into the base year on the default data to get the figures for 2010. Other figures were extracted from default data, which are based on statewide projections and multiplied by the expected growth rate for the municipality. The waste to landfill figure was multiplied by 1.056 in line with the population growth expected for 2010. The percentages in each waste category remain the same.

In the transportation calculation, the data from the VKT calculator for the base year was copied into the VKT calculator for the forecast year and the additional road length (estimated by Infrastructure Management to be 12 km per year) was added. The additional road length (120 km over the next ten years) was distributed between the road types, by using the relevant percentages. i.e. the local roads made up 79% of the total road length and 79% of 120 is 94.5 so this was added to the km of local roads for the forecast year. Once again, these figures are only for travel within the COJ boundary.

**Figure 10: Forecast of Greenhouse gas emissions growth (in equiv tonnes CO2) from 1996 to 2010 for the City of Joondalup Community**




## 6: Conclusion

The large population and extensive land area of Joondalup are important factors in the results that have been obtained for this report. For the Corporate Sector, the total Greenhouse Gas emissions for the 1999-2000 financial year were 20,827 equivalent tonnes of Carbon Dioxide costing a total of $2.9 million dollars in energy costs for the City. Community emissions totaled 1,317,104 tonnes for the 1996 calendar year.

The emissions forecasts show a gradual, uniform increase in greenhouse gas emissions arriving at 20% above base year levels for the corporate sector in 2010 and a 14% increase in community emissions from the base year to the forecast year. This may change however, as the City of Joondalup reaches the extent of its development area. The population is expected to decline slightly so the emissions may eventually steady off if behaviour remains relatively the same.

Joondalup is quite a new area and has only recently become separated from the former City of Wanneroo. Some energy reduction measures are already in place such as the installation of energy efficient lighting in the Joondalup administration building but there is also the potential for a great deal of change.

The population of the City of Joondalup is currently 148,253.8 (as at June 2000) (City of Joondalup 2000a), which represents 11% of the Perth population and 8% of the entire population of Western Australia (Government of Western Australia, 2000). The City of Joondalup therefore has the potential to make significant reductions in the level of Greenhouse Gas emissions for the State.

By completing Milestone 1 of the Cities for Climate Protection Programme, the City of Joondalup has taken the first step in reducing greenhouse gas emissions and the continuation into the other Milestones will mean great improvements to the City. The inventory and forecast of greenhouse gas emissions in Milestone 1 provide the basis from which a greenhouse reduction goal may be set and a Local Action Plan prepared in order to outline activities to achieve this reduction goal (Milestones 2 and 3).

## 7: Acknowledgments

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| Contact | Company | Title |
|---|---|---|
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| ***Brad Sillence*** | City of Joondalup | Acting Senior Administration Officer |
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| ***Robert Elliott*** | City of Wanneroo | Manager Environmental Waste Services |
| ***Ranka Kotur*** | Department of Environmental Protection | Environmental Officer - Waste Management |
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| ***Germaine Peters*** | Western Power | Customer Service Officer |
| ***Kathleen Clayton*** | Western Power | Account Manager |
| ***Rani-Jane Muir*** | Western Power | Account Manager - Retail Division |

