SHAPING THE FUTURE OF ENERGY
CONSULTANCY AND DESIGN OF INTEGRATED ENERGY SOLUTIONS

WWW.RAMBOLL.COM/ENERGY
BUILDINGS
Buildings form a fundamental part of our lives by shaping our communities and daily activities.

For these reasons, Ramboll’s design philosophy is always to make room for the human experience. As one of Europe’s top 3 buildings designers with decades of experience in the global market, we create visionary, sustainable, and award-winning buildings that improve life for users and enhance the surrounding landscape. Read more at: http://ramboll.com/buildings

TRANSPORT
Mobility fuels economic and social development and with 50% of the world’s population now living in urban areas, efficient and reliable transport systems are essential.

To meet this need, Ramboll has been working on some of the world’s largest, most innovative infrastructure projects and is the leading consultancy in the Nordic market.

We create value for transport authorities, contractors and local authorities by providing multidisciplinary technical excellence and minimising resource usage. Read more at: http://ramboll.com/transport

ENERGY
With security of supplies, climate change, energy efficiency and resource scarcity as top priorities on the global agenda, there is a general push towards renewables, although conventional energy will continue to play a significant role in the energy mix in the coming years. As a consultancy, Ramboll is at the forefront of addressing the green transition and offers a holistic approach to energy that supports the sector on the journey towards more sustainable solutions. Read more at: http://ramboll.com/energy

PLANNING & URBAN DESIGN
Ramboll’s holistic approach to urban development encompasses strategy, planning and world class technical design services and is based on an integrated multidisciplinary skills base.

We have an extensive track record working with a number of the world’s largest cities to create liveable, sustainable, and implementable urban development solutions that are fully adapted to the local context. Read more at: http://ramboll.com/planning-and-urban-design
COUNTRIES WITH PERMANENT OFFICES

NORDIC REGION: Denmark – Copenhagen, company head office, Finland, Greenland, Norway, Sweden
EUROPE: Belgium, Cyprus, France, Germany, Italy, Netherlands, Poland, Romania, Russia, Spain, Switzerland, United Kingdom
MIDDLE EAST: Kingdom of Saudi Arabia, Qatar, United Arab Emirates
ASIA-PACIFIC: Australia, China, India, Indonesia, Malaysia, Myanmar, New Zealand, Singapore
THE AMERICAS: Brazil, Canada, Mexico, USA
AFRICA: South Africa

ENVIRONMENT & HEALTH
As a globally recognised environmental and health consultancy, we have earned a reputation for technical and scientific excellence, innovation and client service. Advances in science and technology and evolving regulatory, legal and social pressures create increasingly complex challenges for our clients. We evolve to keep pace with these changes – by adding new services, contributing to scientific advances or expanding geographically.
Read more at: http://ramboll.com/environment-and-health

MANAGEMENT CONSULTING
National, regional and local authorities are responsible for issues that affect us all; from healthcare, education and day care to strategic planning of infrastructure and climate initiatives. Drawing on 500 management experts, Ramboll acts as a trusted partner to public administrations, creating the insights needed to make informed strategic decisions that promote stronger societies.
With unprecedented levels of competition in the global economy, Ramboll focuses on empowering private sector customers with expertise and powerful management tools.
Read more at: http://ramboll.com/management-consulting

WATER
Water is essential to life and one of our most precious resources. Working with municipalities, utilities, and industrial clients, Ramboll draws on proven multidisciplinary expertise to manage the most challenging water resources, wastewater, and storm water issues.
We integrate treatment process selection and engineering, operational services, and regulatory management and planning to deliver innovative solutions that benefit both industries and society.
Read more at: http://ramboll.com/water
A future cost-effective energy system based on renewables requires flexibility and integration of electricity, gas and district energy with a high degree of sector coupling. Ramboll has a holistic view of the energy system, as well as in-depth technical insight into the elements of the system. With this background we support our clients in the transition towards green energy.
ENERGY
ABOUT US

REVENUE IN 2018
EUR 163 MILLION

NUMBER OF EMPLOYEES
Ramboll Energy has approx. 1,800 specialists working dedicatedly with renewable and conventional energy.

GEOGRAPHICAL SPREAD
Ramboll has 55 energy offices in 14 countries, including Denmark, Sweden, Norway, UK, Germany, Poland, Switzerland, USA, Canada, Qatar, UAE, India, Singapore and China.

RANKINGS
Ramboll is ranked no. 1 in Cogeneration, no. 1 in Towers & antennae, no. 2 in Hazardous waste, no. 3 in Wind generation and no. 8 in Offshore and underwater facilities in the ENR survey of top international design firms (Dec. 2018 rankings).

Ramboll has more than 50 years of experience in the planning, design and implementation of energy solutions and is among the ten leading energy consultancies in Europe. We focus on adding maximum value both to our clients and society at large through an integrated and multidisciplinary offering that cuts across the whole value chain.

The projects that we carry out for our clients typically provide the overall society benefits of securing the supply of energy, reducing climate impact, improving energy efficiency and countering resource scarcity. In this way, we contribute to a sustainable development of the energy sector.

