BEFORE A PANEL APPOINTED BY THE MINISTER FOR THE ENVIRONMENT

UNDER The Resource Management Act 1991 (RMA)

IN THE MATTER of a draft national policy statement for freshwater management and proposed national environmental standards for freshwater

AFFIDAVIT OF Personal details removed

FOR

MERIDIAN ENERGY LIMITED

31 OCTOBER 2019

Solicitor acting:

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In-house counsel
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Counsel acting:

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Project Barrister
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QUALIFICATIONS AND EXPERIENCE

1 I am the Chief Executive of Meridian Energy Limited ("Meridian"). I have held this position for the last 2 years.

2 Prior to my appointment as Chief Executive I held senior management roles within Meridian including Chief Financial Officer, General Manager – for Markets and Production and then later General Manager - Retail. I held the position of General Manager for Markets and Production for around six years and this included the responsibility for:
   
i. Operating and maintaining renewable (hydro and wind) power stations;
   
ii. Offering generation, frequency keeping and instantaneous reserves to the wholesale electricity market;
   
iii. Purchasing electricity from the wholesale market to supply Meridian’s Retail and Powershop customers;
   
iv. Meridian’s health and safety framework;
   
v. Managing Meridian’s financial exposure to the wholesale electricity market by entering into financial contracts with other electricity generators and users of electricity;
   
vi. Developing a pipeline of new renewable generation options;
   
vii. Managing the procurement and construction of current and new renewable projects;
   
viii. Maintaining an ongoing relationship with the communities in which Meridian operates; and
   
ix. Overseeing the management of Meridian’s generation assets including the Waitaki and Manapouri Power Schemes.

3 I hold the qualification of Bachelor of Commerce and Administration and I am a chartered accountant. I am a member of the NZ Institute of Chartered Accountants.
SCOPE OF STATEMENT

4 My evidence covers the following topics:

a. A description of Meridian and its electricity generation activities;

b. A brief discussion on the significance of climate change as a major contemporary issue that must be addressed;

c. An overview of the New Zealand electricity system;

d. Opportunities that exist to decarbonise our economy;

e. The critical role that hydro electricity generation plays;

f. The importance of ensuring that any new policy documents issued by the New Zealand Government recognise the critical role that large hydro schemes play in providing low carbon electricity and flexibility within the electricity system to ensure that New Zealand is as well-positioned as it can be to respond to climate change.

5 In preparing this evidence I have considered the following reports and other material:

a. Interim Climate Change Commission Electricity Inquiry Final Report;¹


c. Transpower's report Te Mauri Hiku – Energy Futures.³

MERIDIAN ENERGY LIMITED

6 Meridian is a mixed ownership model company, that is majority owned by Her Majesty the Queen in Right of New Zealand (the “Crown”) and is dual listed on the New Zealand Stock Exchange (NZX) and the Australian Securities Exchange (ASX).

7 Meridian’s purpose is: Clean energy for a fairer and healthier world. The company delivers on that purpose by generating and selling electricity in New Zealand and Australia under two retail brands - Meridian and Powershop. Meridian also owns

² Available from www.productivity.govt.nz/low-emissions
³ https://www.transpower.co.nz/resources/te-mauri-hiko-energy-futures
a company called Flux that develops and licences the software platform on which Meridian, Powershop and a large UK electricity retailer offer their services and products.

8 In New Zealand Meridian owns and manages the nation's two largest hydro power schemes: the Waitaki Power Scheme (WPS) (from Lake Pūkaki down and comprising 6 power stations⁴), and the Manapouri Power Scheme (MPS). These hydro schemes produce approximately 90% of Meridian's New Zealand generation. Meridian also owns five wind farms in New Zealand: Te Uku (Raglan), Te Apiti (Manawatu), Mill Creek (Wellington), West Wind (Wellington) and White Hill (Southland). The location of these generation facilities is shown in the figure below.

9 Meridian has been committed to generating only from 100% renewable sources for the last 15 years. This has included leading the way with development of unsubsidised grid connected wind farms in New Zealand.

