THE CHALLENGING PATH

New Zealand – New Zealand is fortunate to have a wide range of natural resources available for powering the country's industry and homes. Hydropower is the main renewable energy source in New Zealand, supplying 62% of the country's total, with wind turbines supplying 4% and geothermal 18%. The remainder is mainly supplied by gas and a small amount by a large coal-fired power station located near New Zealand's largest city, Auckland.

The two main islands are interconnected for electrical distribution by high voltage DC cables. Two thirds of the population live in the North Island, which is the main source of electricity demand, but electricity can be transferred in both directions depending on the hydrological situation.

New Zealand has committed to be 100% renewable by 2035 and the trend towards replacing fossil fuels and industrial heat with renewables is expected to lead to a doubling of electricity demand by 2050.

This poses a significant challenge for the development of new generation capacity. New Zealand's installed hydropower capacity of 5,437 MW is entirely conventional hydropower, with no pumped storage. Most of the hydropower plants in New Zealand were installed between the 1940s and 1980s. As a result, the bulk of recent capacity growth has been the refurbishment of existing hydropower plants along with the installation of smaller run-of-river schemes. With lower environmental impact, run-of-river schemes and small storage schemes continue to be the favored option for new hydro capacity in New Zealand. Consequently, uprating and refurbishment of existing hydro plants will also likely continue in the medium term.

In order to reach the ambitious national goals for renewable energy, much of the new capacity development will be focused on geothermal and wind energy. Nonetheless, such developments will require the higher performance, flexibility and reliability available from traditional sources of generation like hydropower to perform vital grid control and peaking power functions.

ANDRITZ HISTORY

ANDRITZ Hydro has contributed to the development of hydropower in New Zealand since its early beginnings. Some of the country's very earliest turbines, installed in Reefton in 1908, Akaroa in 1911 and Coleridge in 1914, all came from ANDRITZ Hydro. Subsequently, through the mid-20th century, ANDRITZ Hydro

supplied many large low-head vertical Francis and Kaplan turbines. From the large turbines in the underground powerhouse at New Zealand's largest hydro station at Manapouri (800 MW) to the brand new generators replacing existing units at Aratiatia in the North Island, more than 50% of the installed capacity in the country features either an ANDRITZ generator or a turbine.

The ANDRITZ Hydro team in New Zealand is passionate about delivering fit-for-purpose engineering solutions to our customers. Based on modern engineering solutions, the supply and installation of new equipment on a "from water-to-wire" basis is our core expertise. Naturally, major refurbishments of electro-mechanical equipment and valves, as well as turbine governing and excitation control systems are also part of our product portfolio. In addition, our services include condition assessment, spare parts supply and installation, detailed engineering calculation and advice on technical issues, and troubleshooting. ANDRITZ Hydro furthermore offers upgrade and refurbishment options and advice, as well as refurbishment and repair of all hydropower-related mechanical and electrical equipment.

NEW OFFICE

ANDRITZ Hydro has recently relocated to a larger office and warehouse facility in Christchurch in the South Island. The new office allows for business expansion, more storage on site, as well as a small workshop area for the growing service team.

TO KNOW:

General data:

Population:	4.794 million
Access to electricity:	100%
Installed hydropower capacity:	5,437 MW
Share of generation from hydropower:	62%
Hydro generation per year:	25,304 GWh

ANDRITZ Hydro in the country:

Installed and/or rehabilitated capacity:	3,131 MW
Installed and/or rehabilitated units:	134
Location:	Christchurch
Mailadress:	contact-hydro.nz@andritz.com

