16th December 2011

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Commission for Energy Regulation,
Gas Division,
The Exchange,
Belgard Square North,
Tallaght,
Dublin 24.

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Gas Transmission
Queens House
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Reference:

Response to Consultation Paper "Mitigation Measures to address Potential Capacity Constraints at the Moffat Entry Point in 2013/14"

Dear Mr. Mac Evilly and Mr. Hume,

Thank you for the opportunity to comment on the consultation document "*Mitigation Measures to address Potential Capacity Constraints at the Moffat Entry Point in 2013/14".* I attach BGN/Gaslink response to the paper with reference to the principal question around the potential constraint at Moffat in 13/14 and on the potential mitigation mechanisms highlighted in the consultation paper.

The detailed response attached examines the key issues associated with each of the various options outlined and concludes that the most appropriate solution is to reinforce the onshore Scotland network. BGN/Gaslink believe that the other proposed measures would not resolve the capacity constraint;

- Interruptible Exit Capacity products – Following analysis of industry responses to the "CAG 2012 Business Rules: Capacity (Revision 1.0)" consultation undertaken in mid 2011, the CER and UREG indicated that they did not support the development of Interruptible Exit Capacity Products.

- Fuel switching by gas fired stations and/or large gas consumers – In order to achieve the appropriate demand side reduction, gas fired stations would only be suitable. However, there are significant economic, technical and timing issues that would need to be considered. BGN/Gaslink understand that fuel switching should only be considered in the event of a gas supply emergency and would not be suitable as a market demand side measure.

- Amend Shipper 'Renominations' – This may adversely impact on both the gas and electricity markets. Greater system flexibility, i.e. 'Renominations', will be required to facilitate the increasing wind generation capacity in the Single Electricity Market (SEM).

- Measures involving gas storage – These would be expensive and complex to implement. There is also the risk that the gas in storage would be released to the UK market and therefore not available when required to meet supply demands on the island of Ireland.

- Measures to ensure continued high pressure at Moffat – Consultation with National Grid UK indicate this is an unlikely option. Regardless, such a measure would not resolve the pressure loss in the SWSOS transmission system, which is the cause of the capacity constraint.

The measures outlined above are short term solutions and the short-term capacity constraint referred to in the consultation would also arise under the following scenarios;

- If Corrib were further delayed a capacity constraint would also arise in winter 2014/15 and for each subsequent year Corrib is delayed.

- Post Corrib's peak production period, i.e. approximately 4 to 5 years after Corrib commences, and assuming there are no further supply developments on the Island. The Moffat Entry Point (Interconnector system) will then revert to supplying the significant majority and eventually all of the Island's demand.

- In the event of a Corrib outage (which could occur at any time of year), the Moffat Entry Point (Interconnector system) would be required to meet all, or the significant majority, of the Island's gas demand (assuming no further supply developments on the Island).

Therefore, BGN/Gaslink believe the most optimal mitigation measure should be considered in the context of a capacity constraint in the short term (before Corrib), medium term (with Corrib) and long term (post Corrib).

As stated in the JGCS 2011; uncertainty surrounds both the existing and potential future new supply sources on the Island. Supplies through the Inch Entry Point may cease in 2015/16, Shannon LNG have stated they cannot currently provide a likely start date for operations, Islandmagee storage (Larne) did not make a submission to the JGCS 2011 and North East Storage (Larne) have indicated 2017/18 as an earliest possible start date. BGN/Gaslink are also mindful of current domestic, European and Global economic conditions and the resulting challenges and uncertainty it presents to Investors.

Considering the anticipated growth in future gas demand, including new gas fired power plant, its increasing participation in the ROI energy mix and the uncertainty regarding future new supply sources post Corrib, GB gas imports will continue to be required to meet a significant portion of the ROI's energy requirements. As a result, the Interconnector system will be required to continue providing the safe and reliable service it has provided to date, in transporting GB gas imports to ROI customers.

The single section of 50km transmission pipeline has also being identified in debate regarding SOS over the last number of years. The ESRI have stated, "Ireland is vulnerable to any difficulties with a single pipe", in their latest 'Review of Irish Energy Policy'. The CER's current SOS assessment has

identified the single section of 50 km pipeline as a 'failure mode'. Reinforcing this section of pipeline would greatly enhance the ROI's security of supply.

As noted previously, the capacity limits of the Interconnector system will be approached over the next three winters, thereby necessitating immediate action, either an increase in system (supply) capacity or a reduction in demand. The appropriate mitigation measure should also be appropriate to resolve any capacity constraint in the medium and long term.

Considering all of the mitigation measures proposed in the consultation document and with regard to the 'High Level Principles' proposed by the RAs, BGN/Gaslink believe the reinforcement of the onshore Scotland (SWSOS) network is the most optimal measure. The reinforcement ensures "the physical security and reliability of gas supplies to Ireland", meets the requirement to "enhance links with the UK energy market" and ensures 'the gas continues to flow'. It is also a relatively straight forward solution, with no effect on market/commercial arrangements in both the gas and electricity markets and on the basis that a decision will be taken by the RA's in Jan '12 can be in place by 2013/14.

In summary, after considering all of the options BGN/Gaslink believe reinforcing the single section of 50 km SWSOS transmission pipeline is the most appropriate measure for both 13/14 and beyond in that it not just provides a solution for 13/14 but it also guarantees supply capacity into the future, provides the required supply security and the system flexibility to meet the Islands demand requirements for the foreseeable future.

If you have any inquiries on the attached please contact me at your convenience.

Yours Sincerely,

Denis Twomey
Commercial Manager
Bord Gáis Networks

This response is made by BGN on behalf of BGN, BGE(UK) and Gaslink.

Contents

Executive Summary

The role of natural gas in the Republic of Ireland's energy mix has grown significantly over the past 3 decades, particularly for thermal power generation, with 60% of electricity currently generated from gas fired power plants. This is anticipated to continue growing even with an increase in renewable generation capacity. Natural gas remains the most competitive fossil fuel for thermal power generation, in response to increasing carbon prices and subdued gas prices resulting from abundant global gas reserves.

The interconnector system supplied 93% of ROI gas demand in 2010/11. This contribution is four times that of Great Britain's (GB) largest Entry Point on the NG NTS, St. Fergus, which met 23% of GB supply in 2010/11, this highlights the importance of the Interconnector system to Ireland.

The 1-in-50 weather conditions and corresponding gas demands that occurred on two separate occasions in 2010 (January and December) demonstrated, that though the Interconnector system is robust, it is approaching capacity limits. Both events also provided confidence in the demand forecasting methodology employed by BGN Network Planning, with actual peak demands and forecasted peak demands closely aligning on both occasions.

As noted in the JGCS 2011 and the recently published Winter Outlook; the capacity limits of the Interconnector system (Moffat Entry Point) will be approached over the next three winters should 1-in-50 peak demand arise. Average year peak demands would also result in the Interconnector system operating in a zone of limited capacity, which presents significant challenges to the system operator and increases the risk of network issues arising.

BGN/Gaslink understand that this capacity constraint is not unique to 2013/14, but would also arise under the following scenarios;

- A further delay to Corrib; currently assumed to be online in 2014/15. If Corrib is delayed by 1 year the capacity constraint will also arise in winter 2014/15 and for each subsequent year Corrib is delayed.

