



# **The Scope for Undergrounding Overhead Electricity Lines**

**A Summary Report by the UK Centre for  
Economic and Environmental Development**

**for  
Friends of the Lake District**

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## Executive Summary

### Aims of the Research

This study was commissioned to assess the scope for placing overhead electricity lines underground. The work was carried out by Richard Cowell of Cardiff University, working for the UK Centre for Economic and Environmental Development (UK CEED), an independent foundation that provides practicable sustainable development solutions for government, industry and non-governmental organisations.

The main aim of the research was to inform Friends of the Lake District (FLD) in their campaigning for more undergrounding in Cumbria and to assist them and other organisations in influencing key policy-makers in the public and private sectors. Its prime focus is the lower voltage lines operated by the electricity distribution companies. The research brief sought up-to-date information on the following:

- The *cost and technical implications* of undergrounding overhead electricity distribution lines
- The *planning, environmental and regulatory policy context* for undergrounding
- The availability of *third party contributions* to undergrounding projects, whether in terms of financial provision or works 'in kind'.

Using this information, the research sought to formulate effective strategies, which could be used to encourage greater levels of undergrounding within the electricity industry where appropriate and to identify examples of 'good practice'. Many of the recommendations could be pursued jointly by coalitions of governmental and non-governmental organisations concerned with landscape and amenity, working with the electricity industry.

### Methodology

The research combined a number of approaches:

- Analysis of key documents produced by the electricity distribution companies – annual reports, environmental and social reports, quality of supply reports, Schedule 9 statements – followed up by telephone and face-to-face interviews with a sample of companies
- Analysis of the planning policies for electricity lines adopted by all National Park Authorities (NPA's), all local authorities in Cumbria and a sample of other planning authorities with responsibilities Areas of Outstanding Natural Beauty, followed up with written and telephone inquiries
- Further telephone, e-mail and face-to-face communications with individuals from the Yorkshire Dales Millennium Trust, the Office of Gas and Electricity Markets, Forestry Commission, Lake District National Park Authority, DETR, DTI, Open Spaces Society, Cardiff University Department of Engineering, British Telecom, Countryside Agency, English Nature, and the Council for National Parks
- Review of relevant background literature.

In a number of places, the research has drawn upon and updated a much earlier report, *Undergrounding Overhead Electricity Lines*, produced by UK CEED in the early 1990s for the (then) Countryside Commission.

## Key Findings

### *Landscape Impacts of Overhead Lines*

- There is extensive case-specific evidence that members of the public find the landscape impacts of overhead lines unacceptable. Moreover, these concerns are widely acknowledged by the electricity industry. One can also find assertions that removing overhead lines from a given setting enhances the potential for tourism. What remains virtually absent is any assessment of the 'level' of visual disamenity; for example, by establishing the monetary value of this impact.
- One study conducted by Goultly in the 1970s found positive public support for undergrounding high voltage transmission lines, and some positive willingness to pay for the additional costs. In the mid-1990s, Willis and Garrod examined public willingness to pay for removing eyesores such as overhead lines from the vicinity of canal-side amenity sites. They also found a positive willingness to pay, but not at a level sufficient to cover the costs of undergrounding all the overhead lines that people encountered.

### *System development*

- One of the most important opportunities for managing the impacts of electricity infrastructure on valued landscapes lies in influencing the way in which the distribution system develops. At present, most investment in electricity lines in designated areas takes the form of system refurbishment or replacement rather than new-build, but there are still pressures for new and reinforced lines to meet the growing and changing needs of rural areas.
- The pursuit of greater energy-efficiency might help to alleviate pressures for system reinforcement, and be especially valuable in rural areas experiencing demand growth. Small-scale examples of 'least cost planning' already exist.

### *Asset management*

- Many of the most important decisions affecting the development of electricity infrastructure are taken as part of the asset management processes of the electricity companies. The main factors driving investment in existing assets are performance-related - the need to maintain and improve the condition of the network and to meet quality of supply objectives. Environmental factors such as landscape only tend to enter the equation when circuit-specific solutions are being developed. Influencing the decisions made by the electricity companies are the activities of the regulator, OFGEM, and in particular its regulation of capital spending allowances.
- It is tempting to conclude that more money could be spent on undergrounding if OFGEM allowed electricity companies more capital spending. But OFGEM argues, rightly, that it cannot *make* environmental policy, and in agreeing to its spending reviews, electricity distribution companies are also agreeing that they can meet any environmental requirements. The research identified little evidence that pressures to underground a higher proportion of the network to meet environmental policy objectives have been the subject of much dispute between OFGEM and the electricity companies. Moreover, little has happened recently in the planning policy context for overhead lines to convince OFGEM that there is a firm, non-negotiable reason for companies to spend more resources on undergrounding.
- Interviews with officers from electricity companies and National Park Authorities revealed varying degrees of dialogue around strategic, asset-management issues.

The Yorkshire Dales Millennium Trust achieved some influence over the asset management priorities of Norweb Distribution and Yorkshire Electricity, encouraging them to bring forward village-based schemes for undergrounding. The best example of a company allowing third parties to instigate undergrounding schemes, outside its own asset management programme comes from EPNe in East Anglia. (See 'Undergrounding in Practice' Appendix, below). The availability of funding is a vital factor in lubricating (or frustrating) these strategic discussions.

