Auckland Council

Energy Resilience and Climate Change Mitigation

Strategic Options Consultation Paper for Auckland Council

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Contents

Acronyms and abbreviations

BAU	Business as usual
CO2e	Carbon dioxide equivalent/s
EECA	Energy Efficiency and Conservation Authority
ETS	Emission Trading Scheme
EV	Electric vehicle
FCC	Freight consolidation centre
GDP	Gross domestic product
GHG	Greenhouse gas
GIC	Gas Industry Company
GRP	Gross regional product
GTIP	Gas Transmission Investment Project
GW	Gigawatt
GWh	Gigawatt hours
ICLEI CCP	International Council for Local Environmental Initiatives – Cities for Climate Protection
IPCC	International Panel on Climate Change
kt	Kilotonnes
KW	Kilowatt
KWh	Kilowatt hours
MW	Megawatt
MWh	Megawatt hours
MWp	Megawatt peak
NZ ETS	New Zealand Emission Trading Scheme
Paper (the/this)	The Strategic Options Consultation Paper
PHEV	Plug-in hybrid electric vehicle
RAP	Refinery to Auckland Pipeline
TWh	Terrawatt hours
VKT	Vehicle kilometres travelled
WAP	Wiri-to-Auckland pipeline

1 Preamble

The newly formed Auckland Council is currently developing a strategic planning framework for Auckland, comprising the Auckland Plan, Long Term Plan and Unitary Plan. The plans are underpinned by a vision to make Auckland the world's most liveable city and respond to a strategic framework that puts people at the heart of planning.

Two interdependent objectives within the plan are to secure a reliable and affordable energy supply for Auckland and to reduce the region's Greenhouse Gas (GHG) emissions. More broadly, the Council intends to take a strong leadership role to position the city-region as sustainable, prosperous and world leading in terms of how it manages its energy demand and supply options, and in its response to climate change.

This Strategic Options Consultation Paper proposes a suite of actions that Auckland Council could implement to achieve these goals, and identifies other partners to delivering the outcomes. The actions range from roles of advocacy to the direct funding and management of programs. There are also a number of specific measures to be adopted within the Council's strategic planning frameworks.

The Auckland described in this paper represents a City transformed in terms of the way people live and work, the way in which industry operates and the way Government prioritises investment. The magnitude of transformation is challenging but the experience of other global cities suggests that it is achievable and may attract investment to the region, provide economic benefit to the Auckland economy as a whole and transform Auckland to an ultimately more liveable and equitable city.

This options proposed in the paper are the culmination of two technical studies commissioned by Council. One study proposed a pathway to achieve Council's GHG emissions reduction target and the second study identified options to achieve energy security and resilience, within a low emissions framework. A technical options report was produced for each study and these reports were used for targeted stakeholder consultation. The reports and subsequent consultation provide the evidence base and empirical data for the strategic options proposed within this paper.

This Strategic Options Consultation Paper has been prepared as a consolidated discussion paper setting out a recommended suite of options to achieve an integrated response to the findings of the GHG emissions reduction and energy security studies. The options are selected to align with the planning framework and take into account liveability, identity, economic development and environmental protection in addition to the core objectives of the two studies.

It is understood the paper will be subject to further consideration by Council and a programme of wider community and stakeholder engagement. The purpose of the paper is to elicit critical thinking from stakeholders around the future role of the Auckland Council in the areas of GHG emissions management and securing regional energy supplies.

2 The Importance of GHG Reduction and Energy Resilience

2.1 The National Capital and Global Challenge

Auckland has a critical role to play in New Zealand's future. It is the largest region in New Zealand, home to one-third of the national population, and growth models indicate the region will continue to be the fastest growing region in New Zealand. Recent projections suggest that by 2040 Auckland could reach a population of between 2.2 and 2.5 million people.

Auckland is also the distribution hub for supply of goods to New Zealand's upper North Island cities and regions. As the population of the North Island continues to grow, this role will become more critical.

Economically, Auckland contributes to around 35% of New Zealand's Gross Domestic Product (GDP) annually and is one of a small number of cities worldwide that generate more than one third of national GDP. Auckland's sheer size, predicted growth and increasing national importance mean that securing reliable energy supplies and managing the growth in energy costs are foremost in the Council's thinking in building regional resilience to future global supply and cost volatilities.

Auckland Council has embarked on an innovative project to develop an energy and greenhouse strategy which ensures a responsible transition to a low GHG future whilst safeguarding affordable, stable and sustainable energy supplies for residents and businesses.

Auckland Council further recognises its responsibility to reduce GHG emissions and so contribute its fair share in the global climate mitigation task. The region undoubtedly will be impacted by climate change and the Council is seeking to establish its credentials as a world leader in how it manages its GHG emissions. As such, the Council aspires to reduce the region's GHG emissions by 40% from 1990 levels by 2031.

This paper describes a suite of eight elements and eight transformational investments that together can deliver a future that is both energy resilient and contributes to climate change mitigation through GHG reduction, with details of potential initiatives and the required partnerships. The rewards will be broad and far-reaching in securing a prosperous and liveable future for the city.

Auckland Council recognises that this will not be an easy change. It will require fundamental shifts in how we use and value energy and other resources and will sometimes require challenging decisions. Success will be dependent on the cooperation of government, the energy industry and consumers, and will require all Aucklanders to be more informed about their energy, business and lifestyle choices.

This paper included summaries of the detail included in technical options reports written by Arup for the GHG emissions reduction and energy security studies. Detailed analysis of Auckland's GHG emissions and energy profile now, likely growth models, and anticipated threats can be found in the two reports. The paper is intended to commence the dialogue about Auckland's energy and GHG future, and to inform the wider planning process.

2.2 GHG Emissions in Context

GHG and climate change

Many governments at all levels across the world are setting GHG emissions reduction targets in response to the imperative to limit global warming to less than 2ºC and avert dangerous levels of climate change. For the most part, these targets are either short term pragmatic targets requiring little innovation or step change, or long term ambitious targets with no clear pathway for implementation. Cities are struggling to bridge the gap between what is considered to be achievable within current political and policy frameworks and the level of mitigation required to prevent dangerous levels of climate change. In this context, Auckland is uniquely positioned to leapfrog the world's leading cities in terms of greenhouse gas reductions where it can capitalise on:

- the opportunity under the Auckland Plan to develop policy frameworks which actively promote low GHG growth and development across all areas of policy;
- its natural advantages including a large renewable resource base;
- investment in transport and energy infrastructure which supports low GHG growth and development;
- relatively low per capita household energy consumption;
- institutional capacity and commitment to mitigation across central and local governments; and
- strong connection to and cultural understanding of the value of a healthy environment.

Auckland's GHG emissions profile

In 2009 Auckland's energy use was approximately 33 terawatt hours (TWh) with an associated GHG emissions footprint of 7,265 $ktCO_2e$. A further 2,072$ktCO_2e$ were associated with non-energy emissions as well as an offset of 1,345 $ktCO_2e$ in GHG forestry sinks giving a 2009 emissions footprint of 8,890$ktCO_2e$.

Transport emissions constitute around 40% of total emissions as shown in Figure 1, a high proportion when compared to other global cities. This is in some part due to the relatively low emissions intensity of the New Zealand owing to the large hydro resources, but also due to the high level of car dependency and reliance on road based freight transport within Auckland.

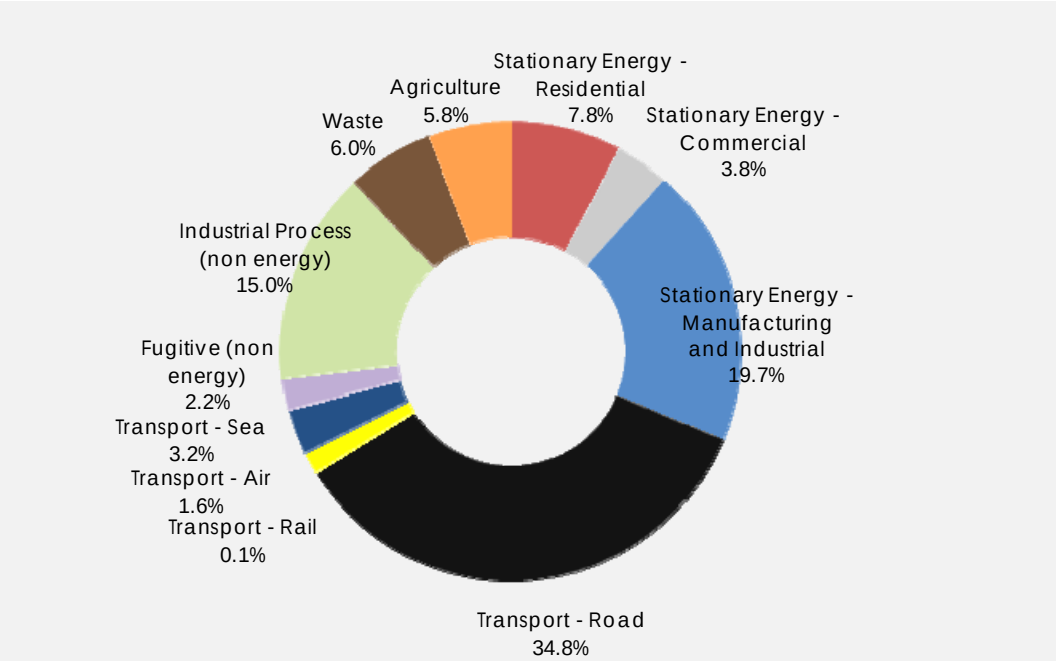

Figure 1 GHG Emissions Baseline 2009

The national context

The New Zealand 2020 pledged GHG target is between 10% to 20% reduction below 1990 levels. New Zealand has also set a longer term 2050 target of a 50% reduction below 1990 levels. This is in line with the majority of other developed countries long term targets including Australia, Canada and the European Union, but falls short of the globally required 80% reduction on 1990 levels recommended by the International Panel on Climate Change (IPCC).

New Zealand has an unusual emissions profile in that the majority of emissions are from agriculture and a relatively low proportion of emissions are derived from stationary energy due to the widespread use of hydro power generation. In this sense, there is less "low hanging fruit" in terms of energy efficiency which in many countries represents the lowest cost of abatement options. The New Zealand target is therefore considered aggressive as it comes at higher cost per unit GDP than many other countries' pledges, including Australia.

In contrast, Auckland's emission intensity in terms of both GHG emissions per capita and Gross Regional Product (GRP) is much less than New Zealand as a whole due to its reduced reliance on manufacturing, industry and agriculture (when compared to the rest of the country) and increased reliance on service industries. This is typical of most global cities.

What are other cities doing?

While many national governments grapple with the reconciliation of these targets, local governments across the world have set about investigating and implementing mitigation targets of their own. Cities in particular have joined forces through programmes such as the ICLEI CCP and the C40 Clinton Climate Initiative to identify effective technological and policy options to reduce GHG emissions.

Auckland Council's GHG reduction target will place Auckland amongst a small group of global leading cities.

The table below summarises the targets of other global cities to demonstrate the order of Auckland's ambition.

Table 1 Comparison of Auckland, New Zealand and international city targets

City/Nation	Target
Auckland	40% below 1990 levels by 2031
New Zealand	Between 10% and 20% below 1990 levels by 2020 50% below 1990 levels by 2050
Sydney	70% below 2006 levels by 2030
Vancouver	80% below 1990 levels by 2050 (33% by 2020)
Rotterdam	50% below 1990 levels by 2025
Oslo	50% below 1990 levels by 2030
London	34% below 1990 levels by 2020 and 80% by 2050

If it is assumed that emissions will abate uniformly across New Zealand, then Auckland will be required to achieve further reductions beyond 2031 to reach the 50% reduction target by 2050 in line with the national long term target. This remaining abatement will require further cuts in per capita emissions as Auckland's population continues to grow to 2051.

