



NEW ZEALAND A FUTURE WITH LESS OIL?

A risk management study for Palmerston North

In 2011, Palmerston North City Council commissioned Abley Transportation Consultants, EAST (Energy Activity Systems Transition) Research and Market Economics Limited to deliver the Palmerston North Peak Oil Vulnerability Study. This study is an evidence-based assessment, providing Palmerston North City Council and Council's stakeholders with information to better anticipate, plan and manage a transition to a less transport energy intensive City. This summary document presents a selection of the findings of the study team. Please contact Abley Transportation Consultants for more information.

"...CURRENT GLOBAL TRENDS IN ENERGY SUPPLY AND CONSUMPTION ARE PATENTLY UNSUSTAINABLE... THE ERA OF CHEAP OIL IS OVER."
INTERNATIONAL ENERGY AGENCY, 2008 WORLD ENERGY OUTLOOK

"NATIONAL AND LOCAL GOVERNMENT POLICIES (PARTICULARLY THOSE ON THE SOCIAL, ECONOMIC AND FINANCIAL FRONTS) SHOULD EXPLICITLY ACKNOWLEDGE THE POTENTIAL FOR HIGH OIL PRICES AND PROMOTE APPROPRIATE CONTINGENCY PLANNING."
UK GOVERNMENT THE OIL CRUNCH: A WAKE-UP CALL FOR THE UK ECONOMY, 2010

WHAT IS ALL THIS NOISE ABOUT PEAK OIL?



Peak oil is a risk management issue for local councils affecting asset management, operations and provision of services. The physical reality is that world oil supply will continuously decline over any conceivable planning horizon. There are currently no practical alternative technologies or substitute resources that will fill the gap between supply and demand left by declining oil supply. This is because oil is very high in energy, and alternatives or substitutes pale in comparison.

The Council, organizations, businesses and households in Palmerston North, the rest of NZ and the world, will all inevitably adapt to using less petroleum. It is possible to maintain a prosperous economy and society during this adaptation. This prosperous adaptation will require solid understanding of current petroleum fuel use the implications to the economy and activity systems if adaptation does not occur. Prosperous adaptation will further require new and innovative adaptive development in the urban form and transport networks.

CAN'T WE JUST FIND MORE OIL?

The world oil supply capacity cannot increase any further, and even with the increased development of deep-sea reserves and heavy tar deposits, the net energy supply is likely to begin declining at an

accelerating rate in the near future. Having less oil supply available than demand, when that demand is inelastic, is a problem. The world oil production capacity has not exceeded an average 75 million barrels per day (mbpd) since 2005¹. It is physically possible that world oil production could go higher by 1-2 mbpd if all producers were operating at full capacity. However, political unrest in the Middle East, war in Libya, environmental disasters and increased demand in Asia mean that the world production is most likely to fluctuate around the current levels for several years and that spare capacity is likely to remain historically low.

THE FUTURE OIL SUPPLY SITUATION WILL BE DIFFERENT FROM THE PAST

Increased oil price and increased political urgency have spurred a rush to rapidly develop the last remaining oil deposits. These remaining deposits include the declining existing resources and the smaller and more difficult to extract geologic formations. Enhanced oil recovery, deep sea, sub salt, tar sands and hydraulic fracturing all require more equipment and energy for extraction than the light, sweet crude reservoirs in porous source rock. More aggressive development of the remaining oil resources will actually act to accelerate the depletion of the world oil endowment and reduce the net energy supply.

¹ US Energy Information Administration Annual Energy Outlook 2011 (DOE/EIA, 2011).

IS OIL REALLY THAT IMPORTANT?

The largest oil end-use by far is petrol and diesel fuel for private travel and freight movements. The elasticity of transportation uses depends largely on the adaptive capacity of each city and freight network. The adaptive capacity for personal transport is a function of geography and available options that use less fuel. The adaptive capacity for freight movement is a function of geography of primary production, logistics systems, and the availability of optional modes that use less fuel. The long-run adaptive capacity of the whole transport sector is critically

dependent on network, infrastructure, and land-use decisions made today. Oil is also used for manufacturing and as a feedstock for materials. There are currently virtually no substitutes for petroleum products that can be developed at a rate to replace the declining oil supply. Oil is also used in primary production for everything from fishing to farming and construction. There are currently no substitutes for diesel fuel that do not require diesel inputs, and that can become available in the market at a rate

PEAK OIL SEEMS LIKE REALLY BAD NEWS. WE DON'T WANT DOOM AND GLOOM.



