ENGINEERING ENERGY GROUP

- OIL, GAS & Petrochemicals
- Power Plants
- Pipeline Projects
- Desalination Plants

Baghdad 1500 MW Combined Cycle Power Plant - Besmaya, Iraq

33°13'45.6"N | 44°35'43.4"E

Engineering for a Better Future
OVERVIEW

Vision & Mission
Engineering Energy Services for EPC Projects
Approach to Design Engineering

REFERENCES

PJSC Nizhnekamskneftekhim 495 MW CCCT-TPP Construction Project, Republic Of Tatarstan, Russia
Dhi Qar 750 MW Combined Cycle Power Plant Project, Iraq
Samawa 750 MW Combined Cycle Power Plant Project, Iraq
Misurata 650 MW Simple Cycle Power Plant Project, Libya
Tripoli West 680 MW Simple Cycle Power Plant Project, Libya
Yayva State District 411 MW Combined Cycle Power Plant Project, Russia
WQ 2 Fuel Gas Treatment, Power Generation & Distribution Project, Iraq
Erbil 500 MW Conversion to CCPP Project, Iraq
Sulaymaniyah W Conversion to CCPP Project, Iraq
Bazyan 500 MW Simple Cycle Power Plant Project, Iraq
Baghdad 1,500 MW CCPP Project, Iraq
Najybia 500 MW Gas Turbine Power Plant Project, Iraq
Zwirina 570 MW Gas Turbines Power Plant Project, Libya
Awbari 640 MW Gas Turbine Power Plant Project, Libya
North Rumaila Crude Oil Turbo Pump Station (PS-1) Project, Iraq
Turkey BOO Gebze / Adapazari / Izmir allāğa Natural Gas CCPP, Turkey
CS-1 Kirkareli Compressor Station, Unit K1,K2,K3,K4 Supply and Construction Projects, Turkey
Derna Desalination Plant Project, Libya
Soussa Desalination Plant Project, Libya
Zawia Desalination Plant Project, Libya
Zuara Desalination Plant Project, Libya
Reference Tank Farm Projects
Reference Pipeline Projects
ENKA's engineering expertise includes civil, structural, architectural, process, electrical, mechanical, piping and instrumentation & control; as well as advanced specialties, including simulation, enterprise integration, integrated automation processes, and interactive 3D modeling.

ENKA integrates engineering, procurement, fabrication, construction, maintenance and project management and aims to become the leading engineering services in the Thermal Power Plants and Oil & Gas Projects.

The project design process incorporates early involvement of construction and commissioning expertise, to ensure projects are designed to be constructed and operated in the most efficient manner.

ENKA Engineering Energy maintains Integrity and Seamless Engineering among own design groups and develops a common language and understanding by using the International Standards, Reputable Norms, and Procedures.

ENKA Engineering Energy offers the best Basic and Detail design for:
- Oil and Gas Process Projects,
- Combined Cycle Power Plants (CCPP) Projects,
- Simple Cycle Power Plants (SCPP) Projects,
- Coal Fired Power Plants,
- Desalination Plant Projects,
- Marine Projects,
- Dam Projects,
- Pipeline Projects,
- Pump Stations,
- Well Pad Facilities,
- Tank Farm Projects.

ENKA Engineering Energy seeks, shares and builds the projects upon experiences and lessons learned.

ENKA Engineering Energy ensures that the projects are optimized:
- Technically,
- Environmentally, and
- Economically.

ENKA’s projects are implemented:
- Ahead of schedule,
- Within Budget Constraints,

To the Full Satisfaction of the Clients with reliability.
Engineering Services for EPC Projects are divided into 4 main phases:

• Endorsement of Design,
• Proposal Engineering Support for EPC Projects,
• Detail Design of EPC Project Execution,
• Field Engineering Management and Coordination.

PREPARATION OF FEED PACKAGES

• Project philosophies, specifications and procedures,
• Basis of design for the Project,
• PFDs, P&IDs and UFDs,
• Heat and material balance including verification simulations,
• Equipment datasheets,
• Equipment list,
• Utility summary list,
• Effluent summary list,
• Safeguarding drawings,
• Relief summary,
• Battery limit schedules/interface schedules,
• Key plot plans,
• Key single line diagrams,
• Geotechnical and Topographic Survey,

And other important FEED studies, e.g.,
• ESIA,
• RAM,
• QRA,
• SIMOP and Constructibility,
• etc.

PROPOSAL ENGINEERING SUPPORT FOR EPC PROJECTS

• Study Client’s Tender documents and list the clarifications,
• Attend Site visits and Pre-bid Meetings,
• Endorsement of the Basic Design,
• Prepare Technical Specifications,
• Prepare technical proposal package that also contains Plant Layout, HMD, WBD, PFDs, P&IDs, SLDs and other relevant documents,
• Evaluate bids for various packages,
• Prepare MTO/BoQs,
• Value Engineering.

EPC PROJECT EXECUTION

• Basic and Detailed Design & Engineering including,
  • Process,
  • Mechanical,
  • Piping Design,
  • Electrical Engineering and Power System Studies,
  • Instrumentation & Control and Automation Engineering,
  • Civil, Structural and Architectural Engineering,
• Procurement Assistance,
• Review of Vendor Submittals,
• Quality Surveillance and Workshop Inspections,
• Organize Design Review Meetings,
• Provide Technical HSE Studies and Organize Workshops,
• Project Scheduling and Monitoring,
• Support to Construction and Commissioning Teams.

FIELD ENGINEERING MANAGEMENT AND COORDINATION

• Co-ordination of inputs from Clients,
• Co-ordination with home offices to bring out Client’s feedback and concerns on engineering issues,
• Facilitate Field Change Request (FCR) and Technical Queries (TQs) in co-ordination with home office design team,
• Follow up Non-Conformity Reports (NCRs) with site quality team,
• Communicating with Vendor Technical Advisors and expedite engineering relevant issues,
• Interface Points Management with Clients site team or other Contractors,
• Co-ordinate marked up drawings from site for preparation of As-built drawings.
A. BASIC DESIGN AND ENGINEERING PHASE:
- Verification of FEED Study (if available),
- Plot Plan,
- Freezing of Design Criteria,
- Implementing of various International norms and regulations such as EN, ASME, API, BS, ISO, IEC, ISA, GOST etc.,
- Finalization of Basic Engineering studies (e.g., Calculations, Equipment Sizing, Flow Diagrams, etc.),
- Prepare PFDs, PIDs, SLDs, Operation & Control Philosophy, Piping & Cabling Routing Plans,
- Electrical Interlocks, Protection systems and material classification,
- Confirmation and elaboration of interfaces,
- Finalization of Packaging Concept,
- Procurement Specifications and Bill of Quantities for bought-out items,
- Material Handling Equipment Design & Supply,
- Bid Evaluation of Vendors and assistance in selection of Package Vendors.

B. DETAILED DESIGN AND ENGINEERING PHASE;

**PROCESS ENGINEERING:**
- Process Flowsheet Simulation,
- Heat and Material Balance (HDM),
- Process Flow Diagrams (PFD),
- Piping and Instrumentation Diagrams (P&IDs),
- Philosophies, design basis document,
- Process Equipment datasheets,
- Develop relief system design,
- Blowdown Study,
- Provide input to cause and effect diagrams,
- Conduct HAZOP,
- Provide input for the alarm and trip point settings schedule,
- Perform relief valve sizing and confirm depressurisation calculations (the flare network is fully evaluated and line sizes are confirmed),
- Prepare Hazardous area classification layout,
- Perform process dynamic simulation,
- Provide input to commissioning and operation manuals,
- Close out any pending HAZOP comments that are generated from the HAZOP reviews,
- Attend model review meetings, review critical lines as routed in the 3D piping model and assist in closure of model tags,
- Assist on other deliverables including interface and tie-in schedules,
- Finalise inlet and outlet lateral line sizing for relief valves and flare model,
- Provide support to field team during pre-commissioning,
- Prepare System Descriptions,
- Enviromental Management Studies,
- Conduct HAZID, HAZOP, HAZMAP, SIL, RAM, Air Pollutant Dispersion and Noise Studies with third party consultants,
- Coordinate with third party consultant and carry out Fire Hazard Analysis, Explosion Hazard Analysis, Computational Fluid Dynamics Modelling of Explosion Overpressure and Quantitative Risk Assessment (QRA).

**MECHANICAL ENGINEERING:**
- Prepare Lists and Schedules: Equipment and Valves,
- Prepare Datasheets of Tanks and Vessels,
- Prepare Detailed Bill of Quantities,
- Handle HVAC, Fire Fighting and Plumbing Design,
- Carry out Compressed Air Supply System Design,
- Water Treatment design as well as Deminerilized, Service and Potable Water Supply Systems,
- Oil Water Separation System Design,
- Prepare Painting and Insulation Specifications,
- Participate Factory Inspection Tests,
- Provide support to Construction and Commissioning teams,
- Compile O&M Manuals,
- Provide support for preparing System Descriptions.

