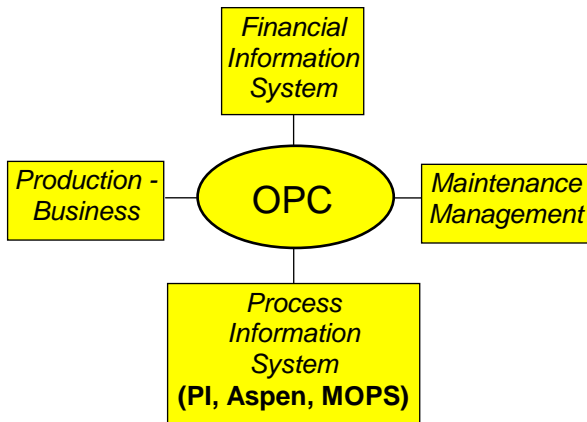


OPC *Millwide Production Scheduling, Decision Support and Optimization*

OPC acquires millwide data from the following sources using API and ODBC connections.



The **OPC What If** display (see first page – upper left window) is the main display where the what-if planning and forecasting is performed. The nine push buttons shown - provide access to the what-if input displays.

These are,

- Graphical Inputs
- Block Schedule
- Slowdowns/Shutdowns
- Rules and Targets
- Furnish Recipes
- Alternate Furnishes
- Additive Recipes
- Grade Changes
- Manufacturing Operations Model

The next four buttons provide access to the forecast displays. These are,

- Forecasts
- Animation
- Scheduled Grade Changes
- Purchased Materials

The user makes changes to any of the nine what-if input displays and then clicks on the OPC button. An eight day plan and forecast is then shown in different colors. (Corresponding forecasts are also shown in the Animation, Scheduled Grade Changes, and Purchased Materials Displays.)

Once an acceptable plan is obtained, the user clicks the 'check-mark' button and the plan is transmitted to the appropriate personnel.

- **Block Schedule** (see first page)

The Block Schedule display enables the production planner to enter and modify the grade runs schedule for each machine at the site. The entries in this display are the main inputs for OPC in determining the required production rates for the mill.

- **Graphical Inputs** (see first page)

The Graphical Inputs display enables the user to 'override' the production plan which has been calculated by OPC for a process unit.

- **Animation** (see first page)

The Animation Display is an effective tool to visualize the production plan and forecast for the entire mill over the future planning period.

- **Slowdowns/Shutdowns**

This display enables the user to enter and modify information regarding the start time, duration and rate of scheduled and unscheduled slowdowns and shutdowns.

- **Rules and Targets**

This display enables the user to enter and modify information regarding the rules and targets for inventories, process units, and the OPC production scheduler.

- **Furnish Recipes**

This display enables the user to enter and modify information regarding the preferred furnishes which are used for each grade and for each machine at the site.

- **Alternate Furnishes**

This display enables the user to enter and modify information regarding the use of alternate furnishes which can be used in place of the preferred furnish on an emergency basis.

- **Additive Recipes**

This display enables the user to enter and modify information regarding the additives which are used for each grade and for each machine at the site.

- **Grade Changes**

This display enables the user to enter and modify information regarding the duration of any grade changes which require a shutdown of any machine.

- **Manufacturing Operations Model**

This display enables the user to enter and modify information regarding the parameters for the manufacturing operations model. These parameters include the size of inventories, the maximum production rate of process units, the ratio of material flows, pulping and washing, and the consumption of steam, power, chemicals, and the production of effluent.

OPC *Millwide Production Scheduling, Decision Support and Optimization*

Generally, the OPC software is 'added into' sites with existing PI, Aspen, or MOPS process information systems.

OPC acquires process information from these systems and also connects to ODBC compliant databases to read or write information such as Financial Information, Production-Business, and Maintenance Management systems.

OPC integrates customer orders and shipping requirements from Production-Business, with material cost and product revenue information from the Financial System, together with the production capacities and constraints from the Process Information System, to monitor and forecast the profitability of the enterprise.

