PC-PUFFIN VERSION 2.0

Produced by

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PC-Puffin is a 24-Hour Daily Dispatch Program fully customized for use by operators at Municipal Light & Power, Anchorage, Alaska.

Program input data is entered for the most part into white-colored text boxes. Boxes of other colors are just informational labels.

You only have to type a number when you want to change it from the value already showing, i.e., you do not have to type every program input every single time. When a new number is typed, it will show on the left-side of the box (left-justified). If you hit Tab, or click another box, the new value will become properly aligned.

An exception to this is the program module "Build Day's Load Using Factors", described on pages 5-6, where the data is controlled via special operations, rather than direct numerical entry. But again, you don't have to create every single value every time -- you only change specific values as desired.

In using the program, be careful not to go too fast, and don't try to click the major control buttons too quickly. At various points of program execution, the computer hard drive will require a brief interim to catch up with program flow. So don't rush -- and maybe try to be aware of what the hard drive is doing.

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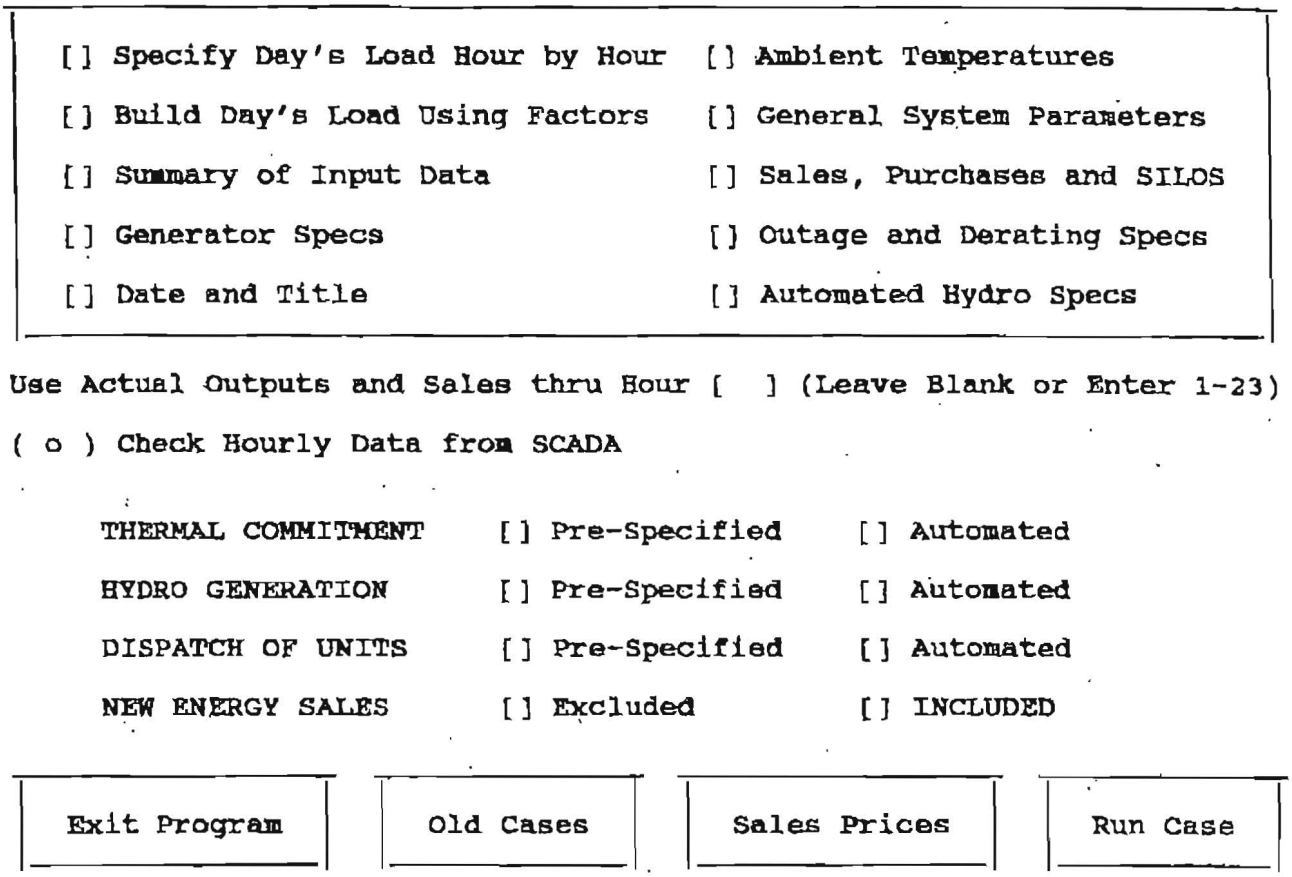


The illustration is a schematic of the PC-Puffin "Main Menu" screen. All program functions are controlled from the Main Menu, including:

(1) Program Input Data (Top Panel)

(2) Actual Outputs Hour (Leave Blank or Enter 1-23)

(3) SCADA Update Button

(4) Run Mode Switches (Pre-Specified or Automated)

(5) Sales Switch (Sales Excluded or INCLUDED)

(6) Program Command Buttons (Bottom Row)

The Program Input Data is explained (by category topic) on pages 4-19.

