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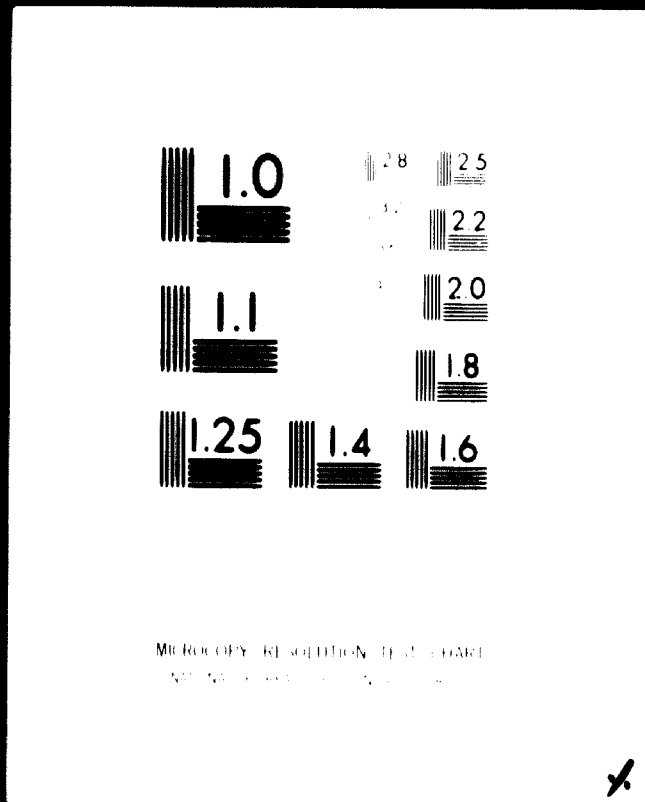
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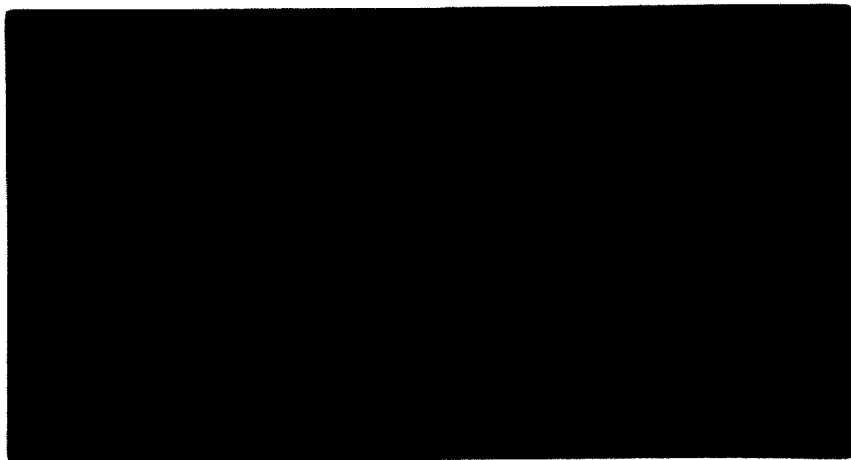


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**01924**

MURNAU  
MÜNCHEN  
DÜSSELDORF

Yugoslavia. FINAL REPORT

for

the Provision of Assistance to Extension  
of the Recovery System for Fibres and  
Fillers at Ivograd Pulp- and Paper  
Mill, YUGOSLAVIA

Project IS/YUG/71/826

003136

**01924**

This Report was elaborated on behalf of UNITED NATIONS  
INDUSTRIAL DEVELOPMENT ORGANIZATION, Technical  
Equipment Procurement and Contracting Office (TEPCO),  
based on the contract No. 73/7 by GOLLWITZER INGENI-  
EURPLANUNG & Co.

Betrifft **Assistance to Extension of the Recovery System for Fibres and Fillers at the Ivangrad Pulp- and Paper Mill, Yugoslavia**

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**ABSTRACT**

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**1. Subject and Performance**

Gollwitzer Ingenieurplanung & Co. examined the fibre recovery systems at white water circulation system of the two paper machines at Ivangrad Pulp- and Paper Mill on behalf of UNITED NATIONS Industrial Development Organization during the months of november/december 1970 and january/february 1971 and submitted proposals to reduce losses of fibres and fillers.

In october 1973 Gollwitzer Ingenieurplanung & Co. received from UNITED NATIONS Industrial Development Organization the order to prepare equipment layouts, specifications and investment analysis for two alternatives of the recovery system at the paper plant. During a repeated visit at the mill in the second half of october 1973, the interimistic development and new installation of both paper machines in Ivangrad were studied, the tender discussed with the mill management and additional measurements taken.

In continuation thereto followed planning, design and specification of the equipment for the improvement of the fibre recovery system and white water circulation system of both paper machines in 2 alternatives:

**Alternative I:**

**PM I:** Additional Sveen Pedersen Flotator. The two existing Sveen Pedersen Flotators shall be run parallely .

**PM II:** Installation of a filter together with a smaller sedimentation plant.

The surplus water will be clarified in a filter to such an extent that the clear water may be used as shower water. This will create a new secondary circulation of the waste water, thus discharging the sedimentation plant further.

Betreff: Assistance to Extension of the Recovery System for Fibres and  
Fillers at the Ivangrad Pulp- and Paper Mill, Yugoslavia

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By use of this sedimentation plant, the fibre  
and kaolin recovery will be improved.

Alternative II:

PM I: As alternative I: Use of the existing Sveen  
Pedersen Flotator with parallel run.

PM II: Installation of a sedimentation plant for the total  
quantity of water. This fibre recovery plant shall be  
dimensioned in such a way that about 2 thirds of the  
clear water may be led back into the circulation as  
sprinkling water for wire cleaning.

Pre-requisite for this plant will be the installation of  
special shower pipes.

UNIDO received on 7th november 1973 an interimistic Report concern-  
ing the project planning. Upon clarification and approval by UNIDO  
of the list of qualified equipment manufacturers, the tender documents,  
specifications and drawings were dispatched on 16th may 1974 to quali-  
fied manufacturers in: Austria, Belgium, Germany, Great Britain,  
Italy, Sweden and Switzerland.

Due to the comparatively small delivery scope, a limited interest for  
presentation of offers was noted, therefore, the list of qualified manu-  
facturers had to be enlarged and the closing date of tender extended.  
From the 7 offers received, 6 treated partial deliveries only.  
Basis for the total costs and calculation of profitability formed the  
offer from Messrs. J.M. Voith GmbH, being the only one who  
stated the complete equipment including erection and start up.  
(See analysis of offers).

2. Investment costs and Rentability

Cost comparision of alternatives I and II described in paragraphe I  
as follows:

	Alternative I	Alternative II
	US \$	US \$
Investment costs	660.000, --	550.000, --
Amortisation (10 years each):	66.000, --	55.000, --
Operation costs per year:	44.620, --	57.640, --

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Since the units are laid out for the same capacity, the savings by the fibre recovery of both solutions (alternatives I and II) are identical.

Savings per year on the basis of Yugoslavian national fixed pulp prices (see details chapter 4) US \$ 102.950, --

Savings per year on the basis of world market prices for pulp (see chapter 4) US \$ 262.500, --

The installation of equipment of both alternatives can be effected without any mentionable loss of production.

The rentability of this investment depends on the prices stipulated for the recovered pulp and filler. If the pulp and kaolin prices rated by the Yugoslave side in december 1973 form the basis for the calculation, the return of the capital investment, based on a 10 years amortization cannot be reached.

These Yugoslavian national fixed prices are limited prices, being far below the today's free world market price for pulp. Therefore, an investment decision, financed to a large extent with foreign currency, should be made under consideration of the free world market prices. On the premises of such pulp and kaolin prices the investment costs are gained within 2 to 3 years after installation of the equipment. It, therefore, seemed realistic to the consultant to indicate a price for the recovered paper raw materials in the cost benefit analysis (see chapter 4.5 "Summary", page 50), representing the average between fixed national prices and free world market price. The invested capital for Alternative II is, thus, amortized in approx. 4.4 years, if the equipment can be procured without any additional financing costs, resp. in 5.5 years if additional capital costs for a 10 % interest of the equipment arise.

Another slight improvement of the rentability is given by the fact that the pulp is recovered in fully beaten conditions so, that for this component of the furnish no further beating energy is wanted.

Furthermore can be stated that rentability should not only be seen under the point of view "recovery" but also under environmental aspects. Even in Yugoslavia sooner or later stream pollution must be inhibited and in the given case be punished by relative amends.



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### 3. Recommendations

The summary of amortization and operation costs of both alternatives does not show any valuable differences.

From the technical point of view and because of its lower investment costs, preference should be given to alternative II.

The offer submitted by Messrs. J.M. Voith, Heidenheim is, due to its completeness as well as international reputation and experience of this company in the special field, recommended for further procedure and negotiations.

Therefore, our recommendation is as follows:

- The mill management reevaluates the pulp price to be set up for the cost calculation and rentability of the investment,
- The mill management starts contract negotiations with Messrs. Voith regarding the supply and installation of the Sven Pedersen Flotators for PM I and the sedimentation plant for PM II according to Consultants planning and the Voith offer, whereby the possibilities of cost reduction described in the report are to be observed.
- A further intercallation of a Consultant for the performance of reorganization of the recovery system for the paper machines PM I and PM II is, in view of the comparatively small investment sum and in case of commission of a fully responsible supplier (f.i. as per the offer from Messrs. Voith) required only for assistance in contract negotiations with the supplier and assistance in startup operations, test run and final acceptance of the equipment.

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## 1. LAYOUTS, TECHNICAL SPECIFICATIONS AND DRAWINGS

### 1.1 Planning Approach and Choice of the Recovery Systems

Subject of this Report is the provision of assistance to the extension of the recovery system for fibres and fillers of 2 paper machines at Ivangrad Pulp- and Paper Mill, Yugoslavia. The services to be performed are described in the contract No. 73/7 between the UNITED NATIONS DEVELOPMENT ORGANIZATION and GOLLWITZER INGENIEURPLANUNG & Co., of October 1973.

