CER

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An Coimisiún um Rialáil Fuinnimh

Common Arrangements for Gas Project

Stage Two Cost Benefit Analysis

20th April 2009

Utility Regulator

ELECTRICITY GAS WATER

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Executive Summary

The Common Arrangements for Gas ("CAG") project proposes to simplify and streamline the operation of the gas transmission assets linking South West Scotland, Northern Ireland, the Isle of Man and Ireland. This would build on the current industry structure, retaining a strong link to the Great Britain (GB) market and has received the support of industry. The project has evolved from the commitment of authorities on the island to undertake practical measures that deliver mutual benefits consistent with their statutory duties and strategic objectives.

This Stage Two Cost Benefit Analysis has considered a wide range of potential impacts on the project and has identified considerable qualitative and strategic benefits including increased investment in the gas industry to improved security of supply across the CAG network. Overall the Regulatory Authorities (RAs) believe that this project would deliver significant benefits to consumers and industry on the island.

CAG seeks to optimise the existing gas infrastructure between all of the jurisdictions, forging the current level of close interaction into a cohesive structure robust enough to play a part in the goal of the European Union to achieve a Single Gas Market. The gas industry is already closely integrated with common use of the Moffat entry point in Scotland, physical interconnection through the South North (SN) Pipeline, contractually operated from the same transmission control room and suppliers and Transmission System Operators (TSOs) that operate in both Ireland and Northern Ireland. We both face similar issues of a relatively immature industry and common security of supply concerns.

The updated analysis has been informed by the ongoing work of both RAs in developing and consulting on the arrangements to deliver CAG. It is based on achieving harmonisation and integration of the arrangements governing gas transmission tariffing and operation as outlined in the Memorandum of Understanding signed by both RAs in February 2008. The CAG project is much less complex and costly than the Single Electricity Market (SEM) which required the design, creation and implementation of a new wholesale market. However significant elements of the project would require legislative support and are dependent on the decision of the Departments in Northern Ireland and Ireland. Therefore, any detailed work must be undertaken in line with the Departments' work programme on legislation to implement CAG. The RAs will therefore align their work plan with the Departments' timetable for implementing CAG legislation.

The cost benefit analysis compares CAG with the optimal counterfactual position. In considering the alternatives to CAG it is clear that 'do nothing' is not an option. Issues such as cross border use of interconnectors (ICs) and the Scotland Northern Ireland Pipeline (SNIP) in an emergency, changes to the Northern Ireland regime to improve streamlining and IC mitigation will have to be addressed in all scenarios. The counterfactual we have used assumes that changes are made to the current industry structure to address some of the issues highlighted above, such as use of the SNP. These changes are further detailed in the analysis.

The main benefits that have been identified are of a strategic nature and as such are difficult to quantify with a great degree of accuracy. We have attempted to provide some quantitative analysis for some of the benefits, for example, around storage facilities. We would emphasise that investment decisions around such projects are complex and we are not suggesting that CAG, in itself, would entail benefits of such magnitude. However the direction and significance of the benefits are clear and represent a considerable benefit from this project. These benefits include:

- Increasing Competition - the larger market which CAG could open up should reduce barriers to competition and so improve the conditions for new suppliers to enter the market with the subsequent benefits of price competition, quality of service and innovative products accruing to all customers.

- Enhanced Investment Potential – it is clear from discussions with developers that the CAG regime will make the gas industry on the island a more attractive investment opportunity. This would have a direct effect on those considering projects, both on their overall viability and on their size. This is relevant in areas such as gas storage and Liquefied Natural Gas (LNG). Indeed it is difficult to envisage how a storage facility would be commercially feasible in Northern Ireland without CAG. Such projects involve investment amounting to hundreds of millions of pounds. Also the availability of gas storage could potentially realise savings to suppliers of £5.75 million per annum by taking advantage of the winter/summer price gas differential.

- Improved Security of Supply - the larger gas network that CAG delivers will create a more robust system to handle incidents and emergencies without affecting supplies. The whole island will also have access to domestic gas fields and storage facilities to reduce the risk of interruption in times of supply shortages. Also the potential for increased investment in LNG and storage would bring direct security of supply benefits. The development of such facilities would significantly improve our ability to maintain supply in an emergency and avoid direct government investment in strategic storage. Both governments could potentially avoid direct investment in strategic storage if commercial ventures developed such facilities. This could amount to an annual avoided cost of £2.8 to £4.1 million for both governments.

- Interoperability with GB and Europe – as Europe moves more towards increased interoperability and the goal of a single market, CAG ensures that both jurisdictions are moving in step with Europe and should allow the island to progress towards further integration with GB and Europe. The implementation of CAG should allow for a more effective interface with the North West (Gas Regional Initiative (GRI)) – the European initiative to create single regional markets within Europe.

- Level Playing field for SEM – in a number of areas, such as tariffs and connection policies, CAG will ensure that all parties involved in SEM are treated equally, thus reducing distortions to the electricity wholesale market.
- Efficient Network Planning – harmonisation of network planning will ensure networks are optimised on an all-island basis and remove any potential for inefficiencies in planning networks and reinforcements. It will also allow consideration to be given for cross border projects that might extend the gas network to the North West of the island.

As well as the list of strategic benefits this analysis demonstrates that even on a purely quantitative measurement the project delivers a net present benefit (NPV) of £10.6 million (over 10 years using a discount rate of 3.5%) across the whole island with positive benefits in both jurisdictions.

In order to determine the costs and benefits to each jurisdiction, individual stakeholders were assigned their particular costs and benefits. After apportioning the costs and benefits to the respective stakeholders, our initial analysis shows £4.1 million net benefits to Northern Ireland and £6.5 million to Ireland. While these are significant figures on their own, however when set against a customer base of 700,000, it is clear that the key benefits of CAG are in delivering strategic goals in line with the RAs' duties.

The principal quantitative benefits identified in our analysis are those derived from operating the gas network in a more efficient manner and from efficiencies in moving to a single IT solution for managing operations. There are also a significant amount of benefits that have been categorised as avoided costs. These are costs that would have to be incurred under the counterfactual but are 'avoided' with CAG. The main CAG costs are implementation costs, consisting of legal and other professional consultants' costs in designing, drafting and implementing the new regime.

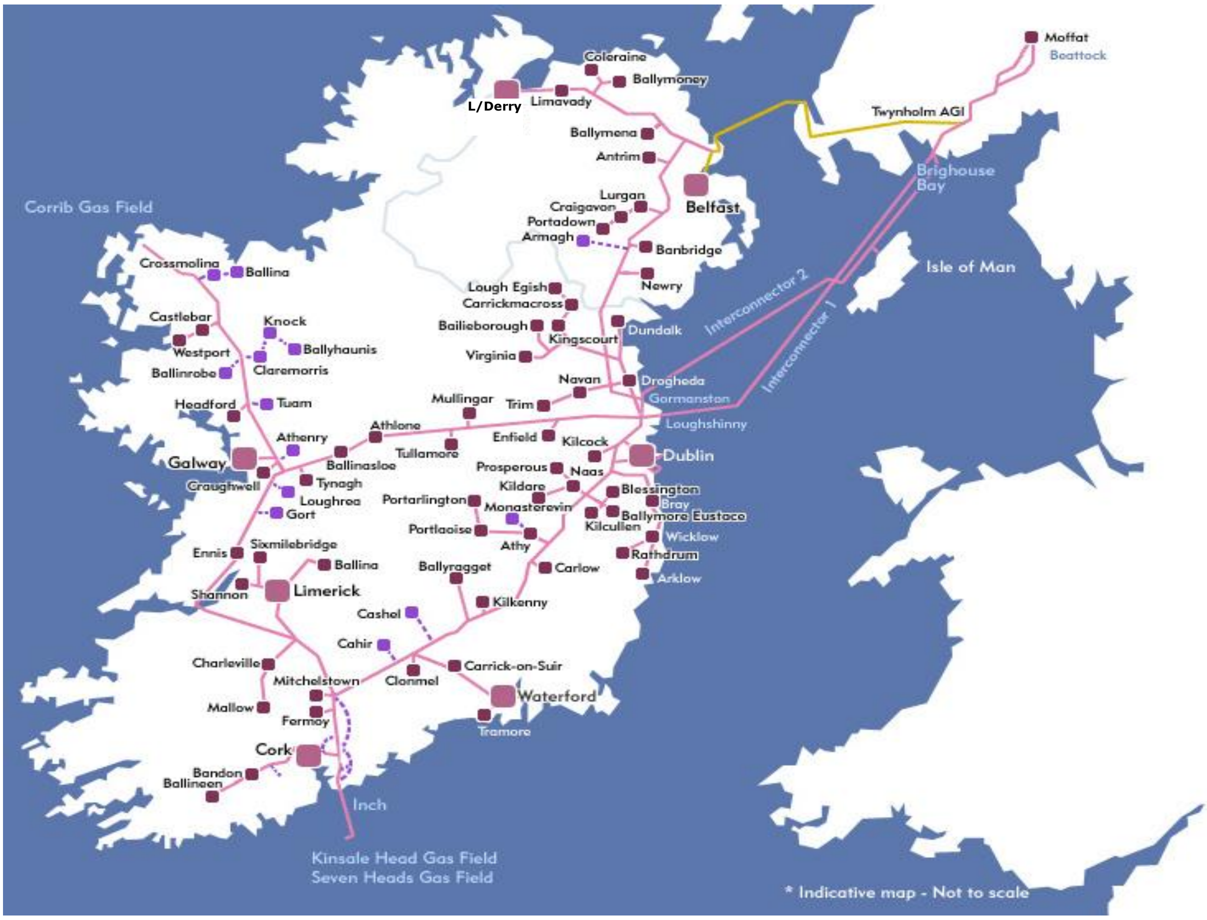
The table below summarises the net present value of the high-level quantifiable benefits that may be expected from the establishment and implementation of CAG. These values are calculated over two timeframes and using two discount rates to reflect the appraisal rates used in both jurisdictions. It should be noted that these figures do not include detail with respect to the harmonisation of gas retail arrangements. The approach has assumed that benefits will be realised in 2010. In order to make 2010 the base year, the future value of costs have been calculated as at 2010.

Summary Table: Discounted Net Benefits of Proposed CAG Project

Discount Rate	10 Years		20 Years	
	€000's	£000's	€000's	£000's
5%	€12,126	£9,701	€20,990	£16,729
3.5%	€13,239	£10,591	€24,263	£19,410

The figures used in the text of the paper are the 'central case' scenario figures in that they are the costs and benefits most likely to materialise as a result of the implementation of CAG. A sensitivity analysis has been applied to include an 'optimistic' and a 'pessimistic' case. The assumptions used with respect to each cost and benefit line for these scenarios are detailed within the paper. In summary, using a 3.5% discount rate, the optimistic case scenario shows an NPV benefit of £16.94m and the pessimistic case a figure of £6.25m.

Map of CAG Network



1.0 Introduction

1.1 Purpose of Stage Two Cost Benefit Analysis

This analysis is a development of the preliminary cost benefit analysis published by the Regulatory Authorities (RAs) on 30th July 2008[1] which drew some high level conclusions on the merits of developing and implementing common gas arrangements as well as helping to inform the decision making process in the scoping of the project. Since July, progress has been made on a number of the Common Arrangements for Gas (CAG) workstreams and as a result the Utility Regulator and CER have decided to issue a 'stage two' cost benefit analysis in an attempt to refine the estimates on the costs and benefits identified in the preliminary paper as well as to scope whether any further costs or benefits have been identified.

This analysis again considers the potential net benefits associated with the development of CAG. The assumptions and underlining principles of this analysis are based on the statement of intent incorporated in the Memorandum of Understanding (MoU) signed by both RAs in February 2008. That is to: "establish All-Island Gas Market Arrangements whereby all stakeholders can buy, sell, transport, operate, develop and plan the natural gas market north and south of the border effectively on an all-island basis. This means that variations in the price and conditions on which gas is bought and sold will be determined by market conditions and economics, not by variations in regulatory arrangements."

The focus of this analysis is to outline the associated costs and benefits in creating such arrangements and to quantify where possible the net benefits that are expected to arise from their implementation.

Although progress has been made in a number of the CAG workstreams, it should be noted that the identified costs and benefits and their associated figures (where quantifiable) will continue to be reviewed as the workstreams progress. We will also have the opportunity to consider in further detail the costs and benefits apportioned to the individual stakeholders.

It should be noted that to date the costs of the project, which chiefly constitute consultancy costs, have been closely monitored by the RAs and they remain in line with forecasts. The costs will continue to be monitored as the CAG project progresses.

The analysis is segmented into four principal sections. The first section details the approach used in the analysis; the current market arrangements and a brief outline of the proposed arrangements. Section two discusses the potential qualitative and strategic benefits of CAG. Section three contains the quantifiable analysis, identifying and quantifying the costs and benefits associated with the different

[1] Common Arrangements for Gas Project , Preliminary Cost Benefit Analysis , 30th July 2008

workstreams of the proposed project. Section four concludes with a summary of the findings of the analysis. Appendix 1 details the calculations presented throughout the paper and Appendix 2 summarises the net present value of the project as a whole.

