BOT Model

Waste Water Disposal in the City of Zagreb, Croatia

Capacity: 1.2 million PE (1.5 million PE) for a waste water flow of 330,080 m³/d (442,370 m³/d)

Procedure: Biological purification of municipal waste water from the City of Zagreb. The plant is designed for a combined water inflow of 30,510 m³/h and a BOD₅ load of 72,000 kg/d and in the final capacity stage for an inflow of 37,790 m³/h and a BOD₅ load of 90,000 kg/d.

Start of works: July 2002

Commissioning: April 2004 Mechanical treatment
October 2006 25% of biological treatment
December 2006 50% of biological treatment
April 2007 75% of biological treatment
August 2007 100% of biological treatment

A company formed by:
WTE Wassertechnik GmbH
RWE Aqua GmbH
Vodoprivreda Zagreb d.d.
As a result of increasing ecological requests and the legal requirement to reduce water impurities, especially in the Sava river, the City of Zagreb and Croatian Waters have put out to tender the Central Waste Water Treatment Plant Zagreb (CWWTP Zagreb) BOT Project. This environmental protection project is one of the greatest challenges in environmental protection in Europe. It has been planned by the Consortium in accordance with specific design and local features and includes the following performances:

- Design and construction of the central waste water treatment plant for 1.2 million PE. and in the final capacity stage for 1.5 million PE
- Design and construction of the associated administrative and operation buildings
- Modification and extension of approx. 5.5 km main drainage channel from the old town
- Construction of approx. 10 km long main collecting pipeline from the new town
- Construction of 4-lane Domovinski Bridge over the Sava river
- Construction of the road connection for the bridge and the access roads for the waste water treatment plant
- Project financing of all investments to be effected
- Operation of the waste water treatment plant and the inflow pumping station situated south of the Sava River for 28 years after signing the contract.

The central waste water treatment plant Zagreb includes the following fundamental parts:

- Inflow pumping station with screw pumps
- Conventional, mechanical treatment stage with strainer rack, ventilated grit and grease chamber as well as primary settling tanks
- Biological treatment level with activated sludge technology and final clarification tank
- Static thickening of primary sludge with gravimetrically operating thickeners and mechanical thickeners of the surplus sludge
- Mesophilic digestion of the sludge in an anaerobic stage for sludge stabilisation and biogas extraction
- Mechanical sludge dewatering.
### Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Inflow loads 1.2 million p. e.</th>
<th>Inflow loads 1.5 million p. e.</th>
<th>Guaranteed load reduction</th>
<th>Guaranteed discharge values</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD&lt;sub&gt;5&lt;/sub&gt;</td>
<td>72,000 kg/d</td>
<td>90,000 kg/d</td>
<td>70 - 90 %</td>
<td>≤ 25 mg/l</td>
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<tr>
<td>COD</td>
<td>156,610 kg/d</td>
<td>191,540 kg/d</td>
<td>75 %</td>
<td>≤ 125 mg/l</td>
</tr>
<tr>
<td>Solid matter</td>
<td>113,900 kg/d</td>
<td>136,430 kg/d</td>
<td>90 %</td>
<td>≤ 35 mg/l</td>
</tr>
</tbody>
</table>

#### THE BOT MODEL

After international, functional invitation for tenders and comparison of the performances offered, the City of Zagreb and the Croatian company Zagrebačke otpadne vode d.o.o. (ZOV), with registered office in Zagreb, signed the Concession Agreement on 16<sup>th</sup> December 2000 for implementing the project. Included in the scope of supply is the complete design, the turn-key construction of the waste water treatment plant and the associated infrastructural measures, their financing and the operation of the waste water treatment plant for a period of 28 years after signing the contract.

