Business Case

The development of an East West Electricity Interconnector

February 2008

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1. Introduction and policy context

Introduction

The Government committed to developing an East West Interconnector (EWIC) in its Energy Policy White Paper and the Programme for Government. An interconnector is an electrical circuit which connects separate electricity transmission (high voltage) systems. In this case the interconnector would comprise of submarine and underground cable across the Irish Sea connecting the transmission system in the Republic of Ireland to that in Great Britain. The National Development Plan 2007 – 2013 reinforces this, in that it highlights the need for timely investment at national level in EWIC ("the Interconnector") and a small number of other large-scale, public-good, energy infrastructure projects, under a new category of Strategic Energy Infrastructure. The importance of the Electricity Interconnector project has been recognised at a European level as the EWIC will help ensure that Ireland is more closely integrated into the wider European energy market. The EirGrid East West Interconnector will have both importing and exporting capacity. EWIC has been designated a "Project of European interest" and is included in the EU Trans-European Networks Priority Interconnection Plan and is currently receiving some finance to cover aspects of project development. At a local level the establishment of the Single Electricity Market for the island is also a step towards improved market integration.

The advantage of this integration, and specifically of the development of the EWIC is: the improved security of supply; increasing competition in the single electricity market; and environmental benefits including (a) the increased ability to accommodate wind generated energy and the potential to export surplus wind-generated electricity, (b) the effect of this in assisting Ireland in achieving it's ambitious targets of achieving 33% of our electricity consumption from renewable sources by 2020 (as outlined in the Energy Policy White Paper), and (c) the reduction in expected carbon credit payments.

The National Development Plan points out that an investment of over €1.2 billion is required in the short to medium term to bring strategic energy infrastructure up-to-date and foster continued economic and regional development in Ireland.

Background

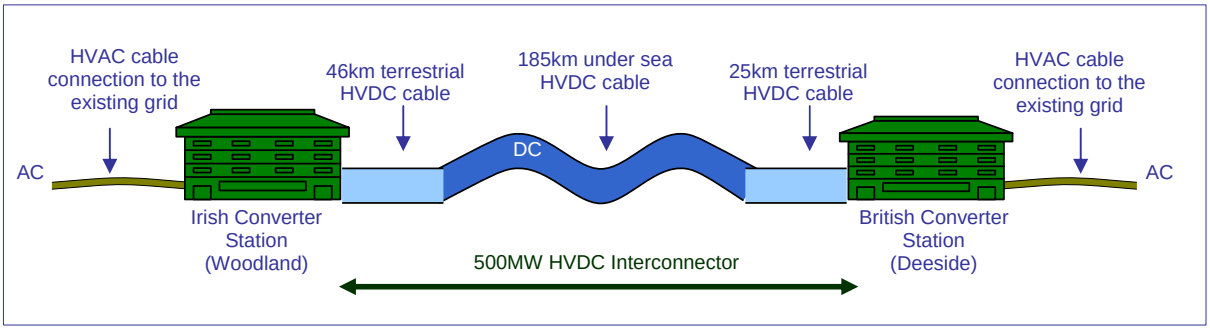
There are currently two Electricity Interconnectors in operation on the island of Ireland, the Moyle Interconnector (which operates at 450 MW), linking the Northern Ireland network to Scotland, and the North South Interconnector[1] between Tandragee and Louth (which operates at 330 MW). In addition, two further Electricity Interconnectors are currently proposed, a second North South Interconnector between Tyrone and Cavan programmed for completion in 2012 and an East West Electricity Interconnector linking Ireland with the Great Britain network in North Wales.

Project description

The EWIC project represents the construction of a cable, capable of carrying 450MW to 650 MW (megawatts) of electricity, from an electricity sub-station in Ireland to an electricity sub-station in the UK, and vice versa. While the Interconnector capacity may ultimately be some capacity level between 450MW and 650MW, for the purposes of this document the project is referred to as a 500 MW Electricity Interconnector. The components of the construction are outlined diagrammatically overleaf.

[1] It should be noted that with the operation of the Single Electricity Market (SEM), the North – South Interconnectors will effectively become part of the internal circuits of the new market.

Figure 1: The proposed East West Electricity Interconnector



The HVDC Interconnector will allow the Irish system to connect to the much larger UK system while allowing control of the power flow. The EWIC will have both importing and exporting capacity and be able to transmit direct current (DC) between the two converter stations, proposed for Woodland, in Ireland and Deeside in Wales. The Electricity Interconnector cable is 256km in length – 185km of marine (under sea) cable and 71km of terrestrial cable (above sea). The converter stations will convert the current to the usual form of alternating current (AC) for onward transmission on the transmission network in the UK and Ireland.

2. Executive Summary

Background to Government Decision

In July 2006 , the Government requested the Commission for Energy Regulation ("CER") as part of its Energy Policy to arrange for the design of a competition for the construction of a East West Interconnector ("EWIC") to Britain by 2012 to be owned and operated by EirGrid. The EWIC was described as "of critical national strategic importance" in National Development Plan 2007 -2013. It was agreed that EirGrid will develop the interconnector and run the competition subject to the determination of all key policy questions by the CER and with regulatory oversight of the procurement process.

Benefits of the Electricity Interconnector

The main benefits of developing an Electricity Interconnector are:

- Enhanced security of supply – The Generation Adequacy Report ("GAR") has identified a need for additional generating capacity over the next seven years to maintain supply security. There is significant capacity available in the British generating market to provide security of supply, via the EWIC for Ireland. In addition, Great Britain is also developing interconnectors with mainland Europe to further contribute to security of supply and market integration.