The Actual Outputs Hour and SCADA Button are explained on pages 20-21.

The Program Command Buttons, and the Run Mode and Sales Switches are explained on the next two pages 2-3.

There will also be a more complete account of the Run Mode Switches, in connection with a discussion of certain special data entry forms for use with Pre-Specified Run Mode options, beginning on page 22.

## Instructions for Using PC-Puffin

ALWAYS DO TWO RUNS:

For each case, always run the program twice:

(1) With Sales Switch set to New Energy Sales INCLUDED, then

(2) With Sales Switch set to New Energy Sales Excluded

Always do this same procedure, even if there are no actual transactions for the day.

RUNNING A CASE:

To run a case, click the Yellow "Run Case" Program Command Button.

Wait a few seconds, then a message for Puffin Run Time will appear.

Wait a few seconds more (listen to the hard drive to know when the computer is ready). Then click "OK" on the message panel.

NOTE: For the Sales Excluded Run (2), the program first asks if you want to keep Inadvertent Tie Flows the same as in the previous Sales Included Run (1). The program runs after you answer "Yes" or "No" to this question.

A series of Results-of-Run Screens will follow. These screens will be further described in this manual on pages 26-28. You can take a look at the results, then click "Go to Menu" when finished.

PRE-SPECIFIED OPTIONS:

If any of the Run Mode Switches is set for Pre-Specified, a set of Initial Hourly Value and/or Pre-Commit Screens is presented before the run actually begins. (These are described on pages 23-25.)

As each screen appears, you can accept or edit the values, as you wish. Click each "Continue" button to advance to the next screen. When the sequence is complete, a confirmation message will appear. If you click "Yes" to the confirmation, the run will begin.

SALES PRICES BUTTON:

When both runs are done (with and without sales), then you can click the Green "Sale Prices" Program Command Button, to obtain an account of transaction costs. The program will first check if the sales and no-sales runs are consistent, and inform you of any problems.

The upper half of the Sales Summary Screen shows the dollar amounts, and the lower half shows the $/MWh equivalents. This Sales Summary Screen is described in further detail on pages 29-30.

# Instructions for Using PC-Puffin

EXCEL COMMAND:

After viewing the Sales Summary Screen, you can return directly to the Main Menu (click "Menu"). Or you can instead click "Excel" to request a final summary run with the updated pricing values. This is called the "Excel Run", because this time the program generates a special file, designed to be exported to an Excel Spreadsheet of archived ML&P daily data.

It's OK to do an Excel run at any time, even if you expect today's data to change before the day is over. The program will overwrite the previous Excel file, each time a new Excel run is performed.

If you click "Yes" to the confirmation message "Do Excel Run Now?", the program will run again. Wait for the Puffin Run Time message, then wait a few seconds more, then click "OK".

Another summary screen will appear, explaining the costs for sales, or the savings from a purchase. You can print a 24-Hour Account of the day's Transactions (yellow button), or Unit Outputs (green), or both. The pink "Show Details" command brings up a listing of other reports you can select, browse, and print.

STORING A CASE:

After doing the Excel run, click "Go to Menu" on the summary screen. A message asks if you want to print any summary reports (in case you had forgotten to do so). Then it asks if you want to "Add the Case to the Bin". If you say "Yes", the case will be stored for someone to call it up, and re-run it, later on.

The blue "Old Cases" Program Command Button on the Main Menu is used to retrieve the cases already stored in the past. Try not to store too many cases at once, as the storage limit is only twenty. Cases can be deleted whenever you like, and a full bin can be cleared.

EXITING THE PROGRAM:

Click the orange "Exit Program" button on the lower left of the Main Menu when you're ready to exit Puffin. An End-Program Screen thanks you for Using PC-Puffin. Just click "Exit", and you're done!

| | |
|---|---|
| [ ] Specify Day's Load Hour by Hour | [ ] Ambient Temperatures |
| [ ] Build Day's Load Using Factors | [ ] General System Parameters |
| [ ] Summary of Input Data | [ ] Sales, Purchases and SILOS |
| [ ] Generator Specs | [ ] Outage and Derating Specs |
| [ ] Date and Title | [ ] Automated Hydro Specs |

The Main Menu offers ten choices of category for Program Input Data. Most categories should be checked at least once at the beginning of every dispatch day.

When an item is selected, a check mark is left in the check box to remind you that you already looked at this category. However, all boxes are cleared after each run of the program.

The following pages present brief discussions of each of the ten categories, beginning with Date and Title.

## Date and Title

(1) Type a brief title in the white box adjacent to "New Title".

(2) If you want to keep the same title from the last run, click the little box under the Old Title (in the blue box).

(3) Use the left arrows to change months (forward = next month), (backward = previous month).

One click = one month, two clicks = two months, etc.

(4) Use the right arrows to change days (forward = next day), (backward = previous day).