The remaining abatement will likely require innovation beyond what can be recognised at this point in time and potentially will come at a higher cost per unit of abatement as the "quick wins" at lowest cost will have already been realised. In this context, the 2031 target will position Auckland to recognise this abatement and play its part in meeting the national target.

Relationship to the ETS

The objective of the New Zealand Government's Emission Trading Scheme (ETS) is to incentivise abatement across the economy at least cost. In this respect, there is a risk that the Auckland target may drive perverse outcomes if local policies incentivise abatement that would otherwise not be least cost.

Notwithstanding, the Auckland target and underpinning policy options have an important role to play in:

- identifying the extent of abatement that would likely be achieved by the ETS without any additional policy intervention by Auckland Council;
- identifying the residual exposure to a carbon price;
- preparing Auckland businesses and residents for higher fuel and utility prices as emissions targets are ramped up in future years allowing them to make decisions with a full understanding of their choices to either conserve energy, or use more energy; and
- branding Auckland as globally competitive clean and green city.

In this context, the target seeks to ensure that there are sufficient opportunities for Auckland businesses and residents to choose low carbon alternatives without affecting quality of life, business viability or productivity. Key to achieving this objective is identifying appropriate policy options which are complementary to the ETS. These could include:

- addressing market failures that are not expected to be adequately addressed by the ETS or impinges on its effectiveness in driving emissions reductions (e.g. research and development

failures, infrastructure provision, split incentives, information failures and excess market power);

- addressing barriers that may prevent the take up of otherwise cost effective abatement measures;
- identifying sectors of the economy and community where price signals are not an effective mechanism to drive decision making or behaviour change; and
- policy options which have a high cost of abatement but will deliver substantial co-benefits which may also be considered as complementary and must be included in cost-benefit analysis.

2.3 Energy Resilience in Context

Auckland relies on energy for its physical and economic well-being and as a key input into its quality lifestyle. Past supply disruptions and sudden price increases have demonstrated the region's vulnerability and poor energy resilience. Auckland Council recognise that securing an adequate, reliable and affordable energy supply is critical as an enabler of economic growth to underpin regional prosperity and achieve the goal of Auckland being the world's most liveable city. The system must be planned to buffer Auckland from future challenges such as rising energy costs and dwindling resources.

A coordinated and transformative response to these challenges has the potential to improve Auckland's resilience to physical and economic shocks to parts of the energy supply chain, enhance capacity to ameliorate future increases in global energy prices, and to reduce the greenhouse intensity of energy use.

Growing demand

Within the next 25 years, the world's total energy consumption is expected to increase by one third. For Auckland, energy consumption projections are higher than this figure, driven by the anticipated fast population growth rate.

In 2009 Auckland's energy use was approximately 33 terawatt hours (TWh) with an associated GHG emissions footprint of 7,265 ktCO2e. Growth projections imply that, without long term energy management, the region will inevitably become increasingly reliant on imported energy supplies and vulnerable to increases in the cost of energy and a price on carbon under the New Zealand ETS. Auckland Council has an important role in managing the magnitude of this growth and views this as an opportunity to also improve energy security, manage price increases and volatility, and reduce regional GHG emissions.

Projections undertaken on behalf of Council suggest that by 2031, Auckland will be spending around 10% of its gross regional product on energy, which is nearly double the current expenditure level.

The region's projected expenditure on energy without strategic leadership or intervention (or the 'business as usual' (BAU) approach) is shown in Figure 2.

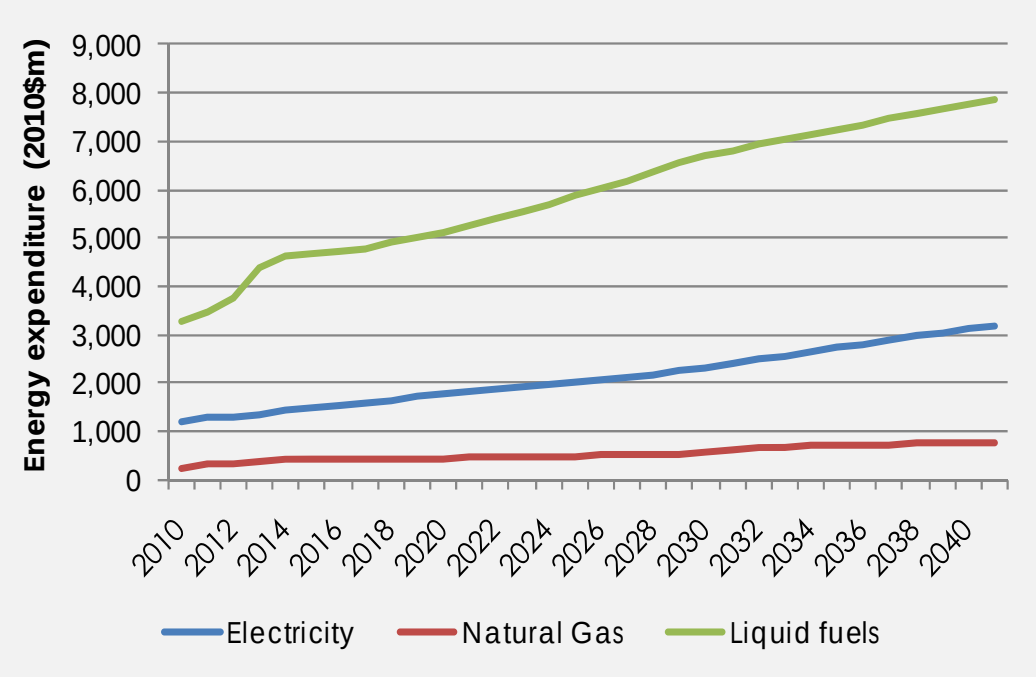

Figure 2 Auckland's projected energy expenditure 2010 - 2040

Aucklanders currently spend around $5 billion per annum on energy (excluding GST and metering charges). Average household expenditure on energy is around 17% of total household income. Increases in household energy consumption and/or energy prices will result in more Aucklanders living in fuel poverty, or finding it difficult to afford sufficient energy to maintain a quality lifestyle. This scenario is a direct threat to Auckland's goal to be the world's most liveable city.

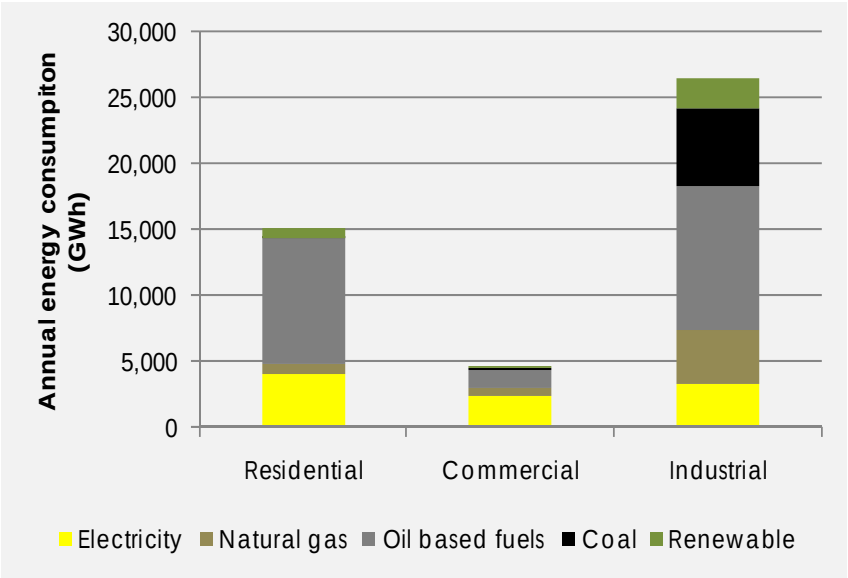

Figure 3 – Breakdown of energy consumption by type and end use sector. Source: EECA end use database

Figure 3 shows the current annual residential, commercial and business consumption for electricity, natural gas, oil based fuels, coal and renewables.

In particular, it shows the residential sector's significant annual consumption of oil-based fuels and electricity.

A complex system

There are significant interdependencies within the energy system in Auckland. The relationships between the energy resources, infrastructure and end use is shown in Figure 4 which maps out the supply chain associated with liquid fuels, gas and electricity in Auckland and links them to their eventual end use. This figure demonstrates the complexity of the energy system in Auckland by noting the interdependencies across the energy supply chains.

It is clear that all areas of Auckland's economy, environment and social fabric are heavily dependent on the supply of energy and are therefore vulnerable to changes in supply. Without intervention in both supply and growing demand for energy in the region (i.e. a 'business as usual approach'), future energy costs and GHG emissions will be largely determined by supply chain (or market) forces.

It is unlikely that a non-interventionist approach to the energy market will deliver the best outcome for the region either in terms of GHG emissions or energy resilience.

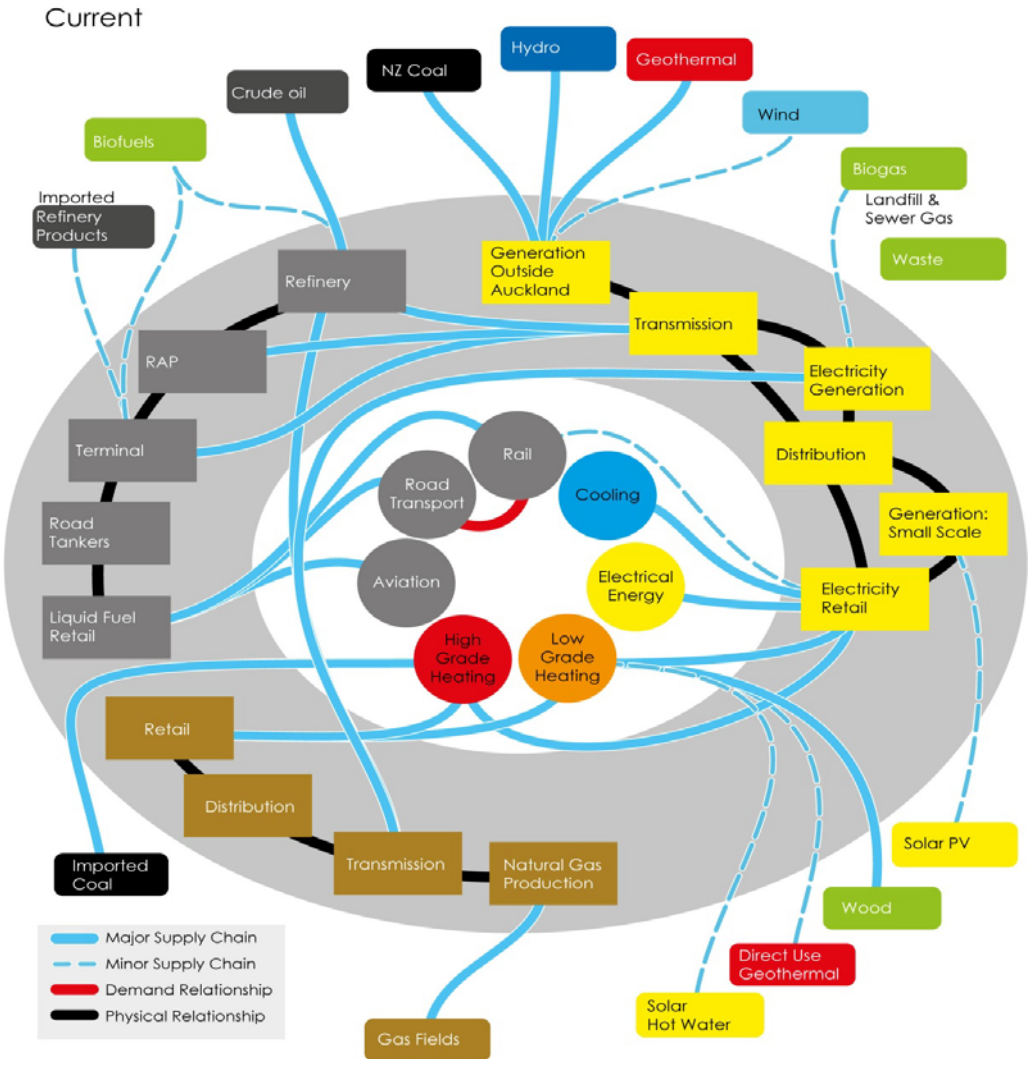

Figure 4 – Interdependencies of current energy supply chains and end use of the energy

There are further interdependencies between the energy system and other sectors in Auckland not documented in the figure above. Of particular note is the relationship between the region's energy system and water and wastewater services. Auckland's water and wastewater supplies use electric motors extensively and accordingly account for a large portion of Council's energy consumption. Measures to reduce water consumption will therefore also reduce energy consumption; and wastewater treatment provides opportunity for bioenergy production which can reduce GHG emissions. Further, water is also a critical component of the energy system, with large volumes of water required in oil refining and energy generation processes.

