



### **BOOST FOR GEOTHERMAL ENERGY**

An international consortium led by GNS Science is building new modelling software that will accelerate the development of geothermal resources worldwide. The powerful, opensource software will be particularly useful for New Zealand's geothermal industry, making geothermal development more efficient and more productive. It directly addresses two big challenges for the industry – improving the efficiency of existing fields, and developing reliable assessments of new geothermal resources. This contribution will help to meet New Zealand's target of generating 90% of our electricity from renewable sources by 2025.

# BETTER DETECTION OF VOLCANIC UNREST

By 2018 we will be advancing the development of remote and automated methods for monitoring the North Island's volcanoes. Our GeoNet project will employ a range of sensing devices and UAVs for early and reliable detection of volcanic unrest. A greater flow of data from fumaroles and crater lakes will enable faster and more robust detection of volcanic unrest and the development of short- term forecasts and automated detection of eruptions.

# **JULY 2017-JUNE 2018**



# REVEALING OUR STORMY PAST TO INFORM OUR FUTURE

GNS Science is working with national and international partners to extend our knowledge of the potential impact of global climate change on the Southern Hemisphere mid-latitudes. Comprehensive knowledge of the drivers that influence New Zealand's climate is limited by the short duration of the instrumental records. This is being addressed via high-resolution climatic archives that span millennia. Through our sediment and ice coring programmes, we will provide detailed environmental observations from Antarctica and New Zealand that will help to reduce uncertainties in the climate models used for predicting future change.

# PROBING THE HIKURANGI SUBDUCTION ZONE

In 2018 GNS Science will lead an International Ocean Discovery Program voyage to drill into the seafloor 50km east of Gisborne using the US ocean research ship JOIDES Resolution. This bold initiative is the first of its kind aimed at understanding slow-slip earthquakes, which are a feature of subduction zones worldwide. The ship will drill three boreholes into the seabed to take core samples and insert equipment to monitor activity on the subduction zone. Similar equipment could eventually be used in early warning systems for earthquakes and tsunamis along the East Coast.

# GNS SCIENCE PROFILE

**Institute of Geological and** Trading as GNS Science **Nuclear Sciences Limited** 

**Head Office** 1 Fairway Drive, Avalon, Lower Hutt 5010

**Other Locations** National Isotope Centre, 30 Gracefield Road, Lower Hutt 5010 Dunedin Research Centre, 764 Cumberland Street, Dunedin 9016

**Postal Address** PO Box 30368, Lower Hutt 5040

**Web Address** www.gns.cri.nz

Ownership Crown-owned entity, established under the Crown Research Institutes Act 1992

**Board** Chairman, Dr. Nicola Crauford

Deputy Chairman, Sarah Haydon

Director, Dr. John Sharpe

Director, Belinda Vernon

Director, Prof. Steve Weaver

**Executive Management** Chief Executive, Ian Simpson

Corporate Services Director and Chief Financial Officer, Graham Clarke

Natural Hazards Division Director, Dr. Gill Jolly

Geological Resources Division Director, Dr. Kevin Faure

Environment and Materials Division Director, Dr. Chris Daughney

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This addendum to our 2016-2021 Statement of Corporate Intent outlines our goals and priorities to meet the expectations of our Shareholding Ministers. The Government's expectations are clear: GNS Science's purpose is to undertake research that drives innovation and economic growth in New Zealand's geologically-based energy and minerals industries, that develops industrial and environmental applications of nuclear science, and increases New Zealand's resilience to natural hazards and that enhances understanding of geological and earth-system processes.

In January 2017, Ian Simpson appointed by the Board started as Chief Executive of GNS Science. Ian has signalled his intention to revitalise the organisation while remaining committed to delivering on a vision of a cleaner, safer, more prosperous New Zealand.

# Enhancing the monitoring of geohazards

The magnitude 7.8 Kaikoura earthquake continues to be a major focus for us. Analysis of the large amount of high quality data collected during and immediately after the earthquake has produced an impressive amount of applied science and there is more to come. There will be substantial

learnings from this event that will have many beneficial applications across New Zealand society and the economy.

We recently signed a contract with the Ministry of Business Innovation and Employment to develop a business plan for enhancements to New Zealand's geohazards monitoring system (EGM).

The first of these initiatives will be implemented during the next six months and include new tools for monitoring geohazards, new training, and new operating procedures. Woven into these initiatives will be lessons from the Kaikoura earthquake that will help to improve our response to earthquakes, volcanic eruptions, landslides, and tsunamis.