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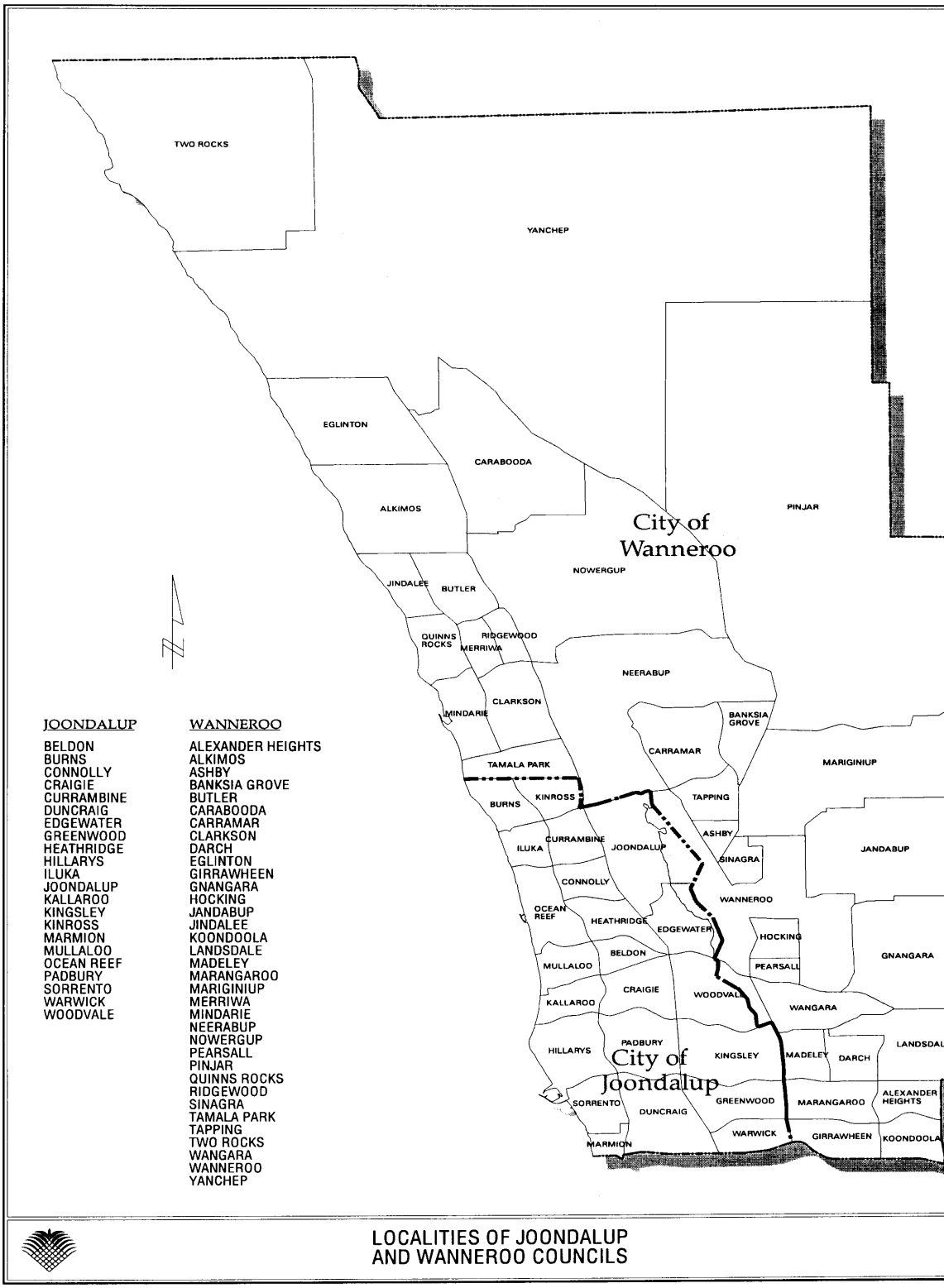
## 9: Index to Figures and Tables

# 10: Appendices

## 10.1: Appendix 1 – Map of the former City of Wanneroo highlighting the area that is the current City of Joondalup Source: Dave Thomson, Urban Design, City of Joondalup




LOCALITIES OF JOONDALUP AND WANNEROO COUNCILS

10.2: Appendix 2 – Summary of Joondalup Corporate Greenhouse Gas Emissions For Base Year 1999-2000 and Forecast Year 2010

Joondalup Corporate Greenhouse Gas Emissions for Base Year 99 - 00 Summary Report Source: CCP Software

| | Equiv. CO2 (tonnes) | Equiv. CO2 (%) | Energy (GJ) | Cost ($) |
|---|---|---|---|---|
| Buildings | 7,086 | 34 | 30,524 | $ 806,080.00 |
| Vehicle Fleet | 922 | 4.4 | 13,643 | $ 322,937.00 |
| Streetlights | 10,135 | 48.7 | 33,169 | $1,434,798.00 |
| Water/Sewage | 2,155 | 10.3 | 7,054 | $ 270,034.00 |
| Waste | 529 | 2.5 | | $ 71,521.00 |
| Other | 0 | 0 | | |
| **TOTAL** | **20,827** | **100** | **84,390** | **$2,905,370.00** |

Joondalup Corporate Greenhouse Gas Emissions for Forecast Year 2010 Summary Report Source: CCP Software

| | Equiv. CO2 (tonnes) | Equiv. CO2 (%) | Energy (GJ) | Cost ($) |
|---|---|---|---|---|
| Buildings | 7,415 | 29.9 | 31,602 | $ 850,279.00 |
| Vehicle Fleet | 922 | 3.7 | 13,643 | $ 322,937.00 |
| Streetlights | 10,636 | 42.9 | 34,807 | $1,511,891.00 |
| Water/Sewage | 5,253 | 21.2 | 17,191 | $ 720,579.00 |
| Waste | 559 | 2.3 | | $ 75,526.00 |
| Other | 0 | 0 | | |
| **TOTAL** | **24,784** | **100** | **97,243** | **$3,481,211.00** |

This report has been generated for Joondalup, Western Australia with software created by Torrie Smith Associates for the Cities for Climate Protection Campaign of The International Council for Local Environmental Initiatives.
Default emissions coefficients were used.