  Furthermore, there is a clear requirement for a fully-dispatchable source of energy supply, which could not only be used as required, but would also provide the capacity and stability that is required to increase the extent to which renewable generation can be accommodated on the system. The Electricity Interconnector would also provide the mechanism by which such wind-generated energy could be exported, in the event of surplus energy generation.

- Promoting further competition in the electricity market as it will allow third party access in a fair, consistent and transparent manner; this in turn should assert downward pressure on electricity prices. For comparison, NIE has indicated that the largest industrial users in Northern Ireland have seen prices fall by 10% since the commissioning of the Moyle Interconnector. During that same period income from interconnector capacity auctions was sufficient to recover the capital costs associated with the interconnector.

- Environmental benefits:
  - Facilitates greater potential to export wind power;
  - Reduces need for carrying reserve;
  - Reduced carbon credit payments.

- Improved fuel diversity. The introduction of the EWIC will diversify the fuel sources used to generate electricity available on the Irish system.

The introduction of EWIC will convey real public good benefits in the above areas. While in some cases these are difficult to quantify with precision, this paper does quantify the key benefits.

Summary of Benefits

In summary the table below sets out the quantifiable benefits identified in respect of the East – West Electricity Interconnector.

Table 1: Annual Estimated Potential Benefits

Benefit	€ million	Likelihood that full benefit arises
Security of Supply (Measured through replacement need for a peaking plant)	40	100%
Environmental – Reduces wind curtailment	10	100%[2]
Environmental – Reduces need for carrying reserve	2	100%
Environmental – Reduces carbon credit payments	28	50%[3]
Total annual benefits		**€66m**
Reduction in market costs per 1% price reduction	20	

The present value (PV) of an annual benefit of €66m, over the asset depreciation period of 30 years, and based on EirGrid's allowed WACC (weighted average cost of capital) of 5.63% (pre-tax real rate) is €946m. When compared to the required capital investment of €596m, this reflects an overall benefit of approximately €350m over the 30 year asset depreciation period[4].

There are also a number of other benefits associated with the Electricity Interconnector which have been identified and for which a financial value cannot be attributed such as increased market confidence and improved competition.

Estimate of Project Cost

The agreed capital costs will not be known until a successful contractor is secured and a tender price agreed. [Redacted sentence] In the meantime, the capital costs estimated being used for the proposed EWIC development and construction costs are estimated at €596m, including contingencies.

Corporate Structure

EirGrid commissioned a Competition Design Report to address the appropriate competition design including corporate and funding structures. This report concluded that the following was the most appropriate structure;

- To hold the asset within a subsidiary of EirGrid, a Special Purpose Vehicles ("SPV"), allowing EirGrid to maintain value and control in a transparent structure, while also ring-fencing costs. Within this option, a number of ownership options were considered, from 100% EirGrid ownership, through third-party equity during commissioning, to a long-term JV structure and leasing structure;

The main reasons for this conclusion were as follows;

- Facilitate minority participation in equity if necessary;
- Meets the mandate for EirGrid to own and operate;
- Ring fences costs from other EirGrid activities;
- Minimises funding costs and maximises borrowing capacity; and

2 This benefit is premised on 33% renewables penetration which is expected shortly after the EWIC becomes operational.
3 This benefit is scaled back to 50% to reflect the fact that EWIC is not expected to be importing all the time.
4 The required capital investment will be more accurately known after the competitive tendering process is finalised.

- Allows significant progress to be made on procurement prior to completion of planning processes which assists in facilitating delivery by 2012.

Other options were looked at in the Competition Design Report, including PPP. These options did not meet the criteria. For example, PPP does not deliver on the mandate of EirGrid owning and operating the asset, there is significant contractual complexity which would delay delivery and it does not facilitate adequate risk transfer for additional costs involved.

As provided for in the Energy (Miscellaneous Provisions) Act 2006 the CER have agreed that all project costs reasonably and efficiently incurred (net of capacity auction receipts) will be allowed to be recovered through the Transmission Use of System (TUOS) charges. EirGrid charges all parties connected to the transmission system TUoS charges and ultimately all electricity users pay TUoS as part of their electricity bills. It is worth noting that different amounts of TUoS are recovered from different classes of customer.

It is expected the SPV will charge EirGrid an availability charge for the use of the EWIC. This charge will be set at a level that allows the SPV to meet all its financing costs and debt service requirements including an appropriate return on the equity committed to the SPV. This charge will be a fully allowable cost of EirGrid's and used in calculating its annual revenue requirements. EirGrid will pass these costs (net of any capacity auction revenue) through to the TUoS customer.

Funding Requirements

[Redacted]

3. Benefits of the Electricity Interconnector

The development of the East West Electricity Interconnector linking Ireland and Britain supports the EU's energy policy package "Energy for a Changing World" which includes a priority interconnection plan for electricity and gas across the EU. The key objectives of this policy are aligned to the economic benefits (both quantifiable and non-quantifiable) of developing an Electricity Interconnector, which are:

- Enhanced security of supply – the demand and supply picture;
- Promoting further competition in the electricity market;
- Environmental benefits:
  - Facilitates greater potential to export wind power;
  - Reduces need for carrying reserve;
  - Reduced carbon credit payments.

The introduction of EWIC will convey real public good benefits in the above areas which are monetised based on empirical evidence and/ or relevant research reports in this section.