These interdependencies demonstrate the need for a coordinated approach, as a policy decision made by any one stakeholder can have ramifications for the entire system.

Despite the challenges that face Auckland, there are also significant opportunities where positive transformations could occur to improve the region's resilience to any physical and economic shocks to parts of the energy supply chain, an ability to anticipate and manage future increases in global energy prices, and contribute its fair share to reducing greenhouse gas emissions.

Infrastructure investment

A key consideration in planning for energy infrastructure is the need to allow sufficient forward planning for consultative and commercial decisions to be made. The long-lived nature of these assets (30-50 years) means that a long term return on the investment must be demonstrable given the significance of the capital borrowings.

There are well advanced plans for further reinforcement of the electricity transmission networks into the region. These are underpinned by demand growth projections and requirements to replace existing aged infrastructure.

However Auckland and its near neighbours in Northland have only single transmission pipelines supplying natural gas and liquid fuels and no current commitment to enhance or expand this capacity. Dependence on imported transport fuels makes Auckland vulnerable to oil price volatility and to potential supply disruptions and with growing demands for aviation fuel, diesel and petrol there will be growing pressure on existing infrastructure to deliver higher volumes.

Concerns around surety of New Zealand indigenous gas supplies is also critical in planning for investment in future pipelines and facilities (this further discussed in Section 4.2). The situation is likely to drive continued regional discussions around mechanisms to reduce the demands for liquid fuel, augment pipelines and also increase regional reserves to cater for this growth.

Renewable resources

New Zealand, and indeed Auckland, is endowed with a number of renewable energy generation opportunities which are likely to be economically attractive in the future and will assist in reducing the greenhouse intensity of the electricity generation in the region. These include large scale wind generation potential and small-scale solar PV (for either generation or solar hot water). Whilst some of these opportunities are not directly competitive with current electricity generation or water heating options, as the cost of greenhouse abatement increases with time, the relative cost of these options is likely to become more competitive.

2.4 The Auckland Plan: A unique opportunity

The Auckland Council was established on 1st November 2010 and has since embarked on an ambitious program to develop a new and strategic planning framework for the whole city.

The Auckland Plan is the key strategic spatial document which will guide the Council's decision making. It is augmented by two implementation plans for the next ten years: the Unitary Plan which details how the Council intends to manage the design, the development and growth of the city; and the Long Term Plan which prioritises the funding to deliver the Auckland Plan on a staged basis. The legislative framework for the Auckland Plan, Long Term Plan and Unitary Plan provide the approach by which the Council can continue to engage with key stakeholders and advocate for its community.

Council's planning process presents a unique opportunity for transformation of Auckland's energy and emissions future by embedding strategies and targets that will shape the future of the city.

The strategic directions proposed in this Strategic Options Consultation Paper are intended to inform the planning process. Coupling planning with understanding of the future energy demands and GHG emission reduction targets will enable Aucklanders to become more resilient and better respond to future unexpected environmental and economic scenarios.

3 Auckland's Plausible Futures

3.1 Auckland's Choice

Arup's analysis, and the experience of other global cities, is that Auckland has two clear choices in regards to energy resilience and GHG reduction. One is to assume the markets will respond and the other is to lead a planned and pro-active transformation. The mechanisms, strengths and weaknesses of each of these responses are described below.

Plausible Future A: Market-led (lowest cost) scenario

One conceivable future for Auckland would involve disparate planning and action by individual energy market stakeholders in response to market signals and government regulation with little or no obligation to respond to economy-wide objectives. Under this scenario, central government and Auckland Council leadership is limited to high level statements related to energy efficiency, fuel switching and renewable energy with limited intervention or implementation of specific enabling strategies.

Growth in energy demand is most likely addressed by increasing supply using the most economic options. Demand management or reduction may conflict with profit motives and therefore would only be driven by external or unforeseen events, such as demand exceeding supply or global price shocks.

Whilst this scenario would offer cost benefit in the short term, over time it is anticipated that unconstrained demand growth for liquid fuels, natural gas and electricity would lead to significant price increases in energy and transport due to the need to source additional fuel sources and build additional supply infrastructure. There is a significant long term risk of these cost increases multiplying across the broader economy due to transport and energy being key inputs to most goods and services.

Under this scenario, it is improbable that the Council's GHG emissions target would be achieved. Further, it is difficult to imagine the NZ ETS functioning effectively in this environment without a heavy dependence on the agricultural sector and/or international permits in order for New Zealand meet the obligations. This in turn will also push prices higher as these externalities are priced into the ETS.

Plausible Future B: Climate responsive and energy resilient scenario

An alternative and plausible approach requires government leadership to guide and drive investment with the objective of GHG reduction and energy security and resilience. Under this scenario demand will be managed and infrastructure investment planned strategically with a view to the greatest long term benefit for the community and economy. The desired energy system arising from this scenario is depicted at Figure 5.

This scenario assumes that all stakeholders, including Auckland Council, industry, business and residents to play a much more active role in planning to deliver reliable and resilient energy supplies, at an affordable price, working within reasonable GHG constraints.

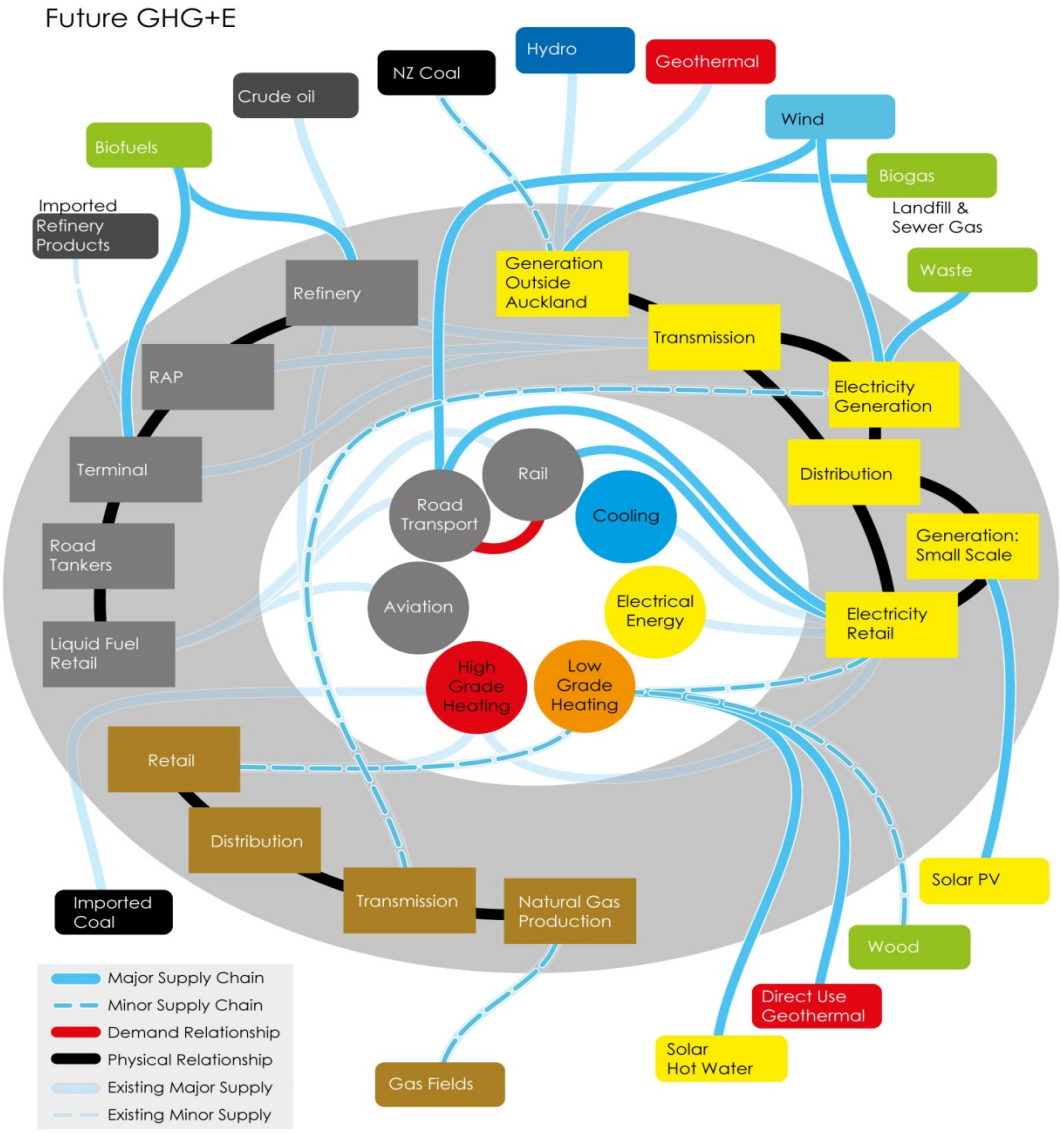

Figure 5 – Scenario 2 - energy security and resilience scenario

The energy security and resilience scenario depicted in Figure 5 relies on assertively managing energy demand and consumption from buildings and transport. This scenario requires:

- development of a number of energy supply including an increase in distributed electricity generation;
- investment in fuel switching including biofuels and biomass cogeneration and a coordinated roll-out of electric vehicles;
- higher rates of public transport patronage and overall reductions in vehicle kilometres travelled;
- widespread community initiatives to reduce energy consumption.

To achieve the goals of this scenario, all strategies would be implemented concurrently. Implementation would be planned to address both short and long term needs, with a view to balancing short and long term investment and cost impacts.

3.2 An Inspiring Vision

In 2031… Auckland is home to more than two and a half million people and is firmly entrenched as a global city of choice to do business and to live. The city is recognised as a world-leader and exemplar in decoupling carbon and economy. Auckland's early investment has positioned it well as the cost of carbon and energy escalates.

In 2031… the productivity and liveability of many other cities in the Australasia region have been significantly affected by dramatic changes in fuel availability and pricing and by rising demand for energy and transport. However Auckland's long term planning and investment in demand reduction and renewable sources has protected the economy and community from the worst of these shocks and earned the city a reputation for resilience and affordability.

In 2031 Auckland will be reaping the social and economic benefits of the decisions it made in 2011.

