Clutha/Mata-Au Hydro Generation

Information for the Otago RPS Hearings Panel

September 2023

Overview

What's been asked from us ...

OTAGO REGIONAL POLICY STATEMENT – FRESHWATER PROVISIONS

- Contact Energy Limited (**Contact**) presented evidence on the hearings on the Proposed Otago Regional Policy Statement - Freshwater Instrument (**Proposed RPS-F**) on 4 September 2023.
- Through evidence, Contact stated that minor changes to the operational regime of the Clutha Hydro Scheme (**CHS**) could improve its efficiency and effectiveness and therefore unlock further opportunities to add to Aotearoa's renewable electricity supply.
- Increasing the proportion and volume of renewable electricity could enable the retirement of existing thermal assets and/or provide for *new and growing demand* as our economy continues to decarbonise (ie transportation and industrial process heat).
- This slide-deck is provided on the basis that it **only** considers the increased electricity generation opportunities.
- Contact is cognisant that any changes to the operating regime or physical environment will require detailed technical investigations and impact assessments – including those on freshwater values. We understand that minimum flows are derived from understanding a wide range of values – including ecological, human-health and cultural.

CONTENTS OF THIS SLIDE DECK

- The Panel asked Contact for further information and 'real world' examples of how operational and physical changes to the CHS could lead to the Aotearoa's broader renewable electricity supply and decarbonisation outcomes.
- The information in this slide-deck is intended to be used to inform the Panel's thinking around how the Proposed RPS provisions would help *or* hinder these broader strategic climate change outcomes.
- The following has been included:
  - Potential hydro-generation opportunities (including *new* generation and changes to the existing operational regime). These opportunities are not new concepts and have been derived from previous investigations and studies undertaken by Contact and its predecessor (ECNZ).
  - Hypothetical examples to show what an altered residual flow regime would look like for the CHS. This will show how the CHS could (1) be operated to better respond to both peak electricity demand, and (2) be complementary to new electricity supply from wind and solar resources.

Potential CHS Opportunities

Important considerations for Aotearoa's future

- From a hydrological perspective, Aotearoa / New Zealand has further hydro potential.
- This includes both *new* developments (ie small-scale to very large projects), and operational improvements to existing hydro schemes. With respect to the opportunities for the CHS, these are outlined in **Table 1**.
- We understand that larger-hydro projects may never be developed due to their significant environmental impacts and investment requirements. However, there may be opportunities to develop smaller- to medium-scale schemes.
- Excluding consideration of the environmental impacts, hydro-generation has several benefits.
- Primarily, it can provide flexibility enabling us to reduce our reliance on thermal peaking generation – and therefore decrease carbon emissions. It is also a lower-cost operation than other forms of generation.

Table 1: Previously investigated *new* potential electricity generation opportunities in the Clutha Mata-Au

Note: this information has been sourced from old ECNZ reports and internal information prior to 2010) and is for illustrative purposes only

	Approximate capacity scale (MW)	Approximate generation (GWh/year)*	Notes
Lower Clutha	Up to 320	Up to 1,590	**Generation stations downstream of Roxburgh have been considered many times over the years. These have largely been discounted due to the significant physical, social and environmental impacts and the investment requirements.**
Hāwea Gates	17	65	The generation would be 'run of river, (i.e. not flexible) and only occur when water was being released via Hāwea Gates.
The Neck	70	250	This has been known about for over 100 years. It is a potential pump storage scheme that offers significant generation flexibility, which likely has wider benefits in terms of replacing thermal peaking generation and optimising local network expansion costs.

*For comparison, Clyde and Roxburgh electricity generation capacity and values are 732MW and 3900Gwh (respectively).