(a) Enhanced Security of Supply – the Demand and Supply Picture

In making an assessment of security of supply, it is important to understand the demand profile in Ireland and compare this with supply currently available in Ireland and additional supply proposed via the Electricity Interconnector.

Demand

The forecasting of future demand for electricity is undertaken on an annual basis. The demand picture for the Republic of Ireland for the next seven years is presented in the Generation Adequacy Report (GAR) and the Transmission Forecast Statement.

Table 3: Forecast of Total Electricity Requirement (TER) and Peak Transmission Demand inthe Republic of Ireland, 2008 – 2014

Year	Median scenario	
	TER (GWh)	Peak Demand (MW)
2008	29,891	5,142
2009	30,819	5,290
2010	31,770	5,442
2011	32,745	5,600
2012	33,745	5,762
2013[5]	44,885	7,868
2014	46,082	8,075

Source: Generation Adequacy Report, 2008-2014, EirGrid

5 The GAR begins to forecast adequacy on an all island basis from 2013, hence the step change in demand.

Table 3 outlines the forecast for peak transmission demand for medium demand scenarios up to 2014. The step change in 2013 corresponds with the completion of the Cavan -Tyrone 400kV circuit which is programmed for completion in 2012. Its introduction allows the full benefit of the all-island market to accrue.

Supply

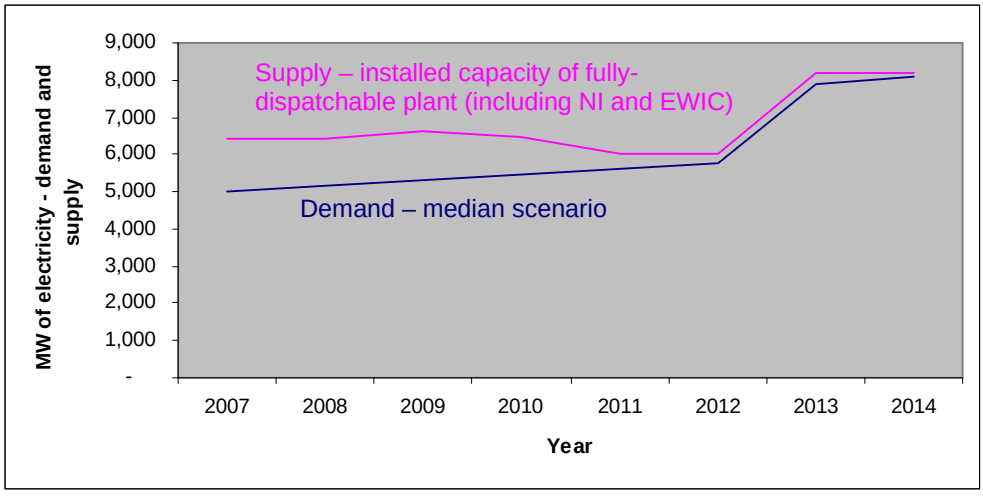
Supply comprises two types of generating facilities:

- Fully-dispatchable plant – this refers to large power generators such as gas, oil-fired and peat plants and hydro generation; and
- Non-fully-dispatchable plant – this consists of industrial-back-up generation, small scale combined heat and power (CHP), small scale biomass, small scale hydro and wind power generation.

The Generation Adequacy Report 2008 - 2014, for the Republic of Ireland, indicates that as at end of 2007, 6,445 MW[6] of **fully-dispatchable plant** capacity is in place; however between 2009 and 2011, approximately 1,300 MW of capacity will be withdrawn due to plant closure. However, 830 MW added by ESB and Bord Gais results in approximately 6,005 MW of 'fully-dispatchable plant' by 2011.

In terms of **non-fully-dispatchable plant**, the GAR shows capacity, again in the Republic of Ireland, as at year end 2007 to be 1,132 MW increasing to 3,076 MW by 2014. This is an increase of approximately 172% and is made up almost exclusively of increased wind power generation (WPG). In 2007, wind powered generation made up approximately 84% of the total non-fully dispatchable plant. This is expected to increase to 91% of the total non-fully dispatchable plant capacity in the Republic of Ireland by 2014.

Diagram 1: Comparison of peak transmission demand (MW) to installed supply capacity (MW) 2008 - 2014[7]



Source: Generation Adequacy Report 2008-2014, EirGrid

Diagram 1 above indicates the extent to which forecast demand would not be satisfied by the availability of supply from fully-dispatchable plant, but requires the availability of supply, particularly from 2011 onwards, from either:

[6] This includes an agreement to place a formal capacity dependence of 200 MW on generation capacity in Northern Ireland and the 400 MW Huntstown 2 facility, which opened in 2007.
[7] The GAR begins to forecast adequacy on an all island basis from 2013, hence the step change in demand.

- both fully-dispatchable and non-fully-dispatchable plant, or
- fully-dispatchable plant including both the NI and EWIC

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EirGrid is required under legislation to advise the CER in relation to the security of supply outlook for Ireland. This obligation is principally achieved through the GAR. Security of supply is assessed by determining the likelihood of there being sufficient generation to meet customer demand, or in other words, by calculating the risk that supply shortages will occur. The potential for supply surpluses or risk of supply shortages is calculated by using statistical techniques to determine the probability that demand will exceed supply. The methodologies used in the GAR are in line with international best practice for the assessment of security of supply.[8]

The conclusion of the GAR is a clear requirement for a fully-dispatchable source of reserve supply, which could not only be evoked when required, but which would also provide the capacity and stability that is required to increase the extent to which renewable generation can be accommodated on the system. The Electricity Interconnector would also provide the mechanism by which such renewable generation, principally wind-generated, energy could be exported, in the event of surplus energy generation. EWIC is identified in the All-Island Grid Study as a key enabler for delivering the ambitious national renewables targets, and indeed the proposed targets for renewables in the recent directive proposal on the promotion of the use of energy from renewable sources (COM (2008)19).

