Finding new ways to harness the elements and meet our energy requirements without detriment to future generations requires ingenuity and dedication. We are working with companies and governments around the world to design, install and maintain facilities that help us achieve sustainable energy targets safely and responsibly.

INTRODUCTION
Fugro facilitates, drives and supports sustainable energy projects throughout the world. We provide a truly integrated package of services, based on the provision of critical knowledge and essential operational support.

We supply the data and services that enhance the safety, efficiency and reliability of design, construction and maintenance activities which, in turn, add value and assurance to every stage of your sustainable energy project.

THE FUGRO GROUP
In diverse locations and environments, onshore and offshore, Fugro companies acquire and interpret earth and engineering data, provide specialist consultancy support, and assist in the design, construction and maintenance of the world’s infrastructure, buildings and facilities.

Fugro works with you, supporting each stage of your operation, from site assessments and planning, through design and construction, to the long-term operation and maintenance of assets and networks. Our knowledge and resources are often key to the safe, reliable and responsible operation of facilities.
SUSTAINABLE ENERGY SERVICES

Diverse technologies are used around the world to turn natural sources of energy into reliable contributors to our power supply needs. With significant investment in infrastructure and technology, performance is paramount, which is why energy companies and contractors trust Fugro to deliver project-wide professionalism, efficiency and value.

OFFSHORE WIND
Our total package of geological, geophysical, geotechnical, environmental, metocean and consultancy services, along with design, engineering and marine construction support, makes us a valuable partner in offshore wind projects.

ONSHORE WIND
We provide technical expertise and global resources to deliver data, advice, support and project efficiencies, regardless of the size and location of onshore wind facilities.

BIOMASS
We contribute to the design and construction of safe, efficient biomass facilities through highly accurate mapping solutions and advanced survey data acquisition and interpretation.

HYDROELECTRIC
Our full life-of-project service provision encompasses aerial mapping, detailed site investigations, laboratory testing and comprehensive risk assessment to deliver project-wide assurance.

SOLAR
Our unique tools enable the potential of solar power-generating facilities to be assessed and their efficiency optimised.

GEOTHERMAL
Our geothermal consultancy, site surveys, mapping, modelling and diverse site investigation techniques ensure that solutions are appropriate, robust and safe.

CARBON CAPTURE AND STORAGE (CCS)
Using geotechnical, survey and geoscience services, we help characterise and select suitable sites. Thereafter, we provide operational and post-injection monitoring as well as legal and permit support.

WAVE & TIDAL
Our turnkey solutions integrate the full range of data acquisition, interpretation and consultancy services, together with foundation engineering and installation support for challenging wave and tidal projects.

NUCLEAR
From pre-build, planning and licensing advice, through detailed site assessments, engineering, design and construction services to long-term monitoring, we help to deliver safe and secure power plants and spent fuel storage facilities.
The location, foundation design, cabling and installation of offshore wind farms require specialist knowledge, skilled people, fit-for-purpose vessels and dedicated equipment, able to operate in challenging environments. Fugro provides a complete life-of-project suite of services, delivering successful offshore renewable energy facilities around the world.

**OUR EXPERTISE**

Fugro has extensive, in-the-field experience, providing detailed seabed analyses and accurate assessments of year-round operational conditions for offshore windfarm sites.

We have worked as active partners in the design and installation of foundations and infrastructure on numerous projects around the world, enhancing understanding of geological, geotechnical and environmental risks. Our input facilitates the decision-making process from initial concepts to detailed designs, whilst our dedicated vessels, jack-up platforms and purpose-built equipment supports the safe installation and cost-effective operation of facilities.

**BENEFITS OF WORKING WITH FUGRO**

Fugro’s extensive knowledge of the marine environment, along with its resources and technical expertise, yield substantial cost and safety benefits.

