Underground Cables

High voltage underground cables can produce higher magnetic fields directly above them compared to that which an overhead line would produce at ground level, because the physical distance from the underground cable to the point of measurement is smaller. The cable installations are designed to ensure the magnetic fields cannot exceed the exposure limits. The field falls more rapidly with distance to the sides and they produce no external electric field.

Substations

Small electricity distribution substations, typically one for every few hundred homes, generally produce up to 2 microteslas close to their perimeter fence (occasionally more if built into another building, usually less for pole-mounted transformers), and often no electric field at all. The fields fall rapidly with distance and within 1 to 2 metres from a typical substation, the fields associated with it are usually indistinguishable from other fields present in homes. Larger electricity transmission substations do not produce very large fields themselves (generally less than a microtesla); the fields close by are mainly produced by power lines and cables entering them. There is no legal restriction on EMF grounds on how close houses can be to substations.

Average Magnetic Field Levels

In the Home

In the vast majority of homes in the UK, the magnetic field, averaged over 24 hours, is between 0.01 and 0.2 microteslas. Less than half a percent of homes in the UK has what is considered to be a high background field. Some of these homes are near power lines, but about half are not.

It is actually easy to experience fields far greater than average background levels for short periods, close to a mains powered appliance or passing by distribution and transmission systems, but short exposures like these do not usually contribute much to the average field over a day.

In the vast majority of homes in the UK, the magnetic field, averaged over 24 hours, is between 0.01 and 0.2 microteslas.

Outside the Home

The occupations where exposure to fields have been investigated in greater detail tend to be those involving power workers. For instance, a typical worker in a UK power station experiences an average field of a few microteslas during working hours, and an electrician perhaps one microtesla. By contrast a typical office worker experiences about 0.2 microteslas. Buried cables in pathways, roads and fields can cause exposures of around a microtesla above the cable.

Potential Health Effects

Could electricity be bad for our health and do EMFs cause cancer or any other disease?

These are important and serious questions which have been investigated in depth in recent decades. Hundreds of millions of pounds have been spent investigating this issue around the world and research still continues to seek greater clarity. However, the balance of scientific evidence to date suggests that EMFs do not cause disease.

Any suggestion of a risk to health is always taken seriously. When considering issues of diseases and what causes them, it is important to look at what the scientific research reveals.

What conditions have been researched?

Most attention has focused on childhood cancer and leukaemia in particular. However, other diseases including adult cancers, heart disease, Alzheimer's disease and other degenerative conditions and depression have been examined, as has the incidence of suicide and miscarriage. Electrosensitivity is a term used to describe symptoms some people attribute to EMFs.

There are three main types of research scientists undertake to try and find out whether EMFs cause disease.

Epidemiology

Epidemiology is the study of patterns of disease in populations. It searches for any statistical link or association between exposure to EMFs and disease in human populations. It was through such studies that concerns about EMFs were first raised in 1979.

Over 40 epidemiological studies have been undertaken, specifically evaluating a possible link between childhood leukaemia and magnetic fields.

The strength of epidemiology is that it looks directly at human populations. However, all it can ever do is observe statistical associations. It can never completely eliminate all the many other factors that determine whether people develop diseases or not, and so it can never prove whether a particular disease is caused by EMFs or not.

Over 40 epidemiological studies have now been performed looking just at a possible link between childhood leukaemia and magnetic fields. Numerous other studies have looked at other diseases. Some of those studies found no association with magnetic fields, but some have found associations, and consequently research continues until a clearer picture can be achieved.

With electric fields, the position is clearer: there is very little evidence suggesting they are a cause of childhood cancer.

All these studies were reviewed by the UK Health Security Agency and its predecessors, and the conclusions are considered later in this guide (see page 13).

Theoretical

Theoretical research looks for a plausible mechanism from physics that can demonstrate how the fields could interact with living systems. Many theories have been put forward but no such mechanism has been established that would operate at the levels of field found in homes or near power lines, and this casts doubt on the existence of health effects attributable to EMFs.

Biological

An important test of any proposed health risk is biological research; laboratory research to observe the effects of EMFs on cells and tissue.

There have been many hundreds of these studies reported and scientists examine them for robust results, which can be successfully repeated in different laboratories.

In over 40 years of research there have been no such reproducible results. The evidence from the laboratory is that low level EMFs of the type experienced by the public do not cause the diseases that have been claimed.

In particular, virtually every agent that is known to cause cancer in humans also causes cancer in mice or rats. However, for EMFs, tests on mice and rats have not identified any reproducible effects.

40 years of research looking for proposed health risk, there have been no such reproducible results.

Some Important UK Research Results

There have been two big epidemiological studies of childhood cancer and EMFs in the UK.