- Post Corrib's peak production period, i.e. approximately 4 to 5 years after Corrib commences, and assuming no further supply developments on the Island. The Moffat Entry Point (Interconnector system) will then revert to supplying the significant majority and eventually all of the Island's demand.

- In the event of a Corrib outage (which could occur at any time of year), the Moffat Entry Point (Interconnector system) would be required to meet all, or the significant majority, of the Island's gas demand (assuming no further supply developments on the Island).

Therefore, BGN/Gaslink believe the optimum mitigation measure should be considered in the context of a capacity constraint in the short term (before Corrib), medium term (with Corrib) and long term (post Corrib).

The arrival of Corrib gas will be a significant benefit to diversity of supply, as it increases the overall supply capacity on the network, increases competition and improves the ROIs Security of Supply (SOS) position. However, its production lifespan is limited with peak production levels anticipated to fall after four years, thereafter Interconnector supplies will once again rise. GB gas imports supplied by the

Interconnector system will be critical in meeting the significant majority and eventually all of ROI's demand, unless future new supply sources on the Island are developed.

As stated in the JGCS; uncertainty surrounds both the existing and potential future new supply sources on the Island. Supplies through the Inch Entry Point may cease in 2015/16, Shannon LNG have stated they cannot currently provide a likely start date for operations, Islandmagee storage (Larne) did not make a submission to the JGCS 2011 and North East Storage (Larne) have indicated 2017/18 as an earliest possible start date. BGN/Gaslink are also mindful of current domestic, European and Global economic conditions and the resulting challenges and uncertainty it presents to investors.

Considering the anticipated growth in future gas demand, its increasing participation in the ROI energy mix and the uncertainty regarding future new supply sources post Corrib, it is probable that GB gas imports will continue to be required to meet a significant portion of the ROI's energy requirements. As a result, the Interconnector system will be required to continue providing the safe and reliable service it has provided to date, in transporting GB gas imports to ROI customers.

Although the subsea section of the Interconnector system has sufficient capacity to meet long term gas demand, part of the onshore section of the Interconnector system in Scotland will require further development, in order to provide the capacity for a safe and reliable supply service in the future. This development will require the reinforcement of the single section of 50 km transmission pipeline between Cluden and Brighouse Bay in South West Scotland[1], currently a 'bottleneck' in the SWSOS transmission system. This reinforcement has been part of the long term network development plan since its inclusion in the "Gas 2025" study published by BGÉ in 1999.

The single section of 50km transmission pipeline has also being identified in debates regarding SOS over the last number of years. The ESRI have stated, "Ireland is vulnerable to any difficulties with a single pipe", in their latest 'Review of Irish Energy Policy'[2]. The CER's current SOS assessment[3] has identified the single section of 50 km pipeline as a 'failure mode'. Reinforcing this section of pipeline would significantly enhance the ROI's security of supply.

As noted previously, the capacity limits of the Interconnector system will be approached over the next three winters, thereby necessitating immediate action, either an increase in system (supply) capacity or a reduction in demand. The appropriate mitigation measure should also be appropriate to resolve any capacity constraint in the medium and long term.

Considering all of the mitigation measures proposed in the consultation document and with regard to the 'High Level Principles' proposed by the RAs, BGN/Gaslink believe the reinforcement of the onshore Scotland (SWSOS) network is the optimum measure. The reinforcement ensures "the physical security and reliability of gas supplies to Ireland"[4], meets the requirement to "enhance links with the UK energy market"[4] and ensures 'the gas continues to flow'. It is also a relatively straight forward solution, with no effect on market/commercial arrangements in both the gas and electricity markets and can be in place by 2013/14.

BGN/Gaslink believe the other proposed measures would not resolve the capacity constraint;

[1] Upgrades to the existing compressor stations in South West Scotland may also be required post 2020
[2] "A Review of Irish Energy Policy" – John Fitzgerald, ESRI, April 2011
[3] The risk assessment is required under regulation EU 994/2010
[4] "Government White Paper: Delivering A Sustainable Energy Future for Ireland"

- Interruptible Exit Capacity products – Following analysis of industry responses to the "CAG 2012 Business Rules: Capacity (Revision 1.0)" consultation undertaken in mid 2011, the CER and UREG indicated that they did not support the development of Interruptible Exit Capacity Products.

- Fuel switching by gas fired stations and/or large gas consumers – In order to achieve the appropriate demand side reduction, gas fired stations would only be suitable. However, there are significant economic, technical and timing issues that would need to be considered. BGN/Gaslink understand that fuel switching should only be considered in the event of a gas supply emergency and would not be suitable as a market demand side measure.

- Amend Shipper 'Renominations' – may adversely impact both the gas and electricity markets. Greater system flexibility, i.e. 'Renominations', will be required to facilitate the increasing wind generation capacity in the Single Electricity Market (SEM).

- Measures involving gas storage – would be expensive and complex to implement. There is also the risk that the gas in storage would be released to the UK market and therefore not available when required to meet supply demands on the island of Ireland.

- Measures to ensure continued high pressure at Moffat – The pressures observed at Moffat in recent years have diminished and within day pressure volatility has increased. Consultation with National Grid UK indicates any change to existing pressure arrangements at Moffat would be unlikely. Regardless, such a measure would not resolve the pressure loss in the SWSOS transmission system, which is the cause of the capacity constraint.

Accelerating the requirement to reinforce the 50 km pipeline in Scotland has associated accelerated costs for industry, which could be considered avoidable in light of Corrib coming on stream. However, BGN have undertaken a Cost Benefit Analysis (CBA), which provides a clear indication of the economic feasibility of the accelerated reinforcement.

After considering all the options, BGN/Gaslink believe reinforcing the single section of 50 km SWSOS transmission pipeline is the most appropriate measure, guaranteeing the supply capacity, the supply security and the system flexibility required to meet the ROI's future demand requirements in 2013/14 and for the foreseeable future.

The construction and commissioning of the SWSOS reinforcement by winter 2013/14, though ambitious, can be achieved subject to; regulatory approval of investment by January 2012, procurement of pipeline materials in early 2012, no unforeseeable delays to the final statutory consents and no other unforeseeable risks.

1. The Moffat Entry Point

1.1 Overview

GB gas imports will continue to meet the significant majority (or possibly all)[5] of the Island's peak day gas demand until Corrib commences commercial production. However, there is a limitation to the amount of GB gas that can meet the Island's demand, despite sufficient gas supplies being available in GB. This limitation is due to the technical capacity of the Moffat Entry Point on the BGÉ system.

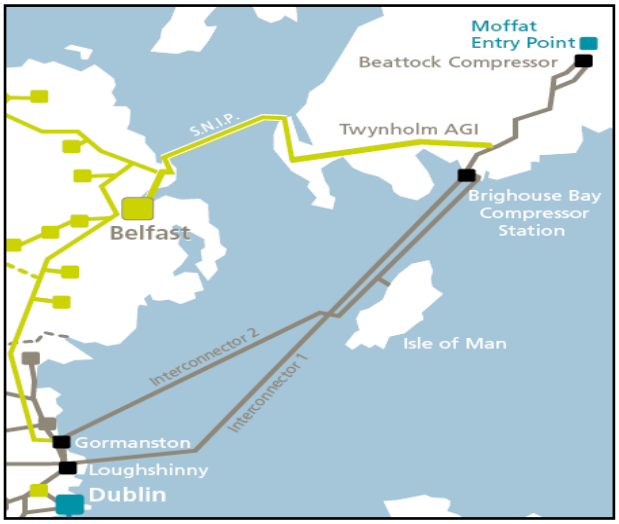
1.2 Moffat Entry Point Technical Capacity

Technical capacity is defined as "the maximum firm capacity that the Transmission System Operator can offer to the network users, taking account of system integrity and the operational requirements of the transmission network"[6].