1.2 Development of CAG

The CAG project proposes to simplify and streamline the operation of the gas transmission assets linking South West Scotland, Northern Ireland, the Isle of Man and Ireland[2]. As part of the European Union, we are committed to the development of a Single European Gas Market. The European Commission has put in place an overarching legislative framework within which all member states are working to achieve the Single Gas Market which is designed to bring benefits to all European citizens and to contribute to Europe's competitiveness.

Within this framework, cross border trading is developing and the interconnectivity of gas networks is increasing. Countries that are physically close are developing closer trading ties. In this environment we face a unique challenge and a unique opportunity. On the one hand the island is far less interconnected than other mainland European jurisdictions but on the other, it has the opportunity to create common arrangements and to realise the benefits of this move for consumers of gas and electricity and for the Ireland and Northern Ireland economies. Furthermore, in the future it may be possible to align gas arrangements in both jurisdictions with that of Great Britain and North West Europe. The implementation of CAG should allow for a more effective interface with the GRI North West region of Europe.

During the last two years, the RAs have engaged in significant work with the relevant Government Departments in Northern Ireland and Ireland. To date, work has concentrated almost solely on the electricity side of the overall project and has delivered notable successes, e.g. the implementation of the wholesale Single Electricity Market (SEM) in November 2007. This SEM work continues and will be ongoing for several more years.

The proposed CAG project is anticipated to be simpler than the implementation of the SEM due to a number of issues, the key one being that there is to be no wholesale gas market on the island along the lines of SEM and both jurisdictions tend to rely on the GB National Balancing Point (NBP) market. There is also the fact that the CAG network is currently operated under contract from a single transmission control room in Cork, Ireland. Therefore CAG would build upon existing arrangements rather than starting from new.

A further reason for the progression of CAG has been the fact that there is now a physical interconnection between the gas systems in Northern Ireland and Ireland following the construction and commissioning of the South North gas transmission pipeline in late 2006. Informal arrangements are in place for emergencies but these need to be formalised and arrangements for normal flows need to be put in place if the Authorities in Northern Ireland and Ireland wish to pursue the forecasted benefits

[2] Referred to as the CAG network in the remainder of the paper.

of harmonisation of gas operation. Without CAG these issues will still have to be dealt with. We further consider these issues below.

1.3 Counterfactual

In order to appraise both the costs and benefits of the proposed CAG project, the RAs have compared a scenario where CAG is implemented against a counterfactual scenario in which we assume the existing systems in Ireland and Northern Ireland continue as would have been the case without CAG. We refer to this in the paper as the "Business-as-usual" (BAU) scenario although, as is made clear below, this scenario will also require a significant amount of changes to the current regime. The BAU is an essential part of this analysis as it is against this that all costs and benefits are assessed.

Under the BAU scenario there are a number of issues that each jurisdiction would have needed to address which would have required changes to systems and contractual agreements. We have explicitly identified these costs in the analysis and they are set out in section 3 as 'avoided costs'. We believe that this methodology provides the greatest transparency. The RAs recognise that as an alternative approach, BAU and CAG could have been presented as two separate options allowing for comparison. However whether BAU is included as an avoided differential cost under CAG or presented as a separate total cost, in either case, it is expected that the same conclusions would be drawn.

For example, under BAU Northern Ireland at some point in the near future would be faced with the costs of harmonising the Northern Ireland transmission network through the introduction of a single Northern Ireland Transmission System Operator (TSO). This would itself bring about similar issues that are faced within CAG such as who the single Northern Ireland TSO would be, how they would be licenced, what contracts would need to be in place as well as the harmonisation of the current transmission network codes to create a single network code. Northern Ireland would also be faced with the need to move from a Postalised tariff regime given the EU preference for entry/exit tariff regimes. This in itself would give rise to substantial design, consultancy, legal and implementation costs in order to oversee this transition.

Additionally, arrangements to allow the flow of gas through the South-North (SN) pipeline will need to be put in place. This will require the development of network codes, arrangements for booking the interconnectors and the development of cross-jurisdictional emergency arrangements. Therefore under BAU, arrangements would be required to deal with the use of the SN pipeline for all shippers who wish to connect to the pipeline in Ireland. In light of CAG the RAs and relevant stakeholders are therefore avoiding the costs associated with having to develop alternative arrangements for the treatment of the SN pipeline.

In Ireland, the arrival of Corrib and Shannon LNG will give rise to decreasing utilisation of the interconnectors and the issue of the resulting rise of interconnector tariffs would have to be addressed. This would involve the hiring of consultants to design and implement the solution. However the issue is being dealt with as part of the CAG tariff workstream with the consultants undertaking the analysis as part of their work.

As discussed above, costs would still be incurred under a BAU scenario. With regard to benefits, it is perceived that the gains would not be as great as those available under a future CAG scenario. For example the opportunity to benefit from operational efficiencies would be more limited under BAU and duplication of IT systems would continue. Strategic benefits may also be curtailed under BAU. For example under BAU, Corrib and Shannon LNG may not be commercially attractive to Northern Ireland or proposed Larne storage ventures may be less attractive to investors without CAG in place.

1.4 Alternative Options

As set out in section 1.5 we have assumed a particular CAG structure. This structure has been assumed in order to allow us to estimate the costs and benefits of CAG. The costs and benefits referred to in section 3 therefore assume we put in place this specific structure. We have also set out above our BAU case which provides the benchmark against which we have measured costs and benefits. There is however the question of whether there is a structure which could be implemented for a lower cost but would still deliver a significant benefit to both Ireland and Northern Ireland customers. The specific options have been considered in detail in the relevant workstream consultations. For example the operations workstream considered whether the benefits of a single operation of the system and a single balancing zone could be delivered by co-ordination between existing TSOs without the requirement for significant licence or legislative changes. However it was felt that this option would incur its own costs to implement without delivering the benefits associated with harmonisation.

The development of a North West European market has also been considered as an alternative approach to CAG. Both RAs are currently actively working with the regulators in the North West Europe Gas Regional Initiative (NW GRI) to create a gas market in this region. This initiative is at a very early stage and will not deliver the benefits expected of CAG in the short or medium term. Therefore NW GRI should be viewed as complementary to CAG as opposed to being an alternative. We have also considered a UK/Ireland market but it is not clear what benefits this would have over a NW European market and it appears optimal for all parties to concentrate on delivering the benefits of a larger market through the NW RGI.

Overall we have not identified any alternative option which would approach the level of CAG benefits. This is a function of the structure of the gas industry on the island whereby the current level of co-operation lends itself to significant harmonisation at relatively low cost.

1.5 Approach to Analysis

This analysis is underpinned by a number of principles. These principles are rooted in the project's core objectives as outlined in the MoU. In summary these are:

- To encourage a “single market” approach that does not create incentives to differentiate between different parts of the market on a member state basis
- To ensure that gas is bought and sold in competitive markets, at both wholesale and retail levels
- To ensure that CAG delivers benefits to customers, north and south, and
- To control and eventually eliminate dominant positions from potentially competitive markets

For the purpose of conducting an analysis of the costs and benefits associated with developing and implementing CAG, this analysis makes a number of assumptions about the final structure of the arrangements. These assumptions are based on the proposals and commitments outlined in the MoU agreed upon by the RAs. It assumes that upon completion of CAG the arrangements will comprise of:

- Single transmission system operation;
- Single transmission tariff methodology;
- Single transmission connection policy ;
- Single approach to transmission system planning and development, and
- Single codes and processes for retail.

This analysis presents both the strategic and quantitative benefits that may arise upon completion of the CAG project. As the strategic benefits are of a qualitative nature it is difficult to apply measurement with a great degree of accuracy. However when a strategic benefit has been quantified the method of calculation and underlying assumptions have been stated. Also where possible the strategic benefits have been supported with examples where such benefits have been demonstrated. These benefits are presented in section two of the paper. Where applicable, the calculations supporting the figures used in the text have been included in Appendix 1.

In identifying and quantifying the quantitative costs and benefits, this analysis compares CAG with the BAU scenario. The costs have been developed by comparing projected operating costs of a combined system with those of the BAU. These projected operational costs are the costs of governing and administering the new arrangements. The possible costs involved in implementing the proposals have also been identified. Typically these included costs associated with designing and implementing rules and procedures, system changes and consultancy and legal costs.

The quantitative benefits of the project have been identified and estimated in terms of the efficiencies arising from CAG relative to BAU and the avoided costs resulting from the harmonisation of the markets in Ireland and Northern Ireland. The quantitative benefits of the project can be categorised largely as either operational benefits or avoided costs.

To support the quantitative analysis, the RAs requested network modelling by BGN and PTL to investigate the potential operational efficiencies of operating the CAG network as a single system. The modelling was based on maximising the use of

SNIP which allows a portion of RoI demand to be supplied from SNIP via the SN pipeline. Channelling gas through the SNIP and SN pipe is an operationally more efficient route than channelling all of the RoI demand through the ICs. As a result of operating the system in this way, less compression at Brighouse Bay Compressor Station is required and fuel-gas savings can be realised.

The analysis has also shown that by operating the system in this way, there are further savings through inventory product that is made available on the interconnectors. On certain days, as flow is diverted through SNIP, additional capacity is made available at Brighouse Bay. This releases capacity on the ICs to effectively be used as 'storage'. This inventory product can then be used as a gas resource, which will offer savings if utilised by suppliers.

The analysis has shown that as Corrib and Shannon become operational the RoI demand on the IC system will decrease significantly and consequently the level of fuel-gas savings will reduce. However the reduction in fuel-gas savings in this scenario will be off-set by the availability of increased IC inventory product. The developments of Shannon and Corrib will reduce the demand on the throughput at Moffat. Consequently this will create higher source pressures at Twynholm and allow a greater volume of exports through SNIP. As flow is diverted through the SNIP additional inventory benefits can then be realised.

In summary, operating Moffat as a single system under CAG will allow gas to be diverted from the ICs to SNIP. This creates additional capacity on the ICs which can be used as inventory product. The developments of Corrib and Shannon will increase the benefits as more gas can be diverted through SNIP due to the increased pressures available at Twynholm.

The analysis is set against a number of assumptions that form the Base Case scenario. As discussed above, key supply side assumptions include Corrib and Shannon LNG coming online in 2009/2010 and 2012/13 respectively. Key demand side assumptions include, amongst others, the introduction of additional power station demand over the period of analysis.

The approach of the analysis was to then calculate the Peak, Median and Minimum Summer Day demand against the Base Case scenario to allow for an approximation of the annual volume of fuel gas savings. The modelling results are further discussed in section 3.2 with the supporting calculations presented in Appendix 1.

The modelling results[3] and underlying assumptions were published on both Regulators' websites on 18th November 2008 and presented to industry at a workshop on the 5th December 2008.

It should be noted that any ongoing annual benefits such as operational efficiencies are assumed to be constant over the ten/twenty year period. In practice these

[3] CER 08/231

benefits will vary but we feel assuming a constant figure is the most appropriate method for the purposes of this analysis.

The information and estimates used in conducting this analysis has been obtained from the various codes and policy documents in both jurisdictions and from discussions between the RAs and system operators in Ireland and Northern Ireland. Where appropriate, costs have been estimated through experience of costs incurred in similar projects such as SEM or Postalisation. This approach has mainly been applied to legal and consultancy costs, which constitute a significant portion of overall costs. In assessing the net present value (NPV) of the ongoing costs and benefits of the project, this analysis assumes a discount rate of 3.5% and discounts the costs and benefits over the first ten years of the project. A 3.5% discount value has been used to be consistent with the Northern Ireland Practical Guide to the Green Book. Additionally, Appendix 2 provides a summary of the net benefits of each work-stream over a ten and twenty year period using a 5% discount value, which is consistent with the cost of capital approved by the CER in the Bord Gáis five-year revenue review completed in 2007 for the period of October 2007 to September 2012. The approach has assumed that benefits will be realised in 2010. Therefore, in order to set 2010 as the base year, future values of costs have also been calculated to 2010. Given the early stage of the project the estimates used in this analysis are indicative only of the actual costs and benefits that will arise when the project is complete and the Common Arrangements for Gas are in place.

Throughout the paper we have expressed all costs and benefits in Sterling. For the purposes of this analysis we have assumed an exchange rate of £1 = €1.25 with the exception of the network modelling which at the time of analysis assumed a rate of £1 = €1.28.

Similarly, the exchange rate will vary over the period of analysis and may impact upon the presented costs and benefits. The RAs will review the analysis should any change provide significant impact to the figures presented.

All costs derived for the purposes of this cost benefit analysis are in 2008/09 prices but have been future valued to 2010 prices using a rate of 3.5%. For example the £497,000 quoted in section 3.1.1 for tariff design costs is £480,000 in 2008/09 costs but has been future valued to 2010 prices at a rate of 3.5%.

