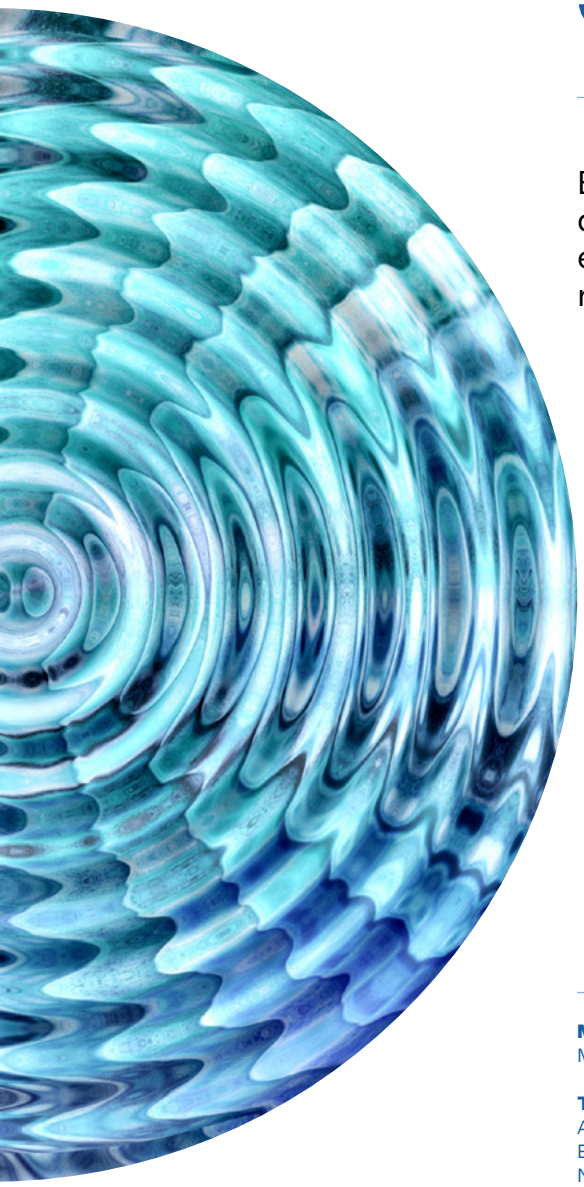
OPPORTUNITY #9

How can we protect ourselves from the possibility of electromagnetic harm or disruption?

ELECTRO-MAGNETIC SHIELD



Between nanoengineering and the rapid and scalable development of new materials, we can create or evolve existing powerful shields to block electromagnetic radiation and interference.

MEGATREND
Materials Revolution

TRENDS
Advanced Connectivity
Electromagnetic Radiation
New Materials

SECTORS AFFECTED
Materials & Biotechnology
Automotive, Aerospace & Aviation
Communication Technologies and Systems
Cyber & Information Security
Data Science, AI & Machine Learning
Government Services

WHY IT MATTERS TODAY

There are natural and artificial sources of electromagnetic field radiation (EMF).[270] Natural sources include lightning and solar radiation, while artificial sources include microwaves, electric motors, mobile phones, radio and power lines.[271] Known as electromagnetic interference (EMI), not only can EMF potentially cause problems for human beings but it can also disrupt the proper functioning of electronic[272] and medical devices[273] and vice versa.[274,275]

To date there is no clear evidence proving that EMF can have lasting harmful effects on human beings.[276] But it does interfere with other technology. The number of artificial sources of EMI continues to increase, as does the number of essential electronic devices vulnerable to EMI. These include new driverless cars, aeroplanes, mobility and navigation systems and medical equipment such as magnetic resonance imaging (MRI) machines and implants.

The World Health Organization monitors legislation around the world relating to exposure to electromagnetic fields on its Global Health Observatory portal, last updated in 2018.[277] Most countries in Europe and Iran have legislation that mandates compliance, whereas the United States and South Africa make compliance voluntary. The majority of countries do not publish any data on this subject.[278]

However, the International Electrotechnical Commission provides guidance. It describes over 50 standards on electromagnetic compatibility that specify ways to measure emissions and set limits including testing techniques, levels and mitigation methods.[279]

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THE OPPORTUNITY

Exposure to low-frequency electromagnetic fields may cause headaches, fatigue and feelings of anxiety. In extreme circumstances, exposure is considered a factor in the development of cancers and problems in pregnancy.[281] A combination of nanoengineering and the rapid and scalable development of new materials offers the hope that we can find ways to shield ourselves from any possible harmful impacts from associated EMF in the present and the future.[282]