The United Kingdom Childhood Cancer Study (UKCCS)

The UKCCS was conducted during the 1990s. It looked at a number of suggested causes of childhood cancer including EMFs. Its particularly large study population, with over 2,000 cases of cancer in total and every case occurring in the UK over roughly a four-year period, made it to credence.

In December 1999, the UKCCS published its first report, on exposure to magnetic fields, and concluded:

"This study provides no evidence that exposure to magnetic fields associated with the electricity supply in the UK increases the risk for childhood leukaemia, cancers of the nervous system, or any other childhood cancer."

Subsequent UKCCS papers in 2000 and 2002 looked at children living close to power lines and at electric fields exposure, in both cases reporting finding "no evidence" or "no support".

The Childhood Cancer Research Group (CCRG)

This 2005 study, also known as the "Draper" study, looked at 33,000 cases of childhood cancer from 1962 to 1995 and the distance of their address at birth from the nearest 275 kV and 400 kV power line. It found an association between childhood leukaemia and these power lines (1.7-fold increase close to the lines, less further away).

However, this association extended too far (600m) from the lines to be caused by magnetic fields, which fall below background levels at much smaller distances. Then a later study from the same group in 2014 looked at more recent cases and found that the association seemed to have diminished over the years and is no longer present today.

There is no simple explanation for these findings, and the original paper concluded:

"We have no satisfactory explanation for our results in terms of causation by magnetic fields or association with other factors."

'Pooled' Analysis

In 2000, an international group, led by Professor Anders Ahlbom from Sweden, took all the separate better-quality epidemiological studies of childhood leukaemia and magnetic fields and pooled the results, so that they could perform one single re-analysis of all the available data. They found that, statistically, there was no significant evidence of any increased risk at the levels of magnetic field to which the overwhelming majority of children are exposed.

The study, however found that where the twenty four hour average value, seen within a home was greater than 0.4 microteslas (which applies to fewer than half a percent of children in the UK), there is a statistical suggestion of a two-fold increased risk. Some of these homes are near power lines, but many are not.

There have been further pooled analyses carried out since Ahlbom, which including more recent studies. These have broadly concluded that there has been a decline in the statistical risk observed over time, with some finding no statistically significant increase in risk of childhood leukaemia and proximity to overhead lines.

It is still unclear if the statistical risk observed is evidence of a weak causal link with magnetic fields, some other factor associated with overhead lines or just by chance.

The authors of the most recent 2022 study concluded:

"Our results are not in line with previous pooled analysis and show a decrease in effect to no association between MF and childhood leukaemia. This could be due to methodological issues, random chance, or a true finding of disappearing effect."

Conclusion

The UKCCS's research did not support EMFs causing cancer, but the first substantive pooled analysis did suggest an increased risk for the highest fields. More recent pooled analysis studies indicate that the evidence on childhood leukaemia is becoming weaker. Evidence from other research such as laboratory studies argues against any link.

Looking at the totality of the evidence, scientists recognise the possibility of a risk for the relatively few children who receive the highest exposure to magnetic fields, despite all of the research carried out it remains no more than a possibility.

The Words 'Risk' and 'Possible'

Nothing can ever be said to be '100% safe' or 'risk free'. Everything we do from the moment we get up to when we go to sleep has a 'risk' attached to it. Most of the risks we encounter in our day-to-day lives or we hear talked about are established or proven risks, where scientific evidence has reached firm conclusions. This enables us to decide, either as individuals or together as a society, on what actions to take in response to the risks.

With EMFs and risk the situation is different; no risk has been proven. Instead, EMFs are sometimes described as 'possibly' a cause of cancer or a 'possible carcinogen.' The word 'possible' is used about all sorts of things in our lives. It does not mean that exposure to EMFs actually does pose a risk. It simply means that there is some evidence and scientists have not been able to rule out the possibility of a risk, which on the basis of present evidence would be small.

Any suggestion of a possible health risk is always taken seriously by the electricity industry. For this reason the industry continues to support high quality research to help to gain a clearer picture of EMFs and to move closer to a final answer.

Corona Ions and Electric Fields

Scientists at Bristol University in the UK have suggested an alternative mechanism for health effects, involving tiny airborne "corona ions" produced by high-voltage power lines, and their interaction with existing airborne pollutants. These corona ions are indeed produced, but in 2004 Public Health England's forerunner concluded:

> ***"...it seems unlikely that corona ions would have more than a small effect on the long-term health risks associated with particulate air pollutants, even in the individuals who are most affected."***

A recent epidemiology study by Bristol University investigating corona ions from high voltage power lines and adult cancers concluded:

> ***"Our results do not provide evidence to support hypotheses that air ion density or electric fields in the vicinity of power lines are associated with cancer risk in adults."***

Microshocks

The electric field beneath a power line charges up objects, and sometimes, if you touch a metal object, you can receive a small one-off "microshock," similar to the shock you sometimes get after walking on a nylon carpet. This can be disconcerting but has no known long-term effect and is not regarded as harmful.