As a people-based company, we believe that the key to our success lies in the motivation, persistence, skills and commitment of our employees. With offices around the world, we combine global knowledge with local presence. Being an international company enables us to mobilise large project teams across geographies and disciplines.

Our services are based on integrity, deep specialist insights and absolute independence of third party providers.

ONE OF THE LARGEST WASTE-TO-ENERGY FACILITIES ON EARTH IN ONE OF THE WORLD’S SMALLEST COUNTRIES
Ramboll is part of a multidisciplinary consultancy technical team for the planning, design and construction management of one of the world’s largest waste-to-energy facilities, which will enable Singapore to reap the benefits of energy and resource recovery maximisation for years to come (image p. 7).
OUR APPROACH

A PARTNER FOR CHANGE

WHAT OUR CLIENTS GET

- A change partner who helps our clients think, design and implement their green energy transition
- A committed partner who takes end-to-end responsibility of our clients' projects
- A partner who listens to our clients' needs and challenges before designing the best solutions
- Proactive out-of-the-box and innovative thinking, translating ideas into pragmatic solutions
- A partner of integrity, offering independent expert consultancy
- Integrated energy solutions based on an understanding of the interaction between the different sectors and technologies, technical insight and multidisciplinary competencies
- Access to strong technical capabilities and best practice

The energy sector is shifting from a system based on fossil fuels to one exploiting renewable energy. As sustainable society consultants, we bring our clients one or more steps closer to a renewable energy system, and we optimise energy efficiency, systems, technologies and processes.

We enable people and organisations to design and implement sustainable change with a lasting impact – for both business and society.

Driving green energy transition should always be built on a holistic understanding as well as in-depth expertise and experience. And it should be built on close engagement between us and our clients because no change encounter is the same, and each initiative, challenge and dialogue therefore calls for depth, creativity and perspective.

We seek long-term relationships with our clients and have worked for many of them for more than 30 years.

We are committed to guiding our clients and their organisations into a better state and to always delivering sustainable energy solutions that are innovative, integrated and flexible to suit the unique challenge at hand.
HOW WE WORK

PROJECT EXECUTION MODEL
Ramboll’s ambition is to be known as the consultancy and engineering partner that sets the industry benchmark for excellence within project management. We are committed to exceeding client expectations and creating successful partnerships by consistently delivering optimised solutions, on time and within budget.

To achieve this, we have a common approach to project management across the Ramboll Group. This includes a stage gate model covering all project phases and practical tools that are based on internationally recognised standards and best practices developed by Ramboll specialists.

DELCIVERING TECHNICAL EXCELLENCE

From idea to operation
We assist our clients on all aspects of a project, ranging from planning and engineering design, to long-term operation & maintenance and lifetime extension. We strive to have a close, proactive dialogue and engagement through the entire project life-cycle.

Owner’s Engineers
We typically act as the Owner’s/Developer’s Engineer or Lead Advisor on multi-million EUR energy investment projects, assisting our clients with project management, technical expertise and engineering, while securing a solid contractual basis (commercially and technically) for the client vis-à-vis contractors/suppliers.

Strong focus on risk management
Risk management lies at the centre of our project management model and is conducted in order to anticipate possible challenges in relation to time, cost and quality. It involves the identification of risks and the proactive initiation of risk control and risk mitigation measures.

Unlike most other consultancies, we work both as strategic advisors and are deeply involved in the implementation phase of our projects, drawing on our hands-on experience of the operation and maintenance of energy facilities.
AVEDØRE POWER PLANT, DENMARK
– ONE OF THE WORLD’S MOST EFFICIENT MULTIFUEL POWER PLANTS
Since the conception of Avedøre Power Plant’s Unit 1 in the 1980s, Ramboll has been a regular advisor to the owner Ørsted on a wide range of specialist issues. We have contributed to the development of the plant’s continuous and flexible adaptations to new fuel types, leading up to today’s state-of-the-art multifuel production of power and heat for Copenhagen’s district heating system (image p. 13).

Our portfolio is unmatched by other consultancies and includes a wide range of projects developed across geographies. Each project represents a different challenge and a unique endeavour with specific requirements which demanded multidisciplinary competencies and knowledgeable management for its successful implementation.

Technology is our passion, and we maintain an unwavering engineering focus in everything we do. We are passionate about delivering world-class, high-quality solutions to our clients.

Through Ramboll’s Project Excellence Platform, we bring together all aspects of project delivery and the associated enablers of continuous people development, clearly defined processes and governance, as well as effective knowledge sharing. This serves to maximise benefits for our clients by creating high value solutions, delivering project certainty, and nurturing strong and enduring relationships.

