Dogger Bank
Electric and magnetic fields

Fact Sheet
June 2013

Background
This fact sheet has been produced in response to concerns raised about and electric and magnetic fields (EMFs) from Forewind's proposed offshore wind energy projects and, in particular, in relation to their onshore high voltage cables. This is an industry-wide issue relevant to Forewind and the Dogger Bank development.

Electric and magnetic fields (EMFs) are invisible sources of energy associated with the use of electrical power and present everywhere in our environment.

Wherever electricity is generated and used there will be electric and magnetic fields. They are present in every office, shop and home and come from everything electrical, ranging from kettles and TVs to computers and mobile phones.

Electric fields
Electric fields are produced by voltage and electric field strengths are measured in volts per metre (V/m) or kilovolts per metre (kV/m). 1 kV/m = 1000 V/m.

The size of an electric field depends on the operating voltage of the electrical equipment and it will exist even when there is no current flowing.

Electrical equipment can be designed to avoid producing an external electric field through the use of screening or coverings. Underground electricity cables, which are enclosed in a metal sheath to screen and protect the cable, do not generate any external electric fields.

Magnetic fields
Magnetic fields are produced by the flow of electricity, the current. Current, which is measured in amperes (amps) can be compared to the volume of water that flows in a hose when the tap is on. A higher current generally means a higher magnetic field as it will vary with power consumption.

Magnetic fields are measured in teslas (T), which is a very large unit, so the normal unit of measurement of magnetic fields is the much smaller microtesla (μT). 1T = 1,000,000 μT.

Sources of EMFs
There are natural sources of electric and magnetic fields as well as those relating to human-made equipment.

Naturally occurring electric fields are produced by the local build-up of electric charges in the atmosphere. The earth's electric field is usually around 100 V/m. In thunderstorms this can increase to thousands of volts per metre.

Everyone is exposed to the earth's magnetic field and it is that which causes a compass needle to orient in a North-South direction. Its magnitude at the earth's surface ranges from 30 μT at the poles, to 60 μT at the equator and is roughly 50 μT in the UK.

The strength of a magnetic field decreases dramatically with increasing distance from the source. Example values of magnetic field levels from common domestic devices can be seen in this table[1]:

	Close to device	One metre distance
Vacuum cleaner	800 μT	2 μT
TV, microwave	50 μT	0.2 μT
Fridge	2 μT	0.01 μT

Dogger Bank proposed cables

Forewind has proposed to use high voltage direct current (HVDC) cables to connect the Dogger Bank offshore wind farms with the onshore converter stations. While high voltage alternating current (HVAC) cables would be used to connect the converter stations with the National Grid Electricity Transmission high voltage substation. Both onshore and offshore, all cables would be buried at least one metre under the ground or below the seabed.

All the cables proposed for the Dogger Bank projects would be covered with metallic screens. **Therefore neither the DC nor AC cables would emit any external electric fields**.

In terms of magnetic fields, the proposed HVDC cable system for each project would be made up of a pair of cables operating as a bipole system. This means that the current in one cable flows in the opposite direction to the current in the second cable, causing the magnetic field from one cable to largely cancel out the magnetic field from the other cable. **Therefore magnetic fields emitted by the DC cable system would be very low**.

The proposed HVAC cable system for each project would be made up of three cables, which would produce magnetic fields that would not cancel each other out.

Determining the exact size of the magnetic field generated by a three HVAC cable system is a complex calculation and needs to be based on data specific to each cable's materials and construction layers.

The magnetic field for HVAC cable systems varies with the power flow and is typically around 10 μT one metre above the surface of the ground. When calculated in addition to the earth's own magnetic field – stated above as 50 μT in the UK – the total is around 60 μT. This is the same as the natural magnetic field at the equator and is not considered to pose a threat to human or animal health, as per the World Health Organisation guidelines.

Therefore, the magnetic fields produced by the AC cables on the Dogger Bank projects will be very low.

The magnetic fields produced by both the DC and AC cables will be well within industry guidelines.

1. Energy networks Association. January 2012 Electric and magnetic fields.

Industry guidelines

The UK Government sets guidelines for exposure to EMFs in this country on advice from Public Health England (formerly the Health Protection Agency). In 2004, the UK adopted the 1998 Guidelines published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and this policy was reaffirmed in October 2009.

These guidelines include reference and permitted levels of exposure. Reference levels are those beyond which further investigation would be required to ensure that the permitted levels are not reached. They also form the basis of a European Union Recommendation on public exposure and a Directive on occupational exposure.

The ICNIRP reference levels are:
– 100 μT for magnetic fields
– 5000 V/m for electric fields.

While the permitted levels of exposure are higher at:
– 360 μT for magnetic fields
– 9000 V/m for electric fields.

Forewind is committed to best practice health and safety in all of its activities. In relation electric and magnetic fields, this means ensuring that its proposed electrical infrastructure for the Dogger Bank wind farms comply with Government policy and with exposure guidelines.

By specifying the cable systems described in this fact sheet, the resultant electric and magnetic fields generated would be extremely low, or negligible, and would fall well under the accepted UK guidelines on exposure levels.

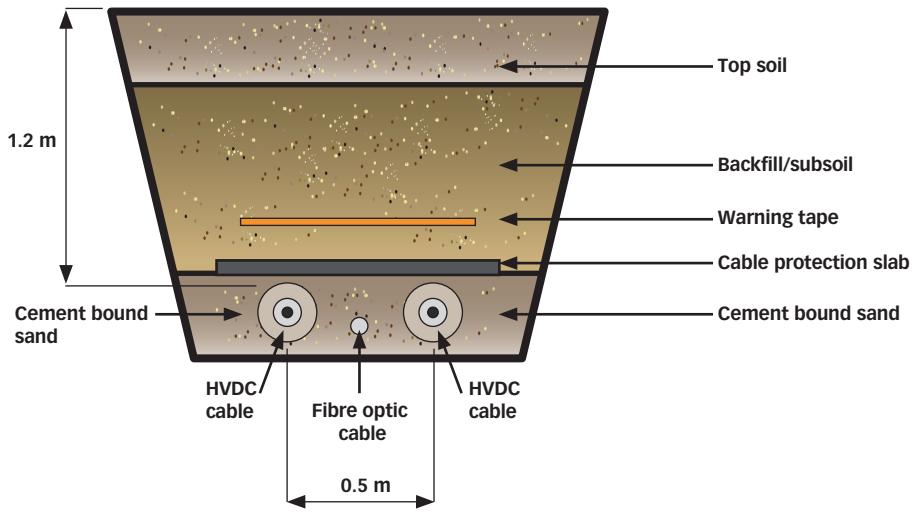
For more information

This factsheet is a summary of electric and magnetic fields in relation to Dogger Bank. For more reading on the topic, please refer to these websites:

www.emfs.info/
www.energynetworks.org/electricity/she/emfs.html
www.who.int/topics/electromagnetic_fields/en/
www.nationalgrid.com/corporate/Our+Responsibility/Our+Impacts/emf/

Size of fields per cable type

	High voltage direct current (DC)	High voltage alternating current (AC)	Reference level of exposure	Permitted level of exposure
Electric field	Zero as cables covered with metallic screens	Zero as cables covered with metallic screens	5000 V/m	9000 V/m
Magnetic field	Approx. 5-10 μT	Approx. 25 μT	100 μT	360 μT



HVDC cables in pairs emit no electric fields due to their metal coverings, and only minimal magentic fields as the current in one cable cancels out the current in the other.

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