As part of the enhancement project, we are working with Australian and US partners to assess how we can improve tsunami monitoring in the Tonga-Kermadec region. When fully implemented, this will not only improve the monitoring of New Zealand's geological perils, they will also contribute to the safety and resilience of communities.

### Milestone in marine geoscience

Preparations are continuing for an unprecedented year-long series of marine geoscience research voyages in New Zealand waters to probe beneath the seafloor to better understand how planet Earth works. Starting in July



2017, the project is occurring under the auspices of the 26-nation International Ocean Discovery Program – the world's largest geoscience initiative. It involves the US-based research ship JOIDES Resolution undertaking six back-to-back voyages in New Zealand, each lasting about two months.

The ship will focus on issues of global importance – earthquakes, tsunamis, climate change, undersea volcanism, seafloor mineral deposits, gas hydrates, and deep-sea microbial communities. The project will contribute to scientific advances in all these areas that will have relevance for decades. GNS Science is either a leader or participant in all six voyages. Cumulatively the voyages represent an investment of about \$150 million in New Zealand science, arguably the biggest ever single investment in our science.

# Strategic review of GNS Science

In the first half of calendar 2017, we started a major strategic review of GNS Science to examine what we are doing and ensure it is in line with the future needs of New Zealand. The aim of the review is to better define our vision out to 2023 and build a roadmap to get there.

Of crucial importance is how we integrate the reviews recommendations with our organisational direction under the Government's Strategic Science Investment Fund. Our 2016-2021 Statement of Corporate Intent will continue to be the basis for our strategic direction until the recommendations of the review are adopted. This is scheduled to occur in the first half of the 2017-18 financial year. As part of the review we will be reviewing our long-term capital expenditure plan and our dividend policy. Our 2017-18 budget and future outlook does not include any costs or benefits arising from the implementation of the review recommendations.

NILOS

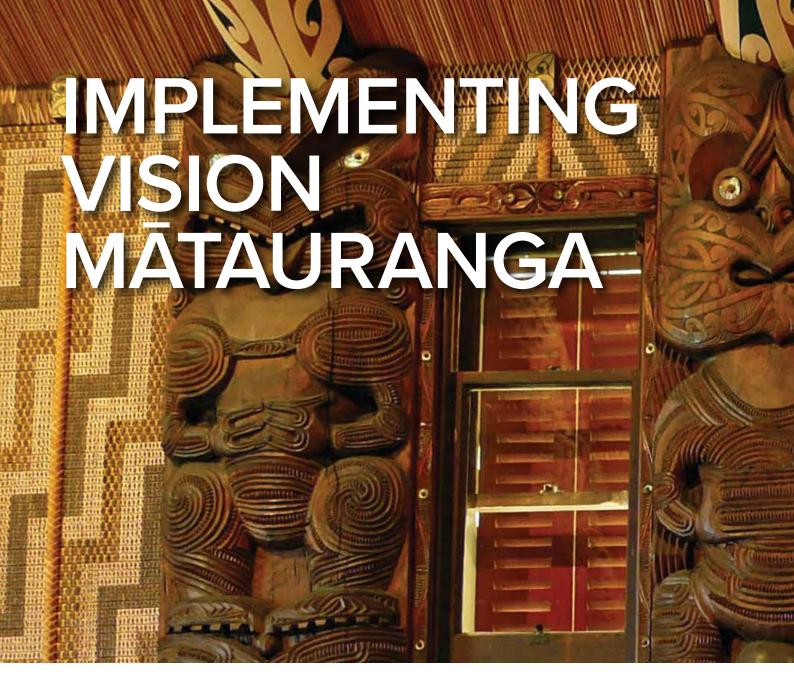
Dr Nicola Crauford,

Chairman

Shydan

**Sarah Haydon,** Deputy Chairman

DELIVERING ON OUR VISION 7



Our refreshed Māori strategy - Te Rautaki Māori - is guiding our efforts to support Māori-relevant science and innovation and contribute to the social, economic, and environmental aspirations of Māori. Our aim is to unlock the potential of GNS Science-Māori relationships to create mutual value.

We do this within the context of our vision of science for a cleaner, safer, more prosperous New Zealand. Te Rautaki Māori describes six principles that GNS Science will follow to build meaningful relationships and enduring partnerships with Māori.

