



26 June 2020

Grant Benvenuti,
Manager Market
Operations Electricity
Authority Wellington
(by e-mail: marketoperations@ea.govt.nz)

Dear Grant

Application for Glenbrook Power Station (an industrial co-generation station) to be classed as Type B for Code purposes

This letter serves as an application for Glenbrook Power Station's Kilns Cogeneration Plant embedded generator connected to GXP GLN0332 to be classified as a "type B industrial co-generator" under Schedule 13.4 of the Code.

Alinta ENZ Ltd (Alinta) makes this application on the grounds that the Kilns Cogeneration Plant meets the following definition of an industrial co-generation station as per Part 1 of the Code:

- b) is reliant on a co-located industrial process because—
 - i) it provides some or all of the electricity that it generates to that co-located industrial process; and
 - ii) it provides some or all of any by-product of generating electricity to that co-located industrial process; and
- c) is tightly coupled to an industrial process;

As such it would benefit significantly from being relieved of the current requirement to stay within tolerance limits of dispatch instructions.

Background:

Alinta ENZ Ltd owns and operates the Glenbrook Power Station, located within New Zealand Steel's ironmaking process.

The Glenbrook Power Station consists of two cogeneration plants, the MHF Cogeneration Plant (MHF Cogen) and the Kilns Cogeneration Plant (Kilns Cogen)

The combined output of the Kilns Cogen and the MHF Cogen plants meets on average around 60% of New Zealand Steel's electricity requirements for their Glenbrook steelworks – the shortfall is met by the grid.

New Zealand Steel's Ironmaking Process Description:

NZ Steel's ironmaking plant uses ironsand and coal and through 3 process stages, produces molten iron. The ironmaking stages are:

- **Multi Hearth Furnaces:**
Ironsand and coal are fed into 4 Multi Hearth Furnaces (MHF) where the coal and ironsand are heated to produce char and primary concentrate (PC).
- **Direct Reduction Kilns:**
The char and PC from the Multi Hearth Furnaces are fed directly to the 4 Direct Reduction Kilns where about 80% of the PC is converted to reduced primary concentrate and char (RPCC).
- **Melters:**
The RPCC from the Kilns is transferred into 2 electric smelting furnaces (the Melters) where it is heated and melted to produce molten iron and slag. In this process a carbon monoxide rich by-product gas called Melter Gas is produced.

Kilns Cogeneration Plant Description:

The Kilns Cogen consists of 4 fired waste heat boilers generating superheated steam at 65 bar(g) and 510 °C to feed a single steam turbine rated at 72 MW.

The fuel source for the Kiln Boilers is primarily Kiln Off Gas, the waste gas generated by the Direct Reduction Kilns. Supplementary fuels for the Kiln Boilers include Melter Gas, a by-product gas produced from the Melters and Natural Gas.

Each Kiln Boiler is directly connected to a Direct Reduction Kiln. The Kiln Off-Gas which is the primary fuel for the boiler contains both chemical and sensible energy is combusted in the Kiln Boiler. The boiler's operation is entirely dependent on the kiln operation – if the kiln stops, then so does the boiler. The Kiln Boilers also utilise the carbon monoxide rich Melter Gas as supplementary fuel. Natural Gas is used to start-up and shut down the Kiln Boilers safely, to provide boiler stability during low kiln feed rates when there is insufficient chemical and sensible energy in the waste gases, and can also be used as a supplementary fuel.

The output of the Kilns Cogen generator is stepped up to 33kV via a generator transformer and is connected to the Glenbrook Substation via CB2462.

With NZ Steel running 4 Kilns, the output from the Kilns Cogen is between 48 – 56 MW from the Kiln Off Gases and Melter Gas.

If a Kiln Boiler trips or NZ Steel stop a Kiln, the output of the Kilns Cogen is suddenly reduced by 25% or between 12 and 14 MW.

Further variability in plant output is caused by New Zealand Steel varying their process feed rates, Melter running conditions and even periods of heavy rain which can also have an effect.