We enjoy a high client satisfaction rate as we are able to meet key success criteria such as deep technical insight and solutions tailored to our clients’ requirements.
AMAZING AL SHAHEEN,
QATAR
This complex field development project called for the drilling of more than 160 production and water injection wells and the construction of 15 new platforms in total. Ramboll was the in-house engineering consultant to Maersk Oil for seven years. Ramboll was responsible for the brownfield design including modifications, completing over 3 million man-hours. Qatar holds the world’s third largest proven gas reserves; and today, Al Shaheen produces around 40% of Qatar’s oil and gas output, contributing significantly to the country’s economy and energy security.
We are a one-stop-shop of energy consultancy and design services. True to our smart engineering approach, our services include top-of-the-line digital solutions. We have strong expertise on the full spectrum of technologies and all parts of the value chain from cross-cutting strategy development & planning to production, transmission and distribution:

- Energy strategy & planning
- Wind energy
- Solar energy
- Waste-to-energy
- Power generation
- Oil & gas installations
- Gas & LNG
- District energy
- Power transmission and distribution
- Towers
- Energy storage
ENERGY STRATEGY & PLANNING

DRAWING ON CROSS-SECTOR AND MULTIDISCIPLINARY CAPABILITIES

Ramboll is a strategic partner to international and domestic clients offering proven commercial, financial and engineering consulting capabilities to assist our clients with the development of strategy documents, business cases, policy and due diligence studies.

We add value to projects by having full local knowledge across Europe, North America, Middle East and Asia to provide understanding of the energy lifecycle and the interaction of the different elements in the energy system.

We provide solutions to the challenges of our client: cities, universities, governments and the EU; investors; generators; transmission system operators; distribution system operators; and large consumers.

We offer a core energy strategy and planning team as the single point of contact within Ramboll for the development, execution and implementation of projects globally.

The core team draws on Ramboll expertise in 300 offices in 35 countries to offer our clients the advantage of a global platform with leading energy sector experts and local knowledge across Europe, North America, Middle East and Asia to provide the right knowledge for the right geography.

The team draws on Ramboll’s multidisciplinary capabilities, e.g. within buildings, environment & health, management consulting and transport.

STRATEGY DOCUMENTS
• Energy supply & demand forecast
• Energy supply strategies
• Energy delivery planning and design
• Storage solutions
• Smart energy
• Energy efficiency & demand side management

BUSINESS CASES
• Investment planning
• Circular economy
• CAPEX, OPEX & ABEX assessments
• Lifecycle assessment ISO55000
• CBA - international best practice

POLICY
• Regulatory analysis & compliance
• Security of supply
• Market models
• Subsidies and frameworks

DUE DILIGENCE
• Commercial & financial
• Technical & operational
• Environmental assessment
• Risk assessment
ENERGY MASTER PLANNING AT THE CITY UNIVERSITY OF NEW YORK, US

The City University of New York (CUNY) is the nation’s leading urban public university. It serves over 500,000 students from 25 campuses, 300 buildings and almost 2.5 million square metres of building space, and it has an annual energy spend of nearly USD90 million. OBG, now Ramboll, has been assisting CUNY with their New York City Carbon Challenge since 2007, having developed climate action plans that identify CUNY’s strategy to reduce carbon intensity by 40% by 2030.

CARLSBERG – NEW URBAN DISTRICT IN COPENHAGEN

In 2009, Carlsberg’s production moved to a new site in Denmark, leaving a 330,000 m² industrial site in Copenhagen open for development. It was the vision to create a new sustainable district in Copenhagen with housing, shops and office buildings in harmony with the historical old buildings and the neighbouring districts. Ramboll planned the infrastructure with a focus on sustainable energy supply.
OFFSHORE
Over 60% of the world’s offshore wind turbines rise from foundations engineered by Ramboll.

ONSHORE
We have provided expert input to onshore wind farms with a nominal output of more than 60 GW in +60 countries.

ONSHORE WIND FARM
RASKIFTET, NORWAY
The public utility of Munich in Germany, Stadtwerke München GmbH (SWM), intends to generate sufficient green energy at its plants to cover all energy consumption in Munich by 2025. As part of this endeavour, SWM has invested in several onshore and offshore wind farms in recent years, including Raskiftet Onshore Wind Farm in Norway. On behalf of SWM, Ramboll provided technical due diligence services including yield calculations and was subsequently commissioned for the supervision of the construction process as the Owner’s Engineer.

OFFSHORE WIND FARM
BORKUM RIFFGRUND I
Ramboll contributed to Ørsted’s successful installation of the world’s first offshore wind turbine foundation based on the Suction Bucket Jacket (SBJ) technology. The scope of our work included the design of the SBJ for the offshore wind farm Borkum Riffgrund I, 37 km off the German island of Borkum. The SBJ was designed with three cup foundations that are slipped into the seabed through suction. It can be installed in a single lifting and assembly process, which reduces installation time and its associated costs. It also has a quieter installation, meeting the new noise restrictions set to protect local ecosystems (image p. 19).

With the rapid growth of wind energy production worldwide, Ramboll offers our clients international, multidisciplinary and wind specific competencies. We offer expert services for the different project phases from early feasibility, business case and impact assessment studies to planning, engineering, implementation, commissioning and the subsequent operation & maintenance and eventually life-time extension or decommissioning.