### *Relative Costs*

- It remains difficult to obtain detailed data information on the real costs of overhead and underground circuits. The cost data that has been obtained (see Table 1, below) shows significant variations between sources with the familiar difficulty of trying to account for these differences. With these caveats in mind, the main features of the costs of undergrounding are as follows:
  - The direct costs of underground supplies of electricity are generally greater than those of overhead supply, rising to extreme factors with the highest voltages.
  - However, the ratios are much more propitious than identified hitherto for the very lowest voltage lines in the most ideal circumstances (usually soft roadside verges, unimpeded by other services), and may approach parity.
  - There is every reason for conservation interests to look beyond the average cost ratios to the scheme-specific costs of undergrounding, since they can be much lower than the 'averages' presented in Table 1 overleaf.
- Electricity companies argue that there are reliability issues involved in using underground cables: failures tend to be fewer in number but take longer to locate and repair than faults on the overhead system. However, this trade-off is complex, and has different implications in urban and rural areas. Current regulatory and consumer pressures to address the problems faced by 'worst-served customers' might militate against rural undergrounding but has sometimes favoured it, especially where interruptions have been caused by severe weather.

**Table 1 Cost comparisons, distribution networks, 1999-2001**

Cost per kilometre (£000s)				
<b>Voltage (kV)</b>	<b>PB Power 2000</b>	<b>Regional Electricity Company 3 - (REC3)</b>	<b>Others</b>	<b>Ratio - o/h: u/g</b>
<b>132</b> single overhead (o/h) double o/h single underground(u/g) double u/g	70.2 146.3 769.5	300-400  1,500	(Trentham)  	PBP 1: 11 (single)  REC3 1: 4-5 (double)
<b>66</b> single o/h single o/h (wood pole) double o/h single u/g	56.2 39.7 117.3 769.5			PBP 1: 14-19
<b>33</b> single o/h double o/h single u/g double u/g	17.0 34.0 180.0	50.0  300-350.0	(Claughton) 32.0  83.0	PBP 1: 11 REC3 1: 6-7 CI 1: 2.6
<b>6.6 and 11</b> o/h (bare conductor) o/h (covered) u/g	16.4 23.0 78.8	16.0 35.0-80.0	40 (REC4) 100-120 (REC4)	PBP 1: 3.4-4.8 REC3 1: 2.2-5 REC4 1:2.5-3.
<b>LV mains</b> o/h (bare conductor) o/h (covered) u/g	11.4 12.9 73.1	15.0 (ABC) 30.0-80.0	 33-40 (REC4)	PBP 1: 5.7-6.4 REC3 1: 2-5.3

One should take care to note that:

- When companies are planning to refurbish an existing overhead line rather than build a new one, the lower costs involved will militate more severely against undergrounding.
- The unit (per metre) costs of village undergrounding schemes are often much greater than undergrounding an equivalent length of line in more open countryside.
- Finding means of reducing the costs of trenching and reinstatement can be an effective means of reducing the additional costs of undergrounding.

#### *The Consents Process for Electricity Lines*

- The consents process for new overhead electricity lines falls under Section 37 of the Electricity Act 1989 and is administered by the Department of Trade and Industry. Consent is granted by the Secretary of State; local planning authorities are important consultees to this process but do not make the decision. Most small changes to electricity distribution systems – such as replacement lines and minor service lines to

individual properties – are permitted development. In these cases, planning authorities and other organisations are dependent on being notified by the electricity companies for a chance to comment.

- The revised regulations for environmental impact assessment (EIA) allow more scope for planning authorities and interest groups to probe developers on the need for high voltage overhead power lines. The accompanying guidance suggests that developers will be required to demonstrate some consideration of ‘alternatives’, and this will generally include undergrounding as well as alternative routes. The new regulations also seek to coordinate the environmental assessment of new electricity generation stations with the associated infrastructure, such as grid lines, that they might require. Most low voltage electricity line developments are unlikely to require EIA.

#### *Planning and Environmental Policy*

- Very few national planning and environmental policies apply specifically to the development of electricity distribution and transmission systems, but the few that exist have sought to secure system development needs while minimising environmental costs. Nevertheless, the development of electricity networks must consider the dense network of policies – local, national and European - supporting the conservation of different categories of landscape and ecosystem. These policies might form the basis of a strong challenge to applications for significant new overhead lines. World Heritage Site status is one such consideration; so too is Section 62 of the Environment Act 1995 (for National Parks); and Section 85 of the Countryside and Rights of Way Act 2000 (for AONBs).
- Even though planning authorities are not the prime decision taker, the development planning process is an important opportunity for giving greater attention to the likely environmental impacts of overhead lines, and for encouraging alternative solutions. More might be achieved if all development plans contained the full range of relevant policies for overhead lines, as well as policies on rural diversification, renewable energy and energy conservation that may help to obviate the need for new overhead connections.
- Some planning authorities have developed robust policies for the treatment of new overhead electricity lines, and been able to defend them through public inquiry. There is evidence that some NPAs are using Section 62 of the Environment Act 1995 as a basis for planning policies that make rigorous environmental demands of statutory undertakers. What is unclear is how far subtle changes in the ‘strength’ of planning policies towards new overhead lines make a significant difference to the amount of undergrounding or re-routing actually achieved. For some, working in partnership and seizing opportunities as they arise is a better explanation of their successes than sticking too rigorously to planning and environmental policies. Evidence also suggests that the focus of collaborative relations between local authorities and the asset planning side of the electricity distribution companies has focused overwhelmingly on Conservation Areas and Conservation Area officers.