The programming language for OPC is Microsoft Visual Basic. OPC uses the Microsoft SQL Server to store its configuration data and its plans and forecasts. Microsoft VBA is used to integrate Microsoft Office into OPC. This provides the user with a very familiar environment in which to carry-out millwide production scheduling and decision support activities.

The control technology for OPC is based on the Company's proprietary technology called Lost Production Modal Control, which de-couples the interactions between process units in the pulp and paper mill. This enables OPC to minimize the number of production rate changes of the process units while achieving the desired production for the mill.

There are two main parts of the OPC System namely,

- OPC Basic System
- OPC 'Optimization' System

The OPC Basic System is comprised of the following modules,

- What-If Decision Support Displays
- Basic Production Scheduler
- Millwide Model Identification

The OPC Optimization System is comprised of the following modules,

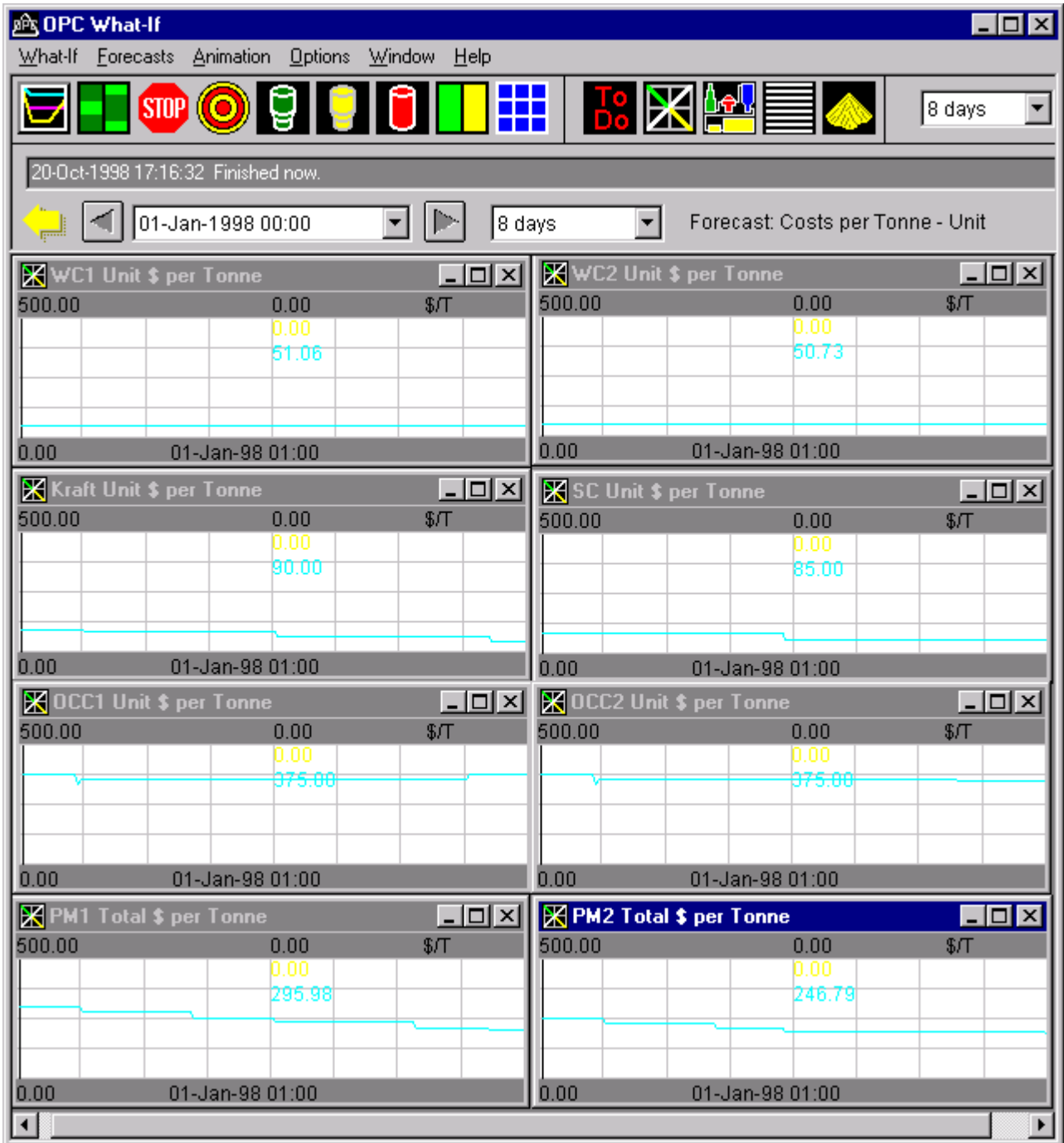
- 'Optimization' Production Scheduler
 - Steam/Power/Liquor Load Shedding
 - Just-In-Time Inventory Management
 - Forced Shutdown Prediction and Prevention
 - Grade Change Coordination
 - Energy-Production Coordination
 - Maintenance-Production Coordination
 - Profit Optimization
- Business-Manufacturing Coordination
- Realtime Cost / Grade Run Analysis
- Lost Production/Mill Bottleneck Analysis
- Mill Capacity Analysis and Optimization

