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Oil Risk Summary

We are all highly dependent in many ways on affordable, available oil. Our ability to get to work and other destinations, and access to products and services we rely on – from food, clothing and shelter to education and health care – relies on access to oil. But according to global experts, supplies of oil are fast running out, and as they do oil prices will rise steeply, with the price of all the things that depend on it rising as well. As oil reserves become scarcer, supply interruptions will also occur. The City of Stirling has the capacity to take important steps towards reducing, and eventually eliminating, the dependence of residents, businesses and the City on crude oil, while at the same time continuing to enhance Stirling’s quality of life and productivity. But action without delay is necessary, because it will take ten years at the very least to turn things around in the ways described.

A crisis in the making

The International Energy Agency is not an organisation given to rash statements. The IEA represents the governments of oil consuming nations like Australia, the United States and countries of Europe, and until recently it had expressed itself cautiously in public discussions over peak oil and its consequences. But in an interview on Catalyst on 28 April 2011, the IEA’s Chief Economist, Dr Fatih Birol, had this to say:

   Interviewer: Dr Birol, are you personally worried?

   Birol: I am personally worried because of the general picture...Governments should have started ten years ago.

If the International Energy Agency believes governments should have started to face the challenge of peak oil ten years ago, it is certainly necessary to face that challenge now. All governments, including local governments, rely heavily on accessible and affordable oil for their daily operations, and local residents and businesses are just as dependent on it. And it’s not just about our personal transport. Everything we buy – from food to houses, from clothes to equipment to medicines – depends in some way on oil, as do the many vital services we rely on, such as health, education, aged care and emergency services.

‘Peak oil’ is the point at which the demand for oil overtakes supply, and from then on oil is predicted to rise more steeply in price and to be harder to obtain, with interruptions in supply likely. It will not suddenly become permanently unavailable. Rather, over time there will be less and less oil, and more and more will need to be extracted from hard-to-reach places at greater expense. The world will be dependent on fewer and fewer oil exporting countries, many in politically turbulent regions, so remaining supplies may be interrupted by geopolitical events, and exporting countries are also likely to retain a larger share of production for their domestic markets. Coupled with diminishing supply is rising demand, especially in rapidly industrialising countries like China and India.
Most experts predict that peak oil will occur around 2014 (plus or minus 5 years) and, as this range indicates, some say it has occurred already. Global conventional oil production has not risen for the period 2006-2011. Commentators stress that conventional oil (the basis of the past 50 years of urban development due to its low price) has peaked and that from here on deep-sea oil, tar sands and other unconventional oil (which is very expensive to extract) is the only source of potential oil production growth. The graph below shows how quickly the price of oil is currently rising. It plunged at the time of the global financial crisis (with many arguing that its previous high price helped to cause the crisis), but it is on the increase again, and if it continues on its present trajectory it will reach $200 a barrel between 2014 and 2016.

Figure 1. Increases in the price of oil per barrel over time

Increases in the price of oil per barrel over time

The International Energy Agency is just one prominent body that recognises the threat posed by peak oil. Other respected agencies that have done so include the International Monetary Fund and the US Joint Forces Command, and in Australia the CSIRO and the Macquarie Bank.

What does this mean for the City of Stirling?

For councils, a timely and effective response to this impending oil scarcity constitutes a prudent risk management strategy. Lloyds of London, the world’s leading re-insurer (insurer of insurance companies), is sufficiently concerned about peak oil to have joined forces with the Royal Institute of International Affairs to produce a report on the subject. Addressed to companies, but equally relevant to councils, it has this to say: ‘Companies which are able to take advantage of this new energy reality [emerging peak oil] will increase both their resilience and competitiveness. Failure to do so could lead to expensive and potentially catastrophic consequences.’ Public bodies that fail to act on a recognised risk in the present may be called on to explain their inaction at some point in the future.
We not only don’t know precisely when peak oil will occur, we also don’t know exactly how its consequences will manifest themselves. A study by Wight and Newman predicts a range of possibilities: volatile price fluctuations and/or intermittent supply interruptions; or progressive price rises and diminishing supply; as well as the possibility of a sudden critical supply interruption in a major field caused by a cyclone, war or terrorism. Councils clearly need to be prepared for many possibilities – for the consequences of peak oil to occur earlier or later; to be sudden, incremental or intermittent; and to be manifested as higher prices or an absence of supply, or both at different times.

The consequences of these rising prices and supply interruptions for Stirling residents, business and the City, if proactive measures are not taken, are likely to be as follows:

- **Residents** will face greatly increased costs for petrol, if they can obtain it at all, as well as very crowded and often highly inadequate public transport alternatives. As well, there will be sharp increases in the costs of goods and services and reductions in their availability, proportionate to their reliance on oil. This will place great strains on household budgets, especially for those on low incomes or those living away from employment and commercial centres, and this may lead to a number of things, including mortgage defaults and tenant evictions (and thus increased homelessness), absences from work and education, inability to access health and other essential services, family stress and inadequate nutrition.

- **Businesses** will also face greatly increased costs for transport and for any goods or services reliant on oil, and reduced availability. This in turn will push up the prices of products and services these businesses are trying to sell, at a time when consumers and other businesses are less able to pay, so sales are likely to slump, leading to business failures or down-sizing, with consequent higher unemployment. Absenteeism will also affect business costs and performance.

- **Council** will have to cope with greatly increased community need as a result of the above factors, at a time when the escalating price of oil greatly increases its operational costs and oil supply interruptions disrupt its services, while council income falls as a result of factors including lower property values, rate payment defaults, reduced use of some Council facilities such as leisure centres, and possibly reduced funds from state and federal governments, who will face similar cost and income pressures. It will also be much harder for council staff to get to work.

From a risk management perspective, it is critical that the City has a plan in place that identifies the risks it faces and the ways it will respond to these risks. This is further discussed later in this summary and then in the next document, the Oil Risk Strategy.

**A better way**

There is, however, a far better option than to simply plan how to cope with a peak oil emergency, important though this is. That option is to plan and implement proactive measures that reduce and, in the long term, eliminate Stirling’s dependence on crude oil. This is a highly complex and challenging goal, but it can be done as long as all levels of government co-operate and bring the community and industry into a rapid de-oiling of the economy. The process needs to start with recognition of the extent of dependence on oil and local government can play an important role in this process.
Australia will be importing as much as 80% of its oil by 2015, and currently around 95% of our transport runs on it. This is why demand for oil is relatively ‘inelastic’: we are so dependent on it, and alternatives take so many years to be widely adopted, that when the price rises we tend to just accept it and pay up. Senior US energy advisor Robert Hirsch has recommended we should start the switch from oil ten years before the onset of peak oil in order to ensure an orderly transition. This takes into account the slow turnover rates of private and commercial vehicles and aircraft, and our fixed long term capital investment in oil refineries. The IEA estimates that a doubling of oil prices would cut immediate demand by only 3%. However, while most of us are currently prepared to pay as the price rises, such rises will nonetheless severely impact on personal, business and government budgets, and as oil supplies continue to diminish, prices will keep increasing and supply interruptions are likely to be increasingly common.

So, peak oil and its consequences are expected to occur within a decade, and a decade is the bare minimum time it takes to move to a non-oil based economy. That's the bad news. The good news is that the measures local government needs to implement now in order to meet this challenge are measures that offer many other benefits - measures that the City of Stirling would most likely want to implement anyway for a range of other reasons. Indeed, the City is already taking many initiatives – introduced for various purposes – that will increase its resilience in the face of peak oil, and these are acknowledged in this report. While they are highly commendable, they are not in themselves sufficient. However, the additional measures recommended in this report will be equally likely to enhance the life of the City and its people – to increase residents’ health and wellbeing, to make businesses more productive, and to save individuals, firms and the City money, as well as reducing greenhouse gas emissions.

Councils around Australia are increasingly formulating plans to face the challenge of peak oil, and so having such a plan is becoming a norm for local government, a key part of risk management and responsible planning for the future. This is reflected in the fact that the Queensland Government now requires all its councils to adopt a peak oil plan. Stirling would be the first council in Western Australia to do so, and if it does it is likely to be seen in years to come as a pioneer in sustainability.

**A focus on the responsibilities of local government**

Reducing vulnerability to peak oil, or implementing emergency measures in the event of its occurrence, involves action at local, state and federal government levels. Local governments concerned about peak oil may want to take action on aspects of the problem that normally sit within state and federal government responsibilities, but this is not advised. There are many actions that local governments can and need to take, and doing these thoroughly and well is their major responsibility. Stirling residents are also Western Australian residents and Australian residents and, as such, they should expect as much help in dealing with peak oil from state and federal governments as from the local government. While state and federal government resources are limited, so are those of local government. It should be assumed at the outset that state and federal governments will take seriously their responsibility for people’s wellbeing. The City of Stirling can certainly advocate – either by itself or in cooperation with other councils – the adoption of particular policies at state or federal levels, but it needs to focus primarily on its own responsibilities to deal with peak oil. There is much to be done that is clearly the job of local government.
The structure of the recommended actions

This Report recommends five sets of complementary measures to be implemented to protect the City of Stirling, its people and its businesses from the adverse consequences of peak oil, and to allow Stirling's functioning and quality of life to be maintained and even enhanced. These are introduced below. But they cannot be implemented all at once, everywhere in the city, to the full extent necessary, so a set of criteria for prioritising and scheduling measures have been included to assist in the process of deciding what should be implemented at different stages, when, where, to what extent and in what ways, and these are also described below.

The five recommended sets of measures are:

1. measures that reduce the number of kilometres that people and goods travel
2. measures that reduce or eliminate the use of oil in personal and freight transport
3. measures that enable Stirling to be less reliant on external sources of electricity derived from fossils fuels, because the price of other fossil fuels is likely to increase as a consequence of peak oil
4. measures to inform and engage residents, businesses and Council personnel in successfully dealing with the peak oil challenge
5. the creation of a contingency plan setting out steps to be taken to reduce the pain and disruption of peak oil if the City has not taken proactive measures in time.

The first three are sets of proactive or adaptive measures that will permanently reduce dependence on crude oil while maintaining and in many ways enhancing the functioning and quality of daily life in the City. Let's look more closely at these:

First, there are **measures that reduce the number of kilometres travelled** by reducing the number and length of trips required for the transport of people and goods. This includes increasing urban density, having more mixed use zoning, and taking initiatives that encourage local production and service provision, and the buying of local products. It also includes a stronger focus on community-building, support for self-provisioning, and measures to reduce the travel of Council staff. Measures that reduce the length of trips will also encourage walking, cycling and public transport use, particularly if transit stations, higher density multi-purpose activity centres and areas of restricted car use are co-located.

The second set deals **with transport measures that reduce or eliminate the use of oil per kilometre travelled** for personal, business or Council purposes. These measures encourage, plan and enable increased use of public transport (with options for rail based freight including cargo trams), cycling, walking, and the use of more fuel efficient vehicles and electric vehicles. They also include demand management measures to reduce car use, as well as ways to reduce oil use in transport by Council staff. Urban land use changes that make public transport, walking and cycling more viable are covered in the first set of measures.

The third set of adaptive measures are those **that enable Stirling to be less reliant on external sources of electricity derived from fossils fuels**, as both these electricity supplies and the fossil fuels they rely on will be in greater demand and subject to price rises and possible supply interruptions once peak oil occurs. This will result from increased use of public transport and electric vehicles, and likely pressure to produce synthetic oil from gas and coal, which fuel most current power generation. Consideration of local, renewable power generation is recommended.
The purpose of the fourth set of measures is to support the implementation of the first three sets. **These measures inform and enable residents, businesses and Council staff to be actively engaged in dealing with peak oil.** It is vitally important for the City to take residents and businesses with it on this journey to resilience in the face of peak oil, for two reasons. Firstly, as a democratic institution, the City needs to have community support for major policy thrusts like this. Secondly, the City needs residents and businesses to help it implement the measures, because implementation involves thousands of individual actions as much as it does Council regulations, programs and budget items. Gaining public support involves community consultation, information provision and behaviour change programs. A vital part of this process is to let people know about the wellbeing, productivity and savings benefits of the measures to be implemented. In addition, it is important that Council staff are informed and able to implement Council policies on peak oil, and this can be achieved through in-service training, information sessions and on-line information, as well as internal procedures to expedite and monitor the implementation of the recommended measures.

So a range of adaptive measures can feasibly be put in place by Council, with support from residents and businesses, to deal with the threats posed by peak oil. However, if the City of Stirling should choose not to heed the advice of bodies like the International Energy Agency and Lloyds of London to take immediate proactive action, or if sudden interruptions in supply or steep price rises occur before Stirling’s measures can be implemented, the Report also recommends that the City prepares a contingency plan with measures to be implemented to reduce the pain and disruption of peak oil when it occurs, as has already been mentioned, and suggestions as to what these contingency measures should contain constitutes the fifth set of measures. These contingency steps need to enable the City to maintain as many services as possible, and to minimise peak oil’s impact on people’s lives, but as indicated this will be in the probable context of greatly increased demand for assistance, significantly higher costs for many items, and reduced Council revenue as a result of economic upheaval. The steps cover four areas:

- enabling Council staff to get to and from work or to work at, or closer to, home
- maintaining essential services that rely on transport, from meals-on-wheels to garbage collection
- overall rationalisation of Council services given likely price rises and reduced City revenue
- Council responses to increased demands for assistance that result from rising prices, shortages of essential goods and services, travel difficulties, social isolation and increased unemployment.

The contingency plan would need to identify: (1) specific adverse occurrences relevant to Council operations and services that peak oil is likely to precipitate (if no proactive measures are taken to prevent this); (2) the likelihood of these occurrences; (3) their consequences for the community; (4) the severity of these consequences; (5) emergency measures Council would need, and be able, to take to deal with the consequences; and (6) possible adverse consequences even *after* emergency measures have been attempted.
This Report recommends the introduction of the adaptive measures as soon as possible – although it is not feasible to do them all at once – while the contingency measures should be planned, but only implemented if they are needed. The more the City implements adaptive measures, the less it will need to implement contingency measures.

**The Oil Risk Strategy**, which follows this, explains in greater detail the science of peak oil, its probable consequences – especially for Stirling’s residents, businesses and Council – and the ways in which the City can protect itself against these consequences, through emergency measures, but more importantly through proactive measures that reduce and eventually eliminate the City’s dependence on crude oil. Those who want a quick overview of this Report can skip this part and just read the Oil Risk Summary and the Implementation Strategy.

**The Implementation Strategy** completes this Report by listing again the recommended measures and the options within each of these measures, and outlining the practical steps required to prioritise, plan and implement the measures. Industrial society has grown up on a diet of cheap, plentiful oil, but we must now waste no time in moving on to energy sources and ways of using and conserving energy that can truly sustain us into the future.
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Oil Risk Strategy
Body of Knowledge
Part Two – Body of Knowledge

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Overview

The Oil Risk Strategy begins with a description of peak oil, its impacts, and the organisations and authorities that are calling for action to protect ourselves from its consequences. It then examines the consequences of peak oil for the people and businesses of Stirling, and for Council operations.

Next it describes briefly the steps that have been taken so far within the City of Stirling to research, discuss and plan an appropriate response by the City to the threat posed by peak oil. Following this, there is consideration of the City of Stirling’s commitment to sustainability, including a commitment to dealing with the issue of peak oil, as demonstrated in a number of strategy plans that the city has produced, and in a range actions that are already underway.

The bulk of the strategy is then devoted to the five sets of measures that are recommended to protect the City and its people and businesses from the threats posed by global oil depletion and the risk of supply shocks.

What is peak oil?