There is a good deal of speculation amongst pundits and various authors about the implications of peak oil. While the majority of the general public is not aware of the issue, awareness often brings serious questions about the future.

equal to the probable supply decline rate.

OUCH! SO WHAT ARE WE DOING ABOUT IT?

The response of government, industry and business to peak oil has historically been denial. This is quite understandable. The implications of the end of growth in energy supply are hard to handle. The implications of declining energy supply are nearly impossible to comprehend based on our past experience.

Avoiding a situation is an understandable response when that situation is negative and where there are no immediate solutions. Another response is to fall back on shared beliefs; technology will provide alternatives and the market will provide new resources. An effective way to avoid the topic is to marginalise those who put forward the issue for discussion and to question analysis.

The key to moving forward from denial to productive risk management is to get a clear understanding of the most pertinent facts about oil supply and the time frame for changes from historical trends. The key to effectively addressing the issue with appropriate decisions at critical times is to use the proven risk management approach.

PHEW, SO WE DON'T NEED TO PANIC. RIGHT?

The best approach is to stop worrying and start setting priorities, gathering information, assessing adaptive capacity, and planning development and re-development projects that increase adaptability. In the PNCC 10 Year (2012-22) Plan, the Council's success is judged by involvement of the residents, informed residents and financial responsibility. The PNCC strategy for peak oil risk management should be based on clear information not fear, and should be transparent, cooperative and participatory with the city residents. The opportunities to reduce fuel demand must

THERE WILL ALWAYS BE ENOUGH OIL... BUT THERE WILL ALWAYS BE LESS OIL.

be the result of thinking and analysis by each business and household. People can suggest things that would help them use less oil and participate in planning for community changes.

Confidence in positive possibilities for managing activities to meet limits can be achieved if the processes involve public creativity and opportunities for new local businesses. Prosperous adaptation will involve technology, business, land use and infrastructure changes that provide for increased productivity while fossil fuel use declines. An important peak oil risk management goal is to avoid destructive change such as loss of productivity, loss of essential services, curtailed travel activity participation, demand destruction, property devaluation and businesses contraction.

SO HOW MUCH OIL ARE WE LIKELY TO HAVE?

An oil supply probability distribution has been developed by analysing a wide range of expert estimates of future conventional oil supply and decline rates. The distribution indicates the probability that a certain oil supply, or more, will be available in a given future year. There is a 97% probability that the amount of oil described by the blue line will be available, while there is a very small probability that an amount greater than that described by the pink line will be available.

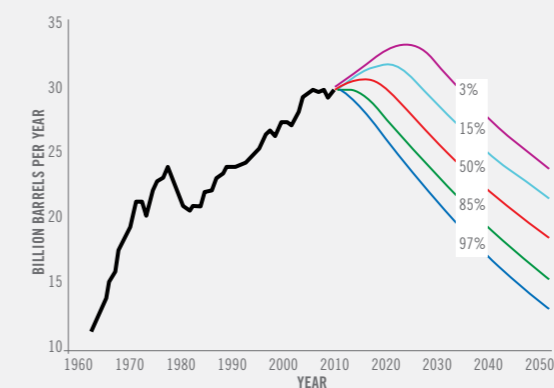
The probability distribution of future fuel supply including all published scientific expert analysis gives a new "risk attitude" approach to long term planning.

The distribution indicates that it is almost completely certain that oil supply will

decline by 2025. Palmerston North City Council has decided to use a relatively conservative risk attitude to understand the impact of future oil supply probability. The position is to have at least 85% probability of oil supply which equates to a 2-3% reduction in supply per annum for the foreseeable future.