The fresh water consumption of the 2 paper machines of the plant with a combined production capacity of presently about 100 tons per day of bleached writing and printing paper rated at about 180 cbm/to of paper is far too high, which results in an excessive loss of paper raw materials.

In the first study on the fibre recovery systems and white water circulation systems prepared by Gollwitzer Ingenieurplanung & Co. on behalf of UNIDO in 1971, it had already been suggested to reduce the fresh water consumption by the partial substitution of clear water.

From the short time measures proposed in this Report, the following recommendations have been realised in the meantime by the mill management:

- Installation of a new pressure pump at the Sveen Pedersen Flotator at the paper machines with a conveying capacity of  $Q = 3.5$  cbm/min and a manometric lifting height of 5 atm.
- During reconstruction of the paper machines, new consistency and level controllers were installed in the constant part by ER-WE-PA.
- Ivangrad Paper Mill has ordered special shower pipes for both paper machines for the reduction of water consumption.

Our expert for this mission, Ing.-grad. Louis Felder, discussed with the mill management the interimistic development of the paper machines and water circulation systems as well as the alternatives of the extension of the recovery systems.

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His partners in conversation were:

Mr. Drago Raicevic, Director General of Ivangrad Paper Mill  
Mr. Marko Ralevic, previously Technical Director, at present  
Development Engineer, residing in Belgrade  
Mr. Bogic Boricic, Technical Director of Paper Mill  
Mr. Tarimir Rakovic, Deputy Technical Director  
Mrs. Vinka Komatina, present Director of Laboratory,

to whom we want to express our sincerest thanks for their co-  
operation.

As a basis for the planning and tendering work to be done, indivi-  
dual water measurements and solid measurements were carried  
out, the pulp and paper flows were checked as well as sedimentation  
test made in the laboratories.

In accordance with the management of the paper mill, the following  
alternatives for the extension of the recovery systems were designed  
and specified for international tendering:

Alternative I

PM I: The 2 existing Sveen Pedersen Flotators will be connected  
in parallel. The clear water will be used as wire  
shower water.

PM II: A sewage filter will be installed in the secondary circuit

The filter clear water will be used as wire sprinkling  
water. The excess water from the secondary circula-  
tion will be purified in a waste water setting plant  
connected in parallel, which is smaller than the sedimen-  
tation plant acc. to alternative II for PM II.

Alternative II

PM I: The 2 existing Sveen Pedersen Flotators will be connected  
in parallel. The clear water will be used as wire shower  
water. (No difference to alternative I for PM I).

PM II: The excess water of the secondary circuit is  
purified in a waste water setting plant, together with  
the shower water for the wire shower pipes.

A possible third alternative (combination of existing Sveen Pedersen

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Flotator for PM I, installation of a new larger flotator for PM II) was not followed up for the following reasons:

- As per the latest development in the clearing technique, preference is given to the sedimentation method, which was not included in the supplier's program at the time of construction of the Ivangrad Paper Mill.
- By the high air content in the recovered stock, sedimentation is favoured in the pipes of the closed approach flow system and the sheet formation on the wire part is affected.
- By means of the planned production increase no. 3 flotator can not be installed in the paper machine hall, so that a new building would be required. The planned alternatives I and II offer the possibility of installation of a filter in the paper machine hall, whereas the sedimentation plant is installed out-doors.
- The utilization of both existing Sveen Pedersen Flotators is considered for both alternatives (I and II).

#### 1.2 Main Technical Data of the Paper Plant

The Ivangrad Paper Mill operates 2 paper machines of the same width, in 1973 a vacuum pick-up was installed in PM I. For the final production stage the output of each of these machines is to be increased to 85 tons per day. The mechanical recovery plant has been designed to suit this volume.

##### Both Paper Machines, PM I and PM II:

Wire width                      S = 3700 mm  
Working speed,  
final stage                      VA = 160 - 300 m/min.

##### Products:

Main Program:                      Writing and printing types of paper,  
wood-free,  
Offset printing paper  
Double paper

Basis weights:                      60 - 120 g/m<sup>2</sup>



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and Fillers at the Ivangrad Pulp- and Paper Mill, Yugoslavia

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### 1.3 Main Design Criteria for the Recovery System

The requirements for the new recovery systems are as follows:

#### 1.3.1 Alternative I: Combined filter and sedimentation system for PM II:

##### a) Waste Water Filter:

Inlet:

White water II from offset printing paper	approx. 120 g/m <sup>2</sup>
Inlet quantity	Q = 2500 l/min
Solid content	2400 mg/l
Ash content	approx. 60 %

Outlet:

Max. solids content	100 mg/l
Permissible deviation	+ 10 %

##### b) Small-Size Sedimentation Plant, parallel running to the Filter:

Inlet:

White water II from wrapping paper made  
of half-bleached sulphate pulp without  
kaolin.

Inlet quantity	Q 2200 l/min
Constant inlet max. fluctuation	+ 10 %
Solids content	1900 mg/l
Ash content	approx. 15 %

Outlet:

Solids content	max. 40 mg/l
Permissible deviation	+ 10 %

#### 1.3.2 Alternative II: Large size sedimentation plant for PM II:

Except for the inlet quantity Q = 4400 l/min all other data are  
as for the small size sedimentation plant, alternative I.  
The difference in the added capacity of the units results in the  
planned safety proposals for the individual systems.

#### 1.3.3 PM I acc. Alternatives I and II

Since the units are already existing, no supplier's guarantee re-  
garding the maximum solids content is required. The pumps for  
the existing Sveen Pedersen Flotators to be connected parallel

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Filters at the Ivangrad Pulp- and Paper Mill, Yugoslavia**

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are laid out for  $Q = 4700$  l/min. incl. reserve.

**1. 3. 4 Drawings**

During the planning phase, the following drawings have been established:

- |           |   |
|-----------|---|
| No. 987/1 | General situation plan with Alternatives I and II (scale 1:200)                 |
| No. 987/2 | Detailed situation plan, stock preparation and constant part (scale 1:200)      |
| No. 987/3 | PM I, flow sheet Alternative I, two Sveen Pedersen in parallel flow             |
| No. 987/4 | PM II, flow sheet Alternative I, filter in combination with sedimentation plant |
| No. 987/5 | PM II, flow sheet Alternative II, sedimentation only                            |
| No. 987/6 | PM I, quantity flow sheet, Alternatives I and II                                |
| No. 987/7 | PM II, quantity flow sheet, Alternative I.                                      |
| No. 987/8 | PM II, quantity flow sheet, Alternative II                                      |

**Note:** As per space requirement of the equipment planned we should like to draw your attention to the fact that only an estimate of the dimensions to be expected is given. In case of order the supplier will indicate the definite dimensions according to the finally chosen equipment.



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## **2. TENDER PROCEDURE AND ANALYSIS**

### **2.1 Delivery Scope**

The tender documents elaborated by us include the supply of complete units. Only the following items were excluded from delivery:

- All foundations and other construction work; demolition of existing structures, such as the performance of break-throughs;
- Electrical wiring between consumer stations and factory main supply;
- Feed pipes for compressed air, fresh-water (sealing water for pumps, etc.);
- Panelling for the light roof and circular corridor of the sedimentation plant;
- Insulation of tanks and pipe systems outside the factory.

The tender documents also ask for the costs of installation, supervision, start of operation and personnel training. Spendings should be paid against statements, however up to a ceiling amount to be indicated in the offer.

Tenderers are requested to present, if possible, financing proposals (suppliers credit) on favourable terms.

Tenderers were requested to offer binding prices for 8 months.

All other conditions of tender and conditions of contract have been determined as to international rules (see in detail the tender documents attached to the report).

### **2.2 Firms invited**

Upon agreement with UNIDO the following firms have originally been asked for their offer:

1. Krauss-Maffei Imperial AG  
Tannenweg 4  
D 8 München 50 /FRG
2. J. M. Voith AG  
A 3100 St. Pölten / Austria

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3. AB PURAC  
S 22104 Lund / Sweden
4. Cellulose Attisholz AG  
CH 4708 Attisholz/Luterbach / Switzerland
5. Passavant-Werke  
D 6209 Michelbacherhütte / FRG
6. Dorr-Oliver  
Croydon / Great Britain
7. E. & M. Lamort Fils  
F 51 Vitry-le-François / Marne / France
8. Wallquist & Co. Aktiebolag  
S 652 25 Karlstad / Sweden
9. Coppée-Rust  
B 1050 Brussels / Belgium
10. Maschinenfabrik Bellmer  
D 7532 Niefern / FRG
11. Lurgi-Gesellschaften  
D 6 Frankfurt 2 / FRG
12. Fractionator AB  
S 10051 Stockholm / Sweden
13. Beloit Italia S. p. A.  
I 10084 Pinerolo, Torino / Italy

Since a number of firms informed us that a presentation of offer was not possible, the tender documents were additionally sent to the companies stated thereafter:

14. W. Dohmen KG Apparatebau  
D 518 Eschweiler / FRG
15. Vereinigte Kessel- und Apparatebau GmbH  
D 3 Hannover / FRG
16. Maschinenfabrik Geiger  
D 75 Karlsruhe / FRG
17. Maschinenfabrik Andritz KG  
A 8045 Graz / Austria
18. WABAG Wasserreinigungsbau  
D 865 Kulmbach / FRG

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Messrs. Voith AG, St. Pölten, informed us that submission of the offer would be made by their parent company in Heidenheim, Germany.

AB PURAC passed the tender documents on to their affiliated company, Messrs. ADKA-MATIC GmbH, Gießen, Messrs. Cellulose Attisholz AG to their licensee competent for Yugoslavia, Messrs. Ruthner Industrieplanungs-AG, Vienna. Dorr-Oliver, Croydon, transmitted the tender documents to their German affiliated company Dorr-Oliver GmbH, Wiesbaden-Biebrich.

