ELECTRICITY AUTHORITY
TE MANA HIKO

ADJUSTING TO NEW ZEALAND'S ELECTRICITY FUTURE

INTRODUCTION

It's a challenging and exciting time in New Zealand's electricity sector as innovation and technology developments are rolled out. Consumers have more choice and control than ever before – they can choose when and who to buy their electricity from, and on what terms.

At the same time, there is a global trend towards more renewable generation. New Zealand is taking a clear lead in this: we've already seen renewable electricity generation sources increase by 20 percentage points over the last decade.

Although driven in part by the Emissions Trading Scheme, the increase in renewables has also been helped by the relatively low cost of wind and geothermal generation, making it a viable economic choice. Developments in the hedge market have played a significant role, in addition to having a well-functioning spot market that signals scarcity.

Over the next few years, these factors look set to increase the contribution of renewables well beyond New Zealand's current level of around 85 per cent in normal hydrological conditions.

The falling cost of solar generation and battery storage technology is also likely to boost renewable generation in New Zealand. These cost trends reflect efforts made by other countries to improve those technologies and lift the share of renewables in their own generation.

Other advanced economies are lagging well behind New Zealand – in the United Kingdom, United States and Australia, renewables make up less than 25 per cent of total electricity generation. New Zealand's increase from 65 per cent to around 85 per cent renewables over the last 10 years sits in stark contrast to those and other countries' results.

To create a balanced electricity system, governments around the world typically pursue three core goals: reliable supply, reasonable prices and, in recent years, higher levels of renewable generation. Setting policy in one area has potential to upset the balance in the other areas. Unfortunately, there are a number of international examples to illustrate this.

Regardless of how the sector changes, the Electricity Authority's role is to promote competition, reliability and efficiency in the industry for the long-term benefit of consumers.

As the sector evolves, we may need to alter the way we regulate it to meet our reliability and security of supply obligations under the Electricity Industry Act.

JOURNEY SO FAR

1996

Competitive wholesale energy market begins

1998

Electricity Industry Reform Act 1998 requires full separation of distribution and supply