One click = one day, two clicks = two days, etc.

(5) Click "Instructions" to get on-line assistance on how to use the program. Click "OK" when finished reading.

(6) Click "Continue" to return to the Main Menu.

## PC-Puffin Load Models

The program provides two ways to build a 24-Hour load profile:

(1) Specify Day's Load Hour by Hour

(2) Build Day's Load Using Factors

## Specify Day's Load Hour by Hour

Simply type in the load (MW) for each of the Hours 1-24. (or Use Last Run)

Click View to see a plot of the day's load profile.

Click Continue when finished.

NOTE: If you finish before filling in all 24 loads, a message will say the loads have not been transferred. So if you exit now, the load values will not be saved.

NOTE: It is almost always more convenient to use the other method for loads, Build Day's Load Using Factors.

$$\text{Load Factor} = \frac{\text{AVERAGE LOAD}}{\text{PEAK LOAD}}$$

## Build Day's Load Using Factors

There are two ways to choose an initial load profile for the day:

(1) Begin with the same load profile that was saved the last time this module was used. Click the tan "Last Run" button.

(2) Choose a sample profile from a Generic File. Click the light blue "Generic File" button.

If Method (2), Generic File, is chosen, the program will ask you whether today is a holiday (Click "Yes" if holiday, "No" if not).

Then the program will tell you what is the peak load (MegaWatts) for the Generic Day, and ask you to enter the Expected Peak for today's run in the long white box. Enter the expected MW peak, then click "OK". If you change your mind, click "Cancel".

If you proceed, the next screen to appear will show a table of the loads for each of the 24 hours of the day. The "Prelim-MW" column shows the starting values as selected above. The values under the "New-MW" label (light blue fields), are built up from these Prelim values, using various operations, to produce the final loads.

## Build Day's Load Using Factors

BUILDING THE NEW MW'S:

The New-MW's in the light blue fields are the hourly values to be used for the actual run. Initially, the New-MW's are the same as the Prelim-MW's, and you don't have to change them, if you don't want to. Otherwise, there are several ways to manufacture new values using the Prelim-MW values as the base.

(1) Universal Changes for All 24 Hours. To increase all 24 loads by say 10%, type 1.10 in the multiply box. To decrease these loads by 10%, type 0.90 instead. To add 1 MW to each of the 24 loads, type 1 in the plus box. To subtract 2 MW instead, type 2 in the minus box. And so forth.

(2) Individual Changes. If you want to increase some but not all of the individual loads, type 1 (or more) in the Increase Box. Then for each load you want to increase, click the light blue field to the left of the current value. Click a second time to repeat, and so forth. Similarly for decrease.

CONTROL BUTTONS:

| | |
|---|---|
| Cancel: | Quit with loads reset to the previous run's values. |
| Reset: | Change the New-MW's back to the Prelim-MW values. |
| View: | See a plot of the day's load (i.e., the New-MW's). |
| Store: | Write the New-MW's back to the Generic File. |
| Save & Exit: | Return to Menu, with the New-MW's saved. |

STORE COMMAND:

For each month, the Generic File contains a sample load for each of the seven days of the week, plus a sample holiday. Using the Store Command, you can update the Generic File whenever you want, to keep it accurate for actual ML&P loads.

For example, suppose you stored the loads for Saturday, January 15, after finishing the final run for that date. Then, one week later, on Saturday, January 22, you can start the day by selecting Generic File for the initial load profile. In effect, you call up the same actual loads as occurred the previous (January) Saturday.

But what do we do when the month changes? Suppose we have come to the first Saturday in February (i.e., Saturday, February 5). This time we can't use the Generic File to fetch last Saturday's loads, because last Saturday was in the previous month, January.

The solution is to go to "Date and Title" and set the date back to Saturday, January 29. Then go to "Build Day's Load Using Factors", select Generic File, then Save & Exit. Return to "Date and Title", and reset to Saturday, February 5. Then the next time you come to "Build Day's Load Using Factors", select Last Run.

## General System Parameters

General System Parameters include: ML&P Spin Requirements; Fuel, Startup, and Plant #1 Overtime Costs; Inadvertent TieLine Costs; and Auxiliary Fuel Usage on thermal units.

REQUIRED ML&P SPIN:

Enter a single value (MW) applicable for the full day. If you prefer using a security margin, you could enter a value somewhat larger than ML&P's actual requirement (say 2-4 MW additional).

Only one spin value is allowed, even though the ML&P spin requirement might sometimes change during the course of a given day. For example, you might start the day running Unit 8, with a 35 MW spin requirement. But if Unit 7/6 comes on line, the spin requirement could go to 45 MW before the day is out (because Unit 7/6 is bigger than Unit 8).

To handle such cases, go to Sales, Purchases, and SILOS, and create an artificial sale or purchase of spin (at zero price), using any company with which ML&P otherwise does no business that day. You can then say the spin requirement is 45 MW all day, if you "buy" 10 MW/Hr free spin in the morning hours. Or you can use 35 MW as the requirement for the day, if you begin "selling" 10 MW/Hr after Unit 7/6 gets going.

