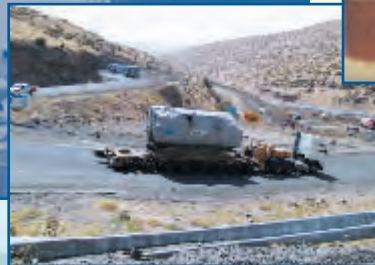
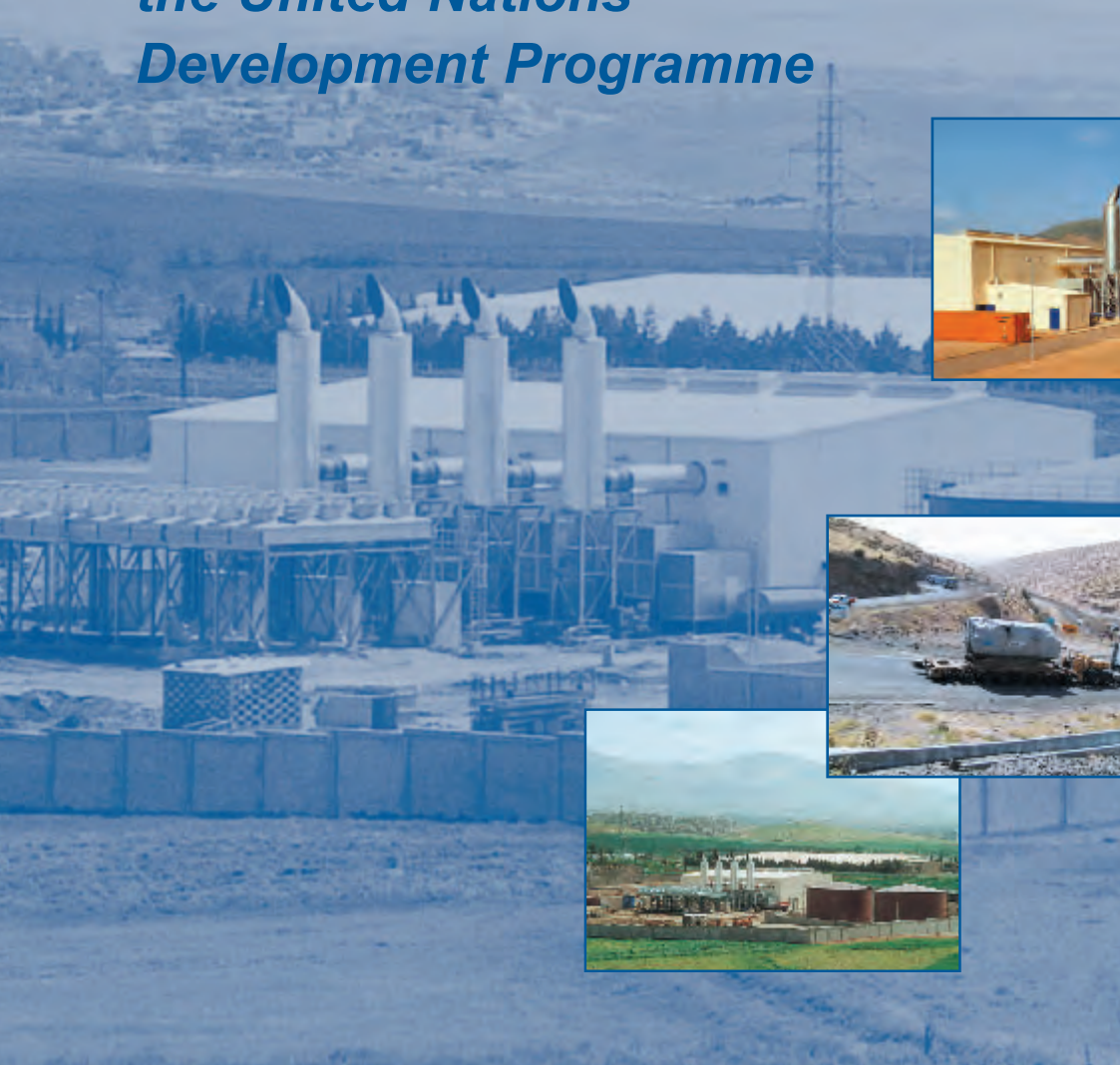


# Three 29 MW Diesel Power Stations, Northern Iraq

*Built in 2001 for  
the United Nations  
Development Programme*



by



Burmeister & Wain Scandinavian Contractor A/S

# Project Background

The "Oil for Food" humanitarian programme for Iraq was initiated in 1996 to soften the impact of sanctions on the population. As a result of major damage to the Iraqi infrastructure and due to a considerable drought in the region, United Nations Development Programme (UNDP) released in May 1999 an international tender for an Emergency Diesel Power Plant in Dohuk on a turnkey basis. This tender was later expanded to cover identical plants in Erbil and Sulaimaniyah. In total, three 29 MW power plants were installed, one in each governorate.

BWSC participated in this tender with MAN B&W Diesel AG (MBD) as engine supplier. Final contract negotiations were carried out in Erbil between UNDP and BWSC in November 1999 and were approved in New York in the middle of December 1999. The contract, which was the most comprehensive for UNDP to date, was signed in Brussels on December 22, 1999.



# Project Execution

In order to build three separate plants in Northern Iraq within the contractual time limit of 18 months, special concepts were developed for engineering, production, logistics and construction.

As a result of a decade of UN sanctions and a lack of any substantial investments, the development of the region has been greatly affected. Additionally, no major projects have been constructed during this period, making the selection of suitably qualified local suppliers and contractors a challenging task. However, the civil works contract for earth works, concrete and building construction was awarded to capable local companies.

