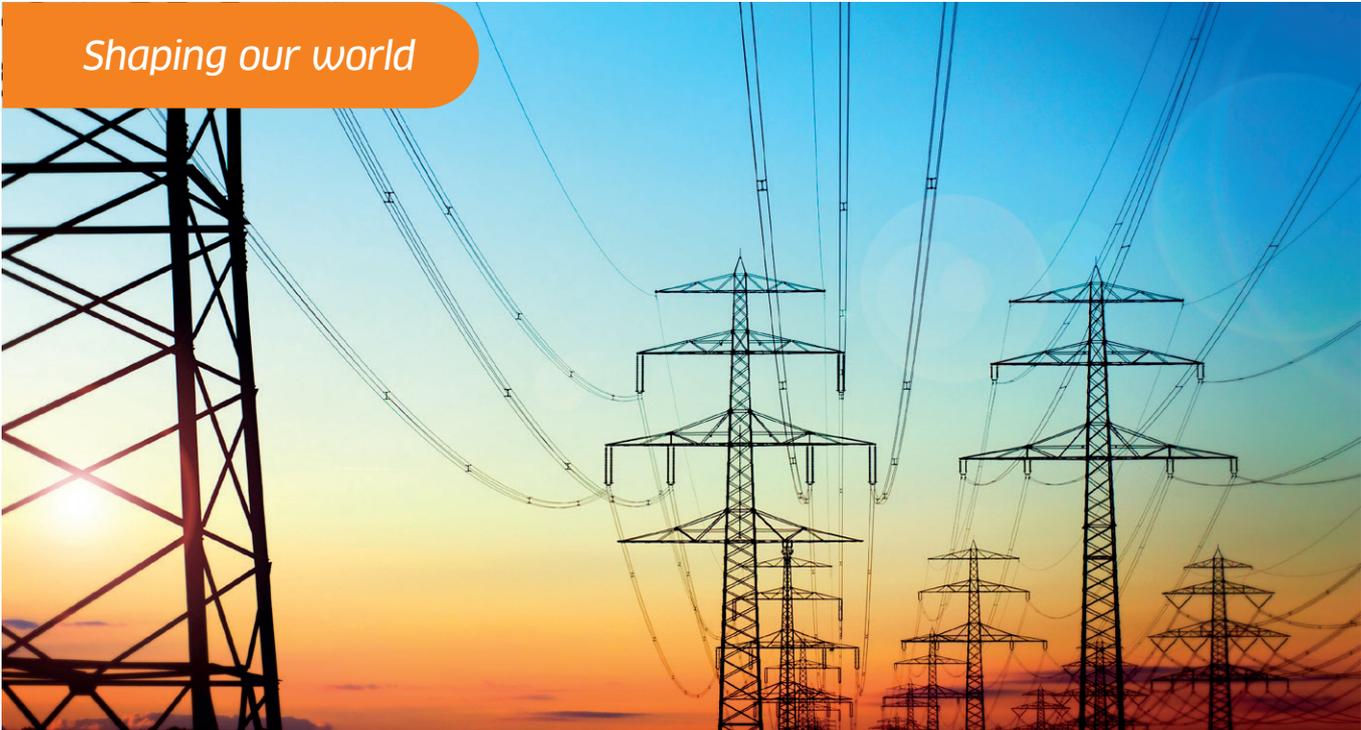


ENERGY

Shaping our world



Innovations in Energy

Energy is our passion, and has been for more than 50 years. As a company of consulting engineers, Tractebel is dedicated to a wide range of planning, management and consultancy services, primarily for complex infrastructure projects.

Fields of Activity

- Thermal power plants
- Desalination plants
- I(W)PPs
- Renewable energy
- Power transmission and distribution
- Energy storage
- Energy management and energy efficiency

Engineering Expertise

Tractebel Engineering GmbH was founded in 1966 and since then has developed into a leading international engineering company with projects in 165 countries.

This experience allows us to offer our clients technically, ecologically and economically optimised solutions and the guarantee of successful project execution from design and planning to approval and realisation.