FUEL PRICE:

Enter the fuel cost ($/MCF) with precision up to five decimal places. Note that in Sales, Purchases, and SILOS, one also enters a fuel cost for sales gas for each company buying from ML&P. So whenever there's a change in price here, you need to check the sales gas prices too.

O&M RATE FOR STARTUPS:

When any thermal unit has a startup, ML&P calculates a start-up cost based on the capacity of the starting unit. The number entered here is a base factor by which that capacity is multiplied (see Generator Specs, Review Units, Definitions). The traditional value 2.26 $/MW has been in use at ML&P for quite some time.

PLANT #1 OVERTIME RATE:

Enter the overtime rate ($/Hour) for Plant #1 overtime operation in effect for the given day. Currently, the rate is $75/Hour weekdays, and $150/Hour weekends and holidays.

Overtime applies All Day on weekends and holidays, but only during Off-Peak Hours on normal weekdays. For the weekday case, you must also define the Non-Off-Peak Hours (i.e., the regular shift hours) during which overtime does not apply. The regular shift begins at Hour-Ending 8 (i.e., 7 AM) usually, and ends on Hour 15 (3 PM).

## General System Parameters

PLANT #1 OVERTIME RATE:

The program includes overtime when determining prices or margins on ML&P sales. If you prefer that overtime not be incorporated in the calculation, you may wish to enter zero for overtime here.

INADVERTENT TIE-LINE COSTS:

The Inflow Penalty is what ML&P would pay ($/MWh) if there were any inadvertent tie-line inflow. The OutFlow Credit ($/MWh) is what it would be paid by other companies, for inadvertent tie-line outflow.

The Inflow Penalty and the OutFlow Credit are both usually $0.00 in actual railbelt practice.

AUXILIARY FUEL USAGE:

The fuel used by the thermal units is defined by a quadratic formula in terms of three coefficients A, B, and C:

$$Fuel = A + (B * P) + (C * P^2)$$

where P is the unit's net output (in MW).

This accounts for the fuel for net loading, but not the additional fuel required for powering the auxiliary machinery in operation at the plant. As a rule of thumb, about 2% is added to the quadratic to account for this. Thus enter 2.00 for Auxiliary Fuel Usage.

NOTE: Hourly values of system lambda do NOT include the auxiliary fuel use component.

NOTE: ML&P may be considering dropping this altogether, perhaps after re-evaluating the units' A, B, C coefficients. In that case, you'd simply enter 0.00 for auxiliary fuel.

## Ambient Temperatures

There are three ways to choose an initial temperature profile for the day:

(1) Begin with a Constant Temperature (i.e., the same temperature each hour). Enter the desired value in the white box.

(2) Begin with a Typical Monthly Profile. Use the arrows to find the month you want.

(3) Begin with the Actual Temperatures you used on the most recent run of the program (Show Hourly Profile from Last Case). This is the default choice, and it is the one most often used.

Having made your selection, click Continue.

The screen shows a Fahrenheit temperature for each of the 24 hours of the day. To edit hourly values, simply click a box and type in a new number. Use Tab or / to move to the next box.

You can also make a universal change by typing in a new day-average value in the white box. For example, if the current average is 50F, and you type in 55, each hourly temperature will increase by 5F.

Click View to see a plot of the day's temperatures. The upper bars are temperatures above the day-average; the lower bars are the ones below the day-average.

If you want to start over, click Reset.

When you are ready to return to menu, click Continue.

## Summary of Input Data

Click Summary of Input Data to obtain a display showing the Date and Case Title, the Load and Temperature by Hour, and a statement of the General System Parameters assumed for the day.

If desired, you may Print this Summary.

Click Return to Menu when finished.

## Generator Specs

DISPATCH POINTS:

The table shows five power point values for each of ML&P's ten units (including Unit 8/9, a possible future unit). Units 5/6 and 7/6 are combined cycle; Units 5 and 7 are their simple-cycle counterparts.

Point 1 is the unit's minimum output level (must be greater than 0). Points 2, 3, and 4 are intermediate points. Point 5 is the maximum output capability. Since the unit's capacity can vary with ambient temperature, the actual Point 5 value could be different each hour. The value in the table is for the day's peak temperature, that is, the smallest Point 5 value over the course of the whole day.

ASCENDING ORDER:

Each unit's dispatch points must occur in strictly ascending order, usually at least 2 MW apart. If any unit shows a violation of the ascending order requirement, its point values appear in red.

The program won't run a case unless the dispatch points are correct for all units (including Unit 8/9). If any violations occur, click Review Units, and enter new values for the offending units.

As the ambient temperature changes over the course of the year, the units' capacities will change as well. This means the spacings for the five dispatch points should be periodically checked. In summer, for example, points 2-4 should be considerably smaller than was the case in winter, because Point 5 itself is smaller.

PRE-MIDNIGHT ON-LINE HOURS:

The program needs to know which units are already on line as the new day begins, in order to initialize the commitments, enforce run time constraints, and apply startup costs as appropriate.