10 The company generates around 30% of New Zealand's current electricity production.

⁴ Two hydro stations in the Waitaki chain above Lake Pūkaki that utilise water from Lake Tekapo – Tekapo A and B - are owned and operated by Genesis Energy Limited, another mixed ownership model electricity company. The Tekapo stations are not included in the “WPS” as that phrase is used in my evidence.
11 Meridian’s hydro stations generate enough electricity to power the equivalent of around 1.7 million homes each year and its wind farms generate enough electricity to power the equivalent of around 190,000 homes each year.

12 The installed capacity of the MPS is 850MW, and it is New Zealand’s largest hydro station. From 2008 to 2017 MPS generated an annual average of 4738GWh of electricity, which represents around 11% of New Zealand’s total electricity demand over that period. The MPS is critical in meeting the electricity needs of the Southland community, and this is evidenced by the fact that even with the MPS in place there are times when Southland electricity demand exceeds supply, and electricity needs to be imported to the region from generation sources further north.

13 The Rio Tinto aluminium smelter at Tiwai Point near Invercargill is Meridian’s largest customer and the largest consumer of electricity in the country, consuming around 13% of New Zealand’s national demand, equivalent to around 37% of Meridian’s annual average generation production. The smelter majority owners have recently announced that they are undertaking a strategic review of the facility. The review is expected to be concluded by the end of the first quarter in 2020.

14 The proposed construction of the smelter at Tiwai Point provided the catalyst for the construction of the MPS by the Government of the day, and what ensued was a famous environmental campaign to ensure that the design of the MPS did not have unacceptable effects. While the smelter provided the catalyst for the MPS it is important to emphasise that there is no direct electricity connection between the smelter and the MPS. All of the MPS’s electricity output is exported to the National Grid operated by Transpower (National Grid), and is then transmitted via the National Grid to meet demand in Southland (including the smelter) and elsewhere in the country.

15 The installed capacity of the 6 stations of the WPS owned and operated by Meridian is 1700MW, and it is the largest integrated multi-station renewable energy power scheme in the country. The WPS supplies around 18% of New Zealand’s total electricity demand.

16 Both the Schemes include the ability to store water. The significance of storage cannot be over-stated, and I discuss this further later in this statement.

17 In addition, the MPS and WPS provide other critical services to the electricity system in the form of frequency keeping and reserves, which ensure the electricity
grid remains stable and that the risk of a cascade failure is avoided if there is an outage or failure in another part of the electricity system.

18 Both schemes now form part of the existing fabric of the environments within which they sit. The MPS was first recognised as a potential scheme as early as 1904 while development of the WPS started from the late 1920s. Meridian has an active and comprehensive programme in place to protect and maintain the critical components of both schemes, including the various power stations, and water control and conveyance structures. As a result, the company expects both schemes to continue to operate as critical parts of the overall electricity system for many decades to come.

19 Meridian retails electricity across New Zealand with around 310,000 customers supplied through the Meridian and Powershop brands. Powershop has an additional 150,000 customers in Australia (electricity and gas). In the UK, the Powershop platform retails to customers via a franchise agreement.

20 Meridian is proud to be a member of FTSE4Good and Dow Jones Sustainability Index, one of only 3 companies in New Zealand on both indexes.

**CLIMATE CHANGE**

21 I believe that climate change is the single biggest environmental issue facing us all. It is the environmental challenge of our time. I am convinced that renewable electricity, and more particularly, available hydro-storage, is critically important as an enabler of New Zealand’s response to this issue, a matter to which I will return later.

22 Through the release of our Integrated Annual Report in August, we became the first New Zealand company to publicly disclose the risks climate change poses to our business. Meridian is now net zero carbon across our operations and we have committed to halve our gross emissions by 2030.

23 We already live in a world that is 1 degree warmer than pre-industrialisation levels, and we are seeing more and more frequent and extreme climate-related events such floods, hurricanes, and droughts. Our climate has already changed. At Meridian we use historical hydro inflow data (i.e. how much and when it has rained for each of the last 86 years for which we have reliable hydrological records) to develop sophisticated models to help us predict likely future inflows so that we can operate the MPS and WPS efficiently and within the environmental constraints imposed by the various river flow and lake level requirements under which we operate. At Meridian recognising that weather patterns are changing, we now put
greater weighting on the more recent rain records than those from 30, 50 or 80 years ago.

24 The overwhelming weight of scientific research and evidence tells us that what we all do over the next two decades will determine whether we live in a 2-degree warmer world (the aim of the Paris Agreement), or an even warmer world than that.

