Price Review of Standard Pricing Approach for Generators

Econnect Project No: 1369

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1 Glossary

AAAC	All Aluminium Alloy Conductor
ACSR	Aluminium Conductor Steel Reinforced
Al	Aluminium
CER	The Commission for Energy Regulation
CT	Current Transformer
Cu	Copper
DSO	Distribution Service Operator
DUoS	Distribution Use of System
ESB	Electricity Supply Board
IWEA	Irish Wind Energy Association
LCTA	Least Cost Technically Acceptable
MV	Medium Voltage (20kV and 10kV)
OHL	Overhead Line
O&M	Operation and Maintenance
SLD	Single Line Diagram
SCA	Steel Core Aluminium
SCADA	Supervisory Control and Data Acquisition
VT	Voltage Transformer
XLPE	Cross Linked Polyethylene

2 Executive Summary

On Friday 21st January 2005 the Commission for Electricity Regulation (CER) issued a document titled - ESB Networks Standard Pricing Approach for Generators. The aim of this document is to introduce the proposed new pricing methodology to be implemented under the new group application method of processing wind generator connection applications. One of the changes proposed under these new procedures are to fix the charges for the connection type or component of the connection. This is being done in order that the pricing of connections can be simplified, thus shortening the time required to process applications.

IWEA Ltd has tasked Econnect Ltd to undertake a detailed analysis of the document and specifically the proposed grid connection equipment costs which are detailed under Schedule 1 - Charges for Generators (refer to appendix 2). The concern is that if these costs are not independently evaluated then generators may end up paying higher connection charges than necessary.

Econnect was formed in April 1995 for the purpose of connecting renewable energy generation to the grid. Since then the company has investigated and connected more than 14GW of generation projects to the utility networks. As a result of this we maintain an up to date database of equipment costs across a range of utilities and at a range of voltages.

Our conclusions are as follows:

- Our findings indicate a significant increase in proposed connection costs over current ESB indicative prices and actual connection costs. The main items, which we found to be significant in terms of cost, were the provision of a 38kV cubicle, provision of a new 110/MV substation, and the upgrading of a 38kV substation from one transformer to two transformers. While a number of the ESB proposed costs were in line with our budget estimates, the average cost increase on the 19 listed items in schedule 1 is 55%.
- We also feel that for an important document such as this, with the potential effects it could have on project viability, considerably more information should have been provided from ESB.
- The main affect of this standard pricing is to take away the generators right to contest the price offered by ESB to connect to the distribution network. This will result in additional costs for generators, which will be higher in many cases than technically required.

Our recommendations are as follows

- Approach ESB Networks to discuss their proposed policy applied to pricing methodologies and to provide more detailed information regarding the breakdown of the listed items.
- Consider opening the lower voltage levels at MV and 38kV, which are currently non-contestable, to contestability. Include shared assets under contestability under certain conditions.

3 Scope of Works

The scope of works covered within this report provides the clients with the following:

- Detailed review of ESB Networks proposed ‘Standard Pricing Approach for Generators‘ regime
- Contact ESB Networks to discuss the new ‘Standard Pricing Approach’ methodology devised
- Contact manufacturers, suppliers and installation contractors requesting information regarding the ESB Networks proposed price regime
- Review ESB Networks connection agreement quotations from the past number of years
- Provide generator connection assets cost breakdown based on Econnect’s experience of generator connections in recent years
- Produce a report, recommendations and review with the client

4 Introduction

This report has come about as a result of the proposed changes to generator connection costs in 'Standard Pricing Approach for Generators' (refer to Appendix 2). At the moment each connection price is made up of a current costing of its component parts. The principle behind this pricing mechanism is the Least Cost Technical Acceptable method (LCTA). Under the proposed new pricing structure the prices of connections or the components of connections will be fixed as per the schedule of prices included in the document.

Even though the main focus of this report is on independently evaluating the costs proposed under Schedule 1[1] a number of points need to be made in relation to the main standard pricing process covered under the proposal. These are covered under section 5 of the report. Section 6 of this report breaks deals with the proposed connection item costs. Section 7 draws conclusions and makes recommendations as to how to proceed in relation to this proposal.

[1] ESB Networks standard pricing approach for generators.

5 Standard Pricing Approach

Even though the main focus of this report is on independently evaluating the costs proposed under Schedule 1 a number of points need to be made in relation to the main standard pricing process covered under the proposal.

The document states that the application of the Standard Pricing approach is the most effective and equitable means of processing the applications while facilitating the provision of DSO connection offers in a timely manner. While there is a need to process the applications in a timely manner the method of having fixed standard prices removes the flexibility of the DSO to charge less for these connections where circumstances allow and forces it to fix it's prices at the top end of the range in order to cover themselves. This is hardly equitable from the generator's point of view.

It is felt that a desktop study and site visit should be adequate to prepare a connection offer. The proposed schedule of charges needs to be reexamined as per our recommendations and conclusions.

In relation to the way that costs are attributed to the various generators by the charging regime outlined in section 5.1 of TSO/DSO Joint document (CER 04/317) there are a number of points, which need to be raised.

Contestability Rights:

The document states that parties will not be entitled to construct, or arrange to construct, any Shared Network. Generators connecting to the transmission network will be entitled to construct, or arrange to construct, any Dedicated Connection Asset. From a point of view of least cost construction, if agreement can be reached between the group or groups involved in the shared asset then this work should become contestable in the same way that dedicated assets are. In relation to the shared and dedicated assets at lower voltages such as, 38kV and MV, these assets should now become contestable as part of this process. This would allow generators to utilise the same contractors that ESB are currently using on their network renewal programme and manage their own connection construction. As well as reducing the issue of fixed costs, it would lower the workload on the ESB personnel thus allowing connection agreements to be processed more quickly. While a fee for integration and design would still have to be paid to the ESB for these services and the construction would be financed by the generator, thus protecting the ESB and final end-user customer.

Refunds:

The document states that there will be no refund for the Shared Network costs, as the generator has only paid a contribution in proportion to his capacity for the associated works. If we take that to mean that in the case of a generator who has paid their share of the total cost of the shared asset but fails to get planning for their own dedicated assets, thus ending their interest in the project, they will get no refund. This would cause difficulty in terms of raising finance from the banks. Some system needs to be put in place where the generator dropping out receives a refund with possibly some reduction for work carried out, and the extra cost due to this being reapportioned to the remaining

developers. In this way the charges would be still allocated 100% to the generators, thereby protecting the final end-user customer.

100% up-front payment for Shared assets:

In relation to the payment schedule the notion of paying 100% of the quoted connection charge for the shared asset before planning permission is even sought for the asset is an issue. The fact that a large amount of capital will be tied up while the assets go through planning permission and development seems unnecessary. Perhaps a system should be considered where a 25% payment is made until planning permission was granted, with the remaining 75% falling due at that point. Clearly the ESB will not have that magnitude of an outlay before construction begins, and this sum for shared equipment would still be of a sufficiently large scale in most instances, to tie in the developers. Construction need not begin until the remaining payments are made thus protecting the ESB and final end-user customer.