The shareholders of Zagrebačke otpadne vode d.o.o. are:

- WTE Wassertechnik GmbH, Essen (leading partner)
- RWE Aqua GmbH, Essen
- Vodoprivreda Zagreb d.o.o., Zagreb

ZOV is the contractual partner of the City of Zagreb and as concessionaire will undertake the function of building contractor and project manager as well as all essential commercial and administrative tasks during maintenance and operation. The technical operation of the waste water treatment plant and the associated pumping stations is the responsibility of Zagrebačke otpadne vode-upravljanje i pogon d.o.o. (ZOV uip), an independent management company with registered office in Zagreb.
During the period of operation ZOV must receive the waste water, purify it and redeliver it in accordance with the required discharge quality. The performances of ZOV will be paid in the form of a service charge by the City of Zagreb. All maintenance and renewal work required during the period of operation are guaranteed by ZOV and performed in such a way as to ensure unrestricted use of the waste water treatment plant after handover.

THE CONTRACTUAL MODEL

For the project development, ZOV was founded as the concession company with registered office in Croatia. This concession company also performs the entire financing and commissioning. The actual technical operation is ensured by the management company Zagrebačke otpadne vode-upravljanje i pogon d.o.o., formed by the concessionaire for a period of 28 years. The Croatian SR Vodogradnja d.o.o. (a company from WTE and RWE Aqua) performs all of the investments, which in this way undertakes the complete investment risk. The contractual partner in the project implementation and plant operation phase on the Croatian side is the City of Zagreb, with technical support from Croatian Waters.
FINANCING

The entire financing for the whole investment is performed by the concession company ZOV.

Apart from the equity the shareholders of ZOV inject into the project, the concessionaire signed Loan Agreements on 14th December 2001 with the German Kreditanstalt für Wiederaufbau (KfW), Frankfurt and the European Bank for Reconstruction and Development (EBRD), London for providing a significant portion of the financing. Both banks, which are well reputed in Croatia from previous engagements and are both AAA rated, have shown their strong interest in participating in the project from the beginning. By this co-operation long term loans (maturities of about 18 - 20 years) with favourable rates could be reached.

THE CROATIAN PARTNERS

The environmental protection and infrastructural project, CWWTP Zagreb, was planned by ZOV under the lead management of WTE. All standards and regulations applicable in Croatia have been worked into the design in close agreement with the City of Zagreb and Croatian Waters (Hrvatske Vode). This co-operation ensures optimised planning with the integration of comprehensive process technology know-how and direct integration of all specific Croatian parameters.

The construction work itself was as far as possible executed by local Croatian subcontractors. The civil construction was completely done by Croatian civil construction companies. Furthermore all other necessary supplies and services were largely provided by local Croatian enterprises.

ECONOMIC EFFICIENCY

The costs for the waste water treatment plant with the carbon elimination standard and the associated infrastructural measures are far below the European price standard.

The tank construction works and superstructures provided, which meet the European and the Croatian standards and regulations, as well as the use of proven plant engineering, ensure low maintenance and renewal costs.

The plant is equipped with fully automatic control and regulation, so that it has been possible to optimise the requirement for supervisory and operating personnel.

Through the use of low energy ventilation devices and through the hydraulically favourable layout of the entire plant, it has been possible to minimise the energy consumption.

With the use of biological process technology, no additional chemicals are required to achieve the necessary reductions.
THE ADVANTAGES

- The implementation of the entire project will be guaranteed by highly qualified technical personnel on both the Croatian and the German side.
- The secured financing will enable the creation of large numbers of jobs in the region, especially for performing the construction and operation of the plant.
- The investment and operating risks will be borne by the partners of ZOV. This makes the waste water purification costs transparent for the Croatian side and calculable over a long period of time.
- The municipal budget will be eased by the project financing, as the refinancing extends over a very long period of time.
- No financial burdens until first commissioning of the waste water treatment plant.
- Through the BOT model, the Croatian contractual partner will extend his guarantee period to the entire contractual term of the project.
- The plant will be constructed and operated in accordance with European standards, under consideration of local regulations, and in accordance with the acknowledged rules of technology.
- The participation of a company of the City of Zagreb in the management company will ensure long term continuous technology transfer, which will enable a smooth hand over at the end of the concession period.