### 2.3 Submission of Offers

Also the additionally invited companies showed little interest in submitting offers, due to the comparatively small delivery scope and the present satisfactory employment of the equipment manufacturers.

The following firms submitted their offer:

- Maschinenfabrik Bellmer KG
- Beloit Italia S. p. A.
- W. Dohmen KG, Apparatebau
- Fractionator AG
- Vereinigte Kessel- und Apparatebau GmbH
- J. M. Voith GmbH
- Wallquist & Co. Aktiebolag

The offers submitted mainly included partial deliveries only, f. i. special equipment for recovery, included in the production program of the respective firms. The only offer which can be considered detailed and complete is that of Messrs. J. M. Voith GmbH for alternative II. A price comparison of the offers of the individual firms is, therefore, not possible.

The following tables 1 and 2 give a survey on the offers received for Alternative I and II. Our tender was provided for quotation in US Dollar, whereas most of the offers are based on DM. In the statement the conversion to US Dollar was based on a rate of exchange of US \$ 1 = DM 2,60.

The works to be done by the own staff of Ivangrad Paper Mill, which are not included in the tender documents and not included in the tables either, are set up on a rate of exchange of US \$ 1, -- = 15,6 ND.

### 2.4 Remarks to the Offers received

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**2.4.1 Gebr. Bellmer KG Maschinenfabrik  
D 7532 Niefern / FRG**

This company has acquired three years ago a licence for sedimentation plants from the British manufacturer Messrs. Simon Hardley. Out of their program, round sedimentation basins with 14, resp. 17 m diameter have been offered for both Alternatives. No comment is made on the purification effect. As per the general experience, this can, however, be considered good.

The costs for delivery ex works including erection and putting into operation for the offered units are as follows:

- Alternative I                    DM 330.600, --
- Alternative II                    DM 419.800, --

Delivery period is stated with 8 months. Terms of payment are stipulated:

- 1/3 upon receipt of the order
- 1/3 4 months after receipt of order
- 1/3 upon conclusion of erection

Bellmer considers their offer binding until the 15th of march 1975, financing proposals are not made.

The round sedimentation basin ("Sediflocculator") offered is, in comparison to a clearing funnel, disadvantageous, due to the required large foundation area. For climate reasons at the Ivangrad Paper Mill a tank covering is needed.

From the offered two round sedimentation plants only the smaller one (for Alternative I) can be installed without difficulties, since the space available for installation between PM hall and line for main supply conduit of the Paper Mill has a max. width of 14 m only.

Instead of the steel basin offered this can also be built in concrete construction by a local constructing firm, resp. the Ivangrad Paper Mill. (Savings DM 181.500, -- resp. DM 253.000, -- see offer of 9th July 1974).

**2.4.2 Beloit Italia S. p. A.  
I 10064 Pinerolo (Torino) Italy**

For the waste water treatment and stock recovery, Beloit Italia constructs disc filterers. The Jones Polydisc filter offered

**Subject Assistance to Extension of the Recovery System for Fibres and  
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by Beloit Italia belongs to the choice articles on the sector of filtering techniques and is being installed in the paper industry with great success for many years already. The max. required solid matter content in clear water of 100 mg/l is being guaranteed.

According to the offer of July 17th, 1974, the price for delivery ex works of the filter is: **DM 419.498, --**  
considering delivery in June 1975.  
Delivery period stated: 8 months.  
Terms of payment:

- 15 % cash on order
- 85 % cash on delivery

No suppliers credit is offered.

The offer is to be considered incomplete, not fulfilling the requirements of the tender, f.i. in respect to erection and putting into operation. Equipment for Alternative I, PM II is offered only.

**2.4.3 W. Dohmen KG  
D 518 Eschweiler / FRG**

This company constructs sedimentation clarifiers "system DUNSCH" for the paper and carton industry for many years already. High efficiency clarifiers are offered with a usable capacity of 720 cbm and 417 cbm, for delivery free construction site, incl. erection.

No comment is made on the solid matter content in the clear water. Under normal conditions a solid matter content of 40 to 80 mg per liter can be reached.

The costs for delivery free Ivangrad Mill and erection as well as non-binding freight cost estimate are (as per offer of 14th July 1974) for:

- Alternative I (small clarifier No. 15) **DM 108.930, --**
- Alternative II (large clarifier No. 17) **DM 190.330, --**

Freight- and travelling expenses are calculated roughly with **DM 25.000, --.**

The additionally offered clarifier No. 14 was, due to its small capacity, not taken into consideration.

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Fillers at the Ivangrad Pulp and Paper Mill, Yugoslavia

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Delivery period is stated with 4 to 5 months  
Terms of payment are as follows:

- 1/3 upon receipt of order
- 1/3 upon delivery resp. ready for shipment
- 1/3 after termination of the erection

The prices are calculated on the basis of the actually  
valid costs for wages and material, right is reserved  
for any equalization.

No financing is offered.

**2. 4. 4AB Fractionator**  
S 252 Stockholm 28 / Sweden

The float-wash system offered by this company is a new  
development and used for clearing of white water. As per  
a leaflet attached to their offer from July 7th, 1974, a  
fine fraction of 440 mg/l is reached by an inlet concentration  
of 540 mg/l, which can be used as sprinkling water. This high  
solid matter content can, however, only be inserted at the  
Ivangrad Paper Mill under condition that the sprinkling  
pipes are equipped with an automatic cleaning device.  
The offer is valid for PM I only.

We do not think it is necessary to combine the offered float  
wash system for PM I with the existing Sveen-Pedersen  
Flotator, since the capacity of both existing and parallelly  
connected Sveen Pedersen Flotators for the clearing of  
white water II is sufficient for the paper machine.

The price for delivery of the filter (for PM I only)  
is, as per the offer

US \$ 25.522,--

Delivery period: 6 months

Payment conditions are as follows:

- 30 % upon receipt of the order
- 30 % upon shipment of equipment
- 15 % on delivery free on site
- 20 % after acceptance of delivery, latest 3 months after  
start up,
- 5 % shall be retained as retention money against bank  
guarantee and must be paid latest 12 months after  
start up.

The offer is binding for 8 months.  
No supplier's credit is offered.

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**2. 4. 5 VKA Vereinigte Kessel- und Apparatebau GmbH  
D 3000 Hannover / FRG**

The funnel clarifier offered by this company is similar to that of Messrs. Dohmen KG. For both Alternatives high performance funnels with a capacity of 250 cbm resp. 500 cbm are offered. It has to be mentioned that the offered clarifiers with 250 cbm and 500 cbm are, as per our opinion, too small for the requirements, in order to reach an ample clearing efficiency. In comparison Messrs. Dohmen offered for Alternative II a receiver with a capacity of 720 cbm and Messrs. Voith one with a capacity of 1.075 cbm. For this reason the larger receiver type SAFEALL (500 cbm) for Alternative I is considered only.

The funnel with a capacity of 500 cbm is offered ex works (as per the offer of 22nd July 1974) at a price of DM 91.580, --

Delivery period 12 to 14 weeks,

Payment is asked as follows:

- 1/3 upon receipt of order
- 1/3 upon accomplishment in the works
- Remaining amount 30 days thereafter

Erection costs will, if applicable, be charged as needed and are subject to the escalator clause. They have been calculated by the bidder with DM 70.000, --

**2. 4. 6 J. M. Voith GmbH  
D 7920 Heidenheim / FRG**

This company manufactures for many years already sedimentation-clearing units for paper- and board industries. In cooperation with the Technical University in Darmstadt the Purgator-Sedimentation clarifier has been developed. It is being built as funnel or round clearing basin.

Voith indicate at a solid matter content in the waste water of 2000 - 5000 mg/l a solid matter content in clear water a daily average of 12 mg/l. The flow rate capacity is 5000 l/min. for the provided type "Purgator 850".

For the large sedimentation plant for PM II acc. to Alternative II, Messrs. Voith offered in addition to the tank type saveall system PURGATOR alternatively a circular clarification basin, whose price is approx. DM 41.000, -- lower.

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Due to the space conditions given at the Ivangrad Paper Mill, this basin with a diameter of 15 m can only be installed if the line of the main supply conduct is being removed.

The offer is complete regarding delivery to German border, assembly and start up assistance and amounts as per the offer of 14th august 1974 for:

- Alternative II (with PURGATOR) to DM 769. 500, --
- Alternative I (a standard price is given which is approx. DM 245. 000, -- higher than that of Alternative II)

Delivery period: 10 months

Payment conditions:

- 30 % when signing the contract
- 30 % against presentation of the shipping documents
- 15 % on arrival on the construction site , latest 3 months after dispatch
- 20 % upon start up and preliminary acceptance, latest 6 months after dispatch
- 5 % on final acceptance, latest 12 months after dispatch

The estimated erection costs of approx. DM 70. 000, -- are to be paid against presentation of invoices, countersigned by the customer, resp. after termination of the erection work.

A performance bond of 1 % of the price quoted will be conceded by Hermes credit insurance AG.

A supplier's credit is not offered.

The offer of Messrs. Voith can be considered as the most complete one, regarding performances required in the tender.

2. 4. 7 Wallquist & Co. , AB  
S 65 225 Karlstad / Sweden

The vat filter WACO built by Messrs. Wallquist has been known in the pulp- and paper industry for many years already and can also be considered a standard article. It is worth while mentioning its safety in operation, due to its simple construction.



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With the quoted filter of 2800 mm dia x 5 m length,  
for the indicated flow rate quantity of 2500 l/min at  
a solid matter content in white water II of 2400 mg/l,  
the solid matter content in the clear water of 100 mg/l  
as required in the tender, is guaranteed.

The price of this filter free Ivangrad is as per the  
offer of 26th august 1974 US \$ 200.000, --

This price is a fixed price for a period of 6 months.

Delivery period is stated with 8 to 10 months.