In order to achieve the relatively short contract completion times and to minimize the uncertainties of working in Northern Iraq, it was decided to utilize prefabrication and modularization for building construction and equipment to the greatest possible extent. This would also allow to optimize the time required for erection work. Consequently, all building components and operation equipment were imported. Construction work and equipment assembly was carried out by local labor whenever possible, working with expatriate key personnel and specialists.

For the powerhouse building, a Danish contractor was awarded a design and build contract, based on the modular concept. The use of a prefabricated steel structure and surface treated cladding elements enabled erection of the powerhouse to be completed in only six weeks – a remarkable achievement considering the local weather conditions, with high temperatures during most of the working day.

A major step to minimizing the local electro-mechanical erection work was the introduction of a common modular unit, the "Main Unit". The Main Unit comprises all the auxiliary equipment for each diesel engine, including cooling, lubrication, and fuel oil supply, together with the low voltage switchboard. The Main Unit was manufactured and pre-tested in the manufacturer's works, i.e. all piping and cabling were finalized before shipment. To shorten transportation time and to reduce costs, the Main Unit was designed for container transport.

All three plants were taken over by UNDP early May 2001. Such an extraordinary achievement of constructing three power plants within 16 months has only been possible with the excellent cooperation, support and enthusiasm of all parties involved, in particular UNDP, the Local Electricity Authority (LEA), and the local Contractors.

# Logistics

Transportation of all the building components and operational equipment for three power plants was in itself a complex and challenging logistical task. Under the "Oil for Food" programme, all transportation must follow very specific procedures and pre-defined routes. More than 600 containers for the project have been shipped from European ports to the Turkish port of Mersin, and then by truck from Mersin to the Iraqi border at Zakho. Finally, from Zakho to the three separate sites in Northern Iraq, a journey of almost 1000 kilometres.

The greatest challenge was the transportation of the 12 individual generator sets, each weighing almost 130 tons. A thorough survey of the entire road journey from Mersin to the three construction sites was undertaken to ensure adequate load-bearing capacity and successful arrival of the generator sets. The road survey included checking of all tunnels and the capacity of all bridges to be crossed. Since the survey revealed limited height and carrying capacity of some individual bridges, it was decided to split the generator set into three shipments, the diesel engine, the generator, and the common bedframe.



-Transport Route -Travel Route by car for personnel

Engine transportation



Erbil Site





Control Room

# Operation & Maintenance

As a part of the turnkey contract, a 28-months Technical Service Agreement (TSA) was signed to assist the LEA during the first phase of plant operation. Under the turnkey contract key LEA staff participated in training sessions at BWSC in Denmark and at the MAN B&W engine factory in Germany. This included operational training, introduction to troubleshooting procedures, and the maintenance and repair of diesel engines, turbo chargers, electrical systems, and control systems. In addition, on-the-job training will continue throughout the TSA period.

After handing over the plants to UNDP, BWSC has been awarded an additional contract for the complete Operation & Maintenance management of the three plants.

## Summary

### Contract

Type ..... Turnkey  
 Contract award ..... December 1999  
 Handing over ..... Erbil: March 2001  
 ..... Dohuk: April 2001  
 ..... Sulaimaniyah: May 2001

## Technical Data for each Site

### Diesel Engines

Make ..... MAN B&W, Augsburg Germany  
 Type ..... 4 x 16V32/40, 4-Stroke  
 Speed ..... 750 rpm

### Synchronous Alternators

Make ..... ABB, Finland  
 Type ..... 4 x AMG 1120 MR08 DSEA  
 Rating ..... 9.330 KVA  
 Voltage/frequency ..... 11,4 kV / 50 Hz  
 Output at 100% load ..... 4 x 7455 kWe at Pf 0.8

### Main Unit

Builder ..... Aura Marine – Finland

### Lube Oil Treatment

Make ..... Westfalia, Germany  
 Type ..... 4 x OSC 15-96-067/10  
 Rated capacity ..... 4 x 1.95 m3/h

### Radiator Coolers

Make ..... GEA, France  
 Type ..... Induced draught  
 Cooling capacity ... HT+LT: 4 x 2170 kW + 4 x 2978 kW

### Fuel Oil Treatment

Make ..... Westfalia, Germany  
 Type ..... 3 x OSC 15-02-067/10  
 Rated capacity ..... 3 x 4.25 m3/h

### PowerHouse Building

Supplier ..... Rambøll, Denmark  
 Length ..... 46 m  
 Width ..... 22.6 m  
 Height ..... 10.9 m  
 Overhead crane ..... 1 x 16 ton  
 Stacks ..... 4 x 17 m

### 11 kV Switchgear

Make ..... ABB, Denmark  
 Type ..... SR-12  
 Voltage/frequency ..... 12 kV / 50 Hz  
 Current ..... 2500 A

# Final Plants

*Main Unit*



*Engine Hall*



*Dohuk Site*



*Sulaimaniyah Site*



# Generator Set Offloading & Assembly

Following the complex logistical task of road and sea transportation, offloading, and assembling of the generator sets commenced at site. In the absence of adequate crane capacity in Northern Iraq, BWSC decided to use sophisticated lifting gear for the operation that was both durable and flexible, i.e. easy to erect, easy to dismantle, and utilized at all three sites. The assembling procedure consisted of several sequences of lifting and sliding of the heavy main components. Within a week at each site all four generating sets were sited on their foundations.



*Engine unloading at site*



*Sliding of engine*



*Engine on foundation*



**Burmeister & Wain Scandinavian Contractor A/S**

Gydevang 35, P.O. Box 235, DK-3450 Allerød, Denmark

Phone: +45 48 14 00 22, Fax: +45 48 14 01 50, E-mail: [sales@bwsc.dk](mailto:sales@bwsc.dk), Homepage: [www.bwsc.dk](http://www.bwsc.dk)