Source: Hydropower & Dams World Atlas 2018

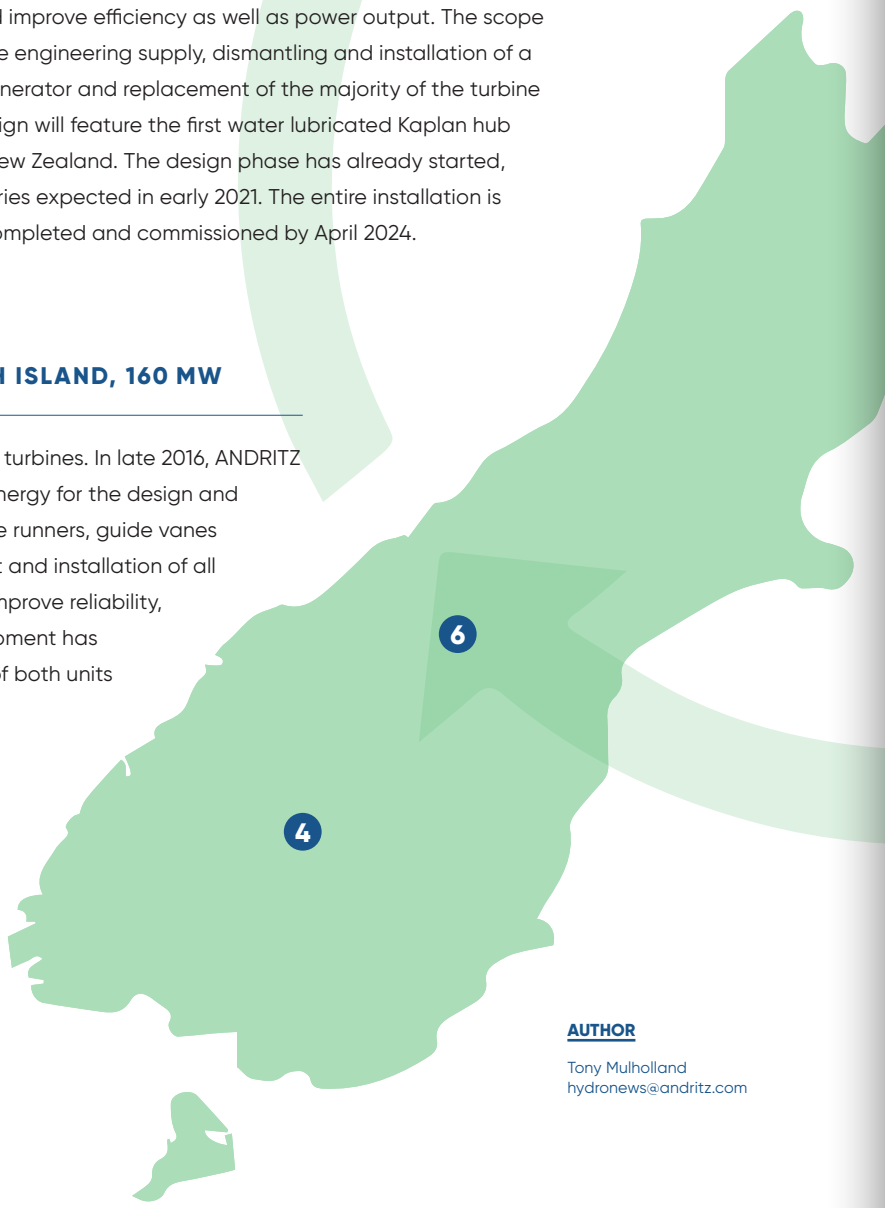
TO RENEWABLE ENERGY

5 KARAPIRO, WAIKATO RIVER, 90 MW

In January 2019, ANDRITZ Hydro signed a contract for the major refurbishment of the three Kaplan units with the main objectives to improve reliability, modernize the equipment and improve efficiency as well as power output. The scope of work includes the engineering supply, dismantling and installation of a completely new generator and replacement of the majority of the turbine parts. The new design will feature the first water lubricated Kaplan hub to be supplied in New Zealand. The design phase has already started, with the first deliveries expected in early 2021. The entire installation is scheduled to be completed and commissioned by April 2024.

6 TEKAPO B, LAKE PUKAKI, SOUTH ISLAND, 160 MW

The station contains 2 × 80 MW existing Francis turbines. In late 2016, ANDRITZ Hydro was awarded a contract from Genesis Energy for the design and model testing followed by supply of new turbine runners, guide vanes and associated parts, along with refurbishment and installation of all equipment on site. The project objective is to improve reliability, hydraulic stability and efficiency. The new equipment has been delivered to site in 2019, with installation of both units expected to be completed in 2020.



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ANDRITZ HYDRO PROJECTS IN NEW ZEALAND

1 ARATIATIA, WAIKATO RIVER, 92 MW

ANDRITZ Hydro will design, deliver, install, and commission three generators, one Francis runner including model test, and three turbine governors for this plant, owned by Mercury NZ. After the refurbishment, the plant will have a significant increase in efficiency and reliability. ANDRITZ Hydro is currently implementing the site works and has already commissioned two units. The project completion is expected by mid-2020.

2 WHAKAMARU, WAIKATO RIVER, 128 MW

ANDRITZ Hydro was awarded the contract to upgrade the turbines in 2013. The agreed scope of supply included four Francis turbine runners, head covers, bottom rings, guide vanes, and the complete replacement of the governing equipment with a new high-pressure system. The final design has a turbine rated just under 32 MW – a rating increase of 22%. Installation and commissioning of the first unit was completed in May 2017. Site efficiency testing took place during commissioning and showed a significant gain in efficiency over the old turbine and more than had previously been expected. Two further units have been completed with the last unit already delivered and expected to be installed in the summer of 2020 to complete the project.

3 PIRIPAUA, LAKE WAIKAREMOANA, 42 MW

ANDRITZ Hydro has supplied two replacement butterfly main inlet valves. The existing slide valves from the 1940s were unreliable and the customer Genesis Energy awarded a contract in 2017 to ANDRITZ Hydro to design, supply, install and commission the replacement butterfly valves. Successful commissioning of the first unit was achieved in June 2019. The second replacement takes place from September to December 2019.

4 UPPER FRASER, FRASER RIVER, 8.1 MW

ANDRITZ Hydro has supplied one vertical, five-jet 8.1 MW Pelton compact turbine, main inlet valve, generator, excitation system and ancillary plant for this plant owned by Pioneer Energy. Civil construction by Pioneer and equipment installation by ANDRITZ was completed in June 2019, with the unit entering commercial service in July 2019. The scheme will produce an estimated 31 GWh of renewable electricity generation and is one of the highest head power stations in New Zealand with a gross head of 475 m.