Pacemakers

The relevant UK regulatory body is the Medicines and Healthcare Products Regulatory Agency (MHRA). The MHRA does not regard power lines as a significant risk for people with implanted heart devices and there is no recorded incidence of a patient coming to any harm this way in the UK. This is reflected in Government policy, which states:

> ***"[MHRA] does not consider that transmission line EMFs constitute a significant hazard to the operation of pacemakers."*** National Policy Statement EN-5 (2024).

Note: Cardiologists may require those with pacemakers to adjust their settings, which can result in them being more susceptible to interference from EMFs, but this is extremely rare. In these circumstances the patient will receive a specific warning from their cardiologist. If you have received a specific warning, you should consult your doctor.

The National and International View

In the UK it is to the UK Health Security Agency, and its forerunners Public Health England (PHE), the National Radiological Protection Board (NRPB), and the Health Protection Agency, that both Government and industry look for advice. In March 2004 the NRPB published a comprehensive review of the science on EMFs. For the key issue of childhood leukaemia, they talk about the difficulties with some of the studies and say: ***"The epidemiological evidence is currently not strong enough to justify a firm conclusion...,"*** but also: ***"Nevertheless, the possibility remains that intense and prolonged exposures to magnetic fields can increase the risk of leukaemia in children..."***

Another key conclusion is: "There is little evidence to suggest...that raised cancer risks of other types, in children and adults, might arise as a result of exposure to ELF [extremely low frequency] magnetic fields...The findings from studies of health outcomes other than cancer have generally been inconsistent or difficult to interpret."

They then note: ***"The results of epidemiological studies...cannot be used as a basis for the derivation of quantitative restrictions on exposure to EMFs."***

These views echo the international consensus. In June 2001 the International Agency for Research on Cancer, IARC, which is an agency of the World Health Organization, published an authoritative opinion on the carcinogenicity of EMFs. IARC classified extremely low frequency magnetic fields as 'possibly' a cause of cancer, on the basis of 'inadequate' epidemiological evidence for most types of cancer and 'inadequate' evidence in animals, but 'limited' epidemiological evidence for childhood leukaemia. For electric fields IARC said all the evidence was 'inadequate.' In 2005 WHO confirmed this classification, but also looked at other effects on health, and said the evidence for any of these being produced by EMFs was ***"much weaker"***. More recent reports by the relevant EU scientific committee in 2007, 2009 and 2015 confirm that these are still a correct summary of the science.

Some scientists hold other views, and sometimes reports are published saying the evidence is stronger (for example, a 2002 report from California and the 2007 Bio initiative report). However, such assessments are not aligned with the international consensus and with authoritative bodies.

The UK Electricity Industry Policy

Health

The UK electricity industry takes any suggestion of a risk to health extremely seriously. The industry believes that the final decision about what constitutes a safe level of exposure should be made by an independent body. It is committed to follow the guidance given by the Government, advised by the UK Health Security Agency, on safe levels of exposure and carries out all its operations within the relevant exposure levels.

As the electricity industry takes public concerns seriously, it continues to provide dedicated EMF resources to assist the public and provide further information. In situations where it is appropriate - particularly in relation to high voltage transmission lines (275kV and 400kV) - this may include offering home visits and the measurement of electromagnetic fields.

Research

The electricity industry is committed to supporting high-quality research to help get closer to a final answer on the EMF issue. For example, the UK Childhood Cancer Study received over £4 million from the industry to enable it to look at EMFs in their study, though the conduct of the study was rigorously independent of the industry. Similarly, one of the electricity companies, National Grid, has given over £5 million to an independent Research Trust to support the very best quality biological research.

In addition, the industry has supported and continues to support numerous other studies, and its own staff carry out research into aspects of exposure to EMFs. National Grid provided the data on power lines that made the CCRG study possible. It is a condition of all the research supported by the industry that the results are published openly in reputable peer-reviewed, scientific journals.

Power lines and property

The UK Government policy is that there are no restrictions on EMF grounds on building homes close to power lines. Clearly the statutory high-voltage safety clearance distances must be followed to prevent the danger. The only EMF requirement is compliance with the exposure guidelines, which all power lines in the UK meet.

This policy was scrutinised and reviewed in the 2000s through a process called SAGE, the Stakeholder Advisory Group on ELF EMFs. SAGE was created in 2004 to provide a forum in which all stakeholders, citizen groups alongside industry, Government, and professional bodies could discuss possible precautionary measures and make recommendations. SAGE published its First Interim Assessment in 2007 containing recommendations on power lines, house wiring, and appliances, and Government formally responded in October 2009.