In simple terms, Entry Point technical capacity is a measure of the amount of gas that can be transported physically from a supply point in the gas network. The technical capacity of the Moffat Entry Point is determined by the technical capacity of the infrastructure between Moffat and the ROI onshore transmission system, known as the 'Interconnector system', comprising of the 'Southwest Scotland Onshore System' (SWSOS), i.e. Beattock compressor station, the onshore Scotland transmission system and Brighouse Bay compressor station, and the 'Subsea Interconnector system' (ICs) i.e. Interconnector 1 (IC1), Interconnector 2 (IC2) and the pressure reduction stations at Gormanston and Loughshinny (See figure 1.1).

The potential technical capacity of the ICs is 51 mscmd[7] (subject to upstream infrastructure and pressures), however the current capacity of the SWSOS system is 31 mscmd[8], thus limiting the current capacity of 'Interconnector system' to 31 mscmd. Therefore, the current capacity of the Moffat Entry Point is limited to the capacity of the SWSOS system, 31 mscmd.

Figure 1.1: Overview of the Interconnector system



[5] Moffat will be required to meet 100% of the Island's demand, if Inch supply is unavailable
[6] European Regulation EC 715/2009
[7] Based on the nominal design capacity of IC1 (17mscmd) and IC2 (34 mscmd)
[8] Details on the Technical Capacity; http://www.BGN/Gaslink.ie/index.jsp?p=136&n=205

1.3 The function of Entry Point capacity

The capacity of an Entry Point, e.g. Moffat, should be sufficient to facilitate the following;

- Meet downstream total daily demand (End of Day Quantity (EODQ)); and
- Provide sufficient flexibility to accommodate 'Renominations', i.e. 'within day' demand fluctuations/changes, which may result from unexpected demand or supply events, e.g. increased demand and/or a supply outage at another Entry Point.

1.4 System Flexibility and Flow Profiling

Ideally 'day ahead' gas demand nominations at the Moffat Entry Point would remain unchanged and there would be no requirement for 'Renominations', allowing the transmission system operator to flow the gas with a uniform flow profile[9], i.e. flat flow profile.

The reality however is very different, with 'Renominations' occurring hour to hour during the gas day, in response to changes in the downstream customer gas demand. This requires the system operator to flow gas in a non uniform flow profile, i.e. stepped/swing profile in order to meet the required EODQ.

'Renominations' at the Moffat Entry Point are inevitable, as it is impossible to consistently predict 'day ahead' gas demand with 100% accuracy. This is particularly relevant to the power generation sector, which accounts for ~60% of peak day demand. Hourly changes or fluctuations to power generation gas demand can occur for a number of reasons, e.g. higher than anticipated electricity demand or lower than anticipated wind levels could potentially result in additional gas fired station(s) being dispatched. To date, the gas network has provided the required flexibility to the Single Electricity Market (SEM).

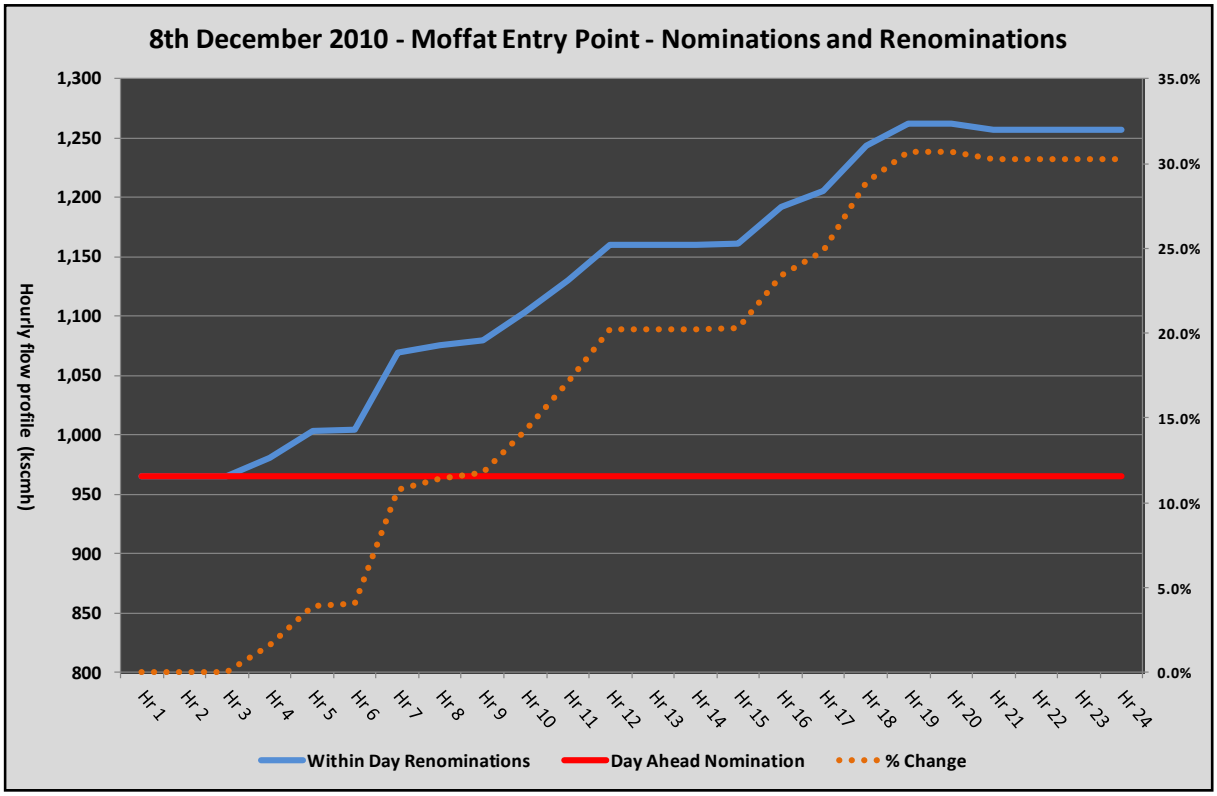
Such events can significantly impact on the scale of 'Renominations' at the Moffat Entry Point, e.g. if a 85 MW OCGT was dispatched unexpectedly, its total maximum gas demand for the day would be equivalent to the peak day gas demand of approximately 60,000 residential homes.

Figure 1.2 illustrates the level of variation between the original 'day ahead' nominations and the actual 'within day' 'Renominations' observed on the 8th of December, during the severe weather period in 2010. As illustrated, there was a variation of +20%, increasing to +30% for a significant number of hours during the gas day. This pattern is not unique to the 8th of December, as similar 'Renomination' patterns are typical on most days.

It is unlikely this scale of 'Renominations' could be accommodated for the 1-in-50 peak day demand forecasts over the forthcoming winters, resulting in a potential shortfall in customer demand requirements, particularly the power generation sector if a sustained cold period occurred, similar to that of December '10.

