GAS & LNG
STRATEGIC AND TECHNICAL ADVICE FOR
ENERGY DECISION MAKERS
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Cover: Upgrade of LNG berth at Ras Laffan, Qatar. Ras Laffan is the centre of LNG and GTL activities in Qatar and the port is considered one of the largest LNG export facilities in the world. Ramboll provided the detailed engineering for a series of modifications of the berth facilities necessary to accommodate the new generation of large LNG carriers.

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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 a transition towards sustainable 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 origin in a gas-producing country, Ramboll perfectly understands energy providers’ challenges and opportunities. Ramboll has provided the oil, gas and energy sector with multidisciplinary engineering solutions for the past four decades.

Part of our unique value proposition is that Ramboll carries out comprehensive market analyses and feasibility studies, environmental and social impact assessment and identifies legislative and environmental requirements as part of energy projects. In that way, we aid energy providers in getting a 360 degree view of their project, identifying opportunities and risks, and forming the necessary basis for long-term strategic decisions.

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“Gas is the perhaps most important and sustainable component of our future energy mix. And for energy providers looking for an independent and seasoned consultant to identify optimum solutions and leverage opportunities, Ramboll is the natural choice”.

Søren Skovgård Møller
Director of Onshore Gas & LNG, Ramboll
FROM EMERGING ENERGY COUNTRIES TO MATURE ENERGY PROVIDERS

New energy nations emerge across the globe, as the quest for prosperity and energy self-sufficiency prompts the exploration of untapped hydrocarbon reserves.

STRONGHOLDs

• Due diligence & litigation support
• System design
• Pipeline design, landfill and routing
• Positioning and dimensioning
• Survey specifications
• Route optimisation
• Flow analysis
• Probabilistic analysis
• Capacity assessment & optimisation
• CAPEX & OPEX estimates
• Impact assessments (ESIA)
• Permits & authority management
• Scanning
• HAZID, QRA

Ramboll acts as partner for emerging energy countries in the transition to becoming a mature energy provider. Our unbiased, well-founded energy consultancy enables decision-makers in choosing and executing the best technical and socio-economic solutions.

Roots in a gas-producing country
Determining the most sustainable and efficient project from a commercial, environmental and technical point of view is not a simple task for any energy provider.

With deep roots in a gas-producing country, our experts have a thorough understanding of the challenges facing an emerging energy nation. Based on our background within oil, gas and renewables, Ramboll has extensive operational and strategic experience, which allows us to give expert advice on the optimum long-term solutions and how to leverage the natural resources.

We have assisted many clients in the complex task of designing a coherent and optimised system of interconnectors, pipelines, compressor stations, metering and storage facilities.

For the gas sector, it is of particular interest that Ramboll carries out comprehensive market analyses and feasibility studies, which form a necessary basis for all decision-making on long-term, strategic gas projects. We follow developments in the gas market closely and embrace new trends vigorously.

Engineering infrastructure
For a nation to prosper from its gas reserves, the right infrastructure needs to be in place, balancing the need for pipeline and storage capacity to cater for fluctuations in supply/demand. Ramboll has provided consultancy services to the midstream sector for years, and our solutions have evolved with the needs and challenges facing the industry. Our expertise ranges from terminals to storage facilities, cross-country pipelines and metering and compressor stations.

Local partners
Ramboll is renowned for our success in establishing local partnerships. The purpose is to supplement our own services and insights with indispensable knowledge about local conditions.

For instance, pipeline system design requires careful planning to select the optimum pipeline route with regard to: overall length, right-of-way access, existing use of the land, population intensity and planning for existing infrastructure. Challenges such as these are often better solved involving local partners.

Risk and safety
Risk and safety form an integrated part of our consultancy services. We take a proactive and multidisciplinary approach to risk analyses and safety screenings to ensure that all safety regulations and requirements are met.

