PEPANZ
PETROLEUM EXPLORATION & PRODUCTION ASSOCIATION OF NEW ZEALAND

AN INTRODUCTION TO

NEW ZEALAND'S OIL AND GAS INDUSTRY

INTRODUCING...

NEW ZEALAND'S ENERGY MIX

www.energymix.co.nz is a website providing accessible and easy to understand information on New Zealand's oil and gas sector, right to the home computers and smartphones of New Zealanders.

The website provides honest and transparent information about the industry, including the challenge of ever-increasing demands for energy, the future role of oil and gas given the need to respond to a changing climate, and the economic benefits our industry can deliver to the country.

For the whole story, visit

www.energymix.co.nz

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CONTENTS

Introduction 4

PEPANZ: Who We Are 5

How is Oil and Gas Formed? 6

Oil and Gas in New Zealand 8

The Importance of Oil and Gas to the New Zealand Economy 10

The Regulatory Environment 12

Protecting the Environment 13

Processes 14

Oil and Gas Products 23

Responding to Climate Change 24

The Future of Oil and Gas 26

New Zealand's Potential 27

INTRODUCTION

New Zealand's oil and gas industry plays an important role in New Zealand. Every year, the industry contributes over $2.5 billion to the New Zealand economy, provides the Government with approximately $500 million in royalties and income tax, and employs 11,000 people.

The impact of these economic indicators can be seen in Taranaki, where the oil and gas industry is concentrated. Oil and gas exploration and production accounts for 41 percent of Taranaki's Gross Domestic Product (GDP) and is the key reason the region has the highest GPD per capita in the country. This means more jobs, higher wages, busy high streets and well-funded community facilities.

Oil is also an important income earner for the country, and is one of the country's top ten export earners. Our high-quality oil earns a premium on international markets and is exported to Australia and Singapore where it is turned into petroleum.

Our gas provides New Zealand homes and industries with instantaneous energy – providing heat, electricity and continuous hot water. Gas is also used to produce a range of products – from fertilisers to methanol – industries that would not exist in New Zealand without a ready supply of natural gas.

Despite these economic benefits, few industries attract wider public debate in New Zealand than the petroleum industry.

On the one hand, we all use oil and gas products in almost every part of our daily lives. Not only is oil used to produce petrol, it is used to create plastics, clothing, cosmetics, and medicines.

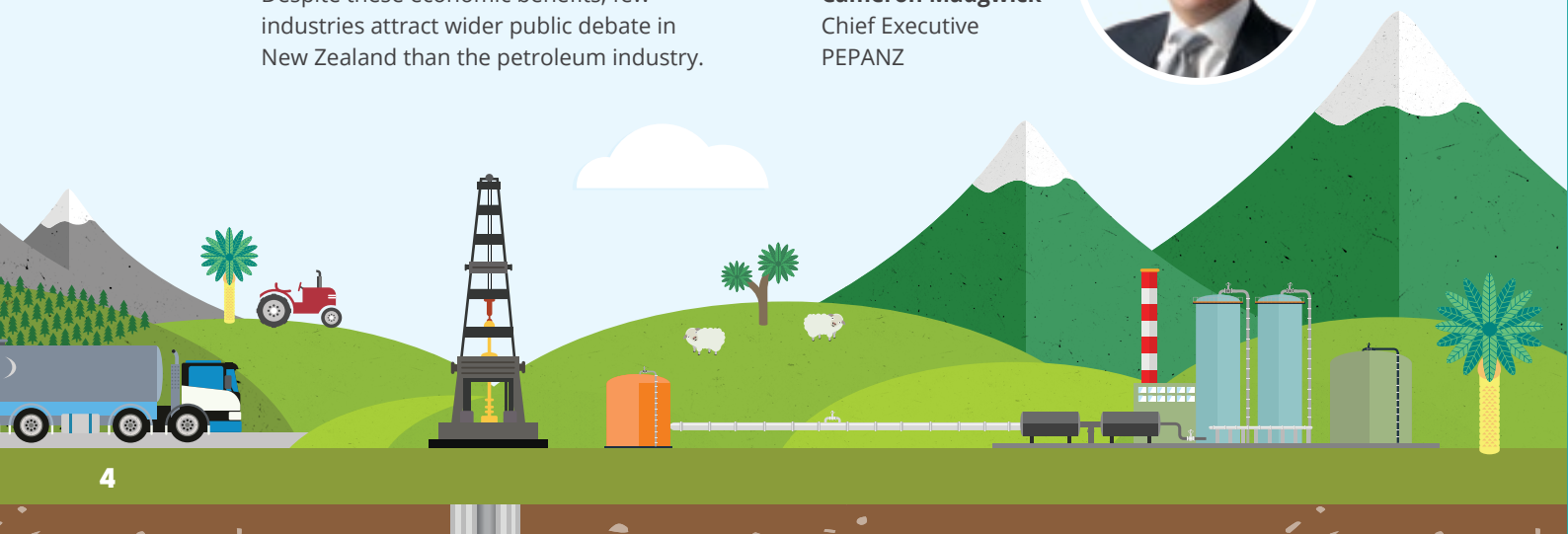
On the other hand, many people are concerned about the environmental impact of the industry and question its role in a world working to limit the impact of climate change.

The world's demand for oil and gas is increasing as energy demand continues to grow. New Zealand has the potential to help meet this demand. At the same time, we need to collectively reduce our emissions to protect our climate.

In this booklet, we aim to address some of these concerns and answer many of the common questions New Zealanders have about our industry. As an industry, we are committed to openness and transparency, developing strong and enduring relationships with the community sharing what we do, how we do it, and why.

We hope that this booklet goes some way to providing useful information and facts, which will help contribute to an informed discussion about the future of the oil and gas industry in New Zealand.

Cameron Madgwick
Chief Executive
PEPANZ



PEPANZ

PETROLEUM EXPLORATION & PRODUCTION ASSOCIATION OF NEW ZEALAND

WHO WE ARE

Established in 1972, we are the industry association of the upstream oil and gas sector.

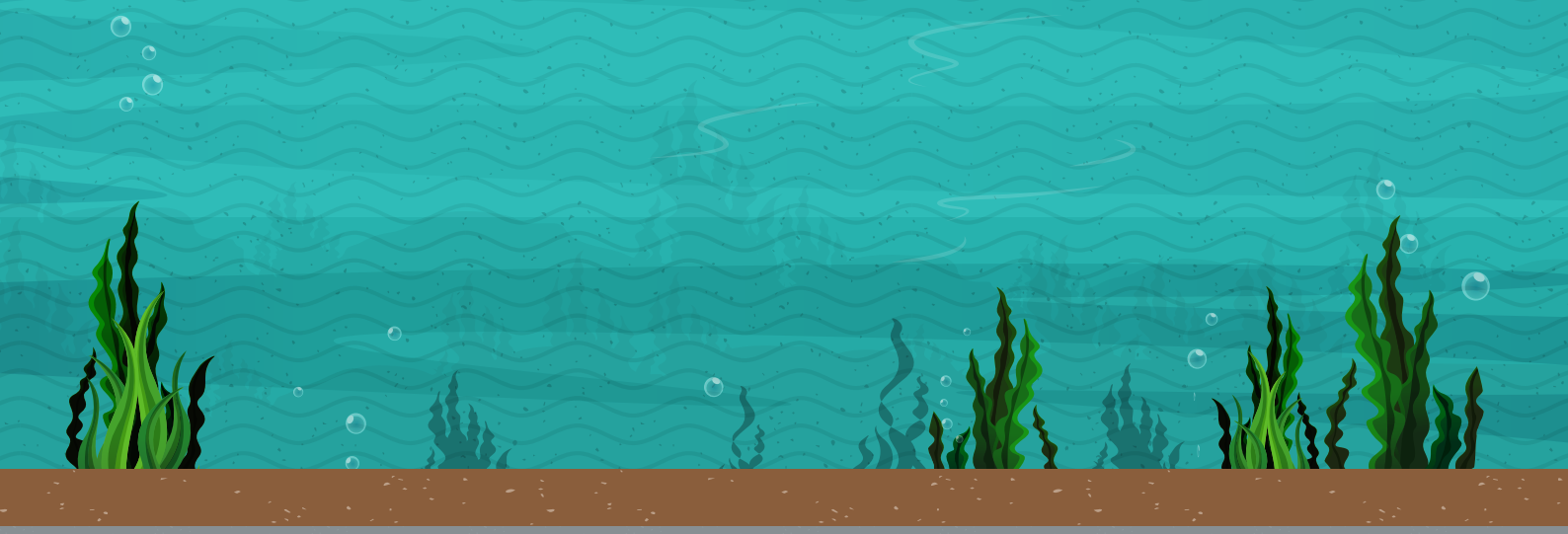
We proudly represent the companies that explore for, and produce, New Zealand's oil and gas resources. Our Member's produce an estimated 95 percent of New Zealand's petroleum.

We also represent more than 50 Associate Members who provide a range of goods and services to the industry.

We advocate on behalf of our Members with central and local government, engage with New Zealanders to help educate and build a stronger understanding about our sector, and provide support to our Members in the work they do.

Oil and gas resources are owned by the Crown on behalf of all New Zealanders and we believe that by developing our industry we can enrich New Zealand's future – the future of our Member companies, our communities and the economic future of our regions.

Learn more at **www.pepanz.com**.