**3D PLANT MODELLING AND PIPING DESIGN GROUP:**
- Capability of carrying out both Smart Plan and Aveva for 3D Plant Modelling,
- Prepare Plant & Equipment Layouts, General Arrangement Drawings,
- Prepare Technical Specifications for Piping Material, Painting, Thermal Insulation, Shop and Field Fabrication of Piping,
- Prepare Engineering Design Standarts for project specific application details,
- Prepare Lists and Schedules for Pipes, Line and Fittings and Pipe Supports,
- Prepare Material Requisitions, Purchase Orders, Detailed Pipe and Fitting Bill of Quantities, Standart Support Bill of Quantities,
- Prepare periodic 3D reports for pipelines, pipe runs, spools, pipe supports, pipe welds, piping specialties, valves, equipments, instruments,
- Prepare Piping Isometrics, Piping Layouts, Pipe Routings, Engineered Support Drawings,
- Run Stress Analysis, Flange Leakage Analysis,
- Provide support to Construction and Commissioning teams.
ENGINEERING

ENERGY

APPROACH

TO DESIGN ENGINEERING (Cont’d)

ELECTRICAL ENGINEERING:

• Prepare Single Line Diagrams, Protection & Metering Diagrams,
• Conduct System Analysis and Short Circuit Calculations (e.g., load flow, motor starting, short circuit, relay coordination, insulation coordination, and etc.),
• Prepare Cable Routing, Cable Tray Layouts, Cable Schedules (HV, MV, LV),
• Carry out Lighting Design (indoor and outdoor),
• Carry out Grounding and Lighting Protection System Design,
• Carry out LV and MV Switchgears Design,
• Coordinate SCADA and PMS Designs with Vendors,
• Design Heat Tracing Systems,
• Participate Factory Inspections,
• Provide support to Construction and Commissioning teams,
• Carry out Switchyard Over Head Line Design,
• Prepare 3D Model of all Electrical Equipment and Cable System.

INSTRUMENTATION, CONTROL AND AUTOMATION ENGINEERING:

• Prepare DCS & PLC system Architecture,
• Specify Field instruments,
• Handle PLC System Integration into Plant DCS,
• Carry out DCS Control Panels and PLC Hardware Design,
• Prepare Process Logic Description & Diagrams,
• Prepare Cause & Effect Diagrams,
• Prepare Instrument Loop Diagrams,
• Prepare Functional Logic Diagrams,
• Prepare Instrument Location Plans,
• Prepare Fire & Gas Detection Location Plans,
• Prepare Instrumentation Schedules and hook-up diagrams,
• Prepare Instrument Control Loop Wiring diagrams,
• Prepare I/O Lists,
• Prepare Control Room Layout,
• Prepare Instrument Termination Diagrams,
• Carry out F&G System Design,
• Carry out CCTV and Security System Design works,
• Participate Factory Inspection and Acceptance Tests,
• Provide support to Construction and Commissioning Teams.

CIVIL STRUCTURAL AND ARCHITECTURAL ENGINEERING:

• Conduct Detailed Structural Analysis,
• Prepare Conceptual Plans & Architectural Details,
• Carry out Geo-Tech and Pile Design,
• Prepare Leveling and Excavation Plans,
• Conduct Static and Dynamic Equipment Foundation Design as well as Structural Steel Design works,
• Carry out Underground and Water Retaining Structures Design Works,
• Design Water Intake and Discharge Structures,
• Design Equipment Support & Process Pipe-Racks,
• Prepare Road Plans and Plant Fence Drawings,
• Carry out Tank Design & Application Plans,
• Prepare Painting Specification for Steel Works,
• Carry Out Special Civil Design such as Chimney, Jetty, Water Intake,
• Provide support to Construction and Commissioning teams.
EXPERIENCES & REFERENCE PROJECTS

PJSC NIZHNEKAMSKNEFTKHIM 495 MW CCGT-TPP PROJECT, REPUBLIC OF TATARSTAN, RUSSIA
DHI QAR 750 MW CCPP PROJECT, IRAQ
SAMAWA 750 MW CCPP PROJECT, IRAQ
MISURATA 650 MW SCPP PROJECT, LIBYA
TRIPOLI WEST 680 MW SCPP PROJECT, LIBYA
YAJVA STATE DISTRICT 411 MW CCPP PROJECT, RUSSIA
WQ 2 FUEL GAS TREATMENT, POWER GENERATION & DISTRIBUTION PROJECT, IRAQ
ERBIL 500 MW CONVERSION TO CCPP PROJECT, IRAQ
SULAYMANIYAH 500 MW CONVERSION TO CCPP PROJECT, IRAQ
BAZYAN 500 MW SCPP PROJECT, IRAQ
BAGHDAD 1,500 MW CCPP PROJECT, IRAQ
NAJYBIA 500 MW GAS TURBINE POWER PLANT PROJECT, IRAQ
ZWITINA 570 MW GAS TURBINES POWER PLANT PROJECT, LIBYA
AWBARI 640 MW GAS TURBINE POWER PLANT PROJECT, LIBYA
NORTH RUMAILA CRUDE OIL TURBO PUMP STATION (PS-1) PROJECT, IRAQ
DERNA DESALINATION PLANT PROJECT, LIBYA
SOUSSA DESALINATION PLANT PROJECT, LIBYA
ZAWIA DESALINATION PLANT PROJECT, LIBYA
ZUARA DESALINATION PLANT PROJECT, LIBYA
REFERENCE TANK FARM PROJECTS
REFERENCE PIPELINE PROJECTS
PROJECT DESCRIPTION

The project is located in the Nizhnekamskneftekhim Petrochemical Plant, in the southeastern part of the city of Nizhnekamsk, on the left bank of Kama river, in the Republic of Tatarstan, Russia.

The project aims at turnkey construction of a new 495 MW combined cycle gas turbine thermal power plant (CCGT-TPP) and its power connection infrastructure.

The CCGT-TPP will have a configuration of two gas turbines, one steam turbine, two heat recovery steam generators, and one natural draft cooling tower.

Main fuel for the CCGT-TPP will be synthetic gas that is byproducts from Nizhnekamskneftekhim production processes, and natural gas will be used as standby fuel.

ENKA SCOPE OF SERVICES

ENKA scope includes the entire EPCC scope except supply of the Gas and Steam Turbines and high voltage connections of the Plant to the Grid, which are under Siemens OOO scope.

Engineering survey works; site preparation; development of design documentation; state expert review; construction permit with the Customer’s support (representing Customer in authorities and General Contractor’s related documents preparation); development of detailed design; dismantling, demolition and relocation of the existing utility lines, buildings and structures; procurement; certification; transportation; customs clearance; construction, erection, start up, testing and commissioning; training; on-site road construction; landscaping; as-built documentation and operational documentation; certificate of conformance; start up permit with the Customer’s support (representing Customer in authorities and General Contractor’s related documents preparation); defects liability.

PROJECT DETAILS

LOCATION
The city of Nizhnekamsk, the Republic of Tatarstan - Russia

OWNER / CLIENT
Public Joint-Stock Company “Nizhnekamskneftekhim” (A member of TAIF Group)

PROJECT DURATION
Dec 2017 - Apr 2021

PJSC NIZHNEKAMSKNEFTEKHIM 495 MW COMBINED CYCLE GAS TURBINE THERMAL POWER PLANT (CCGT-TPP) CONSTRUCTION PROJECT

ENKA and its partner Siemens are to design and build the Misurata and Tripoli West Simple Cycle Power Plants in Libya.

The Misurata project is to add 650 MW and the Tripoli West plant 680 MW to the grids operated by the state-owned General Electricity Company of Libya.

The Misurata project is located in the area of an existing power plant in Misurata, 200 km east of Tripoli, whereas the Tripoli West project is located in the area of the existing Tripoli West Power Plant, 30 km west of Tripoli city center.

The Misurata project is based on a power island configuration for two SGT5-PAC 4000F Siemens combustion turbine generator units, whereas the Tripoli West project is based on a power island configuration for four SGT5-PAC 2000E Siemens combustion turbine generator units.

The turbines of the plants will be dual-fuel fired with light fuel oil and natural gas. The power generated in the turbines will be stepped up to the grid through main transformers.

As fast track projects, the plants are scheduled to enter commercial operation within 62 weeks of the commencement date.

ENKA SCOPE OF SERVICES

Siemens is responsible for the procurement of the gas turbines and auxiliaries, while ENKA is to undertake the overall power plant engineering works, the procurement of all equipment other than the said parts of the main power block, and the completion of all construction, assembly and other works, as well as the commissioning and start-up of the plants.

PROJECT DESCRIPTION

ENKA / Siemens

PROJECT DETAILS

LOCATION
Misurata & Tripoli - Libya

OWNER / CLIENT
General Electricity Company of Libya (GECOL)

PROJECT DURATION
TBD – TBD

CONTRACT TYPE
Lump Sum Turn Key

MISURATA 650 MW & TRIPOLI WEST 680 MW SIMPLE CYCLE POWER PLANTS

<table>
<thead>
<tr>
<th>Type of Plant</th>
<th>Capacity</th>
<th>Type of Fuel / Configuration</th>
<th>Gas Turbine Generator</th>
<th>Steam Turbine Generator</th>
<th>HRSG</th>
<th>Cooling Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined Cycle Power Plant</td>
<td>495 MW</td>
<td>Syngas / 2x2x1</td>
<td>Siemens Unit: 2 Sets, Model: SGT5-2000 Gas Turbines</td>
<td>Siemens Unit: 1 Set, Model: SST-600</td>
<td>TBD Unit: 2 Sets, Model: SST-600</td>
<td>Natural Draft Cooling Tower</td>
</tr>
</tbody>
</table>
ENKA İNŞAAT VE SANAYİ A.Ş.

PROJECT DESCRIPTION

ENKA, with its partner General Electric, will design and build the Dhi Qar Combined Cycle Power Plant, which will add 750 MW to the Iraqi Grid. The project is located near Nasiriyah City, 230 km northwest of Basra, in southern Iraq.

The gas turbines were purchased by Ministry of Electricity of Iraq as part of Mega-Deal between Government of Iraq from GE and will be handed over to GE-ENKA for installation and commissioning. These units are the last gas turbines of the Mega-Deal to be installed. All other materials and equipment shall be purchased and shipped to Iraq by GE-ENKA.