In enabling additional renewable generation, particularly wind, to be accommodated on the Irish system, the East West Interconnector contributes to the delivery of the following benefits:

- it will make a significant contribution to the renewable energy target which is that 33% of all energy usage will be from renewable sources by 2020[9];
- the use of a sustainable and indigenous energy source;
- there are zero carbon emissions from WPG; and
- on-shore wind energy generation is a mature renewable energy technology.

However, the GAR notes that wind power generation does not make a significant contribution to generation adequacy because of the significant probability that all wind power generators could cease generation for a period of time. Although wind power generators are physically separate and located across several dispersed geographic areas, wind conditions can sometimes follow the same trends and therefore this source is limited in terms of ensuring continuity of supply.

In addition to generation capacity across both fully-dispatchable plant and non-fully-dispatchable plant, it is also important to consider the requirement for reserve capacity. Typically load factors are lower in the summer time and therefore planned shut downs for maintenance can be arranged, however, the system must also have sufficient capacity to meet demand in the event that the largest generator unit was to go off line unexpectedly. As a result, generating capacity should always remain significantly higher than peak demand.

In conclusion therefore the GAR has identified a need for additional generating capacity over the next seven years to maintain supply security. This is also fully consistent with the need for an East – West Electricity Interconnector which can provide up to 500 MW of additional capacity at peak times, while also supporting the generation of additional energy from non-fully-dispatchable plants.

Generation Capacity in Britain

As one of the key benefits of having an Electricity Interconnector is in respect of security of supply, this may only be realised if the British market is generating sufficient capacity to meet any peaks in demand in the SEM in addition to supplying energy to the UK market and if that Interconnector has

8 For the purpose of the GAR an assessment is carried out for every half hour of the 2008-2014 study period. From these half hourly probabilities, an annual expectation, known as the Loss of Load Expectation (LOLE), is determined.
9 This is borne out by the All Island Grid Study January 2008.

firm transmission access to the Great Britain system[10]. Similar to the GAR in Ireland, Table 4 below sets out the peak demand forecast in Britain over the next seven year period.

Table 4: Peak Demand Forecasts in Britain

Year	Peak Demand (GW)
2007/08	62.1
2008/09	63.2
2009/10	64.2
2010/11	65.2
2011/12	66.0
2012/13	66.8
2013/14	67.4

Source: National Grid – GB Seven Year Statement, 2007.
Note: These include 300 MW exported to NI through the Moyle Interconnector.

The GB Seven Year Statement shows an anticipated increase in demand over the next seven years of approximately 8.5% (this reflects lower anticipated growth in GB compared to Ireland).

In addition to the increase in demand in Britain, the supply picture is set to increase significantly. The GB Seven Year Statement 2007 indicates that the aggregate power station capacity is set to increase from 78.4 GW in 2007/08 to 101.9 GW in 2013/14, which gives a capacity margin of 35% that is larger than the entire Irish system. The largest component of this change is due to the 12.9 GW increase in CCGT plant capacity coming on line and the second largest increase is due to the growth in wind generation (both onshore and offshore) which is set to grow by 9.3 GW. This availability of excess capacity provides the opportunity to trade electricity across borders. However, this trade is also facilitated by factors such as the non co-incidence of peak demands and forced outages in the Republic of Ireland and GB.

As a result there is significant capacity available in the British generating market to provide security of supply using the East – West Electricity Interconnector. In addition to the supply above, GB are also developing interconnectors with mainland Europe to further contribute to security of supply and market integration.

Quantifying the benefit of security of supply directly is difficult; however one function the Electricity Interconnector can perform is to provide additional supply when demand peaks. In the absence of an Electricity Interconnector, a 'peaking plant' would be required to perform this role. As a result there are potential savings from the reduced need for peaking plants.

A 'peaking plant' is a facility that generally runs only when there is a high/ peak demand for electricity, and typically in Ireland this would operate for only a few hours per year. The generator type most likely to be used to provide this peaking facility would be an open cycle gas turbine as it allows for the generator to be started and stopped without causing damage to the generating equipment. Due to the nature of these plants they have lower efficiency levels than base load plants and are more expensive to operate.

[10] Security of supply is only a meaningful benefit for an interconnector project, such as the EWIC, when the project has firm access which requires a connection offer from NGC. EirGrid has already secured a UK interconnector licence and grid connection in Deeside, in North Wales.

Therefore having the Electricity Interconnector in place is equivalent to the presence of a 500 MW peaking plant on the transmission system. The cost associated with providing a peaking plant with this capacity is estimated at €39.9 million per annum. This cost estimate is based on the Commission for Energy Regulation's (CER's) calculation of the fixed cost of the 'Best New Entrant Peaking Plant' - for 2008 this cost is €79.77/kW per annum. Hence the calculation of a cost saving / benefit of €39.9 million for a 500 MW peaking plant.

(b) Promoting Further Competition in the Electricity Market

One of the key benefits to domestic and industrial users from the introduction of the Electricity Interconnector is the increased competition this should bring to the local market, which in turn should lead to lower electricity prices.