Peak Oil is that point in time when the rate of oil production worldwide starts its inevitable decline. It is widely forecast to occur sometime around 2014 (plus or minus five years). We will probably not know when oil production reached its all-time maximum until some years after the event. As well there are differing definitions and estimates of oil production, so there is considerable uncertainty about the data behind the forecasts. Some observers are more optimistic, but they are now in the minority.

There have been a number of authoritative and important reports warning about Peak Oil or oil scarcity. The International Monetary Fund, Lloyds of London, and the US Defence Department, and in Australia the CSIRO and Macquarie Bank have all warned about oil shortages in the near term. Even the International Energy Agency now supports urgent action. The IEA was established by the oil-consuming nations to counterbalance OPEC and in the past it has been very optimistic about future oil production rates. It has been criticised for caving in to US pressure to understatement the problem, and by the Global Energy Systems group in Sweden for over-estimating production-rates in its forecasts. Now, however, the IEA has become increasingly outspoken in its warnings about declining production rates in the world’s currently producing oilfields, and it has been continually revising downwards its estimates of forward oil production. In general, then, while there are other views, the growing body of evidence from a wide range of sources supports the view that peak oil is likely to occur within the next few years.
Oil rose from $14 a barrel in July 1998 to $145 a barrel in July 2008, before falling briefly to $30 as a result of the global financial crisis, then rising again steeply to almost pre-GFC levels. There is no reason to believe it will not keep increasing to $200 and beyond (barring further economic crises which may bring about temporary reversals). Declining production is just one side of the equation; the other side is rising demand, especially from industrialising giants like China and India – and we have no basis for challenging their right to do so, as they are simply claiming what we already have. CSIRO’s Future Fuel Forum economic modelling has a worst-case scenario of $8 per litre for transport fuel in Australia by 2018 if peak oil occurs soon, and if alternatives like large-scale coal-to-liquids and gas-to-liquids are not on stream.

The majority of world's giant oilfields are already in decline. As a local example, Bass Strait started its decline in 1985 and is now producing only a tiny fraction of its peak yield. Australia’s overall oil production peaked in 2000 and is going downhill fast.

In its comprehensive World Energy Outlook in November 2008, the IEA released results of a unique analysis of 800 oilfields, including all 54 super-giants (> 5 Gbbl) in production today. It estimates that the average production-weighted decline rate worldwide for fields that have passed their production peak is currently 6.7% p.a., and this is expected to increase to 8.6% p.a. in 2030. This means that fresh sources of oil producing a total of 45 million barrels a day (over half the world's current production) will have be found simply to maintain present levels of supply to 2030. According to IEA Chief Economist, Dr Fatih Birol, ‘The world is heading for a catastrophic energy crunch that could cripple a global economic recovery because most of the major oil fields in the world have passed their peak production.’
And yet the International Energy Agency may still be overly optimistic. IEA estimates of future production have been reviewed by Prof Aleklett of the Global Energy Systems group at the University of Uppsala in Sweden. Using the same basic data of decline rates of existing fields and reserves in the ‘yet-to-be-developed’ and ‘yet-to-find’ categories, the Uppsala group forecasts very considerably lower production rates out to 2030. They discovered that the IEA had assumed unrealistically high production rates from the reserves in the new fields, twice as high as has ever been achieved in any oil region, even high-tech areas like the North Sea and the Gulf of Mexico. This, and some other more minor differences, led Prof Aleklett to estimate a global production rate, based on the same IEA data, of 75 mb/day in 2030, compared to the IEA’s 106 mb/day, which is 41% higher than the Uppsala group’s forecast.

Figure 3. Different world oil production forecasts using the same reserve data

As illustrated in the IEA forecasts, declining production in existing fields will be offset in part from production from fields already discovered and being brought on-stream, and from those yet to be discovered. The near-term production from fields already discovered can be estimated from published information on existing and proposed projects. It should also be noted that it is much more expensive to recover oil from deep sea fields and tar sand deposits than from more conventional fields.

As well as planning for peak oil, Australia should also be preparing for sudden oil shocks, bigger than the 1973 and 1979 oil crises. A revolution in Saudi Arabia or a war in Iran, for instance, would cause a dramatic global oil crisis. Contingency planning is recommended for, say, a 30% shortfall of transport fuels for three months or more (analogous to WA’s 2008 Varanus Island natural gas shortage). The natural gas shortage was handled by constraining big industrial users in WA without any significant impact on ordinary people. However, a 30% petrol and diesel shortage would hit WA people much harder than the gas shortage.

It is easy to underestimate the magnitude of future oil price rises, as even a body of the economic calibre of the Australian Bureau of Agricultural and Resource Economics (ABARE) has consistently done, as shown in the following graph. (The coloured lines are the ABARE predictions.)
Governments, communities and investors should be aware of the probability of future oil scarcity. Peak oil will certainly mean peak (petrol-driven) car travel and peak airline travel. Ordinary people and small businesses are making long-term plans on the assumption that fuel availability and travel patterns will remain the same as they are now, an assumption that is quite unfounded.

Peak oil is likely to be upon us very soon, and the time to start to protect ourselves from it is now.

**The likely impact of peak oil in Stirling**

**Impact on Council operations**

The City performs a number of core functions, some of which are statutory obligations, while others are undertaken in response to community expectations. Numerous activities are directly dependent on oil-based fuel inputs. Of the more critical to the health and wellbeing of our community are waste removal and recycling, engineering operations, security patrols, health inspections of food premises, and delivery of meals on wheels. Road re-surfacing, another key role played by local authorities, is dependent not only on fuel inputs to power the equipment used, but also on tarmac, an oil derivative.

Almost all products used by councils, businesses and households are dependent on oil in one or more of three ways: they are almost all *transported* using oil; many are grown, processed or manufactured using *machinery* fuelled by oil; and many are often or always *made* from oil (among other ingredients). This last category includes:
• all plastics, including hoses, water pipes, plastic bags and nylon rope
• many vehicle and engine parts
• many building materials, such as paints, varnishes, glues, caulking products, wiring insulation, light fittings and roofs
• building, gardening and road maintenance tools
• fertilisers and herbicides
• carpets, linoleum and materials for upholstery, curtains and awnings
• computer equipment and phones
• appliances
• inks
• cleaning products
• personal washing products
• clothing and footwear, including protective gear
• many pharmaceuticals

As well, many Council processes – in addition to transport – require oil, for example, mowing, and the construction and maintenance of roads and paths. Examples of the City’s functions and their potential vulnerability to peak oil are as follows:

• **Road surfacing and maintenance**: difficulty in affording resurfacing materials largely composed of oil (tarmac) and high costs of sealing the City’s numerous Rights of Ways

• **Engineering operations**: higher cost of transporting materials on site due to higher fuel prices, and more expensive building materials (with high embodied energy in concrete, bricks and tarmac)

• **Maintenance of parks and reserves**: rising cost of fuel for mowing crews, and escalating prices of oil and gas-derived synthetic fertilisers, pesticides and herbicides

• **Provision of Meals on Wheels service**: rising cost of fuel to deliver meals, higher food prices, higher cost of cooking and refrigeration if electricity prices escalate in the wake of higher fossil fuel prices

• **Waste removal and recycling**: higher cost of fuel

• **Security patrols**: also higher fuel costs

• **Heating of swimming pools**: increased gas prices as the world increasingly switches from costly oil to cheaper gas

• **Air-conditioning and heating of the City’s buildings**: higher electricity prices given increased demand for coal and gas

• **Human resources**: employees having difficulty reaching work, possible demands for higher pay to compensate for escalating costs of living

• **Rates collection and revenue**: landowners’ difficulties paying rates, leading to increased delays and non-payment, and possible reduced funds from state and federal governments due to reduced income and rising costs at those levels of government
• **Income from planning and building approvals**: increased pressure to reduce fees and charges given escalating construction costs, and probably contraction of construction activity as a result of increased materials and construction costs and likely economic downturn

• **Health**: threats to public health from inability to remove waste frequently enough, and increasing cost of some medical supplies.

The Council is also likely to face additional demands on its services as a result of higher prices and possible economic downturns faced by residents, businesses and employees, as described below.

**Impact on the Community**

As the price of transport, food, electricity and other goods and services increases, residents and businesses could become increasingly financially stressed. With higher prices for essentials and concern about financial security, consumer and business demand for more discretionary goods and services (such as cafes and restaurants, and home and garden products) is likely to contract. Businesses facing the squeeze of higher costs and reduced demand for their products and services may lay off staff or possibly cease trading, leading to increased unemployment. Higher consumer costs and increased unemployment may cause more residents to have trouble meeting mortgage and rental payments, leading to mortgage defaults, tenant evictions and higher rates of homelessness. Increased inflation is likely to translate into higher interest rates, further increasing financial stress on residents and businesses.

The combination of housing-related financial stress and transport problems in localities distant from activity centres, employment and public transport is likely to drive down the price of real estate in those localities, perhaps to prices lower than the mortgages of many homeowners. The subprime mortgage crisis in the US serves as an example of how rising loan default rates can trigger a ‘credit crunch’ with serious ramifications for other businesses, since credit is the lifeblood of an economy. Moreover, the subprime crisis has been most acute in America’s highly car-dependent outer suburbs. Transport difficulties in Stirling’s less connected localities may make it hard for residents to access health and other vital services, and to commute to work, leading to higher rates of absenteeism. (See Appendix I: Relative transport vulnerability map.)

The worst-case scenario entails a rapid decline in world crude oil output accompanied by periods of global supply interruptions. This would seriously disrupt passenger and goods transport in Stirling as Australia imports the majority of its refined fuels. Perth public transport could not cope with large numbers of displaced motorists attempting to shift their travel mode. The relevant authorities would find it difficult to procure a sufficient number of additional buses and rail cars in time, due to a backlog of existing factory orders and increased demand for such products from across the world. Fuel would have to be rationed to the highest priority areas such as transportation of food and provision of emergency services. Even these sectors could experience restricted supplies.
By identifying possible risks to Council and community, this Strategy can help inform discussion on adaptation measures. Clearly, the City cannot provide solutions to all the possible risks that may emerge as a result of peak oil. It is therefore essential to think in terms of strategic partnerships with other levels of government, with the community, businesses and non-government organisations. A managed, intelligently proactive transition to an oil-constrained future is infinitely preferable to an unplanned transition characterised by ad hoc individual responses and incoherent actions from government, businesses and residents. The Report argues for the need to identify risks and then work collaboratively to find solutions that are feasible and in line with the principles the City espouses, including that of sustainable development. Across the range of its responsibilities, the City of Stirling has demonstrated its commitment to proactive, collaborative planning in order to meet the challenges of the future and built a great city. The Oil Risk Strategy is submitted as an approach to the issue of peak oil that is consistent with this model of governance to which the City is committed.

**Specific action on peak oil in Stirling so far**

An internal Peak Oil Working Group (POWG) was formed within the City of Stirling, and this has engaged with managers and senior officers across the organisation, in particular arranging briefing sessions for the City’s Sustainability Working Group and for the Leadership Team, which comprises all managers and directors. The POWG facilitated a one-day workshop in February 2009 to explore issues and responses from across the organisation.

Drawing on the input from these consultation processes, the Peak Oil Working Group produced a Peak Oil Strategy and an accompanying Implementation Plan, to identify the issues and map out feasible responses that could be reviewed periodically.

It was then decided that these two documents should be peer reviewed by external consultants, and Curtin University Sustainability Policy (CUSP) Institute and Parsons Brinckerhoff were engaged to conduct this review. The consultants have met with the POWG, the Coordinator of Strategic Planning, the Coordinator of Risk Management and the Coordinator of Emergency Management in the processes of revising these documents, and three revised documents have emerged from this process with the addition of an Oil Risk Summary.

The Vision of the Oil Risk Strategy is as follows: *To maintain quality of life for all with diminishing supplies of oil.* It seeks to realise this vision through five sets of measures:

1. measures that reduce the number of kilometres that people and goods travel
2. measures that reduce or eliminate the use of oil in personal and freight transport
3. measures that enable Stirling to be less reliant on external sources of electricity derived from fossil fuels, because the price of other fossil fuels is likely to increase as a consequence of peak oil
4. measures to gain the support and involvement of residents, businesses and Council personnel in successfully dealing with the peak oil challenge
5. the preparation of a contingency plan containing measures that can be taken to reduce the pain and disruption of peak oil if the City has not taken proactive measures in time.
In addition to this specific process to deal with the issue of oil vulnerability, the City has already identified the need to deal with the issue in a number of planning documents, some of which are described below.

**The City of Stirling’s commitment to sustainability**

The City has produced a number of documents in line with its commitment to planned, collaborative, sustainable development. These include its Strategic Plan, Sustainability Policy, Local Housing Strategy, Integrated Transport Strategy, and draft Cycling Strategy, along with a range of documents produced by the Stirling City Centre Alliance. The Oil Risk Strategy is very much intended to complement these plans.

The most recent Strategic Plan identifies the City’s commitment to ‘the careful and controlled management of non-renewable resources’ and, as part of this, its intention to increase the use of renewable resources. The plan seeks to position the City ‘as a flagship of sustainable urban local government, encouraging innovative, creative and inspirational built form and infrastructure’, as well as continuing ‘to implement and support strategies for sustainable transport including walking, cycling and public transport via education and infrastructure’. It aims to achieve these things by guiding ‘the sustainable development of the major activity corridors, activity centres and...local centres’. Among the localities identified are the Stirling City Centre and the Scarborough Beach Road Activity Corridor, and the need to work in collaboration with the Commonwealth and State Governments is highlighted.

The Sustainability Policy’s set of ten principles emphasises that equal consideration needs to be given to social, environmental and economic aspects of issues, and that decision-making should take into account the long-term implications of decisions, and inter-generational equity. It stresses the need to reduce the City’s ecological footprint, to internalise the full environmental costs of practices and developments, and to take measures to mitigate adverse impacts.

The Local Housing Strategy emphasises the impact of the built environment on the level of car dependency in Stirling, with a high level of dependency leaving ‘large sections of the community and business exposed to the vagaries of a capricious and volatile global energy market’. It further adds:

*Poor road connectivity, absence of commercial and community facilities within walking distance of homes, and inadequate cross-suburban public transport services set the built environment context in which much of our housing is being provided. Single-use “big box” shopping centres sited in a “sea” of asphalt, serve the surrounding residential hinterland. Selective actions applied under the City’s transport, industrial and commercial strategies, provisions proposed under draft Local Planning Scheme 3, and continuing work on Activity Corridor Reviews and Local Area Planning, will help to gradually address these concerns by identifying additional opportunities for higher density and mixed use developments in precincts and corridors well connected to high frequency transit services. In addition to these key land use planning initiatives, the City is also progressing work on its Climate Change Action Plan and has established a Peak Oil Working Group to introduce measures to further mitigation objectives and build resilience in the face of uncertainty and change.*

The local Housing Strategy recommends complementing the focus on mixed use, higher density centres and corridors well connected to transit, with measures in the rest of Stirling to encourage some higher density development and mixed land use in otherwise low density residential areas.
The City’s Integrated Transport Strategy identifies improvements to pedestrian and cycling facilities and bus services as the best ways to address car dependency in these low density areas. Overall, the Transport Strategy seeks to achieve more efficient and sustainable transport of people and goods through improvements to integrated transport planning, public transport, pedestrian and cycling amenity, and demand management of private vehicle travel, with attention to physical infrastructure, policy and travel behaviour. The strategy identifies peak oil as a key issue to be addressed.

In short, all of these plans and policies are moving in the same direction, advocating a City that has higher density, mixed use activity centres and corridors with excellent, well-integrated public transport and walking and cycling facilities, as well as private vehicle demand management policies, with additional measures to increase density, mixed land use and public and non-motorised transport in other parts of the city.