Accurate, reliable data support the decision-making process, remove uncertainty in the design, development and installation of facilities and ensure their long-term, safe operational performance. By understanding the critical factors in establishing correct technical solutions, and integrating services and solutions with a single point of responsibility, we can add measurable value at each stage of your project.
Our input begins at the feasibility stage and continues through the design, construction, installation, operation and eventual decommissioning and removal of offshore wind structures and their infrastructure.

FEASIBILITY STUDIES & SITE INVESTIGATION
Fugro gathers known information, and acquires, processes and interprets new geological, geophysical and geotechnical data to assist in assessing the suitability of offshore sites.

- Desktop studies and site screening
- Metocean desk study and measurements
- Atmospheric modelling to support resource assessment
- Marine environmental services
- Geophysical and hydrographic surveys
- Ground risk assessments and geohazard analysis
- Preliminary geotechnical surveys
- Regional environmental studies e.g. fishing, birds, mammals, noise and shipping.
- Unexploded Ordnance (UXO) surveys
- Environmental laboratory analysis
- Baseline noise measurements
- Terrestrial surveys to support landfill site assessment
- Floating LiDAR

DESIGN & ENGINEERING
The integrity of offshore wind facilities depends on the integrated design and engineering of windmills, foundations, cable solutions and logistics, especially in challenging environments.

We provide a complete picture of every critical element, informing the planning, design and structural engineering phases of the entire project.

- Geophysical and geotechnical surveys
- Laboratory testing including soil dynamics testing
- Metocean criteria to support operational planning and engineering
- Atmospheric, hydrodynamic and wave modelling
- Instrumentation and installation of met towers to monitor wind, wave, currents and water-levels
- Construction survey models and detailed reports
- GIS-based ground models
- Foundation option evaluation
- Structural and foundation monitoring
- Geotechnical engineering services
- Cable route selection, design and instrumentation

MARINE CONSTRUCTION & OPERATIONAL SUPPORT
Fugro is a recognised specialist in marine construction, especially in challenging environments.

We deploy dedicated vessels, jack-up platforms, equipment and personnel to deliver:

- Offshore foundation drilling, piling and installation services
- Satellite positioning and surveying
- Scour and environmental monitoring
- Weather forecasting
- GIS data management
- Mesoscale atmospheric, hydrodynamic and wave modelling
- Real-time metocean data acquisition and online distribution
- Subsea survey, inspection, operations and maintenance services using ROV
- Underwater noise monitoring and mitigation
- Seabed cable tracking and burial depth measurement
- Biofouling studies and solutions
- Cable crossing construction
- Foundation instrumentation and analysis
- Decommissioning services
With sites becoming more challenging and wind farms more sophisticated, due diligence in economic, regulatory and environmental matters is vital. Fugro provides essential data along with technical and logistical insight, enabling taller, heavier turbines, more extensive transmission systems and more challenging development opportunities, such as dikes and built-up industrial areas.

**OUR EXPERTISE**

Fugro has provided consultancy support, geotechnical, geospatial and geophysical data acquisition, data interpretation and modelling, dynamic soil property profiles and environmental assessments to numerous wind farm projects around the world.

Our input enables informed decisions to be made about the optimum location and design of onshore wind farms, and the development of farms to be carried out safely and efficiently.

**BENEFITS OF WORKING WITH FUGRO**

Fugro seamlessly integrates a wide range of specialist disciplines, enabling us to act as a strong and reliable partner on large-scale onshore wind projects.

Our technical expertise, global resources and project management combine in a rational and efficient way, delivering data, advice, support and project efficiencies, often in challenging environments and to tight time schedules. Regardless of the size or location of the project, Fugro delivers.
ONSHORE WIND

Our integrated package of specialist services helps from the initial locating of onshore wind facilities to their eventual decommissioning, minimising their impact on the environment and existing infrastructure, and contributing to their safe and efficient operation.

SITE SELECTION
Fugro is qualified to conduct detailed assessments of proposed sites to establish their suitability for wind generation, the environmental impact of any development, site access and the criteria required to design and engineer solutions.