A measure of competitiveness that can be used in Ireland is the Residual Supply Index (RSI), which measures the share of electricity demand which can be covered in the absence of the largest player in the market. When the share covered is large, it indicates the biggest player is not influential and therefore the market is relatively competitive[11].

The Economic and Social Research Institute (ESRI) has calculated that the RSI of the Irish electricity generating market is currently above 1.1 only 50% of the time. It is estimated that the introduction of the 500 MW Electricity Interconnector would increase the RSI to above 1.1 at least 67% of the time. Therefore, while there is market power among some players in the market to such an extent that the regulators put in place measures to control this market power, the interconnector will significantly increase the competitiveness of the market and will reduce the market power of participants.

EWIC will be available for full third party access, in a transparent and non-discriminatory manner. The Electricity Interconnector may therefore indirectly encourage new entrants to the market over time, as it provides an initial market entry route for GB providers to sell to Irish users (and vice versa), and thus to test the market, before potentially deciding to enter the market. The Interconnector would also indirectly open the Irish market to the wider European market, through the European interconnector network.

In addition to the advent of diversity of suppliers, one of the key financial benefits associated with increasing competitiveness is downward pressure on prices, which drives efficiencies and results in lower costs for industrial/ commercial and domestic consumers. It is estimated that for every 1% decrease in average wholesale electricity prices consumers will benefit by c. €20m annually.

In terms of benchmarking this against other interconnectors, the most relevant comparison is with the Moyle Interconnector, which links Northern Ireland with the network in Britain. An exact comparison is difficult because the benefits of Moyle Interconnector, at least initially, have been directed at industry rather than the domestic market. However, for comparison, NIE has indicated that the largest industrial users in Northern Ireland have seen prices fall by 10% since the commissioning of the Moyle Interconnector. During that same period income from interconnector capacity auctions was sufficient to recover the capital costs associated with the project.

(c) Environmental Benefits

(i) Facilitates greater penetration of wind power and reduces wind curtailment

As noted above, in the analysis of supply and demand, a significant increase in the capacity of wind powered generation is planned over the next six years (from 943 MW in 2007 to 2,443 MW in 2013). The variable nature of wind causes significant challenges for an electricity network in terms of the level of wind generated power that can be connected to the grid. Consequently there is a need for conventional generation sources in reserve, to make good any shortfall when wind levels drop.

[11] Other measures include the Herfindahl-Hirschman Index (HHI) and extensive analysis was conducted on the competitiveness of the market by the CER for the purpose of the development of the Single Electricity Market (SEM).

As a result, the new Electricity Interconnector will provide additional capacity which will allow the system to deal with greater levels of wind power and also support the potential export of wind generated electricity to the GB market, in times of high wind energy generation.

An All-Island Grid Study has been published which, amongst other things, outlines the extent to which the Electricity Interconnector would provide the potential for export of wind generated electricity. The report also identifies a second interconnector to Britain as a key enabler of the current national renewable energy targets, as well as the new proposed EU targets.

Furthermore, in line with global commitments made in Kyoto, the General Adequacy Report 2007 – 2012 indicated that "*with Ireland's excellent natural wind regime … it* [wind generation] *is likely to be deployed extensively to meet the renewable energy target of 33% by 2020*."

One way to quantify the benefit associated with greater penetration of wind on the system is to model the extent to which wind would be curtailed in both the presence and the absence of the Electricity Interconnector. Based on the Grid Development Strategy [2025 scenario of 33% renewables]. The incremental benefit of the second Interconnector (i.e. adding EWIC to the Moyle Interconnector), is over €10m/year in terms of reducing curtailment while also allowing Ireland to meet its renewable energy targets.

(ii) Reduces need for carrying reserve

As noted above, there is a requirement for sufficient reserve to be in place in the event of unscheduled shut downs and/ or other loss in generating capacity. The proposed East – West Electricity Interconnector could be used to provide operating reserve like the Moyle Interconnector. The Moyle Interconnector, in addition to facilitating normal electricity trading between Britain and the SEM, provides reserve to the electricity system on the island of Ireland. Under the arrangement, 50 MW of power will be available immediately in the event of demand exceeding supply, or supply declining due to operational difficulties. The 50 MW would otherwise need to be provided from power stations/ peaking plants on the island of Ireland which would be at a higher cost than can be provided over the Electricity Interconnector.

While a detailed study would be required to calculate the value of this benefit directly, the Moyle Interconnector is currently used to provide reserve, at a net cost of €2m[12] per annum and this could be used as a proxy value for the benefit were the EWIC to be used similarly.

It is also important to note that as the level of wind generated energy on the system increases, reserve will become more valuable, therefore the value currently attributed to the reserve is considered to be conservative.

(iii) Reduced Carbon Credit Payments

Under the Kyoto Protocol, countries are required to reduce their greenhouse gas emissions to levels specified for them in the treaty, this level is known as their cap. Overall, this cap requires countries to reduce their emissions by approximately 5% below their 1990 baseline over the 2008 to 2012 period. Under the Protocol, Ireland is required to limit its Greenhouse Gas (GHG) emissions to an average of 13% above 1990 base year emissions in the period 2008-2012. Although these caps are set at a national level, in practice emissions targets are typically set at individual industrial organisations, such as power plants.

As a result if individual companies expect to exceed their carbon emission allowance, they are required to pay 'cash-out' penalty charges, alternatively known as the purchase of carbon credits, to cover the level of their excess. The cost of carbon credits have varied significantly since their introduction in 2005, but have recently traded in the €20 to €22 per tonne range (ERU). In calculating emissions costs for 2008, the Commission for Energy Regulation has assumed a carbon price cost of

[12] The €2m covers all the benefits associated with reserve and is derived from the cost of interruptible load.