Terms of payment as follows:

- 30 % against order acknowledgement
- 30 % against shipping documents
- 15 % on delivery free on site
- 20 % after acceptance, however not later than 3 months  
after delivery
- 5 % retained as retention money (bank guarantee max.  
12 months after delivery)

A performance guarantee of 1 % of the contractual  
sum is offered (letter of September 21st, 1974).

**2.4.8 W A B A G A G**  
Wasserreinigungsbau  
D 865 Kulmbach / FRG

Messrs. WABAG AG wrote us on 29th june 1974 that  
their offer would be sent end of september 1974, where-  
as they informed us on 19th september 1974 only that they  
would not be able to quote at all.

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## 2.5 Final Remarks on Analysis of Offers

The following tables (pages 19 and 20) represent a comparison of offers for the recovery system of PM II as per alternative I and II.

A comparison of the total price is not applicable, since Messrs. Voith only offered the complete equipment.

Moreover a comparison of costs for reconstruction of PM I is not applicable, hereto we have received an offer from Messrs. Voith only. The offer from FRACTIONATOR refers but to the supplementary equipment for PM I and is not included in the table to follow.

The comparison of the equipment for alternative I shows a Jones Polydisc-Filter offered by Messrs. Beloit. In our opinion this filter is equivalent to that of Messrs. Voith. The Wallquist filter is, also after deduction of the costs for packing (which was stated for all equipment acc. to alternative I, chapter 3.3) with US \$ 12.650, - more expensive than that of Messrs. Voith and therefore the most expensive of all. Furthermore, in spite of its best known technical results and its simplicity, the handicap for the Wallquist filter, as a Drum Filter, is its great space requirement. It, therefore, seems to be out of competition.

It only remains a discrepancy of US \$ 18.000, -- in favour of the Beloit-Filter compared to the price of the Voith-Filter. Negotiations therefore, should be held in order to find out whether Voith, in case of allocation of the total order, would be prepared to include the Beloit-Filter instead of their own.

A comparison of the sedimentation plant is, due to the different performance, rather limited. Besides Voith, Messrs. Bellmer, Dohmen and VKA have suitable sedimentation plants to offer. Neither of the bidders is, on the other hand, prepared to carry out the entire work.

The most competitive offer for the sedimentation plant is that of W. Dohmen KG, Eschweiler, yet not including guarantees. On the other hand will Voith hardly accept the total order with inclusion of the sedimentation plant of Messrs. Dohmen, therefore, a further engagement with this offer (respectively also the offers from Bellmer and VKA) is of use only if the original conception of the contract for allocation of the order is being abandoned.

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Owing to the fact that we can, above all, not take this for  
sure and we recommend too that the entire responsibility  
for delivery, erection and start-up of the recovery system is to be  
left in one hand, the following cost and economy calculation of  
the total offer from Messrs. Voith forms the basis.  
With this assumption we move towards the positive side regarding  
the cost estimate.

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Assistance to Extension of the Recovery System for Fibres and  
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Table I: COMPARISON OF OFFERS (Alternative I)

=====

Equipment	Bellmer US \$	Beleit US \$	Dohmen US \$	Fraktionator US \$	VKA US \$	Veith US \$	Wallquist US \$
<b>Alt. I FM I</b>	-	-	-	-	-	39.423,-	-
<b>FM II</b>							
1. 1 Centrifugal pump 4700 l/min	-	-	-	-	-	4.100,-	-
1 High pressure cen- trifugal pump 800 l/min	-	-	-	-	-	1.820,-	-
1 Centrifugal pump 2.500 l/min	-	-	-	-	-	2.910,-	-
1 Centrifugal pump 2.500 l/min	-	-	-	-	-	2.910,-	-
						11.820,-	
2. 1 Filter without erection	-	127.200,-	161.900,-	25.922,-	-	179.500,-	200.000,-
3. 1 Sedimentation unit without erection	-	-	41.900,-	-	62.000,-	-	-
+ with erection	-	-	-	-	-	-	-
++ incl. freight and erection	-	-	-	-	-	-	-
+++ incl. freight	-	-	-	-	-	-	-
4. Dosing unit	-	-	-	-	-	4.670,-	-
5. Cost rel units	-	-	-	-	-	3.500,-	-
6. Fittings	-	-	-	-	-	2.800,-	-
7. Pipings	-	-	-	-	-	34.900,-	-
8. Nozzle spraying pipes	-	-	-	-	-	6.870,-	-

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Table 4:

COMPARISON OF OFFERS (Alternative II)

\*\*\*\*\*

Equipment	Bollmer US \$	Belelt US \$	Dehmen US \$	Fraktionierer US \$	VKA US \$	Veith US \$
<b>Alt. II PM I</b>						39.423,--
No comparison is made since offer was submitted by Messrs. Veith only						
<b>PM II</b>						
1. 1 Centrifugal pump 4.700 l/min	-	-	-	-	-	4.100,--
1 High pressure pump 800 l/min	-	-	-	-	-	1.020,--
1 Centrifugal pump 2.500 l/min	-	-	-	-	-	2.910,--
1 Centrifugal pump 1.000 l/min	-	-	-	-	-	2.910,--
						11.020,--
2. 1 Sedimentation unit without erection	161.500,--	+	67.000,--	++	-	213.000,--
+ with erection						
++ incl. freight and erection						
3. Dosing unit	-	-	-	-	-	4.670,--
4. Control units	-	-	-	-	-	2.500,--
5. Fittings	-	-	-	-	-	7.890,--
6. Pipings	-	-	-	-	-	35.000,--
7. Nozzle spraying pipes	-	-	-	-	-	6.870,--

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**2.6 Suppliers of consistency and level regulators:**

**1. FOXBORO Deutschland**

Ardennenstraße 30  
D 4000 Düsseldorf 11

**2. EUROCONTROL**

GST-Regeltechnik (Kalle)  
Rensingstraße 47  
D 463 Bochum-Riemke  
W-Germany

**3. FISCHER PORTER GmbH**

P.O. Box 701  
34 Göttingen  
W-Germany

**4. DE ZURICK**

Georg Meller LTD  
Schorllemerstraße 36  
D 4000 Düsseldorf - Oberkassel  
W-Germany

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### 3. INVESTMENT REQUIREMENTS

#### 3.1 Basis for Cost Calculation (Voith offer)

The following investment cost calculation for PM I and PM II is based on the offer of Messrs. J. M. Voith GmbH, since only this offer was complete.

Due to the restricted space conditions in the Paper Mill Ivangrad, from the offered two possibilities for the sedimentation plant, funnel or round clearing basin, the first one was chosen.

In anticipation to the cost calculation we give a short function description of the Voith sedimentation funnel "PURGATOR" resp. its differentiation marks in comparison to other constructions:

##### a) Central Sewage Intake:

The sewage flows centrally in horizontal main direction into the clearing room. The advantage of which is that already in the horizontal intake phase a separation of solid matters and sewage is made. The construction of the other equipment is such that sewage flows vertically downwards into the clearing room, thus the sewage must return upwards in the clearing room and impedes by this means the full function of the superimposed final clearing area.

##### b) Floating Material Drainage

The PURGATOR is equipped with a rotating floating scraper, leading the non-settleable particles into a gutter and, therefrom, outside.

##### c) High Consistency-Condensing

In the tip of the funnel, the PURGATOR is equipped with a thickening device, for high consistency. Thus not only a higher stock consistency is reached but also, above all, a constant recovered-stock consistency.

##### d) Technical Data for the Sedimentation Plant as per Alternative II:

Clearing surface	164 Sqm.
clearing volume	1.075 cbm
max. sewage quantity	4.400 l/min.
max. solid matter content in sewage	4.000 mg/l
solid matter content in sewage required in the tender:	20 mg/l

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mean value per day, indicated by Voith	20 mg/l
upper diameter of the funnel	15 m
total height	22, 4 m

- e) Basis for the sewage filter of Alternative I connected parallelly to the sedimentation unit was again the Voith quotation. The disc filter offered can be considered equivalent to the Jones disc filter of Messrs. Beloit. By use of the Beloit filter, a slight cost reduction would appear.

### 3.2 Summary of Cost Requirements for Alternative I and II

On the basis of the only complete offer submitted (Messrs. J. M. Voith GmbH, Heidenheim), the investment costs result as per the following summary:

#### 3.2.1 Summary of Cost Requirements for Alternative I

a) Machinery and Equipment	<u>US \$</u>	<u>US \$</u>
a. 1) for PM I	44.060, --	
a. 2) for PM II	<u>378.730, --</u>	422.790, --
 b) Foundation		
b. 1) PM I	200, --	
b. 2) PM II	<u>5.000, --</u>	5.200, --
 c) Erection		105.270, --
d) Painting		7.000, --
e) Engineering and start up costs		12.000, --
f) Freight- and Packing costs		12.650, --
g) Customs		63.200, --
h) Standstill of machinery		--
i) Contingencies		<u>31.890, --</u>
		<u>660.000, --</u>
		=====



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**3. 2. 2 Summary of Investment Costs for Alternative II**

a) Machinery and Equipment	<u>US \$</u>	<u>US \$</u>
a. 1) PM I	43. 950, --	
a. 2) PM II	<u>289. 900, --</u>	
		333. 850, --
b) Construction		
b. 1) PM I	200, --	
b. 2) PM II	<u>5. 000, --</u>	
		5. 200, --
c) Erection		102. 380, --
d) Painting		9. 000, --
e) Engineering and start - up costs		12. 000, --
f) Freight- and Packing costs		12. 860, --
g) Customs		50. 000, --
h) Stillstand of machinery		--
i) Contingencies		<u>24. 710, --</u>
		550. 000, --
		*****

**3. 3 Detailed Cost Breakdown for Alternative I**

**a. 1) Machinery and Equipment for PM I**

1. 0. 1 Centrifugal pump  
for delivering white water II from  
the tank underneath the PM to the  
elevated tank.