The project will consist of 1 power block which will produce 750 MW of power at 132 and 400 kV transmission levels. It will include four (4) GE 9E series combustion turbine generators which will be able to fire three (3) types of fuels. The main fuel will be the Heavy Fuel Oil (HFO) and the back-up fuels will be Light Distillate Oil (LDO) and Natural Gas. The design of the equipment will be suitable for operating 24-hours/day, 7-days/week with useful life of 25 years.

The plant will be the first combined cycle project of that will be owned and operated by the Ministry of Electricity. The thermal efficiency will be above 50%, which will help Iraq to save 14 billion m³ of natural gas, and 32 million tons CO₂ over 25 years.

The financing of the Project shall be arranged by Overseas Private Investment Corporation (OPIC) and Export Credits Guarantee Department of UK Government (UKEF).

ENKA SCOPE OF SERVICES

Engineering, Procurement of Balance of Plant (BoP), Construction, Erection, Commissioning and Start-up of the power plant, whereas GE will provide the Power Island Equipment (i.e. Steam Turbine Generator (STG), Heat Recovery Steam Generator (HRSG), Air Cooled Condenser (ACC) and Main Transformers), Distributed Control System (DCS) & Switchyard and the plant performance tests.

ENKA, with its partner General Electric, will design and build the Samawa Combined Cycle Power Plant, which will add 750 MW to the Iraqi Grid. The project is located near Samawa City, 293 km northwest of Basra, in southern Iraq.

The gas turbines were purchased by Ministry of Electricity of Iraq as part of Mega-Deal between Government of Iraq from GE and will be handed over to GE-ENKA for installation and commissioning. These units are the last gas turbines of the Mega-Deal to be installed. All other materials and equipment shall be purchased and shipped to Iraq by GE-ENKA.

The project will consist of 1 power block, which will produce 750 MW of power at 132 and 400 kV transmission levels. It will include four (4) GE 9E series combustion turbine generators which will be able to fire three (3) types of fuels. The main fuel will be the Heavy Fuel Oil (HFO) and the back-up fuels will be Light Distillate Oil (LDO) and Natural Gas. The design of the equipment will be suitable for operating 24-hours/day, 7-days/week with useful life of 25 years.

The plant will be the first combined cycle project of that will be owned and operated by the Ministry of Electricity. The thermal efficiency will be above 50%, which will help Iraq to save 14 billion m³ of natural gas, and 32 million tons CO₂ over 25 years.

The financing of the Project shall be arranged by Overseas Private Investment Corporation (OPIC) and Export Credits Guarantee Department of UK Government (UKEF).

ENKA SCOPE OF SERVICES

Engineering, Procurement of Balance of Plant (BoP), Construction, Erection, Commissioning and Start-up of the power plant, whereas GE will provide the Power Island Equipment (i.e. Steam Turbine Generator (STG), Heat Recovery Steam Generator (HRSG), Air Cooled Condenser (ACC) and Main Transformers), Distributed Control System (DCS) & Switchyard and the plant performance tests.

ENKA İNŞAAT VE SANAYİ A.Ş.

PROJECT DESCRIPTION

ENKA, with its partner General Electric, will design and build the Samawa Combined Cycle Power Plant, which will add 750 MW to the Iraqi Grid. The project is located near Samawa City, 293 km northwest of Basra, in southern Iraq.

The gas turbines were purchased by Ministry of Electricity of Iraq as part of Mega-Deal between Government of Iraq from GE and will be handed over to GE-ENKA for installation and commissioning. These units are the last gas turbines of the Mega-Deal to be installed. All other materials and equipment shall be purchased and shipped to Iraq by GE-ENKA.

The project will consist of 1 power block, which will produce 750 MW of power at 132 and 400 kV transmission levels. It will include four (4) GE 9E series combustion turbine generators which will be able to fire three (3) types of fuels. The main fuel will be the Heavy Fuel Oil (HFO) and the back-up fuels will be Light Distillate Oil (LDO) and Natural Gas. The design of the equipment will be suitable for operating 24-hours/day, 7-days/week with useful life of 25 years.

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The financing of the Project shall be arranged by Overseas Private Investment Corporation (OPIC) and Export Credits Guarantee Department of UK Government (UKEF).

ENKA SCOPE OF SERVICES

Engineering, Procurement of Balance of Plant (BoP), Construction, Erection, Commissioning and Start-up of the power plant, whereas GE will provide the Power Island Equipment (i.e. Steam Turbine Generator (STG), Heat Recovery Steam Generator (HRSG), Air Cooled Condenser (ACC) and Main Transformers), Distributed Control System (DCS) & Switchyard and the plant performance tests.
ENKA with its vast work experience in Russia, prepared a transportation plan together with a local design institute, in the early stage of the project, having all local authorities involved, in order to avoid any setbacks during operation. During construction, unconventional erection methods utilized to gain schedule advantage. For instance, majority of the HRSG building structural steel erection was completed earlier than the erection of the HRSG itself, consuming more workhours and utilization of larger size cranes, however in return provided one month gain in schedule. For any material with delayed deliveries, alternatives were investigated and second orders were placed. Flexibility in work order was applied during start-up and commissioning of facilities.

In the end, the facility was commissioned and handed over to E.ON Russia, right on the original contract schedule and price, without any claims, without any Lost Time Incident (LTI) and in full compliance with international and applicable Russian norms, standards and permits.

ENKA SCOPE OF SERVICES

ENKA’s scope as the EPC contractor of the Yajva Combined Cycle Power Plant Project covered all the works including, engineering, procurement, construction, start-up, testing and commissioning of the plant. ENKA workforce reached to 860 people during the peak periods of the Project. ENKA further provided training for the O&M personnel who will be operating and maintaining the plant.

“Best Global Project Prize in the Power & Industrial category in 2013 Global Best Projects competition of the renowned Engineering News Record (ENR) magazine.”

<table>
<thead>
<tr>
<th>Type of Plant</th>
<th>Combined Cycle Power Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>411 MW</td>
</tr>
<tr>
<td>Type of Fuel</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>Configuration</td>
<td>1x1x1</td>
</tr>
<tr>
<td>Siemens Unit</td>
<td>Siemens Unit, Model: SGTF5-4000F, Rating Per Unit: 300 MW</td>
</tr>
<tr>
<td>CMI Unit</td>
<td>CMI Unit, Type: Vertical Natural Circulation type Un-fired boiler, 2,567,520 kg/h</td>
</tr>
<tr>
<td>Refrigeration</td>
<td>Wet type mechanical draft Cooling Tower(12,620 kg/s, 14 cells)</td>
</tr>
</tbody>
</table>

**PROJECT DESCRIPTION**

The Yajva Combined Cycle Natural Gas Power Plant Project consisted of a single shaft Siemens 1xSCCS-4000F-15 Power Train comprising of a Gas Turbine, Steam Turbine, Generator and Condenser, a vertical natural circulation type un-fired boiler manufactured by CMI as well as all auxiliary equipment such as steam / water cycle, a water treatment plant, controls systems, electrical systems, instrumentation, gas compressors, an administration building, a natural draft cooling tower and a 220 kV switchyard.

ENKA was selected as the EPC contractor by the Owner.

**PROJECT DETAILS**

The Yajva Combined Cycle Natural Gas Power Plant Project is considered as a first in the “Privatization and Reform” program of Russia consisting of power plant projects with new generation capacity in excess of 24,000 MWe in total. This strategic investment for the Owner had an aggressive EPC schedule which included development and approval of the permit engineering to meet TEO and Glasgowexpertza requirements, in other terms, a feasibility study and full compliance with Russian standards and norms of the project’s technical designs and documents. Under these circumstances, ENKA’s project team did not have any options for rework or recovery from an error during the execution of the project. Committed to delivering the project on time and with the highest quality, the team quickly mobilized, planned and managed this challenging initiative working closely with the Owner as a true project partner consistently responding to their concerns and preferences, as well as complying with the local norms and regulations.

Main plant equipment were manufactured according to European standards and needed approval for compliance with Russian standards and norms. ENKA established a Russian documentation team, in the early stages of the project, working closely with the Owner on applications for various certifications such as RosTechnadzor (RTN) for conformity and permit to use.

Remote location of project and the climate effects on heavy transportation was also one of the major challenges, considering the river channels to be used for equipment transport are open only between May and October. Further, the heavy equipment had to be road transported for 50 km from the unloading point to the jobsite.

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PROJECT DETAILS

ACCOMPLISHMENTS:
- Provided significant design margins and redundancy requirements.
- The Project has higher level of operational intelligence and reliability compared to a standard power plant due to being the single source of electric power for a giant oil field. Plant is designed under strict oil and gas standards and specifications (API) with significant design margins and redundancy requirements.
- Project started from a farm land being cultivated by farmers. ENKA, while executing the work, successfully managed cultural relations with locals to avoid any clashes, maintained good relations with the neighboring villages. Plant was located adjacent to the 400 kbdp Central Processing Facility (CPF) and construction was partly performed during commissioning of the CPF in a high hydrocarbon environment.
- Remote location and high temperatures during summer months created unique challenges for the project workforce peaked at 925 people. ENKA set up and maintained a safe and high quality site inclusive of a good camp with recreational areas and provided high quality catering services. A robust safety and security approach was deployed and implemented by ENKA throughout the project duration to protect our workforce, our customer, as well as the environment and communities surrounding the Project. Project was completed with 3.6 million workhours without a loss time accident indicating the fact that measures taken were effective.