In 2031… early investment in energy and transport infrastructure has provided a strong economic foundation for Auckland. Flow-on increases in productivity, development and investment provided a growing revenue base for Council, national government, utilities and businesses, enabling them to quickly retire the debt associated with the initial investment. They are now able to invest in other critical community, economic and business infrastructure. In comparison, other governments and industries in the region are facing the crippling costs of playing infrastructure catch-up.

In 2031… a substantial portion of Auckland's energy is supplied from renewable sources, including the national grid, large scale wind and tidal power station within the city-region, and distributed energy generation from solar PV, bio-mass and district level geo-thermal across the city. The widespread presence of wind and solar generators visually demonstrate the city's energy resilience and Aucklander's have become proud of these city icons.

In 2031… Auckland is a very affordable place to live and do business. Investment in energy efficient buildings and in renewable energy infrastructure means that the cost of energy and rate of energy use in Auckland is well below comparable global cities. Investment in active and public transport infrastructure and an early switch to electric vehicles has also kept the cost of travel low and has reduced congestion, with benefits for productivity. These savings flow on to the cost of all goods and services. Auckland has a general feeling of prosperity and has enjoyed a steady increase in business investment.

*In 2031…*Auckland's urban and built form has noticeably changed. Many Aucklanders live in apartments or on smaller lots of land, both in the city centre and in suburban areas. There are more green open spaces, green corridors and activity centres spread right across the city-region. More people are able to work closer to home and there is greater choice of local shopping and entertainment. Excellent public transport systems and cycle/walk paths mean less cars on the roads. Aucklander's have embraced this change and spend more time using public spaces and reclaiming the streets. All parts of the city – from the revitalised city centre and waterfront to rejuvenated local shopping streets and new activity centres – feel alive, active and interesting. As a result Auckland has built a reputation as a global city to visit.

In 2031… Auckland truly is the world's most liveable city.

3.3 The Task Ahead

Achieving the scenario described above will be no easy task and requires decisive action in the short term.

Auckland is nearing a critical nexus in terms of its energy supply networks. As electricity demand increases there will be a requirement for new generation and new grid infrastructure. Peak electricity demand, largely driven by the residential sector and population growth, presents a substantial near-term challenge. Peak electricity demand has historically been met by natural gas peaking generation. Capacity to meet increased demand will be constrained by the capacity of the gas supply network in the short-medium term and by dwindling national supplies in the medium-long term.

Currently, Auckland is fortunate to be supplied by relatively low emissions intensive electricity from the national grid, of which around 90% is sourced from renewable generation options in some years. Consequently Auckland GHG emissions profile is already very low in comparison to many other global cities. An increased reliance on non-renewable energy sources, such as increasing use of gas to meet peak demand, will erode this advantage. Replacement of the dwindling gas supplies of the Maui gas fields with other more GHG intensive sources, such as less-accessible gas fields, lignite or imported LNG will further impact on the GHG emissions of Auckland.

It is important that Council and community meet this challenge with a shared vision and with an understanding of the cost of not acting.

Similar challenges and complexities exist for expanding the baseload generation capacity, and in planning responses to increasing demand on transport infrastructure.

There is no question that Council will need to engage effectively with all stakeholders, from national government to community, in order to find a way through these challenges and secure Auckland's future.

4 The Building Blocks for an Energy Resilient and Climate Responsive City

An Integrated Strategy

This section describes eight key elements and eight cross-cutting transformational investments which in combination could form Auckland's strategic approach to delivering a secure energy and low emissions future for the region. The elements and investments have been identified following targeted consultation regarding the technical options papers prepared for the energy resilience and GHG emissions reduction studies.

The eight elements draw together key recommendations within each of these studies to create an integrated response for Auckland, which seeks to deliver on Council's objectives of:

- securing long term reliable and affordable energy supply for Auckland; and
- achieving a 40% reduction in 1990 GHG emission levels by 2031.

The elements also take into account a number of other complementary objectives outlined in the Auckland Plan, including:

- Positioning Auckland's as the world's *most liveable city;*
- Delivering cost effective programs which represent *value for money* in how Council spends public finances;
- Positioning Auckland as a *region of choice* for businesses which will drive regional employment and support economic growth;
- Aligning regional strategies to *leverage central government policies and frameworks;* and
- Streamlining planning frameworks.

Finally, the elements have been aligned, wherever possible, with the existing policy foundation of the New Zealand central government and various bodies such as EECA who have commenced the process of driving better energy and greenhouse outcomes for Auckland.

The eight elements are listed below, in no particular priority, and described in the following pages. Each element is supported by context, potential solutions, an evidence-based measurement framework, a suite of potential actions for Council and other stakeholders.

1. **Reducing the consumption of energy in Auckland's buildings.**
2. **Managing the growth in Auckland's maximum demand for electricity.**
3. **Diversifying Auckland's electricity generation options.**
4. **Meeting Auckland's future demand for natural gas and liquid fuels.**
5. **Reducing motor vehicle use and road transport.**
6. **Reducing the GHG intensity of transport.**
7. **Planning the city to support more efficient lifestyle and business choices.**
8. **Reducing non-energy emissions and increasing carbon sinks.**

The elements are supported by eight transformational investments. Each investment cuts across a number of the elements. The eight transformational investments identify the big shifts that need to be undertaken by Auckland Council, Central Government and other stakeholders to deliver the desired future.

Once these proposed elements and investments have been reviewed, discussed and finalised by Council and the community, an implementation plan will be prepared that establishes governance responsibility and timeframes for delivery. In addition to the role for the Council, key stakeholders will need to play their part in delivering a more resilient and low emission future for Auckland. As part of formalising its strategy, Council will need to seek commitments from stakeholders to deliver each of these key elements and to play a part in the transformational investments.

Success will be dependent on collaboration between Council, national Government, industry stakeholders, business and the community.

The final strategy when released by Council will include a comprehensive list of the region's performance measures and commitments to short, medium and long term actions.

Element 1: Reducing the consumption of energy in Auckland's buildings

Buildings and facilities consume the vast majority of electricity and natural gas within Auckland. Increasing the energy performance of existing buildings as well as encouraging, and, over time, mandating best practice to be adopted in new buildings, will reduce total energy consumption in the region. Reduced consumption will improve energy resilience and contribute to GHG emissions reduction.

The challenge

Energy consumed within buildings and industrial facilities in Auckland comprises the vast majority of all end-use electricity consumption. Additionally, many buildings and industrial facilities use significant volumes of gas.

Globally many governments have introduced initiatives to improve end-use energy efficiency. Similarly, Auckland Council would like to encourage best-practice technologies in the region to reduce end-use consumption in its buildings and industrial facilities.

International experience shows that implementing mechanisms to reduce the total energy consumption in existing sites and mandating more stringent requirements for new buildings will reduce end-use energy consumption over time in Auckland.

What solutions could work in Auckland?

Strategies to improve end-use efficiency apply across residential, commercial and industrial buildings and are relevant to both new and existing buildings. Auckland could adopt the following initiatives to achieve this.

- Promote retrofitting of buildings through voluntary programs;
- Introduce legislation for mandatory disclosure of building performance at the point of sale (and possibly for commercial leases) to incentivise retrofit programs;
- Introduce development control processes that mandate compliance for new buildings;
- Retrofit Council's existing building stock and apply best practice standards for new Council building projects; and
- Engage with and inform peak bodies, building and industrial site owners regarding the benefits and available options to improve end-use energy efficiency.

Why is this important?

Reducing energy consumption within buildings will reduce energy demands on electricity and gas infrastructure during peak periods which will, over time, defer local network augmentations.

The reduction in consumption of energy per unit of work output also lowers the total energy requirement for the region, thereby improving energy resilience and reducing GHG emissions. The potential positive outcomes of improved end-use energy efficiency include:

- A reduction in both total consumption and peak demand for gas and electricity, decreasing energy costs and also contributing to the long-term deferral of network and pipeline expansions;
- A reduction in GHG emissions due to reduced consumption;
- Improved energy resilience of Auckland; and
- Reduced operational costs through avoided energy consumption may improve the attractiveness of the region as a place to live, work and do business, improving regional prosperity.

How can we measure success?

Detailed energy consumption data exists for Auckland. Suggested targets for energy efficiency, informed by global best practice, are proposed below for discussion

Metric	2009 (baseline)	2020	2031
Energy Consumption by Residential Sector (electricity and natural gas) per capita (per annum)	3.21 GJ/capita (per annum)	2.07 GJ/ capita (per annum)	1.40 GJ/ capita (per annum)
Energy Consumption by Commercial Sector (electricity and natural gas) per unit GRP (per annum)	0.76 TJ/ $M GRP (per annum)	0.69TJ/ $M GRP (per annum)	0.65TJ/ $M GRP (per annum)
Energy Consumption by the Manufacturing and Industrial Sector (electricity and natural gas) per unit GRP (per annum)	1.69TJ/ $M GRP (per annum)	1.32TJ/ $M GRP (per annum)	0.8TJ/ $M GRP (per annum)

What could Auckland Council do?

Role	*Activity*
Monitor	Auckland Council will monitor the regional consumption data.
Advocate	Auckland Council to advocate for central government and the private sector to provide funding for specific low energy community projects where some capital funding could be provided to retrofit buildings.
Coordinate	Auckland Council to develop a coordinated program which includes delivering on the initiatives detailed in this element including development of standards and identifying urban renewal projects.
Strategise	Based on the results of the regional consumption data, develop an understanding of the effectiveness of the policies and initiatives relating to improving end-use energy consumption. If consumption data is not delivering the expected results, develop strategies to address this issue.
Regulate	Develop new building standards for residential and commercial buildings in Auckland, zoning areas as Low Carbon Precincts, or Low Energy Precincts to encourage best-of-breed approaches. This approach will apply to both residential and commercial buildings. Identify older commercial or residential areas for urban renewal projects to rejuvenate an area and improve existing building stock with the intent of making these areas more attractive for tenants and residents.
Fund	Expand the existing residential retrofit schemes within Auckland.
Manage Assets	Upgrade and manage Council's own building assets to achieve or exceed the desired levels of efficiency.

Who else has a role?

Stakeholder/partner	*Role*
Central Government (EECA)	Take the lead in legislating for mandatory standards and mandatory disclosure of environmental performance. Contribute funding or enable access to discounted capital to encourage investment in improving building stock.
New Zealand Green Building Council and Standards New Zealand	Continue to advocate and assist in developing non-mandatory building rating tools and standards and promote market demand and community awareness of the benefits of green buildings.
Design and construction industry Large property owners/developers and the property industry	Become educated about energy efficient building design and associated technologies and building techniques. Participate in stakeholder discussions and actively participate in promoting voluntary standards.
Distribution businesses in Auckland (Vector Ltd, Counties Power), Transpower, energy retailers	Incentivise and incorporate energy efficiency and considerations within network planning, including consideration of incentivising pricing mechanisms.
Universities and research groups	Monitor/evaluate the impact of policy changes and initiatives in achieving the desired outcomes. Monitor/evaluate the impacts of these changes across community, economic and environmental aspects. Research and develop solutions that contribute to the desired outcomes. Participate in industry and community discourse and education.

Element 2: Managing the growth in Auckland's maximum demand for electricity

Slowing the growth in maximum electricity demand is critical to improve the region's electricity resilience. It also reduces the need to build additional electricity infrastructure which assists in managing upward pressure on electricity prices.

The challenge

New Zealand's electricity system is under growing pressure. The transmission system's highest ever peak demand occurred during the 2011 winter.

Electricity security is harder to maintain when peaks in demand, and the overall shape of demand profiles, do not match the capacity of the electricity supply system. This mismatch generally requires the construction of new generators as well as additional electricity networks just to meet the small time period in which peak demand occurs.