10.3: Appendix 3 – Summary of Joondalup Community Greenhouse Gas Emissions For Base Year 1996 and Forecast Year 2010

Joondalup Community Greenhouse Gas Emissions for Base Year 1996 Summary Report Source: CCP Software

| | Equiv. CO2 (tonnes) | Equiv. CO2 (%) | Energy (GJ) |
|---|---|---|---|
| Residential Sector | 619,183 | 47 | 2,734,881 |
| Commercial Sector | 252,166 | 19.1 | 891,747 |
| Industrial Sector | 216,531 | 16.4 | 1,451,614 |
| Passenger Vehicle | 145,323 | 11 | 2,201,803 |
| Light Commercial Vehicle | 27,876 | 2.1 | 409,797 |
| Trucks | 24,788 | 1.9 | 356,204 |
| Transportation Sector | 197,987 | 15 | 2,967,804 |
| Waste Sector | 31,237 | 2.4 | |
| Other Sector | | | |
| **TOTAL** | **1,317,104** | **100** | **8,046,046** |

Joondalup Community Greenhouse Gas Emissions for Forecast Year 2010 Summary Report Source: CCP Software

| | Equiv. CO2 (tonnes) | Equiv. CO2 (%) | Energy (GJ) |
|---|---|---|---|
| Residential Sector | 654,658 | 43.7 | 2,900,545 |
| Commercial Sector | 304,365 | 20.3 | 1,076,339 |
| Industrial Sector | 274,480 | 18.3 | 1,841,112 |
| Passenger Vehicle | 171,918 | 11.5 | 2,604,745 |
| Light Commercial Vehicle | 32,977 | 2.2 | 484,792 |
| Trucks | 28,310 | 1.9 | 407,560 |
| Transportation Sector | 233,205 | 15.6 | 3,497,096 |
| Waste Sector | 32,986 | 2.2 | |
| Other Sector | | | |
| **TOTAL** | **1,499,694** | **100** | **9,315,092** |

This report has been generated for Joondalup, Western Australia with software created by
Torrie Smith Associates for the Cities for Climate Protection Campaign of The International Council for Local Environmental Initiatives.
Default emissions coefficients were used.

10.4: Appendix 4 – Summary of Default Data for the City of Joondalup Community

Summary of Default data for the City of Joondalup Community
Source: ICLEI

| Residential | Base Year (GJ) | 2010 (GJ) |
|---|---|---|
| Electricity | 1,910,106 | 2,259,121 |
| Natural Gas | 603,634 | 713,930 |
| Heating Oil | 0 | 0 |
| LPG | 98,725 | 116,764 |

| Commercial | Base Year (GJ) | 2010 (GJ) |
|---|---|---|
| Electricity | 826,326 | 997,376 |
| Natural Gas | 241,388 | 291,355 |
| Heating Oil | 2,103 | 2,539 |
| LPG | 43,177 | 52,114 |

| Industrial | Base Year (GJ) | 2010 (GJ) |
|---|---|---|
| Electricity | 458,311 | 577,471 |
| Natural gas | 483,991 | 643,653 |
| Black coal | 257,656 | 345,021 |
| Brown coal | 18,694 | 25,177 |
| Coke | 99,772 | 134,693 |
| Brown coal briquettes | 4,569 | 5,708 |
| LPG | 28,128 | 36,993 |
| Diesel | 485,054 | 582,961 |
| Fuel oil | 33,947 | 45,360 |
| Kerosene | 162 | 201 |

| Transport | Base year | 2010 |
|---|---|---|
| VKT | 1,418,399,052 | 1,813,871,402 |

10.5: Appendix 5 – Summary of Data from Industrial Land Use Report

Data obtained from the report Industrial Land Use Survey: Perth Metropolitan Region 1997 by the Ministry for Planning (May 1999).