HOW IS OIL AND GAS FORMED?

Oil and gas are part of a chemical group known as hydrocarbons.

Hydrocarbons are found in liquid, gas and solid state. As the name suggests, hydrocarbons are chemical compounds consisting entirely of hydrogen and carbon atoms.

In New Zealand, most of our hydrocarbons originated as vegetation from dense forests or microorganisms, like algae and plankton, which lived hundreds of millions of years ago.

As the forests and microorganisms died, they became buried in the ground by sediment (mud, sand, and gravel). This process continued over millions of years, pushing the material deeper and deeper into the earth.

As the sediment was buried deeper, the temperature rose and pressure on the organic matter increased. This heat and compression caused all soluble (or dissolvable) chemicals to be forced out.

The material left behind (kerogen) continued to heat and break down into smaller and simpler hydrocarbons – the building blocks of oil and gas.

Hydrocarbons include methane and ethane (used to produce natural gas), as well as propane and butane (used to produce LPG).

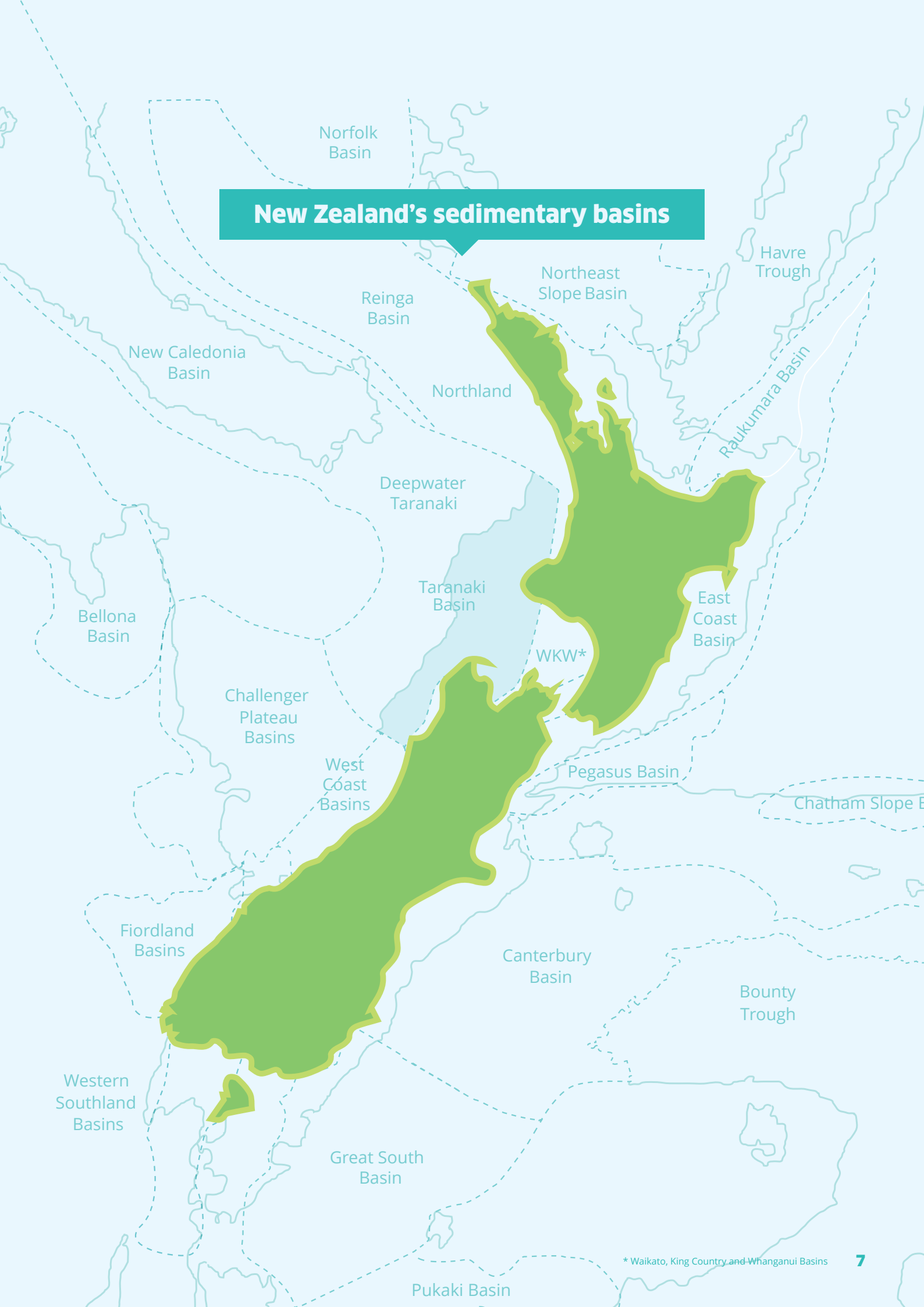
Crude oil contains a range of hydrocarbons (such as pentane, hexane and octane), which are used to produce petrol, kerosene and diesel, as well as other products such as plastics.

Hydrocarbons naturally want to rise to the surface; however, they can become trapped under hard layers of rock, which act as a seal and trap the hydrocarbons under the ground. This process forms reservoirs and these reservoirs can hold large accumulations of hydrocarbons in the form of oil and gas.

Most of the world's oil and gas reservoirs are found in 'sedimentary basins'.

New Zealand has 17 sedimentary basins within its Exclusive Economic Zone, which all have the potential to have hydrocarbon reservoirs.

Currently New Zealand is only producing oil and gas from one of these basins – the Taranaki Basin.



* Waikato, King Country and Whanganui Basins

OIL AND GAS IN NEW ZEALAND

Oil and gas production has a long history in New Zealand.

Early History

Oil and gas naturally want to make their way to the surface from where they are formed deep below. Seepages (places where oil seeps out of the ground) occurred on the New Plymouth foreshore, Kōtuko on the West Coast, and Waitangi (north of Gisborne). At New Plymouth, bubbles of gas were seen along the coast and an oily sheen could be seen on the sea water on calm days.

In early 1865, gunsmith Edward M. Smith collected samples of oil he found among boulders at Ngāmotu Beach, on the New Plymouth foreshore. He sent them to Britain for analysis. Following this, the Taranaki Provincial Government offered £400 for the discovery of a commercial find of oil.

In 1865, a well was dug at Moturoa, on the New Plymouth foreshore. This was the first well in the British Empire, and one of the first in the world. In 1866, it struck gas at 7 metres and oil at 20 metres. Other wells soon appeared, but only a few barrels of oil were recovered in the first years.

In 1904, the first steel drilling rig was brought to New Zealand, and two years later it struck oil. By 1913, crude oil was being held in storage in New Plymouth. A refinery was built, but local production was spasmodic and it could not be sustained. In the late 1920s, a second refinery was built by locals (it closed in 1975). During the 1950s, some pumps sold Peak Oil (named after Mt Taranaki), and the local council used Taranaki diesel in its vehicles.

Modern Exploration Begins

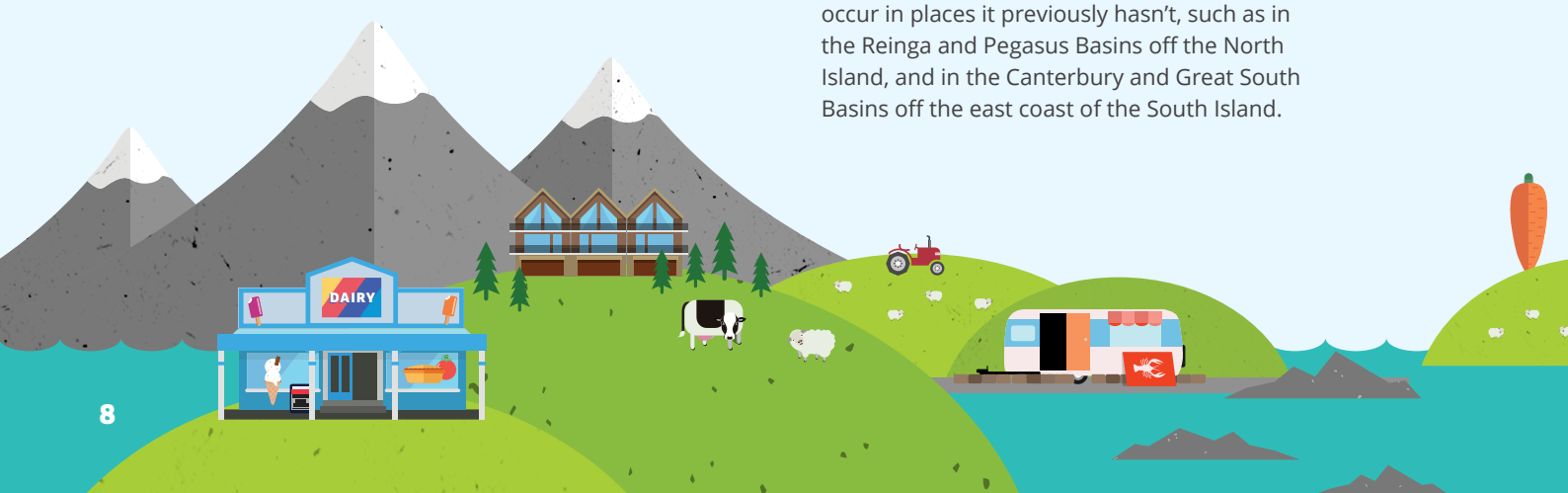
The development and use of new technologies, such as acoustic imaging and deep rotary drilling, resulted in the discovery in 1959 of the large onshore Kapuni gas-condensate field in South Taranaki, followed by the discovery of the very large Maui gas-condensate field in 1969. These discoveries allowed the development of the North Island gas transmission network, bringing natural gas directly to many homes and industries in the North Island.