€21.57 per tonne (this is the price assumed in this business case for calculation purposes, as it reflects a prudent estimate of cost savings)..One further factor which should be considered is the impact that the introduction of carbon credit purchases should have on the activities of the generating companies. Typically, this additional cost would alter the price of generation, for example making coal relatively more expensive than gas leading to greater use of plant with a lower carbon output. This effect is outlined in the diagrams below, which indicate that the effect of the Electricity Interconnector on the Clean Bid Stack is to reduce the generation of coal fuelled energy primarily, on a typical winter day.

On balance therefore the impact on the activities of the generating companies is likely only to have a minimal impact in terms of encouraging the use of more efficient plant. The financial benefit associated with the reduced carbon credit payment is estimated at €28.3m, as follows:

- A single MWh of power generates, on average, 600kg of carbon. This is a 'blended' rate and reflects a mix of rates from 360kg for efficient gas plants to 900kg for coal plants.
- The 500 MW Interconnector has a 50% load factor;
- The price of carbon allowances is assumed to be €21.57 per tonne (in line with the CER assumption).

Therefore, the annual cost saving is calculated as: 500 MW x 50% capacity x 365 days x 24 hours by 0.6 tonnes of carbon x €21.57 per tonne = €28.3m per annum.

(iv) Improved fuel diversity

The introduction of the EWIC will diversify the fuel sources used to generate electricity on the Irish system. It will also result in an overall reduction for the consumer in the price of energy as the price of energy from the Interconnector is forecast at €65/MWh, which is lower than the currently used gas, coal, oil and distillate, as outlined in the diagrams above. The interconnector price is made up of an assumed portfolio of marginal plant in the UK to get a notional price of €65/MWh. This is lower than the gas price because UK gas is slightly lower than Irish gas and it is assumed that it is not always marginal.

(d) Other Non-Quantifiable Benefits

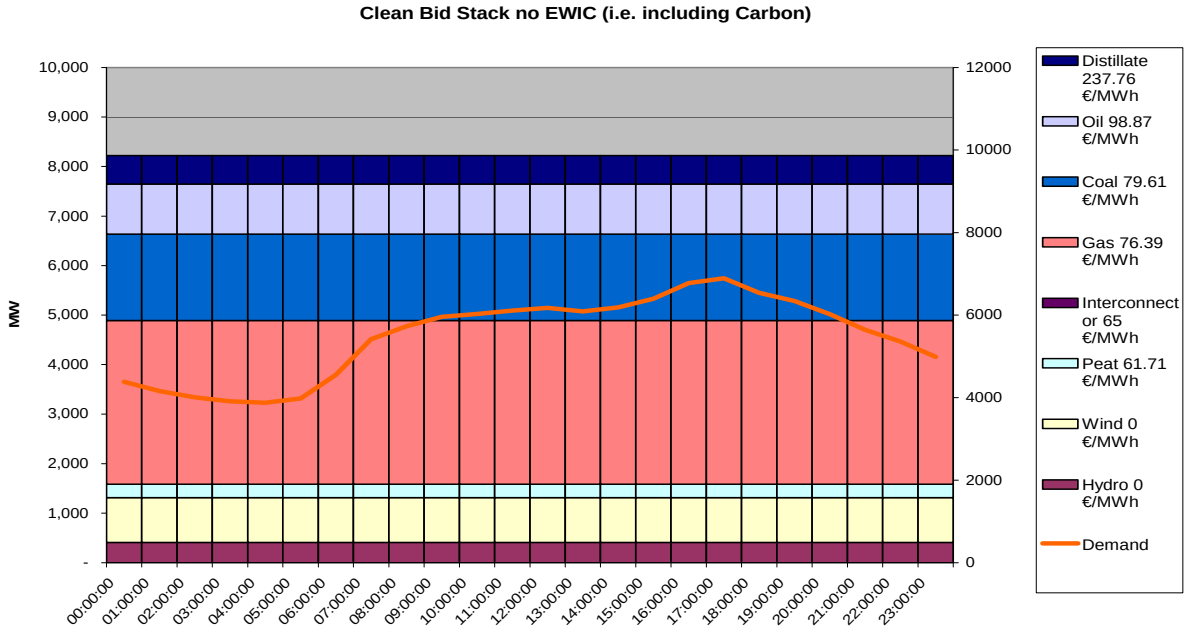
There are also a number of other benefits associated with the Electricity Interconnector which have been identified and for which a financial value cannot yet be attributed. These are briefly described below:

- Increases Market Confidence – the Electricity Interconnector increases the capacity of the SEM and provides a link with the UK electricity market and in turn the European market. As a result the market is no longer seen as isolated and is therefore more attractive to foreign investors who may chose to invest directly in the market, for example through the provision of additional generating capacity (either conventional or renewable) and also increased Foreign Direct Investment in general because of the enhanced security of supply.

- Improved competition – the introduction of an additional source of energy, and in particular the introduction from an external market, improves the level of competition within the market, which in turns leads to a more competitive environment, which not only impacts on the price charged to the end user, but also generates an environment in which incumbent players must kept abreast of international market changes and demands. This improves the overall quality and service proposition within the market.

