

Your ref: CON/05/19  
Our ref: 106002216-001

09 March 2020

Jillian Ferris  
Northern Ireland Authority for Utility Regulation  
Queen's House  
14 Queen Street  
Belfast  
Bt1 6ED

Dear Jillian,

## Carrickfergus configuration and operation

### Introduction

This letter sets out our conclusions from the project AFRY Management Consulting<sup>1</sup> ('AFRY', 'we') has been undertaking for Northern Ireland Authority for Utility Regulation ('NIAUR', 'you'), to provide support, review, facilitation and challenge to GNI (UK) Ltd. (represented by GNI) and Mutual Energy Ltd. ('MEL') (together, the 'TSO s'), in respect of the analysis of the Northern Ireland ('NI') gas transmission network and the proposed configuration and operation of the Carrickfergus Above Ground Installation ('AGI') and Flow Control Valves (FCVs).

### Background

The Carrickfergus AGI, owned and operated by GNI, is the primary point of interface between the MEL and GNI transmission networks. The primary basis for the design of the AGI is to protect the 70 bar(g) rated MEL system from overpressurisation from the 75 bar(g) rated GNI system. Carrickfergus AGI contains FCVs and a variety of ancillary equipment, such as fiscal metering, filtering, slam-shut valves, and station by-pass pipework.

Prior to the implementation of a single balancing zone in NI, the commercial regime required that the title of gas transported on behalf of one set of shippers was legally transferred to another set of shippers for transportation on a separate system. The legal transfer of the title of specific volumes of gas was undertaken at the Carrickfergus AGI. This required fiscal quality flow metering and flow control. Since the implementation of a single Network Code across NI, no such transfer of title takes place at Carrickfergus: transportation across both systems is undertaken on behalf of one set of shippers. As such, there is no requirement for fiscal-quality flow metering, although flow metering is still required to operate the FCVs.

Currently, Carrickfergus is normally operated in a flow control mode. This can cause a significant amount of pressure drop across the site, and also has the effect of severing the connection between the two networks' pressure and linepack movements.

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<sup>1</sup> AFRY Management Consulting, a division of AFRY, the trading name of AF Pöyry AB

The idea of operating the Carrickfergus site in 'free flow' ('FF') had been proposed by MEL. We understand that MEL expected that doing so would lower the requirements for taking balancing actions in the market, thereby lowering the TSOs' balancing costs. We also understand that GNI were keen to ensure that the full implications of FF operation were fully understood, including any costs that might arise. A project to investigate the costs and benefits of the proposal was instigated, and you asked us to provide support to this process.

## Proposed process

The envisaged project comprised:

1. network analysis, to be undertaken by GNI on behalf of the TSOs, which would be required to ascertain and help to quantify any benefits associated with a different modes of operation at Carrickfergus; .
2. economic cost benefit analysis, to be undertaken by suitable consultants; and
3. engineering impact assessment, to ascertain the requirements for (and costs of) changes to documentation (e.g. safety cases), reconfiguration of station control logic (i.e. software changes), and/or investment in physical equipment.

## Information review

We have briefly reviewed a variety of technical, operational, and commercial documentation made available by the TSOs during our assignment. This has included the System Operator Agreement which, notably, contains the Joint Balancing Procedures (JBP), which describe the current process for adjusting the flow control settings at Carrickfergus in pursuance of operational aims (e.g. avoidance of balancing actions). Whilst we have briefly reviewed this material, our understanding of the situation at Carrickfergus has been taken from a telephone conference to discuss the operation of the site (discussed further below).

## Initial meeting

A meeting was held in MELs offices in Belfast on Thursday 2<sup>nd</sup> May 2019, including myself and my subcontractor, Iain Ward, along with representatives from GNI and MEL. The meeting's primary purpose was to agree a set of network analysis modelling that might illuminate the effects on the network of various different modes of operation. In discussing the situation and what might be achieved with various potential reconfigurations of Carrickfergus (along with discussion on what these might mean in practice), it was agreed that the modelling would reflect some actual historical day supply/demand situations (to cover a range of commercial balancing actions and nomination/flow behaviours), and would need to develop three types of model:

- a 'volumetric flow control' ('VFC') model, to replicate the actual operation on each of the historical days modelled;
- a 'regulator wide open' ('RWO') model, which assumed a pressure differential ('DP') across the site of 2 bar, and assumed no commercial balancing action had taken place; and
- a 'free flow' ('FF') model, effectively replicating the situation that might occur if the site did not exist as an AGI, and again assuming no commercial balancing action had taken place.