The 1993 and 1997 figures in the report were used to extrapolate a figure for 1996, which was used as the base year for the Community Sector.

The calculations for the City of Joondalup are as follows:

| | | |
|---|---|---|
| Total number of establishments: | 99 in 1993 | 205 in 1997 |
| Total number of employees: | 716 in 1993 | 998 in 1997 |

From these figures, the number of employees in 1996 was calculated to be 755 full time and 173 part time.

| | | |
|---|---|---|
| The amount of floor space (in $m^2$): | 40,009 in 1993 | 92,049 in 1997 |

From calculations:

| | |
|---|---|
| The occupied floor space in 1996: | 66,685 $m^2$ |
| The vacant floor space in 1996: | 12,349 $m^2$ |

This gives final figures for the City of Joondalup in 1996 of:

| | |
|---|---|
| 79,000 $m^2$ | floor area |
| 928 | industrial employees |
| 179 | industrial establishments |

These figures were not used in the report as they are based on slightly different criteria than the default data.

10.6: Appendix 6 – Results of the Travel Diary Survey conducted by Transport in March 2000 Source: Colin Graham, Transport

A Travel Diary survey was completed in March in many suburbs throughout the Perth Metropolitan area. The City of Joondalup was studied in the suburbs of Beldon, Craigie, Kallaroo, Mullaloo and Woodvale.

Each person in the survey was chosen at random and was required to keep a Travel diary of all of their trips by all modes of transport for one week.

440 households were surveyed with 1273 people.

The results were as follows:

| | | |
|---|---|---|
| Of all trips: | 55% | in car as driver |
| | 25% | in car as passenger |
| | 2% | cyclists |
| | 12% | walking |
| | 6% | public transport |

These figures averaged 37km traveled by all modes per person per day.

| | | | |
|---|---|---|---|
| Trip distance by car: | 10% | < 1 km | average 0.8 km |
| | 18% | 1 - 3 km | average 2.3 km |
| | 13% | 3 - 5 km | average 4.5 km |
| | 24% | 5 -10 km | average 8.2 km |
| | 35% | > 10 km | average ? |

The average trip distance by car was 12.6 km overall.
The average number of car trips per day was 1.62
The average number of drivers per car was 1.1

For people in a car as driver, the average distance traveled per person per day is 23km (VKT).

VKT x 365 (days per year) x population = Total Annual VKT

Total distance per person per day:

| | |
|---|---|
| Car as passenger | 8 |
| Public transport | 3.8 |
| Walking | 1.1 |
| Bicycling | 0.2 |
| Motorcycling | 0.2 |

## 10.7 Appendix 7 – Waste Calculations

Waste data was calculated from the report *Development of Options for a Regional Waste Management Plan for the Mindarie Region* by BSD Consultants (1999).

The community waste to landfill for the City of Joondalup in 1996 was calculated to be 68,873 tonnes.

Figures in the report were available for 1997/98 for the former City of Wanneroo. Joondalup and Wanneroo figures were therefore combined
In 1997/98, 68.2% of the City of Wanneroo's population lived in the area that is now known as the City of Joondalup (based on 1996 census data).

This figure was then extrapolated to a 1996 figure by using the 1996 census population and the 1999 population projection on the City of Joondalup web page.

A figure halfway between the population for 1996 and 1999 was calculated by subtracting the 1996 population from the 1999 population to come up with a 1997/98 population figure of 144,028.

The 1996 population equated to 98% of the 1997/98 population. The waste figure for 1997/98 was therefore multiplied by 0.98 to get a total waste to landfill figure of 67,495.54 tonnes for 1996.