2003

Electricity Commission established

2008

65% electricity generation from renewable sources

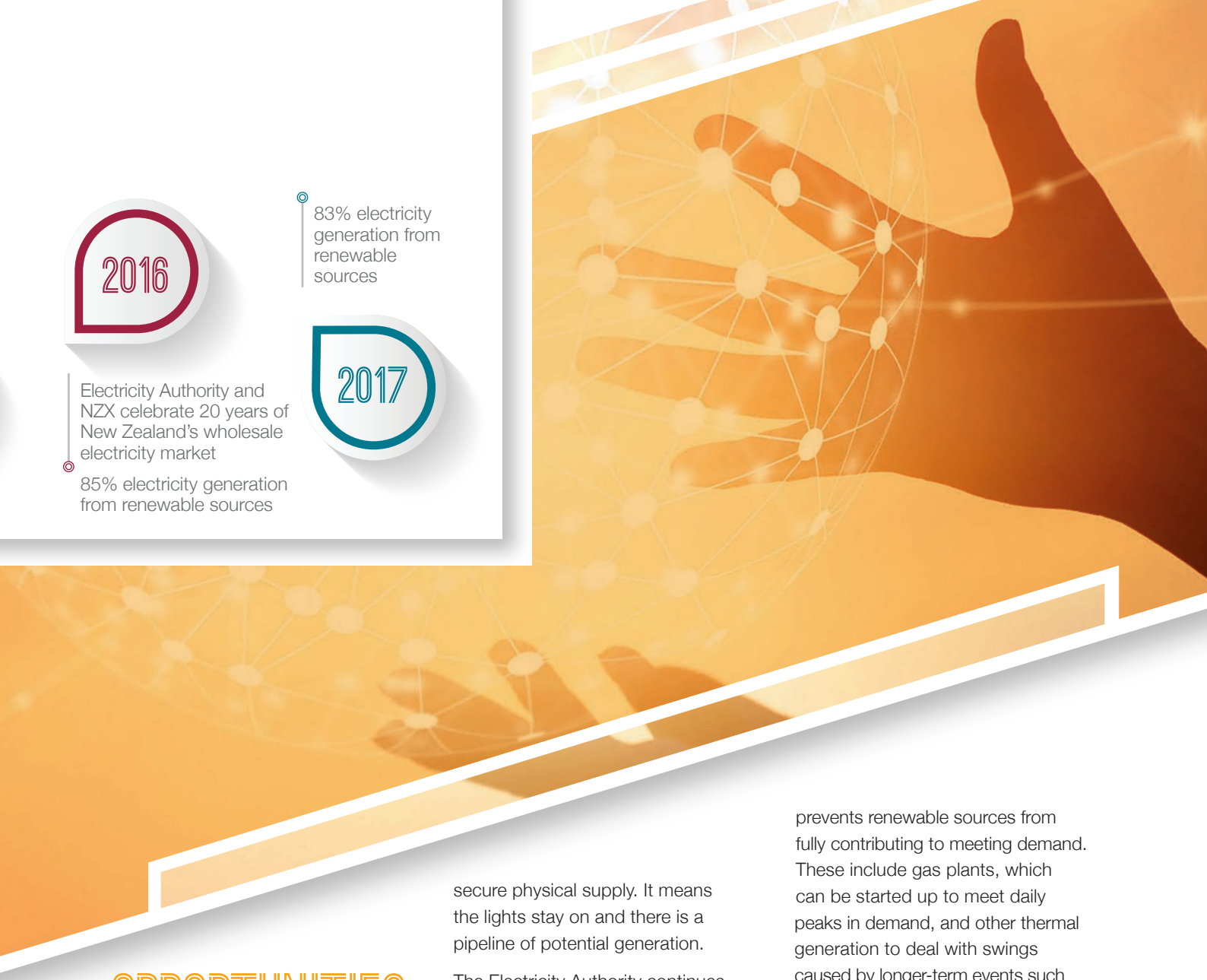
2010

Electricity Authority established

STATE OF PLAY

Some renewable generation is inherently intermittent, such as wind and solar. For wind generation, the wind must blow, but not too hard. Solar power cannot be generated at night, and cloud cover can significantly affect output. While battery storage can modify the intermittent performance of these sources, it is an added cost.

An electricity system with high penetration of wind and solar is likely to face volatile supply from hour to hour and month to month. However, New Zealand is well placed to deliver a secure electricity system that can cope with greater volatility in supply from increased intermittent generation.



OPPORTUNITIES

1 AN ELECTRICITY SYSTEM THAT IS NIMBLE AND RELIABLE

New Zealand benefits from having an electricity system that is secure and flexible. Consumers have a fantastic range of choices available to them, and dry episodes are managed in ways that maintain consumer and investor confidence – largely thanks to better information and incentives for electricity generators and retailers from the reforms introduced in 2011 and 2012.

Requiring market participants to manage their commercial risks, rather than relying on conservation campaigns, has led them to act in ways that support secure physical supply. It means the lights stay on and there is a pipeline of potential generation.

The Electricity Authority continues to modify elements of New Zealand's electricity system to further promote secure electricity supply – especially with increasing renewable generation.

As an example, consumers – in particular industrial and commercial users, but increasingly residential customers – can face strong incentives to modify their electricity demand from the grid when supply becomes tight relative to demand. They can do this by entering into a contract that offers them access to spot market prices and then reducing their consumption when prices are high. We saw this behaviour over winter 2017, when there was a clear trend of industrial and residential consumers on spot price contracts cutting back their electricity use when prices reached daily highs at peak times.

The country has plenty of backup options for when the weather prevents renewable sources from fully contributing to meeting demand. These include gas plants, which can be started up to meet daily peaks in demand, and other thermal generation to deal with swings caused by longer-term events such as low hydro inflows.

New Zealand also has markets for instantaneous reserve and frequency keeping that help ensure the supply of electricity is stable and secure. Instantaneous reserve kicks in when there's a sudden loss of electricity supply. In 2016, we worked with Transpower to improve the inter-island link to enable reserves to be shared across the North and South Islands. The market for frequency keeping has also been extended across both islands.