In relation to costs arising from circumstances outside the control of the DSO during detailed design stages it should be possible to examine and contest these costs.

6 ESB Connection Cost Review

This section covers Econnect's detailed review of ESB Networks schedule of charges for generators.

The following subsections discuss the connection cost breakdown for the following services and equipment supplied by ESB Networks, these include; Line Work, Station Work, Metering, Station Upratings and Cable Costs.

Due to the lack of descriptive information contained in this schedule, it was necessary to make some assumptions in relation to the make up of the individual items in the schedules. This is based on our experience and involvement with the wind energy industry both in Ireland and the UK since 1995. Previous work undertaken by Econnect has provided us with documentation of recent quotes generated by ESB[4] to the CER, dated 11th March 2004. Costing of 38kV 100mm^2 SCA is quoted at approximately €46,000 per km, inclusive of Time at 49%, Material at 30% and Contingency (e.g. Wayleaves, compensation) at 21%. Anywhere it was appropriate to use as a method of validating our prices this methodology was used.

After defining and stating the standard equipment, which we believe to be reasonable in terms of the individual schedule items, a budget estimate was prepared for each one. This budget estimate is based on benchmarked information from Econnect's pricing database. This database is constantly used to carry out estimates and price actual projects. The information is maintained current and valid by constant updating of the data and benchmarking against major supplier equipment prices. These prices include for installation and commissioning. An allowance of 25-30% on budgeted costs was then added for ESB charges. These charges are to cover items such as metering, telecoms, project management, design review, and system planning. Typical industry figures for utilities across Europe would be 20-30%. Previous connection agreements generated by ESB Networks have also been reviewed in detail covering a number of projects from the over the past number of years.

In order to validate our pricing database and in order to achieve a clear indication of the proposed charges, Econnect have contacted manufacturers, suppliers & installation contractors to provide us with quotes in relation to the network equipment and infrastructure. With Econnect's vast experience in renewable energy grid connections and our extensive client contact database, we are able to analyse and provide reliable indicative connection costs. We feel that using these methods has provided us with a clear basis of comparison of equipment costs for both past and present.

Our findings to date indicate a significant increase in proposed connection costs over current ESB indicative prices and actual connection costs. This applies to completed, and on-going generation projects.

We also feel that for an important document such as this, with the potential effects it could have on project viability, considerably more information should have been provided. As well as the lack of definition, there is no attempt made to explain the methodology used to arrive at these prices. A reference is made to the fact that "The charges set out in Schedule 1 are average charges devised on the basis of DSO's experience of generator connections in recent years" however we have analysed the

[4] ESB Networks-Manager Strategy and Regulation, dated 11th March 2004

connection agreements available to us, both through our work in the sector and also those provided to us by IWEA Ltd members and have found that the they do not support this statement and in fact for most of the items quoted in Schedule 1 are considerably higher.

6.1 Line Works

OHL costs provided by ESB are inclusive of installation costs. However ESB originally made no attempt to provide any detailed costing methodology, or to specify the circuit characteristics and properties. Econnect made assumptions in order to arrive at generator connection costs. These have been validated by the provision of greater design parameters and specifics from ESB.

6.1.1 Item 1 – Standard 110kV Line

Econnect assumed the following OHL characteristics based on experience and ESB Networks standard OHL data:

- ACSR, 300 sq mm, design core temperature 80°C, summer rating of 138MVA
- Line is installed on wooden pole (twin pole) and 6 wooden poles to one steel tower.

These assumptions have been validated and in fact are more onerous than the specification provided by ESB.

ESB Networks has proposed generator connection costings for standard 110kV OHLs in the order of €189,860 per km. This is approximately 8% higher than our estimate of 175,760.

No previous documentation providing prices have been submitted to Econnect for 110kV OHL by ESB Networks. However, based on manufacturers, suppliers and Econnect's equipment cost database, we have determined the cost of 110kV OHL at approximately €175,760 per km, inclusive of a 30% margin upfront for ESB engineering and system integration design[5].

Based on our estimates there can be seen to be a significant increase in price on ESB Networks behalf under this new proposal. In view of this, it is therefore recommended to approach ESB Networks to discuss their proposed policy applied to pricing methodologies today.

[5] Typically industry figures are based on 20-30%

6.1.2 Item 2 – 38kV 300mm² SCA

Econnect assumed the following OHL characteristics based on the specifications provided by ESB which are based on the following characteristics:

- Design core temperature 80°C, summer rating of 51MVA (775A)[7]
- Line installed on wooden pole (twin pole)
- 52kV IEC Voltage class
- Max Phase-Earth Voltage 44kV

ESB Networks has proposed generator connection prices for standard 38kV OHL in the order of €102,730 per km. This is approximately 17.95% higher than the €86,040 indicated by our estimates.

Econnect has documents specifying recent prices of 38kV 300 SCA OHL proposed by ESB Networks' Connection Agreements in 2003 and 2004. These indicate a price of approximately €78,000 and €92,000 respectively. Further detailed investigations and discussions with ESB Networks would be recommended to establish the pricing methodology proposed.