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Supporting Uganda’s emerging oil and gas sector
The East African region is emerging as a premier destination for oil and gas exploration and development. Petroleum discoveries have been made in South Sudan, Uganda, Tanzania, Mozambique and Kenya. Uganda – home of 36 million people – is host to multiple natural resources and recently discovered valuable reserves of oil and gas. So far untapped, these new findings are considered a great asset for economic growth. The Hoima-Kampala pipeline is to be developed as part of a refinery project supporting the establishment of a domestic oil and gas industry in Uganda. The project comprises a 210 km (130 miles) pipeline for transport of refined oil products between the Hoima refinery and the Kampala distribution terminal.

Ramboll was involved in the early phase of the project by conducting a utility corridor study including detailed pipeline routing, and an environmental baseline study.

Local partner ensured stakeholder involvement
Ramboll teamed up with Local partner, Newplan, and ran the project in parallel with “Kabaale International Airport” project intended to serve the oil and gas industry and the local communities in Western Uganda. Newplan was performing most of the field work for the Hoima-Kampala pipeline such as topographical survey, geological and geotechnical investigations, EBS and ESIA (Environmental and Social Impact Assessment).

It was crucial to acknowledge that the green fields and rain forests were important parts of the local culture. Thus, active stakeholder management in form of meetings with officials and continuous interactions with the villagers along the route were an essential part of the study. Ultimately, in order to meet the expectations of every party involved in the project, the initial length of the utility corridor and pipeline routing was extended with 10 km (6.2 miles).

Pipeline route scanned from aircraft
Due to the sensitive nature of the green area and its swampy surfaces, Ramboll had to overcome several types of challenges. During the conceptual design phase, three route options were selected based on maps. The routes were then topographically surveyed by using a laser scanner mounted on an aircraft. Ordinary topographical survey from the ground was very difficult due to dense vegetation and river crossings. The results were used to optimise the route before performing other investigations.

For a better understanding of the soil properties, resistivity measurement was performed using DUAL-EM equipment on the whole route except swamp and river crossings. Geotechnical investigations were made through lab analyses of soil from trial pits along the route. The trial pit locations were selected based on the results from the resistivity measurements.

PROJECT DATA
Client Uganda’s Ministry of Energy and Mineral Development
Geography Uganda, East Africa
Project services
• Project management
• Cost estimation
• Technical safety & HSE
• Piping, layout & mechanical engineering
• 3D laser scanning and survey
• Environmental & social impact assessment (ESIA)
Completion year 2016
BRINGING UNBIASED INSIGHTS TO ENERGY DECISION-MAKERS

Gas forms a substantial part of the energy mix that keeps modern society running. Energy providers and decision-makers of today’s energy nations are faced with a number of challenges as they are made liable for a safe, cost-effective and sufficient gas supply.

SERVICES

- Master planning
- Economic studies
- Due diligence & litigation support
- Authority & stakeholder management
- Project management
- Environmental & social impact assessment (ESIA)
- Risk & safety
- Multi-disciplinary engineering services
- Construction management
- Qualification of vendors
- Drafting of contracts / tender material
- Design verifications

Ramboll supports energy decision-makers in getting a 360 degree view on their project’s feasibility by offering expert solutions combining socio-economic, technical and environmental knowledge. Ramboll’s unique combination of all of the above expertise areas enables clients to evaluate a wide range of energy and infrastructure related projects. In close collaboration between technical experts, economists and environmental experts we render the full picture and recommend optimum scenarios for our clients.

A full-service provider - from gas to renewables

Our approach is truly multidisciplinary. Not only do we cover the socio-economic, technical and environmental aspects of your gas project, we also provide full-scale civil engineering services. Ramboll offers to be your single-point of contact throughout the entire project, saving time and costs associated with multiple suppliers and excessive interface coordination. Moreover, our expertise within energy and renewables can successfully be applied to gas projects bridging the transition to cleaner energy forms.

