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## Efforts to Overcome the Limits - Energy Conservation in the Recycled Pulp Manufacturing Facilities

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Pulp Department  
Pulp Section  
Energy-Conservation DIP Group

**Keywords:** Rationalization of conversion of electricity to motive power and heat (motor applied facilities , electric heaters, etc.)

### Outline of Theme

Our factory acquired ISO14001 in 1998, and has promoted the energy conservation activity with all our might. Numerical targets for reduction of electric power and steam consumption were set up in the factory in order to achieve "annual average reduction of specific energy consumption by 1% or more" regulated in the Energy Conservation Law, and the target amount of energy conservation was allocated to each department.

The recycled pulp manufacturing facilities which consumed a lot of electric power was recently installed in the Pulp Department as facilities for recycling; and also, the ozone bleaching facilities which consumed a lot of energy was installed as facilities for dealing with environmental measures in the Department. These facilities triggered deterioration of the specific energy consumption.

Therefore, the DIP (Deinked Pulp) group put it at the top of the issue to reduce the specific electricity consumption in the recycled pulp manufacturing facilities to the limits, and the group worked together to achieve the goal for the energy conservation.

### Implementation Period of the said Example

- Planning period: November 2001~ March 2002 Total of 5 months
- Implementation Period of Measures: April 2002~ March 2004 Total of 24 months
- Confirmation Period of Effects of Measures: April 2004~ July 2004 Total of 4 months

## Outline of the Business Establishment

Production items: quality paper, special paper and communication paper

Number of employees: 369

Annual energy usage (data of FY2003):

Electric power: 351,373 MWh

Crude oil: 25,519 KL

Bark : 25,489 BDT

Tires : 15,380 T

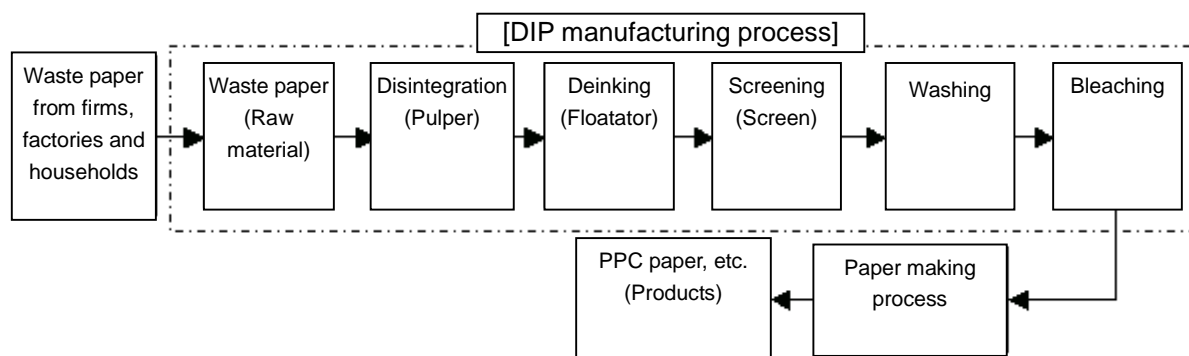
Sludge : 3,888 BDT

Black liquor : 331,937 BDT

## Outline of Target Facilities

The facilities for manufacturing DIP (deinked pulp) by using waste newspaper as main raw material are the target facilities.

Using this pulp, PPC (Plain Paper Copier) paper with the high content of waste paper is manufactured. We are working out more extensive utilization of waste paper by mixing in DIP to other products as required.