The Government response adopted a measure recommended by SAGE called "optimum phasing" which applies to the design of some power lines at 132 kV and above and can result in lower fields, and the electricity industry volunteered to implement this. The electricity industry has since demonstrated to Government its compliance with that policy and continues to do so. It also agreed with a proposal for more information to be provided to the public. However, Government said clearly that it will not be introducing "corridors" along power lines where building would be restricted, because this would be disproportionate to the scientific evidence. It also says that this is a matter for central Government policy, not local decision making.

The electricity industry view

The electricity industry considers that the question of possible measures to reduce fields should be resolved in the best interests of society as a whole, and that a forum like SAGE, where all the different views and opinions were represented and discussed sensibly, is greatly preferable to the alternative of confrontation and argument. We therefore welcome the clarity that the SAGE process and the Government response to it has brought.

We are committed to building and operating our systems in compliance with Government policy, and they already comply with the exposure guidelines. Where there are relatively easy and low-cost ways of reducing fields, it makes sense to adopt these. However, it is in the interests of society as a whole that any measures are proportionate and that they balance risk and cost to society, and that is the reason why Government has decided not to introduce "corridors" in the UK.

This 'EMFs The Facts' was produced by: Energy Networks Association

For further Information:

- National Grid information site on emfs: www.emfs.info
- The EMF public information line can be contacted on 0845 702 3270 or 01926 653382 or: emfhelpline@nationalgrid.com
- Your local electricity distribution company – who is my network operator
- The Institute of Engineering and Technology (IET) electromagnetic fields and heath
- The UK Health and Security Agency website: www.ukhsa-protectionservices.org.uk/contact
- Energy Networks Association website: www.energynetworks.org

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energynetworks.org

6.34 Appendix I: List of bodies, groups and organisations who were consulted by the transmission owner

Scottish MSPs	
First Name	**Surname**
Michael	Matheson
Jamie	Hepburn
Megan	Gallacher
Mark	Griffin
Stephen	Kerr
Monica	Lennon
Richard	Leonard
Gillian	Mackay
Graham	Simpson
Neil	Bibby
Katy	Clark
Russell	Findlay
Pam	Gosal
Jamie	Greene
Ross	Greer
Paul	O'Kane
Scottish MPs	
First Name	**Surname**
Euan	Stainbank
Frank	McNally
Katrina	Murray
Pamela	Nash
Kenneth	Stevenson

Council	Name	Council	Name
North Lanarkshire	Kenneth Duffy	North Lanarkshire	Nathan Wilson
North Lanarkshire	Jim Logue	North Lanarkshire	Kaye Harmon
North Lanarkshire	Andrew Duffy-Lawson	North Lanarkshire	David Robb
North Lanarkshire	Helen Loughran	North Lanarkshire	Bob Burgees
North Lanarkshire	Nicky Shelvin	North Lanarkshire	Frank McKay
North Lanarkshire	William Goldie	North Lanarkshire	Fiona Fotherington
North Lanarkshire	Peter McDade	North Lanarkshire	Jim Hume
North Lanarkshire	James McPhilemy	North Lanarkshire	Margaret Hughes
North Lanarkshire	Danish Ashraf	North Lanarkshire	John Jo Leckie
North Lanarkshire	Gordon Currie	North Lanarkshire	Martin McCulloch
North Lanarkshire	Tom Fisher	North Lanarkshire	Clare Quigley
North Lanarkshire	Alan Masterton	North Lanarkshire	Robert Mckendrick
North Lanarkshire	Claire Barclay	North Lanarkshire	Cameron McManus
North Lanarkshire	Barry McCulloch	North Lanarkshire	Louise Roarty
North Lanarkshire	Adam Smith	North Lanarkshire	Michale McPake
North Lanarkshire	Tom Johnston	North Lanarkshire	Joanne Katy Keltie
North Lanarkshire	Gerry Brennan	North Lanarkshire	Greg Lennon
North Lanarkshire	Ayeshah Khan	North Lanarkshire	Kirsten Larson
North Lanarkshire	Anne Thomas	North Lanarkshire	Alex McVey
North Lanarkshire	David Crichton	North Lanarkshire	William Shields
North Lanarkshire	Paul Kelly	North Lanarkshire	Allan Stubbs
North Lanarkshire	Lorraine Nolan	North Lanarkshire	Josh Cairns