Auckland has the highest density of energy consumption and is experiencing the highest population growth rate in the nation. The majority of electricity used in Auckland is generated outside of the region and supplied via the national grid, therefore growth in demand in Auckland is a major contributor to pressures on the national supply network.

Peak demand is currently supplied by natural gas which may be subject to resource and infrastructure constraints in the short to medium term.

What solutions could work in Auckland?

A combination of solutions that tackle both the capacity of electricity supply and the shape of demand are required to manage this problem economically.

These are summarised on the following page.

What solutions could work in Auckland?

Supply side improvements

Growth in maximum electricity demand in Auckland is a major contributor to pressures on the national electricity grid which is driving a number of major system-wide upgrades.

These upgrades and the associated investment requirements have been identified by Transpower, Vector Ltd and Counties Power in each of their forward planning documents.

Auckland has a major part to play in managing its future growth in maximum demand to prevent unnecessary additional upgrades of the electricity networks.

In addition to increasing the physical capacity of transmission and distribution grids, major advances in 'smart' technology will be utilised by network system operators to improve identification of network outages, reduce the amount of time taken to fix outages as well as reduce the number of outages on the network.

Demand side opportunities

Peak electricity demand can be reduced by shifting electricity consumption from times of peak usage to other times of the day. These measures defer infrastructure investment and assist in managing growth in electricity prices. Traditionally this load shifting has been obtained from the industrial sector and from off-peak tariff switching of domestic electric hot water systems.

It is anticipated that more opportunities for load shifting will arise as new technologies are integrated into electricity networks. These technologies include:

- Smart meters;
- Electronic equipment which is communication-enabled for automated control /demand management within grids – i.e. 'smart grids';
- Distributed generation (refer to *Diversifying Auckland's electricity generation options*); and
- Battery storage.

New Zealand network businesses are among other globally leading companies in implementing new technologies into New Zealand's electricity grid and it is anticipated they will continue to identify new opportunities as they arise.

How will we measure success?

There are a number of data sources that could be used to measure success against this key element. Targets could include:

- Annual growth in peak electricity demand (compared to historic levels) for Auckland;
- The frequency and duration of supply interruptions (compared to historic levels) for different parts of the network (e.g. major metropolitan vs rural networks);
- Number of consumers in the region with smart meters;
- Number of consumers with smart meters who are utilising the additional functionality;
- Installed capacity of distributed generation in Auckland;
- Uptake of network demand management programs (growth in kW of controlled load) in the community; and
- Uptake of network demand management programs (growth in kW of controlled load) by Auckland Council business units.

How will this contribute to energy resilience and emissions reduction?

Smarter network communications and other new technologies have the opportunity to 'unlock' future potential from embedded generation within the distribution networks and also to improve the management of large scale intermittent renewable generation on the transmission networks.

Improving the way in which electricity is distributed through increasing the amount of distributed (localised) generation options will also reduce GHG emissions through reductions in line losses (there are small losses in electricity as it is transported across distances).

In addition to supporting the diversification of generation sources within the region, smarter grid communications and other technologies will show a positive contribution to improving both network reliability and resilience.

Smart meters and in-home displays, when combined with appropriate retail tariffs have the potential to incentivise consumer behaviour toward shifting demand away from network peaks. Over time, this will contribute to deferral of network expansion in specific locations.

Both Vector Ltd and Counties Power are involved in significant smart meter rollouts which will improve the level of understanding and responsiveness within the Auckland electricity networks.

What could Auckland Council do?

Role	*Activity*
Monitor	Monitor city-wide progress against agreed indicators. Monitor the demand management activities of its business units and seek to optimise the effectiveness of the program by working with the electricity network businesses.
Advocate	Advocate for network businesses to streamline processes for connecting embedded generation including the potential for new network tariff structures that may include avoided distribution and transmission charges. Advocate for other businesses to become part of a demand management program leveraging its achievements. Advocate for the roll-out of smart grid technology across Auckland.
Regulate	Develop building regulations that would require major end users to install demand management technologies in new buildings.
Fund	Provide funding to examine the additional benefits of in-home or in-business displays through its own participation in the demand management programs.
Manage Assets	Implement smart meters and other demand management measures which will facilitate participation in peak demand management programs across Council's asset portfolio.

Who else has a role?

Stakeholder/partner	*Role*
Central government	Prioritise funding of smart grid infrastructure. Regulate for demand management projects to be identified and implemented by major energy consumers. Investigate options to regulate to manage potential peak demands arising from electric vehicles.
Distribution businesses in Auckland (Vector Ltd, Counties Power), Transpower, energy retailers	Review the potential for network tariff structures that may include avoided distribution and transmission charges. Incentivise and incorporate peak demand reduction within network planning. Manage smart grid roll out within Auckland.
Design and construction industry Large property owners/developers and the property industry	Become educated about technologies and building management practices that reduce peak loads. Participate in stakeholder discussions and actively participate in promoting voluntary standards. Invest in mart meters and other load management technologies.
Energy intensive industry sectors / major energy users	Participate in stakeholder discussions and actively participate in promoting voluntary standards. Invest in smart meters and other load management technologies.
Universities and research groups	Monitor/evaluate the impact of policy changes and initiatives in achieving the desired outcomes. Monitor/evaluate the impacts of these changes across community, economic and environmental aspects. Research and develop solutions that contribute to the desired outcomes. Participate in industry and community discourse and education.

Element 3: Diversifying Auckland's electricity generation options

A growing number of cities across the world are increasing the generation of electricity within their borders in order to increase energy resilience. Building integrated renewable energy, distributed hydro plants, biogas cogeneration facilities and wind farms are all examples of local generation options.

Auckland has many resource opportunities available to increase locally generated electricity.

The challenge

Globally it is anticipated that the installed capacity of distributed electricity generation will expand substantially as technology options for distribution and storage improve. However current technologies and the economic/governance structure of energy supply present a number of barriers to distributed generation.

Intermittent (for example, electricity generated by wind and solar resources which are not 'constant') and distributed generation can produce grid instability, particularly if uptake occurs in an unplanned manner. This has been demonstrated most recently in Australia, where very rapid update of roof-top solar photovoltaic systems produced system stability challenges for the network providers.

Auckland Council would need to work with distributed generation advocates, electricity network providers and owners of generation sources to identify appropriate measures, such as planning controls or network augmentation to facilitate efficient and effective uptake of embedded generation technologies.

What solutions could work in Auckland?

Auckland has a number of resource opportunities which may see both large scale and small scale (distributed) renewable generation brought to the market in the region.

Based on a recent technical assessment[1], Auckland's renewable resources include:

- At least 500MW of technically feasible large-scale wind potential;
- Around 970 MWp of distributed solar photovoltaic; and
- 250 MW of tidal.

Options for introducing generation technologies which utilise these renewable energy resources are discussed below in terms of small and large scale systems.

Small scale distributed generation

The price of building integrated renewable energy technologies is decreasing while electricity prices continue to increase. It is anticipated these costs will converge before 2020, at which point a rapid uptake of building-based distributed renewable energy can be expected in Auckland. New Zealand's emissions trading scheme also incentivises renewable energy technologies by applying a cost penalty to more emission-intensive generating technologies.

Modelling[1] of solar potential in Auckland indicates that the widespread use of hot water and distributed solar PV could reduce demand for imported supply of electricity by around 3,000 GWh per year and reduce natural gas consumption by more than the equivalent of 1,100 GWh per year.

Auckland Council's Watercare operates embedded generation assets which provide around 40% of its total energy needs. This demonstrates how effective planning for embedded generation can economically meet the needs of an energy-intensive industry.

Large scale renewable generation

Auckland's wind resources provide the largest scale opportunity for renewable generation in the region. Tidal resources may also capitalised upon in the future. Modelling undertaken on behalf of Council[1] indicate a combined generation potential of 5,500 MWh per year from wind and tidal sources.

The intermittent nature of these sources must be understood

[1] Source: Development of an Energy Resilience and Climate Change Mitigation Strategy and Action Plan for Auckland Council, Technical Report – Energy Issues and Opportunities, prepared by Arup on behalf of Auckland Regional Council, 2011

and managed in order for them to play a significant part in Auckland's energy future. Whilst not economic now, the energy industry anticipates that emergent storage technologies will provide longer-term options for 'balancing out' short and longer term intermittent generation. It is anticipated these emergent technologies will enhance the value of Auckland's renewable resources.

Large-scale fossil fuelled generation plant

Whilst central government policy and Auckland Council are strongly supportive of additional renewable energy generation in the grid, it may be necessary to develop additional peaking generation that can both supply the peak electricity demands of the region and provide security of supply during periods when wind, solar or tidal generation may be unavailable.

How will this contribute to energy resilience and emissions reduction?

Increased uptake in distributed electricity generation will help to reduce the total amount of electricity imported into Auckland. This will reduce line losses and also, in the case of renewable electricity generation, will reduce the greenhouse intensity of the region's electricity supplies.

If distributed electricity generation can be aligned with peak network demand periods, it would postpone the need for additional large scale generation to be constructed. This has benefits in terms of cost, resources and GHG emissions, particularly if the distributed generation is renewable.

Achieving this alignment will inform choice of generation source for distributed generation. However it can also be assisted by interventions to change peak demand patterns as described in Element 2.

How will we measure success?

Targets have not been developed for this direction and will be subject to a final strategy. However the following measures could be used to track progress:

- Year-on-year increase in embedded small scale electricity generation located in the region (MW installed and MWh annual output);
- Year-on-year increase in large scale electricity generation (renewable and non-renewable) located in the region (MW installed and MWh annual output); and
- Annual reduction in emissions-intensity of total electricity consumption in Auckland.

What could Auckland Council do?

Role	*Activity*
Monitor	Track the number of installations of solar PV and solar hot water so that they can be included in the regional energy data file. Monitor the portion of imported electricity as a function of total electricity consumed (this would need the cooperation of Transpower and electricity retailers who will hold the relevant electricity data).
Advocate	Advocate for the payment of feed-in tariffs or other incentives that reflect the value of electricity exported to the grid by solar PV (i.e. 1:1 aggregate feed in tariff). Currently retailers typically offer wholesale rates for exported electricity (with some already offering this rate). Assist in information dissemination to the business and residential community about the environmental and potential economic benefits of localised energy generation options.
Coordinate	Play an active role in connecting potential purchasers and installers of building integrated renewables. This could include organising installations of several properties at once in order to save on installation costs.
Strategise	Work closely with distribution network providers, business peak bodies and technology proponents to plan capacity upgrades to the distribution network to support an orderly roll out of embedded and distributed generation systems.
Regulate	Remove existing barriers to installation of integrated renewable technologies on buildings. In particular, review the current requirements of the resource consent process which is required in order to install integrated renewable generation in buildings. Develop local regulatory frameworks to streamline installation of distributed generation systems.
Manage Assets	Lead by example: Council could install building integrated renewable technologies and or embedded generation across its portfolio of buildings and facilities over defined time periods.

Who else has a role?

Stakeholder/partner	*Role*
Central government	Consider the implementation of incentivisation methods such as a feed-in tariff for renewable energy generation. Provide funding for, and/or enable access to discounted capital, to facilitate investment in district and large scale renewable power generation plant (such as wind, tidal, geo-thermal). Implement regulation to manage perverse outcomes from distributed generation.
Distribution businesses in Auckland (Vector Ltd, Counties Power), Transpower, energy retailers)	Identify appropriate measures, such as planning controls or network augmentation to facilitate efficient and effective uptake of embedded generation technologies.
Large property owners/developers and the property industry	Install embedded generation in new and existing buildings. Connect to district level distribution schemes.
Energy intensive industry sectors / major energy users	Invest in embedded generation, including co-generation from industrial processes, to offset consumption and provide energy export capacity.
Universities and research groups	Monitor/evaluate the impact of policy changes and initiatives in achieving the desired outcomes. Monitor/evaluate the impacts of these changes across community, economic and environmental aspects. Research and develop solutions that contribute to the desired outcomes. Participate in industry and community discourse and education.