Operating data:

Delivery: Q = 4700 l/min

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geod. delivery head	H <sub>geo</sub> = 12,9 m	US \$
length of pipe	L = 65 m	4.180, --
<b>2.0.1 High Pressure Centrifugal Pump</b> as booster pump, for delivering clarified water to the couch-broke shower.		
Operating data:		
Delivery	Q = 800 l/min	
Manometric head	H <sub>mano</sub> = 12 atm.	
Supply pressure	H = 6 atm.	1.820, --
<b>3.0 1 Centrifugal Pump</b> for delivering clarified water from the elevated tank to the wire showers.		
Operating data:		
Delivery	Q = 2500 l/min	
Manometric head	H <sub>mano</sub> = 6,5 atm.	2.490
<b>4.0 Control Instruments</b> 1 complete photoelectric cell control for the couch-broke shower and the dilution-water piping for white water II. Complete with solenoid valve, control relay for the pump motor, stopping device for the photoelectric cell, etc.		
Control impulse: break detector, press section		
Locking mechanism: a) upon still stand of the PM b) manually		
Control elements: a) motor of high pressure pump 12 atm.		
carried over		
		8.490, --



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carried over		US \$ 38.490, --
for drive of centrifugal pump squirrel-cage rotor, protection IP 44, n = 1450 rpm.		
	US \$	
9.1	1 Motor N = 22 kW for pump pos. 1. 0	1.320, --
9.2	1 Motor N = 18,5 kW for pump pos. 2. 0	1.120, --
9.3	1 Motor N = 37 kW for pump pos. 3. 0	2.230, --
9.4	Switching devices star-delta contactor motor-protection switch cable and small materials <u>900, --</u>	
	(yugosl.) costs of motors and switching devices	<u>5.570, --</u>
	Machinery and Equipment, price ex works	44.060, -- *****

a. 2) Machinery and Equipment for PM II

1.0	1 Centrifugal pump for delivery white water II from the tank underneath the PM to the elevated tank. Data, principle components and execution as per item 1.1	4.180, --
2.0	1 high pressure pump as booster pump for delivering clarified water to the couch-broke shower. Data, principle components and execution as per item 1.2	1.820, --
	carried over	<u>6.000, --</u>

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	US \$
carried over	6.000, --
<b>3.0 1 Centrifugal Pump</b> for delivering clarified water from the elevated tank of the sewage water filter to distribution pipe for the wire showers. Data, principal components and execution as per item 1.3, however without inflow height	2.910, --
<b>3.0a) 1 Centrifugal Pump</b> for delivering reclaimed pulp stock from the sedimentation clarification system	2.910, --
<b>4.0 1 Sewage water filter</b> for discharge of the sedimentation clarification plant 1 VOITH disc filter I 12 / 12	179.500, --
<b>5.0 1 Sedimentation clarification funnel, Voith type 235</b>  Flow-rate quantity $Q = 2.200$ l/min.	127.000, --
<b>6.0 Proportioning plant</b> for sedimentation auxiliary means	4.670, --
<b>7.0 Control Instruments</b> 1 level control for installation in the clear water collecting tank of the sewage water filter for control of the intake quantity. Complete with transmitter, control device and regulating valve. All other control devices as per Alternative I, item 4.0 described.	3.500, --
<b>8.0 Fittings</b> Same execution and components as per Alternative I, item 5.0, however additionally 1 regulating valve NW 65 in the high consistency pipe of the sedimentation-clarification plant	<u>2.800, --</u>
carried over	329.290, --

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carried over

US \$  
329.290,--

**9.0 Pippings**

- 9.1 Piping no. 4, NW 125, 6 m
- 9.2 Piping no. 4, NW 125, 20 m
- 9.3 Piping no. 5, NW 150, 60 m
- 9.4 Piping no. 5, NW 80, 5 m
- 9.5 Piping no. 6, NW 80, 92 m
- 9.6 Piping no. 6, NW 150, 90 m
- 9.7 Piping no. 7, NW 150, 52 m

34.900,--

- 10.0 5 Nossle Showers  
for the wire section  
principle components and material specifi-  
cation as per item no. 1.8.0**

6.870,--

- 11.0 Electric motors  
squirrel-cage rotor, protection IP 44,  
n = 1,450 rpm.**

US \$

- 11.1. 1 motor N = 22 kW  
for pump item 1.1 1.320,--
- 11.2. 1 motor N = 18,5 kW  
for pump item 2.0 1.120,--
- 11.3. 1 motor N = 37 kW  
for pump item 3.0 2.230,--
- 11.4 1 motor N = 30 kW  
for pump item 4.0 1.800,--
- 11.5 motor protection switch  
star-delta switch  
cable and small material  
for installation 1.200

**Motors and Switching Devices**

7.670,--

**Machinery and Equipment, Price ex Works**

378.730,--  
\*\*\*\*\*

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US \$

**b1) Foundation works for PM I**

We have set up a cost estimate for foundation work being carried out by Ivograd Paper Mill and agreed upon with the Mill as per the calculation rate as follows:

1.0	Changement of 2 existing pump-foundations		
	4 men: 4 x 8 h = 32 h x 22 ND	= ND 700, --	
	concrete B 160, 0,5 cbm x 600 ND	ND 300, --	
2.0	1 new pump-foundation		
	2 men 8 h = 16 h x 22 ND	= ND 350, --	
	concrete B 160, 0,5 cbm	= ND 300, --	
		ND 1.650, --	105, --
3.0	Expenses (roundings)	ND 1.550, --	<u>95, --</u>
	Sum:		200, -- *****

**b2) Foundation works for PM II**

1,0 Changement of the 2 existing pump-foundations and construction of 2 new pump foundations (white water I I and clarified water) calculation as per PM I

ND 1650, --	+ ND 650, --	= ND 2300, --	
other expenses approx.	ND 800, --		
	ND 3100, --		200, --

2.0 1 closed clarified water tank for filter, contents approx. 30 cbm with foundation for sewage water filter,  
1 pump foundation

4 men: 4 x 40 h = 160 h x ND 22, --	ND 3.500, --	
concrete B 160, 9,5 cbm x 600 ND	5.700, --	
1,9 to steel x ND 5000	ND 9.500, --	
sheathing material	ND 3.000, --	
	ND 21.700, --	

1 staircase and protection balustrade

	ND 4.500, --	
	ND 26.200, --	<u>1.680, --</u>
carried over		1.880, --

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		US \$
	carried over	1.880, --
<b>3.0 Foundations</b>		
for sedimentations sewage plant		
1 foundation plate 8 m dia x		
0,4 m thickness = 3,2 cbm concrete		
B 160 x 600 ND =	ND 1.900, --	
1,2 to steel x ND 5.000, -	ND 6.00, --	
5 men 5 x 50 h = 250 h		
x ND 22, --	ND 5.500, --	
with earth work		
	<u>ND 13.400, --</u>	850, --
<b>4.0 Covering and lateral casing</b>		
for sedimentation sewage		
plant		
approx. 90 cbm asbestos -		
corrugated sheets		
90 cbm x ND 120, --	ND 10.800, --	
4 men 50 h x 4 = 200 h		
x ND 22, --	ND 4.400, --	
	<u>ND 15.200, --</u>	975, --
<b>5.0 2 wall break-throughs</b>		
for pipeline,		
break-through and re-		
shutting		
3 men 30 h x 3 = 90 h		
x 22 ND	ND 2.000, --	130, --
5 m of clay conduit 200 mm dia		
relocation with earth work		
5 m x ND 105, --	ND 525, --	
2 men 12 h x 2 = 24 h		
x ND 22, --	ND 525, --	
	<u>ND 1.050, --</u>	70, --
Connection to existing		
sewage pipe		
earth- and concrete work		
2 men 20 h x 2 = 40 h		
x 22, -- ND	ND 880, --	
Concrete and material		
costs	ND 60, --	
	<u>ND 940, --</u>	60, --
	carried over	3.965, --



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		US \$
	carried over	3.965, --
6.0	Other construction work	<u>1.035, --</u>
	Sum foundation works for PM II	5.000, -- *****
<b>c) Erection</b>		
Foreign performances, corresponding to Voith offer for Alternative II		
1.	Disc filter estimate 4 % of US \$ 179.500, -- = 7.170, --	
2.	Sedimentation unit pumps, pipings and other equipment	<u>91.000, --</u> 98.170, --
3.	Travelling expenses, lump-sum	<u>1.000, --</u>
		99.170, --
Own personnel of the mill		
	20 men 20 days = 400 men/days x ND 170 = ND 68.000, --	4.100, --
	Building crane 5 days à US \$ 400, --	<u>2.000, --</u>
		<u>6.100, --</u> 105.270, -- *****
<b>d) Painting</b>		
	of the sedimentation plant inside and outside with chlorid. rubber color approx.	7.000, -- *****
<b>e) Engineering and start up costs</b>		
1.	Engineering	5.800, --
2.	Start-up	<u>6.200, --</u>
		12.000, -- *****
<b>f) Freight and Packing</b>		
	The pipings and components of the se- dimentation safe-all are only packed partially.	

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US \$

<b>Packing for pumps, filters, motors 5 sewer pipes, control devices and fittings</b>	4. 910, --	
<b>Approx. freight costs free German border</b>	3. 200, --	
<b>Approx. freight costs free Yug. border</b>	<u>3. 000, --</u>	
<b>Approx. freight costs free on site</b>	11. 190, --	
<b>250 ND/T x 97 T = ND 24. 200, --</b>	<u>1. 460, --</u>	12. 600, --

**g) Customs**

<b>Approx. rate 15 % of the value until Yug. border, value ex works without electric motors</b>	409. 500, --	
<b>Freight and packing Yug. border</b>	<u>11. 190, --</u>	
<b>approx. 15 % of</b>	421. 700, --	63. 200, --

**h) Stillstand of machinery**

The complete installation can be made without any interruption of the machines, so that no production loss will arise. The connections to the existing system can be performed such as during normal stillstands for small repair work and change of covering.