[9] Technical capacity of Moffat Entry Point is subject to the system being in a steady state, i.e. flat flow profile. The assumption of a stepped/swing profile is likely to reduce the technical capacity of the Moffat Entry Point.

Figure 1.2: 'Day Ahead' nominations and 'Within Day' 'Renominations' on the 8th December



1.5 Moffat Entry Point Peak Day Supply Outlook

The following table illustrates the forecasted 1-in-50 peak day flows[10] through the Moffat Entry Point (Interconnector system) for the next 9 years, the current capacity of the Moffat Entry Point (Interconnector system) and the percentage of capacity utilised (assuming a flat flow profile).

Table 1.1: Moffat Capacity, Moffat Peak Flow Forecast and Moffat Capacity Utilised

Year	*Moffat Capacity[1] (mscmd)*	*Forecast Peak Flow (mscmd)*	*% of Capacity utilised (Flat Flow)*
2011/12	31	30.1	97.1
2012/13	31	28.5	91.9
2013/14	31	30.7	99.1
2014/15	31	21.7[2]	70.0[2]
2015/16	31	23.9[3]	77.1[3]
2016/17	31	25.3	81.6
2017/18	31	27.8	89.8
2018/19	31	29.5	95.2
2019/20	31	31.5	101.6

[1]The capacity of the Moffat Entry Point may increase to 32 mscmd from mid 2012, subject to the successful completion and testing of current engineering works. Details on the Technical Capacity; http://www.Gaslink.ie/index.jsp?p=136&n=205.
[2] If Corrib is delayed one year, Moffat flow for 2014/15 will increase to 31.2 msmcd with 100.6% of capacity utilised
[3] If Corrib is delayed two years, Moffat flow for 2015/16 will increase to 33.4 mscmd with 107.8% of capacity utilised

The forecasted flows in the above table demonstrate that capacity limits of the Moffat Entry Point (Interconnector system) are being approached on the 1-in-50 peak days for the forthcoming winters.

[10] Joint Gas Capacity Statement 2011

The residual of '% of Capacity utilised' is an indication of the amount of physical flexibility available to accommodate 'Renominations'. Also, it's important to note, operating in this zone of limited capacity presents significant challenges to the system operator and increases the risk of network issues arising.

ROI shippers have been advised in advance of the current winter, to flatten flow profiles in the SWSOS system, i.e. provide timely and accurate nominations and 'Renominations'. The availability of the East/West electricity Interconnector from 2012/13 should result in lower gas demand for the 2012/13 peak day, reducing flow through the Moffat Entry Point (Interconnector system).

However, by 2013/14 there is little or no flexibility to accommodate any change to 'day ahead' nominations, i.e. no 'Renominations'. Capacity limits are breached at the Moffat Entry Point (Interconnector system) in 2014/15, regardless of how the gas flow is profiled, and consequently a partial gas supply disruption may occur.

The continuation of existing (or expanded) Celtic Sea operations post 2012/13 could potentially improve the potential capacity constraint at Moffat (Interconnector system). However, supplies from the Celtic Sea through the Inch Entry point are subject to a number of factors including;

- Commercial/contractual arrangements between the facility's operator (Kinsale Energy) and the relevant shippers
- The time of year. If a severe weather period occurred in the latter part of the winter, the required gas stocks and/or the delivery (withdrawal)[11] rate may not be available.

Also, existing storage withdrawal rates would only be sufficient to reduce the magnitude of the capacity constraint, rather than resolve it. A significant increase on existing Inch supply levels would be required to resolve the capacity constraint at Moffat.

In addition to this, in the highly unlikely event of an outage at (or upstream) of Midleton compressor station, could result in the requirement for Moffat (Interconnector system) supply to meet all of the Island's demand.

As Kinsale Energy have not provided any certainty regarding future operations in the Celtic Sea, it is reasonable to accept their base case position for the JGCS, i.e. existing operations may cease in 2012/13, followed by a 3 year decommissioning phase until final cessation of supply after 2015/16. On this basis, the forecasted Moffat flows and percentage of capacity utilised in table 1.1 reflect the central/base view.

1.6 Current limitations at the Moffat Entry Point

The capacity of the Moffat Entry Point is limited by the technical capacity of the SWSOS system, which is currently subject to the technical capacity of Beattock compressor station. The technical capacity of Beattock compressor station is determined by a number of factors, primarily;

- The power available within the compressor units; and
- The station's inlet pressure; and
- The station's discharge pressure

[11] Delivery/Withdrawal rate is a function (in part) of the volume of gas in storage. Higher delivery/withdrawal rates can be achieved when storage is full to max capacity.

The capacity of the station increases[12] if; higher inlet pressures are available, discharge pressures are reduced and/or the power of the compressor units is increased.

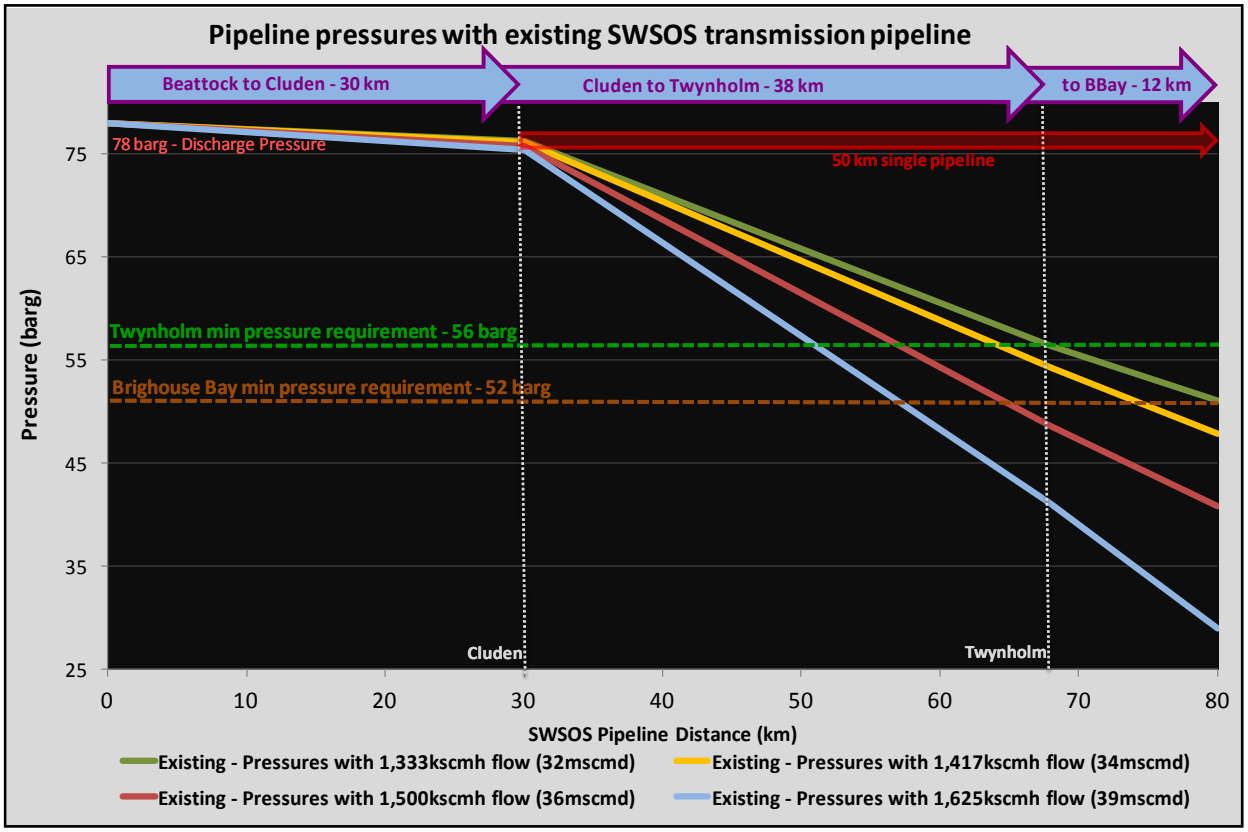
The power available within the compressor units is limited by the existing technology in the station and a station upgrade (including new compressor and turbine technology) would be required to increase this power.