Leaders in Energy

Thanks to our clients, Tractebel has been ranking among the world's top engineering firms in its fields of business for years. Modern project management practices ensure the economic and technological success of the project. Our innovative

solution-oriented approach takes into account all the pertinent legal, industrial and financial policies as well as technical conditions.

Sustainable Solutions

We provide our clients with the right course of action tailored to economically and ecologically sustainable solutions.

Furthermore, we offer our clients selected, well-established and continuously developed expert know-how in fields adjacent to our core business, such as:

- Plant safety
- Strategic management consulting
- Environmental management
- Environmental impact assessment
- Emission trading, carbon finance
- Energy resource analysis
- Energy planning, rural electrification
- Energy management
- Power sector training and instruction concepts

One Partner is all you need

A flexible company organisation and the broad background of our experts with deep understanding of all aspects of project development, operations, economics and implementation enable

us to handle large-scale energy infrastructure projects on an interdisciplinary basis as well as special R&D assignments on an in-depth work level in an optimal way. In the realisation of our projects, we always strive for maximum efficiency by applying state-of-the-art engineering technologies, one of the latest examples being Building Information Modelling (BIM).

The Energy Division employs professionals educated in process engineering, energy and mechanical engineering, electrical engineering, physics, information technology, economics and additionally, contract experts, environmental planners, project controllers, and project managers. Experienced civil engineering staff from the Tractebel group of associated companies are at the clients' disposal as well.

Technical and Economic Services

The energy division's technical and economic services cover the entire energy sector, from the selection of appropriate energy resources for the generation and distribution of power to the feasibility and environment-friendly utilisation of electricity.

Services



Thermal Power Plants

Our services include provision of comprehensive technical and technical-economical consulting, planning, design and project management services.

Thermal power generation utilising fossil fuels such as:

- Gas (natural gas, Syngas, biogas, industrial gases)
- Oil (fuel oil, heavy fuel oil, crude oil)
- Coal (lignite to anthracite)
- Others (waste, pet coke, oil shale, oil sand)

Power plant applications:

- Steam power plants (subcritical, supercritical)
- Simple cycle gas turbine and combined cycle plants
- Diesel and gas motor plants
- Combined heat and power (CHP) applications
- Heating systems
- Desalination and combined water and power plants
- Integrated coal gasification
- Carbon capture and storage
- Flue gas cleaning (dust removal, desulphurisation, NOx-removal)
- District heating



Jebel Ali Combined Cycle Power Plant with Desalination Units, Dubai, U.A.E.

Renewable Energy

Tractebel offers consulting, planning and engineering services for investors, developers, utilities, financing institutions and public authorities supporting energy generation by renewable energy technologies.

The main focus is:

- On- and offshore wind energy projects
- Photovoltaics (PV) – standalone or grid-connected
- Solar-thermal power plants
- Solar heat supply
- Hybrid systems: wind-Diesel, PV-wind, PV-Diesel etc.

We cooperate with experienced research institutes, local partners, project companies and other consultants to ensure the availability of experienced professionals for addressing concerns also on other renewable energy such as biofuels, biomass/biogenous residuals and geothermal energy for heat and power generation.



Ordana Wind Farm, Italy

The consulting services cover the following topics:

- Investigations into regional or local solar and wind energy potential, measurements and mapping
- Evaluation and assessment of renewable energy resources: wind, solar
- Technical-economical studies and expert opinions
- Innovative electrification systems in rural areas
- Integration of renewable energy options into existing systems
- Conceptual design and feasibility studies
- Due diligence studies
- Tendering and contracting support for systems components
- Site supervision, factory inspections, acceptance tests
- Operation supervision and plant inspections



Photovoltaic Power Plant El Palau, Spain

Transmission and Distribution

We offer consulting services throughout all project phases for all transmission and distribution assets including substations and their interconnections by overhead lines or cables as well as the control and monitoring of the same.

- Transmission and distribution networks
- Regional grids and rural electrification (microgrids)
- High-voltage transmission (HVAC / HVDC)
- Substations and transformers
- Overhead lines (OHL)
- Underground cables
- Smart grids / digital substations
- Load dispatch centres (SCADA / DMS / EMS / NA)
- Substation protection, control and monitoring
- Advanced Metering Systems (AMS)
- Battery Energy Storage Systems (BESS)
- Utility telecommunication
- Network planning and power system analysis



132 kV GIS Hall, U. A. E.