The Kilns Cogen electricity output is a function of many factors, including:

- The number of Kilns / Kiln Boilers operating
 - If a Kiln stops, the associated Kiln Boiler stops, reducing the plant output by about 25% or 12-14 MW
 - A Kiln Boiler restart always follows a Kiln start-up, and increases the Kilns Cogen output by 12-14 MW
 - A Kiln Boiler trip results in the loss of 12-14 MW, a restart typically takes 1 ¼ - 1 ½ hours
 - The Kilns operation is largely continuous, however forced outages, unplanned outages, planned outages and major overhauls are the “norm”.
 - Routine Kiln maintenance is carried out every 10-12 weeks during a 12-16 hour “hold day”
 - Each Kiln undergoes a major shut every 2 years. Across the 4 kilns, this means a 4-week major shut occurs every Feb/Mar and Sept/Oct – during these periods the Kilns Cogen output is reduced by between 20 and 25%.
- Turbine planned outages

The Kilns Cogen steam turbine/generator undergoes routine maintenance, during these periods the output from the Kilns Cogen is 0 MW. These outages are aligned with NZ Steel's kiln outages where possible to minimise lost generation.

- Once a year, a 48-hour outage is carried out on the Kilns Cogen
 - Once every 4 years, a 2-week outage is carried out on the Kilns Cogen
 - Once every 8 years, a 4-week outage is carried out on the Kilns Cogen
- Turbine forced outages
 - Unfortunately, they happen from time to time, and the restart can be delayed waiting for the dispatch instruction.
- Ironmaking process throughput
 - The Kilns Cogen output is a function of process throughput as measured by the ironsand fed to the Multi Hearth Furnace
- Kilns process stability
 - Kiln process instability can cause short term variability in the Kilns Cogen output
- Melter operation
 - When the melters are operating they produce Melter Gas, a fuel rich by-product gas - the value of this energy at the Kilns Cogen is approximately 7 MW per melter. If a Melter stops, then the Kilns Cogen output reduces by 7 MW, similarly when the melter restarts, the Kilns Cogen output increases by up to 7 MW
 - The Melter operation is largely continuous, however forced outages, short duration planned outages and long duration planned outages are the "norm", each of these events having an impact on the Kilns Cogen output.
- Melter process stability
 - In the smelting process, Melter Gas evolution can be very variable and cause short term Kilns Cogen output variability of 2-3 MW
- Weather
 - Heavy rainfall affects the raw materials being fed to the process and can disrupt the process causing short term variation in the Kilns Cogen output.
- Natural Gas
 - In addition to natural gas being used for starting and shutting down boilers safely, it can be used as a supplementary fuel
 - Natural Gas used as a supplementary fuel can contribute an additional 10-12 MW
 - Provide stabilisation fuel during periods where there is insufficient chemical and sensible energy in the Kiln Off Gases

Alinta's objective is to maximise the generation of electricity from the available waste energy and the by-product gases – any electricity not generated from the available fuels is seen as a lost opportunity as this electricity is replaced by electricity supplied from the grid. For NZ Steel, the electricity not generated by Alinta is supplied by the Grid – by another generator on the margin.

A Type B Cogeneration classification will allow quicker return to service of Kiln Boilers following a restart by not having to wait for the offer / dispatch process cycle to be met. In addition, the Kilns Cogen output will not need to be restricted within the +5MW band by flaring Melter Gas while waiting for new dispatch target.

Given the fluctuations in steam generation caused by the above, it is difficult to maintain electricity exports within tolerance and to comply with the ½ hour gate closure.

A line diagram is attached of the cogeneration steam and electricity production process.

Seasonal Information

NZ Steel operate the Ironmaking process on a 365 days per year basis and as such only seasonal variations are the scheduled 4-week kiln major outages that typically occur in Feb/Mar and Sept/Oct each year.

Current conditions

The Kilns Cogen currently operates as a Type A co-generator but there are times when the +/- 5 MW limit for this is insufficient for optimal operation. There are times when Kiln Boilers could be brought on-line faster and has to be deferred until a dispatch instruction has been received leading to the power that could be produced by waste energy being produced by last dispatched generator on the grid.

Alinta still expects to be required to comply with dispatch instructions where the system operator has issued a formal notice as defined in part 1 of the Code.

Yours sincerely

A handwritten signature in blue ink, appearing to read 'J Simmons', with a long horizontal flourish extending to the right.

John Simmons
Plant Manager