25 New Zealand along with 195 parties is a signatory to the Paris Agreement that requires all signatory countries to commit to net zero emissions globally by 2050. There is a useful summary of the Paris Agreement in the Productivity Commission Low Emission Economy Report and Box 2.2 from that report is reproduced as Exhibit A to my evidence. It is notable that developed countries are expected to take the lead in pursuing economy-wide emission reductions. This commitment is reflected in a number of Government initiatives including the Climate Change Response (Zero Carbon) Amendment Bill, the establishment of the Climate Change Commission and the setting of a Renewable Electricity Target of 100% renewable electricity in a typical hydrological year by 2035.

26 In NZ we have one of the highest emissions rates per head of population in the world, largely because of the size of our agriculture sector relative to our population. Our economy is highly geared around the production (and exporting) of food products.

27 It is sometimes suggested that given New Zealand’s total emissions are very small in a global context (they make up less than 0.2% of global emissions), why bother. But New Zealand’s size does not justify inaction. Around 30% of global emissions come from small emitting countries like us – collectively, small economies do matter and a global, concerted effort by all is needed to solve this issue. There is an opportunity to show genuine leadership that should also encourage other countries to work harder.

28 Simply being economically rationale, the real cost of carbon will start to emerge as an impost on all economies and in my opinion New Zealand’s ability to transform to a low or net-zero carbon economy will become a source of competitive advantage. While as a nation we could have chosen to defer action, and we might have got away with it for a while, we would have become less and less competitive in a global context. The Hon James Shaw (Minister for Climate Change) made this point when he moved the Bill for its First Reading:5

5 Hansard, Volume 738, sitting date 21 May 2019
The world around us is changing. Eighteen countries have already consistently reduced their emissions over the past decade, whilst their economies have continued to grow and develop. Joining those countries in the transition will ensure that New Zealand maintains and enhances our competitive advantage in a low-emissions world compared with those countries that do too little, too late. Climate change policy does not need to be a trade-off between economic development and emissions reductions. In fact, evidence so far suggests a correlation between reducing emissions and increasing productivity and wealth creation.

29 Therefore, I believe that the time to act is now. I support the Government’s ambition to be net zero carbon by 2050. Given what is at stake it is the only sensible ambition we can have. The passage of the Climate Change Response (Zero Carbon) Amendment Bill and the functions that will be carried out by the Climate Change Commission will provide direction for businesses and investors which will enable the long-term planning and investment in areas which enable practical and economically responsible decarbonisation.

NEW ZEALAND ELECTRICITY SYSTEM

30 The New Zealand electricity system (and electricity systems globally) is managed to balance three essential elements called the Energy Trilemma. The three elements are energy equity, energy security and environmental sustainability. These terms are defined by the World Energy Council as follows:

a. Energy Equity (including Cost and Affordability): Assesses a country’s ability to provide universal access to affordable, fairly priced and abundant energy for domestic and commercial use.

b. Energy Security: Reflects a nation’s capacity to meet current and future energy demand reliably, withstand and bounce back swiftly from system shocks with minimal disruption to supplies.

c. Environmental sustainability: Represents the transition of a country’s energy system towards mitigating and avoiding potential environmental harm and climate change impacts.

31 New Zealand is one of only 10 countries that achieve the top AAA ranking when assessed against the World Energy Council Trilemma Index. This assessment was most recently completed and reported on in 2019.⁶

32 New Zealand’s ranking is made up as follows⁷:

33 The New Zealand electricity system is made up predominantly of generation sources that are connected to the National Grid. The National Grid conveys electricity from where it is generated to where it needs to be consumed. In addition to operating the National Grid, Transpower also performs the role of system operator – matching changes in demand with directions to generators to increase or reduce generation to ensure instantaneously that supply and demand remain in balance. The National Grid delivers electricity to substations where it is transferred to local distribution companies that then convey electricity to the

⁷ https://trilemma.worldenergy.org/##/country-profile?country=New Zealand&year=2019, sourced 14 October 2019
businesses, households and other customers that are supplied power by retail companies. This is represented in the figure below with corresponding information about the annual average sources of generation and the annual average consumption by customer type.