Element 4: Meeting Auckland's future demand for natural gas and liquid fuels

Oil and gas availability, supply and price are amongst the areas of significant global concern. Lack of investment in gas exploration in New Zealand has meant that there is a growing concern regarding long-term indigenous gas availability and price. Similarly, growing demands for liquid fuel for road and air transport are seeing increasing pressure on pipeline capacities.

The Auckland Council is seeking to provide greater certainty regarding the supply of natural gas and liquid fuels through diversification and investment planning.

The challenge

Auckland's rapid population growth is providing challenges for all forms of energy resilience.

Auckland Council is seeking to address liquid fuel resilience through the development of transport planning strategies to influence changes in transport modes. Despite these interventions, vehicle ownership and air travel in the region can be expected to grow, at minimum, in line with population projections.

These upwards trends will continue to place pressure on the availability of liquid fuels in the region and the capacity of the Refinery to Auckland Pipeline (RAP) and the Wiri-to-Auckland pipeline (WAP). Current fuel demands which is seeing greater volumes of diesel and petrol brought into the region by road tankers is not likely to decrease for the foreseeable future.

Similarly, pressures on upstream gas availability, pricing and future gas transmission pipeline capacity constraints into the north island highlight the need for the Council to maintain engagement with the Gas Industry Company (GIC) and those groups in the region potentially impacted by its decisions.

The impact of increasing gas demand in Auckland is also having a demonstrable impact on Northland and its security of gas supplies. Currently during times of peak gas demand, there are insufficient supplies of gas for Northland. The impact on our near neighbours heightens the requirement for appropriate consultation and timely forward investment planning to ensure energy security for the entire north island.

What solutions could work in Auckland?

Investment planning – gas transmission

Gas demand in Auckland is met via the two transmission pipelines to the north island, with gas pipeline networks extending into distribution networks beyond this point. Gas transmission in Auckland has been highlighted as a priority for further investment in the near term. However, a number of obstacles, including the issue of increased prices resulting from the additional infrastructure have also been identified. Auckland Council will continue to engage with the GIC to seek positive outcomes for the region and its business and residential gas consumers.

From a cost perspective, any augmentation of transmission infrastructure will see these costs passed onto all users. Over time deferment in this investment would incur costs in road networks, or in supply as the resource becomes scarcer. Further, given the fundamental role that gas plays in the regional economy it is vital that future end-use demands are met as efficiently as possible.

Investment planning – liquid fuels

Demand for liquid fuel is trending upwards. In particular, growing demand for jet fuel on the RAP means that additional supplies of diesel and petrol are being transported into the region via road tankers. This has a negative impact on GHG emissions as well as the additional impact and risks from heavy vehicles carrying flammable liquids on roads, not to mention the increased congestion and wear and tear on roads.

The Council will continue to work with stakeholders to identify the most appropriate and cost-effective mechanism to improve the efficiency of the RAP and maintain regional fuel security.

Investment planning – gas supplies

Council shall also monitor upstream supplies to determine if, at a future point in time, additional facilities such as an LNG import facility may be warranted in the region. If required, this will require investment support from Central Government and industry stakeholders.

Diversification of fuel sources

A mechanism to address the growth in liquid fuel for road transportation is to consider the impacts of Electric Vehicles (EVs) which could include both pure electric and hybrid electric vehicles (which run on petrol once the electric battery is exhausted). EVs in the future offer a range of benefits for end users, including a reduced exposure to crude oil prices

and price volatility, opportunities to recharge vehicle batteries overnight at economically attractive (off peak) electricity tariffs, and reduced maintenance costs. EVs are discussed further under the key element - *Reducing the GHG intensity of transport*.

Similarly, solar hot water may also encourage consumers to move away from using gas to heat their water, and by doing so, this will increase the volume of available gas for other functions. As with EVs, the economics of this approach will improve with time.

Peak demand for natural gas is in winter, and alternative fuels for heating such as wood, diesel and coal have increased impacts associated with GHG emissions and local air quality. This makes these alternative fuels less attractive on whole-of-life cycle approach.

How can this contribute to energy resilience and emissions reduction?

Gas and liquid fuels are relatively greenhouse-intensive sources and therefore there is a preference to reduce reliance on these fuels. However, it is unlikely in the foreseeable future that the region could function without reliable sources of these fuels and current indications are that the need for additional infrastructure augmentations will arise in the near future.

How will we measure success?

An optimum energy mix to achieve both GHG emissions reduction targets and energy resilience for Auckland is subject to further detailed investigation. Such a study would provide recommended targets for gas and liquid fuels which could be adopted as a measure of success.

What could Auckland Council do?

Role	*Activity*
Monitor	Track the availability and demand for biofuels at service stations within Auckland. Monitor biofuel capacity and consumption. Monitor transport fuel road tanker numbers and movements in the region in order to determine the emissions impact and any other impacts for the community.
Advocate	Maintain an involvement in the Gas Transmission Investment Project (GTIP) to ensure that all possible options are investigated. It will also ensure that social and environmental outcomes are considered. Undertake long term strategic planning which includes consideration of the future of NZ's natural gas supply infrastructure including the possibility of a future requirement for an LNG terminal.
Coordinate	Coordinate a dialogue between the electricity distributors and service stations on EV fast charging infrastructure. Coordinate a dialogue between Refining NZ, Wiri Oil Services Ltd, fuel suppliers and Auckland Transport on fuel transport options.
Strategise	Develop a regulatory framework for a regional biofuel target. Ensure mechanisms are in place to mitigate potential impacts on food production and the environment. Develop a strategy to determine appropriate numbers of EVs which would be utilised within the Council's vehicle fleet.
Regulate	Regulate that all new buildings be built to include EV charging points in the parking area.
Fund	If there is a market failure, consider funding options for EV chargers in key regional locations which may facilitate increased uptake of EVs.
Manage Assets	Purchase EVs as outlined in the Council's fleet EV strategy. Install EV chargers in all Council buildings. Make available leases for Council owned land in strategic locations for EV chargers to locate.

Who else has a role?

Stakeholder/partner	*Role*
Central government	Consider a regulated biofuels target or other incentivisation method. Regulate for demand management projects to be identified and implemented by major energy consumers.
Gas Industry Company	Ensure gas infrastructure has the capacity to meet gas requirements and actively incentivise demand management options. Incentivise and incorporate demand reductions within network planning. Participate in stakeholder discussions.
Large gas users	Manage smart grid roll out within Auckland. Identify and implement demand reduction opportunities. Participate in stakeholder discussions.
NZ Refining company	Monitor and provide data on liquid fuel quantities and capacity of RAP. Participate in stakeholder discussions.
Bioenergy Association of New Zealand	Continue to assess the potential of biofuels in New Zealand and coordinate potential suppliers. Participate in stakeholder discussions.
Wirri Oil Services	Monitor and provide data on liquid fuel quantities stored and distributed. Participate in stakeholder discussions.
Auckland International Airport	Monitor and provide data on jet fuel quantities consumed and projected consumption. Participate in stakeholder discussions.
Port of Auckland	Monitor and provide data on imported liquid fuels. Participate in stakeholder discussions.

Element 5: Reducing motor vehicle use and road transport

Aucklanders are highly dependent on motor vehicles as their primary method of transport. As a result, the transport sector is responsible for more than half of Auckland's GHG emissions. Furthermore, this dependence means Aucklanders are highly vulnerable to increasing and volatile oil prices.

In order to meet emissions reduction targets and improve energy resilience, Auckland needs to reduce its use of motor vehicles in favour of alternative transport options.

The challenge

Auckland includes sprawling areas of urban development which has created a heavy reliance on cars for personal travel. Over time the road network has been expanded to cope with increasing traffic due to growth, but congestion remains a challenge. Public transport services have also improved in recent years, but it is widely recognised that further investment will be required in both public transport and active transport infrastructure to accommodate future growth.

Existing pipeline and rail freight systems in Auckland are nearing capacity. This will cause an increase in road freight movements as growth continues, which will correlate to an increase of GHG emissions, as well as local pollution and congestion.

The NZ ETS and rising fuel prices will provide greater incentive for Aucklanders to reduce travel and/or shift to less GHG emission intensive modes of travel. In order for this shift to be maximised and sustained alternative transport modes must be accessible, affordable and demand responsive. If they are not, commuters and businesses may incur a carbon price rather than switch to a less satisfactory option.

What solutions could work in Auckland?

Travel demand management

Travel demand management refers to initiatives to:

- influence greater use of active transport and public transport; and/or
- reduce the need for or length of motor vehicle travel; and/or
- increase occupancy rates for private vehicle travel.

Options include 'pull' measures - such as cost incentives, increased access, ease of use, or desirability of active or public transport - and 'push' measures which remove some of the

comparative benefits of private vehicle transport.

Active transport infrastructure

The experience of cities around the globe is that investment in active transport infrastructure directly correlates to an increased uptake of active transport. Active transport infrastructure includes: dedicated and safe routes for walking and cycling; urban design principles to improve access, connectivity and permeability of town centres; and end of trip facilities such as secure cycle storage and changing rooms.

Public transport infrastructure

Investment in quality public transport is critical to provide Aucklanders with an attractive alternative that is a less emission intensive and lower cost form of transport. Whilst public transport requires a high capital investment (typically from the public sector), it offers significant benefits in terms of GHG reduction and energy security as well productivity gains and health and local environment benefits. Electric rail is particularly beneficial from this perspective as it can reduce GHG emissions, road congestion and local pollution to a greater extent than road based options.

Freight Consolidation Centres

Freight consolidation centres (FCC) are distribution centres situated close to a town centre, shopping centre or construction sites, at which loads are consolidated. FCCs reduce the number of consolidated loads delivered to the target area for the 'final mile' of the delivery. They improve efficiency through optimisation of land use and faster deliveries. Site selection in proximity to key destination is critical to the viability of FCCs. There are many existing examples of centres which serve major airports as well as temporary centres which are established to serve large construction projects.

Freight transport infrastructure

Non-road freight transport infrastructure has an important role in road based traffic. Both rail freight and pipeline transport offer opportunities to reduce road congestion, GHG emissions, local pollution and improve energy resilience. These options require significant capital outlay and long term planning without which road will remain the mode of choice for distribution of goods to, from, and within Auckland.

How can this contribute to energy resilience and emissions reduction?

The above measures will reduce the extent of growth in travel on Auckland's road networks. This may potentially allow road network expenditure to be reallocated to public and active transport infrastructure and pipeline and rail freight infrastructure.

Quality public transport and active transport will provide viable commuting options for Aucklanders wishing to avoid the high costs of transport fuel. Business will become more efficient and less exposed to a fuel and carbon price as a result of streamlined freight systems.

Auckland's entire transport system will accordingly become relatively less reliant on imported oil based fuel meaning future investment in the liquid fuel supply chain including refining, the oil pipeline and storage terminals may be deferred.

How will we measure success?

City-wide reductions in the use of motor vehicles and road based transport can be measured using available survey data. Possible targets, based on global best practice are provided below for discussion.

Performance Indicator	2009 (baseline)	2020	2031
Proportion of Total Trips by Mode on Auckland's Road network (%)			
Private Vehicle (Private and Commercial)	83.9%	80.1%	76.4%
Public Transport (Bus, Ferry, Rail)	3.8%	7.1%	10.4%
Active Transport (Walking and Cycling)	9.1%	9.6%	10.1%
Freight Trips	3.3%	3.2%	3.1%
Increase in private vehicle VKTs on 2006 levels (%)	8.7%	17.4%	26.0%

What could Auckland Council do?