Subsequent discussions on the network analysis modelling and the results of it have been held by telephone, and this has culminated in a "Technical Note", which GNI has separately forwarded to you. The various assumptions assumed are included therein, but

notably, the RWO scenarios assumed a fixed 2 bar DP across the Carrickfergus site, and the FF scenarios assumed a zero bar DP across the site.

### Technical teleconference

A telephone conference was held on 4<sup>th</sup> September 2019, and attended by myself, Iain and a number of people from GNI (including Declan Burke, Tom Hegarty and Kieran Foley).

In this teleconference, we were informed of the various control systems' operation at Carrickfergus. The current system at Carrickfergus means that, in the absence of an achievable flow control signal (i.e. if the relevant control room sets Carrickfergus to flow at a very high – higher than achievable – flow rate), the current system will control the position of the valves to maintain a 2 bar DP, subject to<sup>2</sup>:

- ensuring that the downstream (GNI) pressure is within its maximum operating pressures (and for which there are also slam-shut valves);
- ensuring that the flow rate does not go above a predefined set point (the "high flow watchdog"), which, if it does, it closes the valve(s) to maintain flows below the high flow watchdog; and
- ensuring that there is no reverse flow (i.e. from the 75 bar(g) rated GNI system into the 70 bar(g) rated MEL system) by operating the 'soft-slam system' which closes the valves where the DP falls below 0.5 bar.

### Conclusions – 'regulator wide open'

We conclude from the technical teleconference that there is no material cost associated with operating Carrickfergus in a mode where it maintains a fixed 2 bar DP across the valves, i.e., closely replicating the operation modelled in the RWO network analysis scenarios<sup>3</sup>. The only change required is to provide an instruction to Carrickfergus to control to a flow rate that is too high for it to achieve under prevailing network pressures.

The RWO network analysis models have clearly demonstrated that there is no risk of reverse flow or overpressurisation and that there are 'improvements' in the pressure profile across the NI network. In the long-run, we would expect such improvements to lower the magnitude and frequency of commercial balancing actions, therefore providing a material benefit to NI consumers.

Also, we would not expect there to be any significant requirements in respect of revising relevant documentation.

1. On the basis that there is no requirement to change to the control logic or equipment at the Carrickfergus site and there is no constraint on the flow instructions that can be sent by the relevant control room, we would be surprised to learn (despite the fact that we have not reviewed it, which we are happy to do) that there are any changes required to the GNI safety case. We would expect that the safety of the full NI gas network is actually improved by not imposing flow control at Carrickfergus.
2. The JBP assumes, but does not require, operation of flow control at Carrickfergus. The effect of the relevant control room sending flow control settings that are higher than achievable will be to render the relevant parts of the JBP inapplicable in the specific circumstances contemplated in the JBP.

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<sup>2</sup> Commensurate with Safety Instrumented Functions and protocols.

<sup>3</sup> Noting that the network analysis models have not included for the additional pressure drop caused by other equipment and pipework at Carrickfergus.

As such, we conclude that there is no reason to continue to operate Carrickfergus in flow-control mode. Moreover, we consider that to do so would result in an inefficient outcome for NI consumers, and may be held as unreasonable.

#### Discussion – ‘free flow’

During the course of the project we have formed the opinion that the proposition of operating the Carrickfergus site as fully open (FCVs set to 100% open, with the bypass pipework also left open) would minimise the pressure loss across the site. This might yield additional benefits compared to the ‘regulator wide open’ mode of operation. Whilst we would not expect it would require the procurement of any additional equipment, it would require careful consideration (e.g. engineering impact assessment), may drive some other reconfiguration, may drive changes to GNI’s safety case and operating practices, and would result in the loss of fiscal metering at Carrickfergus (although arguably this is no longer required). We would expect the net benefits, if any, to be of much smaller magnitude than the net benefits of moving to a RWO mode of operation.

#### Concluding remarks

Assuming GNI’s safety case does not restrict the flow rates instructions that can be sent by the GNI control room, and given the clear demonstration that there is no risk of reverse flow or overpressurisation, there are no impediments to relying on the existing station control logic to control to a DP of 2 bar under normal operation and there are no costs associated with doing so. As the network analysis also demonstrates that there are ‘improvements’ in the pressure profile that in the long run we would expect to decrease balancing costs, we consider that continued operation of Carrickfergus in flow control mode would present an inefficient outcome for NI consumers. We note that it may also be detrimental to the safe operation of the NI gas network.

I am very grateful to have been afforded the opportunity to support NIAUR and NI consumers in this matter. I would also like to extend my gratitude to GNI and MEL employees for their patience, transparency and lucidity - in particular, Siobhán O’Halloran and Shane Rafferty. I do hope that a satisfactory outcome can be found that maximises the efficiency of the NI energy system.

Yours sincerely,



Angus Paxton

Principal