**New Zealand electricity market**

![Diagram of New Zealand electricity market]

34 The New Zealand electricity system has moved from being approximately 65% renewable 10 years ago to now being around 85% renewable. This increase in the contribution of renewable generation has largely been due to new sources of wind and geothermal generation that have come into production. These new generation sources have been supported by existing flexible hydro generation.

35 It is also important to recognise that over much of this time there has been only modest demand growth. As I discuss later, this is not going to be the case over the next few decades.

**DECARBONISATION OPPORTUNITIES**

36 Our electricity sector is exceptionally well-placed to support New Zealand's transition to a low carbon economy. As I noted earlier, around 85% percent of our electricity is currently generated from renewable or low emission sources. As concluded by the Interim Climate Change Committee, this percentage is trending to increase to more than 90% within the next 15 years or so.\(^6\) As a result, carbon

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\(^6\) Interim Climate Change Committee (2019) *Accelerated electrification*, pg. 97
emissions from electricity generation, which are already relatively small, will naturally get smaller as new renewable generation gets built and existing non-renewable generation is retired. The growth in the expected percentage of generation from renewable sources over the next 15 years or so is even more noteworthy when it is recognised that over this period overall demand for electricity is expected to grow significantly, as I discuss below.

Massive opportunity to electrify and decarbonise the energy system
40% of total New Zealand emissions (31.3Mt CO₂e).

37 If we put agriculture to the side, the bulk of NZ's remaining emissions come from the energy sector - mostly transport and stationary energy like industrial heat processes that are typically fuelled by coal and gas boilers. That creates an exciting opportunity for us. We can increasingly decarbonise the energy systems that currently accounts for 32MT⁹ of CO₂e from the wider energy system through increased electrification, largely powered by renewable energy.

38 Transport contributes around 20% of total emissions and there are viable technologies now to drastically reduce those emissions. The global investment in electric vehicle research and development is immense. The available models and travel range for private vehicles will exponentially increase over the next decade, and more electric options for commercial and heavy transport operators are emerging all the time. It makes so much sense for New Zealand, with our large renewable electricity sector, and our need to import fossil transport fuel, to embrace the technology.

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⁹ MfE assess 2017 emissions for energy (stationary + transport + industrial processes) at approximately 33MT.
Likewise, industrial heat and stationary energy lends itself naturally to electrification which is many times more efficient than fossil fuelled base processes. We are now at a point where moving to renewable electricity is becoming much more economically attractive to consumers.

So, an incredible opportunity exists for New Zealand. To take advantage of it we need to ensure that we are able to significantly grow the amount of affordable renewable electricity we generate, and that as the amount of intermittent renewable generation (especially wind and to a lesser extent solar) generation grows we at least maintain the existing generation output and flexibility from storage that our large hydro schemes provide.

To put the importance of protecting the large hydro schemes in context I turn now to discuss in some more detail three inter-related factors, in addition to the decarbonisation opportunities I have already discussed, that will play out over the next three or so decades. They are:

a. Electricity demand is growing;

b. Existing thermal generation plant retirements are planned; and

c. New renewable generation infrastructure will be dominated by wind, geothermal and (to a lesser extent) solar. Wind and solar are both intermittent sources of energy, which means that they only generate electricity when the wind blows and the sun shines, and these environmental factors are uncontrollable, and do not always coincide with electricity demand.

ELECTRICITY DEMAND GROWTH PROJECTIONS

Below I set out a graph showing historical electricity demand (and the generation supply mix that met that demand) and a range of forecast future demand scenarios.
While the various forecast demand scenarios differ, they are all modelled by independent expertly advised agencies. The point of showing these demand forecasts is not to create an impression that any individual forecast is more or less likely than another. Rather, the point is to show that all scenarios point to significant demand growth.

Given the importance of combating climate change and maintaining secure and affordable electricity supply, it would be a major failure not to plan for future scenarios that fall within the ranges represented by these forecasts. The differences in the various demand forecasts reflect different assumptions regarding the rate of decarbonisation, and the rate of underlying demand growth.

The quotient of the existing generation supply that comes from thermal sources that will need to be replaced as New Zealand decarbonises is shown labelled coal and gas, and I discuss this in more detail below.

The large proportion of generation from hydro sources provides the foundation that will enable decarbonisation of the economy whilst ensuring security and affordability of electricity.