Beyond these strategy documents, the City has taken a number of important steps in recent times that enhance sustainability and promote the kinds of changes recommended in this Report. These include:

- plans for transit oriented developments: Stirling City Centre and Mirrabooka Regional Centre
- increased resources for footpath construction
- advocacy for light-rail in a Stirling Alliance submission to Infrastructure Australia
- the development of community gardens at Joondanna and Gwelup
- initiating the recycling of road surfacing materials
- the adoption of a Purchasing Policy and Tender Guide, which has environmental objectives and could be adapted to include criteria related to peak oil
- the introduction of a single bin system for collection and recycling, thus reducing pick-up trips and diesel use, and increasing recovery of recyclables.

This Oil Risk Strategy is entirely consistent with these strategy documents and initiatives. It aims to add to the steps that have already been taken to prepare Stirling for oil vulnerability in the following ways:

- There are some problems that are specific to peak oil, and some measures that must be taken specifically to deal with peak oil. The problems relate primarily to oil’s affordability and availability, and the practicalities of Councils, residents and businesses carrying out normal operations in circumstances of oil scarcity. The measures relate to contingency plans in case the City is not prepared when the consequences of peak oil occur.

- Climate change is achieving much attention, more than peak oil is, but the consequences of peak oil are likely to occur earlier. Thus, focusing on peak oil in addition to climate change strengthens the case for action to reduce oil use, and to switch to renewable stationary energy, and strengthens the case for this action to be as swift as possible.
• There is also a specific ‘payoff’ to those who take action on peak oil that doesn’t occur in the case of action on climate change. People who reduce their carbon footprint get no more benefit - at least in terms of experiencing a better climate – than people who take no action, because the benefits of a better climate are shared across the globe. On the other hand, residents, businesses or councils that act on peak oil reap direct benefits in terms of reduced reliance on a diminishing commodity. Action on peak oil not only protects the actors from that problem; it is also yields a universal benefit by reducing carbon footprints.

• In broad terms, the strategy aims to draw together a range of measures and considerations relevant to peak oil into one coherent whole, including aspects such as possibilities for localised power generation, and necessary information provision and behaviour change measures to engage resident and businesses. Having one coherent strategy – that draws on elements that have already started to be planned and implemented in Stirling – will enable the City to really focus on reducing, and eventually eliminating, dependence on this diminishing resource.

Measures to build protection against peak oil

This strategy sets out the five sets of measures to protect the Council, businesses and residents from the adverse consequences of peak oil that were listed earlier in this document. These sets of measures are now considered in more detail in the pages that follow.

Reducing the kilometres that people and goods travel

In seeking to reduce Stirling’s reliance on oil, it is necessary to address the amount of passenger and freight transport that occurs, that is, the number of trips taken and the distances of these trips. The fewer kilometres travelled the less oil is used, of course, but in addition – as will be more fully explained in the next section – shorter travel distances increase the likelihood that the trips will be taken by modes other than cars.

There are a number of factors, discussed below, that determine kilometres travelled. Consideration is given to general trends and how these are evident in Stirling, and then to measures that can be taken to achieve travel reductions.

Population density

The more sparsely settled the built environment is, the further we have to travel for the various trips we need to make. We are also more likely in such an environment to make single purpose trips in different directions, rather than multipurpose trips to localities close to one another. Australian cities are very sparsely populated by world standards, on par with United States cities. By comparison, Brussels has about 6 times Perth’s population density, while Barcelona is over 16 times as dense. According to a 2010 Australian Conservation Foundation study, Perth is Australia’s most unsustainable city, with – among state capitals – the second lowest population density and the highest passenger vehicle ownership per 1000 people. Australians are now building the largest houses in the world, at an average 215 square metres per new house, compared with 202 square metres in the US, 137 in Denmark (with the largest new houses in Europe) and just 76 square metres in Britain.
At the same time as Australian homes are getting bigger, numbers of people per household are shrinking, and the average Australian home now has around 2.5 occupants. In Stirling the figure is even lower, at around two occupants per dwelling, with a significant recent drop in household sizes at the same time as new houses have been getting larger. The city’s housing market is not adequately responding to the demand for smaller dwellings, especially for the growing elderly population. Added to this is the fact that road reserves consume about 30% of the land in residential areas. This could be less – as it is in many cities around the world – if a reduced percentage of private vehicle trips permitted smaller road reserves in new developments that are large enough to involve road construction. In other locations a part of existing road reserves can be converted for other uses.

Urban sprawl not only means that people have to travel further for various purposes within the boundaries of urban settlement. It also necessitates longer trips to obtain products from adjacent rural areas, such as food, timber, sand and gravel.

It is important to recognise that increased urban densities do not mean reductions in quality of life. This is demonstrated in global wellbeing surveys, such as Gallup Global Wellbeing, in which western European wellbeing levels are on par with those of Australia and the US, though urban population densities are much higher. In fact, there is currently an increased demand in Australian capital cities for higher density inner suburban dwellings, as reflected in real estate prices.

Well-designed higher density urban areas can have housing of 2-5 storeys, and occasionally higher, with less land devoted to private gardens but greater use of gardens that are included (bearing in mind that there is little use of front and side gardens in most low density suburbs). To make up for this loss of greenery around dwellings, and thus to avoid higher temperature ‘heat islands’ occurring, the amount of greenery in a locality can be increased without taking up significantly more space, through:

- street tree planting
- denser planting on verges
- planting on land gained through the narrowing of roads
- greenery in tubs and planter boxes in shopping centres and along footpaths
- high quality small public gardens
- the ‘daylighting’ and greening of streams previously converted to drains
- the use of swales to collect stormwater
- the encouragement of ‘biophilic’ design in building, such as planting on roofs, walls, fences and pergolas (and the adoption of these features for Council buildings).

Increased density is one of a number of factors that can contribute to the walkability of an area, because density makes both transit and mixed land use more viable. Urban compactness also means that buildings are closer to the street, which tends to create more interesting, human scale urban spaces, and a sense of enclosure, safety and ‘transparency’ (that is, clarity of the purpose of buildings).
The City of Stirling is already taking steps to increase the density of the built environment. Its Local Housing Strategy is committed to ‘increase population densities within the pedestrian catchments of Activity Centres and Corridors' (Objective 7) and to ‘prepare the City and the community for the projected changes in climate and energy supply vulnerability’ (Objective 4). The Strategy contains a range of measures to increase density and achieve various other objectives at the same time in mixed use, higher density locations, such as the provision of density bonuses for developers willing to offer a proportion of dwellings that are, for example, lower cost, or of suitable sizes for elderly occupants. In lower density areas it advocates ongoing community engagement to identify additional locations for infill development, as well as provisions for higher density development in lots adjacent to public reserves or Right of Ways, utilising split coding arrangements to preserve heritage character or meet other requirements.

An example of a higher density development in an existing low density Stirling suburb is the proposed development on the former Carine TAFE site, which would include an aged care facility and general housing. This is currently being considered for planning approval, and as conceived it could make a number of contributions to the building of peak oil resilience in the locality, given its proposed higher density, plans to encourage car sharing among residents, and planned high levels of energy and water efficiency in the development.

Mixed land use

If land use in urban areas is highly segregated, with whole suburbs devoted almost exclusively to housing, and quite separate areas for shops, offices, industry or other purposes, then it means that, on average, people have to travel much further to get to work, to go shopping, to conduct other business or to return home. Thus, zoning is a major cause of increased travel. When highly segregated zoning was first introduced it made a lot more sense than it does today, because, for example, industry was often noisy, polluting and unsightly. But with modern regulations and technology substantially reducing and even eliminating these problems, there is much less reason to isolate industry from other land uses, and the need to do so can be considered more on a case by case basis. Issues of pollution and unsightliness are rarely a problem with other land uses, while noise is generally only a problem with certain entertainment venues, and this can also be dealt with on a case by case basis.

Parking and traffic congestion have also been reasons for separating residential areas from shops, offices and other land uses. But council regulations can prevent cars from parking in front of residences and require most parking to be off-street, and there are many ways of discouraging through-traffic in particular streets. More importantly, as this Report argues, urban environments of the future will need to be much more car-free. Thus, rather than driving a car some distance to work or the shops or some form of entertainment, the resident of the future will be much more likely to walk, cycle or catch transit for these trips, which will usually be much shorter.

Such mixed land use will not lead to a decrease in amenity. On the contrary, it is likely to lead to more varied and interesting neighbourhoods, and again the popularity of the inner suburbs of our capital cities, where land use is more mixed, amply demonstrates this.
This Report does not advocate that the switch to more mixed land use occurs evenly across the whole of Stirling. The emphasis needs to be on higher density, more mixed land uses in designated activity centres and along transit corridors, with generally lower densities and less mixed land use elsewhere. However, even in these latter areas, some increase in density and mixed land use is desirable, and additional activity centres based on transit routes may be created at locations within these areas at some future point. The Local Housing Strategy presents a range of options for increasing mixed land use and density together, as has been described. With regard to achieving more mixed land use in predominantly residential areas, some possible non-residential uses include delis or corner stores, cafés and other small shops, health clinics and home-based businesses.

There are great possibilities for the introduction of Transit Oriented Developments (or TODs) in Stirling. These are higher density, mixed use urban developments located at or near transit stations, with excellent walkability, restricted parking and car use, and an emphasis on achieving a high quality urban environment. The planned Stirling City Centre is such a TOD. Transport provisions in TODs can be partly or wholly financed from mandated developer contributions (given that the presence of the transit will enhance property values), or it may simply be anticipated that increased property values will in turn increase revenues to government from these developments (although mechanisms need to be developed to ensure that this additional revenue – from different levels of government – can be used to fund the transit\(^\text{i}\)). Other measures can include parking levies, specified area rates, and tax incremental financing.

As already stated, a major advantage of mixed land use is that it reduces the length of trips people need to make, because home, work, shops, services and other destinations are close together. However, the cost or design of housing can often undermine this benefit. People who work in an area, or access shops and services there, may not be able to afford to live anywhere nearby. Alternately, housing in the area may not match the size of households seeking housing. It may be too small or – increasing common in Stirling – too big (given falling household sizes), forcing people to pay extra for space they do not need or look elsewhere. So the lack of suitable or affordable housing options in an area can force people to live in outlying suburbs or those far from activity and employment centres, and to travel long distances for work and other purposes.

It is quite common for developers to be required to provide a proportion of low income housing units within residential developments, and they could be required, as part of such an arrangement, to provide a designated proportion of that housing to low income employees working in the local area (as is currently being implemented in the City of Perth), and to provide a range of housing sizes. In the case of housing for employees, there may need to be a requirement that these employees have been in a position for a stipulated period of time, and that their employment is ongoing. Such a provision would not only reduce commuting for these local employees; it would also make it more likely that they would stay working in the locality for longer.
Local economic production and retailing

The length of passenger and goods trips will be significantly affected by how local the economy is, that is, how local production is, and how local buying and selling are. On the production side, this relates to the proportion of goods available in Stirling that are manufactured, grown or processed within Stirling, and the proportion of services that are provided by local people. The more goods are locally produced and services are provided by locals, the less travel is likely to have been involved in their provision. On the retailing side, it concerns the proportion of goods bought by the people of Stirling that are purchased within Stirling, or better still, purchased close to their own homes or businesses. The more goods are bought locally, the less travel is involved in these trips.

Considering first the level of local production, much attention has been given to the increasing globalisation of production over the past few decades, and to the theory of comparative advantage that underpins it. Globalisation has been driven by the loosening of restrictions on the flow of goods and finance across national borders, the growth of information and communications technology (ICT), the expanding role of transnational corporations, and the lower labour costs of newly industrialising countries. It has meant that a large proportion of the goods we buy are manufactured overseas and have therefore travelled long distances in vessels and vehicles that are mostly fuelled by oil. As the price of oil rises and its availability diminishes, these goods will become more expensive and their supply more uncertain.

The same applies to goods consumed in Stirling that are produced in Australia but not in or near Perth. Given Perth’s isolation from other population centres, and given that much of the state is arid, a very large proportion of these goods will be transported thousands of kilometres from the eastern states, and will be similarly vulnerable to the price and availability of oil.

However, this does not simply mean that all goods should be sourced closer to home. Efficiencies of scale come into play in the manufacturing or processing of goods and in their transport, such that it is often much more efficient overall – including energy efficient – to produce goods in larger quantities and move them over longer distances. Considering for a moment the transport of these goods, the energy used depends on a lot more than just the distances travelled. It also depends on the mode of transport, its freight capacity and how fully loaded it is, the efficiency of its engine and whether it runs on oil. So a light commercial van with a fraction of a full load of packaged oats may use many hundreds of times the oil to transport each kilogram of oats one kilometre that an efficient diesel train with wagons of bulk oats uses. And of course if the train is renewably powered, the difference is even starker. It has been calculated that, if you consider wheat grown in New South Wales, turned into breakfast cereal there, freighted to Perth, stocked on a supermarket shelf, purchased and taken home in a car, around 70% of the transport energy consumed in this journey from farm to table is used in taking the cereal home from the supermarket.

At the same time, the efficiencies of large-scale global production can be exaggerated or attributed to all industries when they only apply to some. It must be remembered that the great majority of businesses in Australia and other industrialised nations are small to medium-sized businesses, and factors like outsourcing and ICT make it increasingly possible for well-networked small businesses (including manufacturers) to be very competitive. And local businesses stand to become much more competitive as the cost of transport increases. This applies to businesses involved in production, service provision or retailing.
The City of Stirling does not need to be able to calculate all the factors and trends just described. Rather, it needs to ensure that, if it is worthwhile for production, service provision or retailing to occur in Stirling, then there are opportunities for businesses to engage in this. Mixed land use provisions will increase the range of location options for businesses, and good transport to activity centres will improve access for both staff and customers. If these locations are considered desirable places to work or shop then there will be more customers, happier workers, and more job candidates for employers to choose from. On top of this, research indicates that businesses are more productive in denser precincts, and that their employees are additionally productive if these precincts are walkable.

Council can give local businesses a ‘leg-up’ by favouring locally owned and situated businesses in its procurement and investment policies. It can also set up one or more ‘business incubators’, centres within which fledgling small businesses can be located until they are firmly established. Such incubators enable these businesses to share office equipment, reception staff, accounting services and other facilities and services, and to benefit from the business advice offered by the management of the incubators. In selecting businesses for these incubators, the Council may decide to favour those businesses supplying the local market from local production, those meeting basic needs, and those conforming to certain sustainability criteria. It may also consider offering initial or ongoing rate reductions to businesses meeting such criteria.

Council can also facilitate or permit markets close to transit for stallholders selling fresh produce, crafts and other items, and such markets often greatly enhance the character and appeal of a locality (and can thus have a flow-on benefit for other businesses as well). Council can also support the development of Community Supported Agriculture (CSA) schemes. However, if the goal of these measures, in whole or in part, is to save oil, then it must be recognised that inefficiencies in transporting goods to markets and CSA customers, and making return journeys, may in some cases cancel out the oil savings achieved by the shortness of the trips. This needs to be assessed, but even if there are serious inefficiencies, if may be possible for Council to advise small farmers and traders on how they can achieve more efficient transport.

In addition, Council can support self-provisioning, especially of food, at a household or neighbourhood level. Food can be grown in home or verge food gardens (including on roofs in new developments), or in community gardens on existing green space, and Council can facilitate gardening programs and courses. In this way, through some fairly inexpensive measures – including information provision, advice, liaison with educational institutions and perhaps some small grants – it can leverage a large amount of household and community effort. This may not save huge quantities of oil, but communities thus connected and engaged are a ready audience to consider other oil-saving measures and connect with yet other audiences.