PROJECT DESCRIPTION

West Qurna – 2 is a giant oil field in Iraq and the second largest undeveloped field in the world in terms of its hydrocarbon reserves. Recoverable reserves contained in two major formations, Mishrif and Yamama, are estimated at 13 billion barrels. In 2009, a consortium lead by LUKOIL won a tender for the development of the field. As part of the oil field development, Lukoil Mid-East Limited, the lead operator on behalf of the operating consortium has envisaged a Gas Turbine Power Plant (GTPP) to supply power to all oil production facilities. GTPP Project scope consisted of engineering, procurement, construction, commissioning and start-up of a 3x42 MW Simple Cycle Power Generation Plant and Power Distribution System. Project included three (3) GE MS6001B API Class Heavy Duty Dual Fuel Gas Turbine Generators-Simple Cycle 42 MW each at ISO conditions, associated balance of plant, a gas treatment and compression system, a liquid fuel unloading, storage and distribution system, 33 kV / 132 kV GIS switchgear and yard, power management system, buildings, utilities and infrastructure.

UNIQUE CHALLENGES

- Project has higher level of operational intelligence and reliability compared to a standard power plant due to being the single source of electric power for a giant oil field. Plant is designed under strict oil and gas standards and specifications (API) with significant design margins and redundancy requirements.
- Project started from a farm land being cultivated by farmers. ENKA, while executing the work, successfully managed cultural relations with locals to avoid any clashes, maintained good relations with the neighboring villages. Plant was located adjacent to the 400 kbdp Central Processing Facility (CPF) and construction was partly performed during commissioning of the CPF in a high hydrocarbon environment.
- Remote location and high temperatures during summer months created unique challenges for the project workforce peaked at 925 people. ENKA set up and maintained a safe and high quality site inclusive of a good camp with recreational areas and provided high quality catering services. A robust safety and security approach was deployed and implemented by ENKA throughout the project duration to protect our workforce, our customer, as well as the environment and communities surrounding the Project. Project was completed with 3.6 million workhours without a loss time accident indicating the fact that measures taken were effective.

ENKA SCOPE OF SERVICES

ENKA has self performed the full front end engineering design (FEED), detail engineering, procurement, construction, commissioning, start-up and performance testing scope for the project utilizing in-house resources on a lump sum turn-key basis. Specific content of the plant included, three (3) GE MS6001B Heavy Duty Dual Fuel Gas Turbine Generators - Simple Cycle - 42 MW each - ISO conditions; one complete set of 132 kV Gas Insulated Switchgear; one complete set of 33 kV Gas Insulated Switchgear; one complete set of 6.6 kV Air Insulated Switch Gear; step up and step down power transformers; a Black start system, PMS (Power Management System); a Central Electrical Control Room; a Gas Treatment Plant (45,000 Nm³/hour capacity) and compression system included with fuel gas buffer storage in order to allow automatic fuel switcher without having any power interruption or load reduction on gas turbines; liquid fuel tank storage and transfer system, a water treatment plant; firefighting and protection systems, utilities’ networks; all associated buildings including a maintenance shop, all roads and other paved areas including hard and soft landscaping; all security fencing, gates and gate house, CCTV cameras and perimeter lighting.

ENKA further provided training for the O&M personnel who will be operating and maintaining the plant.

ENKA İNŞAAT VE SANAYİ A.Ş.
PROJECT DESCRIPTION

MGH - Mass Group Holding Ltd. signed an EPC contract with ENKA to convert its Erbil Independent Power Project (IPP) from simple-cycle to combined-cycle technology. The primary Erbil Gas Power Station was developed by MGH - Mass Group Holding Ltd. as a simple-cycle project with a capacity of 1,000 MW which is Iraq Kurdistan's largest power plant. The plant is located about 20 km south of the city of Erbil, Kurdistan Region of Iraq.

Erbil Gas Power Station had eight GE - 9E gas turbines at the beginning of the project. Four of them were built in 2009 and the other four gas turbines have been recently completed. All were under operation during project execution. The combined-cycle gas turbines (CCGT) conversion by ENKA added 500 MW to the project by using steam turbines manufactured by GE.

UNIQUE CHALLENGES

The project consists of conversion of live simple cycle plant to a combined cycle plant project under brown field conditions.

ENKA worked under unstable grid conditions and successfully managed to minimize the negative impacts of the grid on the power plant by implementing tailor-designed control.

During the last quarter of the project execution, ENKA worked under significant civil instability and terror activity in the region without interruption and with no effect to contract schedule. ENKA prepared and organized an ever ready evacuation plan by minimizing the potential risk factors to its employees.

The US based engineering subcontractor could not send their engineers to the site due to the security concerns. By organizing regular video conferences ENKA kept the designers up to date and involved in the site day-to-day activities. Another challenge was to obtain residency permits, which took more time than originally anticipated.

Logistics was also one of the major challenges of the project, including not only the delays and obstacles in transportation due to force majeure events near the Turkish - Iraqi border but also the frequently changing Iraqi Customs regulations was also successfully managed with no effect to contract schedule although 51 thousand tons of project materials and equipment had been brought to the site.
SULAYMANIYAH 500 MW CONVERSION TO COMBINED CYCLE POWER PLANT PROJECT

PROJECT DESCRIPTION

MGH - Mass Group Holding Ltd. signed an EPC contract with ENKA to convert its Sulaymaniyah Independent Power Project (IPP) from simple-cycle to combined-cycle technology.

The existing simple cycle Sulaymaniyah Gas Power Station was developed by MGH - Mass Group Holding Ltd. with a capacity of 1,000 MW with eight GE - 9E gas turbines. The combined-cycle gas turbines (CCGT) conversion added 500 MW to the project making the overall capacity of 1,500 MW, by using steam turbines manufactured by GE.

Sulaymaniyah Combined Cycle Power Project is designed to work on two types of fuel - natural gas as the primary and diesel as the secondary source and will utilize the exhaust heat produced by the existing Sulaymaniyah Gas Power Station. Each block consists of four HRSGs, a GE steam turbine generator set and a 40-cell Air Cooled Condenser (ACC) System.

UNIQUE CHALLENGES

The project consists of conversion of live simple cycle to a combined cycle power plant project under brown field conditions. ENKA worked under unstable grid conditions nevertheless successfully managed to minimize the negative impacts of the grid on the power plant by implementing tailor-designed control.

One of the major challenges of the project was to work under major civil unrest in the region. ENKA prepared and implemented a solid safety and security plan based on risk avoidance through careful planning and defensive protection measures to cope with the challenges. Our security approach consisted of good community relations, counter-measures to reduce the risk by deterring, detecting or delaying the threat, and an ever ready evacuation plan should any incident occur.

Through this approach, ENKA minimized the potential risk factors and managed to work without interruption and with no effect to contract schedule.

Due to the circumstances, at times, shipments to the jobsite were interrupted and high labor turnovers were experienced causing ENKA to apply and obtain visas for the new workforce multiple times.

ENKA SCOPE OF SERVICES

The major works under the contract are the design, engineering, procurement, shipment/delivery, installation construction, interconnection, pre-commissioning, commissioning and start-up of eight HRSG’s, two nominally rated 250 MW GE STG’s, two GSUs, an air cooled system and all other balance of plant equipment to convert the simple cycle plant into two blocks of 4x4x1 combined cycle configuration as well as demonstration of parallel operation with the grid at the required net output, performance testing, classroom training of the operating and maintenance personnel, and preparation of integrated operation and maintenance manuals. The scope also includes a 400 kV switchyard for which the interconnection point will be a dead-end structure to be erected by the Ministry of Electricity.

ENKA workforce reached to 1,245 employees during the peak periods of the Project. ENKA further provided training for the O&M personnel who will be operating and maintaining the plant.

Table: Major Quantities

<table>
<thead>
<tr>
<th>Commodity</th>
<th>UoM</th>
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<tbody>
<tr>
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</table>
**BAZYAN 500 MW SIMPLE CYCLE POWER PLANT PROJECT**

**PROJECT DETAILS**

**LOCATION:** Sulaymaniyah, Iraq  
**OWNER / CLIENT:** Qaiwan Group  
**PROJECT DURATION:** Sep 2014 – Mar 2016  
**CONTRACT TYPE:** Lump Sum Turn Key  
**CONTRACT VALUE:** Confidential  
**SIGNIFICANT FEATURES / ACCOMPLISHMENTS:**  
- Utilization of multi-fuel with natural gas as the primary fuel and light fuel oil (i.e. a type of diesel) as the back-up fuel in cases when natural gas is unavailable.  
- Ability to supply of 15 days (47,000 m³) fuel oil on site.  
- 3.5 million workhours without a Lost Time Incident. (As of January 2016)

**UNIQUE CHALLENGES**

The main challenge of the project was meeting the 15 month fast-track project schedule. The project mobilization phase took place at the peak of significant civil unrest in the region. Deploying necessary number of employees to the jobsite took longer than originally anticipated in the contract schedule. ENKA with a successful coordination of procurement, logistics and risk management activities managed to bring 1,500 trucks to site in a very short time period and arranged their unloading at an extremely small lay down. In nearly one year, 15,000 tons of project materials were shipped to the site. Double handling techniques were used during earthworks due to the small size of the job site. Delays to transportation plans due to force majeure events near the Turkish - Iraqi border were handled with no effect on contract schedule. In this project, ENKA also successfully managed working with previously identified local suppliers and subcontractors without any bidding process.

**PROJECT DESCRIPTION**

The Qaiwan Group awarded ENKA the Bazyan Simple Cycle Power Plant Project on a EPC Turnkey basis, on 28th August 2014.  
The project was on a green-field site, located in the Sulaymaniyah Province of the Kurdistan Autonomous Region of Iraq.  
The power capacity of the plant is 500 MW generated by four GE-9E-3 gas turbines, an air insulated switchyard of 132kV, fuel gas conditioning system, three Distillate Fuel Oil tanks, each of 15,000 m³ capacity, a water treatment plant and all Balance of Plant systems, complete with all accessories, including piping, wiring, instrumentation controls and panels and all other facilities and required capabilities.