The projected 2050 level of transport fuel energy use is in the range being used in the 1960-1970's in New Zealand. Of course the population of Palmerston North has grown substantially since then, but the fuel efficiency of vehicles, trucks, buses, farm equipment, processes and homes has also improved. The past sixty years have seen New Zealanders adapt to using much more energy every year. There have been changes in infrastructure,

OIL SUPPLY PROBABILITY

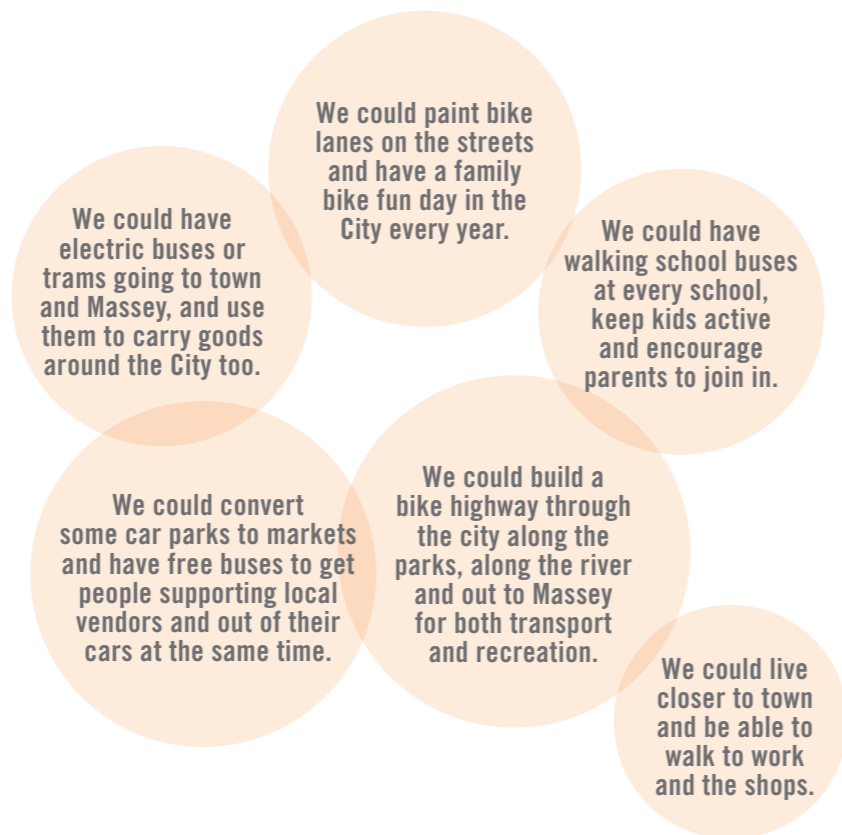


Palmerston North is planning for an 85% oil supply probability.

YEAR	CONDITION	DIESEL (TJ)	PETROL (TJ)
2011	The 'current' fuel use level	2479	2131
2020	2.5% fuel reduction p.a.	1859	1598
2030	2.4% fuel reduction p.a.	1405	1208
2040	2.6% fuel reduction p.a.	1033	888
2050	2.8% fuel reduction p.a.	744	639

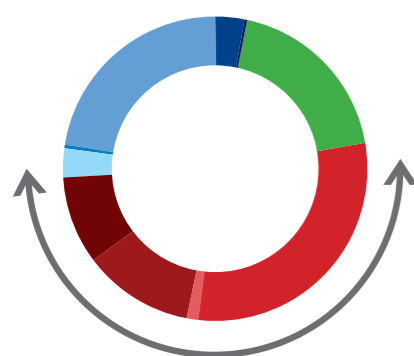
An 85% oil supply probability means 2-3% less fuel every year.

technology and land use every year, and those changes have been in lock-step with changes in behaviour that made more use of low cost and abundant energy. The next sixty years are going to also be characterised by adaptation, and by changes that reduce energy intensity in all activities. The residents, Council, organisations and businesses are also going to find that auditing their transport fuel use and preparing action plans to reduce the need for fuel will improve their own and the city's resilience.