**Table 1**

**Review of Budget Implications of CCP Milestone 1 Report Recommendations**

| Recommendations[1] | Benefits | Implications | Implementation Status |
|---|---|---|---|
| **Recommendation 1:** Where buildings are recorded on the Oracle database, add the Western Power and Alinta Gas account numbers near the location code. Do this for all sections. | Avoids confusion, particularly when the building address varies from the meter location. | Relates to the City's Maximo system. Implementation involves investigation, system set-up costs and operational (ongoing) costs. | Implementation proposed for 2001. |
| **Recommendation 2:** Start recording units of electricity and gas for bills. Do this for all sections. | Minimises time spent looking through bills. Enables easy indication of energy cost increase. | Requires a modification to information input and database management. Costs involve set-up/modification costs and ongoing staff/time costs with data input. | Subject to further investigation before any decision taken. |
| **Recommendation 3:** Record building size and operating hours. | Enables comparisons to be made with other buildings of similar size, operating for similar periods of time. | Administrative project requiring an assignment of task to staff. Minimal budget implications. | Implementation proposed for 2001. |
| **Recommendation 4:** Maintain a record of all vehicle kilometres travelled and the number of days that the car is used. | Fuel use can be recorded accurately despite fluctuations in fuel prices. | Recommendation does not need to be implemented as information is now available. | Not for Implementation. |
| **Recommendation 5:** Find out from Western Power if it is possible to receive bills electronically with the number of units included. | Save time in entering the data onto the Oracle database. | Correspondence required with Western Power. Introduction of new software, based on e-commerce approach, may require a budget of up to $20,000 for software development.<br><br>Possible opportunity for use of "smart metres" or sub metres. | Subject to further investigation before any decision taken.. |
| **Recommendation 6:** Maintain an accurate record of pump activity such as times they are turned on and how long they run for. If a timer is used, this should be kept constant and the days when rain prevents the pumps being needed, this should be noted. | Allows an accurate measure of the amount of electricity used by the pump. | Budget implication is dependant on the proposed methodology and scope to assess electricity usage. Subject to further investigation. | Subject to further investigation before any decision taken. |
| **Recommendation 7:** Record the type of waste that is collected by the City into various categories e.g. Paper, food etc. | Accurate percentages and therefore emissions from waste can be recorded. | Typically carried out as a waste categorisation consultancy project, subject to scope of works and quotations. Budget likely to range between $5,000-$20,000. | Administration view – not for implementation. . |

| Recommendations[1] (Continued) | Benefits | Implications | Implementation Status |
|---|---|---|---|
| **Recommendation 8:** Investigate the possibility of obtaining energy consumption figures from the three suppliers on an annual basis to monitor changes in this sub-sector as well as the commercial and industrial sub-sectors. | Improved data management and annua reporting. | Correspondence to three suppliers. Comments as per Recommendation 5. | Implementation proposed for 2001. |
| **Recommendation 9a:** Obtain a copy of the Ministry for Planning's Commercial Land Use Survey when it is available.<br>**Recommendation 9b:** Purchase the software programme Australia on disk to obtain an accurate record of commercial and industrial establishments in the City of Joondalup. | **9a.** Enables fuller assessments of commercial businesses to be made.<br>**9b.** Provides an effective database for research use for commercial activities. | **9a.** Approximately $20.<br>**9b.** Database/ programme available from retail outlets (assumed cost $200). | Implementation proposed for 2001. |
| **Recommendation 10:** Maintain a list of industrial establishments in the City of Joondalup either by separating them in the rates records or by conducting a survey similar to the Industrial Land Use Establishments, 1997 report completed by the Ministry for Planning | As above. | Dependant on scope and extent of listing and staff time required for implement.<br><br>Information may be available from existing Proclaim system. Requires a review and analysis of property records. | Implementation subject to further investigation. |
| **Recommendation 11:** Investigate the possibility of maintaining emissions figures for Industrial complexes. This is particularly important for heavy industrial complexes, which may release harmful emissions. | Improves database for commercial/industrial sector of the CCP Greenhouse gas inventory. | This recommendation relates primarily to Milestone 3, in which specific actions are proposed for Greenhouse gas reduction. Implementation of this recommendation is premature. | Not for implementation. |
| **Recommendation 12:** Investigate the possibility of obtaining public transport use figures for the COJ and compare these to the private transport. The Department of Transport may be able to provide this information. | Improves estimation of community transportation figures, with improved energy and Greenhouse gas emission estimates. | Recommendation obsolete due to the availability of the recently released TravelSmart project from Department of Transport. | Not for implementation. |
| **Recommendation 13:** Maintain records of total tonnage of waste at the end of each financial year. Investigate the possibility of conducting a waste composition survey. | Provides for improved reporting and characterisation of waste stream. | A waste composition survey involves significant funds for a consultancy project. | As per recommendation 7. |
| **Recommendation 14:** Investigate the possibility of extracting methane from the Tamala Park landfill site to be used as a source of energy for other activities at COJ or the City of Wanneroo. | Utilisation of an unused energy source, reduced Greenhouse gas emissions. | Tamala Park is regionally managed. Previous investigations have already been conducted. Substantial consultancy project | Not for Implementation. |

(1) Recommendations have been re-numbered for ease of use.