The first of these, Kaitiakitanga refers to our own steward ship role as custodians of New Zealand geological information and also our potential to assist Māori with their kaitiakitanga responsibilities and desires.

The second, Manākitanga refers to our relationships and sharing (which includes our partnering with Māori in our research programmes). Third, Whakamaea aims to increase our visibility with Māori, and the relevance of our work to meet Māori needs and interests.

Fourth and fifth, Tikanga and Whakapakari tāngata aim to strengthen our internal processes and the skills of our staff to create strong relationships with iwi.

Sixth, Umanga Māori is about investing in our business approach with Māori so that our research is relevant to Māori business needs. Te Rautaki is aligned closely with He Kai Kei Aku Ringa, the Government's Māori economic development strategy.

An initiative that embodies many of these principles is our Māori internships which are offered annually with the aim of increasing Māori capability in geosciences. Between one and four internships are offered each year.



Prospective interns are invited to apply from high schools and Victoria University with internships lasting from two to 12 months depending on the work available and mutual agreement between both parties.

Interns are involved in a wide variety of work such as rock sample curation and preparation of samples for paleontological and geochemical analysis, plus routine microfossil and geochemical analysis and field work.

Interns develop practical skills in science and technology, they build confidence in doing science by interacting with scientists, and they learn about a range of topics and issues including petroleum exploration, climate change, and seismic surveys.

We encourage them to discuss their experiences with their whanau, hapu and iwi. The iwi benefit for having rangatahi with knowledge and skills in geoscience. GNS Science benefits by having enthusiastic and motivated Māori students to interact with on an almost daily basis.



The overall performance of the Company is monitored via the set of Key Performance Indicators in the table below. These include two GNS-specific indicators, and eight CRI generic indicators, upon which we will report annually; other information, of a commercial-in-confidence nature, is included in the Quarterly Reports to our shareholders. The KPIs should be seen as complementary to the 37 Measures of Success linked to the Research Initiatives and Impacts detailed in last year's SCI.

2017-18 deliverables are::

- » Carbon source and sink data are included in New Zealand emissions reporting.
- » Engaged in the process leading to the next IPCC report.
- Global volcanic impacts database operational and hosted by GNS
   Science, in collaboration with the US Geological Survey and the Global Volcano Model.
- An automated operational earthquake forecasting framework developed.
- » Uptake of the Measuring the Economics of Resilient Infrastructure Tool (MERIT) by key stakeholders.

- » Solutions for the control of corrosion, scaling, and reinjection are being employed by geothermal production companies to improve power station performance.
- » Involvement in the International Partnership for Geothermal Technology (IPGT) and the International Energy Agency-Geothermal Implementing Agreement (IEA-GIA).
- » Maps and associated data sets, interrogated and used for marine and land-use planning and decision making, hazard assessment and risk mitigation, and/or resource prospectivity assessment.
- » Publicly-accessible databases and collections regularly interrogated by research, government and commercial sector end-users, with data and samples making a significant contribution to analysis, decision making and risk reduction.
- » Develop a business plan for enhancements to New Zealand's geohazards monitoring system (EGM).
- » Complete GNS Strategic Review and develop implementation plan.

Indicator	Measure	Forecast 2017	Budget 2018	Outlook 2019
GNS Science Specific				
Organisational culture	Total recordable injury frequency rate, per 200,000 hrs	<1.3	<1.3	<1.3
	Staff proud to work for GNS Science (biennial climate survey)	N/A	90%	N/A

0 PERFORMANCE MONITORING



Indicator	Measure	Year ending 30 June	Forecast 2017	Budget 2018	Outlook 2019
CRI Generic					
End-user collaboration	Revenue per FTE from commercial sources (\$000)		85	82	88
	Papers with New Zealand co-authorship only		15%	15%	15%
Research	Papers with international co-authorship only		42%	42%	42%
collaboration	Papers with New Zealand and international co- authorship		37%	37%	37%
	Papers co-authored		93%	93%	93%
Technology transfer	Commercial reports per scientist FTE		1.0	1.0	1.0
Science quality	Impact of scientific publications (weighted citation index) <sup>1</sup>		3.0	3.0	3.0
Financial indicator	Revenue per FTE (\$k)		229	227	225
Stakeholder engagement²	Surveyed end-users who have confidence that GNS Science considers their sector's priorities when setting its research priorities		>70%	N/A	>70%
		rs who have confidence that le ability to assemble 'best'	>85%	N/A	>85%
		rs who have adopted knowledge n the past three years	>90%	N/A	>90%