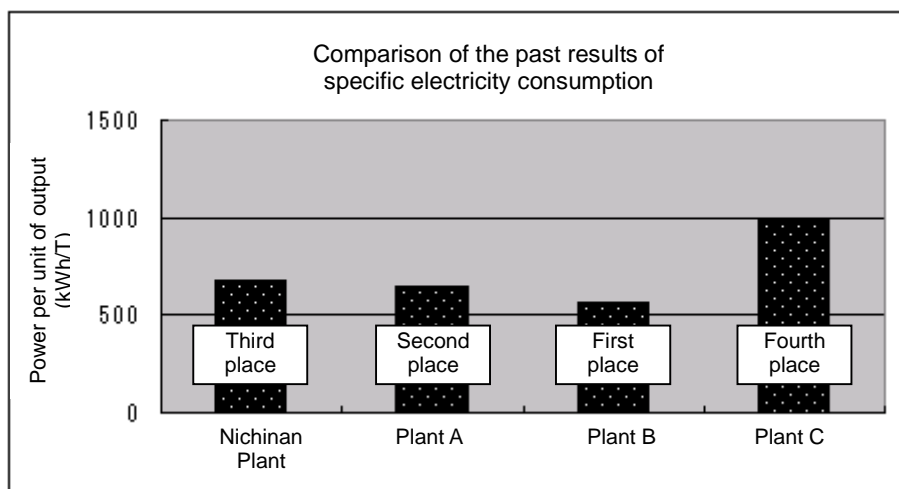


## 1. Reason for Theme Selection

Construction of the DIP manufacturing facilities was completed and the operation was started in 1999. Not production of recycled pulp on the continuous low operation but intermittent manufacturing of the pulp at the design productivity rate of 200T/day by effective use of the finished pulp tower has been performed.

By introducing the intermittent operation, the specific electricity consumption was improved compared with that under the continuous low-productivity operation in the early days of the operation. However, when the specific electricity consumption was compared with that in DIP manufacturing facilities of other three plants, our plant took third place out of 4 plants, so it was not a good result.

Consequently, our plant decided to pursue this theme by promoting the energy conservation in the DIP manufacturing facilities so that the plant would win the first place in energy conservation among the company's DIP manufacturing facilities and would be an energy conservation model plant.



## 2. Understanding and Analysis of Current Situation

### (1) Understanding of Current Situation

Since the operation was started, recycled pulp has been manufactured at the design rate, but the actual capacity of each device is not well grasped because of the insufficient operation hours. Therefore, some devices have extra capacity and some have reached the limits in our plant.

There are some devices which have the possibility of saving electric power or raising the throughput rate by introducing small improvement. Therefore it can be found that our plant

has possibility of saving electric power or increasing the quantity of output by research and improvement.

## **(2) Analysis of Current Situation**

- 1) Some pumps and blowers have surplus capacity even under the full operation.
- 2) Some devices have reached the limits in the capacity under the full operation. The measures for improvement to increase production rate (for raising processing capacity) shall be examined.
- 3) When compared with the process flow of other factories, some devices are found able to be bypassed. After the quality verification, whether the discontinuance of some devices is possible or not shall be judged.

## **3. Progress of Activities**

### **(1) Implementation Structure**

The actual loading test of each pump and blower was carried out together with the DIP Design and Construction Section.

At the same time, in the Recycled Pulp Manufacturing Operation Department, examination of problems induced by the increased production rate and the information exchange with other plants were conducted so as to sort out matters to be improved.

### **(2) Target Settings**

On the assumption that the mean daily production in operating conditions is 230T/day, the specific electricity consumption shall be reduced by 20% than before.

## **4. Details of Measures**

### **(1) Electric Power Saving by Improvement of Blowers**

#### **The current situation**

The blowers were installed in floatators for air blowing in both pre-process and post-process of deinking (deinking facilities) respectively. The large amount of surplus air is released to the atmosphere for the adjustment of pressure of air blowing, since the blowers have the

surplus capacity of blowing.

### Measures

By connecting both pre-process and post-process outlet ducts of blowers at the exit to use them as a single unit and also by making the pre-process blower controlled by an inverter, it became possible to generate only the needed volume of air. Therefore, the electric power energy for generating the surplus air could be reduced. (Fig. 1)

### Effects

The discharge system of large amount of surplus air to the atmosphere could be improved by introducing the inverter into the pre-process blower and connecting the outlet ducts of both blowers. As a result, electric energy was reduced by 400MWh/year.