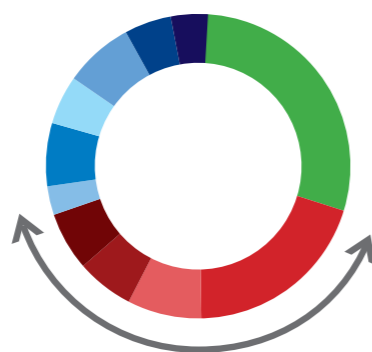


Adaptation to using less fuel will come from personal and business initiatives fostered by the PNCC policies and investments.

CAPITAL EXPENDITURE 2012/13



OPERATING EXPENDITURE 2012/13



- LEADERSHIP
- COMMUNITY SUPPORT
- WORK & CITY PROMOTION
- LEISURE
- ROADING & PARKING
- RUBBISH & RECYCLING
- WATER
- WASTEWATER
- STORMWATER
- REGULATORY
- SUPPORT SERVICES

Palmerston North City Council Draft 10 Year Plan² expenses and capital expenditures with relative exposure to oil supply issues indicated by red.

² At the time of publishing the the PNCC 10-year plan (2012-22) is a draft plan therefore the data is only indicative.

HOW VULNERABLE IS PALMERSTON NORTH?

Palmerston North has a well-defined central area with 90% of the households located within 5 kilometres from the Square in the heart of the CBD. Palmerston North is currently reasonably compact and travel distances are relatively short, such that walking and cycling trips may effectively substitute for most vehicle driver trips.

The CBD, hospital, University and the science centres are key attractors for employment. The industrial and large format retail work places are located along Tremaine Road and follow the main trunk rail line and the Palmerston North – Gisborne Line. This layout of the industrial and large format retail workplaces is well suited for a freight

modal shift from road to rail. Another prominent centre is the Linton Military camp located south west of the central city.

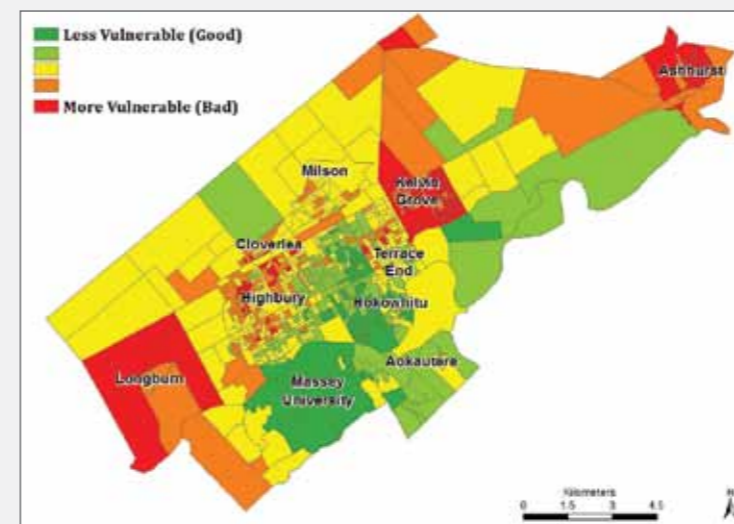
The Vulnerability Assessment for Mortgage, Petroleum and Inflation Risks and Expenses (VAMPIRE) is an econometric analysis methodology³. A relative vulnerability score (called the VAMPIRE Index) is calculated for households based on their degree of car dependence, income level and mortgage index.

A low VAMPIRE index, indicated in green signifies those areas that are less vulnerable to peak oil and the orange and red areas are more vulnerable due to a high degree of car

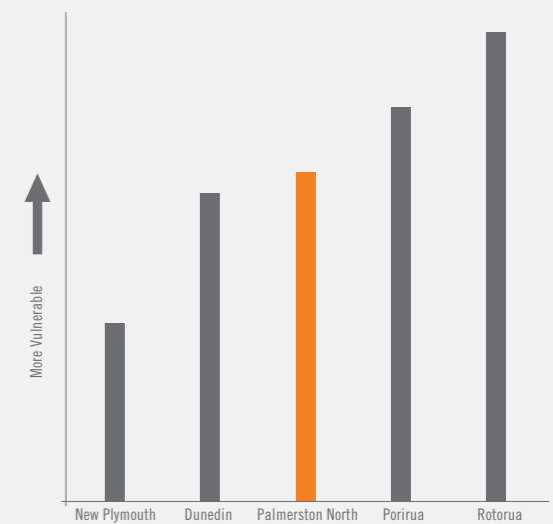
dependence, relatively low income levels and/or high levels of household ownership.