The Maui field made New Zealand self-sufficient in gas. The Maui A platform, which became operational in 1979, was cutting edge for what could be accomplished offshore at the time, and a second platform was built in 1993, which allowed production from the deeper reservoirs.

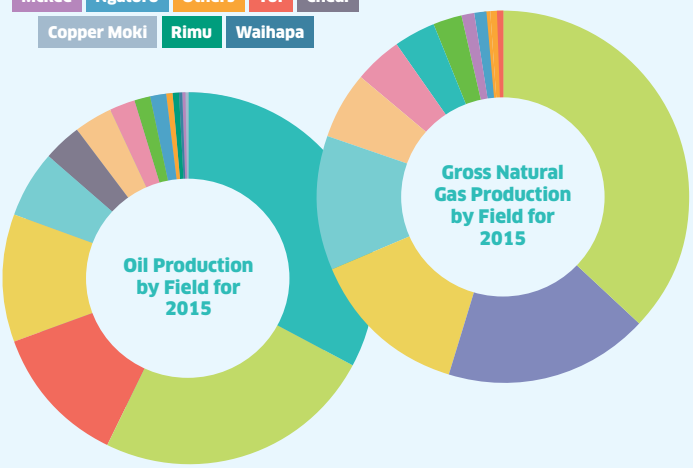
The discovery of the McKee Oil Field in 1979, the largest oil field in Australasia at the time, changed the perception that New Zealand was only rich in gas. McKee is still in production today and has produced almost 48 million barrels of oil to date. The offshore Maari and Tui discoveries, subsequently made in 1998 and 2003, are also substantial and are predominately oil fields.

Today there are 20 oil and gas fields in operation, all based in Taranaki and, as of 2014, almost 6,700 billion cubic feet of natural gas and 450 million barrels of oil have been produced in New Zealand.

New technology is now allowing operators to safely explore at greater depths and further from land. This is allowing exploration to occur in places it previously hasn't, such as in the Reinga and Pegasus Basins off the North Island, and in the Canterbury and Great South Basins off the east coast of the South Island.



Pohokura | Maui | Kupe | Mangahewa | Kapuni | Turangi | Maari | Kowhai | Mckee | Ngatoro | Others | Tui | Cheal | Copper Moki | Rimu | Waihapa



EVERY YEAR
NEW ZEALAND PRODUCES*

175 BILLION CUBIC FEET OF GAS

15 MILLION BARRELS OF OIL

1.5 MILLION BARRELS OF LPG

40,900 barrels of oil per day
(a barrel is 159 litres)

PRODUCED IN 2015

436 million cubic feet of gas per day
(a cubic foot is about 28 litres)

WE ONLY PRODUCE

35%

OF OUR OIL NEEDS

- Gas Field
- Oil Field
- Power Station
- Petrochemical Plant
- Production Station
- Pipelines
- Roads

*On average over the last 10 years

THE IMPORTANCE OF OIL AND GAS TO THE NEW ZEALAND ECONOMY

The upstream oil and gas industry plays an important role in the New Zealand economy.

Every year, the industry contributes over $2.5 billion to New Zealand's Gross Domestic Product (GDP), the Government collects approximately $500 million in royalties and tax from the sector, and oil exports are worth approximately $1.5 billion. In fact, oil is one of New Zealand's top ten export earners.

Crude oil produced in New Zealand is very high quality and fetches a high price on the international market, which is one of the reasons why almost all domestically produced crude is exported. To meet domestic demand for fuel, lower quality Arabian crude oil is imported into Northland's Marsden Point refinery.

Right now, approximately 42 percent of all profit from any producing field is returned to the New Zealand Government in the form of royalties and income tax, and over the last decade New Zealand has received over $3 billion for its oil and gas resources.

Offshore oil and gas is the largest contributor to New Zealand's marine economy, representing 48 percent of the marine economy in 2013 and contributing more to New Zealand's GDP than shipping, fisheries and aquaculture combined.

The industry also generates over 11,000 jobs across the country, and many of these jobs are highly skilled and incredibly productive. Oil and gas workers earn twice the national average salary and create seven times the average income earned per annum, money that is spent in local communities.

The industry generates significant investment into the regions it operates. It costs millions of dollars to discover oil and gas fields, and then millions more to turn that discovery into a producing well or field.

This investment pays for the development of local support infrastructure, from production stations (onshore oil and gas processing plants) to other buildings, roads, piping, reticulation structures, and the salaries of staff and support workers.

In fact, companies operating in New Zealand spent over $1 billion on exploration and production activity in 2015.

OIL EXPORTS ARE WORTH APPROXIMATELY $1.5 BILLION EVERY YEAR. IN FACT, OIL IS ONE OF NEW ZEALAND'S TOP TEN EXPORT EARNERS.

The importance of the oil and gas industry to the economy can be seen in Taranaki, where the industry accounts for 41 percent of Taranaki's regional GDP and provides two percent of the region's employment.

Because of the oil and gas industry, Taranaki has the highest regional GDP per capita in New Zealand, at over $80,000, compared to a national average of around $51,000.

The development of an oil and gas industry also supports the development of other industries. Gas is an essential feedstock for many industrial activities, such as methanol production and urea fertiliser for agriculture, industries that wouldn't exist in New Zealand without a ready supply of reliable natural gas.

Natural gas is also crucial to the electricity system, because it provides backup cover for renewable generation at times when demand exceeds supply, or when hydro lakes are low. Gas-fired power stations ensure New Zealand's electricity supply is reliable and we do not have blackouts.

Gas is also critical to a range of other economic activities that require heat, such as furnaces, milk drying, timber processing and steel production.

NORWAY

AN EXAMPLE OF A STRONG OIL AND GAS ECONOMY

Petroleum has fundamentally transformed the Norwegian economy.

In many ways, Norway is like New Zealand, with around the same number of people and an extensive coastline and marine area.

Oil was first discovered off Norway's coast in 1969, and this was followed by a number of major discoveries.

Norway is now the world's eighth largest exporter of crude oil, and petroleum has fuelled economic growth and contributed significantly to funding the Norwegian welfare state – lifting Norway from a middle income European country, to one of the wealthiest in the world, enjoying extremely high living standards.

To ensure future generations benefit from their natural resources, Norway put aside a proportion of the revenue it receives from its petroleum reserves – building a massive sovereign fund valued at $US882 billion in 2016. The fund owns around two percent of all shares in Europe, and one percent globally. By comparison, New Zealand's current GDP is $US183 billion.

Petroleum has also fuelled a services, engineering and construction industry to support the petroleum sector, and Norway's second largest earner are services to the petroleum industry.

THE REGULATORY ENVIRONMENT

Petroleum resources are publicly owned by all New Zealanders. The Government, as custodian of New Zealand's mineral resources, aims to maximise the value of this resource for the benefit of all New Zealanders.

Domestic and international oil companies invest in exploring for, developing and producing these petroleum resources on behalf of the Government, who in turn receives a substantial share of the returns in the form of royalties and taxes.

Under the Crown Minerals Act 1991, the Government chooses whether to allow exploration, development and production of petroleum resources, in which locations and on what terms. Regulations then apply as to how the required activities are undertaken.

The upstream oil industry is subject to extensive and thorough regulation and oversight. In addition to the Crown Minerals Act 1991, it also covered by the:

- Health and Safety at Work Act 2015
- Resource Management Act 1991
- Marine and Coastal Area (Takutai Moana) Act 2011
- Exclusive Economic Zone and Continental Shelf (Environmental Effects Act) 2012
- Maritime Transport Act 1994, and
- Hazardous Substances and New Organisms Act 1996.

The industry is also overseen and monitored by many central government agencies including New Zealand Petroleum and Minerals, WorkSafe, the Environmental Protection Agency, Maritime New Zealand, and the Department of Conservation, as well as local and regional councils in the regions the industry is operating.

In recent years, major regulatory reform of health and safety and environmental legislation has taken place to bring New Zealand's regime into line with global best practice approaches. The sector has some of the most developed approaches to health and safety management and the industry's culture in New Zealand is internationally regarded, stringent and uncompromising, ensuring workers are safe.

While primary industry activity (such as farming, fishing, mining and forestry) can expose workers to challenging environments, oil and gas workers are safer and suffer less accidents, in gross quantity and per worker, than all other primary industries in New Zealand. In fact, oil and gas workers at production facilities are around four times less likely to experience an accident in their workplace than they are at home.

> **"THE SECTOR HAS SOME OF THE MOST DEVELOPED APPROACHES TO HEALTH AND SAFETY."**

PROTECTING THE ENVIRONMENT

New Zealand has a unique and diverse natural environment and New Zealanders are right to expect that it is protected.

No oil and gas activity takes place until every risk has been identified, addressed and planned for. Every aspect of the design and operation of oil and gas facilities is made to reduce risk levels to as low as reasonably practicable. The risk that most people are concerned about when considering the oil industry is the risk of an oil spill.