- Digital elevation data and land cover imagery to aid wind farm siting
- Atmospheric modelling to support resource assessment
- Environmental Impact Assessments (EIA)
- Landscape conservation support planning
- Airborne and terrestrial topographical surveys
- Archaeological site investigations
- Safety zone studies
- Baseline noise measurements
- Shadow flickering studies
- Feasibility study for dikes

GEOTECHNICAL & GEOPHYSICAL SITE INVESTIGATION
Fugro has half a century of experience in geotechnical and geophysical survey techniques.

We have pioneered technology that acquires, processes, interprets and presents vital data about subsurface conditions. We provide comprehensive testing and analysis expertise, and supply everything from CPT trucks to specialist laboratories.

- Drilling of geotechnical boreholes
- Cone Penetration Testing (CPT)
- Seismic downhole, crosshole and Cone Penetration Testing (SCPT) to determine dynamic soil properties
- Borehole imagery and geophysics
- Geophysical methods for subsurface characterisation and cavity detection
- Geotechnical laboratory testing and analysis
- Foundation recommendations for wind turbines, construction site and supporting infrastructure
- Geohazard analysis
- Vibration prognosis
- Hydrogeological consultancy

CONSTRUCTION & OPERATIONAL SUPPORT
Fugro provides a range of services designed to assist site development and support the construction and eventual operation of facilities.

- Meteorological forecasting and monitoring
- Satellite positioning
- Geo-monitoring (settlement and compaction control)
- Thermal conductivity tests for energy cable design
- Static and dynamic plate load testing for the design of heavy haul roads and crane positioning locations
- Cable route surveys
- Data reporting
- Project management for geotechnical services
- Geospatial systems support
- GIS analysis and geospatial data management
- Geotechnical consultancy
- Pile load testing
- 3D laser control measurements/deformation analysis
- Structural and foundation monitoring
NUCLEAR

Nuclear power plants and waste storage facilities require a careful characterisation of potential geologic hazards, and earthquake-resistant geotechnical design. Fugro assists in the evaluation of sites and plants by providing accurate data on ground conditions and potential hazards, with consultation services based on decades of experience.

OUR EXPERTISE

Fugro works closely with stakeholders including regulatory agencies to plan and implement multidisciplinary projects with uncompromising standards of quality, safety and efficiency.

We maintain a dedicated nuclear Quality Assurance Program, ISO 8001 accreditation, Health, Safety and Environmental programs and training. We have performed site licensing studies and delivered advanced standard plant designs. We have developed new guidelines for international regulatory agencies pertaining to seismic and geologic hazard assessment and provided monitoring at and near development sites.

BENEFITS OF WORKING WITH FUGRO

Over the years, we have established numerous mutually beneficial international relationships with several branches of the nuclear industry.

We integrate our own specialist knowledge, capabilities and resources to provide streamlined solutions to data acquisition, processing, presentation and application. We work closely with owners and licencees to develop practical approaches to addressing regulatory criteria through comprehensive analysis and reporting; and we can serve as a technical liaison with regulatory authorities and plant technology vendors, when required.
NUCLEAR

Our comprehensive seismic hazard studies, sophisticated ground motion calculations, integrated site and laboratory analyses, geotechnical engineering and reporting are all compliant with nuclear industry standards and regulatory criteria.

PRE-BUILD SUPPORT, PLANNING & LICENSING SERVICES
Fugro provides services that support clients in:

- Project planning and advice
- Formal regional siting and ranking studies
- Early Site Permit (ESP) applications
- Construction and Operating Licence (COL) applications
- Geologic hazard data collection and assessments
- Geophysical surveys and site dynamic response
- Regional and site-specific fault and seismic source characterisation
- Detailed site geotechnical characterisation (field and laboratory)
- Dynamic slope and foundation stability
- Liquefaction risk assessment
- Probabilistic Seismic Hazard Analysis (PSHA)
- Preparation of safety analyses reports
- Environmental Impact Assessment (EIA)
- Environmental survey and laboratory analysis
- Biofouling studies and solutions

ENGINEERING & DESIGN SERVICES
For detailed investigation, Fugro is able to acquire the comprehensive data necessary to engineer optimal solutions and accommodation of site parameters to standard plant design.