Inlet pressures are subject to the pressures available from the National Grid (NG) National Transmission System (NTS) at Moffat, and therefore, are outside the control of BGN/Gaslink (subject to existing contractual arrangements)[13].

The discharge pressure at Beattock is within the control of BGN/Gaslink, and therefore (in theory), could be reduced to increase flow through the compressor station, thus increasing the capacity of the Moffat Entry Point. However, there are limitations to reducing the discharge pressure at Beattock.

Beattock is required to provide sufficient pressures to meet the downstream pressure requirements at Twynholm[14] and Brighouse Bay compressor station[15]. A significant amount of pressure is lost between Beattock, Twynholm and Brighouse Bay, particularly during periods of high demand. Figure 1.3 graph illustrates the pressure losses across 80 km SWSOS system for a range of flows, with a pressure losses ranging from ~27.0 barg to 49.0 barg for flows of 1,333 kscmh (32 mscmd) and 1,625 kscmh (39 mscmd[16]) respectively.

Figure 1.3: Existing SWSOS Transmission system pressures for a range of flows



[12] This increase is theoretical and refers specifically to the compressor units. Further analysis and physical testing of the station's subsystems may be required to verify an increase to overall station capacity.

[13] Minimum pressure of 42.5 barg under the Pressure Maintenance Agreement (PMA)

[14] Contractual ('Transporters Agreement') entitlement of Minimum pressure of 56 barg.

[15] Minimum design inlet pressure of 52 barg, however, pressures in excess of 60 barg would be required during periods of peak demand.

[16] 39 mscmd is the max Exit capacity available at the NTS Moffat Exit point (Connection Service Agreement (CSA))

As illustrated the majority of the pressure losses occur in the 50 km single 24" pipeline between Cluden, Twynholm and Brighouse Bay, and increase as the volume of flows increase. Such pressure losses in the SWSOS system place an additional obligation on Beattock compressor station. Beattock is required to discharge at a pressure to meet downstream pressure requirements at Twynholm and Brighouse Bay, but implicit in this, is the requirement to provide pressure to compensate for the significant pressure losses in the SWSOS system.

In effect, the discharge pressure at Beattock is constrained by a requirement to compensate for the pressure losses in the SWSOS system. Removing this constraint would allow Beattock to discharge at lower pressures, thus increasing the capacity of the compressor station and consequently the Moffat Entry Point (Interconnector system).

It is also important to note; increasing the capacity of Beattock compressor station does not strictly mean an increase in capacity of the Moffat Entry Point (Interconnector system). As noted above the constraining factor is the single 50km section of SWSOS pipeline. An increase to the station inlet pressures and/or an increase in compressor power will increase the capacity of the station. However, while Beattock may have the capacity to flow higher volumes of gas, the SWSOS transmission system will not have the capacity to transport the gas downstream to Twynholm and Brighouse Bay.

1.7 Future uncertainties at the Moffat Entry Point

There are a number of other factors which could potentially impact on the capacity of the Moffat Entry Point (Interconnector system).

1.7.1 Pressure

As noted in section 1.6, the capacity of Beattock compressor station is subject (in part) to the pressures available from the GB National Transmission System (NTS) at Moffat, i.e. the inlet pressure to Beattock. Lower Moffat pressures imply a lower station capacity and/or station discharge pressure at Beattock. The current technical capacity (31 mscmd) of Beattock is based on an Anticipated Normal Offtake Pressure (ANOP) of 47 barg. However, the minimum contractual pressure NG are required to provide under the Pressure Maintenance Agreement (PMA) is 42.5 barg. Analysis indicates the Beattock's capacity will reduce to ~27.4 mscmd if a suction pressure of 42.5 barg is assumed.

To date the ANOP pressure (47 barg) has being assumed for 1-in-50 peak day network planning purposes. This was validated by actual pressures[17] observed in early January 2010, when 1-in-50 type weather conditions and demand events occurred. However, during December 2010 and January 2011, the ANOP pressure (47 barg) was breached for a number of hours on a number of days.

Within day pressure variations also impact on compressor station operations. The frequency and magnitude of pressure variations has increased in recent years, as a result of a change in demand/supply patterns in the GB NTS.

National Grid have indicated that the Moffat Exit Point is now considered to be a 'Null' point on the NG NTS; Moffat may receive gas from the North or South of the NTS. The changing supply pattern in GB is expected to continue, i.e. declining indigenous production from the UK Continental Shelf and increased imports via LNG and continental imports. The majority of supply will revert from the North, i.e. through St. Fergus in Scotland, to the South, i.e. Milford Haven, Isle of Grain, etc.

[17] Actual hourly pressures ranged from 50.0 barg to 56.7 barg.

This may impact on the levels of linepack in the North West section of the NTS, and consequently Moffat, leading to pressures breaching the ANOP (47 barg) more frequently, and within day pressure volatility increasing.

Such events could have a diminishing affect on the technical capacity and operation of Beattock compressor station, and consequently the capacity of the Moffat Entry Point (Interconnector system).

1.7.2 Gross Calorific Value (GCV)

The Moffat peak day gas supply forecasts are generated on an energy basis. The volumetric equivalent is derived from the energy forecast and an assumed GCV, 39.77 MJ/scm[18].

Any deviation from the assumed GCV (39.77 MJ/scm) impacts on the volumetric forecast, i.e. a lower GCV implies higher volumes and conversely a higher GCV implies lower volumes.

As noted in section 1.7.1, the supply pattern in GB is changing and this is expected to continue. The majority of supply will revert from the North, i.e. through St. Fergus in Scotland, to the South, i.e. Milford Haven, Isle of Grain, etc. This change could potentially impact on the GCV of gas at Moffat.

If future GCVs at Moffat fall below 39.77 MJ/scm, the peak day flows would need to increase despite no change in the energy requirement. This would exacerbate the potential capacity constraint in onshore Scotland, as the SWSOS system would be required to flow higher volumes of gas than those anticipated in the forecast.

[18] The actual GCV of Moffat gas typically ranges from 39.7 MJ/scm to 40.0 MJ/scm

2. Mitigation Measures to address the Moffat Capacity Constraint

This section discusses the potential mitigation measures that could be implemented to address the potential capacity constraint at the Moffat Entry Point (Interconnector system).

2.1 Interruptible Exit Capacity Products

Arising from a request from the CER and UREG, Gaslink and Mutual Energy developed a consultation paper (Ref: CAG 11013) to assess whether Interruptible Exit Capacity was required at Transmission Exit.

