



Non-Technical Summary

February 2009

CAVAN-TYRONE AND MEATH-CAVAN 400kV POWER LINES

Comparison of High Voltage Transmission Options
Non-Technical Summary



Project co-financed by the European Union
from the trans-European transport budget

Introduction

This is a non-technical summary of the Parsons Brinckerhoff (PB Power) Comparison of High Voltage Transmission Options Report (the Report). The full Report can be found at www.eirgrid.com or at www.nie.co.uk. As indicated in Parsons Brinckerhoff's (PB Power) preliminary briefing note issued by EirGrid and Northern Ireland Electricity (NIE) in February 2008, the Report looks at the main alternatives to an overhead connection and examines the practicalities of placing the proposed 400kV power lines underground, from a project specific perspective. It also explores many of the technical issues, discusses environmental issues and identifies additional costs associated with undergrounding.

In addition to the Parsons Brinckerhoff (PB Power) Report, EirGrid and NIE have commissioned Tokyo Electric Power Company to carry out an extensive system wide study dealing with the issues associated with the installation of long lengths of underground cable in the electricity transmission system on the island of Ireland.

What's Happening?

Northern Ireland Electricity (NIE) and EirGrid propose building a 400kV power line between their two electricity grids that would run from a new electricity substation at Turleenan in Co. Tyrone to a new electricity substation near Kingscourt in Co. Cavan. EirGrid is also proposing to reinforce the grid in the Republic of Ireland with a new 400kV power line from the proposed substation near Kingscourt to the existing substation at Woodland in Co. Meath.

The new developments will:

- Help secure the supply of electricity across the island of Ireland.
- Help meet the growing demand for electricity in the North East of the Republic of Ireland, for homes, businesses and industry.
- Improve the capacity for all-island energy trading, thereby reducing energy costs for consumers.
- Facilitate the use of renewable energy, particularly wind power, across the island of Ireland.

The Report forms part of the Environmental Impact Assessments (EIA) associated with both of these projects.

What did the Report find?

Global Standards

The transmission of electrical energy worldwide is primarily based on High Voltage Alternating Current (HVAC), overhead line technology.

Over 98 per cent of the onshore electricity network in Europe is HVAC overhead line, with the remaining being underground cable. Underground cables are mainly used over short distances, in areas where overhead lines are inappropriate or impossible to use. The Report indicates that the strong trend in the past has been to use overhead lines for high voltage electricity transmission. This trend is not expected to change in the foreseeable future.

Reliability

From the Report it can be seen that an underground cable, over its lifetime, can be expected to be out of service due to unplanned events, for approximately 50 times longer than the equivalent overhead line.

High voltage overhead lines can experience both temporary and persistent faults. Temporary faults occur almost exclusively due to poor weather conditions, principally lightning strikes. These types of faults cause very short interruptions which typically last less than a second. Persistent overhead line faults are rare and when they do occur, the line can usually be reinstated in a short period of time, usually a matter of hours. In either case the electricity consumer is not usually affected by these faults, as they experience no interruption to electricity supply.

If a fault were to occur on an underground cable, of the kind which would be needed for this project, the fault would almost invariably be persistent. As a result, all underground cable faults must be investigated and repaired before the underground cable can be returned to service. The Report found that average repair times for underground cables are much longer than those for overhead lines, requiring weeks rather than hours to repair.

As the Report states, system security all over Europe relies upon the relatively high availabilities provided by overhead line networks. Underground cables suffer less faults than overhead lines, however due to the extended time required to repair a cable fault, an underground cable will usually have a poorer availability than an overhead line. Even the performance of a double circuit underground cable will not match that of a single circuit overhead line. The introduction of significant quantities of underground cable, in strategically important circuits, may therefore compromise system security.

Cost

For these projects, high voltage overhead lines have better availability, are more efficient, more flexible and easier, cheaper, and quicker to install and repair. As a result they would provide the best value for money for electricity customers.

The underground cable option for these 400kV projects is significantly more expensive than the proposed overhead lines.

As can be seen in the table below, the Report states that the initial costs of putting the cables underground would be €588 million, over seven times more than putting the lines overhead, which would cost around €81 million. Furthermore, the running cost of underground cables is nearly €30 million more over the course of their lifetime.

| Costs | Overhead | Underground |
|---|-------------|--------------|
| Meath-Cavan and Cavan-Tyrone construction costs | €81 million | €588 million |
| Operating costs | €44 million | €73 million |

Due to the fact that underground cables are more expensive to install, they are generally used where overhead lines are inappropriate or impossible to install.

Electromagnetic Fields (EMFs)

Electric fields from the proposed overhead line, and magnetic fields from both the proposed overhead line and the underground cable alternatives, would all be lower than European and Irish adopted ICNIRP* Basic Restriction guideline limits.

*The International Commission on Non-Ionising Radiation Protection (ICNIRP) is an independent scientific body comprising the essential scientific disciplines necessary to assess, together with World Health Organisation, possible adverse health effects from EMFs. ICNIRP is the formally recognised non-governmental organisation in non-ionising radiation protection for the World Health Organisation and the European Union (EU).

Route Specifics

Potential route corridors for an overhead line have been identified by EirGrid and NIE for the projects. For the purpose of this study Parsons Brinckerhoff (PB Power) identified an underground cable route corridor. It should be noted that it is almost always possible to identify feasible routes for underground cables. Finding a feasible route corridor however, does not in any way imply that an underground solution is feasible or appropriate.