A form of local trading that is somewhere between community self-provisioning and conventional trade can be achieved through the use of a local trading currency, and Council can support the introduction of such a currency if there is a community initiative to do so. These currencies are common around the world, and are often called LETS (Local Enterprise Trading Schemes) or time dollars.
People sign up to the scheme, receive an initial allocation of the currency, and then start to trade. The currency may or may not have a physical form, but transactions can be recorded on paper or electronically, perhaps with a plastic card. Some local financial institutions even allow transactions in the currency. It generates an ‘extra layer’ of economic activity on top of existing buying or selling of goods and services that people engage in with the national currency, and this layer is exclusively local and usually labour-intensive, and therefore less vulnerable to oil depletion. Examples of services that are commonly exchanged are gardening, home or bike repairs, house cleaning, catering, childcare and hairdressing. Such schemes are also a very good way to build community connectedness and cooperation.

**Community connections and attachment to the locality**

People choose to work, shop, be educated or spend leisure time in particular locations not just for functional or utilitarian reasons. They also base these choices on whether they like the location in an aesthetic sense, and whether they have social connections there that make them feel good. These are under-recognised but important reasons why people gravitate to certain locations. If we want people to do all these things closer to home, we need to do what we can to make it a good experience for them. Otherwise they will simply travel elsewhere for that quality of experience, as is demonstrated by people’s preparedness to travel halfway round the world for a holiday experience that may be only marginally more satisfying that one fifty miles away. And socially relationships are just as important as attractive localities, and have a huge impact on our health and wellbeing. As evidence of this, research has found that if a person who is not a member of a local organisation joins one, their chance of dying in the next year is halved. Thus, Stirling will have trouble persuading residents to work, shop, be educated or engage in leisure activities within the city unless it is able to provide the desired quality of experience. This will involve creating physical environments that people enjoy being in, and helping to build strong networks of social connection within these environments.

A key way in which Council can help to build strong social networks is by facilitating resident and business involvement in local organisations and activities. It can do this in a number of ways: by ensuring that there are attractive community premises available for all kinds of gatherings and activities, by providing seed grants to help groups and activities get going, by supplying the public with information about community groups and activities (including in behaviour change programs discussed later), and by sponsoring selected events, particularly those that can showcase local groups, such as community fairs. More localised economies also tend to build social capital, because shoppers, shopkeepers and producers get to know one another better – often in a range of contexts, which tends to strengthen their sense of shared experience. A study of the opening of Walmart stores in US towns found that in each case the opening of the store caused local businesses to close, which in turn led to a decline in social capital. Another study found that there were ten times as many conversations in a farmers’ market as in a supermarket.

Council can enhance the attractiveness of activity centres and other public spaces in a number of ways. These include:

- a strong emphasis on walkability and cycling, and a minimising of the impact of cars
- streetscapes that are visually interesting, with diverse colours, shapes and materials
• a strong presence of greenery and water, and shading from trees and verandahs
• 'eyes on the street', that is, frequent doors, windows and porches facing the street
• 'soft edges' to the street, that is, the blurring of the boundary between streets and buildings with pot plants, seats, stalls and other features
• maintaining human dimensions, through streets, gardens and squares that are intimate in size, and buildings abutting the street that are no more than four or five storeys high
• lots of places for people to sit
• encouraging human activity in public places: buskers, concerts, fairs, art exhibitions, street stalls, pavement cafés, chess tables, tai chi, and so on.

Council employees’ travel

While Council is only able to reduce the travel of Stirling residents and workers through such devices as persuasion and urban planning, it has more direct control over the movement of its own staff. There are a range of ways in which it can provide the same standard and extent of services for the people of Stirling, while cutting down on travel undertaken by staff.

It can explore arrangements that allow staff to work at or closer to home (for example, in premises of adjacent councils), for some or all of their working time, using email, drop boxes, skype, phone conferencing and similar technology, together with regular but less frequent face-to-face contact. These arrangements can be flexible such that, if practical problems occur, they can be reviewed and changed.

Council can also investigate the decentralised delivery of a range of Council services, perhaps through the establishment of a series of small, localised general-purpose Council premises, each serving as a base for the delivery to the immediate locality of, for example, personal care services or security patrols, using ICT as previously described to maintain good communication with colleagues.

Where feasible, Council can also consider switching to standard or electric bicycles for security patrols and other council services, especially those that have been decentralised as described above.

Recommended measures to reduce the number of kilometres that people and goods travel

These include higher urban densities, more mixed land use, support for more localised economic production and the buying of local goods and services, the strengthening of community connections and attachment to the locality, and reducing the amount of travel undertaken by Council staff. Reducing kilometres travelled will also make the switch to walking, bikes and public transport much more feasible.

I. Increase urban density. Options:

   a. Implement the recommendations of the City’s Local Housing Strategy, in relation to higher-density, mix development in activity centres and corridors, and to other parts of Stirling.
b. Raise allowable heights or dwellings per hectare and/or mandate minimum heights or minimum dwellings per hectare in developments at or near activity centres and transit stations, in order to substantially increase building densities in these areas.

II. **Adopt more mixed use zoning.** Options:

a. Allow mixed residential and other land use in higher density areas near transit stations, subject to provisions to protect amenity, as recommended in the Local Housing Strategy and the Integrated Transport Strategy.

b. Allow mixed use in other predominantly residential locations as appropriate and feasible, for example, allowing more ‘corner shops’, cafes, clinics and home-based businesses.

c. Facilitate the development of transit oriented developments (areas of high density, mixed land use, restricted car access, high levels of walkability and proximity to transit) with funding of transit through property value capture mechanisms.

d. Stipulate the inclusion, within *residential* developments in activity centres and along transport corridors, of a variety of dwelling sizes, and a component of low income housing, including housing for low income local employees.

III. **Encourage decentralised economic production and trading.** Options:

a. Adopt Council procurement and investment policies that favour local businesses engaged in local production for local customers.

b. Support self-provisioning, especially of food, through encouragement or facilitation of home or verge food gardens, community gardens on existing green space, rooftop gardens in activity centres, gardening courses and other measures.

c. Establish one or more business incubators for start-up small local enterprises, particularly those supplying the local market from local production, those meeting basic needs, and those meeting certain sustainability criteria.

d. Consider a scheme to offer initial or ongoing rate reductions to businesses meeting criteria as described in ‘c’ above.

e. Facilitate the setting up of markets for locally made produce near public transport, and of community supported agriculture schemes, subject to an analysis of the oil use and transport efficiencies of these activities, as described earlier.

f. Consider supporting the introduction of local trading currencies if there is community interest.

IV. **Strengthen community connections and attachment to the locality.** Options:

a. Facilitate resident and business involvement in local organisations and activities through provision of community premises, seed grants, information provision, coverage in behaviour change programs, and the sponsoring of selected events.
b. Ensure the attractiveness of activity centres and other public spaces, with particular attention to visual interest, walkability, shading and greenery.

V. **Consider ways of reducing Council employees’ travel.** *Options:*

a. Explore arrangements that allow staff to work at or closer to home (for example, in premises of adjacent councils) for some or all of their working time, using email, drop boxes, skype, phone conferencing and similar technology, together with regular but less frequent face-to-face contact.

b. Investigate the decentralisation of a range of Council services through the establishment of a series of small, localised general-purpose Council premises, each serving as a base for the delivery to the locality of services, for example, personal care services or security patrols, using ICT as described in ‘a’ above.

### Reducing or eliminating oil use in passenger and freight transport

In the area of transport, the second way to reduce oil use is to encourage and enable people and freight to travel using modes of transport that use less oil or no oil at all. Approximately 97% of Australia’s transport is fuelled by oil, and this oil-based transport accounts for 77% of the country’s oil use.\textsuperscript{xv} Thus, to avoid the risks peak oil poses, we need to switch to public transport – trains, light-rail and buses – which either doesn’t run on oil or uses far less per passenger kilometre, or to walking, cycling, electric vehicles, or more fuel efficient petrol vehicles. Trains service the highest volume routes, followed by light-rail (or trams) and possibly bus rapid transit (or BRT, described below), while standard buses service the least volume routes.

Reducing oil use in transport is not just a matter of supplying more trains or buses or footpaths, or making electric cars available. It also depends upon things such as:

- good urban planning, with increased density and mixed land use along transit corridors and at activity centres near transit stations (that is, putting people closer together, and closer to transit)
- the integration of different transit modes with each other and with walking and cycling routes (in other words, making all the parts of a non-oil transport system join up)
- demand management measures to encourage the switch from private vehicles to other modes (helping people ‘over the hump’ of habitual ways of travelling)
- measures to help this switch to occur for Council operations and staff commuting.
Existing City of Stirling strategy documents address these issues very well, for example, the Integrated Transport Strategy and the Local Housing Strategy. As was described earlier in this section, the Transport Strategy advocates more efficient and sustainable transport of people and goods through improvements to public transport, pedestrian and cycling amenity, demand management of private vehicle travel, with properly integrated transport, and integration of land use and transport policies. Thus there need to be ‘high activity’ land uses – that is, higher densities of residents, workers, shoppers and so on – in activity and employment centres close to transit and to good walking and cycling facilities. In low density residential areas the Transport Strategy identifies improvements to pedestrian and cycling facilities and bus services as the best ways to address car dependency. The Transport Strategy’s advocacy of an east-west rail line along Reid Highway, and light-rail along major routes such as Scarborough Beach Road, are other measures that will reduce oil dependency if implemented.

The Housing Strategy also recommends mixed use, higher density development in activity centres and corridors that are well connected to transit, complemented with measures in the rest of Stirling to encourage some higher density development and some mixed land use in otherwise low density residential areas. These land use measures are described in detail in the previous section.

It is worth considering further the complex relationship between transport modes, urban density, distances travelled and travel efficiency. The following are some points to note:

- In cities with a lower proportion of car use less land is required for travel space, because public transport, walking and cycling use the space more efficiently, and this increases urban density (in addition to the many other measures that can increase density).

- In denser areas more people can be close to transit, and if more people can access transit it becomes more viable financially and, in turn, services can become cheaper and more frequent, and capital can be channelled into improvements to the comfort and efficiency of both the vehicles or rolling stock and the stations. In turn, such improvements will attract more passengers and the cycle will continue.

- By contrast, the more cars there are on the roads, the less efficient this transport mode becomes.

- Buses are a special case, because they usually share road space with cars, but bus rapid transit (BRT) can have dedicated lanes, as already occurs in many cities including Perth. This also acts as a demand management measure for private vehicles by restricting road space. BRT is now so popular in some Latin American cities that the buses are starting to bank up – a problem low density Perth is unlikely to have for some time – but this does demonstrate that such BRT services should be complemented with higher-volume train or light-rail services.
• Research has also established that people who use public and non-motorised transport tend to travel less and, specifically, that every kilometre of transit replaces from five to seven kilometres of car use.\textsuperscript{xvi} There are various reasons for this. High capacity transit – that is trains – generally have more direct routes than cars do. ‘Trip chaining’ is more likely, that is, doing several things in one trip, such as commuting to work, shopping and accessing services. Households of transit users are more likely to own one vehicle instead of two (and therefore share trips more) or no vehicle at all (in which case more local travel will be favoured). In time, many transit users, when changing jobs or moving house, will select a workplace or home closer to a transit station and involving shorter commuting distances. Moreover, when people travel less they are more likely to participate in the local economy, thus increasing local connectedness and vitality, and supporting local jobs.

Cities with lower levels of car dependence offer a higher quality of life, at the same time as reducing both travel distances and the use of oil-based travel. There is less congestion, noise, local pollution and road trauma, and it is therefore safer for pedestrians and cyclists. In Copenhagen there has been an \textit{absolute} decline in serious cycling accidents as the number of cyclists has increased. And communities that rely less on car travel have higher levels of social interaction, which have been demonstrated to improve health and wellbeing.\textsuperscript{xvii} There is also greater transport equity, because in cities where fewer people use cars, there is public pressure to maintain high standards of transit and walking and cycling facilities for everyone’s benefit, include for those who cannot afford to drive or are unable to do so.

\textbf{Introducing and financing more transit}

Of course, in Australia public transport is largely a state government matter, so the City of Stirling needs to collaborate with the State Government in order to increase and improve transit services. However, the more urban land use is planned to complement transit services – in the ways described – the more viable the transit will be. ‘Value-capture’ mechanisms can enable some or all of the cost of developing transit services to be met from increases in the value of the surrounding land, as was described in the previous section. As well as this, any aspect of the development or operations of transit can be financed through public-private partnerships, often using value-capture mechanisms.

\textbf{Better walking and cycling facilities}

Walking and cycling will be encouraged in Stirling if both the quantity and quality of walking and cycling facilities is increased. There is already a strong awareness of this within Stirling, as demonstrated in the strategy documents that have been produced, and in meetings between staff and the consultants reviewing this strategy. There is an awareness that attention needs to be paid not only to the issues of safety and weather protection when constructing walking and cycling routes, but also to the pleasantness of the experience.
Demand management

Encouraging people to use public and non-motorised transport and discouraging them from using cars are very much related. Though there are specific measures to advance each of these, the effectiveness of one is essential to the effectiveness of the other. For example, it would be ineffective – and very unpopular – to implement private vehicle demand management measures if there were no feasible transport alternatives, particularly accessible transit. Likewise, it is harder for public transport to be financially viable if no measures are taken to encourage car users to switch to transit.

Thus, when good transport alternatives are in place, car use can be further reduced through a variety of demand management measures. A number of such measures are mentioned in the Integrated Transport Strategy, for example, supporting car sharing schemes and car pooling arrangements, encourage and assisting ‘demand generators’ (for example, schools and workplaces) to implement their own programs to encourage alternatives to car travel, and encouraging businesses to employ more local people.

Measures to boost other transport modes, such as pedestrian-only streets in activity centres, cycle lanes, and dedicated lanes for BRT can have a secondary effect of reducing space for cars. This may increase congestion, but it is not likely to be permanent. Evidence indicates that private vehicle traffic is like air: it expands or contracts according to the space available to it. A study of US cities found no relationship at all between miles of freeway and main road lanes per 1000 residents on the one hand, and traffic delays on the other, because more road space simply meant that more cars took to these roads for longer. Conversely, if there is less road space for cars and delays ensue, motorists will over time be inclined to switch to other modes or make shorter trips.

Parking policy can also encourage people to switch from cars. Such polices include having fewer ground level car parks and fewer parking spaces overall, especially in transit oriented developments and activity centres. Both these measures also save space and thereby increase urban density. Timed and paid parking are other measures. Motorists often expect free parking as of right, but there needs to be an appreciation that a car park is a valuable urban space that can be put to better uses, especially if the cars that would occupy that space impose other costs on society as well. And again, if there are fewer (or more expensive) parking spaces in a given locality, a proportion of motorists travelling to that locality will eventually switch to other modes.

Freight transport

Having as much freight as possible transported by rail will reduce oil use, reduce the rate at which roads need to be repaired (thus saving asphalt, another oil derivative) and improve safety and amenity for the people of Stirling. Collaboration with the State Government needs to continue towards this end. Even if that rail freight is diesel powered, the efficiencies of larger loads mean that much less oil is used for each kilogram moved.
However, even with good freight rail services, there will still be a need for road freight to move goods between the rail freight depot and the factory, warehouse, store or other facility, and so careful attention has to be paid to the location of such facilities. While this peak oil strategy recommends mixed land use in the City of Stirling, a partial exception to this is facilities that frequently receive or dispatch freight by semi-trailer or other heavy road vehicles. They should be located where they are close to possible future freight rail depots, close to each other and close to highways (when there is no rail freight). This does not, however, mean that they have to be kilometres away from commercial or activity centres.