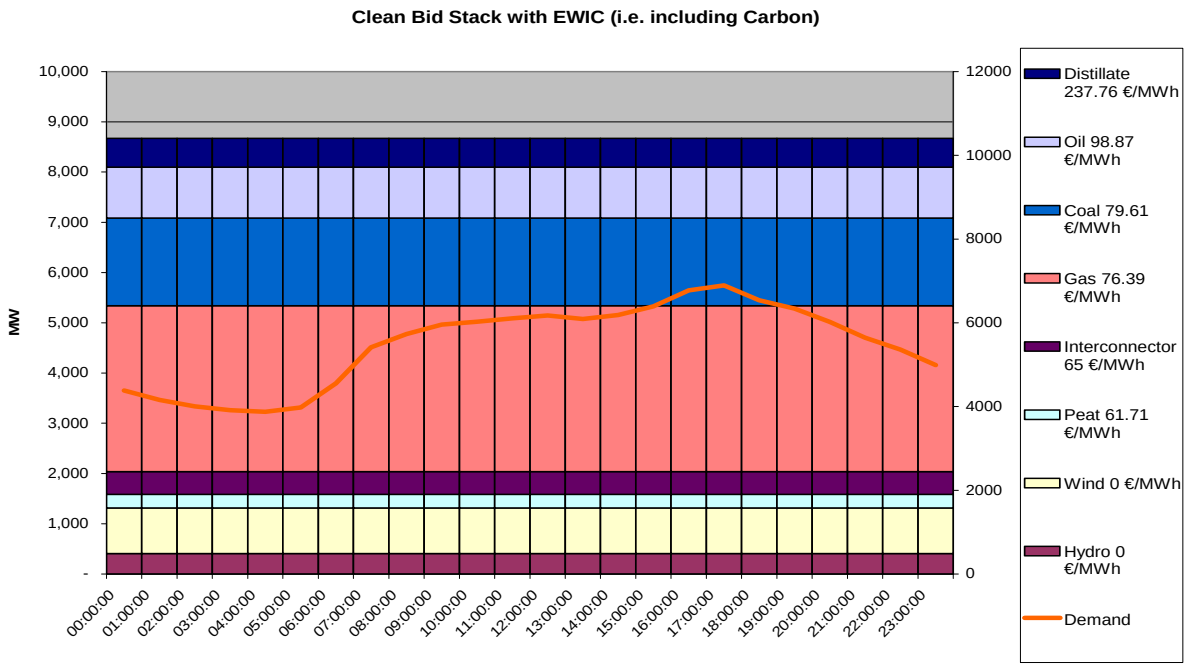
- Guaranteed Third Party Access – the development of the EWIC by EirGrid ensures guaranteed third party access through a transparent and non-discriminatory process.

Diagram 2: The Clean Bid Stack – estimated sources of energy production, without the Electricity Interconnector (Jan 08)



Source: EirGrid derived, Jan 08

Diagram 3: The Clean Bid Stack – estimated sources of energy production, with the Electricity Interconnector (Jan 08)



Source: EirGrid, Jan 08

Summary of Benefits

In summary therefore table 5 below sets out the quantifiable benefits identified in respect of the East – West Electricity Interconnector.

Table 5: Annual Estimated Potential Benefits

Benefit	€ million	Likelihood that full benefit arises
Security of Supply (Measured through replacement need for a peaking plant)	39.90	100%
Environmental – Reduces wind curtailment	10.00	100%[13]
Environmental – Reduces need for carrying reserve	2.09	100%
Environmental – Reduces carbon credit payments	28.30	50%[14]
Total annual benefits		**€66m**
Market Prices - 1% Price reduction	20	

The present value (PV) of an annual benefit of €66m, over the asset depreciation period of 30 years and based on EirGrid's allowed WACC (weighted average cost of capital) of 5.63% (pre-tax real rate) is €946m. When compared to the required capital investment of €596m, this reflects an overall benefit of approximately €350m over the 30 year asset depreciation period[15].

In summary, the benefits of proceeding with the Electricity Interconnector development are:

(a) Security of Supply

Taking the demand and supply picture together the following summary points can be made in respect of security of supply:

- Demand for electricity is increasing by an estimated 3.8% per annum;
- Generating capacity in the form of fully-dispatchable plant will fall from 6,445 MW in 2007 to approximately 6,005 MW in 2011;
- This fall in generation capacity will be replaced largely by a significant increase in the provision of wind power generation, however this form of supply is not considered as reliable given the variability in the wind conditions;
- Comparing forecast capacity – available capacity from fully-dispatchable supply is expected to fall below peak demand levels from 2010 onwards.

In conclusion there is a need for additional generating capacity over the next seven years to maintain supply security. This is consistent with the need for an East West Electricity Interconnector which can provide up to 500 MW of additional capacity at peak times.

13 This benefit is not scaled back to reflect the fact that while 33% renewables penetration is not expected by the time the EWIC becomes operational it will certainly exceed, with possibly up to 42% penetration shortly afterward, possibly as early as 2020.
14 This benefit is scaled back to 50% to reflect the fact that EWIC is not expected to be importing all the time.
15 The required capital investment will be more accurately known after the competitive tendering process is finalised.

(b) Promotion of Increased Competition

While there is market power among some players in the market to such an extent that the regulators put in place measures to control this market power, the interconnector will significantly increase the competitiveness of the market and will reduce the market power of participants.

(c) Environmental Sustainability – Facilitates Greater Penetration of Wind Power and Reduces Wind Curtailment

The Electricity Interconnector should increase the capacity of the system which in turn should increase the potential for the anticipated additional wind generated power to be accommodated onto the system, allowing Ireland to attain its National and European renewables targets. This should then provide the basis for both increased use of wind energy and for surplus wind energy (i.e. wind energy that would otherwise be curtailed) to be exported to the British market.