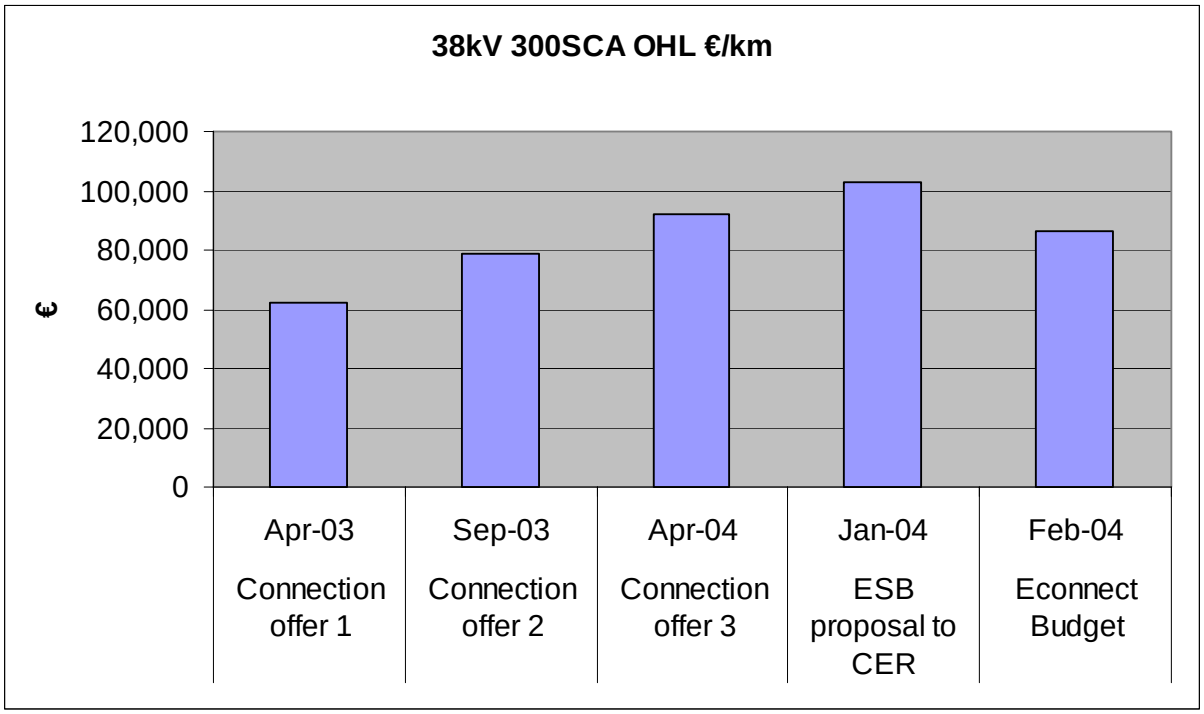

Fig.1 – various costs of 38kV 300 SCA over the period 2003-2005.

[7] Updated specification ESB March 2005

6.1.3 Item 3 - 38kV 100mm² SCA

Econnect has assumed the following OHL characteristics based on the specifications provided by ESB.

The equipment has been re-priced based on the following characteristics:

- Design core temperature 80°C, summer rating of 25MVA (385A)[8]
- Line installed on wooden pole (twin pole)
- 52kV IEC Voltage class
- Max Phase-Earth Voltage 44kV

ESB Networks has proposed generator connection prices for standard 38kV OHL in the order of €67,850 per km. This is approximately 15% higher than the €58,794 per km as indicated by our estimates.

Previous work undertaken by Econnect has provided us with documentation of recent quotes generated by ESB[9] to the CER, dated 11th March 2004. Costing of 38kV 100mm² SCA is quoted at approximately €46,000 per km, inclusive of Time at 49%, Material at 30% and Contingency (e.g. Wayleaves, compensation) at 21%.

Econnect has reviewed several Connection Agreements proposed by ESB Networks for projects undertaken over recent years. These are shown in the figure below.

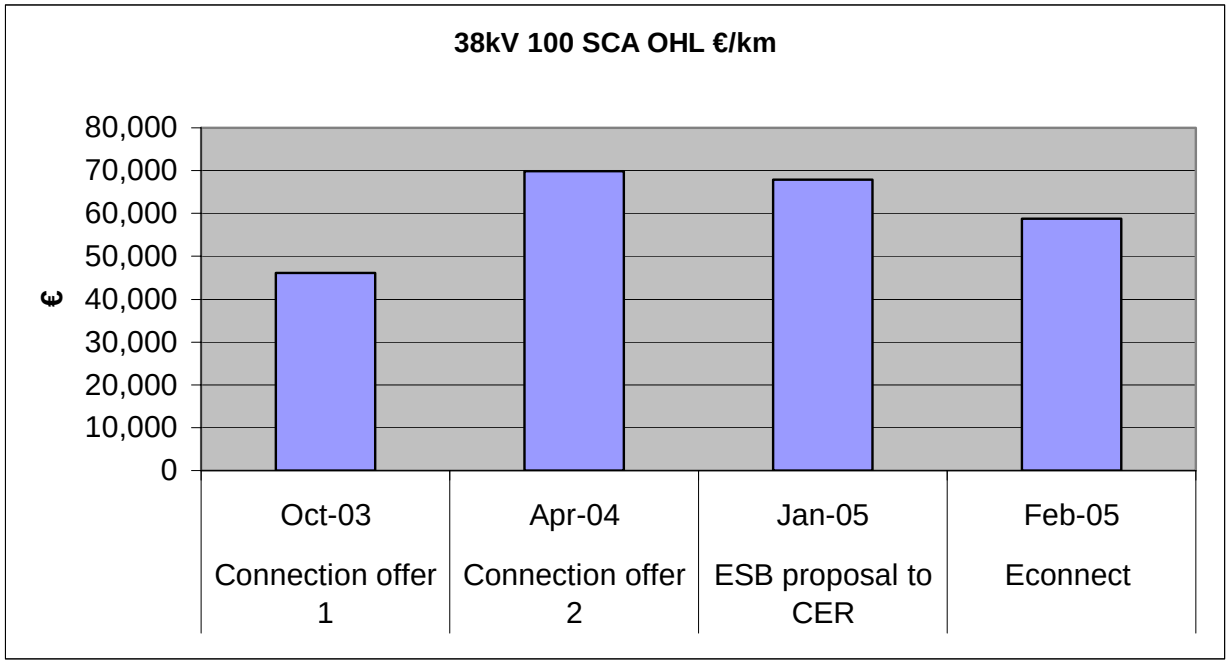

Fig.2 – various costs of 38kV 100mm² SCA over the period 2003-2005.

[8] Updated specification ESB March 2005
[9] ESB Networks-Manager Strategy and Regulation, dated 11th March 2004

As can be seen from this chart in the area of 38kV 300SCA OHL there is little or no consistency in terms of price and it is therefore recommended to approach ESB Networks to establish the pricing methodology proposed.

6.1.4 Item 4 – MV 150mm² AAAC / 92mm² SCA

Econnect has assumed the following OHL characteristics based on the specifications provided by ESB and the Engineering Recommendation P27[10] OHL rating data:

The equipment has been re-priced based on the following characteristics:

- Design core temperature 65°C, summer rating of 14MVA (412A)[11]
- Fault current rating – 11.5kA for 1 sec
- Line installed on wooden pole

ESB Networks has proposed generator connection prices for MV 150 AAAC / 92 SCA in the order of €58,250 per km. This is approximately a 160% higher than the €26,880 price indicated by our estimates.

Econnect has reviewed several Connection Agreements proposed by ESB Networks for projects undertaken over recent years. Figures from 2003 for MV OHL of €22,393, and from 2004 of €25,000 would validate our pricing.