**i) Contingencies**

<b>estimate of approx. 5 % of US \$ 620. 110, --</b>	<u>31. 000, --</u>
--	--------------------

<b>Sum of investment costs for Alternative I</b>	<u>660. 000, --</u>
--	---------------------

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US \$

**3.4 Detailed Cost Breakdown for Alternative II**

**a. 1) Machinery and Equipment for PM II**

The measures for this PM are similar  
to Alternative I

Investment Costs

Machines and Accessories

44.000, --  
\*\*\*\*\*

**a. 2) Machines and Accessories for PM II**

**1.0 1 centrifugal pump**

for delivery white water II from the tank  
underneath the PM to the elevated tank

Data:

Delivery: Q = 4700 l/min WS  
good. delivery  
head max. H<sub>geo</sub> = 12,9 m  
length of piping L = 65 m

4.100, --

**2.0 1 high pressure centrifugal pump**

as booster pump for delivering clarified  
water to the couch-broke shower

Data:

Delivery Q = 800 l/min  
Manometric  
delivery head H<sub>mano</sub> = 12 atm.  
supply pressure H = 6 atm

1.600, --

**3.0 1 Centrifugal Pump**

for delivering clarified water from the  
elevated tank to the wire showers

Data:

Delivery Q = 2500 l/min  
Manometric de-  
livery head H<sub>mano</sub> = 6.5 atm.

2.910, --

carried over

8.910, --

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	US \$
carried over	8.910, --
3.0.a) 1 Centrifugal Pump for delivering reclaimed pulp stock from the safeall clarification system	2.910, --
4.0 1 Tank-type saveall (Voith-type Purgator 850) including erection, however without subsidiary assistance	
Waste effluent quantity 4.400 l/min content 1.075 cbm	213.000, --
5.0 Proportioning plant for safeall accessories	4.670, --
6.0 Control instruments  Principle components as for Alternative I and described in item 1.4.0	2.500, --
7.0 Fittings  Principle components as for Alternative I and described in item 1.5.0, however additionally 1 regulating gate NW 65 in the reclaimed pulp stock from the safeall clarification system and 1 pilot floating regulating valve NW 150 for the level control on the elevated tank	7.090, --
8.0 Pippings	
8.1 Piping no. 8	
8.2 Piping no. 9	
8.3 Piping no. 10	
8.4 Piping no. 11	35.000, --
9.0 5 Nozzle Showers  For the wire section principal components and material specification as per item no. 1.8.8	<u>6.070, --</u>
carried over	202.230, --

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carried over

US \$  
282.230, --

**10.0 Electric motors**

4 squirrel-cage motors with switching  
devices and installation materials  
costs as Alternative I, PM II

7.670, --

Machinery and accessories, price ex works

289.900, --

\*\*\*\*\*

b. 1) Foundation works for PM I  
same costs as for Alternative I

200, --

\*\*\*\*\*

b. 2) Foundation works for PM II

1.0 Pump foundation changement  
of the 2 existing and construction  
of 2 new pump foundations (white  
water II and clarified water)

Standard price as per Alternative I 200, --

2.0 Foundation for safeall-sewage  
plant, 1 base plate approx.  
12 m dia.

Standard price as per Alternative II 1.400, --

3.0 Cover and lateral casing for safe-  
all sewage plant, approx. 170 cbm  
asbestos corrugated sheets

Standard price as per Alternative I 1.900, --

4.0 Wall break-through and removal of  
an earthenware pipe as well as a  
connecting pit to the existing sewage  
pipe

Standard price as per Alternative I 260, --

5.0 Other construction work

1.240, --

5.000, --

\*\*\*\*\*

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US \$

**c. Erection**

Foreign performances as per the  
Voith offer

1. Complete plant PM I and  
PM II with safeall-unit 96.300,--

2. Travelling expenses,  
lump sum 1.000,--

97.300,--

Own personnel  
15 men 20 days = 300 men-days  
x 170 ND = 51.000,-- ND 3.000,--

Building crane 5 days  
& US \$ 400,-- 3.000,--

5.000,--  
102.300,--  
\*\*\*\*\*

**d. Painting**

of safeall-unit inside and outside  
with chlorid rubber-color

9.000,--  
\*\*\*\*\*

**e. Engineering and Start-up costs**

1. Planning 3.000,--

2. Start-up 6.200,--

12.000,--  
\*\*\*\*\*

**f. Freight and Packing**

The pipings and components of the  
sedimentation safeall are packed  
partially only.

Packing for pumps, meters, 5  
spraying pipes, control instruments  
and fittings 4.910,--

Approx. freight costs free German  
border 3.280,--

carried over 8.190,--

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		US \$
	carried over	8.190, --
	Approx. freight costs free Yug. border	<u>3.300, --</u>
	Approx. freight costs free on site	11.490, --
	250 NDIT x 91 = 22.800, -- ND	<u>1.370, --</u>
		12.860, -- *****
<b>g.</b>	<b><u>Customs</u></b>	
	Approx. rate 15 % of the value delivered until Yug. border	320.610, --
	Packing and freight Yug. Border 15 % of	<u>11.490, --</u> <u>332.100, --</u>
		30.000, -- *****
<b>h.</b>	<b><u>Stillstand of machinery</u></b>	
	As Alternative I, no costs	
<b>i.</b>	<b><u>Contingencies</u></b>	
	We have foreseen approx. 5 % of US \$ 521.290, --	<u>24.710, --</u>
	<b>Sum of Investment Costs for Alternative II</b>	<u>550.000, --</u>

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**SUMMARY OF COSTS**

INVESTMENT COSTS	Alternative I		Alternative II	
	Foreign US\$	Yugoslavia Total US \$	Foreign US \$	Yugoslavia Total US \$
Machinery and Equipment PM I	30.490,--	44.060,--	30.490,--	44.060,--
Machinery and Equipment PM II	371.060,--	378.730,--	282.230,--	289.900,--
Foundation PM I		200,--		200,--
Foundation PM II		5.000,--		5.000,--
Erection PM I and PM II	99.170,--	105.270,--	97.300,--	102.380,--
Painting sedimentation plant	6.000,--	7.000,--	8.000,--	9.000,--
Engineering and start-up costs	12.000,--	12.000,--	12.000,--	12.000,--
Freight and Packing PM I and PM II	11.190,--	12.650,--	11.490,--	12.860,--
Customs		63.200,--		50.000,--
Contingencies	28.000,--	31.890,--	24.000,--	24.600,--
<b>Sum</b>	<b>565.910,--</b>	<b>660.000,--</b>	<b>473.510,--</b>	<b>550.000,--</b>



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#### 4. Cost and Benefit Analysis

##### 4.1 Investment Costs and Depreciation

The investment costs are described in detail in chapter 3.

Hereafter, it is being calculated as per the table of page on the basis of the total sum

-	for Alternative I	US \$ 660.000,--
-	for Alternative II	US \$ 550.000,--

The costs do not include any general costs of the Paper Mill Ivangrad resulting from the investment performance as well as no costs for a further intercallation of a consultant. Since these costs should be comparatively low, the investment cost calculation based on the eventually slightly reducing supply price of Messrs. Voith, and additional charges for contingencies of 5 % should be added, the amount set up is justified.

Costs for an eventual production loss do, as per our opinion, not arise, the reorganization measures being possible without stillstand of the paper machines.

Owing to the fact that the installations are made in a paper mill already in operation, no mentionable start up or preproduction costs will arise.

It is further presumed that the payment conditions with the suppliers are such that no financing costs are to be added to the investment costs.

For the new equipment, a depreciation period of 10 years is assumed and the depreciation is an alround reduction, i. e. with equal instalments. This depreciation rate is also valid for the insignificant civil construction works, since foundations only and no buildings are to be set up.

Thus result the following depreciation rates per year:

-	for Alternative I	US \$ 66.000,--
-	for Alternative II	US \$ 55.000,--

##### 4.2 Operation Costs

The operation cost estimate for the new recovery equipments is as follows:

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**4. 2. 1 Auxiliary Materials for Waste Water Clearing**

**a) Flotation PM I:**

(for Alternative I and II)

Turkish red oil and alu-sulfat:

0, 1 ND/cbm; approx. 3, 4 cbm x 0, 1 ND

= 0, 34 ND/min = 490 ND/day = 170. 000 ND/year = US \$ 11. 000,

**b) Sedimentation PM II:**

for Alternative I:

Bentonit and Polymin:

0, 3 ND/cbm

1, 65 cbm x 0, 3 ND = 0, 5 ND/min

710 ND/day = 250. 000 ND/year

= US \$ 16. 000,

for Alternative II:

Bentonit and Polymin as Alt. I

3, 35 cbm x 0, 3 ND = 1, 03 ND/min

1470 ND/day = 515. 000 ND/year

= US \$ 33. 000,

**4. 2. 2 Energy costs ( electric current costs)**

The consumption of electric energy directly connected with the recovery plants is:

for Alternative I:

450 kWh/day x 0, 18 ND/kWh =

80 ND/day = 27. 000 ND/year

= US \$ 1. 730,-

for Alternative II:

700 kWh/day x 0, 18 ND/kWh =

126 ND/day = 42. 000 ND /year

= US \$ 2. 700,-

**4. 2. 3 Personnel Costs**

For the operation of the recovery plants the following expenses are calculated for Alternative I as well as for Alternative II:

1 man 3. 500 ND/month = 42. 000 ND/year

= US \$ 2. 690,

**4. 2. 4 Repair and Maintenance**

Due to the increased sensibility of the filter of Alternative I, 2 % of the total investment costs are calculated for repair work and maintenance. For Alternative II (sedimentation plant) the maintenance cost estimate is 1, 5 % of the total investment costs.