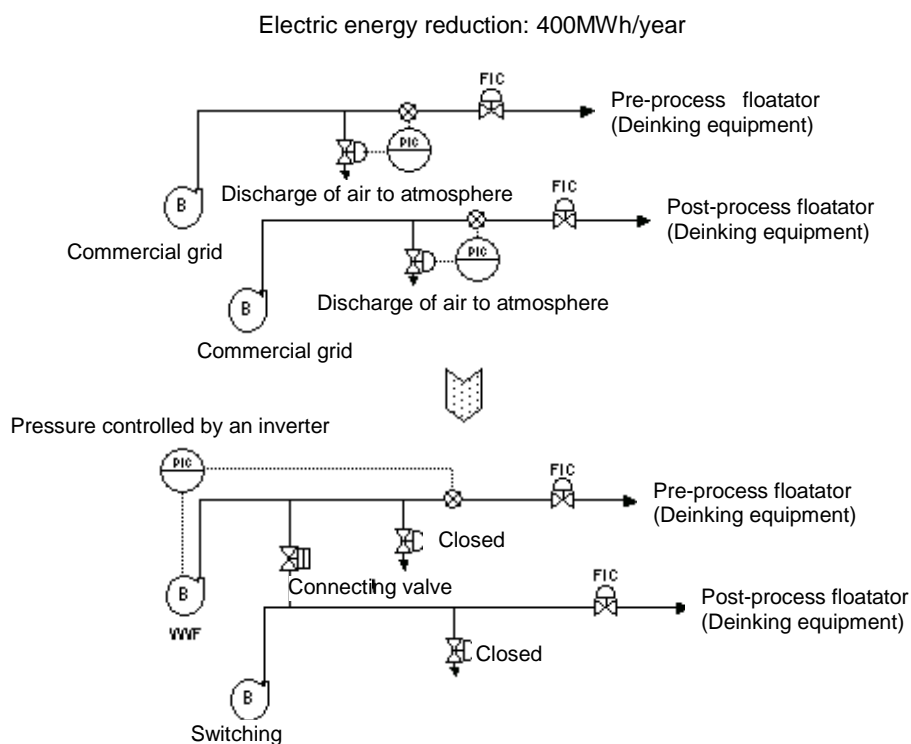


Fig. 1: Structure of blowers before and after improvement

## (2) Electric Power Saving by Improvement of the Pump

### The current situation

A dilute cleaner is used to remove heavyweight foreign substances in the pulp. The primary cleaner feed pump controls the pressure inside the pipe to be at the specified value based on the quantity of the cleaner returned to the feed tank at the constant rotation

rate.

### Measures

Since the cleaner returned to the feed tank needed extra electric power, saving of electric power was made by making the feed pump to be controlled by an inverter. (Fig. 2)

### Effects

By making the cleaner feed pumps of two lines to be controlled by inverters, electric energy was reduced by 1,140 MWh/year.