Oil spills are enormously costly, not only for the environment, but also for the company responsible. That is why the industry spends an enormous amount of money to avoid spills in the first place through cutting edge technology and multiple barriers separating oil and gas from the surrounding environment.

Every large-scale oil and gas facility in New Zealand must have a Safety Case. The Safety Case is an exhaustive document defining the design, build and operation of any oil and gas facility. The Safety Case is required by law, and submitted by oil and gas companies to WorkSafe's High Hazards Unit for acceptance.

All operators must produce detailed plans on how they will maintain well control through the full lifecycle of the well, and in the extremely unlikely event that well control is lost, how they will regain control of a well and respond to an oil spill.

In the unlikely event that an incident did occur it is a fundamental principal that maintaining and recovering well control is the responsibility of the operator, who is liable to pay all costs of bringing the incident under control, the clean-up and recovery.

Maritime New Zealand owns a range of equipment to respond to an offshore oil spill, including skimmers, booms, dispersants and oil recovery vessels. This equipment is purchased and maintained through the collection of the Oil Pollution Levy, which is collected from maritime industries, including the oil and gas industry.

This equipment is stored around the country and can be deployed quickly in the event of an incident.

Given the rarity of major spills around the word, more specialist equipment is stored at strategic locations around the world, including Australia, Singapore and the United Kingdom. If required, this can be deployed by air or ship to respond to a major oil spill incident anywhere in the world.

Regional Equipment Stockpiles

PROCESSES

Block Offer

The New Zealand Government allocates exploration permits in an annual tender process called a Block Offer. The Block Offer process has been undertaken annually since 2012, and the selection of areas for inclusion in a Block Offer is based on their prospectivity and commercial interest.

As part of the Block Offer process, New Zealand Petroleum and Minerals (part of the Ministry of Business, Innovation and Employment, or MBIE) asks the petroleum industry to nominate areas to include in the allocation, consults with iwi and hapū in the proposed areas, and discusses the proposed areas with local government.

Information gathered during this consultation process guides the Minister of Energy and Resources' decision on the final make-up of the Block Offer.

These areas are announced annually, with applications closing approximately six months later. Permit awards are made several months after that, following a Government assessment of their bids.

Petroleum companies do not financially bid for exploration permits. Instead, bids are assessed on their proposed work programme and criteria, including the applicant's technical and financial capability to meet expected health, safety and environmental requirements.

Exploration – Acoustic Imaging Surveys

Once a company has been awarded an exploration permit, they will begin to explore their area. This usually starts with an acoustic imaging surveying (also known as seismic surveying).

This type of survey is an established science that has been used by scientists for decades to better understand the geology of the earth. These surveys produce detailed images of various rock types and their location beneath the earth's surface. This information helps find the location and size of oil and gas reservoirs without the need to disturb the land or seabed.

An acoustic imaging survey involves sending out an acoustic wave. This wave is absorbed into the earth's surface, hitting rocks below the surface, which bounce the wave back to the surface. The returning wave is then captured by sensors.

On land, this may involve either a specialised truck that carries a heavy plate that is used to send a wave into the earth, or the use of small detonated charges to send out a wave. The time it takes for each wave to return to the sensor provides geologists information about the depth of different structures under the earth and possible gases or fluids trapped in rock formations.

Offshore Acoustic Imaging Surveys

Offshore seismic surveying involves a specialised vessel sending out compressed air bubbles. As these bubbles collapse under the pressure of the ocean, they produce soundwaves which are absorbed and reflected back from the seafloor.

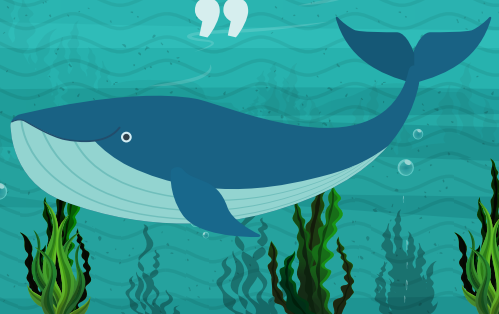
The seismic surveying vessel tows a number of streamers that contain sensors which capture the returning soundwave.

The sound produced from an offshore seismic survey is not strong and is comparable to many naturally occurring marine sounds – such as that produced by a click of a bottlenose dolphin or sperm whale.

To be safe, however, offshore seismic surveys must adhere to the Department of Conservation's Code of Conduct for minimising acoustic disturbance to marine mammals (such as whales, sealions and dolphins).

Each operator must have two independent and trained marine mammal observers and two passive acoustic monitoring operators, and must record all observations of marine mammals before and during operations.

"THE SURVEY MUST BE STOPPED IMMEDIATELY IF A MARINE MAMMAL ENTERS THE PREDETERMINED MITIGATION ZONE."



IN NEW ZEALAND, ONSHORE DRILLING DEPTHS CAN VARY BETWEEN ONE AND FIVE KILOMETRES BELOW THE SURFACE.

THE DEEPEST OIL WELL IN THE WORLD IS Z-44 CHAYVO WELL, LOCATED IN THE RUSSIAN FAR EAST, WHICH IS OVER 12KM DEEP.

Drilling

If the surveys and other investigations show that a commercial quantity of oil or gas is probable, the next step usually involves drilling.

Drilling, whether onshore or offshore, begins by "spudding in", which involves creating a surface hole and inserting a drill bit to begin the drilling process.

When the desired depth of initial drilling is reached, the hole is "cased" with three or four layers of steel tubing. As drilling progresses, it continues to be cased. Cement is then pumped to the bottom which backfills the gap between the rock wall and the outside of the steel tube to lock it in place, providing strength and stability.

As the drilling reaches greater depths, the size of the hole decreases. A hole that began at around 50cm at the surface, finishes at the reservoir of oil at around 15-20cm. Each time the hole reduces in size another layer of casing and cement is installed.

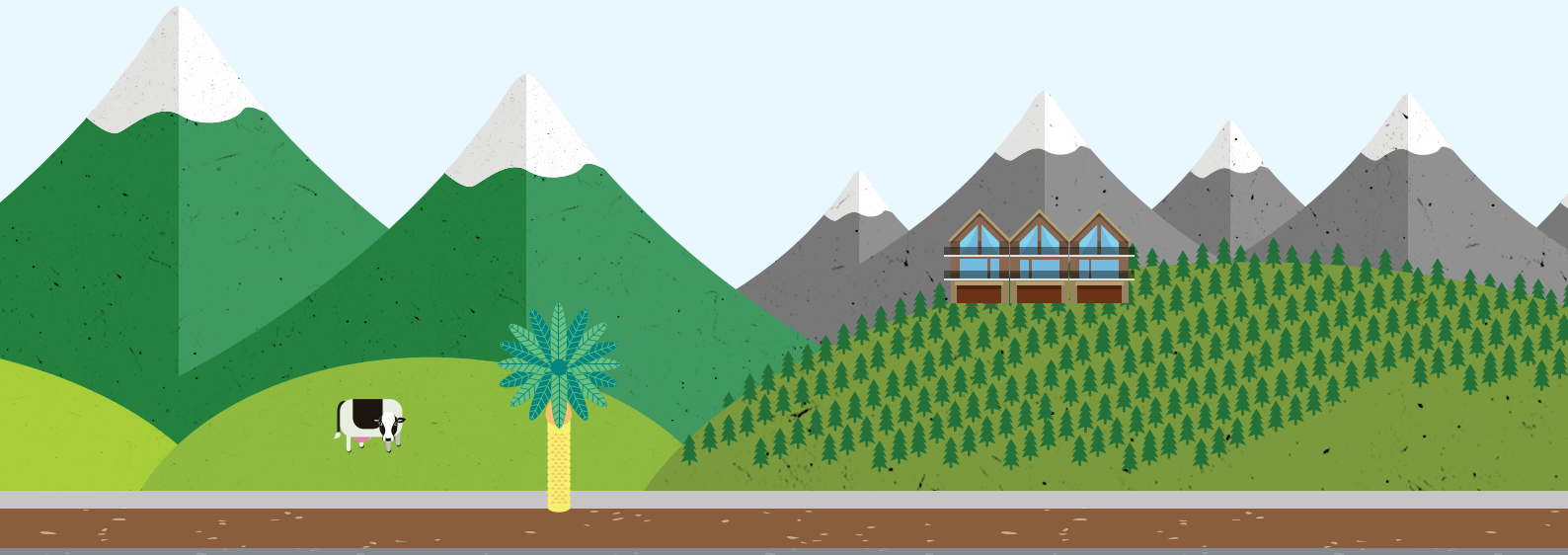
That means when the well has reached its final depth, the hole back up to the surface has on average four layers of non-porous casing and cement to make sure the well is safe and stable for decades to come.

The casing and the cement forms a solid barrier that totally prevents any oil and gas seeping through steel tubing and contaminating the surrounding earth or any fresh water aquifers. The casing and the cement are pressure-tested to ensure that they can tolerate higher pressures than those expected over the lifetime of the well.

Oil and gas reservoirs are located deep below the surface. Even the shallowest wells in Taranaki are drilling down at least one kilometre to reach oil and gas reservoirs. By comparison, most aquifers in New Zealand lie between 50 and 250 metres below the ground.

These aquifers are drilled through in the first days of drilling, and the well is cased with initially one, and ultimately three or more layers of steel casing pipe and cement, to ensure the aquifer is protected. The likelihood of petroleum or fluids reaching an aquifer is incredibly low. This is because the vertical separation of the aquifer and the petroleum layer are kilometres apart, with often many layers of impenetrable rock between them.