We can effectively manage the entire project or contribute with our expertise in different sub-projects according to our client’s needs. Ramboll is a full-service consultancy and wind energy leader with global knowledge and a network of offices and resources that serve clients locally.
BINHAI AND GUANGDONG OFFSHORE WIND, CHINA
Ramboll is, as the first non-Chinese company, designing one of China’s largest offshore wind farms, SPIC Binhai North H2. The wind farm consists of 100 turbines with a capacity of 400 megawatts. In Guangdong further south, there is an increasing demand for energy as well as an urgent demand to reduce air pollution in the cities. Here, Ramboll has at record-breaking speed designed the first two of 500 offshore wind turbine foundations with a total capacity of 3.2 GW. In total, the wind farms will supply wind energy to more than three million households.
MAKING CLEAN WIND ENERGY AVAILABLE TO 3 MILLION HOUSEHOLDS IN CHINA
With smart engineering at the core of our work, Ramboll is a world leading consultant and auditor, providing a full range of solar services. We assist our clients with comprehensive advice and future-proof solutions based on expert knowledge and state-of-the-art technology.

Solar PV
Our multidisciplinary structure enables us to offer holistic services covering every aspect of a solar PV project worldwide. Specialised teams are assembled from across the entire Ramboll group to ensure that the strongest expertise is applied to each individual project. Our services within solar PV range from expert planning, engineering and project management to resource and financial assessments, as well as other specialist studies including ESIA, grid impact studies, and performance monitoring.

As a one-stop-shop of energy services, we offer singular, modular and tailor-made solutions for individual project requirements throughout the entire project life. With our multidisciplinary approach we provide innovative, efficient and cost-effective solutions for all kinds of solar PV projects, including solar PV power plants for IPPs and utilities, solar PV for commercial clients with self-consumption and solar PV as a substantial part of hybrid energy systems. For every project, we always strive for sustainability and with that in mind, we place the focus on designing long-lasting solutions.

Solar heating
Large-scale plants are a special Scandinavian concept for solar heating, supplying energy to the local district heating network through a heat accumulator. Ramboll has participated actively in the development of these solar heating plants and performed research into the latest technologies and underground storage systems. We also provide consultancy services relating to their integration into existing heating and combined heat and power plants.
BOOSTING SOLAR HEATING IN DENMARK
In cooperation with Ramboll, three Danish municipalities in southern Jutland - Logumkloster, Vojens and Gram - converted to new flexible district heating solutions. For Logumkloster, Ramboll devised a strategic master plan for heat production that considered a series of heat production technologies, including different types of electric heat pumps, absorption heat pumps, solar heating and thermal storage of various sizes, biomass boilers, electric boilers as well as optimisation of existing gas. In Gram, Ramboll assisted our client in tripling the size of its solar heating facility.

SHAMSUNA SOLAR PV, JORDAN
Acting as the Owner’s Engineer for the first utility scale (10 MW) solar PV plant in Jordan, Ramboll provided technical support throughout the whole project including feasibility, development, planning & design, EPC tendering process, construction supervision and commissioning.
WASTE-TO-ENERGY

EXPERIENCE
Ramboll has worked on waste-to-energy projects in 45 countries, providing consulting services for 155 new units and retrofits.

WASTE-TO-ENERGY FACILITY IN LONDON, UK
Ramboll is acting as Technical Advisor to North London Waste Authority (NLWA) in the delivery of its North London Heat & Power Project. Ramboll is leading the design development of a new state-of-the-art 700kt/a waste-to-energy facility with combined semi-dry/wet flue gas treatment to meet Best Environmental Practice. We have also conducted thorough technical assessments of the existing waste-to-energy facility to establish its condition and future expected performance, preparing recommendations for investment requirements and costs over short-term and medium-term horizons.

ICONIC AMAGER BAKKE, DENMARK
Amager Bakke is one of the most efficient waste-to-energy facilities in the world. As the Owner’s Engineer, Ramboll has assisted in the planning and implementation of the 560,000 tpa facility, which produces 20% more energy per tonne of waste compared to the plant that it replaces and has emission levels far below limit values. The facility is fully integrated into the urban setting, surrounded by high-end flats, and features a ski slope and other recreational facilities on the roof (image p. 25).

LEADING WASTE-TO-ENERGY CONSULTANT

As the world population and energy consumption increase there is a pressing need for the reduction of waste generation, high-quality recycling and the use of residual waste for efficient and clean energy generation.

Recovering energy from waste
Ramboll is the world’s leading waste-to-energy consultant with unmatched technical insight.

We have an extensive portfolio of successfully completed projects that involved the planning, engineering, procurement and contract management of waste management facilities. We assist our clients through all phases of the project – from idea to operation – and the combination of our experience and expertise means that we can provide no-learning-curve client support.

Our holistic specialist knowledge covers all aspects of asset management, including upgrades and retrofits, and always with a focus on cost and process optimisation.