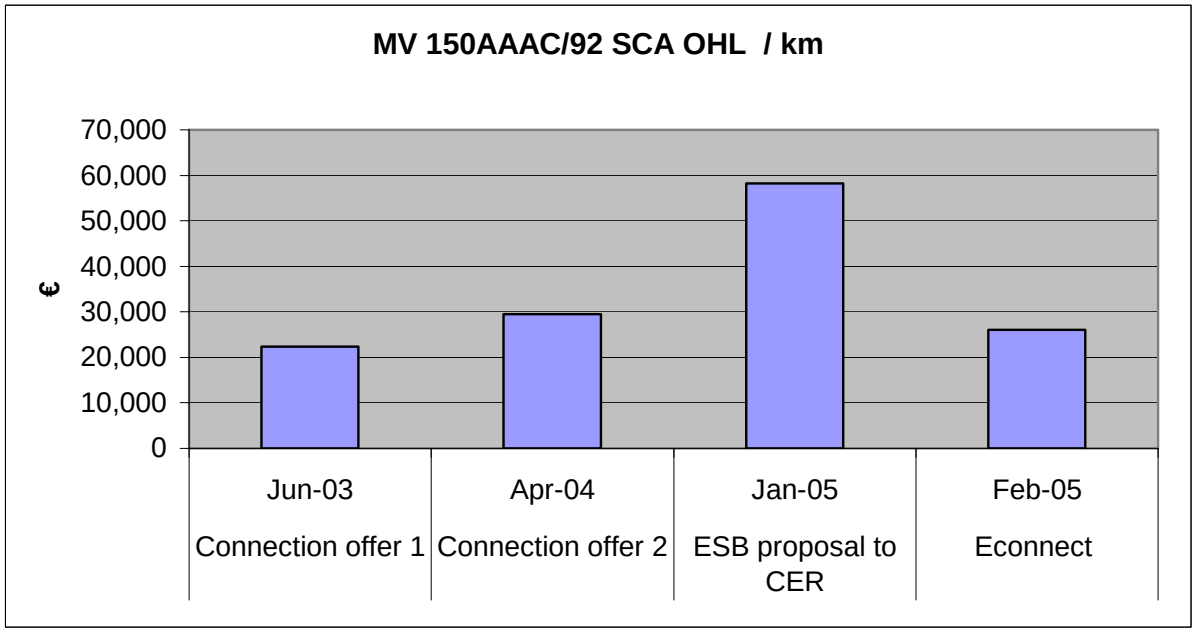

Fig.3 – various costs of MV OHL over the period 2003-2005.

Based on our estimates there is a clear indication of significant increase in price of MV OHL under the ESB Networks standard pricing approach for generators and it is therefore recommended to approach ESB Networks to discuss their proposed policy as applied to pricing methodologies.

[10] Electricity Association; Engineering Recommendation P27; Current Rating Guide for High Voltage Overhead Lines Operating in the UK Distribution System; 1986
[11] Updated specification ESB March 2005

6.2 Station Works

Station work costs provided by ESB are based on there being a spare bay available and are inclusive of installation costs. The line cubicle will require distance protection, but there will be no additional SCADA requirements.

ESB have made no attempt to provide any detailed costing methodology, nor specified the network component characteristics and properties. Therefore Econnect has made assumptions in order to arrive at generator connection costs.

Items have been evaluated in the following subsections based on the assumption of equipping existing outdoor bays that, at present, consist of high-level outdoor tubular busbar only.

6.2.1 Item 5 – 38kV Cubicle,

Econnect has assumed the 38kV cubicle refers to an outdoor line cubicle containing the following network equipment:

- 1 x disconnector
- 1 x Voltage Transformer
- 1 x Current Transformer
- 1 x 38kV circuit breaker
- Control and protection equipment including impedance and cable differential protection where appropriate.

The line cubicle will require distance protection, but there will be no additional SCADA requirements. Metering requirements are dealt with elsewhere.

Based on further specific information received from ESB in March 2005, they have split this item into two separate items.

One is a 38kV cubicle in a 38kV station, which they have priced at €150,850. This is approximately 19% higher than the €126,750 budget price indicated by our costing.

The other item is a 38kV cubicle in a 110kV station. ESB have proposed a cost of €308,010 for this item. This is approximately 143% greater to the €126,750 budget price indicated by our costing.

Our price was built up from previous projects and validated by receiving prices from major equipment manufacturers and installation contractors. Also previous Connection Agreements generated by ESB Networks last year, in 2004 have quoted costs for a new 38kV cubicle in a 110kV station at €124,746 and costs for a new 38kV cubicle in a 38kV station at approximately €132,027.

[12] Cost bases on spare 38kV bay available, Bay with distance protection, no extra SCADA

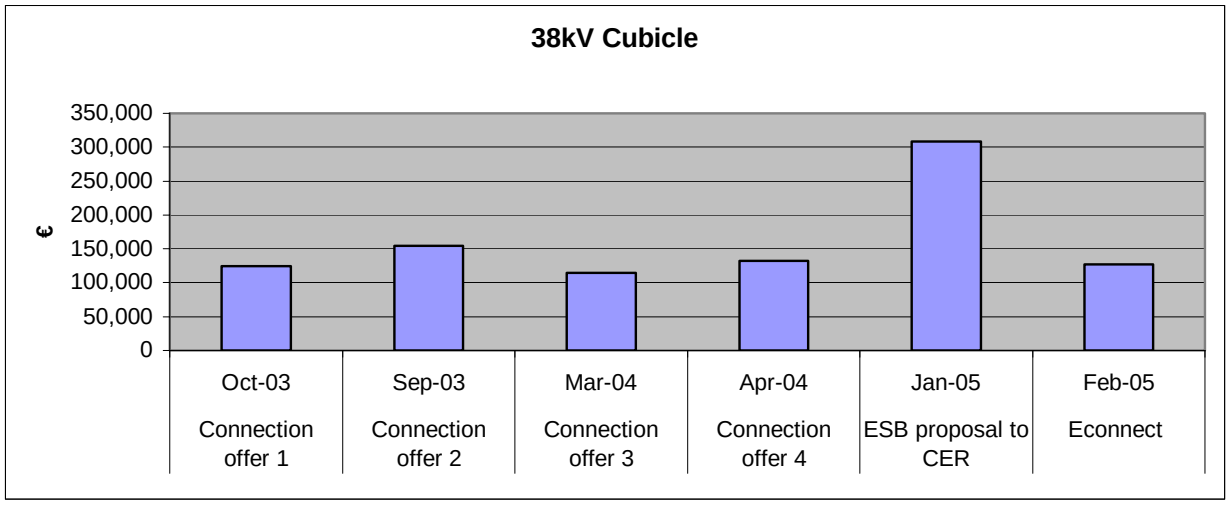

Fig.4 – various costs of 38kV cubicles in both 110kV and 38kV stations over the period 2003-2005.

Based on our budget costs from a number of reliable sources, there is a clear indication of significant increase in price of 38kV cubicles under the proposed ESB Networks standard pricing approach for generators. It is therefore recommended to approach ESB Networks to discuss their proposed policy as applied to pricing methodologies in respect of this item.

6.2.2 Item 6 - MV Cubicle (110kV/MV Station)

Econnect has assumed the MV cubicle refers to an outdoor line cubicle containing the following network equipment:

- 1 x disconnector
- 1 x VT
- 1 x CT
- 1 x MV (20kV or 10kV) circuit breaker
- Control, protection equipment, and SCADA
- Max design voltage 24kV, BIL 125kV
- Power Frequency Withstand 50kV
- Busbar rating 200A and 20kA for 1 second

The line cubicle will require over-current, earth-fault, and sensitive earth-fault protection. Metering requirements are dealt with elsewhere.