If a unit is off-line at midnight, or likely to not run in Hour 1 of the new day, enter 0. If a unit is already on-line at midnight, and has been running a long time, enter 12 or 24. If a unit was started late the previous day, and is expected to keep going, put the number hours it has already been running.

If you start to run a case, but these numbers seem suspicious, the program will inform you that the Pre-Midnight Hours might be wrong, or other than as you really intended. Then you can double-check.

Click "Yes" if you wish to install Unit 8/9.

Click "Explanation" to get help and advice on line.

Click "Continue" when finished with the Generator Specs.
(Program will ask if Pre-Midnight Hours are Correct.)

## Generator Specs

(1) If you wish to view or revise parameters for individual units, click "Review Units". This will bring up Unit 1 first.

(2) Click "Next Unit" to go to Unit 2, then again for Unit 3, etc.

(3) The complete order is Units 1-4, then Units 5/6 and 7/6, then Unit 8, then Units 5 and 7 (simple-cycle), then Unit 8/9.

(4) Click "Previous Unit" to go backwards.

(5) Click "Definitions" to get help on line.

(6) Click "Reset Unit" to restore data for the current unit.

(7) Click "Exit Units" when finished with the individual units.

STATIC DATA:

Most of the parameters entered for individual units remain pretty much constant over the course of time. The most frequent changes involve the power point values, as these are affected by seasonal variations in ambient temperature.

Once in a while, you might also change a minimum run time or down time, to refine unit commitments. For example, increase a unit's down time, if it shuts down then restarts too often. Or increase a unit's run time, if you want to keep it going. You may wish to change commitment factors, to encourage -- or discourage -- using a specific unit. (You can use Pre-Specified Commitments too.)

The A, B, C coefficients would be changed only after someone does a new study of the units' heat rates.

The numbers at the top of the screen define the unit's temperature and capacity relationship. These numbers could also change as new tests are performed, or perhaps when a unit begins to degrade as a result of long service time.

O&M COSTS:

Variable O&M is used to predict wear and tear costs on active units. The harder a unit runs, the greater the cost of its re-conditioning during maintenance. ML&P's traditional O&M rate has been $2.26/MWh for quite some time. The Fixed Cost may be ignored (i.e., 0).

STEAM TURBINE: (Ignore) ~~[redacted]~~ (new programming for Unit 6 was added)

The combined cycle units (5/6, 7/6, and 8/9) have a parameter for Steam Turbine Share. This percent value is used to calculate the output of Unit 6 from those of 5/6 and 7/6. The best value is 20 to 23 for Unit 5/6, and about 28 for Unit 7/6.

## Generator Specs

COST AND HEAT RATE DATA:

The Fuel Input (MCF/Hr) includes Auxiliary Fuel Usage (as defined in General System Parameters).

The Heat Rate at each Dispatch Point (MCF/MWh) is the Fuel Input divided by the Dispatch Point Value.

The Fuel + O&M value at each Dispatch Point ($/MWh) is the Heat Rate times the ML&P Fuel Cost (General System Parameters), plus the unit's variable O&M. This is therefore the Average Cost of operating the unit at the given Dispatch Point.

The Incremental Cost ($/MWh) between two adjacent Dispatch Points is the total cost at the higher point minus the total cost at the lower point, divided by the spread between the two points. It is thus the average cost of raising the unit's output from the lower Dispatch Point up to the higher Dispatch Point.

DISPATCH PENALTY FACTORS:

When the program performs economic dispatch of the thermal units, it considers the units' Incremental Costs as adjusted by Penalty Factors, in deciding optimal dispatch values. The adjusted true costs are called the "Pseudo Costs" of incremental dispatch.

In most cases, the Penalty Factor should be unity (i.e., 1.000), so that the "Pseudo Cost" and the Incremental Cost are the same. Otherwise, a non-unity Penalty Factor can be used to modify the dispatch, so as to satisfy non-economic system constraints.

For example, one would generally prefer that Unit 7/6 not exceed its Dispatch Point 4. This can be accomplished by using a large Penalty Factor (e.g., 4.000) at Point 4, to make the incremental cost appear four times greater than it actually is. This means other units (including hydro) would be dispatched in preference to Unit 7/6, once Unit 7/6 reaches Point 4.

Penalty Factors can also be used to favor a unit. For example, if a unit is being tested, and the company wants to see how it runs at full output, use lower factor values (e.g., 0.500).

The Penalty Factors must be so chosen that the "Pseudo Costs" for each unit occur in strictly non-descending order.

EXIT UNITS:

Click "Exit Units" when you've finished with the individual units. The program will again show the table of Dispatch Points, and you can double-check the values. To get back to the Main Menu, click the "Continue" button here.

## Outage and Derating Specs

(1) After clicking, allow a few moments for the screen to load.

(2) If Unit 8/9 is not installed, the screen shows all current ML&P units, including Units 5 and 7 both simple and combined cycle.

(3) Unit 6 is represented as a component of Units 7/6 and 5/6.

(4) If Unit 8/9 is installed, the screen shows all units other than Unit 8 and Unit 8/9. Click Continue to see those units next.