Electrical Power Systems

We provide engineering services for the complete electrical equipment of power plants and substations as well as industrial plants and transportation facilities.

- Generators, motors
- Power electronics (converters, AC- and DC-excitation)
- Generator bus ducts and integrated devices
- Transformers
- HV-, MV-, LV-switchgear
- Emergency power supply and uninterrupted power supply
- Electrical protection systems
- Cabling, cable routes and cable management
- Earthing, overvoltage and lightning protection, electromagnetic compatibility
- Lighting and small power installations



Pumped-Storage Hydropower Plant Vianden, Luxembourg

Automation and IT

Our services also cover the complete control and automation equipment required for the operation of modern facilities.

- Control systems
- PLC automation
- Instrumentation and measurement
- IT-networks
- Control rooms
- IT-consulting for utilities
- IT and ICS cyber security
- ISMS (ISO 27000)

Communication and Security Systems

- Fire alarm systems
- Loudspeaker systems
- Video systems (CCTV)
- Radio systems
- Telecommunication systems
- Intrusion detection and alarm systems
- Access control systems



Hydropower Plant Goldisthal, Germany

Energy Economics and Planning

We render services to governments, development organisations, private banks, utilities and industrial enterprises in strategic and institutional management. Consulting services regarding infrastructure investments and restructuring projects in the fields of electricity, heat, gas, water and environment are available as well.

Restructuring/Privatisation

In non-liberalized and deregulated energy markets we provide:

- Market entry studies, demand forecasts, demand side management studies
- Expansion planning of power generation, transmission and distribution (including combined power and water production)
- Operation planning of power generation systems
- Analysis of institutional and regulatory frameworks
- Modelling of tariffs and electricity prices

Management Services for Utilities

In emerging and developing countries our consulting services support:

- Planning and implementation of restructuring measures
- Business model development, interim management of utilities
- Improvement of accounting, finance and billing systems
- Operational optimisation of generation, transmission and distribution
- Human resource development
- Training of utility staff and management

Project Financing

In the planning of energy and infrastructure projects we advise our clients on:

- Feasibility studies
- Project financing structures
- Sources of debt and equity finance
- Risk assessment and mitigation
- Contract assistance
- Due diligence

Climate Change Mitigation Services

Within our consulting services for the development of GHG-saving projects, we assist in CDM/JI projects as well.

- Preparation of project baseline studies
- Consulting with regard to selected CDM projects, project concept development
- Economic and financial analyses of emission trading options
- Implementation of emission control and reporting systems
- Preparation of corporate strategies for emission trading obligations
- Structuring of transactions, compilation of selling and purchase contracts

Privately Financed Projects

Our technical and contractual consulting services for investors, banks and governments encompass concept development, assessment, planning and implementation of privately financed power and water projects.

Economic, financial, technical, ecological and contractual evaluation of greenfield developments and acquisition projects are completing our engineering services.

- Conceptualisation, optimisation and preparation of complete technical-economic proposals for and on behalf of the investor
- Evaluation / negotiation of EPC and O&M proposals and contractual documents
- Remaining lifetime estimation and asset valuation of power and water plants
- Project assessment and risk analyses for banks and investors (due diligence)
- Consulting services for I(W)PP and concession tenders, industrial power supply solutions
- Implementation supervision, assistance during first operational period



Jebel Ali Combined Cycle Power Plant with Desalination Units, Dubai, U.A.E.