ESB have proposed a cost of €56,670. This is approximately 32% higher than the €42,900 budget price indicated by our costing. Our price was built up from previous projects and validated by receiving prices from major equipment manufacturers and installation contractors. Also previous indicative pricing", as provided under the ESB Networks "Charges for connection to the Distribution System" - May 2004 would indicate a price region of less than €50,000.

In view of this, it is therefore recommended to approach ESB Networks to discuss their proposed policy applied to pricing methodologies today.

[14] Typically industry figures are based on 20-30%

6.2.3 MV Cubicle with Interface transformer

Based on experience, Econnect has assumed that the interface transformer proposed is made up of the following network components to be installed within an existing MV cubicle with transformer interface:

- 1 x MV disconnector
- 1 x Current Transformer
- 1 x MV (20kV/10kV) circuit breaker
- Control and protection equipment
- SCADA
- 10/20kV - 5MVA interface transformer

ESB have proposed a cost of €255,170. This is approximately 57% higher than the €162,500 budget price indicated by our costing. Our price was built up from previous projects and validated by receiving prices from major equipment manufacturers and installation contractors. Also previous Connection Agreements generated by ESB Networks last year charged this item at approximately €175,000.

Based on these figures, there is a clear indication of significant increase in price of MV cubicles with interface transformers under the proposed ESB Networks standard pricing approach for generators.

In view of this, it is therefore recommended to approach ESB Networks to discuss their proposed policy applied to pricing methodologies.

6.2.4 Item 8 - 38kV Metering and Power Quality

- Metering current transformers and voltage transformers.
- Ancillary wiring and metering enclosure
- Power quality monitor

ESB Networks at present are offering this package at €50,020. Based on our findings, a power quality monitor at €8,000-€10,000 and a metering kiosk at approximately €34,000-€37,000.

Previous records and quotations acquired from ESB Connection Agreements, manufacturers, suppliers and Econnect's equipment costing database provides reliable source of comparisons of EBS Networks standard pricing proposed. At present there is no cause for concern for the pricing methodology implemented for metering equipment and power quality monitors.

6.2.5 Item 9 - MV Metering and Power Quality

- Metering current transformers and voltage transformers.
- Ancillary wiring and metering enclosure
- Power quality monitor

Prices proposed at present by ESB Networks for this package is €25,220. Based on our findings, a power quality monitor and metering is approximately €8,000-€10,000 and €12,000-€15,000 respectively.

Again the costing proposed by ESB Networks has been reviewed and costing figures quoted by manufacturers, supplier, previous ESB Network Connection Agreements and our cost database are not dissimilar to those provided by ESB and therefore see no cause for concern at this time.

6.3 Station Upratings

This has been broken down to into new 110kV Stations, and upgrades of 110/38kV stations from one transformer to two transformers, or alternatively from two smaller transformers to two large transformers. The same approach is taken for the upgrade of the 38kV / MV (20kV or 10kV) substations.

6.3.1 Item 10 - New 110kV / MV Station

Based on experience, on the specifications provided by ESB Econnect has assumed the following network components comprise a new 110kV / MV station. This is based on a tail fed version of the 110kV station proposed for the grid upgrade program. This does not include remote end works or transmission line works that are priced elsewhere. Our budget price consists of two 20MVA 110/20kV transformers similar to that proposed for Corderry substation.

- Max design voltage 123kV.
- BIL 550kV
- Power Frequency Withstand – 250kV
- 1 x 110kV line bay – comprising disconnect, circuit breaker, C.T.s, V.T.s and protection
- 2 x 110kV transformer bays -
- 2 x 110/20kV 20MVA transformers
- 2 x 20kV transformer bays
- 2 x 20kV sectionalising bays
- 1 x 20kV earthing bay

All 20kV line and feeder cubicles are excluded from this section as they are priced elsewhere as are the metering requirements.

ESB have proposed a cost of €4,011,820. This is approximately 31% higher than the €3,073,200 budget price indicated by our costing. Our price was built up from previous projects and validated by receiving prices from major equipment manufacturers and installation contractors.

No previous documentation providing costs have been submitted to Econnect for 110kV/MV Stations by ESB Networks. However, a number of single transformer 110kV stations have been built privately in the last number of years to accommodate wind farm connections. While these would have different circuit arrangements they have been constructed at a significantly lower cost with these stations costing between €1,500,000 and €3,000,000. Our budget price is based on manufacturers, suppliers and Econnect's equipment cost database, and is inclusive of a 30% margin for ESB upfront engineering and system integration design[17].

Based on these figures, there is a clear indication of significant increase in price of 110/MV substations under the proposed ESB Networks standard pricing approach for generators.

In view of this, it is therefore recommended to approach ESB Networks to discuss their proposed policy applied to pricing methodologies.

[17] Typically industry figures are based on 20-30%

6.3.2 Item 11 - 1 x 31.5MVA upgraded to 2 x 31.5MVA

Based on experience, Econnect has assumed the following network components make up an upgrade from a one 31.5MVA transformer substation to a two 31.5MVA transformer substation. This will involve the installation of a new 110kV busbar, 3 new 110kV bays and the construction and installation of a new 38kV line/feeder bay. The cost of the site purchase is not included.

- 110kV busbar 800A – 25kA for 1 second
- Max design voltage 123kV.
- BIL 550kV
- Power Frequency Withstand – 250kV
- 1 x 110kV line bay – comprising disconnect, circuit breaker, C.T.s, V.T.s and protection
- 2 x 110kV transformer bays -
- 1 x 110/38kV 31.5MVA transformers
- 1 x 20kV transformer bay
- 1 x 20kV line / feeder bay
- Control and protection equipment
- SCADA

ESB have proposed a cost of €2,275,650. This is approximately 3% higher than the €2,213,250 budget price indicated by our costing. Our price was built up from previous projects and validated by receiving prices from major equipment manufacturers and installation contractors.

This price is based on the ESB specification however a query needs to be raised as to the requirement to replace all the 110kV bays as this is only an upgrade. Reduction in this number would significantly reduce overall cost.

Based on these figures, there is a clear indication of significant increase in price of 110kV substation upgrades under the proposed ESB Networks standard pricing approach for generators.

In view of this, it is therefore recommended to approach ESB Networks to discuss their proposed policy applied to pricing methodologies.

6.3.3 Item 12 - 2 x 31.5MVA upgraded to 2 x 63MVA

Based on experience, Econnect has assumed the following network components make up an upgrade from a two 31.5MVA transformer substation to a two 63MVA transformer substation. This will involve the installation of a new 110kV busbar, replacement of the existing transformers with two new 63MVA transformers and the upgrading of the 110/38kV transformer bays. The assumption has been made that all switchgear and control and protection equipment has to be upgraded. The cost of the site purchase is also included. No allowance has been made for the existing transformers being reused.