1.6 Sensitivity Analysis

The figures used in the text of the paper are the 'central case' scenario figures in that they are the costs and benefits we feel are most likely to materialise. As a sensitivity analysis however we have included both an optimistic scenario and a pessimistic scenario in our analysis. The optimistic scenario is the outcome whereby the highest net benefits are realised i.e. the lowest cost with the highest benefits, and the pessimistic scenario is the outcome which achieves the lowest net benefits i.e. the highest cost with the lowest benefit. The basis for the optimistic and pessimistic scenarios varies depending on the cost and/or benefit in question. For the majority of costs we have assumed a decrease in any consultancy, design, legal and implementation costs of 15% for the optimistic case and for the pessimistic case we have assumed the costs associated with CAG rise by 25%. The reason why the 15% reduction is not mirrored by a 15% increase is that we are of the opinion, through experience of comparative projects, that the costs are more likely to rise against the central case than they are to fall, due to for example the potential for a delay in the implementation of the project or the legal costs over running as a result of unforeseen legislation requirements. As discussed in section 1.1 however, all costs have been and will be closely monitored throughout the project. The RAs are confident that any deviation from forecasts would be captured early on through internal project controls.

With regards to the benefits assumed for our sensitivity analysis, for the operational benefits such as fuel gas savings, IC inventory, balancing savings and carbon savings the operators have provided a range of benefits depending on the scenario used. Therefore for our optimistic case we have assumed the highest benefit in the range is achieved and for the pessimistic case we have assumed the lowest benefit in the range is achieved. For the other benefits which mostly entail avoided costs this issue does not arise as these benefits are linked to the costs therefore as the costs fluctuate the benefits fluctuate in line with them.

For example the avoided costs of Northern Ireland moving to an Entry/Exit system are linked to the costs incurred through the design, legal and implementation costs of introducing a tariff methodology under CAG. As the design, legal and implementation costs are reduced by 15% for the optimistic case or raised by 15% for the pessimistic case, the avoided costs will fall and rise in line respectively.

The central case is the case referred to throughout the text but where we have made a specific assumption regarding the optimistic and pessimistic case we have explained our rationale.

The analysis also presents a split of the costs and benefits to each jurisdiction. This was achieved by assigning individual stakeholders with their particular costs and benefits. Where applicable, we have assigned the costs and benefits by applying a simple third, two thirds split to Northern Ireland and Ireland respectively.

1.7 Overview of Current Arrangements

1.7.1 Physical System

Currently, the transmission systems in Ireland and Northern Ireland operate independently of each other with only some cooperation on cross border issues, such as emergencies. Both systems share the use of assets at Moffat, which is used to import gas from the GB system. The pipeline splits at Twynholm, from which all gas going to Northern Ireland flows through the Scotland to Northern Ireland Pipeline (SNIP) and all gas going to Ireland flows through the Interconnectors (IC1 and IC2) via Brighouse Bay. Gas is transported through these pipelines and the onshore systems under different codes and by different system operators. A map illustrating the CAG network is presented in section 1.0.

1.7.2 Network Operations

The Northern Ireland gas transmission network consists of three transmission assets. Each asset has its own network code:

- Scotland to Northern Ireland Pipeline (SNIP) owned by Northern Ireland Energy Holdings (NIEH) and operated by Premier Transmission Limited (a wholly owned subsidiary of NIEH).

- Belfast Gas Transmission Pipeline (BGTP) now owned by NIEH due to the purchase of Phoenix Natural Gas transmission assets on the 31st March 08. The system operation of the BGTP, through the establishment of a new company, Belfast Gas Transmission Limited (BGTL), is now integrated into Premier Transmission Limited management structure.

- BGE(NI) hold and operate the third transmission asset – the North West Pipeline, which was built to supply gas to the Coolkeeragh power plant and the South North Pipeline, but has extended the provision of gas to domestic and business customers in the area

Additionally there are two distribution system operators within Northern Ireland: Phoenix Natural Gas Limited and Firmus Energy Distribution Limited with several companies also licenced to supply gas. Modifications have been made to the transmission codes to streamline the contents and harmonise network practices across the system. These include harmonising the nomination and allocation processes, developing a single balancing point and applying the same technical requirements for parties using the network.

The Irish transmission and distribution systems are currently operated by a single operator and governed by a single, unified code providing for the transportation of gas from entry point to customers' supply point. This reflects the Irish market model where there is a clearer separation of shipper and distributor functions. Currently only Gaslink is responsible for the development, maintenance and safety of the Irish transmission and distribution networks. Gaslink is also responsible for the development of the Code of Operations, which outlines the rights and obligations of network users and governs the manner in which gas is transported and distributed through and around the Irish network. The code largely addresses the same operational aspects as the codes in Northern Ireland, such as nominating, allocating, balancing, credit requirements, planning and emergencies, however, the detail of these aspects differ in each jurisdiction.

1.7.3 Gas Quality

There is a discrepancy in the gas quality standard in each jurisdiction. Currently, legislation in Northern Ireland provides for a narrow Wobbe Index of 47.2-51.41MJ/m^3 in its gas quality specification. The Gaslink Code of Operations provides for a wider specification of 45.7-54.7MJ/m^3. Therefore, for gas to flow from South to North, a single gas quality specification is required.

At the request of industry, a Gas Industry Working Group was set up to examine the issue of a single gas quality standard. The Gas Industry Group produced a report[4] which recommended a suitable gas quality specification. The RAs have decided to adopt the proposed specifications recommended within the report as an Entry/Exit specification for the transportation systems in Ireland and Northern Ireland. Further information is available in the Gas Quality Decision Paper[5] published on the 2nd March 2009.

1.7.4 Transmission Tariffs

Tariffs across Northern Ireland are charged on a postalised basis (i.e. all suppliers pay the same charge irrespective of where gas is exited). Previously, tariffs were calculated on the basis of a 50/50 capacity/commodity split, however a decision was taken to change that to a 75/25 capacity/commodity split from October 2008.

Since 2002, Irish tariffs have been charged on an entry/postalised exit basis, with a 90/10 capacity/commodity split. The harmonisation of transmission tariffs is under review as part of the CAG tariff workstream. Indeed the CAG Conclusions Paper on Transmission Tariff Structure[6] concluded that Northern Ireland and Ireland should operate under an entry/exit methodology. The entry/exit methodology and additional work required under CAG transmission tariffs is further discussed in section 1.8.

1.7.5 Connection Policy

The transmission connection policy in Northern Ireland is a 100% deep connection charge, whereby each connecting party pays 100% of the cost of connection to the transmission system (there is currently no Industrial and Commercial customer directly connected to the transmission network in NI).

The connection policy in Ireland is slightly different to that in Northern Ireland and is subject to differences per category user. Large industrial customers such as power plants, pay 100% of the attributable costs of connecting to the transmission network. Medium to small industrial customers pay 30% of the cost of connection, with the remaining 70% added to the regulatory asset base and paid for by all gas customers. The connection policies in Ireland and Northern Ireland also differ slightly in their treatment of 'deep reinforcements'[7]. In both jurisdictions, the relevant system

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[4] CER/09/037

[5] CER/09/036

[6] CER /08/263

[7] Deep reinforcements refer to network investments that are required to facilitate greater loads on the network. They do not relate to one connection point in particular, but the connection of a large

operator is responsible for planning future reinforcements of the network. However, in Ireland, if a connecting party accelerates the need for reinforcement to an earlier date, the connecting party is responsible for the added costs of accelerating the reinforcement only. In Northern Ireland, the connecting party becomes responsible for the total costs of the required reinforcement and not just the costs of accelerating the reinforcement.

1.7.6 System Planning and Development

BGN and PTL already communicate and interact quite closely with regards to network analysis, planning and development. Common figures for supply and demand are often used and information is freely shared. Indeed the transporters and RAs are already working towards a joint 2009 Gas Capacity Statement/Pressure Report. However the processes of planning and developing the systems in each jurisdiction are conducted independently. This is not the most effective way to plan and develop the systems and benefits can clearly be gained by considering the systems together from a security of supply viewpoint. Carrying out system planning and development would entail the development of a common security supply standard, the production of a joint gas capacity statement based on modelling the integrated system and a development framework for the market. Collectively, these would provide inputs into strategic decisions regarding network investments.

1.8 Overview of Proposed Arrangements

As provided for in the MoU, the current proposal for CAG entails the development of arrangements whereby all stakeholders can buy, sell, transport, operate, develop and plan the natural gas market, in both jurisdictions effectively on an all-island basis. Essentially, the project aims to deliver arrangements such that the buying and selling of gas around the island will be based on market conditions and signals.

In terms of achieving this aim and implementing these arrangements, the proposed project will firstly look to develop and implement procedures for the island supporting a single transmission system operation, a harmonised transmission tariff methodology, a single approach to gas quality, a single transmission planning and development process, a harmonised connection policy and harmonised retail processes and systems. The aim is that such arrangements would enhance the efficient operation of the networks, reduce the barriers to entry, increase competition in the gas markets, incentivise investment, provide for more efficient investment and planning of the transmission systems, enhance the security of gas supplies and reduce the potential for undue discrimination between network users, particularly for electricity generators in the SEM.

On a high level, the implementation of a harmonised transmission tariff methodology will require a decision on the best approach to harmonising the structure of the tariffs

facility, i.e. an Industrial Development Agency (IDA) site or a generation station may accelerate the requirement for deep reinforcement of the network in that area if their load demand is to be met.

charged to network users across the island. The CAG Conclusions Paper on Transmission Tariff Structure concluded that Northern Ireland and Ireland should operate under an entry/exit methodology. It was concluded that this would be implemented through two exits, one in Ireland and one in Northern Ireland and that the specific asset configuration at entry required further analysis. The paper also sets out further work that is required under this workstream, such as the capacity commodity split, IC utilisation mitigation issue, transmission tariff treatment of storage and non annual gas products. Therefore this analysis assumes that costs will be incurred for legislative changes required in Northern Ireland for moving from postalisation to entry/exit. Further implementation costs will be incurred in both jurisdictions for the establishment of new contractual arrangements and agreements to underpin the CAG regime.

A single transmission system operation aims to harmonise and integrate the processes and systems used to physically transport gas around the system (i.e. from any entry point to any exit point). Given the current structures and asset owners of the transmission assets, this may be best achieved by adopting a model similar to that in the UK, whereby a single code (the Unified Network Code in the UK) governs the transportation of gas around the network. This approach would not affect the rights of the asset owners and it would provide transparency and clarity for those seeking to transport gas across a number of networks. The RAs have consulted on the options for the high level design of the operational regime and have concluded that a single unified code for the island should be developed which facilitates opt-outs for distribution codes. The RAs have also concluded that a single TSO would best meet the needs of CAG and deliver the benefits of a single operational regime. The single TSO would be responsible for maintaining and operating the single IT interface for shippers. Therefore this analysis assumes that single transmission system operation for the island of Ireland would include the development of a single code of operations, a single 'system operator[8]' and a single IT system through which shippers contract for gas capacity and transport gas across the integrated networks seamlessly.

In conjunction with operational synergies, network users and indeed producers of gas and generators of electricity may benefit from a single policy towards connection to the transmission system. Current discrepancies between the connection policies may distort investment signals to encourage more investment in one or other jurisdiction. The extent to which connection policies should be harmonised needs to be considered e.g. it is unlikely that this would include the connection policy towards new towns where wider social considerations would need to be taken into account[9]. Harmonisation will also require consultation with industry, the design, development

[8] CAG, Conclusions on the Options for the Gas Operational Regime, 16th February 2009.

[9] As part of the consultation on harmonising gas transmission tariffs, the regulatory authorities have proposed the provision of two separate exit tariff regimes. This facilitates the ability of each jurisdiction to take decisions with regards to the development and expansion of their networks on an independent basis.

and implantation of the harmonised policy and a level of coordination between system operators for modifications to the connection policy.

In terms of the development of the networks, an “all-island” approach would provide efficiencies in terms of system planning, investment decisions, security of supply provisions and informing the market of future development. There is currently significant communication between the system operators in both jurisdictions, however asymmetries still exist in the information and scenarios analysed when making network development decisions. A single approach towards planning and development should result in a more efficient decision making process for investment. Furthermore, as this will be on the basis of optimum operation of the integrated systems, there is the potential for deferment of network reinforcement.

The next section outlines and assesses the identified qualitative and strategic benefits of developing, implementing and operating these proposed arrangements. Section three then sets out the quantitative costs and benefits of the implementation of CAG.

2.0 Qualitative and Strategic Benefits

The analysis in section three of this Cost Benefit Analysis has endeavoured to assess the quantitative benefits and efficiency gains that may arise upon completion of the project. However, in addition to these quantitative benefits it is also expected that the combined implementation of the work-streams identified will lead to a number of significant benefits which are difficult to quantify but nevertheless are key considerations in any decision to undertake and implement the CAG project. The strategic benefits identified are; increased competition; encouragement of new investment into the market; enhancement of security of supply; alignment with GB and European goals; a level playing field for SEM as well as potential increased viability for the roll out of gas as a result of a more efficient planning of the network. It is expected that in the long run the value of these benefits will be significant and play a fundamental role in any analysis of this project. The benefits are assessed individually below.

2.1 Increased Competition

Although both the Ireland and Northern Ireland[10] retail markets are fully liberalised very few customers have in fact switched providers in either jurisdiction due largely to the lack of suppliers willing to enter the market. This is particularly evident in the domestic market and one reason for this is that separately the two markets are considered too small to incentivise new entrants into the market.