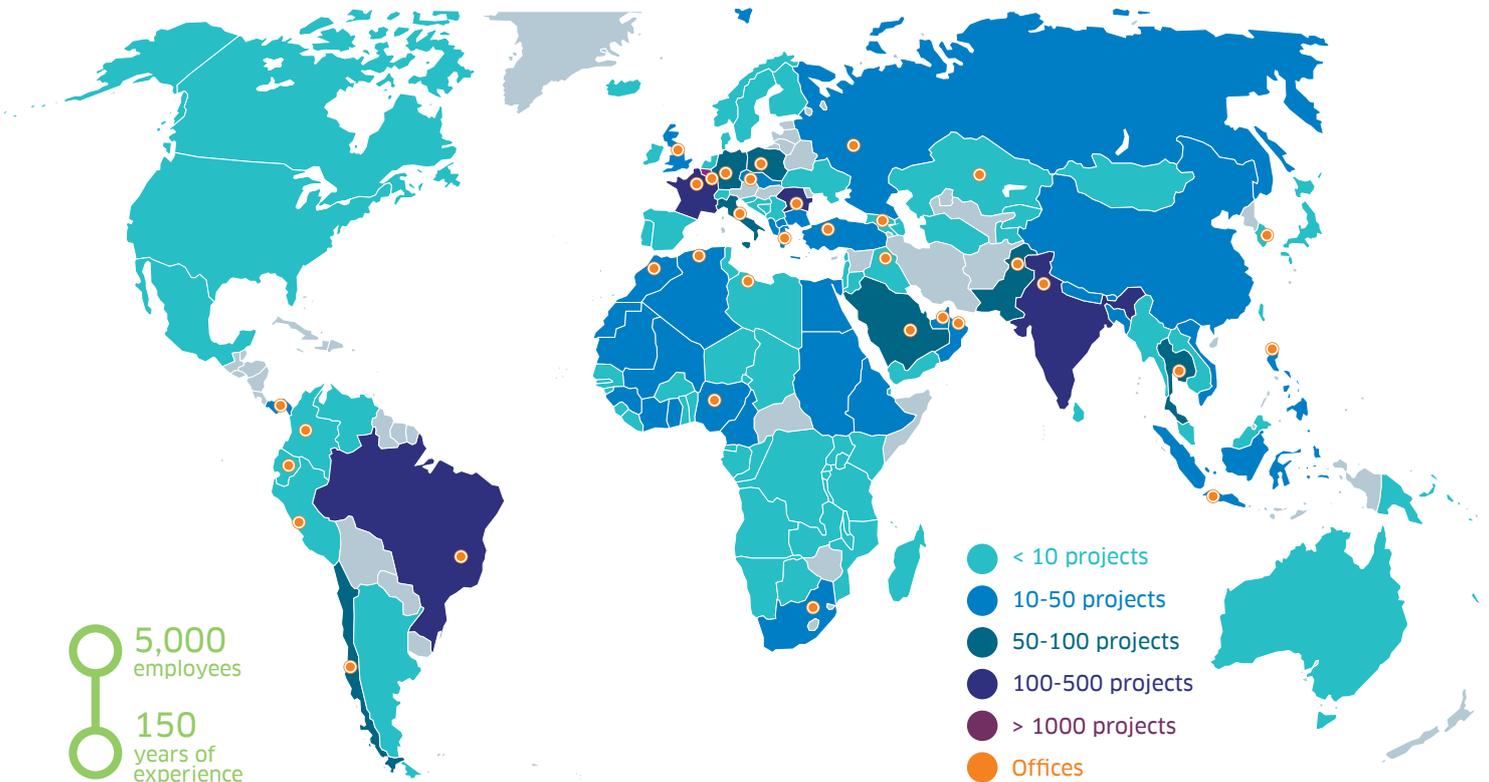
We are Tractebel

Tractebel provides a full range of engineering and advisory services throughout the life cycle of its clients' projects, including design and project management. As one of the world's leading engineering and advisory companies and with more than 150 years of experience, it's our mission to actively shape the world of tomorrow. With about 5,000 experts and presence in more than 70 countries, we are able to offer our customers multidisciplinary solutions in energy, water and urban.

Since December 2014, Tractebel Engineering GmbH (former Lahmeyer International) belongs to Tractebel and thus is part of the international ENGIE group headquartered in Paris. Tractebel (Brussels, Belgium) and Tractebel Engineering GmbH (Bad Vilbel near Frankfurt, Germany) cooperate on numerous international projects as one company.

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5,000 employees
 150 years of experience