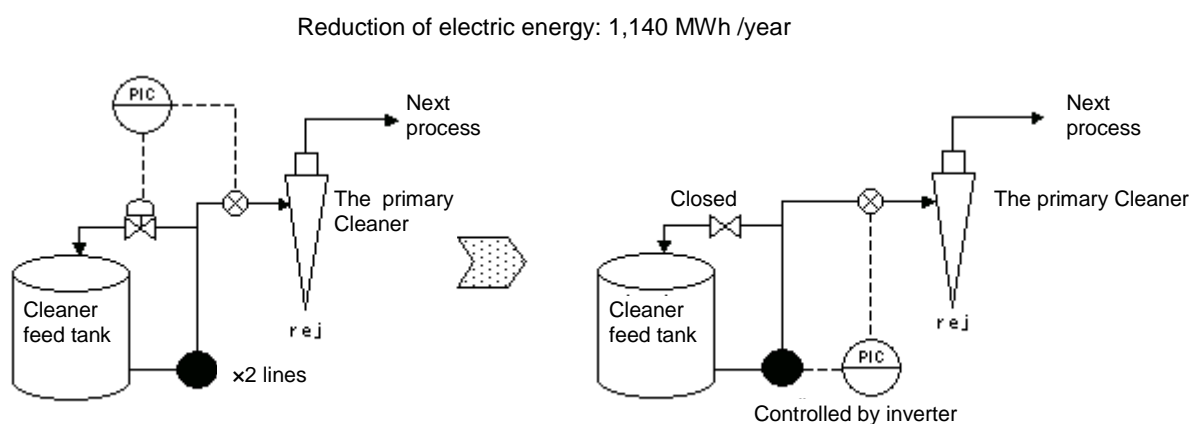


Fig. 2: Structure of cleaner feed tank before and after improvement

## (3) Electric Energy Conservation by Remodeling the Internal Partition Board in the Dissolving Pulper Machine

### The current situation

The fiber flow pulping machine (the horizontal drum pulper) has been used as a pulping machine for dissolving waste paper. But the area of the partition board is bigger than before, since the internal partition board has been remodeled to make it stronger. Accordingly, the volume of pulp stored in the drum has increased in comparison with the traditional-model pulper (Fig. 3-A), and the power load has increased (Fig.3-B).

### Measures

The internal design drawing of the same type of pulper was obtained from the manufacturer, and the electric energy of the traditional-model pulpers in other factories and the present situation of damage of the internal partition board were investigated. Then the shape of the partition board was restored to the original shape after it was confirmed that there was no

problem in its strength (Fig.3-C).

### Effects

By making the area of the partition board to be the same as that of the traditional-model pulper, the storage volume of pulp was decreased and the electric energy was reduced by 225MWh/year.

Reduction of electric energy: 225MWh /year

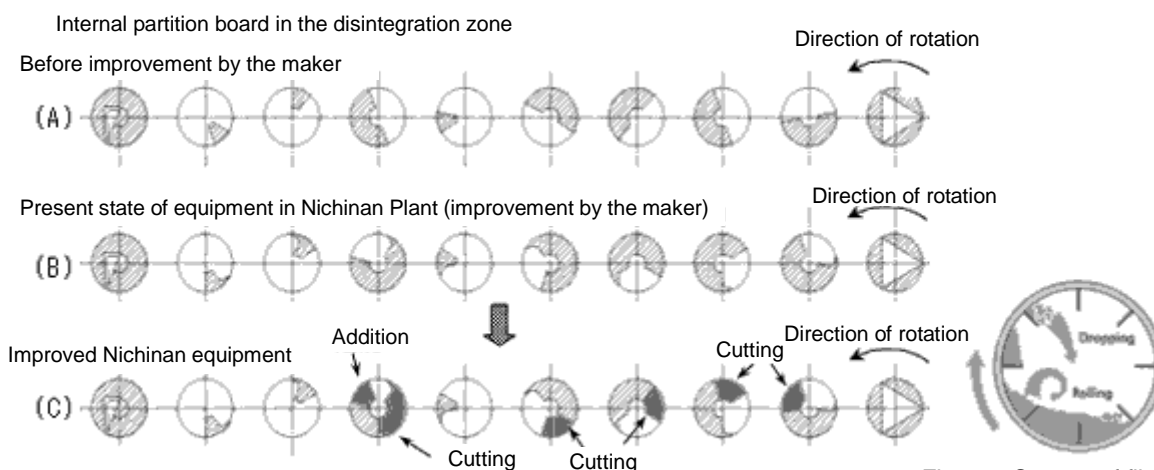


Fig. 3: Structure of internal partition board in the fiber flow pulper

Fig. 4: System of fiber flow

## (4) Electric Energy Conservation by Bypassing the Cleaning Process

### The current situation

Lightweight foreign substances including vinyl pieces and the paste used for magazines as well as heavyweight foreign substances including sand and the iron rust were being removed in the process of cleaners. On the other hand, there was a possibility that the quality of paper can be controlled without using cleaners, since there seemed to be no problem when some plants did not use them.

### Problem points and the progress of improvement

To bypass the process of cleaning meant that heavyweight foreign substances were not removed and, as a result, there was no evidence that bypassing did not have adverse effects on paper products. Therefore, the analysis of foreign substances in the last reject from the cleaners was carried out, and it was judged that the effects of those substances on the products were not significant. Nevertheless, the test was carried out together with the Papermaking Department in order to make sure that there was no problem.