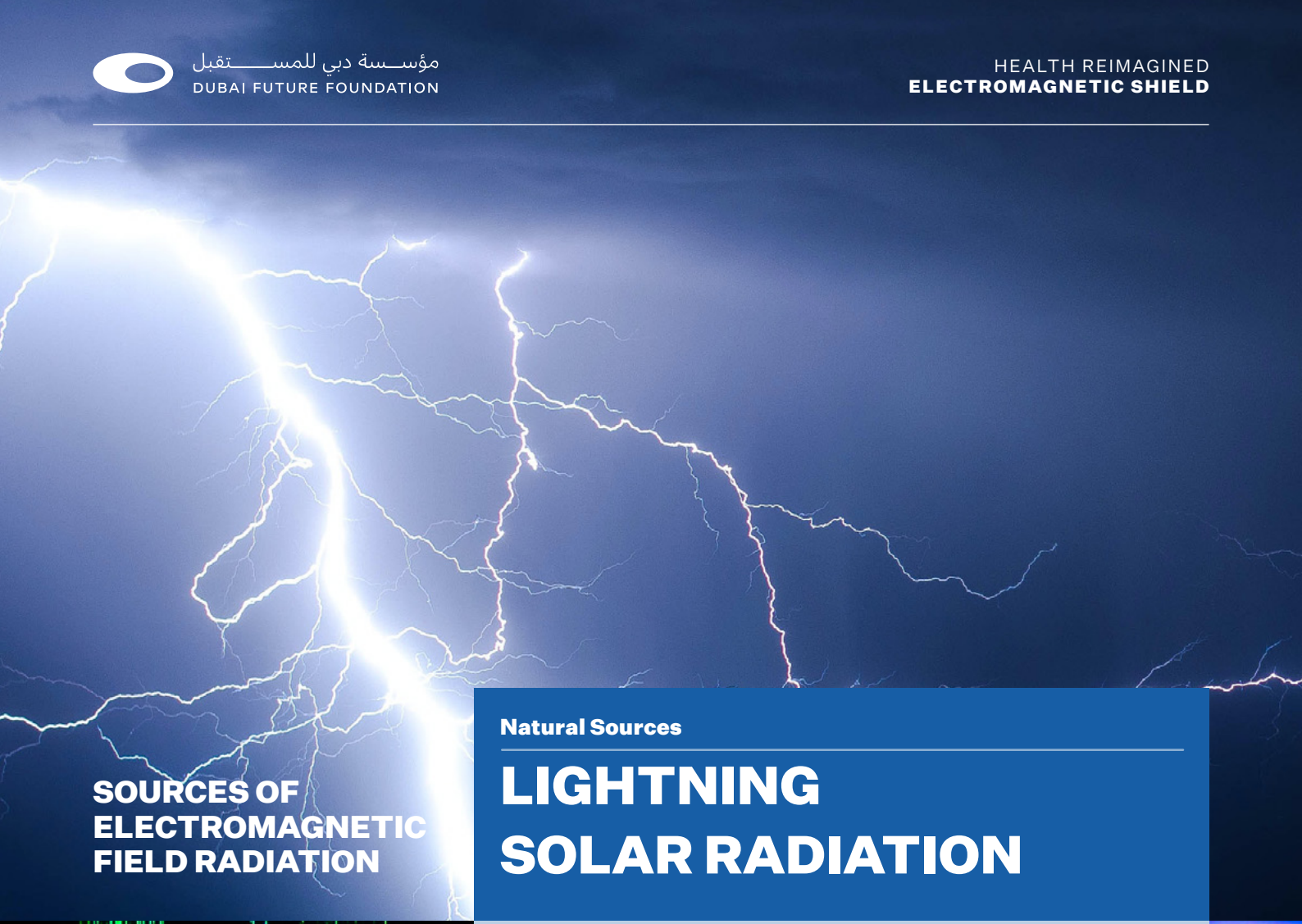
Nanoparticles and other new materials can replace or work in tandem with conventional methods of blocking EMI, such as Faraday cages,[283] EMI gaskets and carbon-fibre concentrated composites.[284] These technologies provide protection by absorbing electromagnetic energy and spreading it across conductive materials. Such EMI-cancelling materials can be used in miniaturised devices, including cardiac, cochlear and neural implants.[285] As the world becomes more dependent on powerful embedded systems, advanced EMI shielding through material science can prevent costly and potentially hazardous errors and outages.

BENEFITS

Protection of essential services. Reduction of the potential risk of harm to human health and the cost of outages.

RISKS

False confidence in electro-magnetic devices leading to exposure beyond sensible limits. A lack of global standards aiming to limit exposure to potentially harmful devices at source.



SOURCES OF ELECTROMAGNETIC FIELD RADIATION

Natural Sources

LIGHTNING
SOLAR RADIATION

Artificial Sources

MICROWAVES
ELECTRIC MOTORS
MOBILE PHONES
RADIO
POWER LINES