<sup>1</sup>Mean 2-year impact factor for SCImago-assessed journals, weighted by the number of GNS Science publications <sup>2</sup>Based on the results of a biennial MBIE-commissioned Colmar Brunton Survey (>50 respondents)

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In recent years, GNS Science has delivered steady profit and cash flows while continuing to invest in its scientific equipment, IT infrastructure and facilities. In the short-term, we have received additional funding in relation to the Kaikoura earthquake and funding to develop a plan for Enhanced Geohazards Monitoring which includes implementing several short-term initiatives. This benefit is reflected in the 8.7% budgeted return on shareholders' equity for the 2017/18 year, which is higher than that forecast in last year's SCI. Whilst our long-term aim is to achieve an annual return on average Shareholders' equity of 8%, the business as usual scenarios presented show a lower level than this. Hence the commencement of a strategic review to refine the future focus of the Company. There will therefore likely be changes to costs and revenues that will arise as a result of the implementation of the review that are not reflected in the budget and forecasts for the coming years, given the impacts are as yet unknown.

MBIE Strategic Science Investment Funding related to Platforms and Databases is assumed to remain flat throughout the planning period. The 2017/18 year reflects the disestablishment of the large experiment fund. Future activities will be funded out of our annual SSIF allocation. We have already received special SSIF funding in relation to undertaking short term initiatives and developing a plan for Enhanced Geohazards Monitoring. This funding expires during the 2017/18 year and no continuation assumption has been included. Revenue from EQC to maintain and operate the GeoNet network is at levels agreed with EQC.

GNS Science has some contestable funding proposals expiring during the 2017/18 year which are reflected in the forecast. We have assumed we win a small level of Endeavour, Marsden and other contestable proposals that we have recently submitted. The plan also reflects changes in commercial revenue aligned with opportunities in our various sectors.

The plan shows an increase in salary costs in 2017/18 with an increase in FTE to strengthen some corporate and science areas, particularly relating to geohazards monitoring and risk. There are also increases in research contracts costs in 2017/18 relate to the Natural Hazards Platform and the Resilience to Natural Hazards Challenge activities. The budgeted Group revenue for

2017/18 is \$89.8 million with total costs of \$79.8 million, creating an EBITDA of \$10.0 million.

The capital plan includes the on-going investment in scientific equipment to support our research activities and to secure new revenue streams. Our rolling IT upgrade and our building and facility refurbishment programmes will continue. Planning has commenced on renovating one of our buildings at Wairakei and on an adaption of space in our Avalon facility. Our capital programme will continue to be funded through existing resources and operating cash flows.

A dividend payment of \$250,000 has been forecast in the 2017/18 financial year.



### Risks

There is forecasting uncertainty associated with our revenue budgets:

The MBIE Endeavour contestable funding system is an extremely competitive process. There is a risk that replacing expiring contracts in 2018/19 and winning additional projects in the following years will not be achieved.

The achievement of our commercial revenue targets is subject to the market and the economic climate, which have been increasingly volatile over recent years. Commercial revenue is rated as a high risk for the Company. Over the last financial year, we have focussed on strengthening our business development and project management capability to mitigate this risk.

GNS Science's budgeting has been prepared on a business as usual basis and we have established achievable targets, within the limitations outlined above regarding the strategic review. There is the upside opportunity, like that experienced in 2016/17, to mitigate any downside risk. GNS Science has the necessary cash reserves to address adverse trading conditions should they occur, without recourse to the shareholders for financial support. We will actively monitor and respond to any risks that emerge.

### **Commercial value**

Section 16(3) of the CRI Act requires the Company to furnish an estimate of the current commercial value of the Crown's investment. We use net asset value as a proxy for the commercial value of the Group. The net asset position as shown in accordance with the company's accounting policies for 30 June 2016 was \$31.5 million.

### **Dividend policy**

Our dividend policy is that funds surplus to the Company's investment and operating requirements, as determined by the principles outlined below, will be distributed to the shareholders. In determining surplus funds, consideration will be given to:

- » Providing for capital investment requirements (including equity investments) without recourse to the Crown for equity injections to the Company;
- Opportunities for internal development expenditure or costs in relation to implementing the strategic review;
- » The Group's working-capital requirements;
- » The short, medium, and long-term financial viability of the Company, including its ability to repay debt, the level of revenue held in advance;

- » Risks of meeting our financial targets; and
- » The obligations of the Directors under the Companies Act 1993 and other statutes.