For example, in Northern Ireland during the course of 2007, the Greater Belfast gas market was fully liberalised, with all customers able, in theory, to choose their gas supplier. However, there is little evidence to show that retail competition is developing. The Greater Belfast area remains open to competition; however within the domestic gas market there are no active competitors to the incumbent supplier, Phoenix Supply. While some players have indicated a desire to enter the domestic retail markets in the longer-term, there is no clear evidence of significant activity in the immediate future. With regards to the industrial and commercial market, although a number of customers have switched to a new supplier in the Greater Belfast area the numbers are minimal.

It is expected that the proposed CAG project, through harmonised policies in both jurisdictions, will be a stepping stone in encouraging new entrants to the market as they will be able to operate more freely within a larger all-island market and will have access to a larger customer base. CAG will provide more flexible, transparent arrangements for parties seeking to operate in both markets such as a single Network Code/Code of Operations and a single transmission IT system. This is likely to encourage new entrants which could reduce market concentration in both jurisdictions, which will in turn further enhance competition on the island. Although it

[10] Greater Belfast Area only

is difficult to quantify the impact of potential competition, analysis by Ofgem[11] has shown tangible benefits to consumers when competition was introduced into the GB market.

As background, between April 1996 and May 1998, competition was introduced into the GB domestic gas market. Previously the supply to the domestic gas market in GB was through the monopoly provider, British Gas Trading. Following liberalisation, Ofgem concluded in 2002 that the market was sufficiently competitive to remove price controls for domestic retail consumers. Ofgem has since conducted an analysis of competition and its benefits to customers in its 'Domestic Retail Report' published in June 2007. Ofgem's analysis suggests that competition has provided benefits in terms of: price, product innovation and service. Their findings are presented below and applied to the case of the markets in Ireland and Northern Ireland in an attempt to assess and quantify the potential benefits of competition to the island.

2.2 Lower Prices

The Ofgem report has presented a national lowering of prices due to the introduction of competition. However it should be noted that the level of competition and therefore the benefits available to consumers will vary across regions. For example, not all customers will have the ability to switch nor will a regional supplier(s) offer all products and services, such as dual fuel tariffs. Consumers may not switch purely on the issue of price. The following section on lowering of prices should be tempered with this in mind.

Competition between suppliers in the GB market has reduced the spread between prices and the most expensive suppliers have been forced to become more competitive to stem customer losses. For example figures from Ofgem for 2007 state that all suppliers had dropped their prices and indeed the average annual bill for a dual fuel customer paying by direct debit was reduced by about £80[12]. Ofgem also illustrated how further savings can be achieved by switching supplier, regardless of payment method. On average, customers can save by switching from incumbent suppliers to the best offer. The average annual savings available for dual fuel customers are £107 for prepayment metered (PPM) customers, £91 for standard credit (SC) customers and £68 for direct debit (DD) customers.

Ofgem also found that suppliers were less inclined to pass through the full cost of increases in wholesale energy prices in a competitive environment. Between 2003 and 2007, Ofgem found that the most competitive supplier increased its prices by £279 less than the actual increases in wholesale prices. This saved an average domestic customer approximately £116 per annum.

[11] Ofgem Domestic Retail Market Report June 2007

[12] National figure calculated by taking the mean value of regional figures

These figures only relate to dual fuel products, which are not available to domestic customers in Northern Ireland and only recent availability in Ireland. Furthermore, the GB market is significantly greater in size than the Northern Ireland and Ireland markets combined therefore, similar savings would not be realised on the island. However it is expected that the implementation of CAG will incentivise new entrants into the market who may be interested in the offering of a dual fuel product. This in itself will bring about the benefits associated with such a product.

The Ofgem report also presents benefits for customers using gas only. Taking a standard credit customer, the average difference in annual bills between the incumbent's standard tariff and the cheapest tariff open to new customers is £37. This represents a potential saving of 6.5% on an annual standard credit bill. For demonstrative purposes, if we were to assume that a 3% saving on annual gas savings was achievable, gas consumers in Northern Ireland and Ireland could potentially realize savings of £6.23 million per annum[13].

It is important to note however that the degree of savings presented above will not be achievable in Northern Ireland and Ireland firstly due to the huge difference in the number of customers and secondly the role of other factors in GB e.g. changes in the GB wholesale market or the abolishing of contracts which tied GB customers to the purchase of expensive gas. However the analysis presented shows that savings from increased competition are available for some customers.

2.3 Product Innovation

A second benefit witnessed by suppliers in GB as a result of increased competition is the introduction of innovative products to retain and attract customers. New innovations include:

- Fixed and capped price deals that shield customers from rising wholesale prices. There has been increasing popularity in price guarantee tariffs, particularly when retail prices were rising. Around 13% of the GB market now has some form of price guarantee product offering customers certainty over future bills.

- Cheaper online tariffs that offer customers savings for managing their accounts online. Savings average around £55 per year (6% of the average GB bill).

- Green tariffs that range from obliging suppliers to source energy from renewable sources, to contributing to carbon offsetting or to financing new renewable energy projects.

- Social tariffs that offer cheaper deals to vulnerable customers. All suppliers currently offer some sort of social tariff and/or rebate to provide cheaper

[13] Appendix 1, Calculation A

energy to qualifying customers. In a competitive market, gas companies may offer social tariffs in order to enhance corporate reputation and brand value.

- Energy Services, such as free home energy surveys, discounted loft and cavity insulation and energy efficient boilers are now being offered to consumers in efforts to reduce energy consumption.

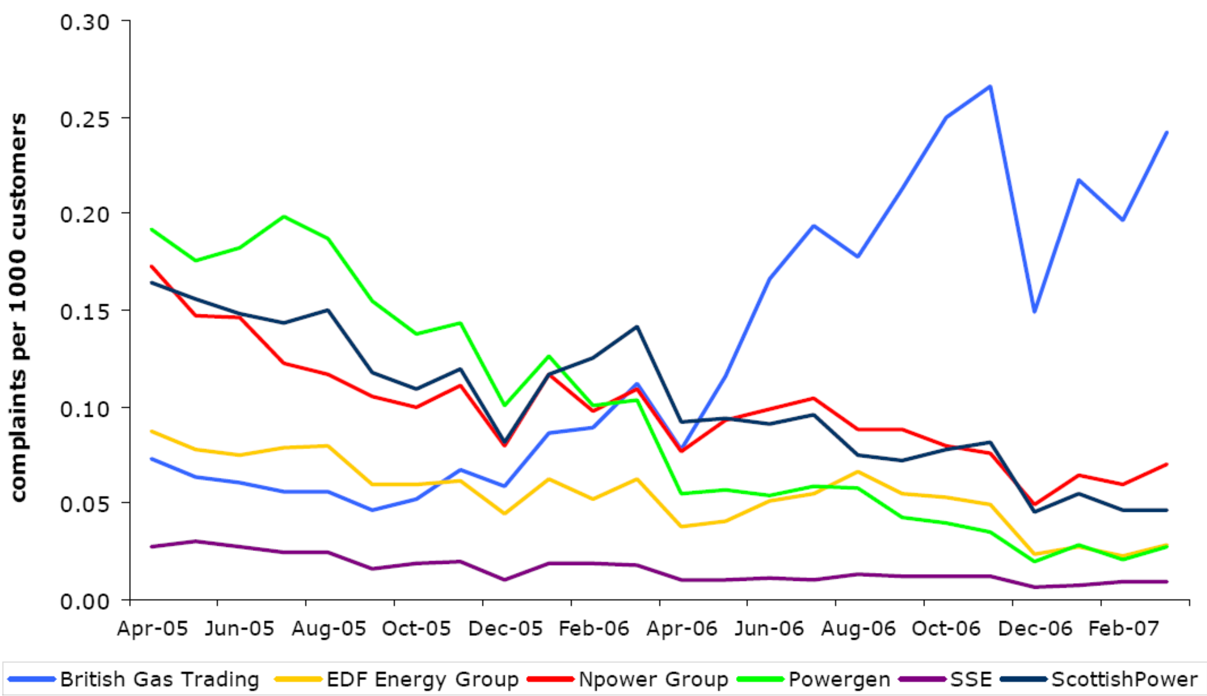
Competition has increased the choice of products available to the consumer in the GB market. Consumers are keen to avail of such services as these products now account for roughly 20% of all energy accounts. Northern Ireland suppliers do not offer such a range of products, as products are differentiated solely on payment method. It is anticipated that with the opening of the all-island market through CAG, consumers could benefit from more innovative products that reflect customer demands.

2.4 Customer Service

The Ofgem report also attributes improvements in customer service to the introduction of competition. Recorded customer complaints have declined for most suppliers and where this is not the case suppliers are addressing by improving their systems.

Figure 1 shows a steady fall in the number of unresolved complaints for 5 of the big 6 suppliers to the GB market. The exception being British Gas Trading which, at the time of analysis, reflected the difficulties faced with implementing a new billing system.

Figure 1: Total number of unresolved complaints made to energywatch per 1000 customers (by supplier) [source: energywatch]



As discussed above, the combination of the GB market being substantially larger than a combined Northern Ireland and Ireland market and the counterfactual of the GB market prior to competition means the benefits presented above may not be realised to the same scale in an all-island market. However the outcomes presented from the Ofgem and The National Audit Office reports are a real demonstration of how competition has provided the end consumer with tangible benefits with regard to price, choice and service.

2.5 Enhanced Investment Potential

The harmonisation of tariffs, connection policy and code of operations for transmission customers, combined with enhanced competition and a larger customer base, would provide greater incentives for investment on the island. Conditions set within an all-island market have the potential to attract new entrants. Indeed, the outcome of the all-island market is a present consideration for investors in existing infrastructure projects; both LNG storage at Shannon and natural gas storage in salt cavities at Larne. Both ventures are significant with preliminary investments estimated at £320 million for Shannon and £250 million for Larne.

Under BAU there is the potential that these projects may not proceed or at least the business plan of the potential investors would need to be reassessed. Both investors have stated that the introduction of CAG will make the island's market a more attractive investment opportunity. Indeed it is difficult to see how a large storage facility in Larne could be viable without CAG. This is because any shipper to Larne from Ireland (and in reverse) would have to pay pancaked i.e. multiple, transmission tariffs which would be likely to make GB storage facilities a more attractive source for shippers in Ireland. While CAG may be a necessary requirement for some projects that is not to claim it would be sufficient as there are many other factors that would feed into investment decisions.

Larne

The possible storage facility in salt deposits at Larne in Northern Ireland for 2014/15 would help alleviate the current lack of gas storage. Estimated capacity for the proposed storage facility at Larne is 500 million standard cubic meters (mscm). The potential gas storage facility at Larne may allow the opportunity to park indigenous and imported gas for release should any supply disruption occur either from upstream infrastructure failures or restrictions on long distance imports. The quantitative benefits of gas storage, in terms of security of supply, are discussed in section 2.3.

Gas storage could also provide significant savings for suppliers by taking advantage of the winter/summer price differential. This benefit is estimated to be in the region of £5.75[14] million per annum.

[14] Appendix 1, Calculation B

Shannon

It is proposed that storage will also be developed by Shannon LNG at Tarbert on the Shannon. This project is planned to be commercially operational by 2012/13 and expected to provide capacity of 17 mscm per day with a potential of 28 million standard cubic meters per day. The addition of an LNG terminal to Ireland's natural gas infrastructure would significantly enhance Ireland's security of supply with respect to gas (see section 2.3). Although LNG storage is expensive, its high delivery capacity would be ideal in the event of an emergency, supply shortages, and/or peak day or severe winter events.

The enhancement of investment potential as a result of the CAG project could also have macroeconomic benefits on the island in the form of the introduction of new jobs and increased revenue through taxation for the respective governments. Indeed the attraction of inward investment is an important part of both Ireland's and Northern Ireland's political and economic policy and the potential investment of Larne, Shannon and any other projects play a role in this.

2.6 Improved Security of Supply

In scoping the proposed CAG project, security of supply has been identified as one of the primary areas where harmonisation between Ireland and Northern Ireland would be beneficial and the attraction of new investment such as Shannon and Larne discussed above will of course enhance the security of gas supply.

The larger gas network that would result from CAG would create a more robust system to handle incidents and emergencies without affecting supplies. The whole island will also have access to domestic gas fields and storage facilities to reduce the risk of interruption in times of supply shortages.

The harmonisation of the emergency arrangements and the gas quality specifications as part of CAG will also aid the security of supply arrangements on the island as it will allow the free transport of gas throughout the two networks in the event of an emergency giving Ireland access to Larne and Northern Ireland access to Corrib, Inch or Shannon. Emergency procedures would need to be incorporated into the all-island Transportation Code(s) which would be facilitated in the CAG work programme.

Although we have stated in section 2.5 above the capital cost of the potential Shannon and Larne investments, it is extremely difficult to place an accurate figure on the actual benefit of the improved security of supply. How big a role CAG would play in attracting these potential investments is open to debate and somewhat subjective in nature but we believe it will play an important role, especially for NI storage.

We have set out below a number of methods which could be applied to produce estimates of the potential security of supply benefits. This results in a range of estimates that provide some insight into the benefits. We have not attempted to quantify the increased likelihood of investments, such as storage, as a result of CAG and any use of the figures produced should take account of this.