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As per the above resulting in:

- Alternative I	US \$ 13.200,--
- Alternative II	US \$ 8.250,--

#### 4.3 Total Costs per Year

On the assumption of the presently valid prices for delivery and erection of the equipment and corresponding construction work (see item 4.1) as well as the operation costs (see item 4.2) the total costs per year for the new recovery unit are as follows:

##### 4.3.1 Total Costs per Year until Depreciation of the Plant

	Alternative I US \$	Alternative II US \$
<u>Depreciation</u>	66.000,--	55.000,--
<u>Operation Costs</u>		
Auxiliary materials Flotation PM I	11.000,--	11.000,--
Auxiliary sedimen- tation PM II	16.000,--	33.000,--
Energy costs	1.730,--	2.700,--
Personnel costs	2.690,--	2.690,--
Repair and mainten- ance	<u>13.200,--</u>	<u>8.250,--</u>
Sum	110.620,-- =====	112.640,-- =====

##### 4.3.2 Yearly Costs after Depreciation of the Plant

After the depreciation period of 10 years, the costs are being reduced to the mere operation costs, on the assumption of today's actual prices amounting to:

for Alternative I	US \$ 44.620,--
for Alternative II	US \$ 57.640,--

##### 4.3.3 Additional Financing Costs

The above mentioned yearly costs for the new recovery equipment are to be increased by the eventually arising financing costs, as far as these are provided by a long term credit.

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#### 4.4 Savings per Year

##### 4.4.1 Basis of Calculations

Upon control of the data, the values included in the Initial Study could be taken over without any mentionable change.

##### Waste Water Quantity:

Actual condition:

present waste water quantity for both PM  
as per Initial Study of 2. 3. 1971 pos. 2. 5. 6 page 43:

$Q = 5 - 6 \text{ cbm/min} = \text{average } Q \text{ } 5,5 \text{ cbm/min.}$

After reconstruction:

average clear water quantity of each PM  
according to the quantity scheme:

$Q = 1.530 \text{ l/min}$

Total quantity for both PM:  $Q = 3.060 \text{ l/min.}$

The remaining waste water quantities not being led through the sewage plant due to the considerable pollution, will be treated under Fresh Water (see page 43).

##### Solid Matter Contents :

Actual condition:

as per Initial Study of 2. 3. 1971 pos. 2. 5. 6, page 43:

Non-clarified waste water with filler:

average Q value: 400 mg/l

Non-clarified waste-water without filler:

average Q value: 250 mg/l

##### After Reorganization

Max. admissible value: 40 mg/l

Percentage of fibre and filler  
in the recovered paper raw material,  
in waste water with fillers:

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Fibres: 40 %  
Fillers: 60 %

Fresh Water:

fresh water consumption actual condition:  
as per summary of the Initial Study of 2. 3. 1971,  
pos. 2. 5. 3, page 37 for one PM:

fresh water quantities after use direct in the channel:

cooling water for paper and storage: 400 l/min  
shower water for felt conditioner : 500 l/min  
loss through open sprinkling hoses: 100 l/min

a) Total quantity of fresh water flowing  
directly into the channel 1.000 l/min

Fresh water being led into the circulation system:

- b) shower water for wire cleaning: 900 l/min  
flows into the white water tank
- c) Wire sprinkling water: 1.200 l/min  
flows into the broke chest
- d) Shower water for vibration screen: 600 l/min
- e) Dilution water for the broke chest 400 l/min
- f) Sealing water, pumps, refiner, etc.: 400 l/min
- g) Dilution of chemicals and kaolin: 300 l/min
- h) Divers secondary consumptions and losses: 200 l/min

Total fresh water quantity in circulation 4.000 l/min

Consumption after reorganization for one PM

The fresh water quantity being led after use directly  
into the channel, remains unchanged.

Fresh water quantity a) remains  $Q = 1.000 \text{ l/min}$

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Fresh water quantity b) replacement by clear water	-
1 Shower pipe for wire cleaning remains	Q = 250 l/min
Fresh water quantity c) replacement by clear water	-
Fresh water quantity d) remains can later be readjusted to clear water	Q = 600 l/min
Fresh water quantity e) replacement by white water II	-
Fresh water quantity f) remains	Q = 400 l/min
Fresh water quantity g) remains later on replacement through clear water possible	Q = 300 l/min
Fresh water quantity h) remains	Q = 200 l/min
<hr/>	
Average fresh water consumption for 1 PM	Q = 2.750 l/min
<b>Fresh water savings for 2 Paper Machines</b>	
actual consumption: 2 x 5000 l =	10.000 l/min
consumption after reorganisation 2 x 2750 l =	5.500 l/min
<hr/>	
Average savings	4.500 l/min

**4.4.2 Cost Savings for Recovery of Fibres and Fillers**

The following pulp prices are the basis for the calculation of the savings, these having been communicated to us by the Management of Ivangrad Pulp- and Paper Mill as the valid prices in Yugoslavia, being the national fixed inland prices:

	bleached	semi-bleached	unbleached
Beech (ND/t):	2140	--	1600
Pine wood (ND/t):	3160	2840	2530

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Estimate for both PM: 330 production days and  
90 % eff. production period.

The paper raw material for the 3 main brands bleached,  
semi- and unbleached papers are being treated separately.

Bleached Papers with approx. 20 - 12 % filler in the paper

Production share per year: 60 % 200 days  
Pulp share: 50 % bleached pine wood pulp  
50 % bleached beech pulp

Reduced raw material loss resp. cost savings:

Actual condition: 5.500 l/min x 0,4 g/l x 1440: 3.160 kg/day  
after reorganization.

3.060 l/min x 0,04 g/l x 1440: ./ 176 kg/day

Savings of paper raw materials: 2.984 kg/day

Fibre share 40 %: 2.984 x 0,4 1.190 kg/day

Cost Savings

50 % beech-pulp: 1.180 t/day x 0,5 x 2140 ND/t ND 1.270,--

50 % pine wood pulp: 1.190 t/day x 0,5 x 3160 ND/t ND 1.880,--

Savings of fibre raw materials: ND 3.155,--

Fillers, 60 % : 2.984 x 0,6 = 1.794 kg/day  
1.794 t/day x 750 ND/t: ND 1.345,--

Savings per day ND 4.400,--

Savings per year under assumption of 200 pro-  
duction days with a 90 % effective production  
period:

4400 ND/day x 200 x 0,9 =

792.000,-- ND/year  
= 50.750,-- US \$/year

=====

Semi-bleached Papers, without Fillers:

Production share per year: 10 % = 33 days  
100 % semi-bleached pine wood pulp

Reduced raw material loss resp. costs savings:

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Actual condition:	5.500 l/min x 0,25 g/l x 1440 :	1.975 kg/day
After reconstruction:		
	3.060 l/min x 0,04 g/l x 1440: ./.	176 kg/day
		<u>1.799 kg/day</u>

**Savings per day:**

1,799 t x 2.840 ND/t :	5.100, -- ND/day
------------------------	------------------

**Savings per year under the assumption of 33  
production days with a 90 % effective production  
period:**

5.100 ND/day x 33 x 0,9 =	150.000, -- ND/year
	= 9.600, -- US \$/year
	*****

**Unbleached Paper without Fillers**

**Production share per year: 30 % = 97 days  
100 % unbleached pulp**

**Reduced raw material loss resp. cost savings:**

Actual condition:	5.500 l/min x 0,25 g/l x 1440:	1.975 kg/day
After reconstruction:		
	3.060 l/min x 0,04 g/l x 1440: ./.	176 kg/day
		<u>1.799 kg/day</u>

**Savings per day:**

<b>50 % unbleached beech pulp:</b>	
1,799 t/day x 0,5 x 1.600 ND/t:	ND 1.550, --

<b>50 % unbleached pine wood pulp:</b>	
1,799 t/day x 0,5 x 2.530 ND/t:	ND 2.260, --

<b>Savings per day:</b>	<u>ND 3.720, --</u>
-------------------------	---------------------

**Savings per year under the assumption of 97  
production days with a 90 % effective production  
period:**

3.720 ND/day x 97 x 0,9 =	320.000, -- ND/year
	= 20.500, -- US \$/year
	*****

**Fresh Water**

Consumption actual condition:	10.000 l/min
Consumption after reconstruction: ./.	<u>5.500 l/min</u>

<b>Savings:</b>	4.500 l/min = 4,5 cbm/min
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Savings per day at 0,18 ND/cbm:

$$4,5 \text{ cbm/min} \times 1440 \times 0,18 \text{ ND/cbm} = 1.165, -- \text{ ND/day}$$

Savings per year

at 330 production days and a 90 % effective  
production period:

$$1.165 \text{ ND/day} \times 330 \text{ days} \times 0,9 = 345.000, -- \text{ ND/year}$$
$$= 22.100, -- \text{ US \$ / year}$$

\*\*\*\*\*

This saving is merely mathematically, since  
the electric current costs arising for the  
pump work of the replacement water are being  
considered in the summary of operation costs.

#### 4.4.3 Summary of Savings

The savings for both Alternatives I and II are similar  
owing to the fact that the recovery equipments are laid  
out for the same capacity. They result as per chapter  
4.4.2 as follows:

Bleached paper with filler:	50.750, -- US \$ / year
Semi-bleached paper without filler:	9.600, -- US \$ / year
Unbleached paper without filler:	20.500, -- US \$ / year
Fresh water:	22.100, -- US \$ / year
<b>Totality of savings per year:</b>	<b>102.950, -- US \$ / year</b>

\*\*\*\*\*

If the basis for the savings are the national fixed low prices for  
paper raw materials, the total costs per year until depreciation  
of the new equipment (see chapter 4.3.2, page 41) are not  
covered.