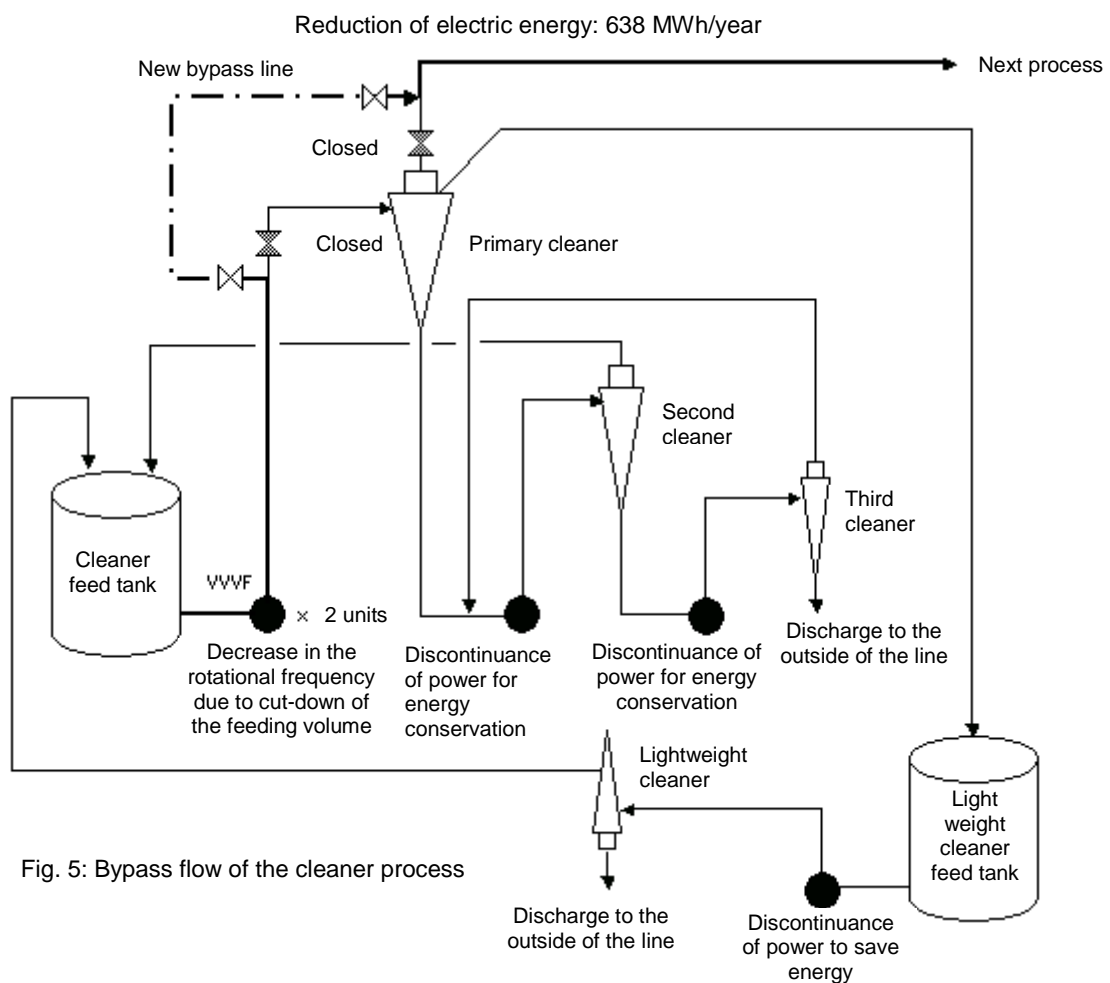
## Measures

By installing the bypass line to discontinue the use of the cleaning process, the use of the following pumps was stopped or the rotational frequency (INV) was reduced for energy conservation (Fig.5).

- Second cleaner feed pump
  - Third cleaner feed pump
  - Light-weight cleaner feed pump
  - Primary cleaner feed pump × 2 units (decrease of inverter rotational frequency)
- } Discontinuance of power for energy conservation

## Effects

By passing the process of cleaners, and discontinuing the use of pumps for saving power or reducing the rotational frequency, electric energy was reduced by 638 MWh/year.