Biogas from waste
Organic waste has become an important raw material for boosting biogas production from both manure and sewage sludge. Biogas can be used locally for the generation of electricity and heat or it can be upgraded for injection into the natural gas network or utilised as a transport fuel. Ramboll has many years of experience in the successful implementation of biogas projects. Our technical expertise enables us to handle the specific challenges that arise when using organic waste for the production of biogas.
POWER GENERATION

EXPERIENCE
Ramboll has designed and constructed more than 100 major power plants, including some of the most energy efficient plants in the world and has been instrumental in the ongoing conversion from fossil fuels to biomass.

TECHNICAL ADVISOR FOR POWER PLANT IN SALALAH, OMAN
Ramboll was selected by Oman Power and Water Procurement Company SAOC to be the technical advisor to the electricity off-taker of the Salalah II IPP Power Plant. The project resulted in a highly efficient plant with an energy conversion that went from 32% in the existing plant to 54% in the new plant. The new plant has a lower fuel consumption and reduced emissions.

LYNEMOUTH POWER PLANT CONVERSION TO BIOMASS, UK
Ramboll provided engineering consultancy services to the conversion of Lynemouth Power Plant from coal to biomass. The converted plant exports around 390MW of low-carbon electricity to the national grid. Wood pellets are imported to the plant from global fuel supply markets, via a newly constructed biomass import terminal at the Port of Tyne (Newcastle UK), which along with the power plant and site fuel storage and handling, also fell within the scope of Ramboll’s work (image p. 27).

INCREASING ENERGY EFFICIENCY WHILE REDUCING CLIMATE IMPACTS

As the world shifts towards a sustainable energy mix, there is a need for thermal power generation plants to reduce emissions, by maximising efficiency or alternatively by switching to the use of renewable fuels such as biomass. Similarly, there is a need for plants to operate more flexibly as the level of intermittent energy sources increases.

Ramboll has pioneered the development of innovative power plants worldwide, having particular expertise in high efficiency power plants, biomass and bioconversions, and cogeneration (CHP).

We have extensive experience in the design and implementation of flexible, fuel efficient combined cycle and major thermal power plants, including expertise in supercritical and ultra-supercritical boiler plants.

Our unique position has been acquired through our contribution to the detailed development and implementation processes of some of the world’s most efficient power plants.

Our specialist knowledge covers the full project life-cycle, from early feasibility study stages through to implementation and subsequent operations and maintenance support, failure investigation, and power plant rehabilitation and upgrades. Throughout all phases we always strive to set and achieve the highest standards of health and safety of a project and subsequent plant operation.
As a front runner in the energy sector, Ramboll’s expertise encompasses the full range of knowledge needed to convert coal-fired power plants to various degrees of co-firing or complete conversion, and to construct new units fuelled with biomass, such as straw, wood chips and pellets.
As global energy consumption continues to grow, oil and gas will continue to play an important role in the world’s energy mix for many years to come.

To make it in today’s fast-paced and competitive oil and gas market, companies depend on advanced technical solutions that combine economic efficiency with stringent health, safety and environmental standards in the production and distribution processes. These elements form an integral part of Ramboll’s independent and multidisciplinary consultancy service, which covers the entire asset life cycle – from early phase studies, FEED, detailed engineering, modifications, maintenance and lifetime extension to decommissioning.

We excel in consultancy and have designed offshore structures for industry giants such as Total, ConocoPhillips, INEOS and Equinor since the 1970s.

Ramboll works across the oil and gas sector, covering engineering services within energy & infrastructure consulting, offshore production facilities, onshore production & refining, pipelines, and Gas & LNG.

**REMARKABLE CULZEAN**

The Culzean field was discovered in 2008 and is one of the largest fields in the British North Sea. With temperatures reaching 170 degrees C and the pressure being three times higher than average fields, a platform optimised for these conditions is paramount. Ramboll carried out the detailed design of three jackets for Maersk Oil (now Total).
RECORD-BREAKING POLARILED PIPELINE

This unprecedented 482 km pipeline crossing the Arctic Circle on an extremely uneven seabed connects new fields in the Norwegian Sea with existing infrastructures to secure future energy supply in Europe. The pipeline was installed at water depths reaching 1,265 m, setting a world record for deep water installation of a 36” pipeline. Ramboll was instrumental in designing the pioneering technical solution for the pipeline, incl. FEED, detailed design, route optimisation, pipeline tie-in, geotechnical foundation design, risk and safety, EIA, and interface coordination.

INVESTIGATING TWO CONCEPTS FOR THE TYRA FIELD, NORTH SEA

The Tyra Field in the North Sea has been in production for thirty years, and the facilities are suffering from seabed subsidence, old age and increasing operating expense. Maersk Oil (now Total) was assessing several lifetime extension options to make continued operation feasible. For the Tyra Future redevelopment project, TFU, Ramboll carried out two pre-FEED (conceptual) studies. Concept 1 focused on examining the rebuild of Tyra East into an unmanned satellite producer, while concept 2 investigated an option to rebuild Tyra East as a field centre with new topsides for several of the existing wellhead and riser platforms.
TECHNICAL ADVISOR FOR GAS-TO-POWER PROJECT, MOROCCO

Ramboll was selected by Morocco’s state power and water utility ONEE to act as the technical advisor to a gas-to-power project, in a joint venture with French partner Sofregaz. The gas-to-power project is part of a programme by ONEE to add 6 GW of flexible, largely gas-fired, power generation capacity, 4 GW of interconnectors with neighbouring countries, and 2 GW of pumped hydro, all by 2030. The planned LNG infrastructure and gas-fired power plants will enable Morocco to manage intermittency as it expands renewable capacity to over half of the installed mix in 2030.