HOW DOES PALMERSTON NORTH COMPARE TO THE REST OF NEW ZEALAND?

The VAMPIRE Index can also be calculated for cities as a whole such that Palmerston North can be compared to other regions throughout New Zealand and Australia. Palmerston North has an average degree of vulnerability relative to other Main Urban Areas and is similar to Dunedin in this regard. Of the main centres identified, Palmerston North has a lower than average rate of car travel to work, and higher than average incomes, vehicle ownership rates and household ownership.



The central city and southern suburbs are less vulnerable with outlying areas being more vulnerable.



Palmerston North assumes an 'average' vulnerability score.

³ VAMPIRE analysis was developed at Griffin University in Australia but has been adapted in this study for the assessment of New Zealand assessment

HOW FAR DO PALMERSTONIANS TRAVEL?

The total vehicles kilometres travelled (VKT) per annum by private motor vehicle⁴ is linked closely with the proximity of households to the core of the City where employment and retail opportunities are prevalent.

People who live in the CBD travel the least, while people in rural areas, like Turitea and Whakarongo, drive private vehicles the most. In terms of reducing peak oil vulnerability, the analysis highlights the importance of retaining a central urban area, encouraging intensification within the 'core', and discouraging single-purpose development in outlying areas.

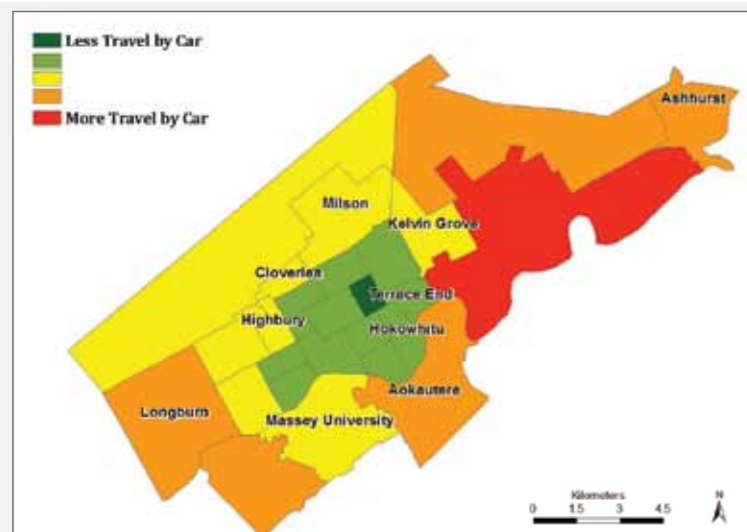
HOW DO PALMERSTONIANS CHOOSE TO TRAVEL?

Palmerston North has the highest incidence of cycling at 3.6% of all trips which is more than twice the national average. It also returns one of the lowest rates of walk trips at 13.6% which is 40% lower than the Christchurch and Dunedin results of 21.5%, and slightly below the national average of 16.1%.

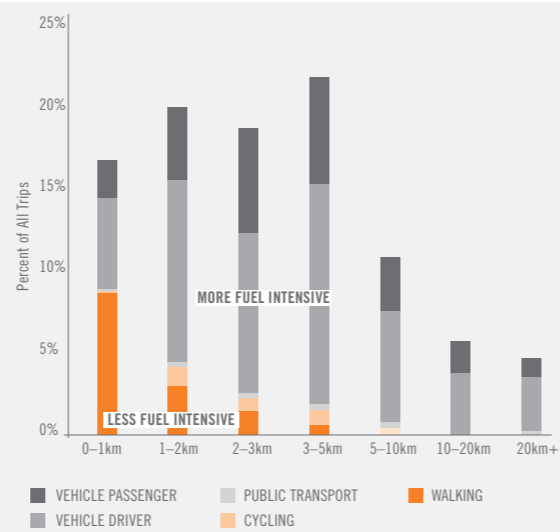
There are opportunities to increase the quantity of walking, cycling and public transport use in the City. Approximately 17% of all trips in Palmerston North are vehicle driver trips of less than 2 km, which is a

comfortable distance for walking or cycling. A further 23% of all trips in Palmerston North are vehicle driver trips of 2km to 5km, which is a comfortable distance for cycling and is further serviced by public transport routes. Most residential locations, workplaces and other activities are situated within 5kms from the Square, with 78% of all trips being under 5km in length.