**ENKA SCOPE OF SERVICES**

The scope of the work covers all engineering, design, procurement, manufacturing, shipment/delivery, construction, installation, testing, interconnection, pre-commissioning, commissioning, start-up, demonstration of parallel operation with the grid at the required net output and performance testing activities as well as preparation of O&M manuals and classroom training of the operating and maintenance personnel. As-built documentation and 12 months warranty services were also provided by ENKA. The design supports a plant operation with two types of fuel – liquid fuel gas and liquid fuel oil.

The ENKA workforce reached 1,135 employees during the peak periods of the project.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>UoM</th>
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<tbody>
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</table>

"Ability to supply of 15 days (47,000 m³) fuel oil on site."
**PROJECT DESCRIPTION**

The Ministry of Electricity of Iraq contracted Mass Group Holding Ltd. to build a mega power plant to provide the state capital with reliable and sustainable electrical power. The plot selected for the plant is located to the south east of Baghdad around 25 km from the centre.

Besmaya Combined Cycle Project will consist of 2 power blocks which will produce 1,500 MW of power at 400 kV transmission level. Each block will consist of two (2) GE 9F series combustion turbine generators which may be operated in open cycle or combined cycle via the use of a bypass stack. In combined cycle mode, the exhaust from the combustion turbines will be directed to Heat Recovery Steam Generators and the steam produced will drive a Steam Turbine Generator. Waste heat will be rejected using a combination of fin-fan coolers and wet cooling tower equipment. Other facilities which will support the power block operation include oil unloading, storage and transfer system, fuel gas conditioning and pressure reduction, plant electrical system including generator step-up transformers, main control system – DCS, water treatment plant and administrative/O&M areas.

The plant is ready to produce power from the Simple Cycle Phase.

**UNIQUE CHALLENGES**

The project is being designed as a world-class power generation facility utilizing the latest technology in the market. Appropriate level of redundancy is included in each system so that no single failure of an auxiliary plant component shall result in the total loss of the unit generating capability. ENKA's engineering team is working on the plant design to satisfy all of Owner’s needs and mitigating design criteria changes due to unforeseen factors.

The city of Baghdad suffered significant damage for the last several decades and just yet rebuilding its infrastructure. It is not possible to rely on the existing infrastructure in the area. Therefore, ENKA has established a self-sufficient temporary construction facilities complex at the jobsite to sustain construction works without any disruption or interruption.

**PROJECT DETAILS**

**LOCATION**
Baghdad, Iraq

**OWNER / CLIENT**
Mass Group Holding Ltd.

**PROJECT DURATION**
Oct 2014 – Feb 2018

**CONTRACT TYPE**
Lump Sum Turn Key

**CONTRACT VALUE**
Confidential

**SIGNIFICANT FEATURES / ACCOMPLISHMENTS**
- The project will help addressing the urgent power needs of Baghdad and improve its living conditions in the Iraqi capital and surroundings.
- First IPP Project in Central Iraq

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One of the major challenges of the project is to work in a social environment suffering civil violence and instability. ENKA has prepared and is implementing a robust security plan based on risk avoidance through careful planning and defensive protection measures. ENKA’s approach to security consists of; good community relations, counter-measures to reduce the risk by deterring, detecting or delaying the threat, and taking extra mitigation measures should any incident occur. The aim of our security system is to provide a secure environment for staff, operators and subcontractors through the effective use of counter-measures, while remaining sympathetic to the facility’s operation, layout and the environmental restrictions.

Over 60,000 tons of project materials and equipment will be shipped to the jobsite through congested Umm Qasr port and partially northern routes. Significant planning and route surveys are required for the successful transportation of oversized cargo. The compliance with frequently changing Iraqi customs regulations and bureaucracy involved in timely customs clearance of goods is a major challenge. ENKA shall leverage its vast experience in Iraq to clear all project cargo without any disputes with customs authorities with careful planning and strictly adhering to the laws and requirements.

**PROJECT DETAILS**

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**ENKA SCOPE OF SERVICES**

ENKA’s scope of work consists of design, detailed engineering, procurement, shipment/delivery of all project materials, installation and construction, interconnection, pre-commissioning, commissioning & start up, demonstration of parallel operation with the grid at the required net output, performance testing, training of the operating and maintenance personnel, and preparation of integrated operation and maintenance manuals according to the division of works for the power plant.

The simple cycle part of the plant will be made up of 4 GE 9F 3-series gas turbines and all auxiliaries. The combined cycle part of the plant will consist of four Heat Recovery Steam Generators (HRSG), two nominally rated 250 MW Steam Turbine Generators (STG) incl. condensers, six GSUs, two wet cooling towers, and all the requisite equipment and systems to make the plant a safe, reliable, efficient combined cycle power generating facility.

<table>
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<tr>
<th>Type of Plant</th>
<th>Combined Cycle Power Plant</th>
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<tbody>
<tr>
<td>Capacity</td>
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<tr>
<td>Type of Fuel</td>
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<td>Configuration</td>
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<tr>
<td>Gas Turbine Generator</td>
<td>General Electric Unit: 4 Sets, Model: 9FA.03, Rating Per Unit: 265 MW</td>
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<tr>
<td>Steam Turbine Generator</td>
<td>General Electric Unit: 2 Sets, Model: D000 33.5” LSB, Rating Per Unit: 250 MW</td>
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<tr>
<td>HRSG</td>
<td>CMI Unit: 4 Sets, Type: Vertical - 2 Stages-HP, LP, with diverter damper and by-pass stack (101.48 kg/s at 536.53C Rating: 708 kg/s at 242.16C)</td>
</tr>
<tr>
<td>Cooling Type</td>
<td>Combination of Fin Fan Coolers and Wet Cooling Tower Wet Cooling Tower Capacity (32,626 kg/s, 14 cells)</td>
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**Major Quantities**

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NAJYBIAH 500 MW GAS TURBINE POWER PLANT PROJECT

ENKA İNŞAAT VE SANAYİ A.Ş.

30

ACCOMPLISHMENTS:
SIGNIFICANT FEATURES / ACCOMPLISHMENTS:

• 1 million workhours without a Lost Time Incident.
• Achieved 40% Iraqi content on direct project workhours.
• On schedule completion of the project provided Iraqis in Basra and on the national grid with more hours of electricity per day.
• Part of largest power investment (Mega Deal) by Iraqi government in the past war era.

PROJECT DESCRIPTION
The Najybiah Power Plant Project, located near Basra, is part of a master plan developed and implemented by Republic of Iraq’s Ministry of Electricity to increase the power generation capacity to meet the rapid growth of demand in the country after 25 years of war and lack of investment.

The Project consisted of engineering, procurement, construction, commissioning and start-up of a 4x125 MW Power Generation Plant to operate in simple cycle mode of operation with three type of fuel, Heavy Fuel Oil (HFO), Natural Gas and Light Distillate Oil (LDO), complete with all Balance of Plant (BOP) systems to support safe and efficient operation of CTG units. Heavy fuel oil (HFO) is used as main fuel for CTG operation whereas, natural gas and light distillate oil (LDO) are used as back-up fuels. Plant has an overall storage capability of 5 days for both liquid fuels (HFO & LDO). Power is generated at 15 kV in the CTGs and stepped up by main transformers to the grid voltage via 132 kV and 400 kV GIS Substations.

Project’s four (4) each GE Frame 9E Gas Turbine Generator Sets were free issued and delivered to site by the Owner.

UNIQUE CHALLENGES
The Najybiah power plant is expected to address the growing demand for power in the country and supply uninterrupted electricity to the people of Iraq. Due to lack of infrastructure and availability of reliable natural gas supply in the region, the plant was designed to function on three different types of fuel to ensure continuity of operations. Storage and distribution systems for the two liquid fuels were carefully designed by ENKA with appropriate design margins and redundancy requirements.

Project site is located on the northern part of Basra province on the banks of Shatt Al Arab River and surrounded by water canals. Weak soil conditions necessitated significant amount of piling for foundations. As part of the EPC Contract, ENKA through its piling specialist subsidiary Kashtas has installed Ø800mm piles over 65,000 meters in total length.

ENKA SCOPE OF SERVICES
ENKA has self performed the basic engineering, detail engineering, procurement, construction, commissioning, start-up and performance testing scope for the project utilizing in-house resources on a lump sum turn-key basis. Specific scope of services provided by ENKA included; complete basic and detailed design and engineering of the plant, supply of all balance of plant (BOP) systems and equipment, all civil works including GTG foundations and structural steel, fuel gas supply and regulating station, all HFO (raw, treated, certified) and LFO fuel tanks (2 ea x 9,050 m³, 2 ea x 4,540 m³, 2 ea x 1,125 m³, 2 ea x 3,245 m³ steel tanks), unloading, metering and fuel treatment systems, auxiliary boiler system, 400 kV and 132 kV GIS systems with step-up transformers, MV and LV substation with auxiliary transformers, instrument and plant air supply systems, black start and emergency diesel generators, Fire protection, detection, alarm and extinguishing systems, water storage, pre-treatment and demineralization plant, plant and on-schedule completion of the project.

UNIQUE CHALLENGES
ENKA further provided training for the Operation and Maintenance (O&M) personnel who will be operating and maintaining the plant.