GLOBAL FOOTPRINT

Ramboll’s gas & LNG portfolio includes a worldwide geographical footprint, from Europe to Morocco, Uganda, Iraq, Qatar, Yemen and Venezuela.

GAS & LNG

BRIDGING THE GREEN TRANSITION

With modern society relying heavily on energy for its continuance and development, governments and energy companies alike are concerned with finding the right energy mix that will meet the demand while allowing the integration of renewable energy. As a future-driven consultancy, our expertise within energy and renewables can successfully be applied to gas projects, bridging the transition to cleaner energy forms.

Gas forms a substantial part of the energy mix that keeps modern society running today, and will continue to do so in the future.

With origins in a gas-producing country, Ramboll perfectly understands energy providers’ challenges and opportunities. Our holistic approach to gas & LNG solutions considers the socioeconomic, the environmental and the public and political factors that influence the market in order to provide the most profitable and efficient energy solutions in all the projects we are involved in.

Ramboll has provided the gas sector with multidisciplinary engineering solutions for the past four decades. Our expert know-how and unique experience range from onshore and offshore gas production to infrastructure projects.
DEVELOPING A GAS SECTOR MASTERPLAN FOR BANGLADESH

Ramboll was awarded the World Bank sponsored project for the development of the Bangladesh Gas Sector Master Plan, aimed at providing Bangladeshi authorities and state companies with a strategic and technical plan for the long-term development of the gas sector in the country.

TECHNICAL ADVISOR FOR THE BALTIC PIPE

Since finalising a feasibility study in 2016 and the EPII terminal feasibility study in 2017, Ramboll has been the technical advisor for the Baltic Pipe project. The Baltic Pipe is recognised as one of EU’s projects of common interest (PCI) and aims to further strengthen the European internal energy market. The Baltic Pipe will provide affordable, secure and sustainable reliable energy not only in Denmark, Poland and Sweden, but also in Central and Eastern European countries and Baltic countries.
DISTRICT ENERGY

EXPERIENCE
Based on 40 years of experience, Ramboll has provided consultancy services to more than 200 district heating systems worldwide, ranging from small village schemes to city-wide transmission networks.

DELIVERING OPTIMAL SOLUTIONS FOR DISTRICT HEATING AND COOLING SYSTEMS

District energy systems have several benefits including improved energy efficiency, enhanced environmental protection, ease of operation and maintenance, as well as reliability, comfort and superior convenience for consumers.

With our decades of experience, Ramboll is globally regarded as one of the most experienced district energy consultants in the world. We are also one of the very few consultants that offer our clients a full range of services on district energy projects from feasibility studies and planning to follow-up on operation and maintenance.

Based on our interdisciplinary approach, our district energy, waste-to-energy, CHP, renewable energy and building installation teams work closely together to provide optimal use of heating and cooling sources.

We use our expertise to offer our clients more sustainable solutions based on the most advanced renewable technologies including biomass plants, geothermal and solar thermal. By use of large heat pumps – which enable the co-production of heating and cooling by reusing surplus heat from facilities like data centres – we also work with electricity integration in the district energy systems.

COPENHAGEN DISTRICT HEATING SYSTEM, DENMARK
Copenhagen’s district heating system is one of the largest in the world, and the associated networks supply low-carbon heat to a city of one million people. For more than 30 years, Ramboll has been the Metropolitan Copenhagen Heating Transmission Company’s main consultant, providing consultancy assistance during all stages of the project from planning and design to operation and maintenance of the city-wide system.
DATA CENTRE SURPLUS HEAT RECOVERY, DENMARK
Ramboll has provided consultancy services for the district heating company Fjernvarme Fyn on an energy centre with large heat pumps, utilising excess heat from the servers of a mega data centre in Odense. The heat pumps increase the temperature of the waste heat, so that it can be used in the local district heating network. It will be Denmark’s largest heat pump to date, and utilisation of data centre excess heat has not been done in this scale before anywhere in the world.

REPLACEMENT OF DISTRICT ENERGY SYSTEM AT STONY BROOK UNIVERSITY, US
The new district energy system supports all the thermal needs of Stony Brook University, which is the largest research University in the State University of New York system. The work was performed on an active university campus and phased to minimise interruptions of academic work and to avoid the use of temporary systems.
HELPING CITIES FLOURISH WITH COST-EFFICIENT DISTRICT HEATING SOLUTIONS
GREENWICH PENINSULA ENERGY NETWORK, UK
Ramboll contributed to the development of the Greenwich Peninsula Energy Network, composed of more than 10,000 homes and commercial space. We were responsible for carrying out the work required for the implementation of a low-carbon site-wide energy infrastructure, consisting in the main of an Energy Centre (image) and a district heating network. The heat production technology was determined through a fuel supply options study and technology appraisal, reflecting the aspirations for low-carbon energy and the requirement for a cost-effective solution.
ENABLING THE INTEGRATION OF RENEWABLE ENERGY INTO THE ELECTRICITY GRID

In a world where energy and power demands are rapidly changing, and where the power generation mix is moving from thermal to renewable sources, Ramboll’s holistic approach enables us to identify the changing demands on the power transmission and distribution networks, while our in-depth knowledge of such networks enables us to provide effective long-term solutions for the networks of the future. The power networks of the future will need to provide security and reliability with changing generation profiles and higher levels of intermittency. With its knowledge and expertise Ramboll is well placed to advise clients on the impact of new generation connections and the needs of future networks.