Council	Name	Council	Name
Falkirk Council	Cecil Meiklejohn	Falkirk Council	Claire Brown
Falkirk Council	Bryan Deakin	Falkirk Council	Jim Robertson
Falkirk Council	Paul Garner	Falkirk Council	Siobhan Paterson
Falkirk Council	Robert Bissett	Falkirk Council	David Aitchson
Falkirk Council	Baillie William Buchanan	Falkirk Council	Stacey Devine
Falkirk Council	Alf Kelly	Falkirk Council	Ann Ritchie
Falkirk Council	Fiona Collie	Falkirk Council	David Balfour
Falkirk Council	Paul Garner	Falkirk Council	Alan Nimmo
Falkirk Council	Brian McCabe	Falkirk Council	Robert Spears
Falkirk Council	William Buchanan	Falkirk Council	Gary Bouse
Falkirk Council	Jack Redmond	Falkirk Council	Margaret Anslow
Falkirk Council	Lorna Binnie	Falkirk Council	Jim Flynn
Falkirk Council	Claire Aitken	Falkirk Council	Laura Murtagh
Falkirk Council	Sarah Patrick	Falkirk Council	James Kerr
Falkirk Council	James Bundy	Falkirk Council	Gordon Forrest
Falkirk Council	Robert Bissett	Falkirk Council	Anne Hannah
Falkirk Council	Iain Sinclair	Falkirk Council	

Council	Name	Council	Name
Glasgow Council	John Daly	Glasgow Council	Sharon Greer
Glasgow Council	Alex Kerr	Glasgow Council	Ruairi Kelly
Glasgow Council	Kevin Lalley		

North Lanarkshire	Barry McCluskey	North Lanarkshire	John McLaren
North Lanarkshire	Claire Louise Williams	North Lanarkshire	Janice Catherine Toner
North Lanarkshire	Lisa Stubbs	North Lanarkshire	Alan Beveridge
North Lanarkshire	Pat Patton	North Lanarkshire	Sophia Coyle
North Lanarkshire	Anne McCrory	North Lanarkshire	Henry Emerson Dunbar
North Lanarkshire	A Campbell	North Lanarkshire	Richard Alan Sullivan
North Lanarkshire	Lesley Mitchell	North Lanarkshire	T Carragher
North Lanarkshire	Gary Robinson	North Lanarkshire	Andrew Bustard
North Lanarkshire	Kevin Docherty	North Lanarkshire	Geraldine Woods
North Lanarkshire	Chris Costello	North Lanarkshire	F MacGregor
North Lanarkshire	Lesley Jarvie	North Lanarkshire	Margaret Boyd
North Lanarkshire	Helen Loughran		

Status	Community Council	Status	Community Council
Active	Central Wishaw	Active	Auchinloch
Active	Gartosh	Active	Banton & Kelvinhead
Inactive	Easterhouse	Unknown	Bellshill
Active	Garthamlock, Craigend & Gartloch	Active	Cairnhill
Active	Swinton	Active	Caldercruix
Inactive	Village Community Council	Active	Carbrain & Hillcrest
Inactive	Westfield Community Council	Active	Castlecary
Active	Armadale	Unknown	Central Wishaw
Active	Airth Parish	Active	Chryston
Active	Avonbridge and Standburn	Active	Cleland
Inactive	Bainsford, Langlees and New Carron	Unknown	Coltness
Active	Banknock, Haggs and Longcroft	Active	Condorrat
Active	Blackness	Active	Craigmarloch
Active	Bo'ness	Active	Dullatur
Inactive	Bonnybridge Community Council	Active	Glenmavis
Active	Brightons	Active	Greengairs
Inactive	Camelon, Bantaskine and Tamfourhill	Unknown	Harthill & Eastfield
Inactive	Carron and Crronshore (excluding Skinflats)	Active	Kildrum
Active	Denny & District	Active	Kilsyth
Inactive	Falkirk Central	Unknown	Kirkwood
Inactive	Falkirk South (covering Hallglen, Glen Village and Lochgreen)	Active	Ladywell
Active	Gramhamston, Middlefield and Westfield	Unknown	Monkland Glen
Active	Grangemouth (including Skinflats)	Active	Muirhouse and Flemington
Inactive	Larbert, Stenhousemuir and Torwood	Unknown	Newarthill
Inactive	Lower Braes (covering Laurieston, Westquarter and Redding)	Active	Newmains & District
Active	Maddiston	Active	North Calder Community Council
Active	Polmont	Active	Overtown & Waterloo
Active	Reddingmuirhead and Wallacestone	Active	Queenzieburn
Active	Sheildhill and California	Unknown	Salsburgh
Active	Slamannan and Limerigg	Active	Seafar & Ravenswood

Inactive	Whitecross	Active	Stepps & District
Active	Westerwood	Active	Thorniewood
Active	The Village		

Non-statutory consultee	Non-statutory consultee
Scottish Wildlife Trust	WO Low Flying and safeguarding
Falkirk Wildlife Trust	John Muir Trust
Falkirk Friends of the Earth	RAF
Glasgow Friends of the Earth	MCofS (Mountaineering Council of Scotland)
Forth Valley Ramblers (Falkirk)	Palacerigg Community Trust
Cumbernauld & Kilsyth Ramblers	Sustrans Scotland
The Conservation Volunteers	Visit Scotland
Voluntary Action North Lanarkshire	Buglife
Community Green Initiative	BT
Cumbernauld Environmental Society	BAA (Glasgow Airport)
RSPB Planning Consultation Team	Glasgow Prestwick Airport
Scottish Rights of Way and Access Society (ScotWays)	Strathclyde Partnership for Transport (STP)
National Trust for Scotland	