There is also potential for light personal or business goods loads to be transported short distances (for example, within an activity centre) on foot or by bike (perhaps augmented by electric power), using cargo bikes, bikes with trailers, and handcarts or trolleys. A cargo bike can transport up to one tonne of goods on flat terrain without the aid of an engine. While such transport is often associated with less developed countries, experience from cities as diverse as New York, Amsterdam and Melbourne is showing that non-motorised goods transport has a place in the mix of sustainable freight options suited to different circumstances. It is certainly an option for moving small loads short distances in an era of oil scarcity, especially in pedestrianised activity centres.

**Recommended measures to reduce or eliminate the use of oil in personal and freight transport**

These include passenger and freight public transport, walking and cycling facilities, recharging infrastructure for electric cars, demand management measures to encourage the switch to transport modes using little or no oil, and measures to help this switch to occur for Council operations and staff commuting.

I. **Seek to increase the provision of public passenger transport** (in collaboration with the State Government). **Options:**

   a. Advocate the introduction of light-rail (LRT) services on key activity corridors, to complement train services and take passengers to and from train stations and activity centres.
   
   b. Advocate the introduction of more buses – gas or electric powered – to complement rail and light-rail services, link residential, commercial and industrial areas, and feed to rail and light-rail stations.
   
   c. Advocate a branch train line along Reid Highway from the Clarkson line to the airport, as recommended in the Integrated Transport Strategy.
   
   d. Adopt a longer term goal of providing frequent transit services within 10 minutes walk of every address in the City.
   
   e. Consider subsidising public transport for Council staff, as part of other policies on staff commuting detailed below.
   
   f. Explore the funding of public transport through value capture mechanisms and public-private partnerships.

II. **Seek to increase the provision of public freight transport** (in collaboration with the State Government). **Options:**

   a. Advocate for better freight rail services.
   
   b. Consider advocating off-peak cargo trams as part of an LRT system.
c. Seek better provisions on buses and LRT for personal goods loads and bikes.

III. **Improve pedestrian facilities. Options:**

a. Install footpaths on at least one side of every street in Stirling, except in short cul-de-sacs.

b. Plant trees for shade along as many footpaths as possible.

c. Enhance pedestrian amenity and safety, with appropriate pedestrian crossings, pedestrian only streets, and other measures to improve walkability.

IV. **Improve cycling facilities. Options:**

a. Build integrated networks of cycle paths or lanes, linked to transit as necessary.

b. Consider bike hire services in major activity centres.

V. **Support electric and more fuel efficient vehicles. Options:**

a. Support the provision of electric vehicle recharging points in Stirling, through amendments to planning codes and development guidelines, adoption of permit procedures and, if necessary, the provision of initial recharging infrastructure.

b. Encourage residents and businesses to buy more fuel efficient petrol or gas vehicles and keep them operating efficiently, through information provision and coverage in behaviour change programs.

VI. **Adopt demand management measures for cars. Options:**

a. Implement parking policies to discourage car use, generally or in specific areas, such as restrictions on ground level car parks, gradual decreases in parking spaces, increased cost or reduced maximum allowable time for public parking, and the stipulation of maximum (rather than minimum) allowable parking spaces in transit oriented developments.

b. Restrict car travel, generally or in specific areas, by converting some roads and road lanes to other uses, e.g., pedestrian and cycling space, public transport and green planting, and introduce traffic calming measures.

c. Encourage car use ‘demand generators’ such as schools and workplaces to introduce their own measures to encourage parents, staff etc to use other transport measures.

d. Encourage the commercial provision of pedestrian trolleys, bike trailers and cargo bikes for the transport of small quantities of personal and commercial goods.

e. Support the development of car sharing schemes, for example, by providing free parking spaces as the street bases for the vehicles.

f. Support car pooling arrangements.

VII. **Enable greater use by Council staff of non-oil transport. Options:**

a. Adopt a medium term goal of converting Council cars, trucks and other vehicles to non-petrol vehicles, such as electric.

b. Use pushbikes, electric cycles and public transport where appropriate.
c. Require, in the medium term, that all cars in salary packages be non-petrol cars.

d. Replace cars and car allowances with travel allowances which can also be used to meet public transport or cycling costs.

**Reducing dependence on fossil fuels for stationary energy**

When oil becomes scarce and its price prohibitive, there will be a major switch to electrified public transport, and to electric cars and other vehicles. This will greatly increase demand for electricity in Stirling and elsewhere – electricity that is currently generated predominantly from gas and coal – and these fossil fuels will almost certainly rise in price as a result. There is also likely to be pressure to produce synthetic oil from gas and coal. Supplies of these non-renewable fuels will peak eventually, and they are both, like petrol, greenhouse gas producers, with coal being the worst of the three. Stirling’s access to electricity, for electrified transport and other purposes, will be largely outside its control, in what is emerging as an era of increasing energy uncertainty.

**Local power generation**

But there are other options. It is now entirely feasible for Stirling to produce a very large proportion of, if not all, the electricity it needs now and in the future. Moreover, this energy can be renewable, non greenhouse gas producing, affordable at today’s prices, and much cheaper in the future than polluting, finite sources. The most promising solution for local power generation today – in terms of sustainability, practicality and cost – is tri-generation power fuelled by renewable gas produced from waste, supplemented by other renewables such as PV panels, wind generators, and tidal, wave and geothermal power, and combined with energy efficiency measures.

The model has been developed by engineer Allan Jones, who is now working to implement it with the City of Sydney. Previously he was responsible for transforming the energy production of the Borough of Woking in the UK. Jones was able, by 2007, to reduce Woking’s greenhouse emissions by 80% from 1990 levels, to generate 98% of the power to the borough from low or zero carbon decentralised sources, and to reduce energy consumption by 51% and water use by 44%.

Key elements of this model are:

- Localised tri-generation and co-generation gas-powered plants that, in addition to producing electricity, also pipe hot water, a by-product of the power generation, into buildings for space heating, water-heating and (if tri-generation) air-conditioning.

- Initial fuelling of these plants from natural gas, with a switch as soon as practicable to ‘syn-gas’, which is non greenhouse gas producing and can be 100% sourced in cities and towns and their hinterlands from municipal, industrial, agricultural and other waste.

- Supplementing this power with other sources of renewable local power generation as described, and with energy efficiency measures.

- Integration of the power generation with world-leading techniques for local water harvesting and recycling, and for local waste collection and recycling, including waste collection through vacuum pipes.
Local tri-generation power works best in denser areas, so it would be very suitable for new higher density developments in Stirling, although it is claimed to still be viable in lower density areas. The power stations are as unobtrusive as a local library. (See Appendix II: A sustainable power revolution in our midst, for a more detailed description of this system.)

Achieving greater energy efficiency

Energy efficient building designs and appliances and retrofitting can save substantial amounts of electricity. The Council and/or local power providers (if there is local production) can supply information and advice about smart and energy efficient appliances, home retrofits, shade planting and other energy efficiency measures (plus PV panels) via LivingSmart, advisory services and information provision. If there is local power generation, differential pricing can be implemented across 24 hours and 7 days to even out the load, and there is also potential for the batteries of parked electric vehicles to feed power into the local grid during the daytime when demand is highest, and then draw power from the grid overnight.

The design of new Council premises, the retrofitting of existing ones, and the procurement of appliances and equipment can ensure that Council property is energy efficient and has on-site power generation. And with the cooperation of Western Power, the most energy efficient street-lighting can be installed, powered by PV panels where feasible.

Local water harvesting

Our water systems use significant amounts of power to capture, move and treat water before it is consumed, and then further power to dispose of it post-use. A great deal of power can be saved if water is harvested locally, recycled after use and only treated to the extent necessary for its specific use. Water harvesting and recycling can be undertaken by the Council, by large developments and by individual property owners. Third pipe systems, especially in new developments, can enable non-potable water to be used for gardens, toilets and other uses not related to drinking, cooking or personal washing.

The use of lakes, ponds, swales and ‘daylighted’ streams (that is, those converted back from drains) can allow storm-water to be collected, decontaminated, stored and re-used as necessary, while at the same time providing features within green areas that are attractive to residents and workers, preserve flora and fauna and help to keep the city cool.

Water use can also be reduced if the Council, residents and businesses favour native, low water use plants, and reduce areas of lawn.
Local waste collection and recycling

More efficient collection and recycling of waste can also save oil, electric power, water, and land that would be used for landfill. As described above, domestic, commercial, industrial and municipal waste and sewage can be used for renewable natural gas power generation. Kitchen and garden waste can be turned into compost or mulch at the municipal or household level. Rubbish and recycled material can be collected from properties by below-ground vacuum pipes, especially in higher density areas. This system avoids the oil use, cost, road congestion, and (usually early morning) noise of garbage trucks. Where conventional collection continues, it may be feasible to reduce the frequency of that collection. If rubbish is properly sealed in biodegradable plastic bags, fortnightly collections should not present a risk to health or amenity. Those who would like more frequent collection or an additional bin can pay extra for these.

Recommended measures to enable Stirling to be less reliant on external sources of stationary energy derived from fossils fuels

These include the local generation of electricity and hot water (for heating and cooling) from renewable natural gas, as well as electricity generation from other renewable sources, the promotion of greater energy efficiency and on-site power generation, and the implementation by Council of energy efficiency measures for its own premises and equipment and for street lighting, given the likelihood that peak oil will have adverse effects on conventional electricity generation, resulting from fuel switching that will increase fossil fuel prices generally.

I. Explore possibilities for local energy production. Options:
   a. Facilitate the development of local tri-generation infrastructure, particularly in activity centres and new developments, powered by renewable natural gas that is fed by municipal and other waste. (See Appendix II: A sustainable power revolution in our midst.)
   b. Consider other sources of local renewable energy, perhaps to supplement renewable natural gas, specifically, photo-voltaic, wind (including off-shore turbines), geothermal, wave and tidal power.

II. Promote greater energy efficiency. Options:
   a. If there is local power generation, incorporate differential pricing across 24 hours and 7 days to even out load, and consider the potential for the batteries of parked electric vehicles to meet a part of daytime electricity demand.
   b. Through Council and/or local power providers (if there is local production) supply information and advice about solar panels, smart and energy efficient appliances, home retrofits, shade planting and other energy efficiency measures via LivingSmart or other behaviour change programs, advisory services and information provision.
   c. Retrofit Council premises as necessary for energy efficiency and on-site power generation, and ensure that any new Council buildings, appliances and equipment meet high standards for energy efficiency and power generation.
   d. Collaborate with Western Power to install the most energy efficient street-lighting, powered by PV panels where feasible.
III. **Promote local water harvesting and recycling for water and energy efficiency.** *Options:*

   a. Encourage water harvesting and recycling in residences and other premises.

   b. Establish municipal water harvesting and recycling, with third pipe systems that separate potable and non-potable water, especially in new developments.

   c. Favour native, low water use plants in Council planting, and reduce areas of lawn.

IV. **Promote local waste collection and recycling for energy, water and land use efficiency.** *Options:*

   a. Consider use of domestic, commercial, industrial and municipal waste and sewage for renewable natural gas power generation.

   b. Encourage household and business composting, and consider the implementation of Council collection of compost and garden waste for recycling.

   c. Investigate vacuum pipe waste collection, particularly for higher density areas.

   d. Consider a reduction in the frequency of waste collection, accompanied by information about ways to reduce and store waste, with the option of a continuation of the current level of service or an extra bin but at an additional cost.

**Informing and engaging residents, businesses and Council personnel**

Measures to reduce oil use in Stirling may be very sound, but unless policy makers take residents and businesses with them in the journey towards a future free of oil dependence, then these measures are likely to be resisted, ignored and ultimately ineffective. Local councils are democratic institutions, and broad support for a policy thrust of this magnitude needs to occur over time. It is now mandatory in Western Australia for local governments to incorporate public consultation in their strategic planning processes. Moreover, the implementation of measures to deal with peak oil and energy supply risks require the cooperation of residents and businesses in their daily actions – for example, in their transport behaviour, in the buildings they construct and buy and occupy, in weekly shopping decisions and water use and the things they teach their children. So residents and businesses need to be informed about, consulted on and engaged in the measures to reduce oil dependence.

**Information provision and behaviour change programs**

People need to understand peak oil: how supplies are diminishing, the likely consequences – including for Stirling – and what can be done to build protection against such consequences. They need information and advice through a range of media and channels: printed and on-line material; talks to local organisations, workplaces, schools and tertiary institutions; local media coverage; a presence at community events, and direct contact with households. As well as seeking to change travel and consumption behaviour, the Council can encourage buyers’ clubs to reduce the cost of green technology, as well as neighbourhood groups to share vehicles and equipment and exchange information and services.
The TravelSmart program in Stirling has so far been very successful in using such channels to inform the Stirling population about the consequences of travel behaviour and about practical ways through which this can change while at the same time enhancing quality of life. In the period 2006-2009, the program achieved an 11% reduction in car-use-as-driver trips, and increases in trips made by public transport, walking and cycling of 24%, 45%, and 72% respectively, and thus 18.9 million kilometres of car travel were saved in the project area. It has achieved such improvements through direct contact with almost 8,000 households, extensive work with schools, businesses and City employees and partnerships with State Government and community organisations on a range of innovative programs. A number of these have now been adopted beyond the boundaries of Stirling. For example, the mapping of school catchments to enable better walk route planning has been taken up by the Department of Transport, ‘walking times to school’ signage has been adopted by other local governments and is now supported by the Department of Transport, and Women on Wheels workshops are now being planned in other municipalities.

The main problem with the TravelSmart program at the moment is that there is just one officer to service the state’s most populous local government area, while other councils have an officer to work with much smaller populations. As a result, there are many measures that the officer cannot pursue due to lack of time. Considering the financial benefits that accrue to the City from reduced private vehicle travel, particularly in the area of reduced road maintenance, and considering how the TravelSmart program has a key role, if not the key role, when it comes to information provision and behaviour change aimed at reducing Stirling’s dependence on diminishing oil supplies, putting more resources into this program would seem to be a very wise investment.

Consultation with residents and businesses
Council can consult residents and businesses as appropriate about the implementation of the measures in this report, and the selection of options, using techniques of deliberative democracy or other consultation methods. This will help to ensure ‘buy in’ by residents and businesses, and also ensure that local knowledge and preferences can guide the selection of the most appropriate implementation methods and options.

Stressing the additional benefits that the recommended measures can achieve
As has been emphasised in these documents, it is important to reduce dependence on oil while at the same time continuing to enhance the lives of the people of Stirling. It is fortunate therefore that the majority of measures recommended in this Report have been demonstrated through research to provide a range of wellbeing, productivity and savings benefits to individuals, businesses and governments. This is good news for the City, but it is also critical that residents and businesses be informed about these benefits through the various information and behaviour change programs that are implemented.
In the area of wellbeing, exercise – including walking or cycling to and from destinations or transit stations – has many demonstrated benefits for health and mood. Better community connections have been shown to result from reduced car use, from more localised economies, and from greater engagement in local activities, and in turn this greater connectedness has been demonstrated to improve health. As one indicator of this, research has established that if people who are not members of a local organisation join one, their chances of dying in the next year are halved. As well, reduced car traffic enhances the amenity of an area, because it reduces congestion, noise, pollution and danger, and frees up public spaces for walking, cycling, socialising and recreation.

In the area of productivity, research has shown that denser precincts are more productive for businesses, and that employees are more productive in walkable localities. And on the matter of savings, localities with reduced car use and greater use of other modes spent less public and private funds on transport overall.