[18] Cost based on new 110kV busbar to be constructed, two trafo bays, one line bay, C/P needed
[19] Cost based on new Civil Works to be installed, uprating of 110kV busbar necessary

- 110kV busbar 800A – 25kA for 1 second
- Max design voltage 123kV.
- BIL 550kV
- Power Frequency Withstand – 250kV
- 2 x 110kV transformer bays
- 2 x 110/38kV 63MVA transformers
- 2 x 20kV transformer bays
- Control and protection equipment
- SCADA

ESB have proposed a cost of €2,756,720. This is approximately 14% higher than the €2,421,380 budget price indicated by our costing. Our price was built up from previous projects and validated by receiving prices from major equipment manufacturers and installation contractors.

Based on these figures, there is a clear indication of significant increase in price of 110kV substation upgrades under the proposed ESB Networks standard pricing approach for generators.

In view of this, it is therefore recommended to approach ESB Networks to discuss their proposed policy applied to pricing methodologies.

6.3.4 Item 13 - New 2 x 5MVA

Initially Econnect had assumed that this item was made up an upgrade from a one 5MVA transformer substation to a two 5MVA transformer substation. However upon receipt of a more detailed specification from ESB it was decided that this referred to a new two by 5MVA transformer 38/20kV substation.

This will involve the installation of a new 38kV busbar and the construction and installation of a new 38/MV transformer bay one 38kV line bay and an MV line/feeder bay. The cost of the site purchase is not included.

- 38kV busbar 1250A - 25kA for 1 second
- Max design voltage 52kV.
- BIL 250kV
- Power Frequency Withstand – 250kV
- 1 x 38kV transformer bay
- 1 x 38kV/20kV 5MVA transformers
- 1 x 20kV transformer bay
- 1 x 20kV line / feeder bay
- Control and protection equipment
- SCADA

ESB have proposed a cost of €1,923,780. This is approximately 54% higher than the €1,250,600 budget price indicated by our costing. Our price was built up from previous projects and validated by receiving prices from major equipment manufacturers and installation contractors.

It would be very difficult to see where a 2 x 5 MVA substation would be used to connect renewable generation.

Based on these figures, there is a clear indication of significant increase in price of 110kV substation upgrades under the proposed ESB Networks standard pricing approach for generators.

In view of this, it is therefore recommended to approach ESB Networks to discuss their proposed policy applied to pricing methodologies.

6.3.5 Item 14 - 2 x 5MVA upgraded to 2 x 10MVA

Based on experience, Econnect has assumed the following network components make up an upgrade from a two 5MVA transformer substation to a two 10MVA transformer substation. This will involve the installation of a new 38kV busbar, replacement of the existing transformers with two new 10MVA transformers and the upgrading of the 38kV/MV transformer bays. The assumption has been made that all switchgear and control and protection equipment has to be upgraded. The cost of the site purchase is also included. No allowance has been made for the existing transformers being reused.

- 38kV busbar 1250A - 25kA for 1 second
- Max design voltage 52kV.
- BIL 250kV
- Power Frequency Withstand – 250kV
- 20kV busbar – 20kA 1 sec
- 2 x 38kV transformer bays
- 2 x 38/20kV 10MVA transformers
- 2 x 20kV transformer bays
- Control and protection equipment
- SCADA

ESB have proposed a cost of €2,130,500. This is approximately 59% higher than the €1,337,960 budget price indicated by our costing. Our price was built up from previous projects and validated by receiving prices from major equipment manufacturers and installation contractors.

Based on these figures, there is a clear indication of significant increase in price of 38kV substation upgrades under the proposed ESB Networks standard pricing approach for generators.

In view of this, it is therefore recommended to approach ESB Networks to discuss their proposed policy applied to pricing methodologies.

6.4 Cable Costs (Excludes all civil works and ducting)

6.4.1 Item 15 - 110kV cable (400mm² Cu)

Cable costs provided by ESB are inclusive of installation costs. All civil works and ducting are excluded. However ESB have made no attempt to provide any detailed costing methodology. Therefore Econnect has made assumptions based on the specifications provided by ESB in order to arrive at generator connection costs:

- Single core, rating 130MVA (685A)
- Max design voltage – 123kV
- BIL - 550kV
- Fault current rating – 26kA for 1 sec
- Power Frequency withstand 230kV
- Cable installed in a duct.
- Joint pits at regular intervals

ESB Networks has proposed generator connection costs for 110kV cable (400 Cu) in the order of €321,470 per km,. This is approximately 112% higher than the €234,889 budget price indicated by our costing. No previous documentation providing costs have been submitted to Econnect for 110kV OHL by ESB Networks. However, we have based this price on manufacturers, suppliers and Econnect's equipment cost database. This price is inclusive of a 30% margin upfront for ESB engineering and system integration design. A 110kV cable installation which was carried out recently with a smaller sized Copper cable than specified here was installed for approximately €200,00/km. However this price included trenching and civil reinstatement work.

Based on our costs from a number of reliable sources, a clear indication of significant increase in costs on ESB Networks behalf. In view of this, it is therefore recommended to approach ESB Networks to discuss their proposed policy applied to pricing methodologies today.

6.4.2 Item 16 - 38kV cable (630mm² XLPE)

Cable costs provided by ESB are inclusive of installation costs. All civil works and ducting are excluded. However ESB have made no attempt to provide any detailed costing methodology. Therefore Econnect has made assumptions based on the specifications provided by ESB in order to arrive at generator connection costs. The following assumption has been made:

- Single core, un-armoured copper screened wired, stranded copper conductor, rating 49MVA (750A)
- Max design voltage – 52kV
- BIL - 250kV
- Fault current rating – 20kA for 1 sec
- Power Frequency withstand 250kV
- Cable installed in a duct.
- Joint pits at regular intervals

[20] Typically industry figures are based on 20-30%

ESB Networks has proposed generator connection costs for 38kV cable (630 Cu) in the order of €113,760 per km. This is approximately 79% higher than the €63,515 budget price indicated by our costing. In the "Charges for connection to the Distribution System" document issued by ESB networks in May 2004 indicative prices for this item were €63,000 per km.

Based on our costings a clear indication of significant increase in costings on ESB Networks behalf. In view of this, it is therefore recommended to approach ESB Networks to discuss their proposed policy applied to pricing methodologies today.