"CAG 2012 Business Rules: Capacity (Revision 1.0)" was issued for consultation on the 5th July 2011. Responses were invited from industry during the 4 week consultation period.

Following the receipt of industry responses the CER and UREG indicated that they did not support the development of Interruptible Exit Capacity Products for the following reasons;

- Interruptible Exit Capacity Products are not suitable to address volatility issues.
- No capacity constraints exist currently (at Transmission Exit).

Based on the above information, BGN/Gaslink are of the view that the introduction of Interruptible Exit Capacity Products would not result in the mitigation of the potential constraints envisaged for Moffat in 2013/14.

This view is predicated on two principal factors:

- Given that there are no existing capacity constraints at Transmission Exit, it is reasonable to suggest that the probability of interruption is very low, thus resulting in the price difference between interruptible and firm products being negligible.
- In this eventuality, no commercial incentive exists to suggest significant uptake of the interruptible products.

2.2 Fuel Switching (Demand Side Management)

In terms of gas, demand side management could seek to reduce customers demand by either requesting them to turn off, reduce demand or source an alternative fuel supply. Such a measure could reduce the forecasted peak demand and peak gas flows through the Moffat Entry Point, and consequently avoid the potential capacity constraint occurring.

Irish gas consumers are categorised as follows;

- Power Generation (Power Gen)
- Transmission Connected Daily Metered Industrial & Commercial (Tx DM I/C)
- Distribution Connected Daily Metered Industrial & Commercial (Dx DM I/C)
- Distribution Connected Non Daily Metered Industrial & Commercial (Dx NDM I/C)

- Residential (Res)

Supply to residential customers is protected under Irish[19] and EU[20] law, and therefore, this sector cannot be considered for demand supply management. NDM I/C customers are predominantly SMEs and may also be considered as protected customers under Irish law, and therefore, may not be considered for demand side management. The Dx DM I/C sector is mainly comprised of commercial type enterprises, including essential services such as hospitals, and therefore are unlikely to be suitable for demand side management. There may be some scope for the Tx DM I/C sector to partake in demand side management, however, Tx DM I/C demand accounts for approximately 4% to 5% of peak day ROI demand, and is unlikely to make any significant contribution to demand reduction compared to other sectors, e.g. Power Gen.

Power Gen is best positioned to yield an effective demand side management response, considering it accounts for ~60% of total ROI peak day gas demand. Currently, there are existing demand side management arrangements in place for the power generation sector, in the event of a gas supply emergency. These arrangements ('Secondary fuelling obligation') require generators to fuel switch from gas within 5 hours of being notified by EirGrid/SEMO, in the event of a gas supply emergency (i.e. loss of a major supply point, e.g. Moffat).

Though fuel switching may be an effective mechanism for demand side management in a gas supply emergency situation, there are a number of factors that need to be considered in using it as a mechanism to resolve a gas transmission capacity constraint.

There are a range of costs associated with fuel switching;

- Gasoil (the secondary fuel at the majority of power stations) is approximately 140%[21] more expensive than the price of gas on a €/GJ basis. This means an additional fuel cost of ~€600k per day for one 430MW CCGT.

- In addition to the above, there may be further fuel costs incurred during the period the plant has fuel switched and is ramping up to max export capacity.

- Significant volumes of demineralised water are required to ensure Nitrogen Dioxide (NOx) and Sulphur Dioxide (SOx) emissions are within the Integrated Pollution Prevention Control (IPPC) licensing requirements.

- Increased carbon costs. Gasoil has a higher carbon intensity than gas, implying higher carbon emissions.

- Transportation costs associated with replenishing fuel and demineralised water stocks.

- Increased fuel and water storage infrastructure at stations, if fuel and water stock levels in excess of existing levels[22] are required.

- Increased maintenance costs associated. Degradation of parts and maintenance intervals may increase after burning gasoil.

[19] Statutory Instrument (S.I.) No. 697 of 2007
[20] European Union (EU) Council Directive 2004/67/EC of 26 April 2004.
[21] Based on current (November '11) fuel prices (Source: Intercontinental Exchange (ICE)).
[22] 'Baseload' stations and 'Peaker' stations are required to hold 5 days and 3 days respectively.

There are also a number of other potential issues that need to be considered when fuel switching;

- Fuel stocks and demineralised water stocks are limited to 5 days for 'Baseload' power stations and 3 days for 'Peaker' plants. These levels of stock may be insufficient to meet requirements during a sustained cold weather period (similar to December 2010).

- The increased risk of an outage. This could potentially occur during fuel switching or when the plant is operating on the secondary fuel.

  EirGrid annually request the various power stations to fuel switch and run on the secondary fuel for a limited number of hours[23]. No test has been undertaken to determine if power stations can operate on a secondary fuel for a sustained period. In addition to this, there has been no secondary fuel testing during severe weather conditions.

- The stations maximum export capacity may be reduced while burning a secondary fuel. This could have implications for generation supply adequacy, particularly during periods of very high electricity demand (that tend to occur during periods of severe cold weather).

- The existing commercial arrangements in the SEM may need to be amended to compensate for the costs incurred by the Generators in fuel switching.

BGN/Gaslink understand that fuel switching should only be considered in the event of a gas supply emergency and would not be suitable as a market demand side measure.

2.3 Amend Shipper 'Renominations'

As noted in section 1.4 'Renominations' at the Moffat Entry Point are inevitable, as it is impossible to consistently predict 'day ahead' gas demand with 100% accuracy.

This is particularly relevant to the power generation sector, which accounts for ~60% of peak day demand. Hourly changes or fluctuations to power generation gas demand can occur for a number of reasons, e.g. higher than anticipated electricity demand or lower than anticipated wind levels could potentially result in additional gas fired station(s) being despatched. To date, the gas network has provided the required flexibility to the Single Electricity Market (SEM).

Amending or constraining within day Shipper 'Renominations' would have a significant impact on the SEM, particularly with the continuing increase of renewable generation on the electricity grid.