These types of initiatives work together to support the security of supply to New Zealand homes and businesses and have enabled us to steadily increase generation from renewable sources. As New Zealand lifts its renewable generation beyond the current level, we can continue to make modifications, including reducing barriers to the use of

batteries and encouraging consumers to change their behaviour, to maintain security and reliability.

2 NEW ZEALAND IS ON A RENEWABLE PATH

New Zealand has a great foundation on which to build higher levels of renewable generation. Existing generators and those proposing new generation are clearly optimistic about the industry and confident about where the electricity sector is heading.

Generators are naturally choosing to increase renewable generation for a range of reasons. One is that some consumers are asking for clean, green electricity and New Zealand's competitive retail electricity market ensures that, to win and retain customers, players in the market cater to that demand. Another reason is that renewable generation is often the cheapest investment option.

A key driver of investment in renewables is the Emissions Trading Scheme, which increases the current and expected future costs of plant with high emissions. The scheme provides an incentive to shift to lower-emission electricity generation. It also provides incentives for those on the demand side, such as industrial companies, to switch to electrical generation.

Investment in generation is a long-term commitment, and it is not just the current price attached to emissions that is important for decision making. The expected future costs of emissions can be even more important. It matters that New Zealand has had a relatively stable scheme for a decade and the scheme is no longer a topic of significant debate.

Investors in New Zealand generation can be almost certain they will have to meet the expected costs of emissions over the life of the plant.

The steadily decreasing cost of renewable technology is another motivator. The installation cost of solar panel systems has decreased 75 per cent in New Zealand in the last decade. There have also been improvements in the efficiency of wind generation. Current build and operating costs for the most efficient large-scale renewable generation options are very close to long-term wholesale electricity market prices. Plenty of generation options around these costs have been consented and many others have been identified. This means that installing more renewable generation to meet increases in electricity demand – for example, from electrification of industrial process heat – is unlikely to put upward pressure on consumer prices.

Knowing that the national grid and our electricity system can easily accommodate more renewable generation (as confirmed by Transpower, the system operator and grid owner) supports investment in renewables.

3 TECHNOLOGY AND INNOVATION DEVELOPMENTS

The electricity industry, which has been stable for many years in terms of technology, is now arguably one of the most active when it comes to innovation and technology developments. Newcomers are entering the retail and distribution spaces with offers based on pricing, transparency and convenience, all of which are made possible through advances in technology or an innovative business model. New types of market participant and technologies are rapidly emerging, including smart home energy management devices.

Distributors are spreading their wings into emerging markets and taking steps to deal with the effects of new technology on their ability to meet their obligations for reliability and resilience. It all adds to the electricity system's ability to manage increased renewable generation.

CHALLENGES

As discussed, New Zealand's electricity system is well placed to accommodate higher levels of renewable generation. However, it needs to be done in a considered way that accounts for key challenges, such as ensuring security of supply and reasonable pricing.

1 THE DOWNSTREAM EFFECTS OF TECHNOLOGY

Thanks to new technologies, many consumers will soon be able to choose their own levels of reliability and security of supply. While these advances can help the electricity system become more robust in terms of reliable supply, it is changing expectations around what security of supply costs and who pays for it.

The Electricity Authority is working on a range of projects that will ensure companies wanting to offer a new product or service to give consumers this level of control don't meet insurmountable hurdles. These projects address what we call 'inefficient barriers'.

For example, we're considering how to ensure consumers and business have equal access to the 'poles and wires' that electricity networks use to transport electricity.

We're considering barriers to consumers entering into contracts with more than one electricity service provider. This could mean a household engages a company that reduces the household's demand when the price of electricity gets beyond a certain point (when demand is high or supply is looking low). Being able to do this could help the electricity system become more secure and, therefore, more open to increased renewable generation.

We're also looking to make it possible for the price of electricity to be seen in real time. While this could make it easier for immediate demand response to occur, it will also make the costs of different sources of electricity more transparent.