Owner’s representative

When Ramboll acts as owner’s representative our clients attain value from having a partner which acts in their best interest helping them to stay in charge of their project. Based on our professional integrity and substantial industry experience, we propose to take away some of the uncertainties that come up in the processes related to strategic energy projects. Clients can lean on us during the long and often complicated processes preceding important investment decisions. We are there to challenge assumptions and help facilitate internal processes; just as we are there to ask questions beyond the scope, and take multiple perspectives on problems. Our large portion of permanent staff supports long-lasting, personal relationships with our clients, and we are well-known for our flexibility and ability to mobilise a project team quickly.

Assessing trends in the energy market

Ramboll’s analysis of the trends of the energy sector, is the basis for establishing relevant scenarios and evaluate possible outcomes. In this way, Ramboll provides a sound basis for the client to determine the most sustainable and efficient project from a commercial, environmental and technical point of view.

01 Consultant on inter-connectors and pipelines

In order to optimise gas infrastructure or distribution systems and secure the supply of natural gas to European citizens, Ramboll has been chosen to study and design numerous inter-connectors and pipelines in Europe.

02 Nord stream pipeline, Baltic Sea

The Nord Stream pipeline is the world’s largest gas pipeline and was built to supply natural gas to Europe from Russia. It transports up to 55 billion m³ of gas per year which is sufficient to supply more than 26 million households. The route designed by Ramboll through the Baltic Sea traverses unique ecosystems as well as busy shipping routes along with areas where chemical munitions were dumped and dangerous sea mines are abundant. Ramboll handled permitting procedures and stakeholder relations, and due to the early-stage environmental planning and input into the construction design, the pipeline was built without significant environmental impact. (Image bottom: © Nord Stream AG)

03 Etil, Wilhelmshaven, Germany

The Etil salt cavern storage facility acts as a key European energy hub. Ramboll was owner’s representative during the development of Etil and the related export project which included a gas pipeline between the gas plant and the Dutch national grid.
The major scope of work included new receiving, gas heating, utilities, and process facilities. Ramboll carried out the FEED study proposing the technical solution.

Securing energy supply
The Norsea Gas Terminal is operated by Gassco, who is the operator for the integrated gas transport system from the Norwegian continental shelf to continental Europe and the UK. This integrated network comprises pipelines, processing plants, and receiving terminals in five countries. The Europipe Receiving Facility in Dornum and the Norsea Gas Terminal outside the North German port of Emden receive gas from the Europipe/Europipe II and Norpipe lines. The Gassco Emden Project was strategically important to the client ensuring the continued operation of the Norsea Gas Terminal and security of supplies in a long term perspective.

Landmark onshore project for Ramboll
The entire work scope for the FEED entailed app. 75,000 man-hours and had a total value of nearly 60 mio DKK. When the project peaked it gave work to some 100 people in total making it one of the largest projects undertaken by Ramboll within this specific area. Ramboll handled overall project management as well as all process, technical safety, 3D, and piping/mechanical.

“The Gassco Emden Project was strategically important for the security of gas supply in the long term. Based on their reputation and engineering competencies, Ramboll demonstrated a good understanding of our goals and challenges, making it a reliable partner to work with. Altogether it was a fruitful collaboration spiced up with an enjoyable atmosphere even though the project team employed close to 100 people”.

Mr. Ole Jan Aarvik - Project Director, Gassco AS

After more than 30 years of operation, the Norsea Gas Terminal in Emden, Germany, needed to be refurbished to maintain safe and reliable gas transportation. Ramboll acted as Gassco’s trusted advisor in the process of scoping the technical solution.
SOCIO-ECONOMIC AND ENVIRONMENTAL CAPABILITIES

Gas and LNG projects are not only technical endeavours; they also require assessments of socio-economic aspects as well as evaluations of environmental impacts.

**SELECTED PROJECTS**
- Technical support to the Ministry of energy and coal, Ukraine
- Monitoring dependence and vulnerability of energy supply system (MODVESS), Croatia
- Gas market assistance to regulatory authority, ANRED, Romania
- Environmental and permitting assistance to Nord Stream AG, Switzerland
- Environmental & social impact assessments for Energinet.dk, Denmark
- Utility corridor study and environmental baseline study for The Ministry of Energy and Mineral Development, Uganda
- Customised models/tools.