Configuration of the OPC System is accomplished using,

- OPC Configuration Application (Wizard)
- MS Excel
- MS SQL Server (ISQL)

OPC - Realtime/Grade Cost Trending and Forecasting

Realtime Costs and Grade Costs can be trended and forecasted as shown below. This enables the user to make production decisions based on cost.



OPC - Foreman's To Do's

The Foreman's To Do's display lists the important activities which will occur during the shift.

The **Production Plan** lists the required production rates in numerical format.

The screenshot shows a software window titled "Foremen To Dos" with a menu bar (File, Options, Help) and a "To Do:" section. Below this is a table of tasks. The "Production Plan:" section includes a dropdown for "Process Units" set to "12" and a data table with 10 rows and 10 columns. The table headers are 1 through 9, and the rows list various production rates.

	1	2	3	4	5	6	7	8	9
Cau Rate	1800	1800	1800	1800	1800	1800	1800	1800	1800
Conc SBL Rate	1804	1804	1804	1804	1804	1804	1804	1804	1804
Evp1 WBL Rate	3000	3000	3000	3000	3000	3000	3000	3000	3000
Evp2 WBL Rate	3000	3000	3000	3000	3000	3000	3000	3000	3000
Kiln Mud Filter Flow Rate	600	600	600	600	600	600	600	600	600
Kraft Rate	480	480	480	480	480	480	480	480	480
OCC1 Rate	240	240	240	240	240	240	240	240	240
OCC2 Rate	240	240	240	240	240	240	240	240	240
PM1 Production Rate	720	720	720	720	720	720	720	720	720
PM2 Production Rate	720	720	720	720	720	720	720	720	720
RB HBL Rate	1214	1214	1214	1214	1214	1214	1214	1214	1214
SC Rate	480	480	480	480	480	480	480	480	480
WC1 Rate	1920	1920	1920	1920	1920	1920	1920	1920	1920
WC2 Rate	1315.07	1315.07	1315.07	1315.07	1315.07	1315.07	1315.07	1315.07	1315.07

OPC - Configuration: Step 1

The OPC application can be easily configured to the site.

First, the process units and inventories for the site are defined. The grades are then defined. Next, the furnishes and the additives are defined.