Three methods are presented:

i. **Avoided Cost of Strategic Storage** - This benefit can be characterised by the situation whereby CAG triggers the development of storage projects which avoid the need for both jurisdictions to procure strategic storage facilities. In order to calculate the potential strategic storage requirements we have used the information from the report, "Common Approach to Natural Gas Storage and Liquefied Gas on an All-Island Basis", commissioned by both the Departments of Ireland (DCENR) and of Northern Ireland (DETI) in April 2008.

   For the costs of such storage we have referenced, a Directorate General Energy and Transport study[15] (DG Tren).

   Over a period of 20 years the provision of strategic storage through commercial ventures could represent an annual avoided cost of £2.8 to £4.1 million[16] for both governments.

ii. **Economies of Scale –** This benefit assumes that no commercial storage is developed but CAG allows for the development of one optimal sized joint storage facility that could meet the security of supply requirements for both Northern Ireland and Ireland rather than a separate facility in each jurisdiction. It is expected that a larger shared facility would benefit from economies of scale in construction costs. Therefore the combined cost for each jurisdiction constructing their own separate facility would be greater than the costs of developing a single, shared facility.

   Therefore on the basis of these figures the potential economies of scale achievable through developing a shared facility under CAG could offer a one off avoided cost of £9.6 to £12.9 million[17].

iii. **Avoided Cost of Interruption** – Again this assumes that CAG triggers a commercial investment in a storage facility and this avoids future customer interruptions as a result of gas supply shortages. The Energy Markets Outlook Report December 2008[18] calculates that forcing 10% of gas demand off the system involuntarily could cost the British economy £300 million/day. This could cost £9 million/day when applied to the combined economies of

[15] Study on natural gas storage in the EU, October 2008.

[16] Appendix 1, Calculation C.

[17] Appendix 1, Calculation D

[18] http://www.berr.gov.uk/files/file49406.pdf

Ireland and Northern Ireland. Taken over a period of 10 days, this amounts to an avoided cost of £91[19] million.

Obviously there are a large number of contributing factors to these figures and the relationships are complex. A thorough macroeconomic analysis would be required by the respective government departments to fully analyse the potential cost of interruption. We recognise that the figures do not take into account the probability of there being 10 days of interruption without storage in place.

The above methods aim to quantify the potential security of supply benefits that may be realised as a result of CAG. This is not to suggest that the CAG would, of itself, entail costs or benefits of this order of magnitude. The key point is that, projects such as storage and LNG bring real benefits and any consideration of a project which makes such investments more likely needs to factor this into the analysis.

Implementation of CAG would also work towards achieving, in part, the EU Commission's Energy Security and Solidarity Plan, published in November 2008. This plan seeks to strengthen solidarity between member states as a starting point in addressing Europe's increased dependence on fuel imports although we recognise that CAG is not a pre-requisite for this.

2.7 Interoperability with Great Britain and Europe

It is important that a harmonised operational regime implemented through CAG is compatible with present and future developments towards an EU Single Market in Gas. It is important therefore that any new all-island arrangements should not hinder the interoperability of the Ireland and Northern Ireland markets with the GB and EU markets, either now or in the future. Rather the intention of CAG is to enhance interoperability with the GB market, so that Irish and Northern Irish consumers can benefit from access to a larger more liquid market.

This would align to the preferred European approach of achieving an EU Single Market in Gas by adopting a step-by-step regional approach. Ireland, Great Britain and Northern Ireland are members of the North West Gas Regional Initiative and as such are committed under the Memorandum of Understanding between the energy regulators of this region to progress the development of a single market in accordance with Directive 2003/55/EC.

Initial steps to achieve a single gas market are to review key cross border issues such as harmonisation of codes possibly through a European network code dovetailing individual National codes. Under CAG, we would hope to learn lessons that can be applied at a European level and believe that the implementation of CAG will facilitate a clear interface with these projects.

[19] Appendix 1, Calculation E

2.8 Level Playing Field for SEM

The structure put in place for the Single Electricity Market ("SEM") means that power generators bid into the market based on their short run marginal cost therefore the costs they incur play a fundamental part in determining how often they run and indeed the efficiency of their operation. It is important therefore that the arrangements in place for the generator's use of the gas transmission network do not positively or negatively affect one power generator over another.

The current situation whereby the gas transmission arrangements in Ireland and Northern Ireland are not harmonised is not ideal in ensuring a level playing field within the SEM.

The implementation of CAG in the form of a harmonisation of products, connection policies and tariff regime will help reduce distortions in the electricity market.

2.9 Efficient Network Planning

The proposed implementation of CAG will include the harmonisation of network planning which will ensure that the networks are optimised on an all-island basis and any potential for inefficiencies in planning networks and reinforcements will be removed. This work will include the development of a Joint Capacity Statement for both jurisdictions which will enable the development of an integrated System Planning and Development function. It is the case that currently Ireland produces an annual Gas Capacity Statement and Northern Ireland produces an annual Pressure Report so the production of only one report will also have the benefit of removing the costs of producing two reports. This Joint Capacity Statement will facilitate the optimum development and operation of the system as well as aiding the creation of a common Security of Supply Standard. The Joint Gas Capacity Statement will also be used to support decisions on issues of strategic storage.

In terms of efficiency, a joint approach may help to avoid the duplication of asset investments to secure gas supplies in both jurisdictions. In a report by the House of Lords on 'Liberalised Markets and Security of Supply'[20] it was stated by a number of gas transporters across Europe that unilateral planning and investment across member states has in the past led to duplication of investments and consequently higher prices for consumers.

The harmonisation of network planning will also allow consideration to be given for cross border projects that might aid the viability of extending the gas network to the North West of the island. This is of particular relevance in Northern Ireland as the Utility Regulator's principle objective is "…to promote the development and maintenance of an efficient, economic and co-ordinated gas industry in Northern Ireland." Therefore anything that increases the potential to develop the gas network in either jurisdiction, or that will allow cross border opportunities to be fully scoped, or will help ensure all areas currently without gas have every opportunity to be

[20] http://www.publications.parliament.uk/pa/ld200304/ldselect/ldeucom/105/105.pdf

considered for connection should be encouraged and the harmonising of network planning as part of CAG is an integral part of this.

2.10 Summary

Although CAG could provide tangible benefits in the region of £12 million (as discussed in section 3), the most valuable benefits for both jurisdictions are in the strategic benefits that will be achieved through the completion of CAG. CAG may facilitate and encourage competition and investment in jurisdictions, reducing barriers to market entry and providing a larger market for potential investors and new entrants. This could in-turn provide greater security of supply to the two jurisdictions and greater service and product offerings to customers.

CAG could also support the SEM in providing a level playing field for all gas generators on the island, removing the current discrepancies that exist. Also, in creating a harmonised market, CAG could facilitate integration into the EU Single Market, providing a stepping-stone for further integration with Great Britain and Europe.

3.0 Quantified Benefits

For the purpose of the quantitative element of this cost benefit analysis, the initial figures estimated for the CAG project are discounted over a ten-year and twenty-year timeframe using two discount rates of 3.5% and 5%. This reflects the different appraisal methodologies used in the two jurisdictions. These figures are presented in the summary table in Appendix 2. However, it should be noted that the figures quoted both in the text and summary tables presented throughout section 3 represent the Sterling net present value of the estimated figures, discounted over a ten-year period at a rate of 3.5%. All costs are in 2010 monies having been future valued if necessary from 2008/2009 monies using a rate of 3.5%.

3.1 Harmonised Transmission Tariff Methodology

The goal of the transmission tariff workstream is to design and implement a single tariff regime across the entire CAG network. As discussed in section 1.8, this workstream has already progressed with the RAs concluding that an entry/exit tariff is the preferred methodology. However further design work is required prior to the implementation phase of the workstream. The costs and benefits of the tariff workstream are further discussed below.

3.1.1 Costs

As discussed above the RAs continue to engage with industry to design an appropriate harmonised tariffing regime to facilitate the transportation of gas around the island. The final design of a single transmission tariff methodology is estimated to cost the system operators and RAs in both jurisdictions approximately £497,000. This includes the identification of the various tariff options available, an analysis and scoping of the impact of these options, consultation on the most appropriate option and the development of a methodology for tariffing on a single gas market basis.

Implementation of the finalised tariff methodology will require legal consultancy and may require legislative and licence changes in Northern Ireland. This includes the statutory provision for postalised tariffs in Northern Ireland, a review and change of which is likely to cost approximately £447,000 in legal consultation and advice across both the RAs and their respective department.

The development of an administrative function for calculating and distributing the respective tariffs and revenues would also be required to implement the tariff methodology i.e. an all-island equivalent to the Northern Ireland Postalised System Administrator. It is expected that the single system operator would perform this function. £41,000 has been assigned to this cost line to account for the design of the formula and its inclusion in the respective licences as well as agreements around setting up such a function.

In terms of the optimistic case it is assumed that all of the costs decrease by 15% compared to the central case. For the pessimistic case scenario however it is assumed that costs increase by 25%, the exception being the design costs which we have assumed as increasing by 15%. The reason being that the consultants for the tariff workstream have been in place for a number of months now and have therefore completed a large part of their analysis; we therefore feel there is less of a risk of an over run in this cost.

3.1.2 Benefits

Operational Impacts

The principle benefit of a harmonised transmission tariff methodology for the island is that it would facilitate single system operation. These benefits are presented in the operations section 3.2.2.

Cost Avoidances

Other than the principle benefit of facilitating single system operation there are a number of avoided costs which would have been necessary under BAU.

The CAG Conclusions Paper on Tariff Harmonisation notes that Entry Exit is the preferred tariff methodology under the proposed EU Third Package. Therefore, for Northern Ireland, the implementation of CAG will avoid the one-off costs involved in moving from the current postalised tariff regime to an Entry Exit methodology under the BAU scenario. As such, delivery of the CAG project will avoid the associated design, legal, legislation and licensing costs. Given Northern Ireland's experience of moving to a postalised tariff in 2004, it is expected that these costs would have been substantial. We have attributed a benefit of £457, 000 to this avoided cost applicable to Northern Ireland only. This avoided cost is made up from the Northern Ireland element of the costs set out above, specifically the Design, Legal Consultancy and Implementation costs.

Similarly, under a BAU scenario for Ireland, the underutilisation of the ICs would need to be considered. Again the issue of IC mitigation is addressed within the CAG project, so avoids the design, legal consultancy, legislative and licensing changes that would have incurred under the BAU scenario. We have attributed a benefit of £176, 000 to this avoided cost applicable to Ireland only. A third of the total Design, Legal Consultancy and Implementation costs apportioned to Ireland have been used to calculate this avoided cost.

A harmonised transmission tariff methodology also facilitates and provides for on-going benefits to the gas market as a whole in the form of enhancing competition and providing transparency and clarity to the market participants. These market benefits were examined in section 2, which analysed the market impacts of each work-stream and their collective impacts on the gas markets.

For our sensitivity analysis, because the benefits of the tariff workstream are avoided costs and are therefore linked to the costs outlined in 3.1.1 they fluctuate in line with the costs both in the optimistic and pessimistic cases.

3.1.3 Net Benefits

The independent overall net cost for the design, development and implementation of a harmonised transmission tariff methodology is £352, 000. However, this figure does not include or consider the overall market benefits of incorporating a harmonised transmission tariff methodology and the extent to which this facilitates the operation of other aspects of CAG, such as creating a level playing field for network users (particularly electricity generators), enhancing competition, incentivising new investment and reducing the barriers to entry to both gas markets.

Table 3.1: Harmonised Tariff Methodology CBA

Costs[21]	Optimistic	Central	Pessimistic
1.Design	£422K	£497K	£571K
2.Legal Consultancy, Licence & Legislation	£380K	£447K	£559K
3.Implementation	£35K	£41K	£52K
Total Costs	£838K	£985K	£1,182K
Benefits			
4. Avoided Costs of NI moving to entry/exit under BAU.	£388K[22]	£457K	£550K
5. Avoided IC Mitigation costs	£150K	£176K	£211K
Total Benefits	£538K	£633K	£761K
Net Benefit	**(£300K)**	**(£352K)**	**(£421K)**

[21] All costs incurred during the development and implementation of the CAG project have been revised and calculated so that they are presented in 2010 prices (i.e. the future value of the costs were calculated at a rate of 3.5%)

[22] As this is an 'Avoided Cost' Benefit it is linked back to the costs, therefore as costs fall the avoided cost (and hence the benefit) will also fall. This is the case for all 'Avoided Cost' Benefits.

3.2 Single Transmission System Operation

In assessing the costs and benefits of integrated system operation and harmonising transmission arrangements a number of assumptions have been made to support this CBA. As discussed in section 1.5, the assumptions that underpin the network analysis contribute directly to the costs and benefits of single transmission system operation. A key modelling assumption is that the use of SNIP is maximised under this approach. To enable this, it is further assumed that an approximate capital cost of £497,000 will be incurred to reinforce the SNIP and increase the pressure levels along the pipeline so that the potential operational efficiencies can be realised.

As outlined in section 1.8, the RAs have concluded that a single system operator would best meet the needs of CAG and deliver the benefits of a single operational regime. Therefore this analysis assumes that a single system operator will act as the contact point for all network users seeking to transport/access gas at any point of the integrated system. It has also been assumed that the codes of operation will need to be aligned and brought together in a single unified code.