During drilling a blowout preventer is also fitted, which is a large mechanical device that can control or close the well if necessary to prevent a blowout (the uncontrolled release of crude oil and/or natural gas).



Hydraulic Fracturing (Fracking)

Hydraulic fracturing, or fracking, is a process used at some drill sites to extract oil and gas and has been practiced around the world for decades. It makes it possible to extract oil and gas that is trapped so tightly within rock that it can't flow.

The process injects water, proppant (sand or ceramic beads) and a very small proportion of chemical additives into a well at high pressure. This creates small cracks in the rock, usually only a few millimetres wide.

Most of the chemical additives used in fracking are common and can be found in most households. Additives are necessary to prevent bacterial build-up and corrosion and to transport the proppant and hold it in place.

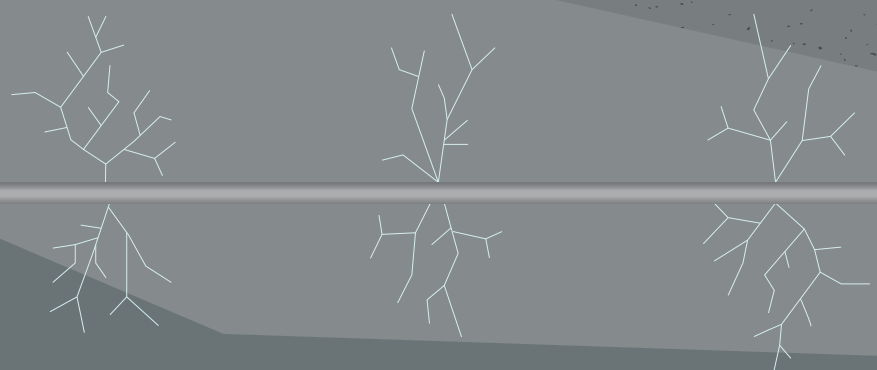
The proppant keeps the cracks open, creating channels the oil and gas can travel through to the well. Hydraulic fracturing is only effective with rock that has extremely low permeability (low ability for liquids or gas to pass through).

Once the operation has been completed, the fracking fluids are recovered and are safely stored, treated and diluted. It is then disposed of by deep well injection (pumped into old wells and stored several thousand metres underground).

The first frack occurred in New Zealand in 1989 and since then there have been around 100 fracks.

Any frack operation must go through a resource consenting process with the appropriate regional council to ensure all activity complies with regulatory oversight.

Fracking in New Zealand has been thoroughly investigated by the Parliamentary Commissioner for the Environment, who found that fracking can be undertaken safely if "operational best practices are implemented and enforced through regulation", as is the case in New Zealand.



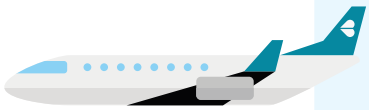
There has been a lot of bad press for fracking – especially overseas.

Fracking in the US and overseas is widespread, with thousands of wells being drilled by hundreds of operators.

In the past some wells fell outside industry best practice, were drilled to shallow depths, and were haphazardly managed. This potentially compromised the water table and caused surface spillage and other contamination.

How is Fracking in New Zealand Different?

New Zealand companies drill far less wells (to date less than 100 fracks have occurred), and these take place in a very limited geographic area, under a stringent regulatory regime.

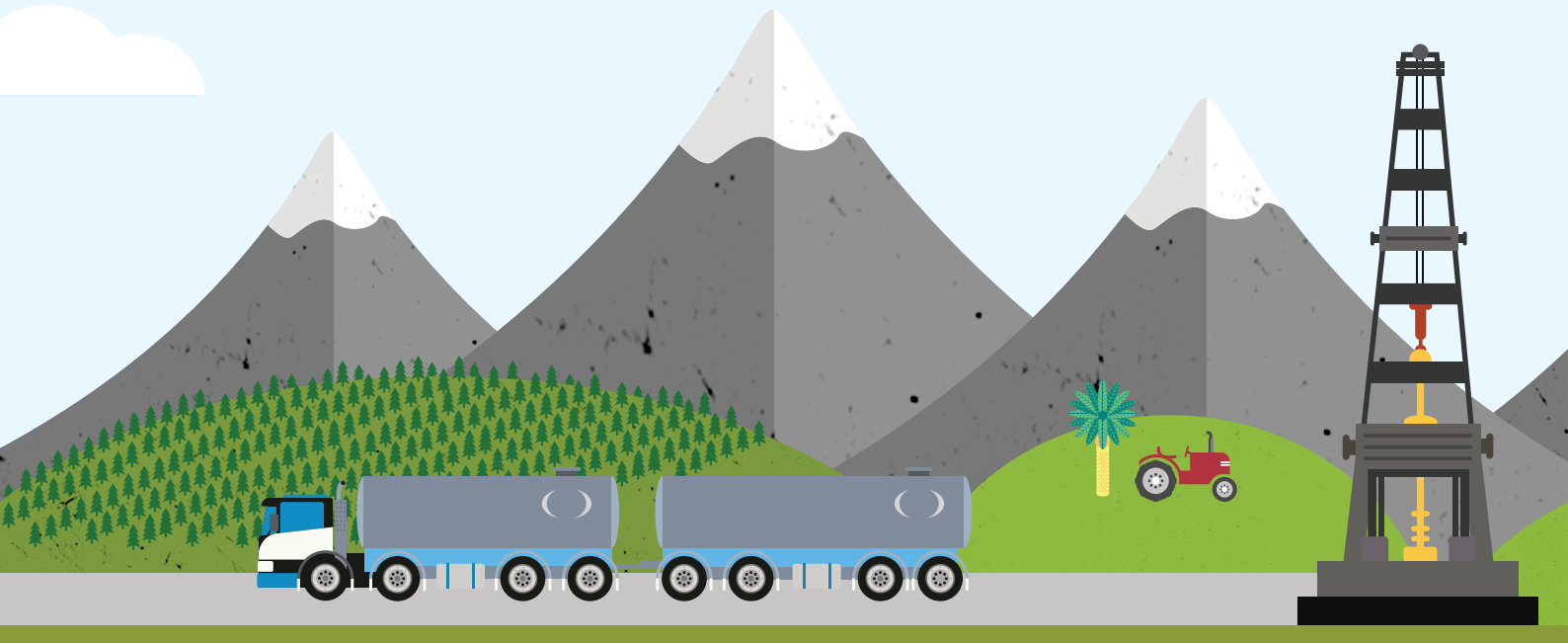


Does Fracking Cause Earthquakes?

Injecting fluids deep underground through fracking has been known to induce minor (macro) seismic activity in New Zealand.

According to GNS Science, seismic activity associated with fracking is generally less than magnitude 2.0. A 2.0 shake produces surface vibrations similar to nearby passing truck.

Records from earthquake monitoring systems show no evidence of fracking causing earthquakes felt on the surface.



Production

Production is an industry term that refers to the process where the raw oil, gas and water mix that comes out of a well is separated into their constituent parts. Within the industry, 'Production' usually refers to the factory-like installations that are surrounded by pipes. These pipes reticulate and distribute the oil, gas and water through a separation process.

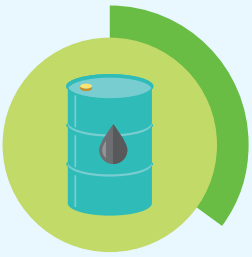
Once complete, the separated oil is transported, either by pipe or truck, to the nearest port for export to refineries (predominately in Australia and Singapore) or for further processing and/or distribution in New Zealand.

Gas, once suitably purified, is compressed and then transported by pipe for distribution around the North Island. This type of gas is known as natural gas. LPG (liquid petroleum gas) is also produced and then transported around the country by truck or gas bottles to be used domestically and commercially for heat and cooking and to power the BBQ!

All production stations are inspected multiple times a year by local government inspectors, and assessed against resource consent conditions. These inspectors make sure all activity adheres to resource consents granted by councils under the Resource Management Act. Central government regulators also regularly visit production stations to ensure these stations are operating safely.

Monitoring pays special attention to stormwater discharges, drilling mud storage and disposal, treatment facilities and receiving waters. Inspectors also monitor off-site receiving environments. Water samples are also taken of stormwater discharges.

"GAS ACCOUNTS FOR ALMOST HALF THE ENERGY USED FOR FOOD PROCESSING AND ONE THIRD OF THE ENERGY USED IN WOOD PROCESSING, WHICH COLLECTIVELY REPRESENT MOST OF NEW ZEALAND'S EXPORTS."