If undergrounded, this project would require approximately 815km of cable (six cables would be needed, and the length of the route would be in the region of 135km). According to the Report, it could typically take a single factory nearly seven years just to supply the high voltage cables. The materials required for an overhead line could be obtained in a much shorter time frame.

Environmental Impacts

The Report also seeks to give balance to the discussion on the impact that underground cables and overhead lines have on the environment. It seeks to provide an informed view of the impacts caused by both technologies.

Who is Parsons Brinckerhoff (PB Power) and why was the Report produced?

Parsons Brinckerhoff (PB Power) is a leader in the development and operation of infrastructure to meet the needs of communities around the world. It was founded in 1885. It has over 150 offices in 25 countries, with its headquarters in New York City. It employs over 12,000 people around the world.

The firm provides strategic consulting, planning, engineering, programme and construction management services.

The work associated with this Report was led by a high voltage transmission specialist from Parsons Brinckerhoff (PB Power). Additional leading experts were retained by Parsons Brinckerhoff (PB Power) to provide advice in their respective areas of proficiency. These were:

- Cable Consulting International Ltd is a specialist underground cable consultancy that provides practical advice on the manufacture, installation, jointing, termination, maintenance and repair of high voltage AC and DC underground power cables.
- Mark Turnbull Landscape Architect is a landscape architecture practice that provides consultancy services in landscape planning, design implementation and management, planning, landscape, visual and environmental assessment.
- RPS is an international multi-disciplinary consulting company that has worked on some of the largest civil engineering projects carried out in the island of Ireland in recent times, including the South-North gas pipeline for Bord Gais Eireann (Northern Ireland).

Environmental Impacts - Overhead Line

The Report states that overhead line installations have the potential to impact on visual amenity in certain environments, though this may be somewhat mitigated by careful routing. Their effects on other aspects of the environment are more limited since, apart from the sites of tower foundations, they pass over most natural heritage (flora and fauna) and cultural heritage (including archaeological) features.

Environmental Impacts - Underground Cable

Underground cable installations have the potential to impact on natural heritage and cultural heritage, in particular archaeological features. This impact could be best mitigated through a combination of careful route selection and a comprehensive programme of land and facility reinstatement following the construction works, avoiding designated areas altogether if possible.

The Report

The Report was produced as part of a requirement to examine possible alternatives to the proposed new High Voltage Alternating Current overhead transmission lines. In producing the Report the authors:

- Consulted with members of the Meath-Cavan and Cavan-Tyrone 400kV Project Team and reviewed inputs received as part of the wider consultation process.
- Examined available relevant data relating to the projects study areas.
- Surveyed and mapped proposed route corridors in respect of their own expertise, normally working in small groups to facilitate understanding of the interactions in these complex projects.
- Obtained unit costings; requested from several sources including cable and equipment suppliers.
- Derived estimates from Parsons Brinckerhoff's (PB Power) own costing data, where appropriate.
- Established the feasibility of the alternative underground technologies and made technical, environmental and cost comparisons between them and the proposed overhead line projects.

Key Conclusions

- The Report has found there is no underground cable circuit, of the kind and length required for these projects, anywhere in the world.
- Most faults on an overhead line are caused by the weather. Any damage can be repaired quickly, typically in a matter of hours.
- In comparison, underground cables can be expected to be out of service due to faults, for much longer periods than overhead lines.
- For these projects, it would cost electricity customers over seven times as much for underground cables, as compared to overhead lines.
- For these projects, overhead lines are more efficient over the short and long term. It would be more expensive to operate and maintain an underground cable than an equivalent overhead line. This would, again, add to customers' costs.
- Both the overhead line proposal and any proposed underground alternative would comply with all national and EU guidelines on the exposure of the general public to electrical and magnetic fields (EMFs).
- The Report facilitates a comparison between the environmental issues that may arise in the implementation of an overhead or underground cable solution. The Report confirms that there are environmental impacts associated with both solutions and that these can be mitigated.
- **From the Report's findings, taking into account a balance of the security, reliability, cost and environmental considerations, the overhead line solution has emerged as EirGrid's and NIE's preferred option for the Meath-Cavan and Cavan-Tyrone 400kV projects, as it secures the regional electricity needs and has significant advantages over an equivalent underground cable solution.**



For more information, you can:

- Download full report from www.EirGrid.com
- Visit the Information Centres:
 - Navan Information Centre, Number 1, Newbridge, Athlumney, Navan, Co. Meath.
Open Mondays and Tuesdays,
10:00 am to 5:00 pm or upon request.
Ring us at 046.902.7855 for more information.
 - Carrickmacross Information Centre, Carrickmacross Workhouse, Shercock Road, Carrickmacross, Co. Monaghan.
Open Wednesdays and Thursdays,
10:00 am to 5:00 pm or upon request.
Ring us at 042.969.0000 for more information.
- Ring us at lo-call 1890.25.26.90
- Email us at meathcavanpower@eirgrid.com or cavantyroneinterconnector@eirgrid.com



For more information, you can:

- Download full report from www.nie.co.uk
- Ring us at 08457 643643
- Email us at nsipro@nie.co.uk
- Write to us at:
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