6.4.3 Item 17 - MV cable (400mm² XLPE)

Cable costs provided by ESB are inclusive of installation costs. All civil works and ducting are excluded. However ESB have made no attempt to provide any detailed costing methodology, nor specified the circuit characteristics and properties. Therefore Econnect has made assumptions in order to arrive at generator connection costs. The following assumption has been made:

- Single core, un-armoured aluminium screened wired, stranded copper conductor, rating 22MVA @ 20kV (550A)
- Max design voltage – 22kV
- BIL - 125kV
- Fault current rating – 20kA for 1 sec
- Power Frequency withstand 50kV
- Cable installed in a duct.
- Joint pits at regular intervals

ESB Networks has proposed generator connection costings for MV cable (400 Cu) in the order of €51,450 per km. This is approximately 25% higher than the €41,184 budget price indicated by our costing. In the "Charges for connection to the Distribution System" document issued by ESB networks in May 2004 indicative prices for this item were €39,000 per km.

Based on our budget costs there is a clear indication of significant increase in charges on ESB Networks behalf. In view of this, it is therefore recommended to approach ESB Networks to discuss their proposed policy applied to pricing methodologies.

6.4.4 Item 18 - 38kV cable end mast

Cable end mast costs provided by ESB are inclusive of installation and civil costs. However ESB have made no attempt to provide any detailed costing methodology, nor specified the circuit characteristics and properties. Therefore Econnect has made component assumptions in order to arrive at generator connection costs.

- Steel tower of lattice construction
- Cable support brackets and insulators.
- Civil works including foundations

ESB Networks has proposed generator connection costs for 38kV masts in the order of €44,750 per mast. This is approximately 15% higher than the €39,000 budget price indicated by our estimates.

Based on our budget costs there is a clear indication of significant increase in charges on ESB Networks behalf. In view of this, it is therefore recommended to approach ESB Networks to discuss their proposed policy applied to pricing methodologies.

6.4.5 Item 19 - 110kV cable end mast

Cable end mast costs provided by ESB are inclusive of installation and civil costs. However ESB have made no attempt to provide any detailed costing methodology, nor specified the circuit characteristics and properties. Therefore Econnect has made component assumptions in order to arrive at generator connection costs.

- Steel tower of lattice construction
- Cable support brackets and insulators.
- Civil works including foundations

ESB Networks has proposed generator connection costs for 110kV masts in the order of €140,230 per mast. This is approximately the same as the €138,600 budget price indicated by our estimates.

Based on our budget costs there is a clear indication of significant increase in charges on ESB Networks behalf. In view of this, it is therefore recommended to approach ESB Networks to discuss their proposed policy applied to pricing methodologies.

7 Conclusions and Recommendations

The document lists proposed generator connection costs, however makes no attempt to describe the equipment involved in these costs or the methodology used to arrive at these costs. The document is vague and does not include sufficient information to set generator connection costs at these levels going forward without providing a more detailed breakdown of what the priced items are made up of and by what method these prices were arrived at. As mentioned a number of times during the report it is recommended to approach ESB Networks to discuss their proposed policy applied to pricing methodologies and to provide more detailed information regarding the breakdown of the listed items.

In May of 2004 the Commercial and Customer Asset Management and Regulation department of ESB Networks issued a document titled, “Charges for connection to the Distribution System”. Included in this document is a table of indicative generator connection charges. The typical costs are 25 – 90% lower for the common items that are listed in this document as against those proposed under the new group connection charging schedule. While these prices are indicative only, some method of determining these prices was utilized within ESB networks and a different method, or perhaps even the same method yielded vastly different prices for the same items just seven months later. While there are some legitimate cost increases in terms of steel, copper and aluminum, and even labour, they do not add up to the types of increases to be found here.

The document states, “the implementation of this Standard Pricing approach for DSO is critical to the successful implementation of Gate 1”. We would contest this and say that if this standard pricing, at the levels suggested by ESB, is implemented then this poses a large threat to the financial viability of projects within gate 1.

The document states, “the continued application of the current design mechanism would result in a further delay in the provision of DSO connection offers”. The existing connection process for generators involves a number of site visits. The new DSO Connection Offer pricing is based upon a desktop study plus a site visit to estimate the volume and type of material required. By how much will the new method reduce the time required to produce connection offers? The detailed design will still have to be carried out which may result in a revised connection offer having to be issued.

The main affect of this standard pricing is to take away the generators right to contest the price offered by ESB to connect to the distribution network. This will result in additional costs for generators, which will be higher in many cases than technically required. This method will also not follow the premise of Least Cost Technical Solution. One solution would be to open the lower voltage levels at MV and 38kV, which are currently non-contestable, to contestability. This would reduce the workload of ESB personnel and speed up the provision of DSO connection offers. Another possible solution would be to operate an “open book” format for the connection. This occurs in industry where pricing of a particular aspect of a project is at issue but in order to progress the project it is agreed to carry on with the contractor making available to the client all the costs involved in that aspect of the project. This would ensure transparency of costs and also protect the user from paying for the costs.

Our findings to date indicate a significant increase in proposed connection costs over current ESB indicative prices and actual connection costs. The average cost increase on the 20 listed items in schedule 1 is 37%. This applies to completed, and on-going generation projects. A point, which needs to be taken into account, is that the Econnect prices are budget prices and it is expected that better prices could be secured from manufacturers and contractors at project build stage.

We also feel that for an important document such as this, with the potential effects it could have on project viability, considerably more information should have been provided. As well

as the lack of definition, there is no attempt made to explain the methodology used to arrive at these prices. A reference is made to the fact that “The charges set out in Schedule 1 are average charges devised on the basis of DSO’s experience of generator connections in recent years” however we have analysed the connection agreements available to us, both through our work in the sector and also those provided to us by IWEA Ltd members and have found that the they do not support this statement and in fact for most of the items quoted in schedule 1 are considerably higher.