This can include:

- Airborne mapping and terrestrial surveys
- Geophysical surveys
- Geotechnical and geoenvironmental testing
- Geotechnical engineering
- Construction Materials Testing (CMT/NDT)
- Construction mapping
- Soil-Structure Interaction (SSI)
- Foundation field design and testing
- Onshore, nearshore and offshore geotechnical surveys
- Accredited Cone Penetration Testing (CPT)
- Project management
- Cyclic soil laboratory testing

CONSTRUCTION & OPERATIONAL SUPPORT
Fugro provides support throughout the design, construction and operation of plants, including developing, manufacturing and operating specialist tools that meet site-specific construction requirements.

Our range of services includes:

- Geotechnical instrumentation
- Marine vertical shaft drilling and installation services for cooling and intake structures, up to 8 m diameter
- Static and bi-directional foundation load testing and analysis
- Geologic mapping and surveys
- Field testing of fill and foundation excavations
- Quality control
- Nondestructive testing of concrete
- Laboratory materials testing
- Marine environmental monitoring
- Intake biofouling studies
Wave and tidal power has vast potential to provide a clean source of energy and meet renewable energy targets. However, the economic viability and testing phases prior to commercial sanction, and the harsh environmental conditions of suitable sites present considerable challenges. Fugro’s expertise and technology facilitates the delivery of appropriate solutions through consenting, design and engineering services.

OUR EXPERTISE
Fugro provides a fully integrated, turnkey solution that covers all phases of wave and tidal renewable energy developments from site selection and feasibility through to EIA consent and construction.

This includes the provision of survey services including, geophysical, geotechnical and environmental as well as data interpretation and integration, ground risk assessments and geohazard studies, metocean measurements and monitoring solutions, foundation engineering, marine construction support and systems performance evaluation. Consultancy services include, feasibility studies, consenting, consultation, post-consent monitoring, management plans and decommissioning plans.

BENEFITS OF WORKING WITH FUGRO
Fugro provides an integrated package of consultancy and survey services, project-critical data, fit-for-purpose resources, technological expertise and in-the-field experience.

In this way, we provide cost-efficient solutions to enhance the consenting of, as well as the design, installation and maintenance of, wave and tidal devices. By identifying and mitigating project risks, Fugro helps safeguard project schedules and profitability.
Providing detailed environmental and geological knowledge, with specialist engineering services, marine construction support and long-term monitoring capabilities, Fugro is the ideal partner on technically and logistically challenging wave and tidal energy projects.

FEASIBILITY STUDIES & SITE INVESTIGATION
Fugro gathers known information, and acquires, processes and interprets new geological, geophysical, metocean and environmental geotechnical data to assist in assessing the suitability of sites for wave or tidal devices.

- Mapping of constraints and risks
- Initial desktop studies and site visits
- Resource assessment through regional/local modelling
- Characterisation of metocean conditions to support project planning
- Geophysical and hydrographic surveys
- Ground risk assessments and potential geohazard identification
- Unexploded Ordnance (UXO) surveys
- Environmental sampling and testing

ENVIRONMENTAL, CONSENTING AND ASSESSMENT
Fugro provides environmental consenting, assessment, and consultation advice and support for all phases of development from site selection and feasibility, through the Environmental Impact Assessment (EIA) process, to consent application and post-consent monitoring and decommissioning plans.

- GIS and data management
- Survey data collection and monitoring including geophysical, geotechnical, metocean, ecology, birds and marine mammals
- Pre-consent support including scoping, EIA, HRA, regional environmental assessments, and related application documents and licences
- Post-submission/consent support including marine licences, management/monitoring and decommissioning plans, consent conditions support and ad hoc advice and services
- Cable and route selection, design and installation methodology
- Geotechnical engineering services

DESIGN, ENGINEERING, CONSTRUCTION & OPERATIONAL SUPPORT
Fugro provides detailed surveys and geoconsultancy and is a recognised specialist in marine construction and installation, especially in challenging environments.