(5) If All Hours Onward? is clicked, a value entered in Hour N for a unit carries through to Hour 24, for that same unit.

(6) If Current Hour Only is clicked, the value applies only for the hour in which it was entered.

NUMERIC CODES:

For each unit and hour, the allowed values are 0, 1, 2, 3, 4, or 5.

The choices are normally: 5 = Unit Fully Available, or
0 = Unit Fully Unavailable.

The values 1, 2, 3, and 4 are used for partial availability, i.e., deratings. The numbers 1, 2, 3, 4 refer to the units' power point levels, which are shown if you click Generator Specs. The unit is derated to its capacity at that particular dispatch point.

For example, if Unit 1 is assigned value 3 for any hour, then its available capacity that hour is simply the number of MW shown for its third dispatch point, on the Generator Specs Screen.

If you wish to change the value at point 3, then click the Review Units button, and type in the new value you desire.

SIMPLE CYCLE AND COMBINED CYCLE:

If Unit 5/6 has an hourly value > 0, then Unit 5 (simple cycle) is automatically set to 0 = Not Available. Conversely, if Unit 5 has an hourly value > 0, then Unit 5/6 (combined cycle) is reset to 0.

Similar rules apply for Unit 7/6 and Unit 7 (simple cycle), as well as Unit 8/9 and Unit 8 (simple cycle), if Unit 8/9 is installed.

STARTUP ON SIMPLE CYCLE:

Sometimes when Unit 5/6 starts up, it is limited to an essentially simple-cycle mode for the first hour or two, because the boiler on Unit 6 needs time to heat. This can be handled by making Unit 5/6 unavailable until one or two hours after Unit 5 starts.

## Outage and Derating Specs

STARTUP ON SIMPLE CYCLE:

First run the program with Unit 5/6 available all day, and find the hour N it starts. The re-run the program with Unit 5/6 unavailable, but Unit 5 fully available until hour N+1 or N+2, and with Unit 5/6 available the rest of the day.

In most cases, you'll get the effect you want (make sure you aren't short on hydro). Also set the Minimum on Unit 5 (simple cycle) to a reasonable value appropriate for this mode (20 MW?).

USING OUTAGES TO CONTROL COMMITMENT:

Whether the program is run with Pre-Specified Thermal Commitment or Automated Thermal Commitment, a unit cannot run if its availability status = 0. This can be used to fine tune program runs, when using Automated Thermal Commitment.

For example, if you know Plant 1 units won't be used today, you can set them all to 0 for hours 1-24, even if some of them are actually capable of running if needed. This restricts the program's search range, so the commitment decisions might be more realistic.

If you want a particular unit to shut down in a particular hour, you can give it status 0 that hour. For example, if Unit 8 is committed at the start of a day, but you desire to switch to Unit 7 in hour N, then make Unit 8 unavailable (status = 0) in hour N.

## Automated Hydro Specs

The two ML&P hydro units are Bradley Lake and Eklutna. Each facility is represented on a generic -- or parameter -- basis in the Automated Hydro Specs. These Automated Specs govern the dispatch of both hydro facilities, when the program is run with AUTOMATED HYDRO GENERATION.

If the program is run with PRE-SPECIFIED HYDRO GENERATION, the hydro dispatch is instead controlled using specific hourly input screens.

The following describes the interpretation and use of the Automated Hydro Spec screens for Bradley Lake and Eklutna.

## Bradley Lake Parameters

(1) The Transmission Loss is the expected or known loss (total MWh) for the day. The Energy Generated (at the plant site) is equal to the Delivered Energy plus the Transmission Loss.

(2) The Minimum if Committed value is the least amount delivered in any hour in which Bradley Lake's output is greater than zero MW. This is usually 5 MW minimum output if committed.

(3) The Dispatch Limit is the maximum amount Bradley Lake is allowed to deliver in any hour (not counting losses). Usually 23 MW.

(4) The Maximum Spin if Committed is Bradley Lake's spin credit when its output is non-zero (the spin is 0 if the output is 0). This value is usually 7 MW. The spin could be less than 7 MW, if the output is within 7 MW of Capacity. For example, if the output is 28 MW, the spin is 2 MW, since the capacity is only 30 MW.

(5) The Capacity is ML&P's share of the total facility (30 MW).

(6) The Energy is total number of MWh to be Delivered for the Day. The Total MWh Generated (at the plant site) equals this amount plus the day's losses (if any).

(7) The Variable Cost ($/MWh) applies to the Total MWh Generated, including losses. This is also called a 'wheeling charge'.

(8) The Fixed Cost is usually ignored (i.e., put 0).

If the box for Actual Outputs (Main Menu) is blank, the Energy (6) is allocated for the full 24-hour day.

If this box is non-blank, and the value is N (1-23), then some of the Energy (6) is pre-scheduled for hours 1 to N, and the balance is allocated for hours N+1 to 24.

Click Continue to proceed to Eklutna.

## Eklutna Input Parameters

(1) The model allows Eklutna to be assigned two different values of Operant Capacity during designated portions of the day.