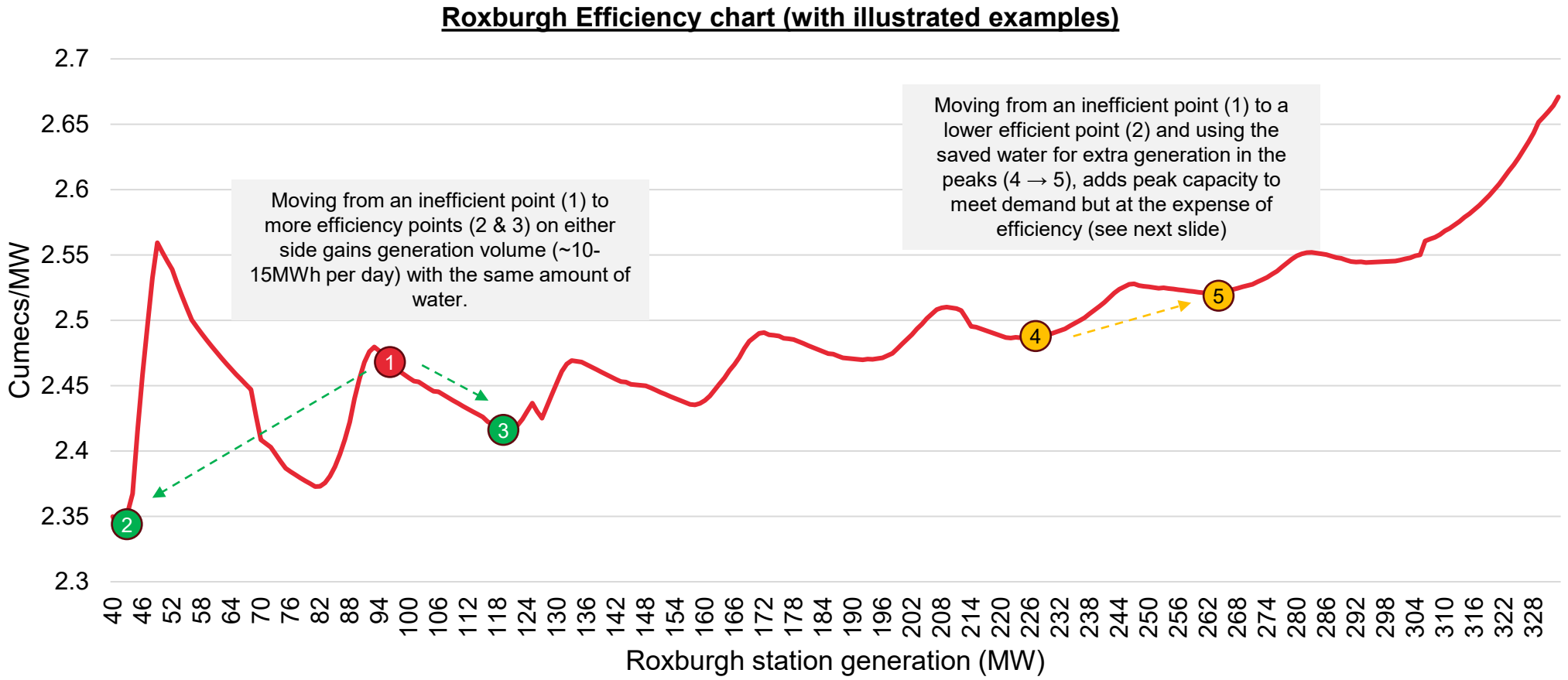
Improving the efficiency of our *existing* hydro-generation operations will accelerate our ability to achieve our climate change targets

How changes to the minimum flows at Roxburgh and Clyde will contribute to the decarbonisation of our economy

- We have analysed (as an example) the minimum flow condition frameworks for August 2023 v pre-2007 generation profiles for our Roxburgh operations. This provides insight into *how* changes to the minimum flows could unlock further generating capacity, and [also] therefore also how more stringent limits imposed via a policy framework would further constrain generation capacity.
- The following two slides illustrate the difference in *how* electricity generation could occur under the two different consented minimum flow requirements (August 2023 v pre-2007).