All scenarios demonstrate a considerable need for investment in new renewable generation. The Interim Climate Change Committee modelled this to be an
increase in installed capacity by 2035 of between 3,400 MW (business as usual) to 5,500 MW (accelerated electrification) as shown in the figure below¹⁰:

![Figure 4.3: Installed generation capacity in 2035](image)

48 To put this unprecedented growth into perspective, increasing generation capacity by 3,400 – 5,500 MW by 2035, would represent approximately:

a. Between two to three Waitaki Power Schemes or four to seven Manapouri Power Schemes, or

b. Between twenty five to thirty nine West Wind windfarms

49 My view is that new renewable investment is likely to be primarily in wind, geothermal and solar technologies. I do not foresee substantial new hydro generation, particularly with significant storage, unless there was a significant change in policy settings. This makes it imperative to protect the advantage our existing hydro generation provides to NZ.

THERMAL PLANT RETIREMENTS

50 Below I set out a figure showing expected generation plant retirements over the next two decades as existing plant reaches the end of its life.

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¹⁰ Interim Climate Change Committee (2019) Accelerated electrification, pg. 51
51 The point I wish to draw the Panel’s attention to is the significant amount of existing (thermal and renewable) generation that will likely come out of the system in the next 15 or so years. This is important to understand for three reasons.

52 First, as generation plant retires it needs to be replaced with new generation capacity simply to maintain current levels of output. Put simplistically, if 500MW of plant is decommissioned we need to install 500MW of new plant somewhere else to maintain the status quo. New generation infrastructure is therefore necessary even without demand growth.

53 Second, provided retiring thermal plant is not replaced on a like-for-like basis there will be a corresponding reduction in carbon emissions. That, on its own, can only be a good thing in terms of our climate change response.

54 Third, a major benefit of thermal generation is its flexibility. Thermal fuel resources are able to be stored, and gas and coal-fired generation is able to be switched on and off. As thermal plant is retired that flexibility and ability to use stored energy comes out of the overall system, and the importance of our large hydro infrastructure, with the flexibility it has as a result of the ability to store water, becomes ever more important.
EXISTING LARGE HYDRO IS CRITICALLY IMPORTANT TO NEW ZEALAND

55 In earlier parts of my evidence I have addressed the importance of the electricity output and flexibility of hydro as a renewable source of electricity with the ability to store fuel (water).

56 In this section of my evidence I describe how New Zealand’s hydro generation capacity is made up, and I emphasise the critically important nature of the small number of large hydro schemes that contribute the vast majority of hydro output and which contain most of our storage.

57 Below I set out a graph of the cumulative output of New Zealand’s 18 largest hydro scheme catchments11. Highlighted in blue are the 6 largest of those catchments. These are the 6 catchment schemes the Government has identified in its ‘exception’ policy in the Draft National Policy Statement for Freshwater Management.

58 The 6 largest catchment schemes together account for just over 90% of all hydro generation. The next 12 schemes combined (and indeed all remaining hydro

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11 The data for this graph is sourced from the Electricity Authority, and is available at https://www.emi.ea.govt.nz/Wholesale/Datasets/Generation/Generation_MD/
schemes in New Zealand combined) produce significantly less electricity than any one of the Waitaki, Manapouri, Waikato/Tongariro\textsuperscript{12} and Clutha schemes.

59 Meridian's schemes – WPS\textsuperscript{13} and MPS - are the two largest schemes and together account for over half New Zealand's total hydro generation.

60 The key point I would like the Panel to note is that as a country we have an incredible back bone of hydro generation that makes up between 50% and 60% of total electricity generation today. Hydro is our 'super' renewable foundation. What makes it super is that it can ramp up and down swiftly and seamlessly to enable our system to accommodate large amounts of 'intermittent' renewables that, for example, only generate when the wind blows or the sun shines. Hydro can fill in the gaps quickly and get out of the way quickly when not needed. In a way our hydro storage lakes are super large and efficient batteries. As a result, the cost of integrating intermittent generation like wind and solar into the electricity system in NZ is about $1/5$ of what it costs other countries like Europe and Australia.

61 The point I am making is that these large schemes both produce the majority of the electricity we need as a nation and provide the flexible renewable base upon which we can build large amounts of new intermittent renewable generation capacity while avoiding both security of supply issues and the need to retain large thermal generation capability.