## **(5) Reduction of Specific Electricity Consumption due to an Increase in Daily Production**

### **The current situation**

Though recycled pulp was produced at the design rate of 200T/day, the performance of each facility is under survey and there is a possibility that a daily output may be able to be increased. The daily production of some devices exceeded the production recommended by the manufacturer and was close to the upper limits. But we thought that we might solve the problems by making improvement, and so we decided to gradually increase a daily production to remove bottlenecks.

### **The problem points accompanied by an increase of the daily production**

- 1) With the increase of the volume of waste paper for dissolving in the pulper, the quantity of the un-dissolved pulp also increased, and the yield of pulp tended to be declined.
- 2) The dehydration rate of the disk filter in the pre-process of dehydration and washing decreased accompanied by an increase of the amount of throughput.

As the throughput of the press dehydrator in the next process reached the limits, the daily production hit the peak.

- 3) As conveyance capability of the discharge screw conveyor in the bleaching tower reached the limits, the daily production hit the peak.
- 4) As the amount of water for dilution in the screening process of the post-process was insufficient, the daily production hit the peak.

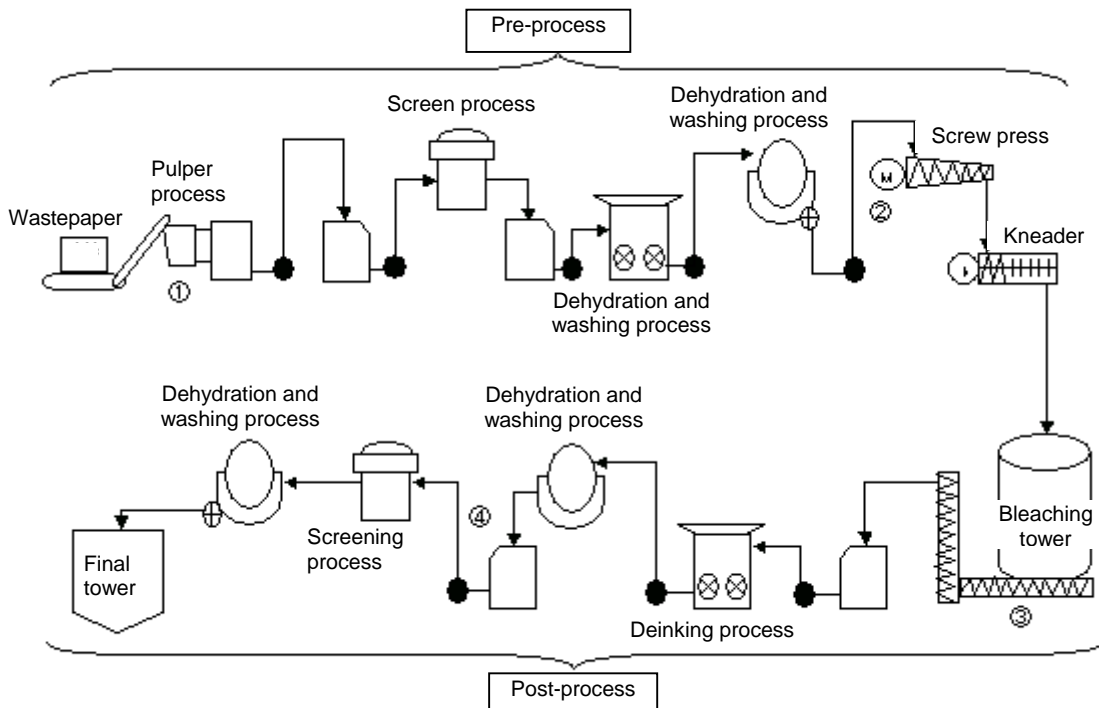
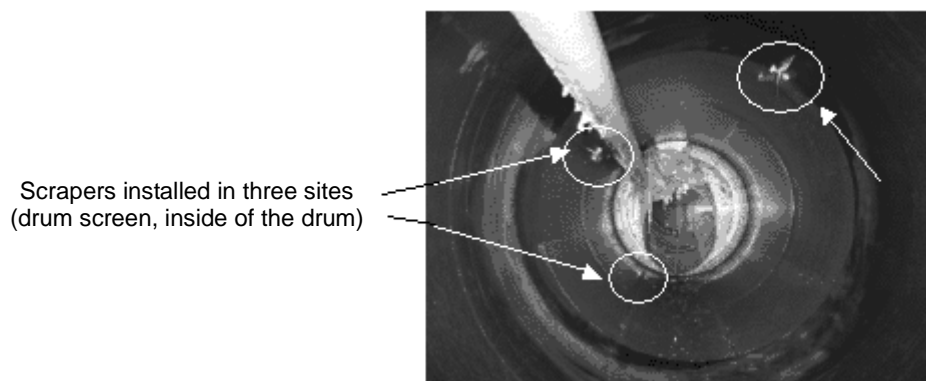