Information and implementation processes within Council

It is also necessary that, within Council, staff are informed so that they can properly implement measures related to oil supply and depletion risks, and this can occur through in-service training, information sessions and on-line information. As well, there need to be processes in place to expedite and monitor the implementation of measures and options, and to arrange research or investigations as required. Suggested processes are discussed in the Implementation Strategy, but in broad terms they involve incorporation of the measures in this report, as much as possible, through planning processes such as the Strategic Plan and Corporate Business Plans, as well as six-monthly meetings of Officers to review and plan peak oil measures, supported by a newly created Peak Oil Advisory Group within Council.

Recommended measures to gain the involvement of residents, businesses and Council personnel in dealing with the peak oil challenge

The measures described in this Report require broad support from residents and businesses, and many, perhaps most, cases require the active engagement of residents, businesses and Council personnel if they are to be successfully implemented. The measures in this section are designed to enable that to happen, by providing information and conducting behaviour change programs for residents and businesses, consulting the community on matters of implementation, and informing and enabling Council staff to implement measures to reduce oil use.

I. **Provide information and behaviour change programs.** Options:
   
   a. Increase resourcing of the City’s existing TravelSmart program in order to enable it to expand its work with households, businesses, schools and community organisations.

   b. Provide information about peak oil, its causes and consequences (particularly for the City of Stirling), the measures planned to avoid these consequences, and the wellbeing, productivity and savings benefits of these measures, to residents and businesses, through on-line and printed information, advisory services, local media, and talks to community organisations, workplaces and schools, with a particular focus on how the measures being adopted can advance wellbeing and productivity and save money.
c. Encourage buyers’ clubs to reduce the cost of buying green technology, as well as neighbourhood groups to share vehicles and equipment and exchange information and services.

II. **Consult with residents and businesses.** *Options:*

a. Consult residents and businesses as appropriate about the measures in this Report and their implementation, using techniques of deliberative democracy and other consultation methods.

III. **Adopt measures to ensure Council staff have the information to implement Council policies on peak oil.** *Options:*

a. Provide in-service training, information sessions and on-line information for Council staff as necessary.

*Emergency measures to reduce the adverse consequences of peak oil if necessary*

This whole Report can be said to constitute a peak oil risk management strategy, in that it identifies a serious risk – peak oil and its consequences – and then recommends a series of proactive measures to be taken to protect the City of Stirling, its residents and its businesses against peak oil’s consequences, by significantly reducing and eventually eliminating the use of oil.

However, reaching the stage where Stirling is substantially protected from the effects of global oil depletion will take a decade at the very least, and so a risk management strategy also needs to include actions that can be taken in the event that the City is not adequately prepared when the more serious consequences of peak oil are felt – an Emergency Management Plan in other words. These consequences will not necessarily occur suddenly. In fact there is a good chance that oil prices will just steadily rise and contribute to steady price increases for other goods and services, and over time this will increase cost pressures for Council, businesses and residents in the ways described below, if sufficient measures are not taken to prevent this.

Thus it is necessary that an emergency plan be prepared, but this may be a staged process, given the time (and therefore resources) it would be likely to take to develop a fully detailed plan from the outset. As changes to the price and (possibly) availability of oil occur and as Council adopts proactive measures to protect the city, a sense of which parts of the plan need more detailed development will become clearer. In this Report there is a recommendation that every six months Council Officers review progress in protecting Stirling from the consequences of peak oil, and it is important that the Coordinator of Emergency Management is part of this process. It is likely that over time, in line with changes to the price and availability of oil, certain proactive measures, which were previously not seen to be so urgent, come to be judged as urgent. And a point may be reached when that urgency and seriousness justifies activation of part or all of the emergency plan. A supply interruption or very sudden price rise may make this decision obvious. In general, then, it is a matter of having some level of planning in the near future for a peak oil emergency, and developing this in particular areas as specific risks are judged to have become more likely.
There will need to be a decision, possibly by the Coordinator of Emergency Management, as to whether there should be a stand-alone Peak Oil Emergency Plan, or whether all or part of it can be part of a broader fuel emergency plan or other plan. A major difference between peak oil and other causes of fuel shortages or price rises is that the other causes are likely to be temporary, whereas the consequences of peak oil are permanent, even though there may be fluctuations in supply and price. Thus, a peak oil plan would need to deal with a much more long-term emergency. The following are aspects of this possible emergency.

Given Council, resident and business reliance on oil – not just for transport but for all the goods and services that use oil in production or transport stages – an interruption to supply or prohibitive prices would have dramatic consequences for the local economy, for the meeting of basic needs and for most Council operations. To restate these consequences for Stirling as described in the Oil Risk Summary they are likely to be as follows if the City is not prepared:

- **Residents** will face greatly increased costs for petrol, if they can obtain it at all, as well as very crowded and often highly inadequate public transport alternatives. As well, there will be sharp increases in the costs of goods and services and reductions in their availability, proportionate to their reliance on oil. This will place great strains on household budgets, especially for those on low incomes or those living away from employment and commercial centres, and this may lead to a number of things, including mortgage defaults and tenant evictions (and thus increased homelessness), absences from work and education, inability to access health and other essential services, family stress and inadequate nutrition.

- **Businesses** will also face greatly increased costs for transport and for any goods or services reliant on oil, and reduced availability. This in turn will push up the prices of products and services these businesses are trying to sell, at a time when consumers and other businesses are less able to pay, so sales are likely to slump, leading to business failures or down-sizing, with consequent higher unemployment. Absenteeism will also affect business costs and performance.

- **Councils** will have to cope with greatly increased community need as a result of the above factors, at a time when the escalating price of oil greatly increases their operational costs and oil supply interruptions disrupt their services, while council income possibly falls as a result of factors including lower property values, rate payment defaults, reduced use of Council facilities such as leisure centres, and possibly reduced funds from state and federal governments, which will face similar cost and income pressures. It will also be much harder for council staff to get to work.

The Emergency Management Plan would therefore need to cover the following areas:

- enabling Council staff – particularly those providing essential services – to get to and from work or to work at, or closer to, home
- maintaining essential Council services that rely on transport, from meals-on-wheels to garbage collection, especially those services the cessation of which would pose a serious risk to health or safety
- overall rationalisation of Council services given likely price rises and reduced City revenue
• a feasible Council response to increased demand for assistance that result from rising prices, shortages of essential goods and services, travel difficulties, social isolation and increased unemployment

• identification of the most vulnerable groups in the community, services to them that might be disrupted, and how the Council might deal with this.

One way the emergency plan might set out specific risks and responses to them is as follows, (although the Coordinator of Emergency Management may have other ways of structuring the necessary information).

1. the specific adverse occurrence that peak oil is likely to precipitate – if no proactive measures are taken to prevent this – particularly but not exclusively those that are relevant to Council operations and services

2. the likelihood of this occurrence

3. its consequences for Stirling

4. the severity of these consequences

5. emergency measures Council would need, and be able, to take to deal with the consequences

6. possible adverse consequences even after emergency measures have been attempted.

Below are some hypothetical risks addressed in this way, which may serve as examples. Each one assumes that no (or insufficient) proactive measures having been taken beforehand. They are not presented as necessarily accurate or sufficient descriptions of risks and appropriate measures to take, but rather as an indicator of the kinds of risks to be considered and as a possible format for a risk management plan. In such a plan, all existing council services and facilities should be considered, as well as additional needs and circumstances that peak oil may precipitate and Council may need to respond to. The first three risks below relate to normal council services, while the last two relate to changed circumstances brought on by peak oil.

It needs to be remembered that Council responses will most likely be constrained by reduced income, increased overall need, increased costs and/or disrupted supply of oil and other goods and services, as well as possible staff absences. The same constraints will be faced whether the services are delivered by Council or by private contractors. The hypothetical risks are as follows.

**Rubbish Collection**

*Risk:* Rubbish not collected, or collected much less often, as a result of increased cost of fuel or interruptions to supply

*Likelihood:* High

*Consequences:* Risk of disease, and serious loss of amenity, from uncollected rubbish

*Severity:* Medium

*Council response:* Distribute strong plastic bags. Encourage more recycling (e.g., composting).
Limitations of Council response: Plastic bags (made from petrochemicals) may be in short supply. Council measures may not decrease total volume of rubbish significantly, leading to spillage and possible disease spread. Illegal rubbish dumping may occur on public or private land. There may be liability issues for Council.

Meals-on-wheels
Risk: Meals-on-wheels not delivered as often, or at all
Likelihood: High
Consequences: Hunger and malnutrition, accidents from clients trying to prepare own food
Severity: High

Council response: Walk meals-on-wheels to homes; use volunteers; perhaps prepare meals in more decentralised locations; deliver less frequently, with higher reliance on frozen food; supplement food supplies from local home grown food, and food donations.

Limitations of Council response: Longer time required to deliver and possible reduced quality control may lead to increased food spoilage and consequent illness; less frequent deliveries may mean there are still some consequences as listed above; reduced health surveillance and social contact for clients (co-benefits of food deliveries); possible liability issues for Council.

Personal care services
Risk: Personal care services for people with restricted or no ability to look after themselves may not occur as often, or at all.
Likelihood: High
Consequences: Possibility of accidents, hunger or malnutrition, illness and death
Severity: High

Council response: Access clients on foot or by bicycle; use volunteers, including relatives and friends of clients.

Limitations of Council response: Possible reduced standards of service; increased time taken to see each client given slower travel modes; less ability to transport equipment; possible liability issues for Council.

Increased homelessness
Risk: Increased homelessness as a result of factors described – people sleeping rough and staying in emergency accommodation, cars and the homes of acquaintances
Likelihood: High
Consequences: Increase in suffering, malnutrition, illness and accidents; cessation of, or absences from, work and education; possible increased crime and social conflict
Severity: Medium-high

Council response: In cooperation with state and federal governments and the community, obtain as suitable as possible accommodation for homeless.
**Limitations of Council response:** To the extent that extra accommodation obtained is insufficient or inadequate, all of the consequences described above may continue; conflict and stress where homeless are boarding or staying with others; possible liability issues for Council from housing of people in less than satisfactory conditions.

**Increased lawbreaking**

**Risk:** Stealing of food, petrol and other basics; squatting in private and public premises; social conflict and possible violence; perhaps increased substance abuse

**Likelihood:** High

**Consequences:** As described above, leading to increased accidents, illnesses, insecurity, social discord, and pressure on police, courts and prisons, and on health and welfare services.

**Severity:** Medium-high

**Council response:** In cooperation with police, state and federal governments and the community, try to meet needs that are precipitating lawbreaking, to provide extra protection for people and property, and to improve community relations.

**Limitations of Council response:** Limited resources of local and other levels of governments will limit their ability to deal with these issues.

In general terms, the idea is that these measures would only need to be implemented in an emergency, but there may be some measures that need to be implemented earlier. For example, Council may choose to increase its stores of diesel or petrol to be available if these fuels become unavailable or very expensive, and in similar fashion it may stockpile emergency food supplies. It should be acknowledged, however, that the stockpiling of fuel, food and other essentials, if undertaken on a large scale by governments, organisations and individuals in Australia and across the world, would only exacerbate shortages for those individuals and organisations that had not stockpiled these essentials. This may precipitate conflicts over the stockpilers’ moral right to retain these goods, and even attempts to forcibly obtain them.

It may also be necessary, in the early stages of an impending emergency, to enlist community volunteers to assist with various services or to donate goods or accommodation, and to start to train people in particular tasks.

**Recommendations about the planning of contingency measures that can be implemented in the event that Stirling is not sufficiently prepared when serious consequences of peak oil occur**

These measures will not need to be implemented if proactive action is implemented quickly enough to reduce, and eventually eliminate, the dependence of the City, residents and businesses on oil, but should be prepared and kept on hand in the event that this is not the case.

1. **Prepare an Emergency Management Plan, identifying risks from a peak oil emergency, their likelihood, their consequences and the severity of these, appropriate Council responses and the limitations of these. Options:**
   a. Create a separate Peak Oil Emergency Plan.
   b. Incorporate peak oil in a broader Fuel Emergency Plan.
c. Develop the plan in more detail over time as necessary.

Conclusion

Given the Stirling community’s dependence on oil in many facets of life, the diminishing supplies of this resource pose a serious threat to the meeting of basic needs and the quality of life in Stirling. The City has begun to take important steps toward reducing dependency on oil, but more needs to be done. This Oil Risk Strategy sets out a range of measures through which this can be achieved. These measures are practical, demonstrated ways of reducing oil use, well within the capacity of Stirling to implement. Moreover, they will not detract from the quality of life in Stirling. On the contrary, they are likely to make it a place in which there are:

- pleasant, varied, interesting places to live
- increases in walking, cycling and transit, leading to more exercise and better health and wellbeing
- stronger community connections, reducing social isolation and vulnerability, and a deeper sense of ‘place’
- reduced transport and infrastructure costs for government
- less time and money spent travelling
- more productive businesses given greater fuel efficiencies and reduced travel.
Appendix I: Relative transport vulnerability map

This map for Perth shows the most vulnerable areas in red, through to the least vulnerable areas in green. It shows vulnerability of private car users to rising fuel prices in relative, not absolute, terms.

The colour of each dot represents the average vulnerability of residents in an area; it does not apply to all residents in that area.

It incorporates public transport services at 2004, so does not yet include the new southern railway.

Dept for Planning and Infrastructure, August 2006
Appendix II: A sustainable power revolution in our midst

Peter Newman, Rob Salter, Vanessa Rauland and Colin Beattie, CUSP Institute, Fremantle

There is a proven existing model for the generation of affordable, renewable, non-greenhouse-gas-producing power for our cities and towns that deserves careful consideration by all planners.

The model has been developed by engineer Allan Jones, who is now working to implement it with the City of Sydney. Previously he was responsible for transforming the energy production of the Borough of Woking in the UK. Allan was able, by 2007, to reduce Woking’s greenhouse emissions by 80% from 1990 levels, to generate 98% of the power to the borough from low or zero carbon decentralised sources, to reduce energy consumption by 51% and water use by 44%. He did this through a local utility set up by the Municipality and funded by some major energy companies in Europe. This Public Private Partnership (PPP) has implemented a new approach to the provision of power, water and waste collection through a local, highly efficient tri-generation system and a range of energy and water efficiency measures.

Allan Jones then worked for the London Climate Change Agency, which set a target of 60% reduction in emissions for London by 2025 through changes to energy, water, waste and transport systems; their targets are being delivered by the same model of decentralised energy.

Now Allan has the task of transforming the City of Sydney’s power, water and waste systems, where the goal is to reduce the city’s greenhouse emissions by 70% by 2030, based on 2006 levels whilst ensuring that a cost effective source of power is available.

The key elements of the model are:

- Localised tri-generation and co-generation gas power plants and a local distribution system that has common trenching for power and thermal energy pipes (the key to the massive reduction in power needs)
- Initial fuelling of these plants from natural gas, with a switch as soon as practicable to ‘syn-gas’, which can be 100% sourced in cities and towns and their hinterlands from municipal, industrial, agricultural and other waste
- Integration of the power generation with world-leading techniques for local water harvesting and recycling, and for local waste collection and recycling
- Supplementing this power generation with wind generation (especially off-shore), wave and tidal power, solar PV’s on buildings, small-scale geothermal and energy efficiency measures.

This model is not only affordable, but also results in savings, which can flow either to the power generators or retailers to invest in further improvements to the system, or to end users. And it is local enough to be implemented – in whole or in important parts – by councils and businesses, in apartment buildings and by groups of residents. Several projects in WA are proposing to follow this model – the Stirling City Centre project, the Cockburn Coast (Landcorp project), and the Cities of Fremantle and Geraldton.