A comprehensive and valued public transport network, and well promoted walking and cycling culture in Palmerston North, are fundamental to reducing the City's dependence on the private motor vehicle.



Average Vehicle Kilometres Travelled increases for households located further from the Central City.



Many trips in Palmerston North can be cycled or walked.

WHAT ARE THE ECONOMIC IMPACTS OF PEAK OIL?

Economic analysis produced using the Economic Futures Model⁵ describes the ramifications of failing to plan for reduced oil use for the local and regional economy. The outcomes of not planning for adaptation are stark.

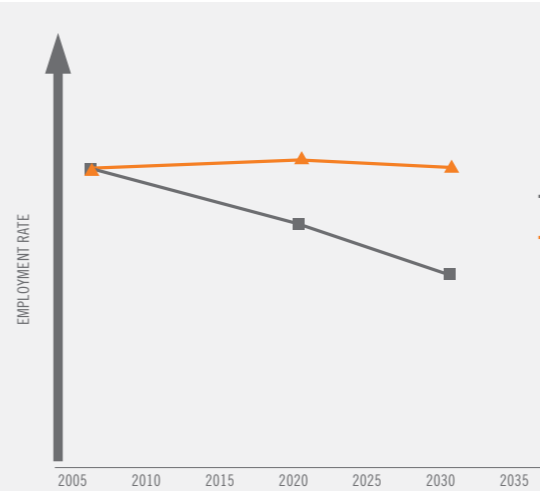
Through economic modelling, a number of alternative futures for Palmerston North are considered. Among these, a scenario referred to as the 'No Intervention' scenario aims to answer the question "What might our economy look like in the future under a situation where the total quantity of fuel consumed is substantially less than that of today, but the current economic

structure and the way in which people behave remains largely the same?". Without significant changes in production methods, economic output is severely curtailed by future limits on fuel supply.

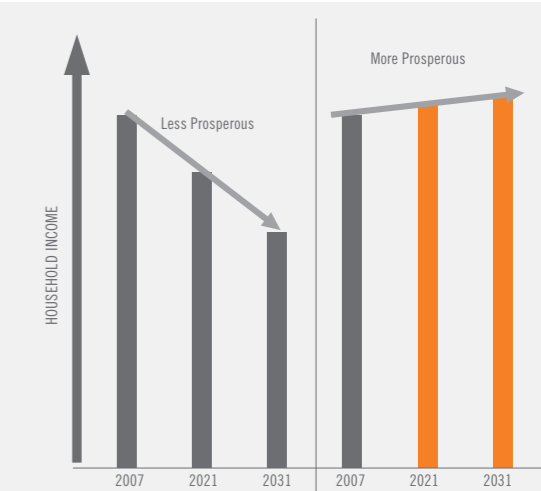
By contrast a 'With Intervention' scenario utilises the same global fuel supply constraints as the 'No Intervention' scenario, but additionally assumes that a number of management interventions, designed to reduce the economy's reliance on fuel, are implemented. The management interventions are successful in creating a decoupling of the trends in economic output growth and fuel consumption.

In terms of household expenditures, if the price of fuel were to increase by \$1 per litre, this factor alone will cause a net loss in local and regional value-added of nearly 1%. There is a clear need to provide, in the future, means for households to travel that do not involve significant increase in costs.

The creation of a successful adaptive economy is also likely to entail some major changes in economic structures, so that road transportation becomes significantly less important. Although this is clearly a threat to the local logistics sector, it can also be seen as an opportunity. Firms that are agile and able to pursue opportunities in providing ways to achieve levels of service with fewer resources will perform well under changing market conditions.



If we don't adapt to peak oil the economy could potentially rapidly decline and the number of employed people will fall sharply.