Community groups	Community groups
Cornerstone House Centre	Bonnybridge Community Hub
The Link Community Facility	ROOTS HHFS Foodbank & Community Events
Forge Community Centre	Bonnybridge Youth Football Club (Bonnybridge YFC)
Abronhill Community Centre	27th Bonnybridge Scout Group
Muirfield Centre	CVS Falkirk
Cumbernauld Alternative Network (CAN)	Falkirk Local History Society – Archaeological Research
Cumbernauld Central Credit Union	Greenhill Historical Society
Cumbernauld Music Centre Trust	The Royal British Legion Scotland
Cumbernauld Dog Training Club	Girlguiding Cumbernauld
Model Railway Group	Abronhill Regeneration Forum
Condorrat Social Club	The Centre Cumbernauld

Statutory consultee	Statutory consultee
Scottish Government ECU	Civil Aviation Authority
NatureScot	Fisheries Management Scotland
Historic Environment Scotland	The Coal Authority
Scottish Water	British Horse Society
SEPA	Defence Infrastructure Organisation (MoD)
Scottish Forestry	Association for the Protection of Rural Scotland (APRS)
The Crown Estate	West of Scotland Archaeology Service (WoSAS)
Health and Safety Executive	Network Rail
Forestry and Land Scotland (FLS)	National Air Traffic Services
Transport Scotland	

6.35 Appendix J: Project FAQs

Can you tell me more about Electric and Magnetic Fields (EMFs)?

Wherever electricity is used there will also be electric and magnetic fields. This is inherent in the laws of physics – we can modify the fields to some extent, but if we are going to use electricity, then EMFs are inevitable.

Like many other things that we encounter in nature, EMFs can be harmful at high-enough levels. But the fields required, for example, to start interfering with the body's nervous system are much greater than those produced by the UK electricity system. Hundreds of millions of pounds have been spent investigating this issue around the world. Research still continues to seek greater clarity; however, the balance of scientific evidence to date suggests that EMFs do not cause disease.

For more information, please see https://emfs.info/

Are you consulting landowners?

Yes. Owners and occupiers of land that might be affected by the preferred route, overhead line uprating or substation extension proposals will be contacted. If you believe that your land may be affected and you have not yet heard from us, please get in touch.

How are you consulting local people?

We first consulted on our proposals in 2021, and we consulted on our revised plans during January and February 2025. Following this, we consulted on our detailed plans in October and November 2025 and held our final information events in February 2026. These final events allowed us to present the final project proposals and explain how feedback from earlier consultation and engagement has been considered ahead of submitting our consent applications.

You can find full details on the Have Your Say page.

What is involved in uprating overhead lines from 275kV to 400kV?

When uprating (increasing the capacity) overhead lines, we usually need to replace the conductors (wires), and the insulators from which they are suspended.

We do not usually need to replace the existing L8 steel towers (pylons) as they are designed to carry circuits up to 400kV. We survey the foundations of each tower to decide whether any work is required.

Prior to uprating the overhead line, we may need to create temporary accesses to the towers and laydown /storage areas for our equipment, usually mid-way along the route.

Linesmen will climb each tower and the existing insulators will be unbolted and lowered to the ground using a tractor and winch. This will also be the method of lifting the new insulators into position.

Following commissioning of the overhead line, all equipment and temporary access/storage areas will be removed with the land being reinstated to its former use/condition.

Can the new line go underground?

Under the Electricity Act 1989, SPEN is required to consider technical, economic and environmental matters, and reach a balance between them.

High voltage, high capacity overhead lines is the proven choice for the bulk transmission of electricity throughout the world based on economy and reliability.

SP Energy Networks (SPEN) will consider undergrounding a 132kV, 275kV or 400kV overhead line, or section of that line, in particular circumstances where no suitable route for an overhead line can be identified. You can find out more about this in our *Approach to Routeing and Environmental Impact Assessment* document, which is available on our website.

What will the new overhead line look like and how high will it be?

The new overhead line will be carried on L8 lattice steel towers (pylons), similar to those already in place on the existing Denny to Bonnybridge overhead line. Each tower will have three arms on each side, and each arm will carry a set of conductors (wires). This is because there will be a circuit on each side of the towers, and each circuit has three sets of wires. The towers are made of galvanised steel. They are grey in colour and will become duller in appearance over time.