Allan Jones was able to meet with a range of people from state and local government, industry, universities and the NGO sector when he was here in Perth from 18-21 April 2011, as well as addressing several public events including one sponsored by Western Power. His final presentation was filmed and is available at www.sustainability.curtin.edu.au/films/latest.cfm.
The model can be explained in more detail as follows.

Local co-generation or tri-generation power plants

In a typical centralised coal power station, 66% of the energy produced is lost as waste heat. What's more, huge amounts of water are required to cool the plant down. Then 7% of the remaining energy is lost travelling long distances in the transmission and distribution networks (this may be even higher in the SWIS due to the long distances involved. As a result, a total of at least 69% of the energy generated is lost before it even reaches the consumer.

Local co-generation and tri-generation plants address this problem in two ways.
First, the heat produced as a by-product of power generation is captured and piped to consumers for use locally. In co-generation plants it is used to heat buildings and water, or for a range of other purposes (including the purification of water in the water recycling process). Tri-generation plants use not only the thermal energy for heat but, by adding absorption chillers to the process, they also provide air-conditioning for buildings. This would be a critical part of the process in the SWIS, as air-conditioning is the major factor in causing peak power issues that cost over $80 million for just one and a half days a year on average.
Second, because the power plants are local, there are no transmission losses and very little power is lost in the process of distribution to end-users. (The plants have to be local to be co-generational or tri-generational, or otherwise the heat would dissipate over the long distances transmitted.)
In turn, the significantly higher efficiency of localised co-generation and tri-generation power plants means big savings in energy and money. As an example of the difference these systems can make, electric-powered air-conditioning accounts for 60% of Sydney CBD’s electricity consumption. Under a tri-generation system, not a watt of electricity would be required for this air-conditioning because the cool air would all be sourced from the heat the system generates.

Sourcing the fuel for the power plants

This system initially runs on natural gas. On top of the efficiencies resulting from co-generation and tri-generation systems and from the decentralisation of plants, natural gas produces up to 54% fewer greenhouse emissions than coal. But this is just the beginning.
Within a relatively short time frame, natural gas can be replaced by ‘syn-gas’, which is produced using plasma arc gasification and other technologies. Syn-gas can be generated from 100% renewable sources and produces no greenhouse emissions. It can be sourced from municipal, commercial, industrial and agricultural waste, from sewage, from landfill gas, from low carbon coal seam methane and from any other local source of carbon. Enough of these gas sources exist in urban areas and their hinterlands to service tri-generation and co-generation plants if they are supplemented by local alternative sources such as wind, solar, tidal or wave power generation.

Integrating power generation with water and waste systems

This model for power generation can be introduced by itself, or it can be integrated with leading edge local water harvesting and recycling and local waste collection and recycling. These three closed loop systems can be integrated to maximise their efficiency and minimise water and power use, emissions, landfill use and costs.
The local harvesting of water would involve the collection of storm-water and water from rooftops and its purification to be used as non-potable water for municipal, industrial, commercial, residential or agricultural purposes. Residential use would be
most practical in new developments as additional plumbing is required. Heat from power generation can be used in the purification process. Non-potable water can meet 90% or more of our water needs, while of course 100% of reticulated water is currently purified to potable standards, with the additional power use, emissions and cost that this entails.

Local waste collection and recycling – with non-recycled waste used in the gasification system to produce syn-gas in a non-greenhouse-gas-producing process – reduces the amount of waste going to landfill to zero or near zero. On top of this, automated vacuum waste collection systems eliminate the use of garbage trucks, thus also eliminating their fuel use, emissions, noise, cost and contribution to road congestion.

**Urban density and sustainable transport systems**

These power generation, water and waste systems work best in denser urban precincts, but they are still practical and cost effective in less dense localities.

They can be introduced separately to, but nevertheless complement, low carbon transport systems: integrated public transport modes (trains, light-rail and buses), excellent walking and cycling facilities, and demand management measures that encourage the switch from private vehicles to more sustainable transport modes.

In the Appendix below a summary is provided of the Landcorp approach to the Cockburn Coast project, and this demonstrates how a decentralised approach to infrastructure combined with light rail can create a highly efficient and liveable 21st century city. The results demonstrate that the Cockburn Coast development could result in 33% less car use, 55% less energy use and 75% less water use, and all for just $5600 per dwelling which in a mortgage would not even be noticed.

**In conclusion**

This system of power generation has been demonstrated to work – to meet power needs in a way that is efficient, affordable and sustainable. When combined with local water and waste systems it generates many additional benefits, not the least of which is the saving of water. WA cannot afford to allow these opportunities to pass it by.
Appendix to ‘A Sustainable Power Revolution in Our Midst’
Cockburn Coast Sustainability Analysis

In response to LandCorp’s ethos of sustainability, the Cockburn Coast District Structure Plan (2009) includes a set of sustainability performance targets as shown below.

<table>
<thead>
<tr>
<th>Category</th>
<th>Target Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water</strong></td>
<td>• 30% reduction in potable water (against per capita average)</td>
</tr>
<tr>
<td></td>
<td>• 60% wastewater re-use</td>
</tr>
<tr>
<td><strong>GHG emissions</strong></td>
<td>40% reduction in stationary GHG emissions (against per capita average)</td>
</tr>
<tr>
<td><strong>Transport</strong></td>
<td>• 60% of dwellings to be within 800 m of public transit</td>
</tr>
<tr>
<td><strong>Waste</strong></td>
<td>• 20% waste reduction (against per capita average)</td>
</tr>
</tbody>
</table>

Parsons Brinckerhoff and Curtin University Sustainability Policy (CUSP) Institute (the PB-CUSP Alliance) were engaged to explore and refine possible solutions that will meet or exceed the targets set by the DSP.

The approach taken was to model the project using a proprietary tool, CAP Precinct which has been developed by Kinesis to measure sustainability performance in key areas including:

- potable water (kL H2O/person/year)
- energy emissions (greenhouse gases) (tonnes CO2-e/person/year)
- transport (vehicle kilometres travelled) (hours/person/week).

The baseline used for the analysis is the Perth Metropolitan average.

**Results**

The results showed that the targets could be met relatively easily at an additional cost of $4,700 per dwelling.

A review and refinement of the original targets was undertaken to test the potential of a higher performance scenario. The new targets are as follows.

<table>
<thead>
<tr>
<th>Category</th>
<th>Target Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water</strong></td>
<td>• 80 kL/pers/yr total (25% reduction against per capita average)</td>
</tr>
<tr>
<td></td>
<td>• 40 kL/pers/yr scheme (75% reduction against per capita average)</td>
</tr>
<tr>
<td></td>
<td>• Zero scheme/potable water used outside homes and buildings</td>
</tr>
<tr>
<td><strong>GHG emissions</strong></td>
<td>50% reduction in stationary GHG emissions</td>
</tr>
<tr>
<td><strong>Transport</strong></td>
<td>• 35% reduction in Vehicle Kilometres Travelled (VKT)</td>
</tr>
</tbody>
</table>

The results achieved are shown below. The technologies required to meet the ‘High Performance Case’ targets came at a modest increase in cost of $900 per dwelling. A significant change in performance can be achieved and, in addition, there is a 17% improvement in household affordability in terms of annual utility costs.
The approach taken to achieve these results is through implementation of a number of technical solutions which surprisingly, do not include any unproven or new innovations.

The ‘high performance’ scenario was recommended and includes the green infrastructure initiatives of:

- building and precinct level tri-generation for multi-story residential and non-residential heating and cooling
- use of recycled wastewater and groundwater for third pipe non potable water supply for irrigation and toilet flushing
- solar photovoltaics
- solar hot water systems (for residential detached and semi-detached)
- higher standards of building performance in thermal efficiency and water efficiency (7 star NatHERS and 4.5 star WELS respectively)
- high efficiency appliances (4.5 star energy; 4.5 star water)
- 22% recycled content in all concrete construction materials
- high frequency light-rail
- reduced car parking supply.

The case study demonstrates the viability and cost effectiveness of decentralised energy development.
Part Three – Implementation Strategy

OVERVIEW

RECOMMENDED MEASURES

MEASURES THAT REDUCE THE NUMBER OF KILOMETRES THAT PEOPLE AND GOODS TRAVEL

MEASURES THAT REDUCE OR ELIMINATE THE USE OF OIL IN PERSONAL AND FREIGHT TRANSPORT

MEASURES THAT ENABLE STIRLING TO BE LESS RELIANT ON EXTERNAL SOURCES OF STATIONARY ENERGY DERIVED FROM FOSSILS FUELS

MEASURES TO GAIN THE INVOLVEMENT OF RESIDENTS, BUSINESSES AND COUNCIL PERSONNEL IN DEALING WITH THE PEAK OIL CHALLENGE

A SUGGESTED PROCEDURE TO IMPLEMENT THE MEASURES IN THIS REPORT, AND TO SELECT AND IMPLEMENT OPTIONS

CRITERIA FOR PRIORITISING AND SCHEDULING ACTIONS

IMPLEMENTATION GUIDELINES

FOOTNOTES
Overview

The third part of this strategy, the Implementation Strategy, outlines how an Oil Risk Strategy for Stirling could be put into practice to permanently protect the City, its residents and businesses from the adverse consequences of a post-peak-oil world that is more vulnerable to higher fuel prices and oil supply shocks.

Firstly, it consolidates the recommended measures in Document II, the Oil Risk Strategy, into one list, grouped as five sets of measures.

Secondly, the Implementation Strategy suggests a set of procedures for planning, implementing, monitoring and reviewing measures to reduce Stirling’s dependence on oil.

Thirdly, it suggests criteria against which these measures, and more specifically the options within each measure, can be assessed for implementation and sequencing.

Finally, this document provides guidelines for the implementation of those options chosen for adoption.

ADOPTION OF SPECIFIC ACTIONS TO REDUCE OIL SUPPLY RISKS TO THE CITY

This Implementation Strategy does not preclude the requirement to secure the City’s formal support for any specific action derived from this document. Any specific proposal considered likely to be effective in reducing vulnerability to the risks relating to oil supply shocks or gradual price increases driven by global oil depletion will need to be considered carefully using the criteria discussed in this Strategy. The City’s Executive Team will need to make a final decision in relation to any specific action. In so doing, they will have regard to constraints including financial and staff resources, and existing regulatory and legal frameworks. Actions with significant resource implications may need to be presented to Council for formal consideration and adoption.

Recommended measures

The measures recommended for implementation, which have been described more fully in the Oil Risk Strategy, are as follows. Following each measure is a list of options which can be considered as ways of realising the measure. These options are by no means exclusive; others can be considered.

Measures that reduce the number of kilometres that people and goods travel

These include higher urban densities, more mixed land use, support for more localised economic production and the buying of local goods and services, the strengthening of community connections and attachment to the locality, and reducing the amount of travel undertaken by Council staff. Reducing kilometres travelled will also make the switch to walking, bikes and public transport much more feasible.

I. Increase urban density. Options:
   a. Implement the recommendations of the City’s Local Housing Strategy, in relation to higher-density, mix development in activity centres and corridors, and to other parts of Stirling.
b. Raise allowable heights or dwellings per hectare and/or mandate minimum heights or minimum dwellings per hectare in developments at or near activity centres and transit stations, in order to substantially increase building densities in these areas.

II. **Adopt more mixed use zoning.** *Options:*

a. Allow mixed residential and other land use in higher density areas near transit stations, subject to provisions to protect amenity, as recommended in the *Local Housing Strategy* and the *Integrated Transport Strategy*.

b. Allow mixed use in other predominantly residential locations as appropriate and feasible, for example, allowing more ‘corner shops’, cafes, clinics and home-based businesses.

c. Facilitate the development of transit oriented developments (areas of high density, mixed land use, restricted car access, high levels of walkability and proximity to transit) with funding of transit through property value capture mechanisms.

d. Stipulate the inclusion, within *residential* developments in activity centres and along activity corridors, of a variety of dwelling sizes, and a component of low to moderate income housing, including housing for local Key Workers.

III. **Encourage decentralised economic production and trading.**  
*Options:*

a. Adopt Council procurement and investment policies that favour local businesses engaged in local production for local customers.

b. Support self-provisioning, especially of food, through encouragement or facilitation of home or verge food gardens, community gardens on existing green space, rooftop gardens in activity centres, gardening courses and other measures.

c. Establish one or more business incubators for start-up small local enterprises, particularly those supplying the local market from local production, those meeting basic needs, and those meeting certain sustainability criteria.

d. Consider a scheme to offer initial or ongoing rate reductions to businesses meeting criteria as described in ‘c’ above.

e. Facilitate the setting up of markets for locally made produce near public transport, and of community supported agriculture schemes, subject to an analysis of the oil use and transport efficiencies of these activities, as described in the Oil Risk Strategy.

f. Consider supporting the introduction of local trading currencies if there is community interest.

IV. **Strengthen community connections and attachment to the locality.** *Options:*

a. Facilitate resident and business involvement in local organisations and activities through provision of community premises, seed grants, information provision, coverage in behaviour change programs, and the sponsoring of selected events.
b. Ensure the attractiveness of activity centres and other public spaces, with particular attention to visual interest, walkability, shading and greenery.

V. **Consider ways of reducing Council employees’ travel.** *Options:*
   a. Explore arrangements that allow staff to work at or closer to home (for example, in premises of adjacent councils) for some or all of their working time, using email, drop boxes, skype, phone conferencing and similar technology, together with regular but less frequent face-to-face contact.
   b. Investigate the decentralisation of a range of Council services through the establishment of a series of small, localised general-purpose Council premises, each serving as a base for the delivery to the locality of services, for example, personal care services or security patrols, using ICT as described in ‘a’ above.

**Measures that reduce or eliminate the use of oil in personal and freight transport**

These include passenger and freight public transport, walking and cycling facilities, recharging infrastructure for electric cars, demand management measures to encourage the switch to transport modes using little or no oil, and measures to help this switch to occur for Council operations and staff commuting.

I. **Seek to increase the provision of public passenger transport** (in collaboration with the State Government). *Options:*
   a. Advocate the introduction of Light Rail Transit (LRT) services on key activity corridors, to complement train services and take passengers to and from train stations and activity centres.
   b. Advocate the introduction of more buses – gas or electric powered – to complement rail and light-rail services, link residential, commercial and industrial areas, and feed to rail and light-rail stations.
   c. Advocate a branch train line along Reid Highway from the Clarkson line to the airport, as recommended in the City’s *Integrated Transport Strategy*.
   d. Adopt a longer term goal of providing frequent transit services within 10 minutes walk of every address in the City.
   e. Consider subsidising public transport for Council staff, as part of other policies on staff commuting detailed below.
   f. Explore the funding of public transport through value capture mechanisms and public-private partnerships.

II. **Seek to increase the provision of public freight transport** (in collaboration with the State Government). *Options:*
   a. Advocate for better freight rail services.
   b. Consider advocating off-peak cargo trams as part of an LRT system.
   c. Seek better provisions on buses and LRT for personal goods loads and bikes.

III. **Improve pedestrian facilities.** *Options:*
   a. Install footpaths on at least one side of every street in Stirling, except short cul-de-sacs.
b. Plant trees for shade along as many footpaths as possible.

c. Enhance pedestrian amenity and safety, with appropriate pedestrian crossings, pedestrian only streets, and other measures to improve walkability.

IV. **Improve cycling facilities.** *Options:*
   
a. Build integrated networks of cycle paths or lanes, linked to transit as necessary.

b. Consider bike hire services in major activity centres.