**Environmental studies and regulatory compliance**
Managing environmental and societal impacts has become essential in the stakeholder management that all energy companies and governmental institutions must commit themselves to as actors in the petroleum industry. Ramboll provides identification and prediction of potential environmental challenges and impacts during the entire EIA/SSA process, hereby ensuring that projects stay in compliance with regulatory requirements.

**Policy and sector studies**
In the field of gas/energy infrastructure, Ramboll provides assistance for the identification of projects of common interest for countries and supranational organisations worldwide. Some of our major policy and sector studies include national gas strategies for Yemen, Bosnia-Herzegovina, Kosovo and Poland. We have a long track-record working for the European Union advising about strategies for natural gas storage and priority corridors for energy transmission. On a global scale we have provided decision-makers with energy market interconnection plans and suggested strategies for trans-national energy markets.

**Disciplined technical, financial and economic due diligence**
Ramboll offers our clients expert assistance in a broad range of transactions. Our approach is hands-on, and we are able to quickly mobilise a team of experts to take on diligence exercises. Our work within the due diligence field includes contract reviews, analyses of project fundamentals and value drivers, and transaction risks benchmarked against the cost and risks involved in investments in new projects. We look at technical, financial and economic diligence as well as environmental assessments and authority approvals.

"Establishing the viability of the project is a significant step towards a common goal of providing affordable, secure and sustainable reliable energy among the citizens of the Nordic and Central Eastern European community."

Sofie Løweon
- Project Manager, Energinet.dk

**Baltic Pipe, Baltic Sea**
The Baltic Pipe pipeline project outlines the initiative at interconnecting the Danish and Polish gas markets to reinforce the security of supply through diversification and increased competitiveness. The pipeline will go from Copenhagen, Denmark, to Niechorze, Poland. Ramboll was awarded a feasibility study to provide socio-economic, financial and technical foundation for the prospective Baltic Pipe implementation.
PROVIDING FEASIBLE AND SOLID SOLUTIONS FOR LNG PROJECTS
LNG SOLUTIONS

LNG allows suppliers of natural gas to meet distant demands in a cost-effective manner. LNG projects call for large investments and specialised knowledge. Ramboll specialises in handling the clients’ risks and realising their opportunities by providing professional and independent consultancy services.

**SERVICES**

- Feasibility studies (incl. market analysis)
- Economic and financial studies
- Conceptual engineering and FEED
- Site selection studies
- Separation and gas pre-treatment facilities
- LNG liquefaction facilities
- LNG transport facilities
- LNG storage and regasification facilities
- LNG port and marine facilities
- Detailed design and procurement
- Construction and commissioning management
- Operations support
- Coordination with authorities
- Environmental and social impact assessments (ESIA)
- Qualification of vendors and drafting of execution contracts
- Owner’s representative during detailed design and construction.

**LNG value chain**

Ramboll’s multidisciplinary and agile approach enables us to bring the right socio-economic, environmental and technical insights to LNG decision makers. Our services cover the entire LNG value chain from exploration site to gas conditioning, LNG storage, LNG transport, LNG regasification, gas transmission systems and underground gas storage services.

**Market and economic studies**

In the early phase, our expert market and economic studies provide facility owners, investors and other stakeholders with the necessary basis for making the right investment decision while our engineers will ensure selection of the optimum technology.

**Technology selection**

As one of few independent engineering consultancies, Ramboll offers competent assistance to plant owners in accessing the priority design of others, and evaluating different technologies and life cycle costs in the early phases of LNG projects.

Not all technologies are suitable for all climates, some technologies are motion sensitive and there can be significant differences in the heat efficiency. The liquefaction and re-gasification processes require considerable amounts of energy, and the differences in energy consumption between different technologies have a great impact on the overall profitability of the facilities.