(2) Full Capacity refers to the ML&P share of Eklutna and its minimum hourly ML&P generation during peak hours of the day.

(3) Reduced Capacity refers to ML&P's share of Eklutna and its minimum hourly ML&P generation during off-peak hours. For example, if the plant is taken out for maintenance in certain hours, the Reduced Operant Capacity, and the Minimum Output, would both be 0.

(4) The Reduced Operant Capacity can be the same as the Full Operant Capacity (e.g., if Eklutna is fully available all day). However, the Reduced Capacity can never EXCEED the Full Capacity.

(5) You must specify at least one interval (Reduced-Capacity Hours) during which Reduced Capacity will apply (e.g., Hours 1 thru 6). Of course, if Reduced Capacity and Full Capacity are the same, this interval doesn't matter.

(6) If you wish, you can also specify a second interval (Additional Reduced-Capacity Hours), e.g., Hours 22 thru 24. If you prefer having just one interval, leave the second blank: click on the words ADDITIONAL HOURS to blank the second two squares.

(7) Eklutna spin is equal to Operant Capacity minus output. If the output is 0, then the spin is 0 too. Therefore it is IMPORTANT that the Minimum Output be non-0, except when on maintenance.

(8) The Energy is total number of MWh to be generated for the day, where it is assumed that Eklutna has zero transmission losses. The Variable Cost ($/MWh) applies to this MWh total.

(9) The Dispatch Limit is the maximum amount Eklutna is permitted to generate in any given hour. During Reduced-Capacity hours, the maximum permitted output is the Reduced Operant Capacity, or the Dispatch Limit, whichever is less.

The Fixed Cost is usually ignored (i.e., put 0).

If the box for Actual Outputs (Main Menu) is blank, the Energy (8) is allocated for the full 24-hour day.

If this box is non-blank, and the value is N (1-23), then some of the Energy (8) is pre-scheduled for hours 1 to N, and the balance is allocated for hours N+1 to 24.

Click Continue to return to the Main Menu.

## Sales, Purchases and SILOS

(1) ML&P Inter-Utility Transactions, as well as ML&P SILOS Schedules, are controlled from a Transactions Menu Screen.

(2) The Menu Screen provides for a total of four different companies with whom ML&P can exchange energy and/or spin.

(3) If you wish to change the name of any of these companies, click the blue "Company Names" button, then enter the new name (up to six characters, capital letters preferred).

(4) Click the circle to the left a company's name, to call up daily data for that company.

(5) Click the circle next to SILOS, to call the ML&P SILOS schedule.

(6) Click the circle next to GENERAL SUMMARY to obtain a summary of today's scheduled power and spin transactions (including SILOS).

(7) When you are finished up with Sales, Purchases and SILOS, click the "Save & Exit" button to return to the Main Menu.

STATUS LABEL (OLD vs NEW):

For each company, the Current Status is either NEW (blue color) or else OLD (orange). Click on the word NEW to convert to status OLD, and click on OLD to convert back to NEW.

In most cases, a company's status value should be NEW. The status changes to OLD only in a case of multiple transactions, where this company is first on a list. This might happen when (a) ML&P sells to more than one company on the same day, and (b) the sales prices for the second company, third company, etc., need to be determined independently of the first company.

This can happen, for example, if the second company causes ML&P to start a new unit which would not have been used had only the first company been involved. In other words, "OLD vs NEW" is the way to price sales on a sequential basis, rather than just conjointly.

EXAMPLE (OLD vs NEW):

Suppose Company A came first, then Company B came later. First, enter the sales and associated spin (if any) for Company A, with Company A status = NEW, and Company B set to zero transactions.

Return to the Main Menu, then run the program (click "Run Case") with (New) Sales Included, then again with (New) Sales Excluded. Then click "Sales Prices" to find the price or margin for A.

Next return to Sales, Purchases and SILOS, set Company A to OLD, Company B to NEW, and enter the sale for Company B.

## Sales, Purchases and SILOS

EXAMPLE (OLD vs NEW):

Return to the Main Menu, run with (New) Sales Included, then (New) Sales Excluded, and again click "Sales Prices". The price and the margin for Company A will be the same as before. And Company B is evaluated under the assumption Company A is already locked in.

WARNING (OLD vs NEW):

If any sale as been set to status OLD, but subsequently there are changes in system data (loads, temperatures, hydro energies, etc.), then you must reset the sale to status NEW, then re-run with Sales Included, then Sales Excluded, and then redo "Sales Prices".

The reason is that these changes affect the MCF used for the sale, so these MCF need to be re-calculated. Changes which do not make the MCF different are OK -- including simply changing prices and/ or the pricing method on the OLD sale.

## Individual Company Data

(1) Click the circle next to the Company Name on the Transactions Menu, to call up daily data for that Company.

(2) Power deals are on the LEFT: Click Buys MWh, or Sells MWh.

(3) Spin deals are on the RIGHT: Click Buys Spin, or Sells Spin.