V. **Support electric and more fuel efficient vehicles.** *Options:*
   
a. Support the provision of electric vehicle recharging points in Stirling, through amendments to planning codes and development guidelines, adoption of permit procedures and, if necessary, the provision of initial recharging infrastructure.

b. Encourage residents and businesses to buy more fuel efficient petrol or gas vehicles and keep them operating efficiently, through information provision and coverage in behaviour change programs.

VI. **Adopt demand management measures for cars.** *Options:*
   
a. Implement parking policies to discourage car use, generally or in specific areas, such as: restrictions on ground level car parks, gradual decreases in parking spaces, increases in cost or decreases in maximum allowable time for public parking, and the stipulation of maximum (rather than minimum) allowable parking spaces in
      
      i. Transit Oriented Developments.

b. Restrict car travel, generally or in specific areas, by converting some roads and road lanes to other uses, e.g., pedestrian and cycling space, public transport and green planting, and introduce traffic calming measures.

c. Encourage car use 'demand generators' such as schools and workplaces to introduce their own measures to encourage parents, staff etc to use other transport measures.

d. Encourage the commercial provision of pedestrian trolleys, bike trailers and cargo bikes for the transport of small quantities of personal and commercial goods.

e. Support the development of car sharing schemes, for example, by providing free parking spaces as the street bases for the vehicles.

f. Support car pooling arrangements.

VII. **Enable greater use by Council staff of non-oil transport.** *Options:*
   
a. Adopt a medium term goal of converting Council cars, trucks and other vehicles to non-petrol vehicles, such as electric.

b. Use pushbikes, electric cycles and public transport where appropriate.

c. Require, in the medium term, that all cars in salary packages be non-petrol cars.

d. Replace cars and car allowances with travel allowances which can also be used to meet public transport or cycling costs.
Measures that enable Stirling to be less reliant on external sources of stationary energy derived from fossils fuels

These include the local generation of electricity and hot water (for heating and cooling) from renewable natural gas, as well as electricity generation from other renewable sources, the promotion of greater energy efficiency and on-site power generation, and the implementation by Council of energy efficiency measures for its own premises and equipment and for street lighting, given the likelihood that peak oil will have adverse effects on conventional electricity generation, resulting from fuel switching that will increase fossil fuel prices generally.

I. **Explore possibilities for local energy production. Options:**
   a. Facilitate the development of local tri-generation infrastructure, particularly in activity centres and new developments, powered by renewable natural gas fed by municipal and other waste. (See Appendix II: *A sustainable power revolution in our midst*, in the Oil Risk Strategy.)
   b. Consider other sources of local renewable energy, perhaps to supplement renewable natural gas, specifically, photo-voltaic, wind (including off-shore turbines), geothermal, wave and tidal power.

II. **Promote greater energy efficiency. Options:**
   a. If there is local power generation, incorporate differential pricing across 24 hours and 7 days to even out load, and consider the potential for the batteries of parked electric vehicles to meet a part of daytime electricity demand.
   b. Through Council and/or local power providers (if there is local production) supply information and advice about solar panels, smart and energy efficient appliances, home retrofits, shade planting and other energy efficiency measures via LivingSmart or other behaviour change programs, advisory services and information provision.
   c. Retrofit Council premises as necessary for energy efficiency and on-site power generation, and ensure that any new Council buildings, appliances and equipment meet high standards for energy efficiency and power generation.
   d. Collaborate with Western Power to install the most energy efficient street-lighting, powered by PV panels where feasible.

III. **Promote local water harvesting and recycling for water and energy efficiency. Options:**
   a. Encourage water harvesting and recycling in residences and other premises.
   b. Establish municipal water harvesting and recycling, with third pipe systems that separate potable and non-potable water, especially in new developments.
   c. Favour native, low water use plants in Council planting, and reduce areas of lawn.

IV. **Promote local waste collection and recycling for energy, water and land use efficiency. Options:**
   a. Consider use of domestic, commercial, industrial and municipal waste and sewage for renewable natural gas power generation.
b. Encourage household and business composting, and consider the implementation of Council collection of compost and garden waste for recycling.

c. Investigate vacuum pipe waste collection, particularly for higher density areas.

d. Consider a reduction in the frequency of waste collection, accompanied by information about ways to reduce and store waste, with the option of a continuation of the current level of service or an extra bin but at an additional cost.

**Measures to gain the involvement of residents, businesses and Council personnel in dealing with the peak oil challenge.**

The measures described in this Report require broad support from residents and businesses, and many, perhaps most, cases require the active engagement of residents, businesses and Council personnel if they are to be successfully implemented. The measures in this section are designed to enable that to happen, by providing information and conducting behaviour change programs for residents and businesses, consulting the community on matters of implementation, and informing and enabling Council staff to implement measures to reduce oil use.

I. **Provide information and behaviour change programs.** *Options:*

   a. Increase resourcing of the City’s existing TravelSmart program in order to enable it to expand its work with households, businesses, schools and community organisations.

   b. Provide information about oil supply risks and peak oil, its causes and consequences (particularly for the City of Stirling), the measures planned to avoid these consequences, and the wellbeing, productivity and savings benefits of these measures, to residents and businesses, through on-line and printed information, advisory services, local media, and talks to community organisations, workplaces and schools.

   c. Encourage buyers’ clubs to reduce the cost of buying green technology, as well as neighbourhood groups to share vehicles and equipment and exchange information and services.

II. **Consult with residents and businesses.** *Options:*

   a. Consult residents and businesses as appropriate about the measures in this Report and their implementation, using techniques of deliberative democracy and other consultation methods.

III. **Adopt measures to ensure Council staff have the information to implement Council policies relating to oil availability risks.** *Options:*

   a. Provide in-service training, information sessions and on-line information for Council staff as necessary.

The planning of contingency measures that can be implemented in the event that Stirling is not sufficiently prepared when serious consequences of global oil depletion or international energy supply shocks occur. These measures will not need to be implemented if proactive action is implemented quickly enough to reduce, and eventually eliminate, the dependence of the City, residents and businesses on oil, but should be prepared and kept on hand in the event that this is not the case.
IV. Prepare an Emergency Management Plan, identifying risks from an oil supply emergency, their likelihood, their consequences and the severity of these, an appropriate Council response and the limitations of this. Options:

a. Create a separate Oil Supply Emergency Plan.
b. Incorporate peak oil concerns into a broader Fuel Emergency Plan.
c. Develop the plan in more detail over time as necessary.

A suggested procedure to implement the measures in this report, and to select and implement options

It is recommended that there be a three-pronged approach to the implementation of the measures in this report.

Firstly, there should be an emphasis on considering these measures for implementation within the City’s normal planning processes, particularly as part of the Strategic Plan, Corporate Business Plans, and annual plans for each business unit.

Secondly, Council Officers should meet six-monthly to review progress on reducing the City’s oil dependency and plan steps to be taken in the following six months.

Thirdly, an internal group should be formed to monitor and assist in the implementation of the measures to deal with oil vulnerability. In other words, this Oil Risk Advisory Group, with representation from relevant business units, would have a watching brief, and would assist Managers of those units and other staff to implement the measures, for example, undertaking or arranging necessary research or investigations.

Criteria for prioritising and scheduling actions

Measures to reduce oil dependence cannot all be implemented simultaneously, and each measure cannot in most cases be implemented right across the municipality at once, so the following criteria may be useful in determining what should be implemented at different stages, when, where, to what extent and in what ways:

I. Value for money: the amount of oil use a measure will save for each dollar the City spends.

a. This will be more predictable in Council operations where changes in trip lengths or transport modes for specific purposes can be planned and implemented, whereas the extent to which residents switch transport modes as a result of transport infrastructure provision or particular incentives will be harder to predict.

b. However, research evidence, some of which is sited in the Oil Risk Strategy, can give guidance in a range of relevant areas, and pilot projects can be undertaken to test out changes in one small area. Council will also be able to draw on the assessment tools of Kinesis, with whom it has entered into a contract, to predict the impact of planned changes.

II. Cost: how much the measure costs overall.

a. This is more predictable because expenditure will be planned and budgeted for.
b. If it involves something provided to the public for no fee or a below-cost fee, then demand for it might not be entirely predictable, but a limit can be set on the amount to be spent on it.

c. Measures that involve the introduction of, or changes to, regulations or zoning will be less expensive, unless there are high costs involved in ensuring compliance.

d. Many measures, such as the introduction of parking charges, reduced Council travel, or more energy efficient street lighting, will be revenue positive in the long term.

III. Co-benefits: whether, and to what extent, the measure has other advantages.

a. Co-benefits can include cost savings, increased business productivity, improved health or wellbeing for residents, or reduced local pollution and greenhouse gas emissions.

b. Generally speaking, in cities that are more densely settled and have a smaller proportion of trips taken in private vehicles, much less is spent on travel by both travellers and governments.

c. More active transport modes – walking, cycling and transit – have proven health and wellbeing benefits for travellers, and fewer cars mean less noise, congestion, local pollution and road trauma.

d. Non-car travel has also been demonstrated to promote greater community connectedness, which also has proven health benefits, and locally owned businesses have also been shown to promote community connections.

e. Businesses in denser precincts are more productive, as are employees in walkable localities.

IV. Essential service provision: whether the measure helps to safeguard the capacity of the City to provide essential services.

a. Critical Council services such as meals-on-wheels and personal care services ensure that the elderly and disabled have meals and assistance with activities of daily living, including the taking of medication. Rubbish collection is another vital service without which there would be disease outbreaks and a serious loss of amenity, while inspectors of food premises protect the public from unsafe food and consequent illness.

b. No Council services could be provided at all if staff are unable to get to work, or if Council buildings and vehicles are not maintained.

c. Cost increases, business downturns, higher unemployment and other economic costs of peak oil or protracted energy supply shocks are likely to increase the demand for Councils to provide essential services.
V. **Engagement value**: the effectiveness of the measure in informing residents and businesses about oil vulnerability and engaging them in ways of dealing with it.

a. Initiatives like local markets or community gardens may not save huge amounts of oil, but they can be ways through which residents become actively engaged in reducing their oil dependence. Apart from promoting the growing or buying of local produce, such activities bring people together and provide opportunities for information dissemination and discussion.

b. Green building and green infrastructure developments and activity centres with mixed uses (including residential) can demonstrate their many benefits to residents and business from other parts of Stirling, especially if they also have visual displays and (temporarily) vacant residences for the public to view.

c. Yet other measures have the express purpose of informing and persuading people to take action to lessen oil dependence, such as behaviour change programs and information services.

VI. **Public acceptability**: Whether the measure can be implemented without threatening the viability of the whole program to build resilience to the effects of global oil depletion and energy supply shocks.

a. Unpopular measures can make other measures that are linked in the public’s eyes unpopular as well, and thus reduce public acceptance of the general policy thrust of reducing dependence on oil.

b. Sometimes less popular measures can be implemented if it is expected that, once in place, they will be seen as having fewer disadvantages and more benefits.

VII. **Sequencing**: the order in which connected measures need to occur.

a. Measures that contribute to the same outcome will need to be rolled out at around the same time, for example, the range of measures to deter car use and encourage the use of other transport modes.

b. In many cases the lead time for these measures will differ greatly, so those taking a longer time will need to be started earlier. For example, a plan to have better quality and more shaded footpaths will require the trees to be planted first given the time they take to grow.

c. Some measures may harm others if implemented at the wrong time. For example, the laying of pipes under verges as part of hot and cold water distribution in local tri-generation power systems, or of automated vacuum garbage collection systems in medium and high density precincts, would need to occur before there was denser planting on verges.

VIII. **Readiness**: Whether there is sufficient information about the measure to decide if, when and how it should be implemented (if not, it will need investigation or research).

a. If it is not possible to answer all the other criteria questions above in relation to this measure, then more information is needed. In this case, it should be re-cast as a proposed investigation, rather than a measure to be implemented, and then be reconsidered according to these criteria.
b. Alternatively, Council staff – who will do a certain amount of preparation on all proposed measures before they are considered for implementation according to these criteria – may decide in the first place to put it forward as a proposed investigation or study.

c. This can be undertaken by Council staff or outside consultants and, as stated, Stirling already has a contract with Kinesis and the use of Kinesis software, which will yield much information relevant to building resilience against the effects of peak oil.

Sometimes these criteria may pull in different directions. An important example of this concerns the question of whether to concentrate on those parts of the City that have the most potential to be resilient in the face of peak oil, and thus can model desired change, or to concentrate – on equity grounds – on those parts that are most vulnerable to the problem of global oil depletion. We recommend a middle path in this instance, with a focus on those areas with the most potential for change, but with attention in the more vulnerable areas to walking and cycling facilities, bus services, electric car recharging infrastructure, information services, behaviour change programs, and encouragement of community connections. In addition, if opportunities become available in these less dense outlying areas, higher density, mixed use activity centres with residential components and public transport may be able to be developed.

**Implementation guidelines**

Once a decision has been made to implement a measure, a number of further decisions need to be taken to achieve this. The implementation questions listed below may help to either guide this process or supplement existing implementation procedures:

- Which section of Council is responsible for it?
- Is it a measure to be implemented, or is it an investigation of a possible measure? (If the latter, subsequent questions may not be answerable or relevant.)
- What will be its capital and annual operating costs? Will it generate income, and where will that be directed?
- What is the target or indicator/s of successful completion?
- What are key timelines and/or milestones on the way to implementation?
- Where will funding come from (internal or external sources) and which Business Unit budget will it sit within?
- Will it involve changes to regulations, by-laws, policies, zoning, etc? If so, what?
- Will it require new staff, and at what skill level, or will it involve upskilling of existing staff? How will this upskilling happen?
- Will it involve changes at State or Federal Government levels? If so, what representation will be made to State or Federal governments, and will this be by Stirling alone or with other local governments?
- If it is an action to be implemented, will it require any further research or investigation first? If so, what will need to be researched, what will be the process for doing so, who will do this, and what resources and time are required?
What, if any, measures need to precede its implementation?

What, if any, measures need to be introduced at the same time?

Does it impact on other areas in a way that requires attention? Give details.

Does it involve the public or business acting differently? If so, what steps need to be taken to inform, enable and motivate this?

What other aspects of implementation need to be noted or attended to?

Through these means the necessary measures can be introduced in a planned and systematic way. Peak oil represents a serious threat to the good functioning, prosperity and wellbeing of the people and businesses of Stirling, and to the Council that acts on their behalf. But with careful planning and community support, Council can take all the necessary steps to protect Stirling from these threats, and in so doing enhance resilience and quality of life well into the future.
Footnotes

i Catalyst, ABC Television, 28 April 2011. Birol also stated during this interview that conventional oil sources peaked in 2006.

ii Technically speaking, this is a consequence of peak oil rather than a definition. The term refers to the point at which crude output peaks, typically when around half the resource has been exhausted globally. The remaining half becomes increasing difficult and then impossible to extract.

iii Guardian, 11 July 2010.


v However, the fact that the graphs on this and the next page (sourced from ASPO, the Australian Association for the Study of Peak Oil and Gas) have a different peaking date is indicative of the range of views on the subject, but mostly within a narrow band of time.

vi See Figure 2.5 in P Newman and J Kenworthy, ‘Chapter 2: Evaluating the Transport Sector’s Contribution to Greenhouse Gas Emissions and Energy Consumption’, in R Salter, S Dhar and P Newman (eds), Technologies for Climate Change Mitigation: Transport Sector, UNEP, Roskilde, Denmark, 2011, p 16.


viii Peter Martin, Sydney Morning Herald, 30 Nov 2009.

ix City of Stirling, Local Housing Strategy, p 9.


xii Research into this issue is currently being undertaken by James McIntosh at CUSP.


xv Australian Senate Report, 2007


xvii Salter et al (eds), Technologies for Climate Change Mitigation.