We tailor our services to meet our clients’ needs. Our services range from specialised technical advice and power system studies (steady state and transient studies) to techno-economic feasibility studies, technical due diligence, front end engineering design and project management. We offer full Owner’s Engineer services for project delivery as well as detailed engineering design when appropriate.

We have a wealth of expertise and experience in power system studies, grid connections for thermal and renewable generation and large industrial loads, offshore transmission systems, transmission lines and towers, cables, AIS and GIS substations, switchgear, transformers and reactors, protection, control and automation and HVDC interconnections. Our capability is at voltages up to and including 500kV.

Our power transmission and distribution skills are complemented by Ramboll’s expertise in thermal and renewable power generation, offshore substation platform design, civil and structural engineering and environmental impact studies.
Ramboll provided technical due diligence services to Diamond Transmission Corporation (part of the Mitsubishi Group) in connection with the acquisition process for the UK offshore transmission (OFTO) schemes. These schemes provide the transmission link between the offshore wind farms and the onshore grid system.
AN INNOVATIVE SOLUTION FOR OVERHEAD TRANSMISSION LINE TOWERS TO ENERGINET
Together with the architect Dissing+Weitling, Ramboll was appointed to design the innovative Thor towers for the 2x400 kV grid for Energinet. The transmission line will establish high voltage connection in the southern and western part of Jutland, Denmark. Compared to traditional transmission line towers made of steel angle bars, the new tower is made of steel tube elements to obtain an elegant design, which is installed and maintained with less effort, compared to existing power pylons.

150M MAST FOR LUND UNIVERSITY, SWEDEN
Ramboll entered into a full turnkey-contract with Lund’s University for the engineering, procurement and construction (EPC) of a 150m guyed metmast. After completion of the detailed design, Ramboll handled the manufacturing and delivery of mast and accessories before completing the installation of mast and foundations. Installation of the mast-sections was performed by helicopter (image p. 39).

Ramboll focuses on reducing the total site costs for our clients, without compromising on sustainability and high quality. Our global presence and extensive engagement in international standardisation and R&D ensures that we can continue to provide world class solutions to our clients. Based on our cost-efficient philosophy, our masts and towers are optimised by minimising wind load, foundations, logistics and installation time.

Supply and installation
In selected business segments Ramboll offers a full turn-key towers solution to our clients, from engineering, and procurement to construction (EPC).

Ramboll has been working with towers since the company was founded in 1945. We offer our clients a broad spectrum of consultancy services from analysis, technical due diligence, measurement and design to construction of masts and towers.
ENERGY STORAGE

WORLD RECORD BREAKER
Ramboll broke the world record for largest heat storage pit with the design and construction of a 200,000 m³ heat storage facility.

USING SURPLUS ENERGY
The challenge for energy storage facilities is not only to increase the market share of surplus energy from wind, solar and hydro, but rather to use it cost-effectively.

Ramboll offers our clients the smartest solutions for their projects and society based on expertise in analysing the energy infrastructure and its energy carriers for electricity, gas and thermal energy. We take into account quality and time – ranging from seasonal storage to frequency stabilisation.

Our solutions cover electricity, gas, district heating (hot water) and district cooling (cold water), and encompass a wide range of storage solutions including heat storage tanks and pits, cold storage tanks, natural gas storage, compressed air in caverns, electric batteries, frequency stabilisation, hydro power and pump stores, and steam storage tanks.

Cities acting as a virtual battery
A smart energy system that relies on fluctuating energy sources such as wind and solar power requires new, flexible energy usage and storage solutions. The water-based integrated energy system in the cities can be exploited as a cost-effective means of using and storing electricity.

With its large thermal storage facilities for hot and cold water in combination with large heat pumps, compressor chillers and electric boilers, the system can use a lot of electricity while the prices are low and avoid electricity consumption in times of high prices. Compared to individual solutions without storage capacity, i.e. small heat pumps and compressor units that need electricity every day or even every hour, the water-based energy system is equivalent to a virtual battery.

Ramboll has been involved in a wide range of projects for planning and designing all components of the integrated energy system in cities, e.g. the district heating system in Greater Copenhagen.

Electrical storage
As emerging technologies, chemistries, and platforms (mobile, EV & stationary) mature, the future for electrical storage is very promising. These assets allow for great potential to dynamically act as a load or a resource, balancing in real time the many requirements of our critical infrastructure.