62 The current and future alternatives to the storage flexibility that is provided by hydro generation in New Zealand are either: thermal fuel storage and electricity generation, a very large over building of baseload (renewable) generation, batteries or demand management and user efficiency.

63 Increased thermal fuel use is environmentally unacceptable in light of climate change. Over building baseload generation will impose massive additional costs on the electricity system that would ultimately have to be recovered from customers. Batteries will play a role in the future electricity system, and their cost is reducing, but they are still expensive and do not provide the scale of storage that hydro does – by way of example the storage capacity of Lake Pukaki is equivalent to 150 million Tesla Powerwall batteries and would cost approximately

\textsuperscript{12} Note that while Waikato and Tongariro (TPD) are shown as separate schemes on this graph and are addressed as separate schemes in the Draft National Policy Statement, the two schemes are related in the sense that the TPD diverts water into Lake Taupo, and from there the water flows through the Waikato Scheme

\textsuperscript{13} The Waitaki figure in the graph is for the Waitaki catchment and accordingly incorporates all 8 stations in the Waitaki chain, including the Genesis-owned Tekapo A & B stations. If those two stations were removed the 6 remaining stations operated by Meridian would still be the nation's largest scheme.
$1.8 trillion at current rates\textsuperscript{14}. Demand response and increased user efficiency is definitely one of the ways that electricity supply and demand will be managed in the future but it will be together with supply side growth. Greater energy efficiency and demand response assumptions are factored in by all organisation that develop models of demand growth forecasts that I referenced earlier.

CONCLUSION

64 I am advised by counsel that the proposed provision in the Draft National Policy Statement intended to protect the contribution the large hydro schemes make to New Zealand's climate change response (including the Meridian schemes I have described in this evidence), requires regional councils to do no more than just consider the importance of those contributions. If that is the case the possibility exists that regional or more parochial interests could prevail over those national values, with the result that these critical renewable generation assets could lose some of their flexibility or electricity output.

65 For the reasons I have explained in this evidence I think that kind of outcome is a significant risk that needs to be guarded against. I cannot over-emphasise to the Panel how important these big hydro schemes are, and my request is that you recommend to the Minister for the Environment that these schemes be given much greater protection.

\textsuperscript{14} The basis for this calculation is hydro storage in lake Pukaki between lake ranges of 516.4m - 532.5m is 1,950GWh. The equivalent storage could be provided by 150million Tesla Power 2 batteries (at 13kWh each). Those batteries at current prices would cost $1.8 trillion (at $12K each). The batteries would also need to be charged.
The Paris Agreement

Since 2015, 195 parties, including New Zealand, have signed the Paris Agreement, committing to the goal of net-zero emissions globally in the second half of this century (Box 2.2).

Box 2.2 The Paris Agreement

The central aim of the Paris Agreement is to keep global average temperature rise this century well below 2°C above pre-industrial levels, and to pursue efforts to limit temperature increase to 1.5°C. The Agreement entered into force in November 2016.4

To achieve these temperature outcomes, the Agreement aims to peak global emissions as soon as possible, and to later undertake rapid reductions to reach net-zero emissions in the second half of this century. Net-zero emissions means balancing the amount of GHGs emitted into the atmosphere with the amount of GHGs removed from the atmosphere by sinks (e.g., forests).

Under the Agreement, each government must communicate their Nationally Determined Contribution (NDC) every five years. Each NDC outlines a country’s chosen ambition for emissions reductions, taking into account its domestic circumstances and capability. These commitments are voluntary. However, failing to comply with these commitments puts a country at risk of being “named and shamed” by the international community, and suffering reputational damage.

Emissions reductions pledged so far in NDCs cover roughly only a third of reductions needed to achieve the 2°C target. Countries are expected to set increasingly ambitious emission reduction targets. Article 4 of the Agreement requires developed countries like New Zealand to take the lead in pursuing economy-wide emissions reductions. The Agreement also encourages countries to prepare a long-term development strategy by 2020, which sets out its policy approach to transitioning to a low-emissions economy.

Source: UNEP (2017a); UNFCCC (2018b).

A Solicitor of the High Court of New Zealand

31/10/19