We will review this policy and the level of dividend as part of the strategic review.

The Board will detail, in a submission to shareholding Ministers, within two months of the end of each financial year:

- » The amount of dividend (if any) recommended to be distributed to the shareholders; and
- » The percentage of tax-paid profit that the dividend represents.

### Compensation

Where the Crown wishes us to undertake activities or assume obligations that will result in a reduction of our profit or net worth, the Board will seek compensation sufficient to allow the Company's position to be restored. No compensation is currently being sought from the Crown.

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Group Ratios and Statistics						
Year ending 30 June	Forecast 2017	Budget 2018	Outlook 2019	Outlook 2020	Outlook 2021	Outlook 2022
Revenue (\$000)	85,600	89,814	88,674	90,738	92,795	94,307
Revenue growth	12%	5%	-1%	2%	2%	2%
Operating results (\$000)						
Operating expenses and depreciation	81,696	85,762	86,069	87,924	89,449	91,020
EBITDA	9,764	10,052	8,685	9,014	9,646	9,687
EBIT	1,408	3,904	4,052	2,605	2,814	3,346
Profit before tax	4,284	4,322	2,875	3,084	3,616	3,557
Profit after tax	3,084	3,112	2,070	2,220	2,604	2,561
EBITDA per FTE	10	10	7	7	8	8
Total assets	60,827	60,064	61,196	62,736	64,167	67,065
Total equity	34,296	37,158	39,228	41,448	44,052	46,613
Capital expenditure	6,000	7,000	8,500	8,500	7,300	7,300
Liquidity						
Quick ratio	2.23	1.97	1.82	1.67	1.66	1.78
Profitability						
Return on equity	9.4%	8.7%	5.4%	5.5%	6.1%	5.6%
Operating margin	4.6%	4.5%	2.9%	3.1%	3.6%	3.5%
Return on capital employed	26.4%	25.2%	20.7%	20.4%	20.6%	19.6%
Operational risk						
Profit volatility	15.2%	15.8%	14.4%	12.4%	5.3%	5.3%
Forecasting risk	-1.5%	-0.7%	-0.1%	0.3%	0.5%	0.0%
Growth/Investment						
Capital renewal	102%	117%	140%	137%	116%	114%
Dividend (\$000)	250	250	-	-	-	-
Financial strength						
Equity ratio	56%	62%	64%	66%	69%	70%
Cash and short term deposits (\$000)	15,247	12,844	10,896	9,356	9,207	10,620

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# ACCOUNTING & BUSINESS POLICIES

The Institute of Geological and Nuclear Sciences Limited is established under the Crown Research Institutes Act 1992 and the Companies Act 1993. Its subsidiary companies are established under the Companies Act 1993. The financial statements have been prepared in accordance with the Crown Research Institutes Act 1992, the Public Finance Act 1989, the Companies Act 1993, the Crown Entities Act 2004 and the Financial Reporting Act 1993.

Consolidated financial statements for the Group comprising the Institute of Geological and Nuclear Sciences Limited (the Company) and its subsidiaries are presented.

The principal activities of the Company are to undertake geoscience and nuclear science research, development and consultancy, predominantly in New Zealand.

The financial statements have been prepared in accordance with New Zealand generally accepted accounting practice. They comply with New Zealand equivalents to International Financial Reporting Standards and other applicable Financial Reporting Standards, as appropriate for profitoriented entities. The financial statements also comply with International Financial Reporting Standards.

The financial statements of the Group have been prepared on an historical cost basis, except that derivative financial instruments are measured at their fair value.

The financial statements are presented in New Zealand dollars, which is the Group's functional currency. All values are rounded to the nearest thousand.

Subsidiaries are those entities controlled by the Company. Control is achieved where the Company has the power to govern the financial and operating policies of an entity to obtain benefits from its activities.

The financial statements of subsidiaries are included in the consolidated financial statements using the purchase method of consolidation. The effects of intra-group transactions are eliminated in the consolidated financial statements.