Once projects like these are progressed and consumers have more choice over the reliability and security of supply they receive, a system based on charging everyone for security of supply to the whole country may not be viable.

2 SUPPLY RISKS NEED TO BE MANAGED

Security of supply is a big consideration. New Zealanders want to be assured that their lights will turn on when they flick the switch and any risks to their power supply are under control. Because consumers value security of supply highly, they're prepared to pay for the backup generation and demand response resources needed to provide it, but naturally they don't want to pay more than the value it provides.

In some other countries, sharp increases in renewable electricity generation have undermined security of supply. New Zealand has a robust voluntary hedge market for retailers and large consumers to manage the financial impacts of supply risks. This provides efficient incentives for parties to build and supply the amount of backup generation consumers want to have available in the market. With some further enhancements, our hedge market offers a strong platform for dealing with the potential volatility of renewable generation, without the requirement for subsidies for backup generation in the form of capacity markets or other arrangements.

Future changes in technology – for example, battery storage and enabling residential demand response – mean the possibilities for backup and intermittent capacity will need to be carefully approached. It will be all too easy to adopt yesterday's solutions from overseas, only to find that they don't work in New Zealand's hydro-dominated system and they crowd out future innovations and new technology.

3 KEEPING PRICES REASONABLE

The cost of renewable generation technology is steadily decreasing. In addition, the build and operating cost of much renewable generation is close to long-term wholesale electricity prices, meaning increases in renewable generation to meet demand growth is unlikely to put upward pressure on prices to end consumers.

With currently available technology, if we're looking to avoid using any 'backup' fossil-fuelled generation in years when New Zealand has normal levels of hydro inflows, we'll need to have more renewable generation available. Much of it will need to sit idle in wet years, or significant volumes of hydro water will need to be spilled. Either way, the 'effective' cost of renewable generation to replace the last few per cent of fossil fuel-based reserve capacity could be far higher than the cost to purchase, install and operate, because some will be utilised only rarely. However, this scenario is based on current technology, and technology in the electricity sector is no longer static. It is changing rapidly and costs are also falling sharply for new technologies such as batteries, small-scale generators, and energy sensors and smart control systems that turn electricity on and off in response to price and system security signals.

The Authority is heavily focused on removing any inefficient barriers to the adoption of these new technologies. Among other things, it is encouraging distributors to adopt service-based and cost-reflective pricing to enable technology changes. It is also reviewing the transmission pricing methodology to ensure Transpower's charges are similarly focused. Unless parties see the real distribution and transmission costs of their decisions, they are unlikely to adopt the most appropriate technologies.

CONCLUSION

New Zealand is already among the leaders in renewable generation and during the last 10 years it has achieved a lot more than many other nations in increasing the country's share of renewables. The country also has plenty of potential to increase renewable generation well beyond current output, without any material impact on costs to consumers.

With an electricity system that is flexible and resilient, New Zealand is in a strong position to manage increased levels of intermittent generation such as wind and solar.

However, the country will need to rely on innovations in technology and demand management – and ensure adoption isn't thwarted by unnecessary barriers – to retain high reliability standards and current cost levels if New Zealand is to avoid the use of fossil-fueled backup generation, in years with normal hydro inflows.

The Authority's current work programme considers the adoption of new technology and the greater demand management required. Some elements will not be popular. There will undoubtedly be parties that object to distributors changing how they charge for their services. Some distributors are likely to resist the Authority's attempts to enable other parties to provide batteries and control systems for demand response on their networks, effectively in competition with those distributors. Some retailers may resist the Authority's attempts to allow consumers to buy and sell electricity services from several parties – for example, by selling the surplus output of their solar panels to the best buyer in the market or their neighbour.

Because of the variety of differing perspectives, it's important for the Authority to clearly explain its rationale for the strategies it's pursuing. We're looking forward to more forums and meetings with stakeholders to discuss New Zealand's renewable future and how the country can ensure the reliability and security of our electricity system alongside reasonable prices.

For further information about our work, visit **www.ea.govt.nz**