Fig. 6 Dehydration and washing process

### Details of Measures

- 1) A pulper scum washer (drum screen) was improved and scrapers were installed so as to improve agitation-dissolution capability of the drum. As a result, un-dissolved pulp decreased and a daily production increased.



### 2-1) Review of the operating conditions of the disk filter

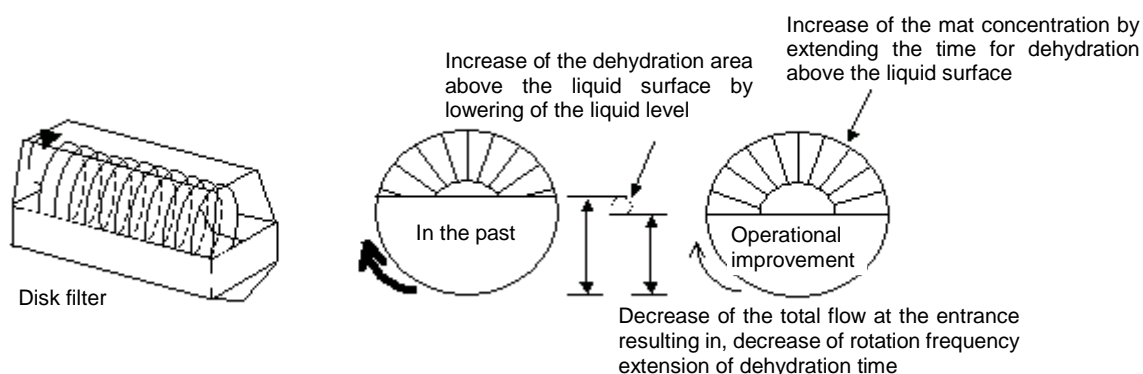
( In the past ) Manufacturer standards

- The liquid level of the vat is raised so as to increase the filtration area.
- The pulp concentration at the entrance is diluted at 1.1% so as to increase the volume of the filtrate and to increase the vacuum dehydration force.



**(Improvement)**

- The liquid level of the vat was lowered so as to prolong the time for stripping the pulp mat from the liquid surface.
- The pulp concentration at the entrance was increased to 1.6% so as to reduce the total flow at the entrance and to lower the drum rotation frequency in order to extend the time for dehydration.
- The pulp concentration of the dehydrator at the exit increased from 8.5% to 10.0%.



**2-2) The spring of the damper presser at the exit of the screw press (pressurizing dehydrator) was changed.**

By decreasing the diameter of the damper spring wire (12mm → 6mm), the capability of conveying pulp was improved and the production of dehydration and washing process in the pre-process was improved.

**3) The pulley ratio of the discharge screw conveyor in the bleaching tower was changed so as to increase the rotational frequency.**

As a result of the change of pulley ratio, the rotational frequency was increased from 9RPM to 12RPM.

The production capacity of bleaching tower was improved.

4) The piping of the dilution water line in the screening process of the post-process was remodeled, and the piping pressure drop was eliminated. As a result, the problem of shortage in the quantity of water was solved (Fig.7).