With our simulation tools, we support and design all kinds of battery storage and assist our clients in the implementation phase. Our services include both the electrotechnical design and the economic optimisation of the capacity and power. Depending on the application, battery storage today has several different functions and business models. They enable peak shaving, equalise the fluctuating feed-in of electricity from renewable energy plants and save the energy in times with excess renewable generation.

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HEAT STORAGE PIT
RECORD IN
VOJENS, DENMARK
As a consultant for Vojens District Heating in Jutland, Denmark, Ramboll designed and constructed a 200,000 m³ heat storage facility in an old gravel pit. It was driven by an extension of the existing solar heating plant from 17,500 m² to 70,000 m² – breaking the world record in the process. The entire project was carried out without subsidy and has reduced the cost of heat production substantially.

CHP ACCUMULATOR
TANKS, AVEDØRE PLANT,
DENMARK
Ramboll designed large-scale heat accumulators, allowing the Avedøre CHP plant – one of the world’s most efficient multi-fuel power plants – to decouple heat and power production, optimise demand economics and support a system with high wind power generation.
Innovation is at the heart of Ramboll’s approach. We see creative thinking and innovation as key drivers for success and with that in mind, we continuously invest in the development of new engineering methods and techniques that harvest the full potential of new and existing technologies to create and offer more efficient and cost-effective services to our clients. Below are some examples of how we use the latest technologies to help our clients solve their problems and advance their projects.

**True Digital Twin**
Offshore structures such as platforms and wind turbines are billion dollar investments. With the True Digital Twin technology the operation and maintenance costs can be reduced and decisions on lifetime extension can be made on the basis of a genuine understanding of the structures.

Ramboll’s True Digital Twin continuously monitors the structure in a digital model updated with real-time information about the loads affecting the structure, using an innovative structural health monitoring system combined with digitalisation. This intelligent asset management technology can be used for assets in other parts of the energy sector where structural behaviour can be monitored.

**ROSAP/cloud computing**
The Ramboll Offshore Structural Analysis Program – ROSAP – has been developed over the past 30+ years to meet the ever-increasing demands for structural design, optimisation and lifetime extension of offshore structures. ROSAP provides indispensable tools for new design, modification work and lifetime extension assessments of onshore and offshore steel structures, covering all phases from transport and lifting to in-service.

To further optimise the design, Ramboll has worked with several cloud vendors to improve its in-house software in this area through cloud computing, providing our engineers with a platform with faster, more robust and cloud-based storage and execution.

**VR/AR visualisation**
As our energy projects and designs become increasingly more complex, new solutions are required to visualise our projects, both in the design phase and during operation. Virtual Reality (VR) presents itself as a powerful technology that delivers more realistic and interactive visualisations of our engineering designs and models, while simultaneously enhancing the communication process with project stakeholders. Unlike VR, which requires an entirely virtual environment, Augmented Reality (AR) simply adds computer-generated images to the existing natural environment to enhance the current perception of reality. This is a strong project planning and implementation tool.

**3D laser scanning and survey**
Ramboll has worked with 3D laser scanning and surveying since the late 1990s. 3D laser technology facilitates the capture of physical objects such as structures, pipe work and mechanical components. Through survey analysis this is converted to a virtual but true to life as-built 3D model. With the 3D laser technology, errors can be prevented and new designs can be precisely tailored to fit existing layouts.

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**INVALUABLE SOFTWARE**
Ramboll Offshore Structural Analysis Program (ROSAP) has been used for more than 3,100 individual foundation designs for wind turbines for 62 offshore wind farms around the world, accounting for a total nameplate capacity of 13,800MW.
MONO BUCKET CONCEPT FOR OFFSHORE WIND TURBINE FOUNDATIONS

Ramboll has established a close collaboration with Universal Foundation on an on-going joint development project concerning the design and certification of the Mono Bucket concept, including load iterations with MHI Vestas Offshore Wind. We assisted our client with the design basis, design briefs, collision analysis, load calculations and structural verifications of the structures. The designs were subsequently turned into real-scale 3D models able to be visualised and interacted with using VR technology.

SIRI A TRUE DIGITAL TWIN (SHMS), NORTH SEA

For the Siri Offshore Platform located in the North Sea, cracks were observed in the structure. This required extensive repair and reinforcement, and analysis and re-certification for keeping the facility in production. Ramboll assisted the client by creating a True Digital Twin of the platform based on real-life measurement data from an installed Structural Health Monitoring System (SHMS). The purpose of the True Digital Twin was to improve and control the structural safety of the platform during all phases of the project from the time of observation of the crack development, during the re-assessment analysis and to final repair of the platform. The project resulted in the minimisation of costly shut-downs and platform evacuations, while maintaining a high safety level.
Ramboll is a leading engineering, design and consultancy company employing 15,000 experts. Our presence is global with especially strong representation in the Nordics, UK, North America, Continental Europe, Middle East and Asia Pacific. We constantly strive to achieve inspiring and exacting solutions that make a genuine difference to our clients, end-users and society at large.

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