3.2.1 Costs

The introduction of a single operation system will require significant consultation with market participants and is likely to be the most time consuming aspect of the project. The establishment and implementation of the system operator and the development of a single unified code will necessitate the termination of the current contracts between the various network users and their respective system operators and the development of new agreements, codes and contracts to accommodate the new market structure.

This body of work will involve considerable legal review and advice. It is anticipated that this will account for a large proportion of the overall project costs. It is currently estimated that the consultation, design, development and implementation of this new market structures, supporting functions and rules and procedures will cost in the region of £2,086,000. This cost does not include the establishment of a new independent grid control but assumes that an existing grid control will be expanded to an all-island basis and used to accommodate the all-island arrangements. Approximately £770, 000 will account for the consultation and legal review of the single unified code. A further £571,000 has been allocated to the licence changes which will be needed to set-up the single system operator. The legal costs required in establishing the contractual relationships between the different stakeholders particularly the new relationship between the transmission asset owners and the single system operator is estimated at £497,000 and legislative changes at £248,000

The current discrepancy in the approved gas quality standards in each jurisdiction would be addressed in the absence of CAG in order to allow gas to flow safely between the two systems. This would entail the development of a single standard for the island and may require physical infrastructure to treat the gas and to ensure that the gas entering the system is within the required specification. The provision of treatment facilities can be very expensive and the question as to how these are paid for needs to be addressed. However this cost has been excluded as it not a cost specifically attributable to CAG.

The total cost therefore of designing, developing and implementing single system operation arrangements is estimated to be £2.6 million over the implementation period allowed for the project.

As with the tariff costs we have set our optimistic case operations cost figures 15% lower than our central case and our pessimistic case 25% higher due to the rationale set out in section 1.6.

3.2.2 Benefits

Efficiency of system operation and carbon savings

With an integrated system operation function, the commercial boundaries currently in place will be removed and gas can flow optimally around the system. BGN and PTL modelling of an integrated system, as described in section 1.5, has shown operational efficiencies by reducing fuel-gas usage and additional interconnector inventory product.

Fuel Gas Savings

With regards to fuel-gas savings, results show that there is scope, at certain times of the year, for supplying some of the Ireland demand from the SNIP pipeline instead of the IC system. This approach will reduce fuel-gas usage at the Brighouse Bay compressor. Analysis shows that there is considerable scope for use of the SNIP on a summer day with limited scope throughout the winter period. The benefits gained vary on the scenario considered together with the available pressures and gas price.

Depending on the scenario i.e. the pressure, gas price and year, the modelling has indicated a range of savings. For the purpose of this analysis we have taken a constant annual benefit of £320,000[23] for our central projection, which equates to a £2.66 million NPV figure over 10 years. This central projection is calculated by taking the average of the fuel savings for the different scenarios over the five years.

Inventory Product Savings

The fuel gas savings discussed in section 1.5 vary as Corrib and potentially Shannon LNG reduce Ireland demand on the IC system. Therefore under a Corrib and Shannon scenario fuel-gas savings will reduce post 2012/13; however this will be offset by the availability of an increased IC inventory product. Again a range of benefits are presented in the modelling results due to the variation in contributing factors. For the central case, we have attributed an annual constant benefit of

[23] Appendix 1, Calculation F

£320,000[24] per annum (£2.66 million NPV over 10 years). This figure is an average of the IC inventory product savings presented from the network analysis. The assumptions and method of calculation are presented in Appendix 1 however it should be noted that this figure assumes shippers access and take advantage of the additional inventory available.

It is important to note the relationship between fuel-gas savings and inventory product set against the scenario assumed. For example there will be limited or no fuel-gas savings but increased IC inventory product if Shannon is assumed to operate in the summer period. This is due to Shannon LNG reducing the demand on the IC system which will increase pressures at Twynholm and allow additional flow to be diverted through the SNIP. This will in turn release capacity on the ICs allowing inventory product to accumulate. Conversely if Shannon isn't available in the summer period then fuel-gas savings will be realised through maximising the use of SNIP.

These benefits are deemed to be as a result of CAG since CAG would remove the contractual and operational barriers that would allow the operation of Moffat in this manner. Otherwise the transmission networks would continue to operate separately and the benefits of joint operation would not be achieved. For example to extend the scenario above, if Shannon LNG were to operate during the summer period, additional inventory product would become available on the ICs. However, without CAG, this benefit would not be available to Northern Ireland. Similarly the fuel-gas savings, through efficient use of the SNIP, would not be available to Irish consumers under the current arrangements. Therefore CAG sets the conditions that allow the operation of the transmission assets as a single network which, as indicated by the modelling analysis, will result in tangible monetary benefits.

Since the fuel gas savings and inventory product are inversely related, the pessimistic and optimistic cases for both fuel gas savings and inventory product should also reflect this relationship. Therefore to model this relationship we have presented a combined benefit of £400,000 for the pessimistic case and £1,200,000 per annum for the optimistic case. This is based on the lowest and highest combined savings figures[25]. The NPV value of these figures are presented as £3,327K and £9,980K respectively in Table 3.1

Balancing Savings

Furthermore, these operational efficiencies will give rise to savings in the number of balancing actions currently undertaken by the transmission system operators on a daily basis. A larger system will be more capable of 'absorbing' the behaviour of network users, thereby reducing the level of gas purchased by the system operators to balance the system on a daily basis.

[24] Appendix 1, Calculation G

[25] Appendix 1, Calculation H

The benefits of a larger system on balancing are two-fold, the first is the saving from a reduction in the volume of balancing gas purchased and the second is the saving from any potential reduction in the price paid for the balancing gas required due to the greater competition for balancing gas. The number of balancing actions taken by operators can vary significantly on a daily basis so it is difficult to know by how much the larger system (as a result of CAG) would reduce the volume of balancing gas.

The operators have however attempted to quantify the potential benefits from both a reduced volume and a reduced spread. The assumptions and method of calculation are presented in Appendix 1.

Combining the reduced volume and reduced price amounts to an annual saving of £115, 000[26]. This results in a £931,000 NPV figure over 10 years. As our sensitivity for the optimistic case we have assumed NI balancing gas to be 80% lower which equates to £140,000 per year saving and for the pessimistic case we have assumed NI balancing to be 20% lower which equates to £90,000 per year saving.

Carbon Savings

Reduced fuel requirements to operate the transmission system will also give rise to carbon savings in the area of 1,000 tonnes per annum. This will accrue a constant saving of approximately £32,000[27] per annum at a price of £32 per tonne[28]. This translates into a net present value of £266,000 over the first ten-years of the project going live (at 3.5% discount rate). We have used £56,000 and £8,000 per annum for our optimistic and pessimistic case analysis respectively.

Avoided costs of developing arrangements for the SNP

A single unified code could eliminate the need to develop arrangements to accommodate connection to and transportation along the SN pipeline, including a Network Code for the southern section of the SN pipeline and IC booking arrangements for Northern Ireland. Emergency arrangements can be streamlined between the relevant system operators in the two jurisdictions which will also reduce costs. These one-off cost avoidance benefits are estimated to be £745,000 across the three transmission system operators.

Administrative Efficiencies

Single system operation will also provide administrative efficiencies on an ongoing basis both for network users and the system operators. Network users will benefit from communicating with one system operator as opposed to multiple transmission system operators. The system operator will also benefit from a single unified code

[26] Appendix 1, Calculation I

[27] Appendix 1, Calculation J

[28] The Social Cost of Carbon and the Shadow Price of Carbon: What they are, and how to use them in Economic Appraisal in the UK. Economics Group, Defra, December 2007.

and streamlined code modifications process which will reduce the level of monitoring and administration required. There are also administrative efficiencies for the RAs in regulating a single code and adopting a single TSO price control. There will also be benefits from collaborative working on joint issues such NTS Exit reform and European matters. These efficiencies are initially estimated to equate to an on-going annual saving of approximately £80,000. This is viewed as a conservative estimate and we will review this figure as the CAG structure crystallises. Over ten years this amounts to an NPV saving of £665,000 (at 3.5% discount rate).

Avoided costs of setting up an Northern Ireland single TSO

If, without CAG, a single operational regime for both jurisdictions is not achievable and we have assumed so in our BAU case, it could be desirable to formalise a single balancing zone and single code for Northern Ireland. This would require the design and implementation of a Northern Ireland TSO and with it all the licence, code, contract and IT changes involved. We have linked these costs directly to similar NI costs for CAG and they amount to £945,000.

In all instances where consultation is required, without CAG, a consultation by each jurisdiction is necessary. By carrying out work jointly, CAG reduces the consultation costs borne by the regulators and industry participants. However we have not factored such economies into these figures.

For the purposes of determining the optimistic and pessimistic case figures all of the avoided costs referred to above as benefits are linked to the costs, as a result they vary in line with the costs. The exception being the administrative efficiencies which we have assumed to increase by 15% in the optimistic case and fall by 15% in the pessimistic case.

At this stage in the analysis, the benefits for fuel gas savings, inventory product, carbon savings and balancing savings have been apportioned by applying a simple third, two thirds split for Northern Ireland and Ireland respectively.

3.2.3 Net Benefit

Providing for the initial one-off costs in developing the required arrangements in establishing a single system operation of £2.58 million and the resulting operational benefits of £8.87 million, the estimated net present value of the net benefit for the island as a whole of implementing ‘single system operation’ at transmission level is estimated to be £6.29 million .

Table 3.1: Single System Operation CBA

Costs	Optimistic	Central	Pessimistic
1. Investment in SNIP for efficient operation	£422K	£497K	£621K
2.Consultation and drafting of Single Code of Operations for transmission	£655KK	£770K	£963K
3.Review and redrafting of licenses	£486K	£571K	£714K
4.Review and drafting of contracts	£422K	£497K	£621K
5. Legislation	£211K	£248K	£311K
Total Costs	£2,196K	£2,583K	£3,229K
Benefits			
6.Fuel Gas Savings	£9,980K (combined)	£2,661K	£3,327K (combined)
7. IC Inventory product		£2,661K	
8. Balancing Savings	£1,198K	£931K	£732K
9.Avoided costs in developing arrangements for SNP	£633K	£745K	£932K
10.Administrative efficiencies	£765K	£665K	£566K
11.Carbon savings	£466K	£266K	£67K
12. Avoided NI TSO set-up costs	£804K	£945K	£1,182K
Total Benefits	£13,845K	£8,874K	£6,806K
Net Benefit	**£11,649K**	**£6,291K**	**£3,577K**

3.3 Single IT Systems

The analysis of the costs involved in developing a single IT system to accommodate CAG, is based on the assumption that one of the current systems used by the system operators will act as the template for the new system. In effect, an existing system will be adapted to systemise the common arrangements and subsequently extended out to all network users on the island.

3.3.1 Costs

Although it is assumed that new IT systems will not be required for CAG, some adaptation to the current system will be required. This arises as a result of the requirement to systemise the tariffing methodology, integration of the two networks and code changes to accommodate the CAG project. It is estimated that this redesign and redevelopment of existing IT systems may cost in the order of £745,000. A further cost will be incurred in providing IT training to all network users and in extending the system to newly integrated network users. This is expected to incur a further once-off cost of £141,000. The total cost of providing a single IT system to support harmonised operations is £886,000. However it is anticipated that further work will be required to determine costs that are incurred by suppliers specifically as a result of CAG.

For the purposes of our sensitivity analysis we have assumed a decrease in IT costs of 15% for the optimistic case and an increase of 25% for our pessimistic case.

3.3.2 Benefits

Significant ongoing benefits are likely to arise as a result of the need for only one IT system going forward. These benefits are largely due to licensing, maintenance and development savings. It is estimated that both BGN and PTL will combined save in the area of £480,000 per annum (NPV of £3,992,000 over 10 years @ 3.5%) in licensing and maintenance savings alone. A further £80,000 per annum (NPV of £665,000) would be saved by the system operators in ongoing redevelopment costs, which would be shared across both systems and all system users.

A further saving of £80,000 per annum (NPV of £665,000) would also be achieved in the development and systemisation of Code Modifications on an on-going basis as only one system will be involved.

In total, the net present value of these combined ongoing savings is estimated to accrue to £5.323 million.

As discussed under the operations section, under BAU, IT development work would be required to facilitate flows across SN. The estimated cost for this work is £186,000. This is a quarter of the costs to redesign and redevelopment the existing IT systems identified above.

Additionally significant IT costs would be incurred as part of work to create a single TSO in Northern Ireland and to move to an entry/exit system. The estimated cost for this work is £186,000. Again this avoided cost is a quarter of the total costs to redevelop the existing IT systems.

For the sensitivity analysis it has been assumed that the direct savings from licencing, maintenance and development of the IT system increase by 15% for the optimistic scenario and decrease by 15% for the pessimistic scenario. For the avoided cost benefits these are linked to the costs of altering the IT system so therefore fluctuate in line with these costs.

3.3.3 Net Benefit

Netting off the total once-off costs required to develop the IT system with the ongoing cost avoidances of maintaining and developing a single system as opposed to two, delivers a total net benefit of approximately £4.8 million from this work-stream.