We deploy dedicated vessels, jack-up platforms, equipment and personnel to deliver:

- Marine engineering construction support
- Foundation drilling and installation
- Jack-up support services
- Satellite positioning services
- Survey and inspection of cable burial depth
- Subsea services using ROVs, tracked vehicles, ROTVs and divers
- Metocean measurement profiling software and consultancy
- Meteorological monitoring
- Environmental monitoring
- Unexploded Ordnance (UXO) surveys
As enthusiasm for geothermal energy continues to grow, increasing numbers of governments and construction companies are investing in geothermal power plants and infrastructure. Fugro contributes to the safe planning, design, construction and operation of these facilities, helping communities gain access to a clean, natural alternative to non-renewable fossil fuels.

**OUR EXPERTISE**

Fugro provides a total package of geothermal exploration and exploitation solutions designed to minimise and mitigate risks, manage the development process and optimise returns on project investment, e.g., through cascade system technology and design.

We provide global expertise in end-to-end consultation and planning; with the latest satellite, aerial and ground-based geophysical survey techniques and high-level imaging, with 2D and 3D mapping and modelling of geothermal reservoirs.

**BENEFITS OF WORKING WITH FUGRO**

Fugro’s seamless integration of multidisciplinary expertise provides customers with a single point of reference across large-scale projects.

Technical know-how, global resources and project management combine in a rational and efficient way. We have the insight, the technology and the worldwide resource network to deliver project efficiencies, regardless of the size or location of the geothermal project.
GEOTHERMAL

Fugro’s experience in the geothermal sector is based on over fifty years operating in the petroleum exploration and production industry, which, together with its integrated service delivery, makes it the ideal partner for geothermal projects.

CONSULTANCY

Fugro conducts studies to assess project feasibility; makes production assessments to aid the decision-making process; provides a business model with recommendations; draws up specifications and tender documentation; looks after permits and regulations and provides technical consultation throughout the development of facilities.

Our project-wide capabilities include:

- Geological and hydrogeological investigation
- Petrophysical interpretation (permeability, porosity)
- Remote sensing geological and terrain (morphology and vegetation) interpretation
- Time-Domain ElectroMagnetic (TDEM) geological and geothermal interpretation of prospects
- Radiometric, magnetic and magnetotelluric (MT) geological and geothermal interpretation of prospects
- 2D/3D seismic interpretation
- Static reservoir modelling: structural, sedimentological and petrophysical
- Reservoir evaluation and volumetrics
- Dynamic reservoir modelling
- Doublet spacing design
- Plant site and foundation design
- Ground motion and subsidence modelling
- Systematic assessment of inactive oil and gas boreholes
- Fieldwork and site supervision
- Project management

SITE INVESTIGATION & DATA ACQUISITION

We conduct detailed geological and geophysical site investigations to confirm the feasibility and suitability of sites for development to geothermal energy use.

Our range of satellite, aerial and ground-based geophysical investigation techniques optimise the degree and quality of information about the proposed site. This informs development solutions as well as safety and operational criteria.

- Time-Domain ElectroMagnetics (TDEM)
- Magnetotellurics (MT)
- GPS-positioned gravity
- Site investigation for foundation design
- - Boreholes
- - Cone Penetration Testing (CPT)
- - In situ testing
- Shear wave velocity profiling
- Thermal response testing
- Injection and pumping tests
- 2D & 3D seismic reflection
- Crosshole and tomographic boreholes services
- Petrophysical wireline logging and well site geology
- Geophysical assessment of engineering possibilities
- Vertical seismic profiling (VSP)
- Remote sensing
- Radiometrics
- Magnetics