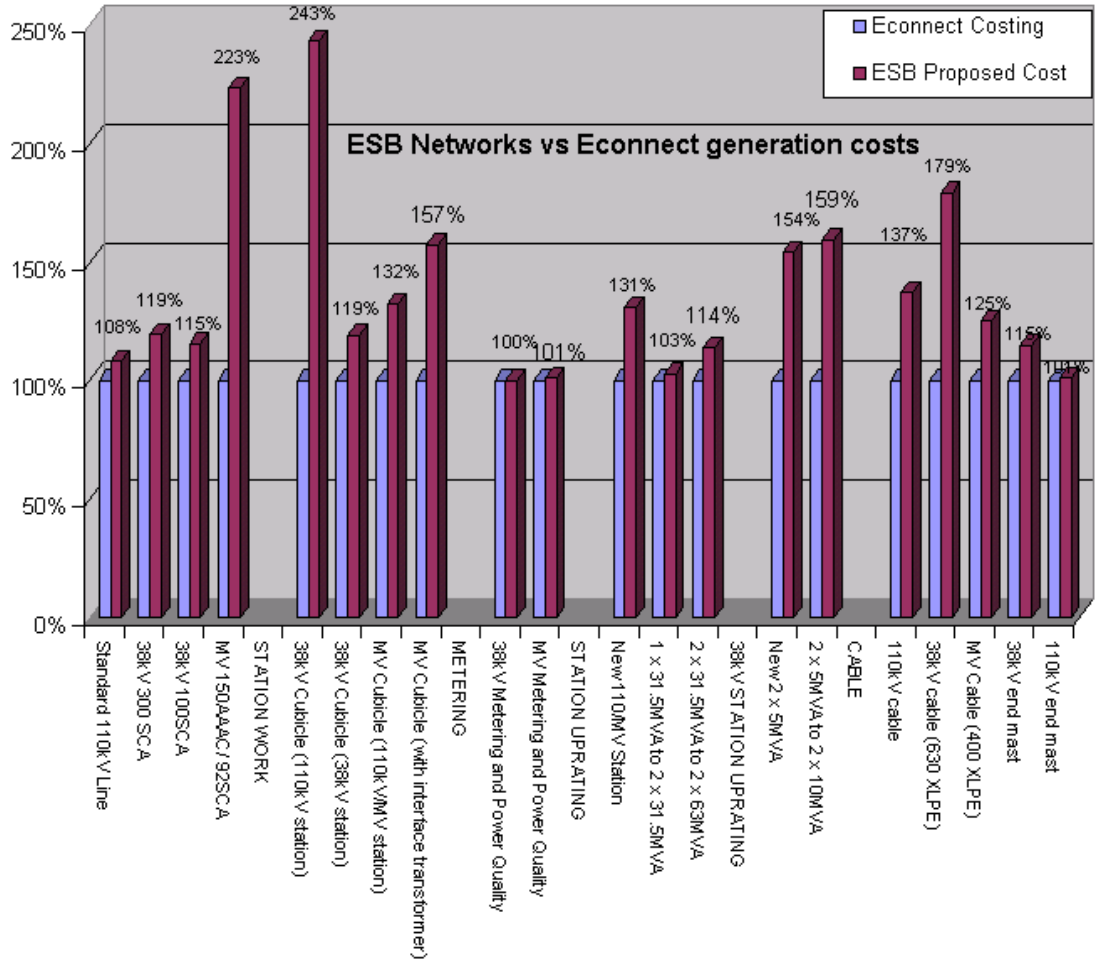

Fig.4 – ESB Networks Standard Pricing Arrangement proposed costs versus Econnect estimates.

Appendix 1 - ESB Networks “Charges for connection to the Distribution System” - May 04 - Table A12

Table A12: Indicative Generator Connection Charges

NB: Excluding Reinforcement costs[1]

Connection Voltage and Method Options for MEC Capacity Ranges (Indicative only)

CONNECTION MEC RANGE (kVA)	CONNECTION VOLTAGE OPTIONS[2]	CONNECTION METHOD OPTIONS[2]
> 30,000	110kV	Customer advised to refer to National Grid
12,000 - 30,000	110kV	Customer advised to refer to National Grid
	38kV	38kV Dedicated feed from 110kV/38kV substation[3]
6,000 - 12,000	38kV	38kV Dedicated feed from 110kV/38kV or 38kV/MV substation[3]
	38kV	38kV Tee (tees are not permitted in every situation)[3]
700 - 6,000	38kV	38kV Dedicated feed from 110kV/38kV or 38/MV substation[3]
	38kV	38kV Tee (tees are not permitted in every situation)[3]
	MV	MV Dedicated feed from 38/MV substation[4]
<700	MV	MV Dedicated feed from 38/MV substation[4]
	MV	MV Tee[4,5]

Typical Costs of Connection Methods (Indicative only)

CONNECTION METHOD	ON-SITE TERMINAL SUBSTATION (€ '000)	UG CABLE (€ '000 per km)[6]	O/H LINE (€ '000 per km)[7]	ESB SUBSTATION (€ '000)[8]
38kV Dedicated	54 -57	63	34 - 82	68 - 162
38kV Tee	54 -57	63	34 - 82	N/A
MV Dedicated	14	39	12 – 28	40 - 54
MV Tee	14	39	12 – 28	N/A

Notes

1	Reinforcement Costs are dependent on local network configuration and are identified at Planning Study stage.
2	ESB to determine the connection voltage and the connection method option based on available capacity in the local network.
3	The availability of capacity in a 38kV network is based on the total capacity of the network between its points of contact with the 110kV system.
4	Based on the assumption that there is capacity available in the 38kV network feeding the substation.
5	The availability of capacity in a MV network is based on the total capacity of the network between its points of contact with the 38kV system.
6	Costs are based on cable cost only and do not include trenching, ducting, reinstatement, forestry / landowner compensation etc.
7	Costs are based on standard overhead line construction and do not include forestry / Eircom / landowner compensation costs etc.
8	Costs assume that there is space in the relevant ESB substation compound for the new feeder cubicle.

Schedule 1: Schedule of Charges

Table 1. Schedule of Charges for Generators[12] Excluding VAT

No.	Description	Unit	Total €
	LINE WORK		
1.	Standard 110kV line	Per km	189,860
2.	38kV 300SCA		102,730
3.	38kV 100SCA		67,850
4.	MV 150AAAC / 92 SCA		58,250
	STATION WORK		
5.	38kV Cubicle[13]	Per cubicle	308,010
6.	MV Cubicle (110KV/MV Station)[14]		58,670
7.	MV Cubicle with Interface transformer[15]		255,170
	METERING		
8.	38kV Metering and Power Quality		50,020
9.	MV Metering and Power Quality		25,220
	STATION UPRATINGS		
	110kV Stations		
10.	New 110kV / MV Station[16]	Station	4,011,820
11.	1 x 31.5 MVA to 2 x 31.5 MVA[17]		2,275,660
12.	2 x 31.5 MVA to 2 x 60MVA[18]		2,756,720
	38kV Stations		
13.	2 x 5 MVA	Station	1,923,780
14.	2 x 5 MVA to 2 x 10MVA		2,130,500

[12] In accordance with the practice in relation to other charges, these will need to be reviewed and updated on an annual basis.

[13] Cost based on spare 38kV bay available, Bay with distance protection, no extra SCADA
[14] Cost based on MV bar available, Bay with overcurrent protection
[15] Cost based on MV spare bay available, Bay with overcurrent protection
[16] Cost based on tailed 110kV station, standard connections, remote end works not included
[17] Cost based on new 110kV busbar to be constructed, two trafo bays, one line bay, CIP needed
[18] Cost based on new Civil Works to be installed, uprating of 110kV busbar necessary

CABLE COSTS (Excludes all civil works and ducting) [18]			
15.	110kV cable (400Cu)	Per km	321,470
16.	38kV cable (630XLPE)		113,760
17.	MV cable (400 XLPE)		51,460
18.	38kV cable end mast	Per Mast	44,750
19.	110kV cable end mast		140,230

Notes:

1. All costs exclude site acquisition costs
2. Up to two cable end masts may be required per cable circuit.