Table 3.3: Single IT Systems CBA

Costs	Optimistic	Central	Pessimistic
1.Alterations to current IT System	£633K	£745K	£932K
2. Roll-Out and training to shippers	£120K	£141K	£176K
Total Costs	£753K	£886K	£1,107K
Benefits			
3. Licensing & maintenance savings	£4,591K	£3,992K	£2,994K
4. Development costs savings	£765K	£665K	£499K
5.Avoided Code Modification Costs	£765K	£665K	£499K
6. Avoided IC and SN IT booking arrangements	£158K	£186K	£233K
7. Avoided IT costs of NI single TSO	£158K	£186K	£233K
Total Benefits	£6,438K	£5,695K	£4,458K
Net Benefit	**£5,685K**	**£4,809K**	**£3,350K**

3.4 Harmonised Connection Policy

This analysis has considered only the costs and benefits of a connection policy at transmission level. It is assumed that connection policies will continue to allow for varying distribution and local level connection policies in each jurisdiction.

3.4.1 Costs

Developing a standard connection policy for transmission in both Northern Ireland and Ireland will require considerable analysis of the various options available and their potential impact on the resulting charges for connection. Any agreed policy will require consultation with all existing and potential stakeholders. It is estimated that this stage of the project will incur a once-off cost of approximately £99,000, which is accounted for by some technical advice and consultation on the various options, but largely by the legal costs involved in developing a policy suitable for both jurisdictions.

Following approval of a common connection policy an administrative function may be required to administer and charge the connection policy according to the common gas arrangements. The principles and business rules of this administrative function will require further consultation with the market's stakeholders. Once established, the continuing operation of this function will incur an ongoing operational cost of approximately £8, 000 per annum in administrative costs and in the monitoring and updating of the connection policy as required. This equates to a net present value of £68,000 over the first ten-years of the project (at 3.5% discount rate). The estimated cost of implementing this administrative function is £116,000.

The sensitivity analysis assumes that costs decrease by 15% in the optimistic case and rise by 25% in the pessimistic case due to the arguments set out in section 1.6.

3.4.2 Benefits

The principal benefit of a common connection policy is the elimination of any distortions and no perverse location incentives particularly for generators. A common policy will also facilitate the introduction of common tariffing arrangements and the common code. A harmonised connection policy will also provide once-off avoided costs for each of the transmission system operators in negating the requirement to develop an independent connection policy for the South North Pipeline. Combined, these quantifiable benefits equate to an approximate saving of £149, 000, equally shared amongst the system operators in both jurisdictions.

The benefits of a harmonised connection policy are assumed to rise by 15% and fall by 15% for the optimistic and pessimistic cases respectively.

3.4.3 Net Benefit

The net cost in developing common connection policy at transmission level is £134,000. This is largely due to the technical analysis and legal advice that would be required to harmonise the current connection policies. However, this figure does not account for the market benefits that such a policy would deliver in terms of eliminating perverse investment incentives, providing transparency and reducing the administrative burden on potential customers seeking to connect in either market. Nor does the figure account for the contribution of the policy to the overall goal of the CAG Project. These qualitative benefits will be addressed later in the analysis when examining the collective impact of each work-stream on the actual gas markets in terms of competition, security of supply and transparency.

Table 3.4: Harmonised Connection Policy CBA

Costs	Optimistic	Central	Pessimistic
1.Design and consultation of single policy	£84K	£99K	£124K
2.Implementation of Policy-standardisation of policies	£99K	£116K	£145K
3.Ongoing operational cost – administration and monitoring	£58K	£68K	£85K
Total Costs	£241K	£283K	£354K
Benefits			
4.Market transparency and delivery of the CAG Project	The implementation of a 'Common Transmission Connection Policy' will remove a level of discrimination between network users at transmission level and will facilitate the full implementation of a 'Common Transmission Tariff Methodology' and the 'Single Unified Code of Operations'.		
5.Operational – avoid costs in developing policy for SNP & administration of one policy	£171K	£149K	£127K
Total Benefits	£171K	£149K	£127K
Net Benefit	**(£69K)**	**(£134K)**	**(£227K)**

3.5 Single System Planning and Development

As a starting point a common security standard would be useful and this could be developed as part of the project with little or no expenditure. This would inform the planning and development decisions arising from a joint gas capacity statement. There could be technical consultancy required for this estimated at £25,000.

Currently Ireland produces an annual gas capacity statement and Northern Ireland produces an annual Pressure Report. In both cases, the modelling work is carried by Penspen on behalf of BGE. Assuming that the modelling process and approaches remain the same, there will be no costs involved in formally establishing an integrated System Planning and Development function.

The main benefits that can be gained from a joint study is that the integrated system will be modelled rather than the two independent systems. This will indicate the optimum operating regime for the whole system and can be used to more accurately assess the operational benefits which will result from the common gas arrangements.

It will also allow system planning on the basis of the integrated systems and will show whether investments can be deferred as a result of the more optimal operating regime. This work will be central to the CAG project and the systems operations function going forward.

In terms of the sensitivity analysis the cost of developing the security of supply standard is assumed to fall by 15% in the optimistic case and rise by 25% in the pessimistic case. Again this is to cover any potential increase in legal costs due to delay.

Table 3.5: Single Planning and Development CBA

Costs	Optimistic	Central	Pessimistic
1.All island Modelling and Joint Capacity Statement		No additional Cost	
2. Development of security of supply standard	£21K	£25K	£31K
3. Strategic Storage Decision		Not included in calculation	
Total Costs	£21K	£25K	£31K
Benefits			
4.Ability to quantify operational efficiencies 5. Defer investment, rationalise network development		Not quantifiable — the benefits themselves will accrue to operational and planning and development efficiencies	
6.Capital Cost Savings of Strategic Storage			
Total Benefits	**-**	**-**	**-**
Net Benefit	**(£21K)**	**(£25K)**	**(£31K)**

4.0 Conclusions

This Stage Two Cost Benefit Analysis identifies significant strategic benefits in addition to the quantitative benefits expected from streamlining the operation of the proposed CAG network.

The strategic benefits that the analysis identifies are:

- Increasing Competition
- Enhanced Investment Potential
- Improved Security of Supply
- Interoperability with GB and Europe
- Level Playing field for SEM Efficient Network Planning

In addition, the quantitative analysis estimates that the CAG project will deliver a net benefit of approximately £10.6 million (discounted over a ten-year period at a 3.5% discount value) to both jurisdictions. The RAs view that this provides a strong basis for pursuing the project.

Appendix 1

This appendix shows the breakdown of the calculations referenced throughout the paper. To aid understanding and to track the calculations, the columns are referenced in square brackets with capital letters e.g. [A] and rows are referenced with lower case letters e.g. ‘a’. The figures in bold have been included in the main text.

Calculation A – Annual gas savings

A 3% saving on an average gas bill (of £593) is £17.80. Assuming 350,000 customers benefit (out of a customer base of 700,000), this would translate into a saving of **£6.23 million** (350,000 x £17.80).

Calculation B – Gas storage Summer/Winter differential

This calculation is based on the ‘intrinsic’ value of gas storage, i.e. the benefit gained from the difference between winter and summer gas prices only. The ‘extrinsic’ value, i.e. the additional benefit gained through reusing storage space or ‘cycling’ is not presented. The extrinsic value would offer larger savings than those presented for the summer/winter differential.

Gas Storage – Intrinsic value				
a	Summer/Winter differential:	20 pence per therm		
b	Storage capacity (500 mscm):	183 million therms		
c	Annual intrinsic value: (a x b) (per annum)	£36,700,000		
		Minimum	Mean	Maximum
d	Annual operating expenditure (£ per mscm for a 500 mscm facility)[29]	£8,000	£36,000	£64,000
e	Annual capital expenditure	£22,400	£25,900	£29,400

[29] Source: DG Tren Study on Natural Gas Storage in the EU, Oct 2008

	(£ per mscm for a 500 mscm facility)[29]			
f	Annual operating expenditure (d (mean) x 500 mscm)	£18,000,000		
g	Annual capital expenditure (e (mean) x 500 mscm)	£12,950,054		
h	Annual potential savings (c-f-g)	**£5,749,946**		

This is a simplified and generalised calculation as there are other costs such as cushion gas, compression, leaching and buildings costs unique to the Larne site, that would need to be factored into the calculation to provide a more realistic figure. However with this in mind, the intention is to show that there are significant savings available by using gas storage to benefit from the summer/winter price differential.

Calculation C – Security of Supply: Avoided Cost of Strategic Storage Method

This method is based on the assumption that CAG will trigger the development of storage projects through commercial ventures which would avoid the need for both governments to procure strategic storage solutions. In order to calculate the potential strategic storage requirements we have used the information from the report, "Common Approach to Natural Gas Storage and Liquefied Gas on an All-Island Basis", commissioned by both the Departments of Ireland (DCENR) and of Northern Ireland (DETI) in April 2008. In this report it stated a number of recommendations one of which was that "60 mscm of gas to be stored for the domestic market to be delivered at 6 mscm/day for 10 days".

For the costs of such storage we have referenced, a Directorate General Energy and Transport study[30] (DG Tren) which estimates that the average capital expenditure for developing storage ranges between £0.68 million to £0.96 million per mscm for a 100 mscm facility depending on storage type. We have cross referenced some of the figures used with other information we have received from industry and they confirm that the ranges used are appropriate.

Using these values a 60mscm strategic storage facility would cost in the range of £40.8 to £57.6 million. This represents a potential avoided cost of £40.8 to £57.6 million for both governments. Such an investment would be financed over a number of years. Over a period of 20 years the provision of strategic storage through commercial ventures could represent an annual avoided cost of **£2.8 to £4.1** million for both governments.

[30] Source: DG Tren Study on Natural Gas Storage in the EU, Oct 2008.

The variations in estimates are expected as the geological and technical qualities of individual fields vary. Also the engineering and economic data used in cost estimation are subject to uncertainty and fluctuations in market conditions.

Avoided Cost of Strategic Storage Method			
a	Recommended security of supply standard	60 mscm	
		Minimum	Maximum
b	Capital expenditure (£ per mscm for a 100 mscm facility) [29]	£680,000	£960,000
c	Total capital expenditure for security of supply standard (a x b)	£40,800,000	£57,600,000
d	Annual avoided cost of total capital expenditure (over 20 years at a rate of 3.5%) (c annualised)	**£2,870,732**	**£4,052,798**

Calculation D – Security of Supply: Economies of Scale Method

This benefit assumes that no commercial storage is developed but CAG allows for the development of an optimal sized joint storage facility that could meet the security of supply requirements for both Northern Ireland and Ireland rather than a separate facility in each jurisdiction. It is expected that a larger shared facility would benefit from economies of scale in construction costs. Therefore the combined cost for each jurisdiction constructing their own separate facility would be greater than the costs of developing a single, shared facility.

Analysis from the DG Tren study shows decreasing investment costs as working volume increases. The figures provided show a range of £0.64 to £0.84 million per mscm for 500 mscm and £0.48 £ to 0.62 million per mscm for 1000 mscm.

While the report shows clear economies of scale benefits we have taken a simple extrapolation of these figures to provide a range of benefits. If each jurisdiction were to pursue its own strategic storage facility then we have assumed that they will build two facilities of 30 mscm rather than one of 60 mscm. The two 30mscm facilities would cost £19.2 to £25.2 million to each government (using the 500 mscm figure). The security of supply recommendation for a single, shared facility under CAG could cost £28.8 to £37.4 million (using the 1000 mscm figure). We have used the 500mscm and 1000mscm figures as a simplified example of the doubling of the size of a storage facility although we recognise that the unit costs would be higher for 30mscm and 60mscm facilities. Therefore on the basis of these figures the potential economies of scale achievable through developing a shared facility under CAG could offer a one off avoided cost of **£9.6 to £12.9 million**.

Economies of Scale Method			
a	Recommended security of supply standard	60 mscm	
		Minimum	Maximum
b	Total project capital expenditure (£ per mscm for a 500 mscm facility) [29]	£640,000	£840,000
c	Total project capital expenditure (£ per mscm for a 1000 mscm facility) [29]	£480,000	£624,000
d	Total cost of two 30 mscm storage facilities (using 500 mscm figure) (a x b)	£38,400,000	£50,400,000
e	Total cost of single 60 mscm facility (using 1000 mscm figure) (a x c)	£28,800,000	£37,440,000
f	Potential economies of scale savings (d – e)	**£9,600,000**	**£12,960,000**

Calculation E – Security of Supply: Avoided Cost of Interruption Method

This method assumes that CAG triggers commercial investment in a storage facility and that this would avoid future interruptions in the event of a restriction to supplies. The calculation is based on analysis of the GB market adjusted for the smaller ROI and NI markets.

Avoided Cost of Interruption Method		
a	Cost per day to Great Britain of forcing 10% of gas demand off the system[31]	£300,000,000
b	Total number of gas consumers in Great Britain	23,000,000
c	Total number of gas consumers in Ireland and Northern Ireland	700,000
d	Estimated equivalent cost per day to ROI and NI [(c/b) x a]	£9,130,434

[31] Source: Energy Markets Outlook Report December 2008

e	Recommended number of days security of supply	10
f	Total avoided cost of interruption (d x e)	**£91,304,347**

Calculation F – Fuel Gas Savings

BGN and PTL modeling of an integrated CAG network shows operational efficiencies by reducing fuel-gas usage and additional interconnector inventory product (see calculation G).