NAJYBIAH 500 MW GAS TURBINE POWER PLANT PROJECT

LOCATION:
Al Najybiah, Basra - Iraq

OWNERS / CLIENTS:
Ministry of Electricity, Iraq

LOCATION AND SCHEDULE:
May 2013 – May 2015

CONTACT TYPE:
Lump Sum Turn Key

CONTACT VALUE:
US$ 217 million

SIGNIFICANT FEATURES / ACCOMPLISHMENTS:

• 1 million workhours without a Lost Time Incident
• Achieved 40% Iraqi content on direct project workhours
• On schedule completion of the project provided Iraqis in Basra and on the national grid with more hours of electricity per day
• Part of largest power investment (Mega Deal) by Iraqi government in the past war era

PROJECT DESCRIPTION
The Najybiah Power Plant Project is located near Basra, is part of a master plan developed and implemented by Republic of Iraq’s Ministry of Electricity to increase the power generation capacity to meet the rapid growth of demand in the country after 25 years of war and lack of investment.

The Project consisted of engineering, procurement, construction, commissioning and start-up of a 4x125 MW Power Generation Plant to operate in simple cycle mode of operation with three type of fuel, Heavy Fuel Oil (HFO), Natural Gas and Light Distillate Oil (LDO), complete with all Balance of Plant (BOP) systems to support safe and efficient operation of CTG units. Heavy fuel oil (HFO) is used as main fuel for CTG operation whereas, natural gas and light distillate oil (LDO) are used as back-up fuels. Plant has an overall storage capability of 5 days for both liquid fuels (HFO & LDO). Power is generated at 15 kV in the CTGs and stepped up by main transformers to the grid voltage via 132 kV and 400 kV GIS Substations.

Project’s four (4) each GE Frame 9E Gas Turbine Generator Sets were free issued and delivered to site by the Owner.

UNIQUE CHALLENGES
The Najybiah power plant is expected to address the growing demand for power in the country and supply uninterrupted electricity to the people of Iraq. Due to lack of infrastructure and availability of reliable natural gas supply in the region, the plant was designed to function on three different types of fuel to ensure continuity of operations. Storage and distribution systems for the two liquid fuels were carefully designed by ENKA with appropriate design margins and redundancy requirements.

Project site is located on the northern part of Basra province on the banks of Shatt Al Arab River in a relatively high populated area. ENKA, while executing the work, successfully managed cultural relations with locals to avoid any clashes and maintained good relations with its neighbors.

"1 million workhours without a Lost Time Incident"
ZWITINA 570 MW GAS TURBINES POWER PLANT PROJECT

PROJECT DESCRIPTION

Zwitina Power Plant is designed for Simple Cycle Operation. The plant consists of 2 Combustion Turbine Generators (CTG) each nominally rated at 285 MW power producing capacity at generator output terminals at ISO conditions. Base fuel is natural gas while diesel oil is also available as backup fuel.

The CTG’s are Siemens Model SGTS-PAC-4000F.

Overall plant design, sub-systems design and selected equipment are suitable for future conversion into Combined Cycle Operation.

Power island equipment (i.e. Combustion Turbine – Generator packages and their auxiliary packages) have been procured directly by GESCO (Global Electricity Service Company of Libya) while ET was responsible for complete plant engineering, procurement of Balance of Plant (BOP) equipment and material, natural gas pipeline and complete site works (construction and erection), commissioning and start-up.

UNEQUE CHALLENGES

The Zwitina Power Plant has been planned to assist elimination of great power shortage especially in the Eastern Libya as well as to feed newly established 400 kV National Electricity Network all over the Libya territory.

The project site is located just near the sea at a sandy coastal area. Underground water level is just 80 cm below project ground level therefore piling and continuous dewatering is needed during civil construction. Comprehensive insulation systems have been applied against salty sea water absorption to the infrastructure of the facilities.

At the end of successful commissioning and putting into the operation, each unit's actual capacity is reached to 305 MW. This figure is more than the design capacity (285 MW) and very rare and exceptionally good output compared to the other similar model turbine applications all over the world.
PROJECT DETAILS

LOCATION:
South West of Sebha City in the Southern Region of Libya

OWNER / CLIENT:
General Electricity Company of Libya (GECOL)

PROJECT DURATION:
Dec 2010 – Nov 2017

CONTRACT TYPE:
Lump Sum Turn Key

SIGNIFICANT FEATURES / ACCOMPLISHMENTS:
• After the first force majeur occurred in Feb 2011, we were the first Contractor which had resumed site activities in October 2012, not only in the southern region but throughout the whole of Libya.
• Engineering, Procurement and Site Works progress had been ahead of Contractual Schedule by six (6) months and had reached up to 98% physical completion by the time the site had to be evacuated in September 2014 with great effort in lieu of the prevailing circumstances in Libya.

ENKA SCOPE OF SERVICES
Turn-key engineering, supply for BOP parts and complete plant (including 50 km of crude oil pipeline), construction, erection and commissioning of 4x160 MW Simple Cycle Power Generation Plant. Power Island of the plant consists of 4 units of Siemens SG75-PAC 2000E Combustion Turbine + SGen5-100A Generator sets.

The project is designed and supplied to operate in simple cycle mode of operation, complete with all Balance of Plant (BOP) systems to support safe and efficient operation of CTG units.

OTHER SERVICES:
• Engineering, design and documentation for the complete project scope
• Procurement and transportation
• Construction and erection works (including vendor supervision)
• Commissioning, testing, start-up and handover
• Training services for plant operation & maintenance staff
• Initial operation spare parts.
PROJECT DESCRIPTION

PS-1 Depot, located approximately 60 km west of Basra, is one of the major crude oil storage depots in Iraq housing ten storage tanks each with 82,000 m³ capacity. Oil produced at the super-giant Rumaila oil field, which comprises over one third of Iraq’s total production, is collected here and pumped to Al Fao Terminal, located 140 km away, for export via a 48” Pipeline. PS-1’s operations are critical for maintaining uninterrupted export of oil to sustain oil sales which constitutes almost all of Iraq’s income.

A modernization and expansion program developed by South Oil Company of Iraq is underway to restore integrity, operability and reliability as well as increase oil export capacity. Main part of this program is the Crude Oil Turbo Pump Station (PS-1) Project consisting of EPC delivery of a pump station adjacent to the existing pump station complete with all balance of plant equipment and systems.

The new pumping station has two 13 MW Gas Turbine Driven Turbo Pump Units, delivering oil 6,100 m³/hr at a pressure of 685 meters at the 42” discharge.

UNIQUE CHALLENGES

The Project has been designed to a high level of operational intelligence and reliability due to being a critical facility for oil exports from a giant oil field. Plant is designed under strict oil and gas standards and specifications (API) with appropriate design margins and redundancy requirements.

Construction works were performed whilst the adjacent existing pump station remained operational. ENKA adhered to respective Simultaneous Operation (SIMOPS) procedures strictly to ensure safety of the plant and personnel during the execution. Detailed method statements and construction schedules were prepared in order not to disturb ongoing operations: ENKA have coordinated all interfaces with SOC’s Operations Team as required. Additionally, connections to existing headers and pipelines were implemented with hot tapping operations without the interruption of shutting down and emptying those section of pipes or manifolds. Existing pump station continued to be in operation whilst tie-ins were being done. A robust safety and security approach was deployed and implemented throughout the project duration to protect our workforce, our customer, existing facilities as well as the environment and communities surrounding the Project.

ENKA SCOPE OF SERVICES

ENKA Teknik, a wholly owned subsidiary of ENKA, has been awarded the EPC contract for the Crude Oil Turbo Pump Station for PS-1 Depot by South Oil Company. ENKA Teknik provided full detail engineering, procurement, construction, commissioning scope for the new station consisted of: two 13 MW Turbo Pump Units, Fuel Gas Booster Compressing and Regulation Station, Compressed Air System (Instrument and Service Air), Crude Oil Drain Tank, Waste Water Tank, low voltage power distribution and control system, a Station shelter complete with overhead cranes for maintenance.

Project’s engineering and design effort was carried out at ENKA’s main office in Istanbul, Turkey.
PROJECT DESCRIPTION

Following a build-own-operate (BOO) tender in 1997, the InterGen-ENKA partnership was awarded the right to build, own and operate the Gebze Power Plant with a nominal capacity of 1,554 MW, the Adapazarı Power Plant with a nominal capacity of 777 MW and the İzmir Power Plant with a nominal capacity of 1,523 MW, respectively. An ENKA and Bechtel joint venture was the turnkey EPC contractor for all three plants.

Each power island in these natural gas-fired combined cycle power plants consists of two combustion turbines/generators, two heat-recovery steam generators and one steam turbine/generator. In the Gebze and Adapazarı power plants, natural draft dry cooling towers serve each power island, whereas in the İzmir plant, low-profile forced draft wet cooling towers were built, using seawater as a cooling medium.

The combustion turbine generators were supplied by General Electric (USA), the steam turbine generators by Alstom Power (Germany), the closed cooling system by EGI (Hungary), the heat-recovery steam generators by CMI (Belgium), the switchyards by Siemens (Turkey-Germany), the main and auxiliary transformers by Alstom (Turkey), the water treatment plant by Aquatech-ENKA Teknik (USA-Turkey), the gas RMS systems by ENKA Teknik (Turkey) and the DCS control systems by ABB-Bailey (USA).

At various times during construction, as many as 12,000 workers were employed at all three plants. The Gebze and Adapazarı power plants were completed in 2002 and the İzmir plant in 2003.

In that period, meticulous planning and close supervision have enabled ENKA to successfully complete planned maintenance in the shortest times yet achieved for GE 9FA+e machines and also achieve 99.8% availability at the Adapazarı plant, nearly 7 percentage points higher than the industry average, and a global record in F-class gas turbine technology. Considering that performance, Power Magazine selected the Adapazarı plant as one of the award-winning gas-fired top plants in 2011.