Household income levels are also likely to reduce unless intervention strategies are developed to manage oil use.

⁴ Data sourced from the Ministry of Transport

⁵ Developed by Market Economics Limited

SO WHAT DOES PALMERSTON NORTH DO NOW?

The Palmerston North City Council must manage the city services in a way that continuously reduces transport fuel demand at a rate of 2-5% per year. The Council must also facilitate local communities, businesses and organisations to manage their fuel use adaptation. The measure of success for any Council action is the provision of adaptive capacity that also provides ancillary social and economic benefits. A number of specific management strategies are recommended that fall into five broad categories as follows:

- a. LAND USE AND URBAN FORM – Adaptive urban development in the CBD, developing high intensity (but not necessarily high density), multi-destination centres and stimulating growth in adaptive areas identified in this report accessible by low-energy modes of transport.
- b. CAPITAL SPEND STRATEGY – Restructure funding and planning requirements in transport energy inefficient areas. This funding can then be re-directed into infrastructure for less fuel-dependent modes of transport and as incentives for centred urban development zones.
- c. ABILITY TO CHOOSE – Increase the

accessibility of public transport, cycling and walking infrastructure. Shift implicit priority in traffic engineering from private vehicles to less oil dependent modes. Provide community active mode activities and travel assessments. Place the top priority on safety of people walking or cycling.

d. EMBRACING TECHNOLOGY – Improve the efficiency of the private, commercial and Public Transport vehicle fleets. Develop low-energy high-efficiency infrastructure to link key destination zones in the City, and support the electrification of regional rail transport.

e. SUPPORT BUSINESS – Work with industry to facilitate a freight mode shift from road to rail. Provide support for supply chain risk assessments for businesses and organizations. Encourage further development of sectors with lower fuel intensity. Advocate to the Government for support of research to develop a New Zealand freight inter-modal matrix and innovations which enhance logistic efficiency and integration.

The path forwards for Palmerston North is to facilitate 'Adaptive Design', focusing on fiscal planning, traffic engineering, transport planning, urban design and

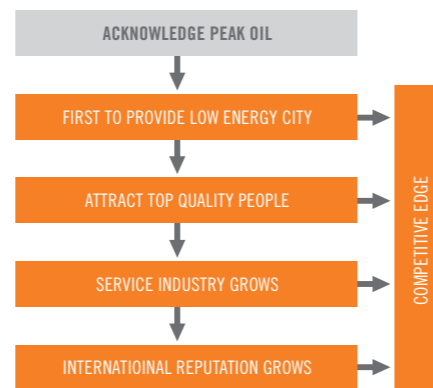


PHOTO: LAURA RIDLEY

land use planning. These five facets of Council have a common mission in the face of peak oil – to manage risk and to achieve prosperous adaptation.

It is recommended that the City actively promotes the outcomes of this study both locally and nationally to create awareness of peak oil as a problem affecting us all. This will serve a dual function of also raising Palmerston North's profile in New Zealand and overseas.

Palmerston North has already started a journey towards peak oil adaptability and resilience by acknowledging and reacting to peak oil. The City has the opportunity to lead the way for other New Zealand cities, and in doing so can gain a competitive edge in attracting top-quality people and a strong international reputation.



MEET THE STUDY TEAM



Steve is the Managing Director of Abley Transportation Consultants, a specialist transportation engineering and planning firm. Steve is well known having undertaken leading research into Integrated Transportation Assessments and more recently he developed the national methodology for how to measure accessibility for the New Zealand Transport Agency. Accessibility is a new area of study in New Zealand that is closely linked with the study of peak oil.



Susan is an Associate Professor at the University of Canterbury, the Director of EAST Research and has an unparalleled reputation in the study of peak oil. Susan's strategic research is aimed at delivering sustainability through Transition Engineering, creating the fundamentals of a low-fossil energy system, and conceiving bridging technologies, control systems and methods to manage the transition to more sustainable systems.



Garry is a Director of Market Economics, a consultancy with specialist experience in integrated economic, social and environmental assessment. Garry has led numerous of projects in the public and private sector and has developed several integrated assessment toolkits which are now widely used in New Zealand for tracking progress towards sustainable development.



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