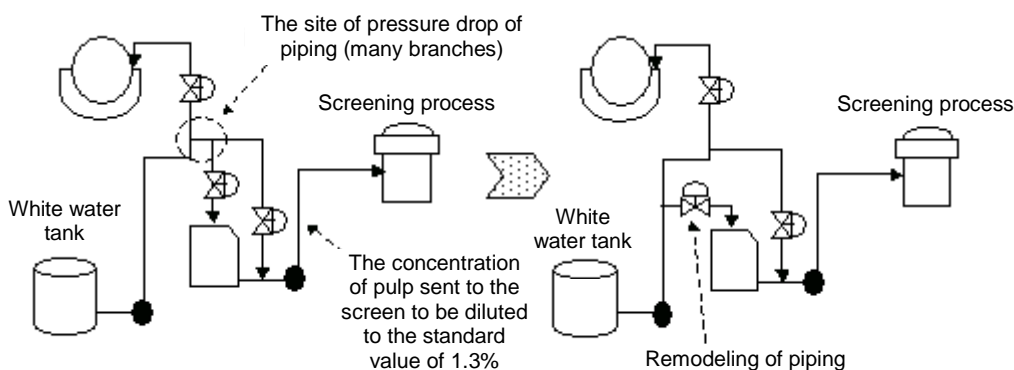


Fig. 7: Improvement of the dilution water line

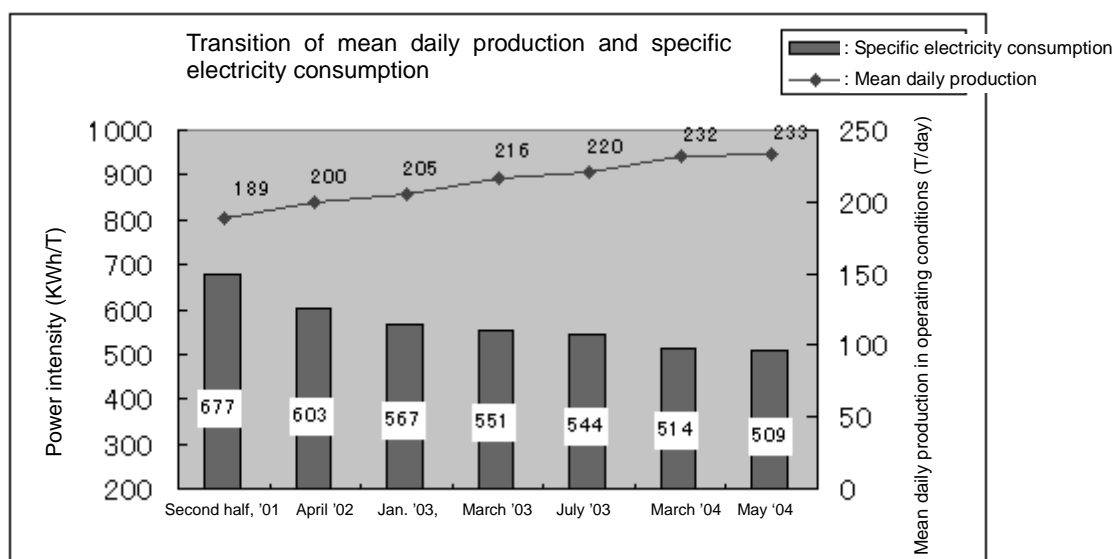
By implementing countermeasures described in [1] ~ [4], The daily production in real operation was increased.

**Daily production in real operation: 189 T/day      232 T/day**

The target daily production was achieved.

## 5. Effects after Implementing Measures

Electric energy saving of various devices and increase of the daily production resulted in significant reduction of specific electricity consumption of output compared with that at the beginning of introducing the improvement plan.



**Reduction of specific electricity consumption: 168 KWhT**

The 25% target reduction rate was achieved.

Annual reduction of energy consumption: 8,940 MWh

## 6. Summary

The priority measures for improvement this time consisted of energy conservation and increase of mean daily production by implementing creative efforts. There was a possibility that an increase in mean daily production might lead to an increase of the load of various devices as well as degradation of the quality of pulp accompanied by the performance decrement of devices. In order to avoid those problems, our group cooperated together to tackle them by introducing creative efforts which led to the good results.

We think that our plant was able to be one of the top DIP plants for energy conservation by making various energy conservation efforts.

The increase of mean daily production enabled the plant to increase the blending rate of waste pulp in paper manufacturing. Accordingly, this contributed not only to energy conservation but also to environmental purposes.

## 7. Challenges for the Future

We are going to continue the energy conservation activities while we will address a new challenge of saving steam usage by effectively utilizing heat sources.