Also, Factory Mutual (FM) Global awarded all three power plants the status of “Highly Protected Risk” in recognition of ENKA’s commitment to the reduction of potential losses through a stringent program of risk mitigation and prevention.
DERNA DESALINATION PLANT PROJECT (SEA WATER THERMAL (MED-TVC) PLANT)

Project site is located in Derna city in the eastern part of Libya in a relatively high populated area. ENKA, while executing the work, successfully managed cultural relations with locals to avoid any clashes and maintained good relations with its neighbors. Such regional location and high temperatures during summer months created unique challenges for the project workforce peaked at 450 people.

ENKA SCOPE OF SERVICES

ENKA has self performed the basic engineering, detail engineering, procurement, construction, commissioning, start-up and performance testing scope for the project utilizing in-house resources on a lump sum turn-key basis. Specific scope of services provided by ENKA included; complete basic and detailed design and engineering of the plant, supply of all balance of plant (BOP) systems and equipment, all civil works including foundations and structural steel, Product Water Tanks (2 x 20,000 m³), Make Up Water Tank (1 x 500 m³), HFO Tanks (1 x 20,000 m³, 1 x 5,000 m³), 2 x 40,000 m³/day sea water intake system including 20 kg/hr electro-chlorination system, 2 x 1,000 m HDPE offshore sea water intake piping (dia. 1,400 mm), complete interconnecting piping of the plant, fire fighting system, MV/LV electrical & control and switchgear systems with aux. transformers, instrument and plant air supply systems, Emergency Diesel Generators, waste collection and treatment system, batteries and UPS System, Ventilation and air conditioning (HVAC) systems, overhead cranes and maintenance hoists, power plant distributed control system (DCS), mechanical and electrical erection, complete civil and structural works, supply of spare parts, and start-up and commissioning of the plant. ENKA further provided training for the O&M personnel who will be operating and maintaining the plant.

ENKA scope also covers 9,000 m water distribution DI piping line (dia. 600 mm) with 2 x 10,000 m³ water storage tanks.

PROJECT DESCRIPTION

Derna Desalination Plant Project, located in Derna city in eastern part of Libya, was in part of a development plan implemented by General Electricity Company of Libya, in the period of 40th Anniversary preparations of Libyan Leader, to cover high demand of reliable water sources in eastern part of Libya.

The Project consisted of engineering, procurement, construction, commissioning and start-up of a 2 x 20,000 m³/day Water Production Plant with two type of fuel, Heavy Fuel Oil (HFO) and Light Fuel Oil (LFO), complete with all Balance of Plant (BOP) systems. Heavy fuel oil (HFO) is used as main fuel for MED Desalination Plant operation whereas, light fuel oil (LFO) are used as back-up fuels. The project consists of a redundant sea water intake system of which complete basic and detailed engineering was included in EPC scope of the Project.

Main process and equipment, MED evaporators, boilers and auxiliaries are supplied by Sidem (Veolia, FR) as consortium partner of the Project.

The project includes a water distribution network line with water storage tanks.

UNIQUE CHALLENGES

Derna Desalination Plant is expected to address the growing demand for water in eastern part of the country and supply reliable water to public.

Sea water intake onshore system construction needed micro piling implementation to eliminate excessive amount of water flows through subsoil cracks. The micro piling system was carefully designed by ENKA to overcome natural difficulties. As part of the EPC Contract, ENKA through its piling specialist subsidiary Kasktas have installed Ø340mm micro piles in 685 pcs in total.

Offshore portion of sea water system was challenge in eastern Mediterranean Sea under unexpected open sea conditions. Design and implementation of offshore portion were performed with appropriate design margins and redundancy requirements.

DERNA DESALINATION PLANT PROJECT (SEA WATER THERMAL (MED-TVC) PLANT)
SOUSSA DESALINATION PLANT PROJECT (SEA WATER THERMAL (MED-TVC) PLANT)

ENKA SCOPE OF SERVICES

ENKA has self-performed the basic engineering, detail engineering, procurement, construction, commissioning, start-up and performance testing scope for the project utilizing in-house resources on a lump sum turn-key basis. Specific scope of services provided by ENKA included; complete basic and detailed design and engineering of the plant, supply of all balance of plant (BOP) systems and equipment, all civil works including foundations and structural steel, Product Water Tanks (2 x 20,000 m³), Make Up Water Tank (1 x 500 m³), HFO Tanks (2 x 5,000 m³), 2 x 40,000 m³/day sea water intake system including 20 kg/hr electro-chlorination system, 2 x 500 m HDPE offshore sea water intake piping (dia. 1,400 mm); complete interconnecting piping of the plant, fire fighting system, MV/LV electrical & control and switchgear systems with aux. transformers, instrument and plant air supply systems, Emergency Diesel Generators, waste collection and treatment system, batteries and UPS System, ventilation and air conditioning (HVAC) systems, overhead cranes and maintenance hoists, power plant distributed control system (DCS), mechanical and electrical erection, complete civil and structural works, supply of spare parts, and start-up and commissioning of the plant. ENKA further provided training for the O&M personnel who will be operating and maintaining the plant.

Major Quantities

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UNIQUE CHALLENGES

Sousa Desalination Plant is expected to address the growing demand for water in eastern part of the country and supply reliable water to public. Offshore portion of sea water system was challenge in eastern Mediterranean Sea under unexpected open sea conditions. 2 x 500 m HDPE pipe string was floated and sank in one piece to be installed on sea bed. Design and implementation of offshore portion were performed with appropriate design margins and redundancy requirements.

Project site is located in near Soussa city in the eastern part of Libya. ENKA, while executing the work, successfully managed cultural relations with locals to avoid any clashes and maintained good relations with its neighbors. Such regional location and high temperatures during summer months created unique challenges for the project workforce peaked at 380 employees.

PROJECT DESCRIPTION

Sousa Desalination Plant Project, located in Sousa city in eastern part of Libya, was in part of a development plan implemented by General Electricity Company of Libya, in the period of 40th Anniversary preparations of Libyan Leader, to cover high demand of reliable water sources in eastern part of Libya.

The Project consisted of engineering, procurement, construction, commissioning and start-up of a 2 x 20,000 m³/day Water Production Plant with two type of fuel, Heavy Fuel Oil (HFO) and Light Fuel Oil (LFO), complete with all Balance of Plant (BOP) systems. Heavy fuel oil (HFO) is used as main fuel for MED Desalination Plant operation whereas, light fuel oil (LFO) are used as back-up fuels. The project consists of a redundant sea water intake system of which complete basic and detailed engineering was included in EPC scope of the Project.

Main process and equipment, MED evaporators, boilers and auxiliaries are supplied by Sidem (Veolia, FR) as consortium partner of the Project.

Sousa Desalination Plant Project

LOCATION: Sousa - Libya
OWNER / CLIENT: General Electricity Company of Libya (GECOL)
PROJECT DURATION: Aug 2006 – Aug 2010
CONTRACT TYPE: Lump Sum Turn Key
CONTRACT VALUE: EUR 25 million
SIGNIFICANT FEATURES / ACCOMPLISHMENTS:
• 15 million workhours
• First supply and delivery of Floating HDPE offshore pipe (dia. 1,400 mm) in total 500 m length in one piece bundle from Turkey. First parachute channel crossing of HDPE pipe string by floating method with tug boat in total of 650 m.
• 500 tons of concrete water intake head erection in 12 m depth under seawater.
• 6 pcs of concrete blocks, 85 tons each, transportation by means of floating in 2 miles.
• First Çanakkale m length in on piece bundle (dia. 1,400 mm) in total 500 floating HDPE offshore pipe.
• Emergency Diesel Generators, waste collection and treatment system, batteries and UPS System, ventilation and air conditioning (HVAC) systems, overhead cranes and maintenance hoists, power plant distributed control system (DCS), mechanical and electrical erection, complete civil and structural works, supply of spare parts, and start-up and commissioning of the plant. ENKA further provided training for the O&M personnel who will be operating and maintaining the plant.

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e-mail: enka@enka.com | web: www.enka.com
**PROJECT DESCRIPTION**

Zawia Desalination Plant Project, located in Zawia city in western part of Libya in 60 km distance to capital city Tripoli, was in part of a development plan implemented by General Electricity Company of Libya, in the period of 40th Anniversary preparations of Libyan Leader, to cover high demand of reliable water sources in eastern part of Libya.

The Project consisted of engineering, procurement, construction, commissioning and start-up of a 4x20,000 m³/day Water Production Plant with three type of fuel, Heavy Fuel Oil (HFO), NG and Light Fuel Oil (LFO), complete with all Balance of Plant (BOP) systems. NG is planned to be used as main fuel for MED Desalination Plant operation whereas; heavy fuel oil (HFO) are used as back-up fuels.

Main process and equipment, MED evaporators, boilers and auxiliaries are supplied by Sidem (Veolia, FR) as consortium partner of the Project.

The project includes a relatively large water distribution network line in 142 km with water storage tanks and pumping stations.

**UNIQUE CHALLENGES**

Zawia Desalination Plant is expected to address the growing demand for water in western part of the country and supply reliable water to public.

Project site is located in Zawia city in the western part of Libya in a highly populated area. ENKA, while executing the work, successfully managed cultural relations with locals to avoid any clashes and maintained good relations with its neighbors.

Soil improvement has to be performed by means of replacement of subsoil with adequate fill material in the project site for foundations of heavy loads.

Such regional location and high temperatures during summer months created unique challenges for the project workforce peaked at 620 employees.