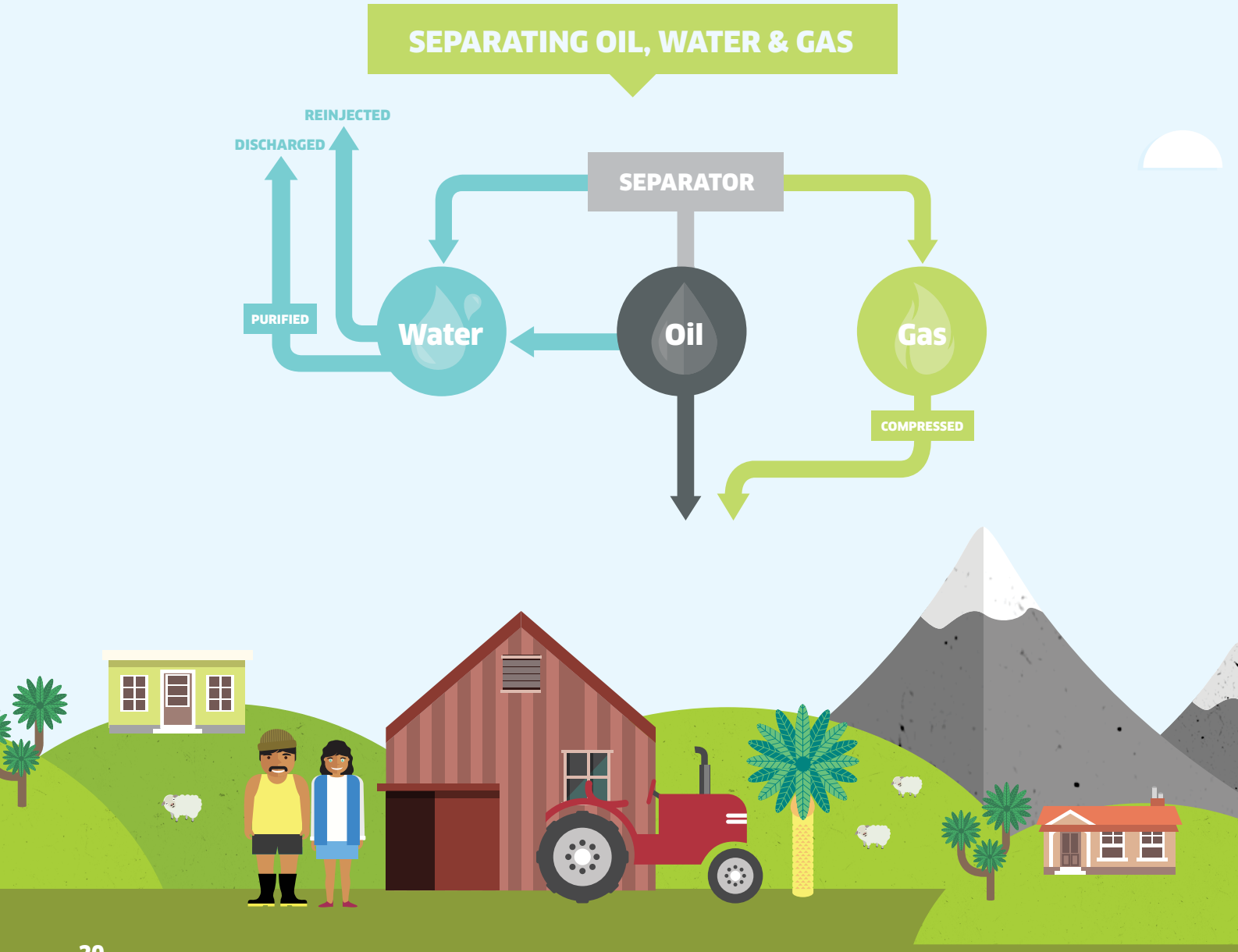
RIGHT NOW, OIL ACCOUNTS FOR ABOUT ONE THIRD OF THE WORLD'S PRIMARY ENERGY SUPPLY.

New Zealand's Oil Refinery

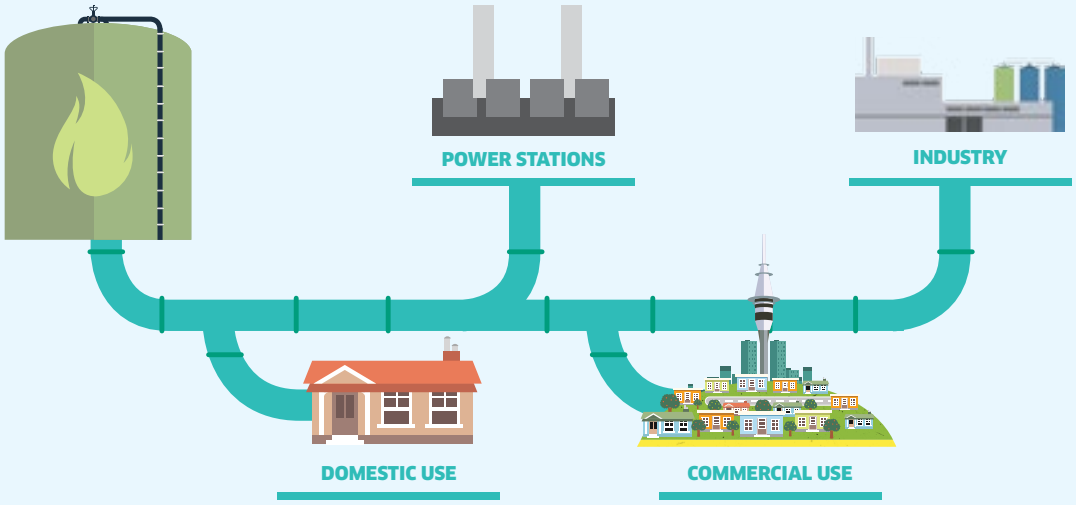
New Zealand's only oil refinery is at Marsden Point, Whāngārei, and it is designed to supply the majority of New Zealand's domestic demand.

The refinery began operating in 1964 and produces a full range of petroleum products from petrol and diesel to bitumen. It operates on low-grade (and relatively low-cost) Middle East crude oil. About 94 percent of the oil it processes is imported, with the remainder sourced from New Zealand fields.

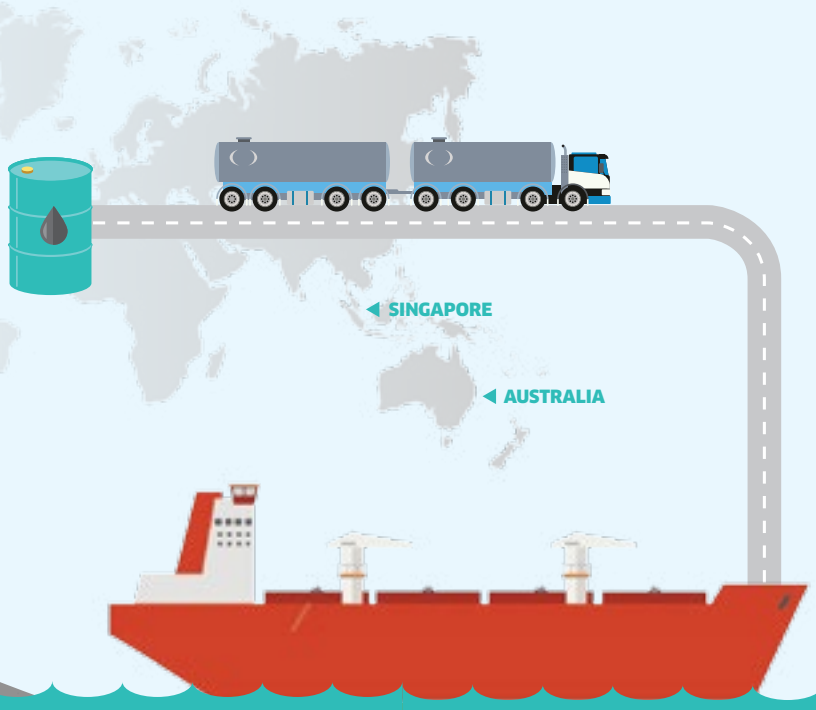
New Zealand's higher quality oil and condensate (light oil) are sold at higher prices on the international market – mostly to Australia and Singapore.



WHAT HAPPENS TO THE GAS



WHAT HAPPENS TO THE OIL



Landfarming

Drilling for oil and gas produces significant quantities of drilling cuttings. Cuttings consist of sedimentary rock, clay, hydrocarbons, minerals and salts.

The cuttings must be disposed of responsibly and sustainably. Landfarming involves spreading the cuttings over the land, which are then dug into the soil by tractors. The land is left for a period of time to allow naturally occurring microbes to breakdown the organic compounds found in the cuttings – particularly the hydrocarbons.

Landfarming requires resource consent. Before landfarming begins, baseline data is collected for surface water and groundwater quality, flow paths and soil characteristics. This information provides an assessment of the site suitability for a landfarming operation.

If resource consent is granted, monitoring by the regional council ensures consent conditions are complied with.

According to all reports and testing, landfarming is a safe and sustainable way of disposing of drilling cuttings. If landfarming does take place, the Ministry of Primary Industries advises that the land is not stocked and crops are not harvested until the concentration of hydrocarbons in the soil are at or below specified levels.

Landcare Research analysis has determined that once these levels have been reached, no risk to food safety or animal welfare exists and the land can be used for any purpose, including for stock or crops to produce meat, milk, fruit or vegetables.

Landfarming has actually been found to improve less productive and marginal farming land and make it more productive. Research has shown that when landfarming is done on sandy soils near the coast, it increases the value of the land from around $3,000 to $5,000 per hectare to $30,000 to $40,000 per hectare, representing major added value for the landowner.

“LANDFARMING HAS ACTUALLY BEEN FOUND TO IMPROVE LESS PRODUCTIVE AND MARGINAL FARMING LAND AND MAKE IT MORE PRODUCTIVE.”