A joint arrangement is an arrangement whereby the Company or its subsidiaries have joint control over an entity. Joint control is the contractually agreed sharing of control of an arrangement, which exists only when decisions about the relevant activities of that entity require the unanimous consent of the parties sharing control. A joint arrangement is either a joint

operation or a joint venture. For a joint operation the Group recognises its share of assets, liabilities, revenues and expenses on a line-by-line basis using the proportionate method. For a joint venture the Group recognises its interest in a joint venture as an investment and accounts for that investment using the equity method.

In applying the accounting policies, there is the requirement for judgements, estimates and assumptions to be made about the carrying amounts of some assets and liabilities. The estimates and assumptions are based on historical experience and other relevant factors. Actual results may differ from these estimates.

Further detail in respect of the accounting policies for the Group is set out in the GNS Science Annual Report for the year ended 30 June 2016. No significant changes in accounting policies are envisaged between the above policies and the budget and forecast information included in this document.

# Shareholder consent for significant transactions

The Board will obtain prior written consent for any transaction or series of transactions involving full or partial acquisition, disposal or modification of property (buildings, land and capital equipment) and other assets with a value equivalent to or greater than \$10 million or 20% of the Company's total assets (prior to the transaction), whichever is the lesser.

The Board will obtain prior written consent of shareholding Ministers for any transaction or series of transactions with a value equivalent to or greater than \$5 million or 30% of the Company's total assets (prior to the transaction) involving:

- acquisition, disposal or modification of an interest in a joint venture or partnership, or similar association;
- » acquisition or disposal, in full or in part, of shares or interests in a subsidiary, external company or business unit;
- » transactions that affect the Company's ownership of a subsidiary or a subsidiary's ownership of another entity; and
- » other transactions that fall outside the scope of the definition of the Company's core business or that may have a material effect on the Company's science capabilities.

### Investments in capital assets

We will invest in capital equipment and facilities that will enhance our ability to develop our business and provide an appropriate rate of return on the investment. Return on investment will be monitored to provide a basis for future investment decisions.

### **Procurement of services**

We will continue to assess the procurement of services, facilities and resources that may be shared among the Crown Research Institutes and other related organisations. This assessment will involve the use of All of Government purchase arrangements negotiated by MBIE and other government agencies.

### **Databases and collections**

The Company has policies on the management of its data and collections, which comply with applicable legislation, including the Official Information Act 1982, the Commerce Act 1983, the Crown Research Institutes Act 1992, and the Privacy Act 1993.

We will make our scientific datasets and collections publicly available using a suitable Creative Commons license, except: 1. when data or collections were obtained or created for a third party. In this circumstance we will maintain any agreed confidentiality or restriction on use until the data or collection has entered the public domain; or 2. when Creative Commons licence terms are not appropriate, for example, where access fees are necessary to sustain our business by giving us a return on investment from our own resources.

Whenever possible we will adopt international, national, or industry standards applicable to the data. When this is not possible, we develop organisational standards.

A portion of our Strategic Science Investment Funding is received to enable us to maintain our databases and collections, and facilitating their wider use.

We will not dispose of, without the prior permission of the shareholders, any of the Nationally Significant Databases and Collections for which we have responsibility; nor will we dispose of any other database or collection we consider to be of national significance without first discussing this with the shareholders.

Regard will be held to the Crown
Research Institutes Act 1992 and the
Public Records Act 2005 when disposing
of any database or collection. We will
advise shareholders of any dispute
regarding the terms of access and use
of any Nationally Significant Database
or Collection. The Company will make
all reasonable attempts to settle the
dispute with the disputing party. We
will refer the matter to shareholders in
the absence of any agreement within
30 days of notification of a dispute. Any
decision by the shareholders will be
binding on the Company.

### Image credits

#### FRONT/BACK COVER

Mt Aspiring National Park, South Island, Cassie Matias - unsplash.com

### UPCOMING MILESTONES (pages 2–3):

Nga Awa Purua Geothermal Power Station, Wairakei, Mighty River Power/Tauhara North No. 2 Trust

Ruapehu erupting, Lloyd Homei

Icicles in Antarctica, Rebecca Roper-Gee, Antarctica New Zealand

Ocean view, Canterbury from IOIDES Resolution, Martin Crundwell

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Winter sunset Mount Ruapehu, Paul Grimwood

### IMPLEMENTING VISION MĀTAURANGA (pages 8–9)

Meeting House, Waitangi, Unknown

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Cliffs and Jagoon at Castlepoint, Wairarapa, Lloyd Home

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