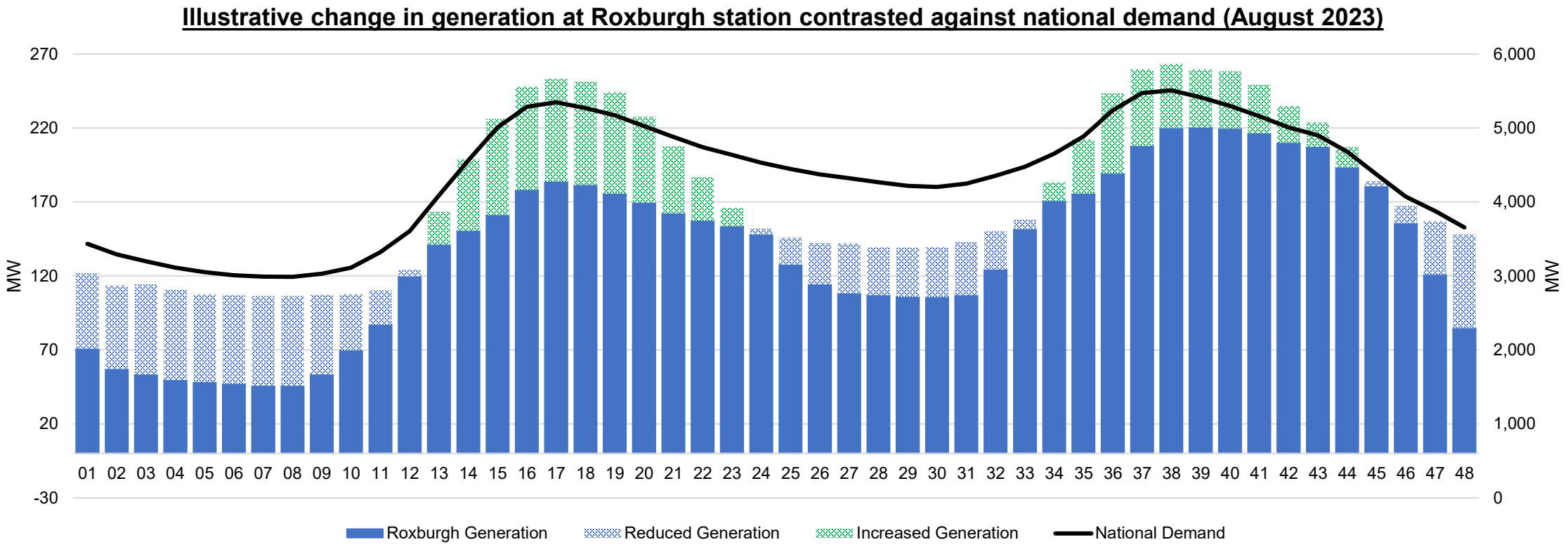
Benefit	MWh/day or Capacity	Slide/graph reference	Notes
Additional generation through improved efficiency	10–15 MWh	Slide 5 (Example 1) Moves generation from inefficient point 1 on the graph to more efficient points 2 & 3	This volume is equivalent to an addition 500 – 700 NZ households daily electricity demand being meet with renewable electricity. It would have also prevented the 9-14 tonnes of carbon that would have been emitted from coal-fired generation each day in August that was required to meet that demand.
Peaking capacity uplift by shifting the timing of waters discharge of from the station.	>70MW	Slide 5 (Example 1) Moves generation from point 1 to points 4 to 5. Slide 6 (Example 2) Generation is better utilised to meet peak demand.	Should security of supply be a greater concern on any given day then water saved in low demand periods can be utilise to meet peak demand. A scenario that will be more prevalent as NZ moves to more intermittent forms of generation. Note – operating in this way can result in a loss in efficiency but is vital when needed.

Example 1



- The current condition framework for minimum flows at Roxburgh is not matched to the generation capability of the turbines at this site – they are not running at their stated efficiently meaning that there is *lost* generation.
- The 2007 condition framework would enable Contact to operate the Roxburgh site to better *match* supply with demand by releasing water *when* there is demand. This means that Contact could "hold-back" water and release it to create electricity when it is required.
- This shows that due to the current minimum flows, we have reduced ability to respond to peak demand periods that may occur at other times during a 24-hour period.

Example 2



- This slide shows Contact's August 2023 generation profile (shown over one day which is 48 half-hour trading periods), and what the generation profile would look like *if* we could operate under the pre-2007 consented minimum flows regime.
- Note that for August 2023, thermal generation was necessary to meet the daily peak national demand.
- The solid-blue and shaded-blue is what was generated in August 2023 (current consent condition). The black line shows New Zealand's national demand.
- During the **trough** of national demand there is generally an abundance of renewable generation options available – we have more than enough supply options to meet demand.
- During the **peak** of national demand there is generally not an abundance of generation options available, and wind and solar can only operate when it is windy and sunny (respectively). At present, peak demand is currently meet using hydro and thermal generation (noting that thermal generation will decline markedly over the next decade).
- This graph shows that the pre-2007 minimum flow would enable Contact to move generation from the trough (where there are plenty of other generation options available) to the peak (where there are not many options available and will be less as we retire our thermal sources). This is shown as the green-shaded area.