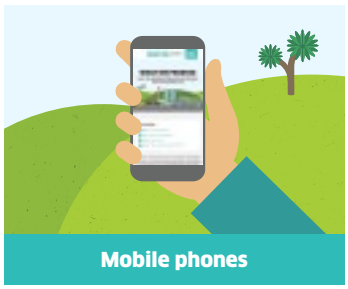
OIL AND GAS PRODUCTS

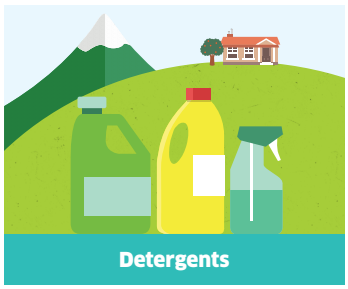
While oil and gas are used for transport fuels, heating, generating electricity and power industry, the unique properties found in hydrocarbons are used in the manufacture of thousands of everyday items – including plastics, clothing, detergents, telephones and medicines.

In New Zealand, gas is also used as an essential feedstock for urea (a fertiliser) and methanol production, industries that wouldn't exist in the country without a ready supply of gas.

Urea is produced at the Ballance agri-nutrients plant at Kapuni, which uses gas from the nearby gas fields. Urea is then used by farmers to make their land more productive, enabling them to produce more milk, wool and meat that can be exported.

Methanol is produced by Methanex at two facilities in Taranaki. Methanol is a major export product and is used in the manufacture of a variety of everyday products such as paint, DVDs, polyester and nylon.

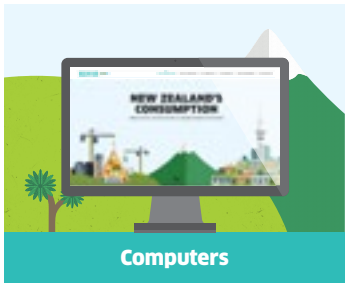

Mobile phones


Detergents


Footballs and boots

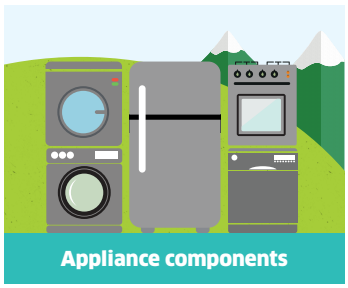

Cosmetics

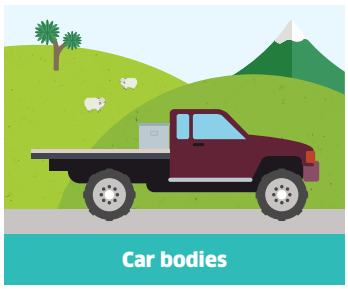

Eyeglasses



Computers


Tooth brushes


Appliance components


Car bodies

RESPONDING TO CLIMATE CHANGE

Reducing greenhouse gas emissions is a global issue that requires global engagement and action.

The 2015 United Nations Climate Change Conference in Paris, held in late 2015, negotiated the Paris Agreement, a global agreement to address the challenge of climate change, the text of which represented a consensus of the representatives attending it.

It was agreed to limit the global temperature rise to 2 degrees Celsius above pre-industrial levels, and pursue efforts to limit the temperature rise to 1.5 degrees Celsius.

Under the agreement, each nation is required to set an emissions target. New Zealand has pledged to reduce greenhouse gas emissions to 30 percent below 2005 levels by 2030.

To meet this target we will collectively need to reduce our emissions through greater efficiency and lower carbon intensity, investigate carbon capture and storage, and manage methane emissions.

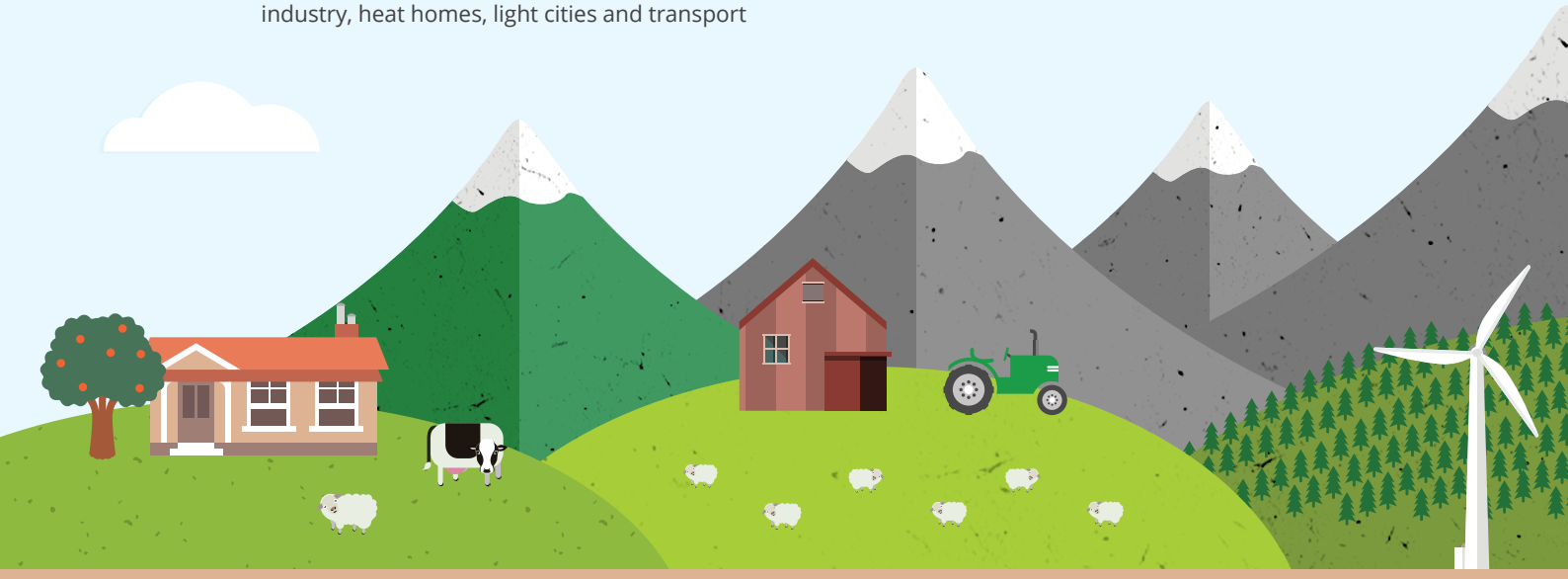
At the same time, the demand for energy is also growing as the world population increases, economies develop and we become more urbanised.

The world will continue to require access to affordable and reliable energy to power industry, heat homes, light cities and transport people and goods. Energy is a critical element in economic development and alleviation of absolute poverty. There are currently 2.2 billon people with no, or very poor, access to energy.

While there is no doubt the world's energy mix will change significantly over the coming decades, to meet the world's energy demand we will need to use more of everything.

Around the world, significant amounts of electricity are still generated by coal-fuelled power stations. The substitution from coal to gas is one of the fastest, lowest cost and most secure routes to reducing emissions for many countries. Direct use of gas and use of efficient gas technologies can lower energy related emissions.

Natural gas will be an important transition fuel as the world tackles climate change. Natural gas generates the least CO_2 of the fossil fuels, but retains all the advantages. Natural gas is instantly available, offsetting the intermittency of supply by solar and wind power – the sun does not always shine and the wind does not always blow. Gas is also relatively affordable and could be used as a transport fuel – particularly for heavy transport and shipping.



New Zealand's Unique Emissions Challenge

Unlike most other developed countries, New Zealand has fewer low-cost options to reduce emissions compared with most other developed countries.

While agriculture accounts for a small amount of most countries total emissions, in New Zealand agriculture emissions make up just over 49 percent of total emissions.

Further, unlike most other countries, New Zealand's electricity generation is dominated by renewable energy – with nearly 80 percent of electricity generated from renewable resources.

New Zealand has the third highest renewable primary energy supply in the OECD, only behind Norway and Iceland in our use of renewable energy. This leaves little room to achieve significant reductions in emissions in electricity generation.

Approximately 17 percent of New Zealand's emissions are from transport. In fact, transport emissions are greater than electricity, manufacturing and fugitive emissions (those caused by leaks) combined.