Towers have a standard height of 46 metres but can go up to 63 metres where required to ensure electrical safety clearance to the ground. They are placed approximately 300 metres apart, but the exact distance between them will vary depending on the landscape and any obstacles such as roads, rivers and railway lines.

How and where will the proposed new Bonnybridge-Glenmavis overhead line connect to the existing Easterhouse-Newarthill overhead line (the XX route)?

The proposed new overhead line will connect to the existing Easterhouse-Newarthill overhead line near New Monkland cemetery.

A new 'tee-in' section will be created at this point, allowing the existing XX overhead line to move away from residential properties at Grantown Gardens and Eden Court.

Please see the Preferred Route map for more detail.

Who gives you permission to construct new overhead lines?

An application for consent under Section 37 of the Electricity Act 1989 to install the proposed overhead lines will be submitted to the Scottish Government Energy Consents Unit. As such, Scottish Ministers will make the final decision as to whether or not it is granted.

Who will pay for this project?

The cost of investment in the electricity system is partly borne by consumers through electricity bills, so we work hard to be economic and efficient in the way we maintain and grow the network.

The amount we invest in our networks and the amount we are able to recover is agreed with Ofgem, which is committed to working with industry, governments and consumer groups to deliver a net zero economy at the lowest cost to consumers. Find out more about Ofgem.

How much will the project cost?

It is early days and at this point we are unable to cost the project fully. This will happen when we have a definite proposal.

What exactly are you proposing?

The Denny to Wishaw Network Upgrade Project includes new infrastructure and some changes and reinforcements to existing infrastructure. Please see The Proposal page on this website for full details.

Why is the Denny to Wishaw Network Upgrade needed?

The UK is in the middle of a transformation, with the electricity we use increasingly coming from greener, cleaner sources, as new renewable generators replace older fossil-fuelled power stations.

Our planning work with the National Energy System Operator (NESO) has identified that, for the UK to meet its Net Zero carbon emissions targets, we need to reinforce the network between Denny and Wishaw so it has extra capacity to transmit additional green energy.

This reinforcement includes uprating some existing overhead lines from 275kV to 400kV to increase their capacity, and building the proposed new overhead transmission line between Bonnybridge and a point near Glenmavis, enabling the additional green electricity to flow into the wider transmission network.

Find more detailed information in our Need Case document.

What statutory obligations does SP Energy Networks have?

Statutory obligations are set out in the Electricity Act 1989 and in the transmission licence. It includes a responsibility to develop and maintain an efficient, coordinated and economical transmission system in accordance with security and quality of supply standards. An obligation to connect new power generators to the system and, make sure any work carried out keeps disturbance to the natural and built environment and the people who live in it, work in it or enjoy it to a minimum.

Who are SP Energy Networks?

SP Energy Networks is part of the ScottishPower Group. It is responsible for the transmission and distribution of electricity in central and southern Scotland, and, through SP Manweb and SP Electricity North West, the distribution networks in North Wales and North West England. Its role is to maintain, operate and invest in the network to secure a safe, reliable, and economic service for current and future consumers.

How will you determine the final route of the new overhead line?

The routeing of overhead lines is a complex process, requiring a balance to be struck between statutory obligations, engineering requirements, economic viability, the environment, and people who live, work or enjoy leisure time in the area.

Established guidelines for routeing transmission overhead lines are in place, which combine in-depth environmental studies with technical and economic factors. A key part of this is consultation with landowners, stakeholders and the public to inform the development of the project.

You can find out more about how we develop routes in the *Approach to Routeing and Environmental Impact Assessment* document, which is available to view on our Preferred Route page.

You can find detailed information specific to the routeing of the proposed new Bonnybridge to Glenmavis overhead line in the *Routeing and Consultation Document*, and the *Preferred Route Option – Update Report* which explains how the original proposals have been modified since 2021. Please see the Project Document page.

Who regulates SP Energy Networks?

SP Energy Networks is regulated by Ofgem (Office of the Gas and Electricity Markets) the independent national regulatory body. Further information about Ofgem is available on:

- www.ofgem.gov.uk Consumer Affairs team on 020 7901 7295
- Emailing consumeraffairs@ofgem.gov.uk

6.36 Appendix K: Summary of the 2021 Project and stakeholder feedback

In 2021, SP Energy Networks consulted on its preferred route option for a new 400-kilovolt (kV) overhead line (OHL) between Bonnybridge Substation, west of Falkirk and an existing 275kV overhead line (known as the "XX route"), north of Glenmavis. Further information on the 2021 Project is available in SP Energy Networks' *Denny to Wishaw Network Upgrade Bonnybridge to Glenmavis 400 kV Overhead Line: Routeing & Consultation Document (May 2021)*, which can be accessed here: Denny_to_Wishaw_Network_Upgrade_Routeing_and_Consultation.pdf.