**ENKA SCOPE OF SERVICES**

ENKA has self performed the basic engineering, detail engineering, procurement, construction, commissioning, start-up and performance testing scope for the project utilizing in-house resources on a lump sum turn-key basis.

Specific scope of services provided by ENKA included, complete basic and detailed design and engineering of the plant, supply of all balance of plant (BOP) systems and equipment, all civil works including foundations and structural steel, Product Water Tanks (2 x 20,000 m³), Make Up Water Tank (1 x 500 m³), LFO Tank (1 x 2,500 m³), complete interconnecting piping of the plant, fire fighting system, MV/LV electrical & control and switchgear systems with aux. transformers, instrument and plant air supply systems, Emergency Diesel Generators, waste collection and treatment system, batteries and UPS System, ventilation and air conditioning (HVAC) systems, overhead cranes and maintenance hoists, power plant distributed control system (DCS), mechanical and electrical erection, complete civil and structural works, supply of spare parts, and start-up and commissioning of the plant. ENKA further provided training for the O&M personnel who will be operating and maintaining the plant.

ENKA scope also covers 142,000 m water distribution DI piping line with 9 pcs of water storage tanks (2 x 20,000 m³, 5 x 10,000 m³, 1 x 5,000 m³, 1 x 2,500 m³) and 4 pcs of pumping stations.

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PROJECT DESCRIPTION

Zuara Desalination Plant Project, located in near Zuara city within 10 km in western part of Libya, in 100 km distance to capital city Tripoli, was in part of a development plan implemented by General Electricity Company of Libya, in the period of 40th Anniversary preparations of Libyan Leader, to cover high demand of reliable water sources in eastern part of Libya.

The Project consisted of engineering, procurement, construction, commissioning and start-up of a 2 x 20,000 m³/day Water Production Plant with two type of fuel, Heavy Fuel Oil (HFO), and Light Fuel Oil (LFO), complete with all Balance of Plant (BOP) systems. HFO is planned to be used as main fuel for MED Desalination Plant operation whereas, light fuel oil (LFO) are used as back-up fuels.

Main process and equipment, MED evaporators, boilers and auxiliaries are supplied by Sidem (Veolia, FR) as consortium partner of the Project.

UNIQUE CHALLENGES

Zuara Desalination Plant is expected to address the growing demand for water in western part of the country and supply reliable water to public.

Project site is located in coast line of Zuara city in the western part of Libya. Soil was weak to withstand heavy loads of the project structures. So ENKA had to perform piling work with dia. 600 mm drill hole in total of 3696 m in length.

Such regional location and high temperatures during summer months created unique challenges for the project workforce peaked at 280 people.

ENKA SCOPE OF SERVICES

ENKA has self-performed the basic engineering, detail engineering, procurement, construction, commissioning, start-up and performance testing scope for the project utilizing in-house resources on a lump sum turn-key basis.

Specific scope of services provided by ENKA included; complete basic and detailed design and engineering of the plant, supply of all balance of plant (BOP) systems and equipment, all civil works including foundations and structural steel, Product Water Tanks (2 x 20,000 m³), Make Up Water Tank (1 x 500 m³), LFO Tank (1 x 5,000 m³), complete interconnecting piping of the plant, firefighting system, MV/LV electrical & control and switchgear systems with aux. transformers, instrument and plant air supply systems, Emergency Diesel Generators, waste collection and treatment system, batteries and UPS System, ventilation and air conditioning (HVAC) systems, overload cranes and maintenance hoists, power plant distributed control system (DCS), mechanical and electrical erection, complete civil and structural works, supply of spare parts, and start-up and commissioning of the plant. ENKA further provided training for the O&M personnel who will be operating and maintaining the plant.

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Major Quantities
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<tr>
<td>1</td>
<td>TP.AO - Algida Refinery New Storage Tanks</td>
<td>Izmir, Turkey</td>
<td>Türkiye Petrol Endüstrisi Anonim Ortaklığı T.PAO (Turkish Petroleum Co., Inc.)</td>
<td>Fabrication, erection, piping and insulation of 24,000 ton floating roof crude storage tanks, 4,200 ton insulated fixed roof oil tank.</td>
<td>2016</td>
<td>2018</td>
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<td>2</td>
<td>Construction and Erection of the Newly Built Middle Anatolian Refinery</td>
<td>Kirkkale, Turkey</td>
<td>Türkiye Petrol Endüstrisi Anonim Ortaklığı T.PAO (Turkish Petroleum Co., Inc.)</td>
<td>Construction and erection of the following storage tanks of the Middle Anatolian Refinery, 82 cylindrical tanks for the storage of crude oil and 60 products, 31 of which have floating roofs. Tank capacities change between 10,000 m³ and 136,000 m³. The total capacity is 3,250,000 m³</td>
<td>1979</td>
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<td>3</td>
<td>Perlum “Yummy” Complex New Tank Farm</td>
<td>Izmir, Turkey</td>
<td>“PETKIM - Petrokimya A.S.”、“PETKIM - Petrochemical Co., Inc.”</td>
<td>Fabrication, erection, piping and insulation of 9,000 m³ stainless steel tanks for Acetic Acid including cooling, cooling stations, steam heating, insulation and instrumentation.</td>
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<td>Acetic Acid Tank Farm</td>
<td>Izmir, Turkey</td>
<td>“PETKIM - Petrokimya A.S.”、“PETKIM - Petrochemical Co., Inc.”</td>
<td>Design, supply and erection of 1,000 m³ stainless steel tanks for Acetic Acid including cooling, cooling stations, steam heating, insulation and instrumentation.</td>
<td>1988</td>
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<td>5</td>
<td>Zawa Potable Water Pipeline</td>
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<td>GECoL (General Electricity Company Of Libya)</td>
<td>Design, supply and erection of the following storage tanks of the Zawa Potable Water Pipeline Project:</td>
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<td>Zawa Desalination Plant Extension</td>
<td>Libya</td>
<td>GECoL (General Electricity Company Of Libya)</td>
<td>Design, supply and erection of the following storage tanks of the Zawa Desalination Plant Project:</td>
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<td>Dema Desalination Plant</td>
<td>Libya</td>
<td>GECoL (General Electricity Company Of Libya)</td>
<td>Design, supply and erection of the following storage tanks of the Dema Desalination Plant Project:</td>
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<td>Soussa Desalination Plant</td>
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<td>GECoL (General Electricity Company Of Libya)</td>
<td>Design, supply and erection of the following storage tanks of the Soussa Desalination Plant Project:</td>
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<td>9</td>
<td>Zawa Desalination Plant</td>
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<td>GECoL (General Electricity Company Of Libya)</td>
<td>Design, supply and erection of the following storage tanks of the Zawa Desalination Plant Project:</td>
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<td>10</td>
<td>4x160 MW Awbari Gas</td>
<td>Libya</td>
<td>ENKA İNŞAAT VE SANAYİ A.Ş.</td>
<td>Replacement of pumps at the existing pump stations PS3, PS4 and PS5. Construction of three new pumps (PDF, PS3, PS4 and PS5), complete with high voltage substation, MV substation, fire fighting, fire alarm system, telecontrol / telecommunication and instrumentation system, 438.5 MW, 11 KV pump / motor sets, station piping, cathodic protection systems and residential areas.</td>
<td>1983</td>
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**SELECTED TANK FARM REFERENCED PROJECTS**

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<td>11</td>
<td>6 x 125 MW GE DE Nabyse Gas Turbine Power Plant</td>
<td>Iraq</td>
<td>Ministry of Electricity of Iraq (MIE)</td>
<td>Engineering, procurement, construction, commissioning and startup of 2x 285 MW Simple Cycle Power Generation plant on turn-key basis. Power Island has consisted of 2 units of Siemens SGT5-800CC combustion turbine-generator sets completed with auxillary system.</td>
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<td>Electrical Power Station Beimsaya 150 MW CCGT</td>
<td>Iraq</td>
<td>Masr Group Holding Limited</td>
<td>Engineering, procurement, construction, commissioning and startup of 4x 50 MW Simple Cycle Power Generation plant on turn-key basis. Power Island of the plant has consisted of 4 units from Siemens SGT5-1000CE combustion turbine + SG500-90A Generator sets.</td>
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**SELECTED PIPELINE REFERENCED PROJECTS**

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<tr>
<td>13</td>
<td>Iraq - Turkey Crude Oil Pipeline Expansion Project</td>
<td>Turkey</td>
<td>BOTAS : Bursa Hafif &amp; Petrol Tasma A.S. (BOTAS : Transportation by pipelines Inc.)</td>
<td>Replacement of pumps at the existing pump stations PS3, PS4 and PS5. Construction of three new pumps (PDF, PS3, PS4 and PS5), complete with high voltage substation, MV substation, fire fighting, fire alarm system, telecontrol / telecommunication and instrumentation system, 438.5 MW, 11 KV pump / motor sets, station piping, cathodic protection systems and residential areas.</td>
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**SELECTED PIPELINE REFERENCED PROJECTS**

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<td>Iraq - Turkey Crude Oil Pipeline Expansion Project</td>
<td>Turkey</td>
<td>BOTAS : Bursa Hafif &amp; Petrol Tasma A.S. (BOTAS : Transportation by pipelines Inc.)</td>
<td>Replacement of pumps at the existing pump stations PS3, PS4 and PS5. Construction of three new pumps (PDF, PS3, PS4 and PS5), complete with high voltage substation, MV substation, fire fighting, fire alarm system, telecontrol / telecommunication and instrumentation system, 438.5 MW, 11 KV pump / motor sets, station piping, cathodic protection systems and residential areas.</td>
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**SELECTED PIPELINE REFERENCED PROJECTS**

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