An Important Note on Carbon Leakage

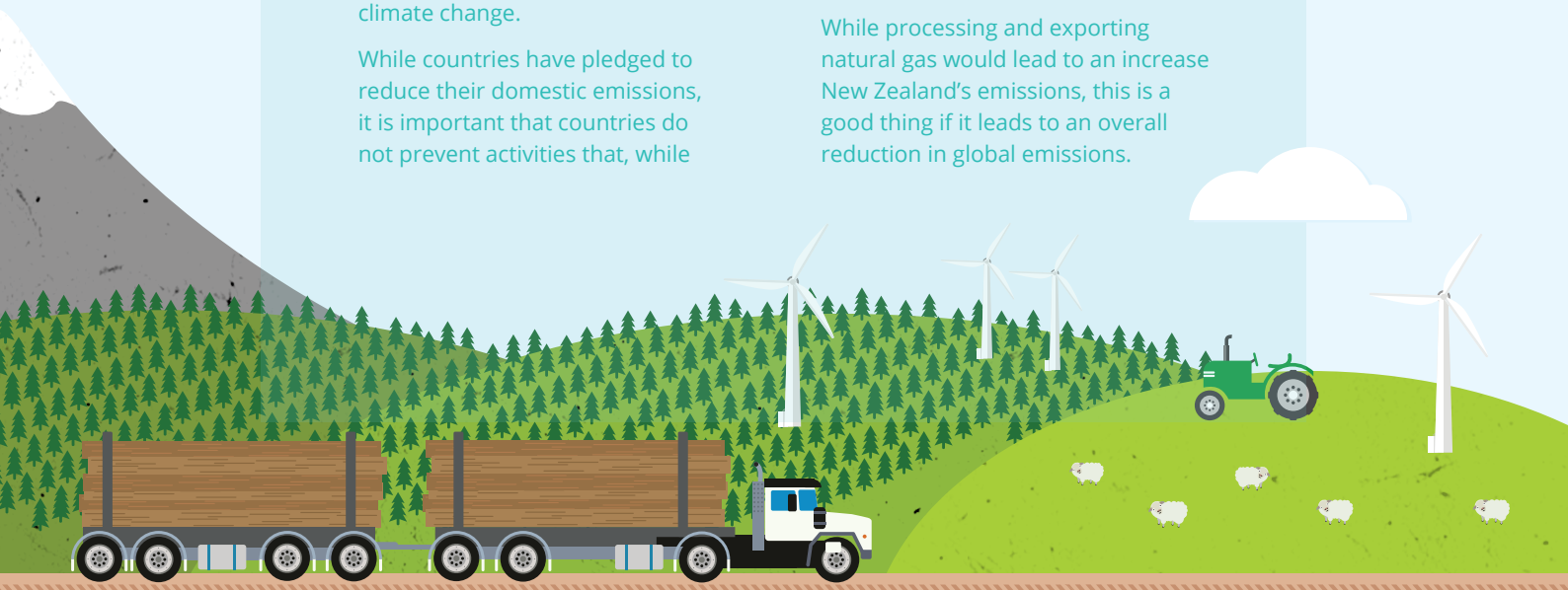
Carbon leakage occurs when emissions in one country increase as a result of an emissions reduction by a second country with a strict climate policy.

The climate does not care where carbon emissions come from. What matters is that total emissions are reduced to limit the impact of climate change.

While countries have pledged to reduce their domestic emissions, it is important that countries do not prevent activities that, while increasing their individual emissions, would lead to an overall global reduction in emissions.

For example, a very large gas find in New Zealand might allow large quantities of LNG to be exported to other countries, where it could be used to replace coal, which emits twice as much carbon dioxide as gas.

While processing and exporting natural gas would lead to an increase New Zealand's emissions, this is a good thing if it leads to an overall reduction in global emissions.



THE FUTURE OF OIL AND GAS

Access to affordable and reliable energy sources will continue to be critical in the modern world.

Oil and gas has been one of the cornerstones of the world's energy mix for over 100 years. Right now, oil accounts for about one third of the world's primary energy supply. It is over half if you include natural gas.

Oil and gas have provided the world with a high-quality energy source. Because oil is a liquid, it is easy to transport and store. It is stable and releases large amounts of energy, while natural gas provides instant energy that is cleaner to burn than coal.

Every year, the world uses 35 billion barrels of oil, or 96 million barrels per day (each barrel is 159 litres). While renewable energy will play an ever-increasing role in meeting the world's energy demands, it will take many years before renewables are in a position to replace oil and gas.

In fact, the International Energy Agency forecasts consumption of natural gas will grow by 50 percent by 2040 and oil demand will increase to almost 38 billion barrels per year, or 103 million barrels per day over the same period.

Energy demand will continue to be driven by a growing and increasingly urbanised and wealthy population. The world's population is expected to grow from around 7.5 billion in 2016 to 9 billion in 2040.

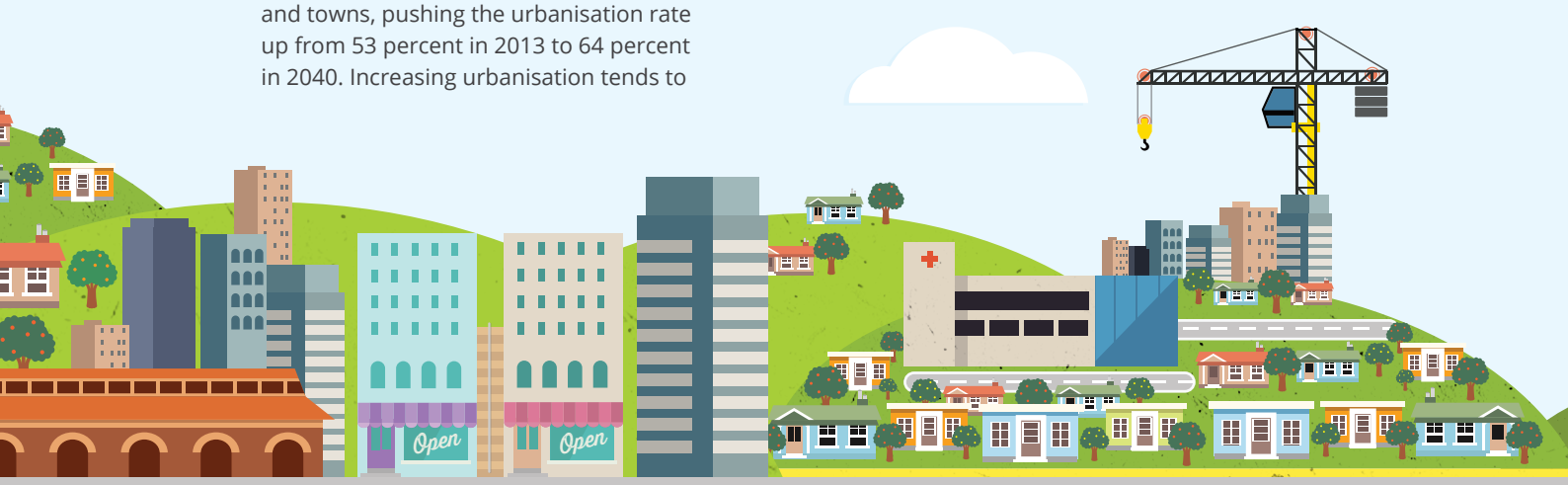
At the same time, the world's population will become increasingly concentrated in cities and towns, pushing the urbanisation rate up from 53 percent in 2013 to 64 percent in 2040. Increasing urbanisation tends to increase energy demand because those living in cities usually use more electricity – they need energy to commute to work, and their workplaces often require access to ready supplies of energy.

The rapidly growing middle classes in India and Asia will also consume increasing amounts of energy. Every year millions of people are being lifted out of poverty and as they become wealthier, they will demand more energy to enjoy the lifestyles afforded by the modern world such as car ownership, using more electronic goods and purchasing more consumables.

As economies develop, they also require access to reliable and cheap energy to power their industries and households. All of this means the world is going to need more energy in the future.

Primary energy consumption is forecast to increase by 37 percent between 2013 and 2035, with energy consumption expected to increase by 1.4 percent every year.

Meeting this demand will require massive global investments in all forms of energy supply and, while the use of renewables will grow significantly in some areas, for the foreseeable future oil and gas will still be the cornerstone of world energy, with forecasts predicting it will still makeup over half of the world's energy supply by 2040.



NEW ZEALAND'S POTENTIAL

Currently New Zealand's oil and gas production is concentrated in one basin – the Taranaki Basin.

The Taranaki Basin is only one of 17 sedimentary basins that surround New Zealand that have possible commercial quantities of oil and gas.

New Zealand remains underexplored by international standards. Approximately 96 percent of 'New Zealand' is underwater – a fact that holds significant implications for our economic potential and industries such as oil and gas. New Zealand is resource rich, yet only small amounts of our seafloor have been mapped or examined in detail.

As well as oil, exploration activities are also focussed on finding future gas reserves, which will remain an important component of New Zealand's energy mix. As our current gas supplies start to dwindle in the 2020s, we will need to find replacements, and this will likely drive exploration activity in the years ahead.

International interest in New Zealand remains strong. The country is viewed as a favourable investment destination with an open and market-based economy that relies on exporting goods, has strong regulatory settings and a stable political environment.

While the oil price has fallen in recent years, it is expected that prices will increase as demand growth outstrips supply growth. This is because the fall in oil prices in late 2014 led to a reduction in exploration activity around the world, with companies delaying decisions on where they invest their capital resources. In fact, global discoveries are at their lowest level since the 1940s.

This steep decline in exploration activity will inevitably lead to a future supply gap, driving prices up and encouraging renewed exploration activity to bring on new supplies.

There remains considerable potential for further discoveries. Whilst the ultimate extent of New Zealand's petroleum resources remains uncertain, successful exploration and development in these basins would significantly contribute to economic development both nationally and regionally.

A recent economic analysis has shown that a large gas discovery off the east coast of the South Island would be transformational for the country. If the gas was piped to shore, it could be used to make methanol, fertiliser and industrial heat for users such as dairy plants.

The study found that over $7 billion ($591 million every year) would be added to New Zealand's GDP during the 12-year construction phase and more than 68,000 jobs would be created. Once created, the field would support 3,200 jobs in ongoing operations.

Over the life of the field, up to $15 billion could be added to New Zealand's GDP and $32 billion of royalties and taxes could be generated.

> **"SUCCESSFUL EXPLORATION AND DEVELOPMENT IN THESE BASINS WOULD SIGNIFICANTLY CONTRIBUTE TO ECONOMIC DEVELOPMENT BOTH NATIONALLY AND REGIONALLY."**

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