Units:

	Drying - Pulp		Pulp Dryer 2	PD2	>
1	Drying - Pulp	1	Pulp Dryer 1	PD1	▲
2	Drying - Pulp	2	Pulp Dryer 2	PD2	■
3	Fiber Line	1	Chipping 1	WC1	▼

Grade Classes:

	Mill	>
0	Mill	

Grades:

0		Mill	Mill	Mill
0	0	Mill	Mill	Mill

Unit Grades:

	Pulp Dryer 2	Mill	>
1	Pulp Dryer 1	Mill	▲
2	Pulp Dryer 2	Mill	■
3	Chipping 1	Mill	▼

Furnishes:

Pulp Dryer 1	>		
BRHD 1	>		
BLHD 1	0	>	<

Additives:

Pulp Dryer 1	>
	>
	>

Variables:

PD1 Production			
kg/s	86.4	Tpd	0
1000	0	1	>

Messages:

OPC - Configuration: Step 2

The external inputs (tags from PI, Aspen, MOPS Process Information Systems, and ODBC databases) are then defined.

The **Unit Configuration** defines the connections of the process units and inventories for the site.

For the **Scheduler**, the user selects from a menu of production scheduling strategies for each process unit.

OPC Configuration - Step 2

File

External Inputs:

PD1 Production (Tpd) 1000

Unit Configuration: (-1 = primary upstream, -2 = secondary upstream, 1 = primary downstream, 2 = secondary downstream of the process)

	CB1	BR1	BL1	CB2	BR2	BL2	WBL	SBL	HBL	GLS	WLS	LMS	Lime	PL	BR01	BR02
PD1			-1													-2
PD2						-1										-2
WC1	1															
CD1	-1	1					2					-2				
BP1		-1	1													
WC2				1												
CD2				-1	1		2					-2				
BP2					-1	1										
EVP							-1	1								
CONC								-1	1							
OP									1	1						

Scheduler:

0

1

2

3

4

5

6

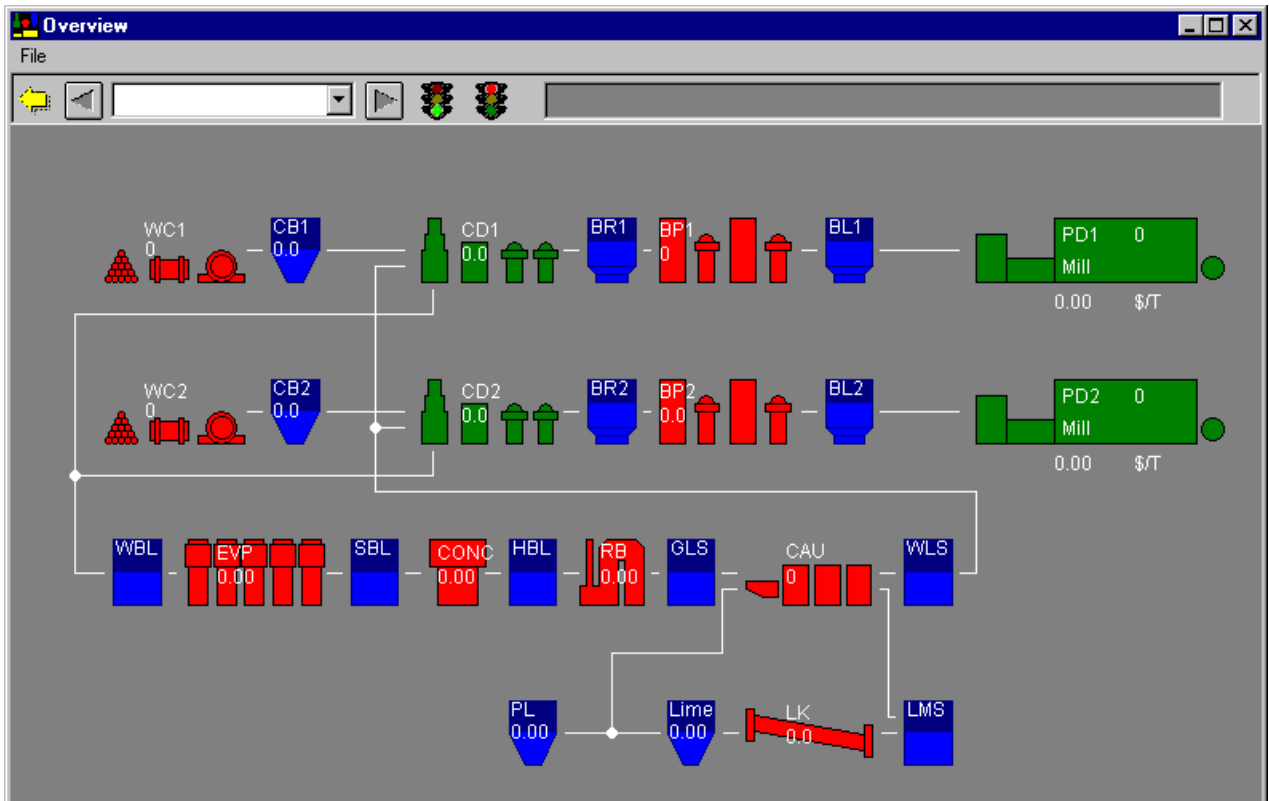
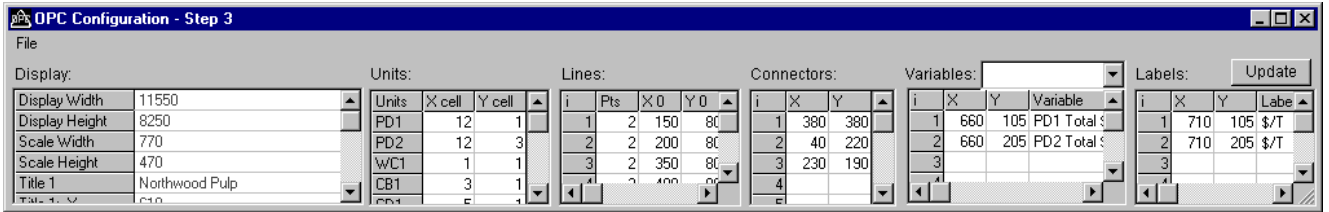
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Liquor Recovery Loop:

WBL WBL

OPC - Configuration: Step 3

The next step involves the layout of the Animation (Overview) display, and is shown below.



This display enables the user to enter and modify information regarding the parameters for the manufacturing operations model. These parameters include the size of inventories, the maximum production rate of process units, the ratio of material flows, pulping and washing, and the consumption of steam, power, chemicals, and the production of effluent.

Parameter	Units	Value
Steam Consumption at 0 kg/s	kg/s	0
Steam Consumption at max kg/s	kg/s	18
Power Consumption at 0 kg/s	W	0
Power Consumption at max kg/s	W	5000000
Chemical Consumption at 0 kg/s	kg/s	0
Chemical Consumption at max kg/s	kg/s	0.04
Effluent Production at 0 kg/s	m3/s	0
Effluent Production at max kg/s	m3/s	0.04
Maximum Rate	kg/s	11.574
Kilograms in process unit	kg	200000
Availability		0.95
Wood Moisture	kg/kg	0.5
Yield		0.5
Wash Ratio (wash/pulp)	kg/kg	5
Liquor Ratio (liquor/fiber)	kg/kg	2.37

OPC - Configuration: Production Rules and Targets

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This display enables the user to enter and modify information regarding the rules and targets for inventories, process units, and the OPC production scheduler.

Rule / Target	Units	Value
Kraft Maximum Rate	f	1
Kraft Minimum Rate	f	0.5
Kraft Minimum Change	f	0.05
Kraft Multi-Line Mode	f	0
Kraft Startup Rate	f	0.5
Kraft Ramp Up Rate	f/hr	0.25
Kraft Ramp Down Rate	f/hr	0.25
Kraft Time Delay for Restarting	hr	2
Kraft Upstream Level for Startup	f	0.2
Kraft Downstream Level for Startup	f	0.8