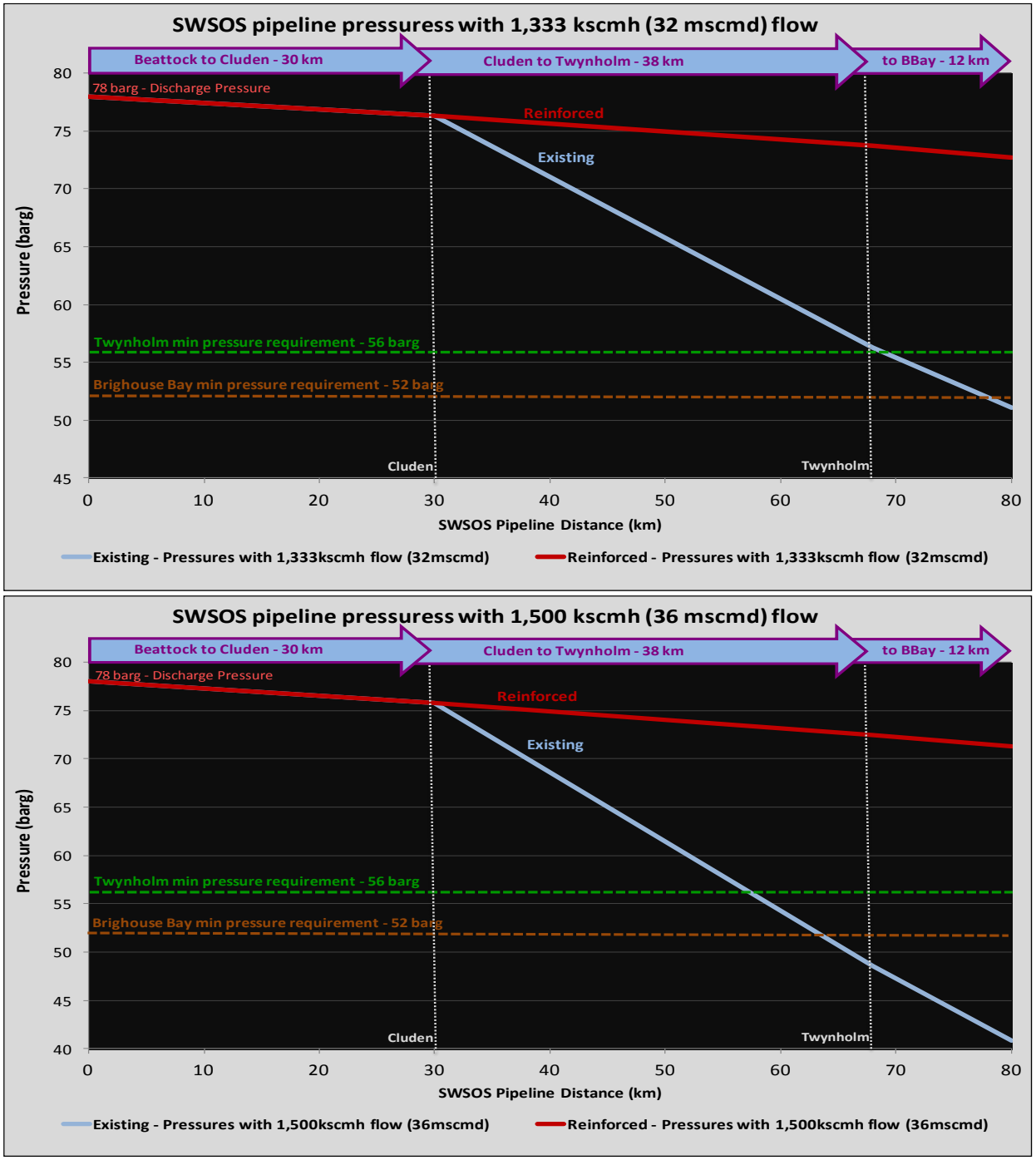
2.4 Reinforce the SWSOS system - 50km single section of pipeline

Figure 2.1 illustrates the pressure losses in the SWSOS system with the existing single 50 km pipeline and with the 50 km pipeline twinned[24].

[23] EirGrid have indicated approximately 1 to 2 hours

[24] Existing 50 km pipeline is twinned with a 36" diameter pipeline

Figure 2.1: Existing & Reinforced SWSOS Transmission system pressures for a range of flows[25]



As noted in section 1.6, Beattock is currently required to provide additional pressure to compensate for the significant pressure losses in the SWSOS transmission system. However, as the pressure losses are significantly reduced with the reinforced/twined pipeline, the required discharge pressure at Beattock is reduced, thus increasing the capacity of the station.

In addition to this, the reinforcement removes the 'bottleneck' and increases the capacity of the SWSOS transmission system, which can now transport high volumes of gas to Tywnholm and Brighouse Bay and provide sufficiently high pressures.

The provision of high pressures at Brighouse Bay is very important, as the capacity of Brighouse Bay is subject (in part) to the station inlet pressures, i.e. the greater the inlet pressure the greater the station capacity.

[25] The range of flows included in the graph are for illustration purposes.

Detailed comprehensive desktop compressor and network modelling studies indicate the capacities at Beattock and Brighouse Bay increase by 10% to 20%[26], if the 50 km single section of SWSOS pipeline is reinforced. As a result, the capacity of the Moffat Entry Point (Interconnector system) will increase to a level that is sufficient to meet the forecasted peak day requirements at Moffat over the forecast period[27].

In effect, reinforcing the 50km single section of SWSOS pipeline could increase the capacity of the Moffat Entry Point (Interconnector system) by ~10% to ~20%. In addition to this, the reinforcement could allow for the full potential capacity of the IC system (51 mscmd) to be realised[28], if the compressor station(s) in Scotland were also upgraded in the future.

Reinforcing the SWSOS transmission system provides a safeguard against a loss in the current capacity of the Moffat Entry Point (Interconnector system), that could result from lower pressures at the Moffat Entry Point with the existing system (see section 1.7.1).

The other additional benefits to reinforcing the SWSOS system are discussed in section 3.

2.5 Measures Involving Gas Storage

Given the commercial, and market drivers of storage, it is difficult to see how it could be relied upon to meet the definitive needs of the gas market for 13/14. Assuming the gas is physically available in storage on the Island it may not be available for supply to the Irish Market as the owners of the gas have the option of selling the gas into the UK market to avail of potentially higher prices. This would in itself worsen the supply situation on the island. The reverse flow of gas into the UK market, and it not being available to meet the supply demands in ROI and NI, is particularly feasible with the introduction of the Reverse Flow Product at Moffat.

In the event that an obligation is placed on parties to hold strategic storage this would have a high cost associated with it. These costs would include both the cost of purchasing and storage of the gas which costs would be passed on to the consumer. The costs of the gas itself would likely relate to peak prices to reflect what the suppliers would get if they were selling the gas into the market at times of peak prices. Use of storage could therefore be an extremely costly event and in any case would only be a temporary solution for 13/14 where as twinning onshore Scotland would be an enduring solution from which the gas market would benefit over an extended period.

In the event that similar arrangements were again required in 14/15 this could be an even greater cost to the consumer for what is effectively a short term solution.

2.6 Enhanced Pressure Arrangements at Moffat

Increasing the inlet pressure at Beattock would increase the capacity of the compressor station. The inlet pressure at Beattock is subject to the available pressure at the Moffat Exit Point on the NG NTS.

Under existing contractual arrangements, NG is required to provide a minimum pressure of 42.5 barg at Moffat. However, NG have advised BGN/Gaslink of a higher Anticipated Normal Offtake Pressure

[26] Further analysis of the station's subsystems would be required to verify they can meet the higher flows.

[27] It is likely an upgrade to the SWSOS compressor stations will be required post 2019/20, particularly if Moffat reverts to being the main source of supply to the Island.

[28] Subject to the provision of this capacity at the Moffat Exit Point on the NG NTS (currently 39.0 mscmd)

(ANOP) pressure of 47 barg (i.e. the expected pressure under normal circumstances). The technical capacity of Beattock compressor station is based on the 47 barg ANOP. (It should be noted the ANOP was breached on a number of occasions during the 2010/11 winter).

Enhanced pressures at Moffat would increase the capacity of Beattock compressor station, however, as noted in section 1.6 the constraining factor in the SWSOS system is the single 50km section of transmission pipeline. Pressures in excess of the ANOP may increase the capacity of the station[29], enabling higher flows, however, the SWSOS transmission system would not have the capacity to transport the high volumes of gas downstream to Twynholm and Brighouse Bay and/or provide sufficiently high inlet pressures at Brighouse Bay.