In the absence of the EWIC the cost of curtailing the production of wind generated electricity is estimated at €10m per annum. The availability of the EWIC would reduce or eliminate this cost.

(c) Environmental Sustainability – Reduces the Need for Carrying Reserve

Given the scale of excess capacity in the British market, reserve arrangements can be agreed with Britain, in a similar way to that currently in place with the Moyle Interconnector. This reduces the need for standby reserve from power stations on the island of Ireland.

(c) Environmental Sustainability – Reduced Carbon Credits

Reduced generation requirements lead to a reduction in the level of greenhouse gas production which will result in a decrease in the level 'cash-out' penalty payments for the production of excess carbon.

4. Preliminary Cost Estimates

The development of the proposed Electricity Interconnector represents a significant capital investment in the infrastructure of the State. The agreed capital costs will not be known until a successful contractor is secured and a tender price agreed. This is expected to occur in Q2 of 2008.

In the meantime, the estimated capital costs associated with the proposed EWIC development, described in Section 1, on a component basis, are outlined in the table below.

Table 6: Estimated capital costs for the East-West Electricity Interconnector

Interconnector component	Cost elements	Estimated capital cost €m	Estimated capital cost €m
Converter stations	• Irish converter station (Woodland) • English converter station (Deeside)		
Land cable (HVDC)	• Ireland (Landfall – Woodland) (46km) • England (Landfall – Deeside) (25km)		
Marine cable (HVDC)			
Total Construction Costs			
Land acquisition Project development costs Interest during construction Reinstatement / disturbance costs			
Total capital costs			
Contingency			
Total costs (including contingency)			€596

Source: PB Power & ESBI

Therefore the core construction costs are estimated at €415m, while the overall development costs are estimated at €596m.

Assuming that the construction and commissioning takes place over a six year period from 2008 to 2013 inclusive, in order for the Interconnector to be operational by 2012, the cash flows associated with the capital costs are estimated to arise over the period as follows:

Table 7: Estimated annual cash flows associated with the EWIC 2008-2013

	2008 €m	2009 €m	2010 €m	2011 €m	2012 €m	Total €m
Converter stations Cable						
Total construction costs						
Land acquisition Project development costs Interest during construction Reinstatement costs						
Total capital costs						
Contingency						
Total costs (including contingency)	35.73	69.74	67.74	136.35	186.44	596.00

Source: PB Power and EirGrid

The Government has agreed that EirGrid will develop this Electricity Interconnector, which is to be in place by 2012. EirGrid are running a transparent and competitive procurement process for the Interconnector, resulting in the selection of a robust development option. The development option for the Electricity Interconnector must be reflective of EirGrid's priorities which are:

- To establish an appropriate EirGrid ownership structure;
- To retain appropriate control of the operation and access to the Electricity Interconnector; and
- To ensure network stability and security.

[Redacted paragraph]

5. Proposed Financial Package

[Redacted section]

6. Appendix

RSI calculation

The level of competition in Ireland can be measured by the Residual Supply Index (RSI), which varies with different amounts of interconnection. The RSI is defined as:

$$RSI_t = \frac{\text{System Capacity}_t - \text{Largest Capacity}_t}{\text{Demand}_t}$$

Where *Largest Capacity* measures the capacity of the largest player in the market and t indexes the period. Essentially the RSI measures the share of the electricity demand that can be covered in the absence of the largest player in the market.

It should be noted that the RSI measure is relatively new and has been developed in the context the Californian market in early 2000 the structure and regulation of which is entirely different to the Irish situation, indeed it is questionable whether any electricity would pass the RSI test even markets that have been acknowledged by most commentators as being competitive. Differences, in particular the market design, ex-post pricing, the level of uncertainty on the demand/wind balance, capacity payments, bidding principles etc, would need to be considered before drawing any firm conclusions.

Comparable interconnector projects

A review of the debt: equity ratios pertaining to 4 international interconnector projects indicates that debt ratios can range from 72% to 90% of total funding requirements. Details of these comparable projects are outlined in summary format below.

Comparable interconnector projects

Interconnector	Debt	Equity	Description
Cross Sound	90%	10%	Links New England and New York electricity grids. Project gearing is 90% due to the secure and predictable nature of the cash flows associated with this project.
Bakun Project	80%	20%	The cost of this project is approximately US$2.4bn, and it is due to be completed by 2012.
Estlink	80%	20%	Links the Baltic States to Finland and reduces dependency on Russia for supply. Total cost of €110m, with 80% debt funding and 20% self-financed by the shareholders. Length of interconnector is 100km, 70km of which is submarine cable.
Basslink	72%	28%	Links Tasmania and Victoria via 280km of undersea cable.

Glossary

ESRI	Economic and Social Research Institute
RSI	Residual Supply Index
SEM	Single Electricity Market
TUoS	Transmission Use of System
GWh	Giga Watt Hour – 1 million kilowatt hours (kWh)
MW	Mega Watt – unit of 1 million watts
MWh	Mega Watt Hour – one MW used for one hour
GDP	Gross Domestic Product
COD	Close of development
RAB	Regulated Asset Base
SPV	Special Purpose Vehicle
WACC	Weighted Average Cost of Capital
GDS	Grid development strategy
NPRF	National Pension Reserve Fund
PV	Present Value