**Site selection and environmental assessments**

We believe that selection of the optimal site for an LNG terminal should be based on the interface with existing facilities, existing gas transmission infrastructure, risk assessment and environmental impact analysis. Our extensive experience with conducting infrastructure, risk and environmental assessments enable our clients to identify options and qualify decisions in relation to all kinds of onshore and offshore oil and gas projects.

**Civil engineering for LNG facilities**

LNG facilities are linked to ports and marine structures. Ramboll is one of the largest companies in Europe within civil engineering, geophysical analysis, geotechnical engineering and foundation design and we hold vast experience in steel and concrete structures. With a multidisciplinary approach, we handle all civil engineering aspects of an LNG project pertaining to ports and marine engineering and storage tank design. We assist from planning, initial investigation, design and tender, to implementation, inspection and supervision.

**ucs LNG projects in the Baltic region**

- Gävle LNG terminal - Conceptual study for LNG terminal in Gävle, Sweden
- Roadmap for LNG import facility in Klaipeda, Lithuania
- Safety report and EIA for Hortobágy LNG terminal, Denmark
- LNG terminal in Paldiski, Estonia

**02 Finngulf LNG Terminal, Finland**

For several years, Ramboll had assisted Gasum Oy with their plan of constructing a terminal for LNG import to the South coast of Finland. Following the feasibility study Ramboll was awarded a contract for project management services that focused on the critical tasks of the project.

**03 LNG plant for Stigsnæs Gulfhavn Oil Terminal, Denmark**

Stigsnæs Gulfhavn Oil Terminal is located in a growing traffic area that services both Western Europe and the Baltic. The terminal has an extensive record in safe storage and handling of jet fuel, gas oil, and diesel products for the leading companies in the oil industry. Ramboll performed a study to evaluate the technical pre-feasibility of an LNG plant at Stigsnæs.
**Ramboll Oil & Gas in Brief**

Success in today’s fast paced and competitive oil and gas market depends on advanced technical solutions that combine economic efficiency with stringent health, safety and environmental (HSE) requirements during the entire asset life cycle.

Ramboll is specialised in handling our clients’ risks and realising their opportunities by providing professional and independent consultancy services.

**Roots in gas-producing country**

Ramboll has its origin in Denmark – a gas-producing country since the 1970’s. Hence we have the experience gained from helping Danish operators for the past four decades in strategic analyses, facility designs and production optimization. Today Ramboll has extended its geographical reach and with offices in more than 35 countries, we can offer local support tailored to local regulatory frameworks and conditions.

**ABOUT RAMBOLL**

Ramboll is a leading engineering, design and consultancy company founded in Denmark in 1945. The company employs 13,000 globally and has especially strong representation in the Nordics, UK, North America, Continental Europe, Middle East and Asia-Pacific.

With more than 350 offices in 35 countries, Ramboll combines local experience with a global knowledgebase constantly striving to achieve inspiring and exacting solutions that make a genuine difference to our clients, the end-users, and society at large.


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**COUNTRIES WITH PERMANENT OFFICES**

FOR AMERICAS

- Brazil
- Canada
- Mexico
- USA

FOR AFRICA

- South Africa

FOR ASIA-PACIFIC

- Australia
- China
- India
- Indonesia
- Malaysia
- Myanmar
- New Zealand
- Singapore
- Thailand

FOR EUROPE

- Belgium
- Cyprus
- France
- Germany
- Italy
- Netherland
- Poland
- Romania
- Russia
- Spain
- Switzerland
- United Kingdom

FOR MIDDLE EAST

- Kingdom of Saudi Arabia
- Qatar
- United Arab Emirates

FOR NORDIC REGION

- Denmark – Copenhagen, company head office, Finland, Greenland, Norway, Sweden

**13,000 experts**

**300 offices**

**35 countries**

**1,500 experts working with different aspects of energy, incl. Gas & LNG**

Our comprehensive market analysis and feasibility studies form a necessary basis for all long-term decisions. We specialise in early-phase studies and have a mindset that requires us to plan ahead, resolve issues and keep everything on track throughout the project. In this way we ensure successful implementation of the client’s production asset or system.