#### 4.4.4 Cost Savings on the Assumption of the free World Market Prices for Pulp

It is assumed that approx. 480 t pulp will be saved per year  
which will bring additional increase of paper production of the mill.  
Savings in procurement of bought market pulp could be used for  
financing for the investment of the sewage plant. The following  
pulp prices are world market prices for contractfree quantities  
per august 1974, they are approx. 60 % above the normal world  
market quotations for pulp. They represent thus contrary to the  
artificially low prices as per item 4.4.3

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the other extreme i. e. a kind of maximum prices.

	bleached	semi-bleached	unbleached
Beech US \$/t	560	-	480
Pine wood			
US \$/t	625	530	400

The paper raw materials are being subdivided as per item 4.4.2, for:

**Bleached Papers quantities as per item 4.4.2**

Costs savings:	US \$
50 % beech-pulp: 1,190 t/day x 0,5 x 560 US \$/t	334, --
50 % pine wood pulp: 1,190 t/day x 0,5 x 625 US \$/t	373, --
Pulp raw material savings:	<u>707, --</u>
Fillers, 60 %: as per item 4.4.2	85, --
Savings per day	<u>792, --</u>
Savings per year at 200 production days with a 90 % effective production period:	
792 US \$/day x 200 x 0,9	142.000, -- US \$/year

**Semi-bleached Papers, without Fillers**

Production share per year: 10 % = 33 days  
a 100 % semi-bleached pine wood pulp quantities as per item 4.4.2

Savings per day  
1,799 t x 530 US \$/t: 955, -- US \$

Savings per year at 33 production days with a 90 % effective production period:  
955 US \$/day x 33 x 0,9 = 28.400, -- US \$/year

**Unbleached Papers, without Fillers**

Production share per year: 30 % = 97 days  
100 % unbleached pulp quantities as per item 4.4.2

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Savings per day:	US \$
50 % unbleached beech pulp: 1,799 t/day x 0,5 x 420 US \$/t:	376, --
50 % unbleached pine wood pulp: 1 799 t/day x 0,5 x 480 US \$/t:	426, --
Savings per day:	<u>804, --</u>
Savings per year at 97 production days with a 90 % effective production period: 804 US \$/day x 97 x 0,9 =	70.000, -- US \$ / year *****

Fresh Water as per item 4.2.2.

Savings per year:	22.100 US \$ / year *****
-------------------	------------------------------

Paper Raw Materials

Bleached papers with filler:	142.000, -- US \$ /year
Semi-bleached papers without filler:	28.400, -- US \$ /year
Unbleached papers, without filler:	70.000, -- US \$ /year
Fresh water	22.100, -- US \$ / year
<b>Totality of Savings per Year</b>	<u>262.500, -- US \$ / year</u> *****

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#### 4.5 Summary

At the present stage of evaluation of offers and without a renewed contact with the Yugoslave authority in charge of the determination of national pulp prices and the procurement of the equipment, a more exact statement of the cost benefit analysis is not possible.

It depends mainly on the finally agreed price for the equipment, the financing possibilities (and ev. additional arising financing costs) and the rentability calculation from the sight of the Yugoslave economy system concerning the prices for the recovered paper raw materials as well as the water saved.

The additional calculations can be set up without difficulties from the Ivangrad Pulp- and Paper Mill by means of the data given in this Report, considering the up-to-date prices.

In order to come to a final statement, the following rate of return analysis of invested capital will be carried out, however under the explicit condition of an eventually necessary changement of the following assumptions:

- Assumptions: - Investment cost and depreciation as established in item 4.1
- Operation costs, as per item 4.2
  - Financing costs with a total investment per year of approx. 5 %.
  - Savings calculated on basis of the medium value resulting on one side from the national fixed pulp prices communicated to us (see page 47) and on the other side from the prevailing world market price for pulp, (see page 49).
  - Savings are equal for both alternatives, as per item 4.4.3.

<u>Yearly Costs</u>	<u>Alternative I</u> <u>US \$</u>	<u>Alternative II</u> <u>US \$</u>
Depreciation (10 % of the investment costs)	66.000, --	55.000, --
Operation costs	44.620, --	57.640, --
Additional financing costs (yearly approx. 5 % of the investment costs)	<u>33.000, --</u>	<u>27.500, --</u>
Costs yearly during 10 years depreciation period	143.620, --	140.140, --

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Yearly savings of paper raw ma- terials and water	182. 725, --	182. 725, --
0, 5(102.950. --+262. 500. --)		
<u>Yearly profit</u>	39. 105, --	42. 585, --

Within the 10 years depreciation period additionally arising costs, resp. cost increases can be paid from this profit. Upon expiry of the depreciation period the profit per years increases in accordance to the depreciation no longer applicable, such as the financing costs will have expired by then.

Not considering a firm depreciation period such as at the fiscal calculation of profit but trying to find out how quickly the invested capital is being amortized by savings, result of the calculation is as follows:

	Alternative I US \$	Alternative II US \$
Operation costs	44. 620, --	57. 640, --
Savings	<u>182. 725, --</u>	<u>182. 725, --</u>
Difference per year	138. 105, --	125 085, --

The capital to be invested will be earned resp. amortized at Alternative I (660. 000 US \$) in approx. 4, 8 years time, at Alternative II (550. 000 US \$) in approx. 4, 4 years, if no additional financing costs will arise.

Considering that the total investment costs have to be financed with an average rate of interest of 10 %, this results in additional interest costs of approx. 5 % of the investment costs per year for the entire financing period at an equal amortisation. Under consideration of this additional financing expenses, the following calculation is set up:

	Alternative I US \$	Alternative II US \$
Operation costs	44. 620, --	57. 640, --
Financing costs	<u>33. 000, --</u>	<u>27. 500, --</u>
Sum of yearly costs	77. 620, --	85. 140, --
Yearly savings	<u>182. 725, --</u>	<u>182. 725, --</u>
Difference per year	105. 105, --	97. 585, --

Betrifft **Assistance to Extension of the Recovery System for Fibres and  
Fillers at the Ivangrad Pulp- and Paper Mill, Yugoslavia**

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Under consideration of an approx. 10 % interest charge ,  
the investment costs are recovered at Alternative I in  
approx. 6,3 years and at Alternative II in approx. 5,7  
years by means of savings at the paper raw materials  
and water.

**5. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS**

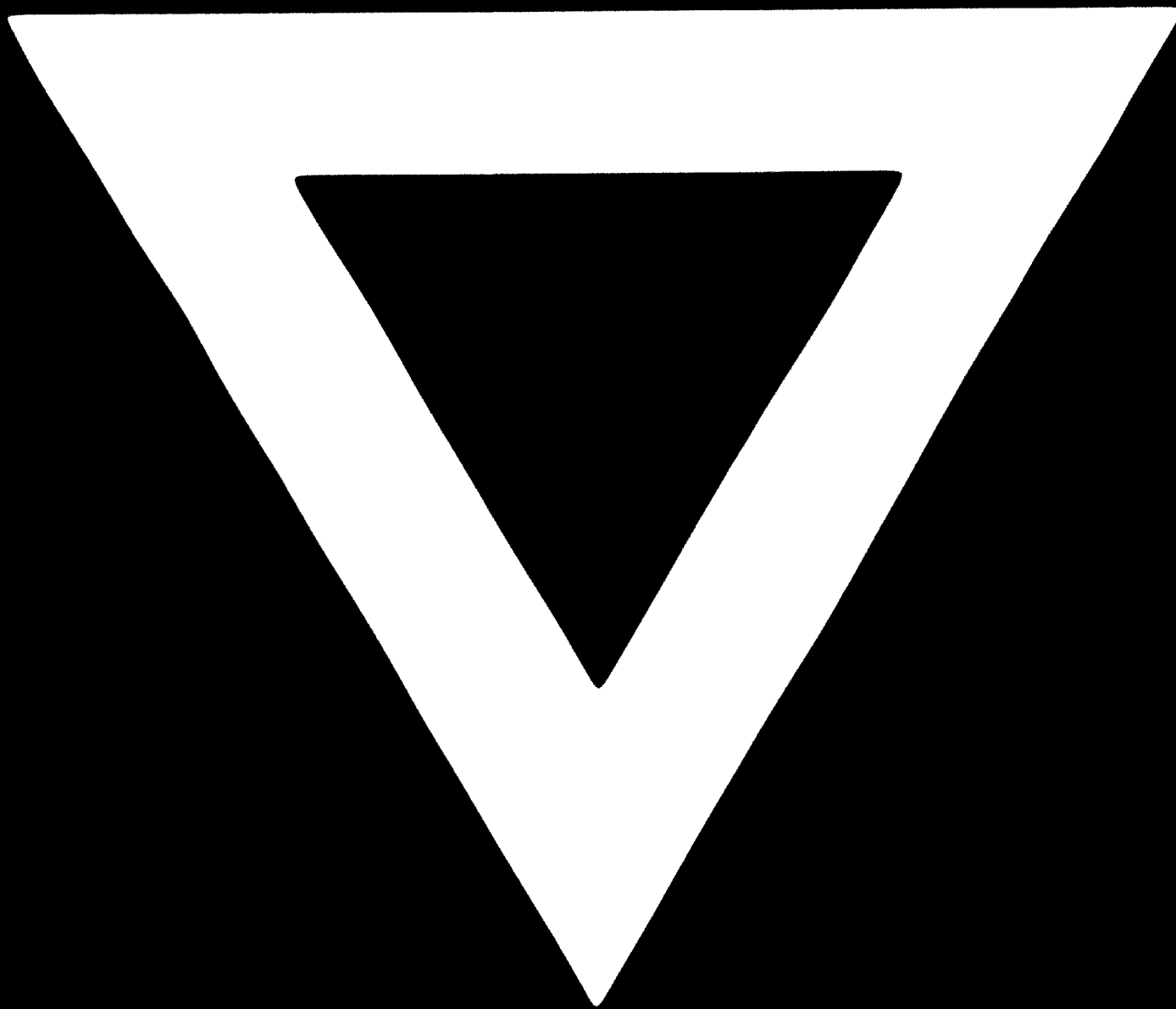
In order to avoid unnecessary repetitions we refer to the  
above abstract of this Report, in which the essential results  
and recommendations from the elaboration of this order are  
summarized for the quick reader.

**GOLLWITZER INGENIEURPLANUNG & Co.**

**Annex: Original quotations  
from manufacturers  
(1-fold only),**

**Tender Documents of the  
Consultant (1-fold)**

**C-932**



**82.11.04**