With regards to fuel-gas savings, results show that there is scope, at certain times of the year, for supplying some of the Ireland demand from the SNIP pipeline instead of the IC system. This approach will reduce fuel-gas usage at the Brighouse Bay compressor. Analysis shows that there is considerable scope for use of the SNIP on a summer day with limited scope throughout the winter period. The benefits gained vary on the scenario considered together with the available pressures and gas price – see SNIP Exports under CAG table below.

SNIP Exports under CAG				
Pressure	Modeling Results:			Total SNIP Exports (GWh/y) [A]
	Winter Peak-day (GWh/d)	Winter Shoulder (GWh/d)	Summer Minimum (GWh/d)	
55 bar-g				
2008/09	0	0.8	17.3	2643.2
2009/10	0	11.4	1.2	2257.4
2010/11	0	8.7	11.3	3232.1
2011/12	0	0	0	0
2012/13	0	4.7	0	848.6
50 bar-g				
2008/09	0	8.7	22.6	4869.2
2009/10	0	17.8	1.2	3429.1
2010/11	0	15.4	11.3	4439.9
2011/12	0	0	0	0
2012/13	0	4.7	0	848.6

For the Estimated Fuel Gas Savings calculations [B] the operators have assumed 0.5% of the Total SNIP Exports [A] since fuel usage at Brighouse Bay Compressor Station is typically 0.5% of throughput.

Estimated Fuel Gas Savings			
Pressure	Fuel-gas savings (GWh/y) (0.5% of [A]) [B]	Value of fuel-gas savings 60p/therm (€/y) ([B] x 34180 (GWh to therms conversion) x 1.28 (exchange rate) x 60p) [C]	100p/therm (€/y) ([B] x 34180 (GWh to therms conversion) x 1.28 (exchange rate) x 100p) [D]
55 bar-g			
2008/09	13.22	346,923	578,205
2009/10	11.29	296,286	493,810
2010/11	16.16	424,217	707,028
2011/12	0.00	0.00	0.00
2012/13	4.24	111,379	185,632
50 bar-g			
2008/09	24.35	639,088	1,065,147
2009/10	17.15	450,073	750,122
2010/11	22.20	582,755	971,258
2011/12	0.00	0.00	0.00
2012/13	4.24	111,379	185,632

The ‘zero year’ (2011/12) where no benefits are available is due to two additional power-stations coming online and a flat load profile used for Northern Ireland. The additional power-station demand would fully utilise SNIP capacity and therefore removes the option of routing a portion of RoI demand through the SNIP. Consequently fuel-gas savings and inventory product would not be realised under this scenario. However if an annual load profile for Northern Ireland was used it is likely that some benefits would be available, particularly during the summer period. Therefore the assumption of a zero year is questionable and very conservative.

The central case was calculated by taking the average over all of the years for both pressure levels and pricing figures including the zero year. This approach was taken to smooth out variations in the scenarios with the intention of providing a more rounded mid-range figure and to present a single figure representing fuel gas savings.

The averaging approach taken for the central analysis however cannot be applied to the pessimistic and optimistic cases, given that the fuel gas savings and inventory product are inversely related. The approach to represent the pessimistic and optimistic values takes the maximum and minimum combined totals for fuel gas savings and inventory product savings. These are presented in Calculation H.

Average Estimated Fuel Gas Savings	
	Central Case (Average value of [C] and [D])
Actual	€394,947
Rounded	€400,000
Sterling	**£320,000**

The modelling calculated the benefits using a number of assumptions including pressures at Dublin City Gates of both 50 bar-g and 55 bar-g and gas prices of both £0.60 per therm and £1.00 per therm. The analysis was based on projected demand for the period 2008/09 to 2012/13. The magnitude of the benefits will obviously be dependent on the price of gas which was high at the time of the modelling although has fallen since. Indeed as the future gas price will vary from 2010 to 2020, the level of benefit assumed across the whole period of analysis will also fluctuate. The RAs are mindful of these variations and will review the analysis appropriately.

Further information on the assumptions and background to the analysis is available from the original network modeling results published on the 18th November 2008[32].

Calculation G – Value of Additional Interconnector (IC) Inventory Product

The fuel gas savings presented above will vary as Corrib and potentially Shannon LNG reduce demand on the IC system. However the reduction in fuel gas savings will be offset by the availability of additional inventory product on the IC.

A value of €35,714 per GWh/d (row e) is placed on the additional inventory product using 2007/2008 IC inventory value estimates. This figure is then used to calculate the value of the additional IC inventory product over the time periods and pressures modeled.

Value of Current Interconnector Inventory		
a	Total value of transactions and withdrawals on IC inventory 2007/2008	€1,200,000
b	IC inventory product charges 2007/2008	€200,000
c	Value of IC product (a – b)	€1,000,000
d	Total IC Inventory capacity 2007/08	28 GWh/day
e	Value per GWh/d (c/d)	€35,714

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Value of additional Interconnector Inventory Product		
Pressure	Modeling results: Additional IC Inventory Product (GWh/d) [A]	Value of Additional IC Inventory Product (€/y) e (table above) x [A] = [B]
55 bar-g		
2008/09	7.2	257,143
2009/10	6.2	221,429
2010/11	8.9	317,857
2011/12	0	0
2012/13	22.3	796,429
50 bar-g		
2008/09	13.3	475,000
2009/10	9.4	335,714
2010/11	12.2	435,714
2011/12	0	0
2012/13	22.3	796,429

Average Value of additional IC Inventory	
	Central Case (Average of [B])
Actual	€363,571
Rounded	€400,000
Sterling	**£320,000**

The approach to calculating the pessimistic and optimistic case for additional IC inventory savings is presented in Calculation H.

Calculation H – Combined Fuel Gas and Inventory Savings

Since fuel gas savings and IC inventory product savings are interdependent, it was more realistic to combine these figures when calculating the pessimistic and optimistic cases. For example, if Shannon LNG is available on a summer month, then fuel-gas savings at Brighouse Bay will be low, however as the demand on the interconnectors will be reduced there will be increased IC inventory available during this scenario. Hence an inverse relationship between fuel gas savings and inventory product is established, i.e as one increases, the other decreases and vice-versa. To determine the pessimistic and optimistic case, the lowest and highest total values have been used as tabled below. The lowest value excludes the zero year, since as discussed in Calculation F, some level of benefit would be expected.

Combined Fuel Gas and Additional IC inventory savings					
Pressure	Modeling results: Fuel gas savings (60p per therm) € [A]	Modeling results: Fuel gas savings (100p per therm) € [B]	Modeling results: Additional IC Inventory Savings € [C]	Combined IC Inventory and fuel gas savings (60p) € [A] + [C] = [D]	Combined IC Inventory and fuel gas savings (100p) € [B]+ [C] = [E]
55 bar-g					
2008/09	346,932	578,205	257,143	604,066	835,348
2009/10	296,286	493,810	221,429	517,715	715,239
2010/11	424,217	707,028	317,857	742,074	1,024,885
2011/12	0	0	0	0	0
2012/13	111,379	185,632	796,429	907,808	982,062
50 bar-g					
2008/09	639,088	1,065,147	475,000	1,114,088	1,540,147
2009/10	450,073	750,122	335,714	785,788	1,085,837
2010/11	582,755	971,258	435,714	1,018,470	1,406,973
2011/12	0	0	0	0	0
2012/13	111,379	185,632	796,429	907,808	982,062

Pessimistic and Optimistic Combined Savings		
Combined IC inventory and fuel gas savings	Pessimistic (lowest value [D])	Optimistic (highest value [E])
€	€517,715	€1,540,147
Rounded	€500,000	€1,500,000
£	**£400,000**	**£1,200,000**

Calculation I – Balancing Savings

It is expected that operational efficiencies will give rise to fewer balancing actions required to balance the CAG network. This is based on a larger CAG network being more capable of absorbing the behavior of network users. Firstly this should lead to potential savings due to lower volumes of balancing gas being purchased [D]. Secondly, as there will be less balancing gas for resale within the system, it is expected that competition will reduce the price paid for balancing gas [E]. The method of calculation provided by the transporters is explained below.

The method has been to take the current Northern Ireland annual balancing volume (based on historic figures) and estimate a central case where the balancing volumes reduce by 50% under CAG. To quantify this benefit, the reduced balancing volume was then multiplied by the current average spread between buying and selling the gas in Northern Ireland i.e. the unit cost of balancing. Alternatively it could have been assumed that both NI and RoI balancing actions fall by 25%. Given the fact that the RoI system, which has twice as much capacity as the NI system, but the same number of balancing actions is some indication of the potential for a larger system's economies of scale to reduce balancing actions significantly.

For the benefit from a reduction in the spread between buying and selling the remaining balancing gas required we have assumed that the NI price falls inline with the RoI price which is lower because of the size of the market and therefore the volume of balancing gas being bought/sold. We have therefore taken this reduction in price that Northern Ireland would achieve and multiplied this by the remaining balancing gas required (50% of current NI requirement in this example).

The calculations below are based on reductions to the Northern Ireland annual balancing volume of 4,162,307 therms (April – October 2008 figures). A price of 3.5 pence per therm has been assumed for the volume reduction savings [D] and a price of 1.5 pence per therm for the reduced price savings [E]. The central case assumes a 50% reduction to this balancing volume. As Northern Ireland and Ireland have similar balancing volumes this reduction is similar to applying a 25% reduction to the entire CAG network. The pessimistic case uses the 20% figure and the optimistic case uses the 80% total savings figure.

Balancing Savings						
Reduction to current NI annual balancing gas volume % [A]	Reduced NI annual balancing gas volume (therms) [B]	Remaining balancing gas (therms) 4,162,307 - % [B] = [C]	Potential savings due to volume reduction £ [B] x 3.5 p = [D]	Potential savings due to reduced price £ [C] x 1.5p = [E]	Balancing buy fixed fee £ [F]	Total Saving £ [D] + [E] + [F] = [G]
100	4,162,307	-	£ 145,681	£ -	£ 11,400	£ 157,081
90	3,746,076	416,231	£ 131,113	£ 6,244	£ 11,400	£ 148,756
80	3,329,845	832,461	£ 116,545	£ 12,488	£ 11,400	**£ 140,432**
70	2,913,615	1,248,692	£ 101,977	£ 18,731	£ 11,400	£ 132,108
60	2,497,384	1,664,923	£ 87,408	£ 24,975	£ 11,400	£ 123,784
50	2,081,153	2,081,153	£ 72,840	£ 31,219	£ 11,400	**£ 115,459**
40	1,664,923	2,497,384	£ 58,272	£ 37,463	£ 11,400	£ 107,135
30	1,248,692	2,913,615	£ 43,704	£ 43,707	£ 11,400	£ 98,811
20	832,461	3,329,845	£ 29,136	£ 49,950	£ 11,400	**£ 90,487**
10	416,231	3,746,076	£ 14,568	£ 56,194	£ 11,400	£ 82,162
0	-	4,162,307	£ -	£ 62,438	£ 11,400	£ 73,838

Calculation J – Carbon Savings

Reduced fuel gas savings to operate the transmission system will also give rise to carbon savings. The amount of gas saved is based on the fuel gas savings presented in calculation F, column [B] namely 4.24 GWh/y, 24.35 GWh/y and 14.1 GWh/y representing the minimum, maximum and average fuel gas savings figures respectively. The fuel gas savings are converted into gas tonnage and multiplied by €40 per tonne[33].

Carbon Gas Savings						
	kWh [A]	Cubic Meter of gas [A] x 0.0949 (kWh to cubic meter of gas conversion) = [B]	Tonnes of gas [B] x 0.0007502 (cubic meter gas to tonnes of gas conversion) = [C]	Carbon Saving € [C] x €40 = [D]	Carbon Saving Rounded € [D] rounded = [E]	Carbon Saving £ [E] x 0.8 exchange rate
Optimistic	24,346,000	2,310,435	1733	€69,330	€70,000	£**56,000**
Central	14,105,125	1,338,576	1004	€40,167	€40,000	£**32,000**
Pessimistic	4,243,000	402,660	302	€12,083	€10,000	£**8,000**

[33] The Social Cost of Carbon and the Shadow Price of Carbon: What They Are, And How To Use Them In Economic Appraisal In The UK, Economics Group, Defra, December 2007.

Appendix 2

Summary Table of Discounted Net Present Values over 10 year and 20 year timeframes

Net Benefits	**10 Year Timeframe**				**20 Year Timeframe**			
	5%		3.5%		5%		3.5%	
	€000's	**£000's**	**€000's**	**£000's**	**€000's**	**£000's**	**€000's**	**£000's**
Harmonised Transmission Tariff Methodology	(441)	(353)	(441)	(353)	(441)	(353)	(441)	(353)
Single Transmission System Operation	7,223	5,779	7,866	6,293	12,343	9,874	14,233	11,387
Single IT System	5,536	4,429	6,012	4,809	9,328	7,462	10,728	8,583
Harmonised Connection Policy	(161)	(129)	(168)	(134)	(210)	(168)	(227)	(182)
Single System Planning and Development	(31)	(25)	(31)	(25)	(31)	(25)	(31)	(25)
Total Net Benefits	12,126	9,701	13,239	10,591	20,990	16,792	24,263	19,410