Role	*Activity*
Monitor	Monitor the uptake of public and active transport modes and undertake necessary analysis to identify barriers to uptake.
Advocate	Develop a travel web-based application which assists Aucklanders to understand travel choices and make informed decisions to reduce vehicle travel.
Strategise	Incorporate provision for active and public transport options in integrated land use planning. Plan for transport nodes that are easy to find and access, connected to other transport nodes and areas of activity and are sited and designed to improve safety for users. Plan for public transport upgrades towards a high quality, safe, accessible and integrated network of services, fares and ticketing. Make planning provision for corridors for non-road based freight options (such as rail and pipelines). Develop a freight strategy incorporating consideration of freight consolidation centres through a mixture of local planning or financial mechanisms.
Regulate	Establish maximum car parking controls.
Fund	Prioritise investment in improvements to, and expansion of, public and active transport services and infrastructure. Install real time public transport information across the city via displays and smart phone technology. Provide change facilities and bike storage at key activity nodes and transport interchanges to support active transport choices.
Manage Assets	Reduce parking provision in Council buildings. Provide secure bike storage and cyclists change facilities at Council workplaces.

Who else has a role?

Stakeholder/partner	*Role*
Central government	Prioritise investment in improvements to, and expansion of, public and active transport services and infrastructure. Contribute funding to projects to reduce freight and transport related traffic through development of transmission lines for liquid fuels and gas.
Auckland Transport	Manage public transport infrastructure upgrades. Coordinate existing public transport services to ensure reliable, safe and affordable public transport services. Promote public transport options to the community and investigate investment such as live timetable information that can support increased patronage.
KiwiRail Group	Manage ongoing roll out of rail infrastructure and electrification of existing rail infrastructure.
Employers and Property Sector	Provide shower, change and storage facilities in workplaces and major centres to support active transport modes.
Universities and research groups	Monitor/evaluate the impact of policy changes and initiatives in achieving the desired outcomes. Monitor/evaluate the impacts of these changes across community, economic and environmental aspects. Research and develop solutions that contribute to the desired outcomes. Participate in industry and community discourse and education.

Element 6: Reducing the GHG intensity of transport

Transport in Auckland is predominantly undertaken using oil based fuels and as a result the transport sector is responsible for more than half on Auckland's GHG emissions.

Reducing the need for travel and providing for alternative travel options will significantly reduce the growth in trips made by motor vehicle transport. However, there will inevitably remain a need for transport fuels. To reduce dependency on oil based fuels and vulnerability to increasing and volatile oil prices, alternative and less GHG emission intensive fuels will be required.

The challenge

The majority of transport in Auckland is oil based, meaning Aucklanders are highly vulnerable to fluctuations in the supply and price of global oil markets. Oil based transport is also very GHG intensive

The NZ ETS and rising fuel prices will provide greater incentive for Aucklanders to shift to less GHG emission intensive modes of travel, including more fuel efficient vehicles and electric vehicles.

Currently the two main options for less emission intensive transport fuels are electric vehicles and biofuels. High efficiency vehicles will also play a role in reducing the emission intensity of transport.

However without coordinated planning, removal of existing barriers and targeted incentives, the uptake of these emerging technologies may be slow. In the case of electric vehicles, uncoordinated uptake, may actually impact the electricity sector by increasing peak demand and hence electricity security of supply.

What solutions could work in Auckland?

Improved vehicle efficiency

Improving vehicle efficiency will result in reduced carbon emissions without necessarily any change in behaviour. Engine technology has advanced considerably since the 1970s with vehicles purchased today likely to be more than 22% more efficient than vehicles purchased in 1979. Therefore this measure is likely to occur without any intervention by

Auckland Council or other stakeholders.

Biofuels

There are significant quantities of waste biomass potentially available to supply the developing New Zealand biofuels industry which can directly replace oil based transport fuel products including petrol and diesel. Sources include the timber and forestry industries as well as agricultural industries across the country. There may also be the potential for biofuels to be generated from purpose grown energy crops. The wider impacts of such crops require further investigation before advocacy of such a policy is to be considered. Although biofuel collection, processing and supply has GHG impacts, they are significantly lower than those from conventional oil based fuel products.

Electric vehicles

Electric vehicle (EV) technologies are developing at a rapid pace, potentially offering a near-term low-GHG alternative to the petrol and diesel powered vehicles of today. With adequate investment in the necessary infrastructure, and supportive government policy, a large scale transition to EV's and plug-in hybrid electric vehicles (PHEV's) could be achieved in Auckland. This would provide many economic, environmental and social benefits including lower operational and maintenance costs, no pollutant emissions, lower overall GHG emissions and reduced dependence on imported oil.

Ongoing rail electrification

The rail sector in Auckland is currently heavily dependent on diesel fuel. A current programme of electrification is being undertaken funded by central government which will see new electric trains on the rail network by 2013. It is imperative that this programme is fully realised to alleviate the rail sectors of its oil based fuel dependency.

Development of additional transmission lines

As noted elsewhere, increasing the capacity of fuel and gas pipelines will replace these fuel based transport modes with less GHG intensive modes of transport.

How can this contribute to energy resilience and emissions reduction?

Despite initiatives to reduce travel on Auckland's road network, there will inevitably remain a large demand for transport fuels. In order to reach the GHG emissions target the GHG intensity of these fuels must be reduced through a shift to higher vehicle fuel efficiency, electric vehicles and biofuels.

Further, oil based transport fuels are relatively greenhouse-intensive sources and highly vulnerable to increasing and volatile oil prices. Existing oil based fuels are supplied either via the Refinery to Auckland pipeline or directly imported implying a vulnerability of the transport system to the effective and efficient functioning of the RAP. The measures reduce the transport system's dependency on the RAP and hence the energy security of the region.

How will we measure success?

City-wide switches to more efficient and non oil-based transport options can be measured using fuel sales data and vehicle sales data. Possible targets, informed by global best practice are provided below for discussion.

Metric	2009 (baseline)	2020	2031
Fraction of Total Light Passenger and Light Commercial Vehicle Fleet Comprised of Electric Vehicles	0%	11.0%	48.4%
Proportion of transport fuels purchased within Auckland (%)			
Petrol	52.7%	36.7%	22.7%
Diesel	45.%	50.8%	55.2%
Other (natural gas/LPG)	1.1%	1.1%	1.0%
Biofuels	0%	7.7%	14.4%
Electricity	0%	3.7%	6.7%

What could Auckland Council do?

Role	*Activity*
Monitor	Track the availability and demand for biofuels at service stations within Auckland. Track the availability and demand for EV recharge points.
Advocate	Continue to advocate to central government for the ongoing electrification of the existing rail network to further improve the GHG emission intensity of rail transport. In the short term, encourage the provision of biodiesel, bioethanol and EV charging at service stations. Leading by example: switch Council vehicles to biodiesel, bioethanol or electric. Advocate for EECA to establish requirements for all new vehicles to meet high efficiency standards. Disseminate information to the community about high efficiency vehicles and promote replacement of old, inefficient vehicles. Lobby for investment in additional pipelines for gas and liquid fuels.
Coordinate	Utilise advocacy and/or financial incentives to facilitate the development of : • a collection service for currently under-utilised organic waste from urban and rural areas (e.g. garden waste, forestry residues, agricultural residues); and • a bio-fuel conversion and processing facilities in Auckland and surrounds through advocacy.
Regulate	Develop the regulatory framework for a regional biofuel target. Ensure mechanisms are in place to mitigate potential impacts on food production and the environment. In the longer term, consider regulating for the provision of biodiesel and bioethanol and EV recharging at service stations. Incentivise high efficiency vehicles through reduced parking charges and tolls. Require new developments to provide charging infrastructure for EVs.

Who else has a role?

Stakeholder/partner	*Role*
Central government	Incentivise the EV sector. Contribute funding to projects to reduce freight and transport related transport through development of transmission lines for liquid fuels and gas.
Car manufacturers and retailers	Ensure cars available for purchase in NZ are warrantied for use with biofuels. Import or manufacture EVs.
Fuel Suppliers and Retailers	Invest in bio-fuel processing plants. Install pumps for the supply of bio-fuels at retail outlets. Provide rapid charging outlets for EVs.
KiwiRail Group	Manage ongoing roll out of rail infrastructure and electrification of existing rail infrastructure.
Property Sector	Incorporate EV charge facilities in car-parking facilities.
Universities and research groups	Monitor/evaluate the impact of policy changes and initiatives in achieving the desired outcomes. Monitor/evaluate the impacts of these changes across community, economic and environmental aspects. Research and develop solutions that contribute to the desired outcomes. Participate in industry and community discourse and education.

Element 7: Planning the city to support more efficient lifestyle and business choices

Many of the strategies for energy resilience and GHG emissions reduction will be enhanced by integrated land use and infrastructure planning. The Auckland Plan presents an opportunity to undertake integrated planning for compact development areas across the city that optimise catchments for energy generation and transport infrastructure; and provide well-planned infrastructure that attracts residents and businesses to the renewed precincts.

The challenge

Auckland is characterised by low-density residential areas radiating around a CBD. This model is difficult to serve with public transport and provides limited opportunities for people to work close to home. The low density form also reduces the potential efficiencies offered by distributed generation and district energy systems.

A comparison of global cities highlights a link between higher density of both housing and jobs across a city-region and lower GHG emissions, therefore more compact development is widely considered critical to a low-carbon urban future. Compact development has also been shown to deliver a range of social, health, economic and environmental benefits. However the negative impacts of poorly planned and delivered compact development can outweigh the benefits. Auckland Council has recognised this and is exploring models of quality compact growth.

What solutions could work in Auckland?

The Draft Auckland Plan sets out a development strategy for a transition to a quality compact city. This strategy needs to be supported by a framework which includes detailed local area planning and appropriate development controls. Investment in catalyst projects and exemplar building design could also assist in delivering the desired outcome.

Low carbon precincts are identified development areas that have targets, controls and incentives to achieve low carbon outcomes beyond city wide targets. Low carbon precincts would be consistent with compact growth patterns and would incorporate local energy solutions such as distributed generation and district energy systems, as well as rigorous standards for energy efficiency in buildings, infrastructure and travel modes.

How can this contribute to energy resilience and emissions reduction?

Areas of quality compact growth can reduce car-based travel by providing services and jobs close to dwellings and supporting high frequency public transport.

The compact form also makes localised energy solutions, such as distributed generation and district energy systems, more viable and efficient.

Low carbon precincts create an environment in which low carbon solutions are fostered and are demonstrated to the wider community, thereby creating wider uptake of these options over time.

How will we measure success?

Quality compact growth in itself provides only a small direct reduction in energy consumption and GHG emissions on a per capita basis, largely because of reduced travel demand. However, quality compact growth has further potential to facilitate options for shared services and reduced infrastructure. Most importantly quality compact growth may facilitate options for decentralised energy including thermal networks and low carbon zones.

The measure for success will therefore be seen in the form of reduced VKTs, shorter trips and more trips made by active transport in areas representing quality compact growth. The uptake of thermal networks and success of low carbon zones in these areas will also be indicators of the success of this measure.

What could Auckland Council do?