An enhanced pressure arrangement as a standalone solution, would not resolve the potential capacity constraint at the Moffat Entry Point (Interconnector system). In addition to this the pressures observed at Moffat in recent years have diminished and within day pressure volatility has increased. Consultation with National Grid UK indicates any change to existing pressure arrangements at Moffat would be unlikely.

2.7 Recommended solution

After considering all the options, BGN/Gaslink believe reinforcing the single section of 50 km SWSOS transmission pipeline is the most appropriate measure, guaranteeing the supply capacity, the supply security and the system flexibility required to meet the ROI's future demand requirements for the foreseeable future.

The construction and commissioning of the SWSOS reinforcement by winter 2013/14, though ambitious, can be achieved subject to; regulatory approval of investment by January 2012, procurement of pipeline materials in early 2012, no unforeseeable delays to the final statutory consents and no other unforeseeable risks.

[29] Regardless of any increase to the station's inlet pressure, the station's discharge pressure is limited to 85 barg; the MOP of the SWSOS transmission system.

3. Additional Benefits to Reinforcing the 50 km SWSOS Pipeline

In addition to resolving the potential capacity constraint at the Moffat Entry Point (Interconnector system), there are a number of other benefits to reinforcing the single section of 50 km SWSOS pipeline;

- Security of Supply
- Fuel gas savings
- Increased operational flexibility

3.1 Security of Supply

"A secure supply of energy is essential for a modern economy. Any major failure in supply could have dramatic negative consequences for welfare"[30]. Despite the ROI having the SOS benefit of two subsea pipelines and the two SWSOS transmission pipelines between Beattock and Cluden, this benefit is somewhat diminished by the 50 km single section of SWSOS pipeline.

A breach to the 50km section of single pipeline would result in the total loss of Moffat supply to the Island (upstream of Twynholm) or the ROI and IOM (downstream of Twynholm). Reinforcing the single section of pipeline provides a complete dual pipeline system between Moffat and the ROI onshore transmission system. This would remove the vulnerability of relying on a single section of pipeline to supply the significant majority of the Island's supply.

Removing this vunerablility would also improve sentiment towards the Irish gas industry, considering the dependency on gas and consequently the single SWSOS transmission pipeline, particularly for the power generation sector and their customers.

In addition to transporting GB gas supplies to the ROI and IOM, the ICs provide a SOS service to the ROI. The pressure in the ICs is maintained to ensure minimum operational requirements and sufficient linepack to meet approximately two days of non-power generation gas demand, in the event of a gas supply disruption. Higher pressures in the ICs correspond with periods of high demand, when a greater level of linepack is required.

Analysis indicates the pressure in the ICs would need to be in excess of 125 barg on peak demand days to ensure two days of non-power generation gas demand could be met in the event of a gas supply disruption. In order to transport Moffat supplies from the SWSOS system to the ROI (and IOM), Brighouse Bay would be required to discharge at pressures in excess of the ICs pressure.

Brighouse Bay's capacity is subject to a number of factors, primarily, the inlet pressure, discharge pressure and power within the compressor units. If the station is required to discharge at a high pressure (exceeding 125 barg), a corresponding increase in the inlet pressure and/or compressor power is required, otherwise the station's capacity would reduce. However, the compressor power is limited by the existing technology, unless a compressor upgrade is undertaken. Therefore, higher inlet pressures are required.

[30] "A Review of Irish Energy Policy" – John Fitzgerald, ESRI, April 2011

With the current SWSOS transmission system, pressures at the inlet to Brighouse Bay would not be sufficient to provide the required discharge pressure, without impacting on the station's capacity. During periods of peak demand the pressures in the ICs may need to be reduced in order to free up transportation capacity, thereby ensuring EODQ volumes are met. In effect, this reduces the security of supply stock in the ICs. It is therefore unlikely IC linepack would be sufficient to meet minimum operational requirements and two days of non-power generation gas demand, in the event of a gas supply disruption.

Reinforcing the single section of the SWSOS transmission pipeline would result in sufficiently high inlet pressures at Brighouse Bay, whereby the station would have sufficient capacity and could discharge at the required high pressures, without any need to reduce pressures (SOS linepack) in the ICs (notwithstanding the need for 2 days of linepack or not).

3.2 Fuel Gas Savings

3.2.1 Beattock Fuel Gas Savings

The function of the compressor unit(s) is to compress the gas, i.e. to increase the pressure of the gas from the inlet pressure conditions to the required discharge pressure. The gas turbines provide the power/energy to the compressors and consume fuel gas to provide this power. An increase to compression implies an increase in turbine power, and consequently an increase in fuel gas consumption.

As stated in section 2.1, Beattock is required to provide pressure to compensate for the pressure losses in the SWSOS transmission system; these pressure losses range from 27 barg to 49 barg depending on flows (see figure 1.3). An Increase in discharge pressure implies an increase in compression. There is a cost associated with providing this additional/compensatory compression, i.e. the cost of fuel gas.

Reinforcing the single section of pipeline significantly reduces the pressure losses in the SWSOS transmission system (see figure 2.1), and consequently the required discharge pressure at Beattock is reduced. Reducing the station's discharge pressure implies a reduction in compression[31], and consequently turbine power and fuel gas consumption.

The same fundamentals also apply at Brighouse Bay. Higher pressures would be available at the inlet to Brighouse Bay, implying a reduction in compression, turbine power and fuel consumption.

Preliminary analysis[32] has determined annual fuel gas savings ranging from ~€1 million to ~€2 million subject to Corrib supply volumes. The fuel gas saving would increase if lower pressures occur on the inlet to Beattock, and/or if flows exceed the forecast for GB imports.

3.2.2 SWSOS Pressure Conditions

Currently pressure conditions in the SWSOS transmission system can fluctuate significantly throughout the day, particularly during periods of peak flows. Such pressure fluctuations impact on operations at both Beattock and Brighouse Bay compressor stations, requiring the compressor units to 'ramp up' and

[31] Assuming the station inlet pressure conditions are unchanged
[32] Based on steady state (flat flow) conditions

'ramp down' and/or additional compressor units to operate, in response to pressure fluctuations downstream (Beattock) and upstream (Brighouse Bay) in the SWSOS transmission system.

The 'ramping up' or 'ramping down' of a compressor unit would not be considered an efficient mode of operation compared to operating the compressor on a single 'set point'. Operating the compressors under such a regime is likely to result in increased fuel gas consumption. In addition to this, the requirement to operate additional compressor units would also result in increased fuel gas consumption.

Reinforcement provides for steadier pressure conditions in the SWSOS transmission system. The frequency of compressors operating in an inefficient mode of operation would significantly reduce, as would the requirement for additional compressor units to run. This would result in reduced fuel gas usage at both compressor stations.

3.3 Increased operational flexibility and efficiency

Reinforcing the SWSOS transmission system would provide for greater operational flexibility of the SWSOS system. The interdependence between Beattock, Brighouse Bay and Twynholm would significantly reduce and the two SWSOS transmission pipelines could operate independently of each other. The level of operational flexibility is important to facilitate both existing and future commercial and regulatory requirements.

Future gas market developments will present considerable challenges in operating the transmission network such as virtual reverse flow at Entry Points, increased wind generation capacity resulting in increased within day gas demand volatility and the potential for a single All-Island transmission network under the Common Arrangements for Gas (CAG) regime.

Increased operational flexibility may provide greater scope for operating the network with regard to reducing maintenance and wear on the network assets, which could result in capex savings.