The technical and financial viability of connecting power generators or industrial units to the electricity network is a key factor in the viability of a project.

The grid connection for power generators, both thermal and renewable, must provide the ability to export generated energy in a reliable manner and in compliance with the requirements of the relevant grid code(s).

The grid connection for industrial units must provide a reliable supply that enables a satisfactory operation of the industrial process.

At the feasibility stage of a project, it is important to examine all aspects of the grid connection, balancing technical engineering with analytical studies to demonstrate grid code compliance and reliability, the cost benefits of alternate options and the ability to achieve consents and connection agreement. Detailed engineering and power system studies follows agreement of the concept for the optimal grid connection.

As a well-respected, international multi-disciplinary consultancy, Ramboll advises on all aspects of the grid connection, bringing all the required expertise in one coordinated team of specialists. Ramboll is particularly experienced in the connection of:

• Renewable and hybrid generators, including wind generators, solar PV plant and hybrid plant including wind turbines, solar cells and energy storage
• Thermal generators
• Oil and gas facilities and other major industrial units

Ramboll is experienced in providing advice relating to both large capacity grid connections to electricity transmission networks or smaller capacity grid connections for embedded connection within electricity distribution networks. Our services can be tailored to client-specific needs and range from technical due diligence, specialist technical studies, feasibility studies and concept engineering through to detailed engineering design and project and construction or commissioning management.

Our expertise covers the full range of services needed to provide services relating to grid connections. These include:

• Technical and environmental due diligence
• Transmission line and/or cable routing, including environmental impact assessment (EIA) and consenting activities
• Power system studies, including:
  • Steady state load flow and short circuit
  • Reactive compensation
  • Dynamic and transient stability analysis
• Grid Code compliance
• Harmonic studies
• Insulation coordination, lightning and switching studies

For further information, please visit www.ramboll.com or contact us

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• Design and analysis of earthing and lightning systems relating to new and existing sites using CDEGs analysis software
• Technical guidance and advice relating to Generation Connection Agreements of embedded generation. This includes:
  • Identification of suitable grid connection points
  • Assessment of the strength of both transmission and distribution electrical networks in relation to their ability to support new embedded generation. The team is fully aware that grid connection considerations at an early stage can prove to be particularly useful during the site selection process
• As part of design considerations, the team has experience in considering aspects which include network voltage suppression related to energisation, the effects of system and grid faults, inrush currents associated with the site transformers and the voltage suppression at the point of common coupling on the network
• The team can also advise on connection standards including the Engineering Recommendation (ER) of P28 and G59 to ensure that designs are fully compliant
• Preparation of electrical protection scheme functional specifications for all types of electrical equipment. Experience in setting of protection associated with ER G59 for the connection of embedded generators
• Statistical assessment of plant availability
• Technical feasibility studies, concept engineering and engineering design for:
  • Onshore substations including civil and primary plant engineering covering primary plant layout, specification and engineering design for switchgear (AIS and GIS), transformers and reactors, etc. up to 500kV
  • Offshore substations, including the primary plant layout, specification and engineering and including detailed engineering design of the Offshore Substation Platform (OSP)
• Protection and control, including determination of protection philosophy, preparation of key diagrams and protection relay setting studies
• Offshore and onshore cable routing and engineering, including geo-technical and seabed assessment
• Transmission lines, including specification of conductor configuration, line profile and detailed tower and foundation design
• Fault and failure investigation and analysis
• Project, construction and commissioning management or full owner’s engineer services
• Advice regarding life-cycle asset management

TECHNO-ECONOMIC ASSESSMENT OF GRID CONNECTION OPTIONS
CUSTOMER Vattenfall Europe Windcraft GmbH
LOCATION Baltic Sea, Germany
PERIOD 2016
SERVICE PROVIDED The provision of a techno-economical assessment of the transmission options associated with the development of two offshore wind farms off the German coast.

KILGALLIOCH 240MW ONSHORE WIND FARM GRID CODE COMPLIANCE STUDIES
CUSTOMER Iberdrola Engineering & Construction
LOCATION Kilgallioch, Scotland
PERIOD 2016
SERVICE PROVIDED Grid code compliance studies covering load-flow, dynamic voltage control and fault ride through capability.

REDHOUSE ENERGY STORAGE PROJECT
CUSTOMER Bolshoy Renewables Limited
LOCATION Scotland
PERIOD 2018
SERVICE PROVIDED Transformer energisation, harmonics, voltage flicker and earthing studies in relation to the connection of a new battery storage facility.