Role	Activity
Monitor	Monitor the progress, quality and nature of development in the compact nodes and low carbon precincts against the desired outcomes.
Advocate	Promote the low carbon precincts in order to attract anchor/catalyst businesses and development.
Coordinate	Work with the property sector to identify funding models / incentives that will enable the preferred model of development Liaise with the property sector in the development of planning and development provisions to ensure they are enabling of development rather than a hindrance.
Strategise	Create a clear strategic framework for quality compact growth and for low carbon precincts within the Auckland Plan. Undertake integrated land use, transport and infrastructure planning for the identified development nodes/precincts.
Regulate	Adopt development controls to realise the desired form and mix of development.
Fund	Fund enabling infrastructure for public and active transport, low carbon energy and the public realm. Investigate the potential for incentives to attract investment to these areas, particularly for catalyst or exemplar projects.
Manage Assets	Lead by example: Undertake strategic building projects for Council and community infrastructure that demonstrate the preferred model of develop and act as catalyst projects for new areas of compact growth and/or low-carbon precincts.

Who else has a role?

Stakeholder/partner	*Role*
Central government	Ensure new projects undertaken by Central Government in Auckland contribute to Council's desired urban form. Revise building regulations to achieve alignment with Council's model of development.
New Zealand Green Building Council and Standards New Zealand	Align the Green Star tools and other non-mandatory building rating tools and standards with the objectives of achieving quality, compact growth.
Design and construction industry Large property owners/developers and the property industry	Become informed about planning and design solutions that will achieve the desired model of development. Participate in stakeholder discussions and actively participate in promoting voluntary standards.
Universities and research groups	Monitor/evaluate the impact of policy changes and initiatives in achieving the desired outcomes. Monitor/evaluate the impacts of these changes across community, economic and environmental aspects. Research and develop solutions that contribute to the desired outcomes. Participate in industry and community discourse and education.

Element 8: Reducing non-energy emissions and increasing carbon sinks

Whilst stationary energy and transport account for approximately 70% GHG emissions in Auckland, other activities in also contribute to GHG emissions and offer opportunities for emission reduction.

Emerging innovative methods of emissions abatement in these sectors could further reduce the Auckland's emissions profile and potential deliver greater productivity efficiency and efficiency within the region.

The challenge

Of Auckland's GHG emissions, approximately 30% occur in the form of non-combustion related emissions as a result of other process including:

- Agricultural
  - methane emissions from livestock,
  - nitrous oxide emissions from soils,
- Industrial (non combustion) process emissions
  - iron reduction in the steel industry
- Waste
  - methane emissions from solid waste decomposition in landfill
  - methane emissions from wastewater
- 'Synthetic' greenhouse gases
  - hydrofluorocarbons and perflourocarbons used in the refrigeration and air-conditioning, aerosol, fire protection and foam-blowing industries
  - sulphur hexafluoride used in electrical switching equipment and in scientific applications.

Until recently the majority of these emissions have gone unchecked with industry given no strong regulatory imperative or financial incentive to reduce emissions.

The NZ ETS covers industrial process emissions but will not cover agricultural emissions until 2015 or synthetic gases until 2013. During this interim period and beyond there is challenge to ensure that mechanisms are in place to promote the reduction in non energy emissions.

In addition the biogenic carbon flux can vary year to year as a result of anthropogenic and non anthropogenic causes. Biosequestration occurs as a result of terrestrial or marine

photosynthesis and the subsequent, long-term storage of the carbon-rich biomass. Terrestrial sequestration can be improved by the restoration or enhancement of degraded ecosystem, forestation, afforestation, and soil management. The main challenge to these practices is the availability of land and the competing demands of food production, fuel production and urban growth.

What solutions could work in Auckland?

Forestation of Riparian and Marginal Land

Planting forests on riparian and marginal land represents a bio-sequestration opportunity for Auckland. This would involve managed plantations within land that is not suitable for agricultural or urban growth. The plantations may in many cases be eligible to earn GHG credits under the NZ ETS. Auckland Council could assist and facilitate this process.

Biochar

Biochar is the product of thermal degradation of organic material in the absence of air using a process known as pyrolysis and may be used a soil conditioner. Various potential benefits can be obtained using biochar derived from plant or other feed stock material to lock carbon in soil, improve farm productivity, as well as reduce nutrient leaching. Biochar may also assist the agricultural sector in meeting its 2015 obligations under the NZ ETS.

Marine Sequestration

Globally, marine eco-systems are being lost at a rapid rate. The main reasons blamed are unsustainable resource use practices, poor watershed management, poor coastal development practices and poor waste management. In order to enhance and restore the capacity of marine ecosystems to sequester Auckland Council could invest in the regenerate by managing coastal ecosystems for conditions conducive to rapid growth and expansion of seagrass, mangroves, and salt marshes.

In the first instance Auckland Council could established a project to examine which marine species are the fastest and most effective in taking up carbon. In the first instance, this could be informed by the Ministry for Agriculture and Forestry data on carbon sequestration.

Industrial process emissions

The industrial process emissions attributed to Auckland are solely as a result of the reduction of iron sand reaction occurring within the Glenbrook Steel Mill which produces carbon dioxide from coal via a non combustion reaction. This reaction is stoichiometrically fixed. Without changing its process or reducing production, no abatement could occur.

Notwithstanding, there may be opportunities for capture of this or any other relatively pure source of carbon dioxide for sequestration utilising algae, which could have a variety of uses including biofuels and/or biopolymers.

Zero waste to landfill

There is a large opportunity for recycling waste and waste

minimisation in Auckland. Recycling has been shown to have a higher environmental benefit than all current waste to energy technologies. Once waste minimisation and recycling have been maximised there is an opportunity for residual organic waste to be converted to energy. Auckland could consider a waste to energy plant to treat all of Auckland's residual Municipal Solid Waste and Commercial and Industrial Waste While the landfills that are used to dispose Auckland's waste are highly effective at capturing methane, alternative processes are much more effective from a GHG perspective by generating more energy from the waste and avoiding the release of methane into the atmosphere.

Sewage to energy

Auckland's waste water treatment system already treats a significant proportion of the City's biosolids with anaerobic digestion to generate biogas and eventually electricity with small reciprocating engines. There remains a significant volume of wastewater that is treated by other processes that do not generate biogas including industrial and municipal wastewater.

Agriculture

There are a range of farming practices being investigated worldwide to reduce both methane emissions from livestock and nitrous oxide emissions from soils. These include such measures as feed replacement, irrigation management, crop rotations, sowing techniques, liming and enhanced efficiency fertilisers. Auckland Council could work with the agricultural sector in the application of these practices and to further reduce its liability under the NZ ETS.

How can this contribute to energy resilience and emissions reduction?

The reduction of non energy emissions plays an important role in realising the 40% GHG emissions reduction target. Quick wins in the reduction of industrial process emissions, landfill emissions and synthetic gases can often be achieved through consultation with industry at a relatively low cost. Forestation and enhancement of degraded marine and terrestrial ecosystems also offers great potential and a raft of environmental and cultural cobenefits.

Waste to energy and sewage to energy offer the dual benefits of reducing emissions and diversifying decentralised energy production. These options are emerging as a cost effective solution to both waste disposal, GHG reduction and energy supply for Auckland

How will we measure success?

The measurement of the effectiveness of GHG sinks is an evolving science. Existing accounting methods will be backed up by a programme of continuous emissions covering Auckland to accurately quantify carbon emission sources and sinks to verify accounting data.

Auckland Council is funding a PhD research project with the University of Auckland which quantifies atmospheric GHG fluxes and measures their temporal variability at annual, seasonal and diurnal scales, and determines the proportion of anthropogenic, biogenic and geogenic GHG sources and sinks.

In addition, the following metrics for waste and sewage to energy are proposed.

Metric	2009 (baseline)	2020	2031
% Total Waste Generated Sent to Landfill	Not known	64%	85%
Installed Sewage to Energy Generation Capacity	10.7MW	16MW	21MW

What could Auckland Council do?

Role	*Activity*
Monitor	Continuous monitoring of GHG emissions to verify accounting of sinks and sources.
Advocate	The reduction of non-energy industrial process emissions and synthetic gases through consultation with industry. Promote waste reduction and recycling programs in the community.
Coordinate	Coordinate programme for emissions reduction with agricultural industry to reduce liability under NZ ETS. Engage with Maori groups to integrate traditional land management practices with GHG reduction initiatives.
Strategise	Waste to energy for the Auckland's municipal waste to determine the feasibility of a facility within the region. Increased energy production at Watercare's wastewater treatment plants through feasibility studies.
Regulate	Establish long term targets and caps for industrial emissions.
Fund	Provides incentives for industry to transition to lower emission technologies and practices. Incentivise the development of industries founded on recycling and on exploration of closed loop industrial processes.
Manage Assets	Undertake programme of riparian and marginal land management reforestation. Maximise recycling and waste to energy opportunities at hard waste collection areas and sewerage treatment plants.

Who else has a role?	
Stakeholder/partner	*Role*
Central government	Align centrally supported land management activities with GHG reduction strategies.
NZ Landcare Trust and community based land care and land management groups	Adapt programs, research and funding to support the objectives of GHG reduction through effective land management.
Rural industries / food producers	Adapt farming and land management practices towards 'carbon farming' outcomes.
Forestry Industry	Manage forests to enhance the GHG emissions reduction outcomes.
Major industry / emitters The waste management sector	Transition industrial processes to less GHG intensive technologies and practices. Invest in offset programs. Investigate closed loop industrial processes, industrial ecology and resource mining from the waste stream. Explore opportunities for co-generation and waste-to-energy.
Universities and research groups	Monitor/evaluate the impact of policy changes and initiatives in achieving the desired outcomes. Monitor/evaluate the impacts of these changes across community, economic and environmental aspects. Research and develop solutions that contribute to the desired outcomes. Participate in industry and community discourse and education.

Eight Transformational Investments

Initiation of the transition to a low-GHG and energy secure Auckland will require leadership and courage from Council. The strategy requires investment that may have long pay-back periods, it may require new taxing and rating regimes to realise returns on it investment, and it will require changes in the personal decisions people make about travel and consumption.

The list below summarises eight major transformational investments required to deliver the eight elements described in the preceding pages.

1. **Deploy large scale renewable energy plant(s) within the Auckland region.**
2. **Establish extensive smart grid and metering infrastructure.**
3. **Realise a widespread uptake of distributed generation.**
4. **Secure the supply, storage and non-vehicle based transportation of gas and liquid fuels.**
5. **Increase dependence on bio-fuels and bio-mass.**
6. **Switch to electric vehicles.**
7. **Establish a reliable, integrated, attractive, convenient, safe and low-GHG public transport network.**
8. **Transform Auckland's urban form to a compact, quality city of energy efficient buildings and industries.**

5 Moving Forward

This report describes a suite of strategic directions and supporting initiatives that can secure a low-carbon, energy resilient future for Auckland. These options have been proven by other leading Councils and cities around the world, and have been selected for their specific relevance to Auckland's context.

Council's challenge and task now is to engage in robust and constructive debate about these options to develop a comprehensive framework that garners widespread responses from all stakeholders.

When compared with other cities in New Zealand, Australia and North America, Auckland already has a relatively low GHG footprint. However, there is a risk that under business as usual Auckland will experience an upward trend in consumption of fuel and power, and peak power in particular such that existing infrastructure will quickly reach its limits. Under such a scenario stationary energy generation may in fact become more carbon intensive and liquid fuels increasingly expensive and dependent on a road network already at capacity.

This strategy seeks to address energy and greenhouse gas from an end user perspective where Auckland Council can exert its greatest influence. That is, where demand can be managed at the local scale with technologies and spatial planning approaches and infrastructure investment planned accordingly energy resilience and GHG reduction can go hand in hand with economic prosperity and liveability objectives.

Auckland's GHG reduction and energy resilience objectives are achievable. The eight elements and associated transformational investments outlined in this study describe a city that has achieved these twin objectives. It is also a highly liveable city, one that has better air quality, fewer cars, activated streets, greater job diversity, improved resilience and healthier people.