The table below provides a summary of key issues raised in relation to the 2021 preferred route option, and where appropriate how they have been addressed in the identification of the modified preferred route option:

Issues raised	**Summary of consultee feedback**
Slamannan Plateau Special Protection Area (SPA) and Site of Special Scientific Interest (SSSI)	A number of respondents raised the Slamannan Plateau SPA and SSSI highlighting the susceptibility of the SPA's qualifying species, taiga bean geese, to collisions with OHLs. The 2021 preferred route option was developed to avoid the designated site and was routed to the west of it. This was informed by bird surveys as well as available records, which indicated use of the site and surrounds by taiga geese was predominantly to the east of the designated area. The modified preferred route option also avoids the SPA and includes proposals to remove an existing 132kV OHL route that slightly encroaches on a part of the SPA.
Antonine Wall World Heritage Site	Route selection across the Antonine Wall, part of the Frontiers of the Empire World Heritage Site (WHS) was a key focus of consultation feedback provided by Historic Environment Scotland (HES). It noted the alternative options considered and agreed with the conclusion that alternatives to the 2021 preferred route option would be more likely to have a greater impact on the WHS as well as the setting of the scheduled monuments. In order to reduce potential impacts on the WHS, including cumulative impacts with existing OHLs, HES also highlighted opportunities for mitigation with regard to tower positioning and rationalisation of existing OHLs. As noted above, it proposed to remove an existing 132kV OHL that spans the WHS in order to reduce potential wirescape related effects on the designation.
Woodland (including Ancient Woodland Inventory sites and native woodland)	A small number of respondents highlighted that the 2021 preferred route option crosses areas identified on the Ancient Woodland Inventory as well as areas of native woodland as per the Native Woodland Survey of Scotland. There are approximately seven Ancient Woodland sites within or adjacent to the 2021 preferred route; five sites between Bonnybridge Substation and Drum Wood, one site west of Fannyside Muir and one site south of Palacerigg Country Park. The modified preferred route option has been narrowed in some sections to avoid or reduce potential impacts on woodland, but in some sections, particularly between the Forth and Clyde Canal and Howierigg woodland cannot be completely avoided.

Palacerigg Country Park	North Lanarkshire Council highlighted the potential impact on Palacerigg Country Park. The location of the park and wider constraints including sites of the highest environmental value (the Slamannan Plateau SPA and SSSI as well as West Fannyside Moss Special Area of Conservation (SAC) and SSSI) significantly influence route selection. As noted above and in the original routeing study, routes to the east of the SPA were considered less preferable owing to their potential impact on its qualifying bird species. On balance, the constraints that are present mean a route through the country park is considered preferable to one through or to the east of the statutory designated sites, which has greater potential to affect the qualifying species of the SPA. The modified preferred route option largely follows the 2021 preferred route option but has been narrowed in places through the country park. It seeks to make best use of existing woodland and shelterbelts to reduce the impact as much as possible. The removal of the existing 132kV OHL route provides some opportunity for the modified preferred route option to repurpose the existing wayleave through the country park and reduce some impacts within it.
Wildlife Sites or Sites of Interest for Nature Conservation	North Lanarkshire Council noted the potential to impact on a number of Sites of Interest for Nature Conservation (SINC). A number of SINCs are present and overlap with Palacerigg Country Park. As set out above, on balance it is preferable to route within or closer to these sites than the Slamannan Plateau SPA and SSSI as well as West Fannyside Moss Special Area of Conservation (SAC) and SSSI to the east. A number of these SINCs are also crossed by the existing 132kV OHL. By removing it and replacing it with the new 400kV OHL as part of the modified preferred route option, the overall impact on these SINCs can be reduced. South of Palacerigg Country Park, there are approximately five SINCs close to or crossed by the 2021 preferred route option. As far as possible, the modified preferred route option has been re-routed or narrowed to avoid encroaching upon these. However, the distribution of these sites as well as other constraints (in particular rural properties) means some SINCs are unavoidable.

Summary of modifications made to the preferred route for 2025 PAC 1 Consultation

- A change to the 2021 preferred route option taking account of where it starts within Bonnybridge Substation and the uprating of ZG route.
- Changes to and rationalisation of other existing OHLs in the vicinity of the 2021 preferred route option.
- A change to the 2021 preferred route option to connect it to an extension at the existing Cumbernauld Substation, including an extension of the substation.
- A change to where and how the 2021 preferred route option connects to the XX route in the Glenmavis area as well as modifications to the XX route.

Further information on the modifications to the 2021 Project and its progression prior to PAC 1 in 2025 is available in SP Energy Networks' *Denny–Wishaw Network Upgrade Bonnybridge to Glenmavis 400 kV Overhead Line Preferred Route Option Update Report (December 2024)*, which can be accessed here: https://www.spenergynetworks.co.uk/userfiles/file/DWNO_PROUR.pdf.