#### *Wayleaves and Land Ownership issues*

- The owner or occupier of land that is crossed, or is proposed to be crossed, by an electricity line can have significant influence on the line development process. This is because electricity companies need to obtain ‘wayleaves’ – a bundle of rights to construct, use, inspect and maintain their electricity infrastructure. Difficulties in obtaining wayleaves for new lines, or the threatened termination of wayleaves for existing lines, might cause an electricity company to consider moving the line or

occasionally even undergrounding it, rather than face the costs of a public inquiry. Where disputes are not resolved, it falls to the Secretary of State to determine whether to grant the 'necessary wayleave'. Much ultimately depends on the environmental, functional and economic merits of the line proposed, although wayleave negotiations may highlight additional issues such as health and safety.

- It is difficult to clarify the implications of the 'inalienability' status of land held by the National Trust for overhead lines. Electricity companies and the organisation itself are reluctant to see electricity infrastructure routed across Trust land but this stems more from its recognised conservation status than from its inalienability *per se*. Similarly, there is little evidence that the legal status of Common Land, in itself, materially affects the development of electricity infrastructure, although 'works' that would impede common rights need a special consent. Arguably the most interesting test of the implications of ownership rights is unfolding in the New Forest, where the Forestry Commission decided to request that any new or replacement lines be placed underground.

### *Third Party Funding for Undergrounding*

- In general, the research failed to identify significant new external funding sources for undergrounding. The resources of governmental and non-governmental organisations are likely to remain the major source of additional contributions towards undergrounding schemes.
- The scope for using European Objective 2 money for rural landscape enhancement work varies across the country, according to the priorities adopted in different regions. This research did not attempt a comprehensive review of European Programme support but it did conclude that the scope for using this source to finance rural undergrounding schemes in north-west England is limited. In almost all cases where economic development assistance is being sought, schemes should adopt a partnership structure and are more likely to achieve success if undergrounding is justified as bringing tangible economic benefits.
- Support from the Heritage Lottery Fund (HLF) has been used to co-fund undergrounding schemes but only in exceptional circumstances, notably where undergrounding also delivers ecological benefits such as reducing the risk of bird strikes in nature reserves. Although the Yorkshire Dales Millennium Trust was successful in securing Millennium Commission support for a programme of environmental works that included undergrounding, in its successful bid to the HLF for a new round of funding lottery support is not available to co-fund undergrounding schemes.

### *Utility Cooperation*

- The coordination of utility provision to major new development is generally well-established: indeed, it is a lucrative area of business for utility companies.
- The research identified instances where overhead electricity lines and telephone wires had been undergrounded simultaneously, and the residual impacts on street lighting dealt with successfully. However, this positive experience seems to be becoming less frequent as British Telecom regional engineers refuse to participate in joint undergrounding schemes. The argument has been that broadband, short range line-of-sight radio technology will make existing terrestrial phone lines redundant in the next ten years. However, this position is at variance with their more positive-sounding environmental policies. Moreover, one might argue that it is disingenuous

of BT to use this as an argument for not undergrounding overhead phone lines when they do not in fact have any strategy for removing obsolete phone lines.

*Strategic Arguments for Undergrounding*

- The attention given to undergrounding within corporate environmental reporting is variable. Looking at the Schedule 9 statements, companies are unwilling to use these legally grounded statements to make direct commitments to substantive measures. For those companies that produce environmental reports, all mention visual impacts and undergrounding; some assess 'net change' in the length of system above and below ground; some set targets to complete new procedural measures and amenity projects; but only one sets a substantive target for the length of undergrounding to be completed in the coming year.
- There is not the data to establish whether 'better reporting' and 'sharper targets' necessarily yields better performance in tackling the visual impact of overhead systems. The close connection between company target-setting and OFGEM's price control review process begs the question of whether company environmental reporting could be seen as an independent variable for progressing undergrounding: rather, meaningful target-setting might need to link together the policy drivers (in Schedule 9, Sections 62 and 85) with the allocation of funding. Yet there remains merit in using system of targets and reporting to give meaning to the statutory duties on electricity companies towards amenity and designated areas.

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Writing about a topic such as undergrounding, which bridges issues of engineering, economics and environmental planning, inevitably compounds the risks of making mistakes. Of course, any that remain within the text are the responsibility of the author alone. However, in a spirit of cooperation, and to ensure that this topic does not need to be re-investigated anew every ten years, I would be delighted to receive any comments, criticisms or updates that people might have.

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