(4) The Fuel Price ($/MCF) can be different from the ML&P own-load price, if some special contract is in effect. Otherwise, just use the own-load Fuel Price (in General System Parameters).

(5) The Sales O&M has traditionally been $2.26/MWh, the same as the variable O&M on the thermal units (see Generator Specs).

(6) The Spin Price will be $0.00/Hr-MW in case of an ML&P sale with associated donated spin (e.g., to Golden Valley).

ENTERING HOURLY DATA:

If Propagate Boxes? is marked YES, a value entered in Hour N will carry through to Hour 24. If marked NO, Hour N alone is affected. It's easy to enter data quickly, with Propagate Boxes, even while using the phone. If you are right-handed, hold the phone in your left hand, type a value, Tab to the next hour, and the next, etc., then type the next value, then Tab again, and so forth, until you finish at Hour 24. (Probably even easier if left-handed!)

## Individual Company Data

SALES WITH ASSOCIATED SPIN:

When Golden Valley (GVEA) buys power from ML&P, the custom has often been that ML&P receives a spin credit (in the form of GVEA SILOS) to match each hourly sale. In effect, there is a purchase of spin, at zero price, associated with the sale.

To model the associated SILOS (i.e., donated spin), simply indicate that ML&P buys spin (from GVEA), and set its price to 0.00 $/Hr-MW. Then for each hourly sale (MW) on the left side of the screen, use the same value for spin (Hr-MW) on the right side of the screen.

PRICING METHODS:

There are three ways to set up pricing for an energy sale:

(1) Fixed Price = Enter the $/MWh.

(2) Two-Price = Enter the $/MWh for the first NNN MWh, then Enter a different $/MWh for the rest.

(3) PreSet Margin = Enter the ML&P Margin (in $/MWh).

If method (1) or (2) is chosen, the program calculates ML&P's actual margin, as based on the PreSet Prices.

If method (3) is chosen, the program will calculate the sales price (i.e., the fixed price needed to earn the given margin).

Energy purchases, as well as spin sales and purchases, are always based on Fixed Price: enter the $/MWh.

(*) Click Reset to restore the previous company data.

(*) Click Return when finished with this company.

## ML&P SILOS Schedule

(1) Click the circle next to the word SILOS on the Transactions Menu, to call up the day's ML&P SILOS Schedule.

(2) Enter the ML&P SILOS being armed each hour (enter 0 if none).

(3) Click Reset to restore the previous values.

(4) Click Return when finished with SILOS.

Actual Outputs Hour N/A until SCADA interface done

(1) If you enter a value from 1 to 23 in the box for Actual Outputs and Sales on the Main Menu Screen, the program will run so that the output of every unit is the same as it was in the previous Sales Included Run, up through that hour.

(2) Alternatively, if you have just updated Puffin from SCADA (see next page), the program will run so that each unit's output is the same as in the SCADA data through that hour.

(3) The Actual Outputs Hour thus provides a way to match the actual system behavior for the first part of the day, and then let the program predict the rest of the day by algorithm.

(4) At the end of the day, you do not put the value 24 in this box, because all of the actuals are now known, and there is nothing left to predict. Instead, make the Actual Outputs Hour blank, and run the program using Pre-Specified Dispatch of Units.

(5) To blank the Actual Outputs Hour, click on the word 'blank' to the right of the Actual Outputs box.

(6) Pre-Specified Dispatch of Units is explained on page 25.

(7) The Actual Outputs Hour is useful when there is a major change in the system in the middle of the day. Suppose Unit 7/6 goes down unexpectedly, for example, in hour N. To model this, you go to Outage and Derating Specs, take out Unit 7/6 from hour N through 24, then re-run the program.

(8) If Automated Hydro is used, and the Actuals Hour is blank, you find that much of the hydro which was IN FACT dispatched prior to hour N, is now shifted to hours N+1 to 24, because Unit 7/6 is replaced by more expensive units (e.g., Unit 8).

(9) This is not an accurate picture of the day, since you know the hydro was used already, as a matter of fact. It isn't correct to pretend some of it could have been held back, had one only KNOWN Unit 7/6 was about to fail. So, if you enter N for the Actuals Hour, you model the outage's real effects better.

SALES EXCLUDED CASES:

If the Actual Outputs Hour is N, the program run will include all of the ML&P sales (both the OLD and NEW types) through hour N, even for the so-called "Sales Excluded" Case. This is because the program is matching actual outputs (not hypothetical outputs) through hour N.

So for the Sales Excluded Case, the Actuals Hour is usually blanked. In a situation like (7-9) above, one could do a preliminary run with Actual Hour = N, to obtain a more realistic hydro dispatch for hours N+1 to 24. But in the last, official Sales Excluded run, the Actual Outputs Hour must be blank (or if non-blank, at least set to an hour earlier than the first hour any NEW-type sale begins).

## Updating Puffin from SCADA (A future addition)

(1) As the actual day is proceeding, you can periodically update the program data for loads, temperatures, inter-utility transactions, unit outputs, and other items, to match with the values recorded in the SCADA system, or the Dispatcher's Log Sheets.

(2) On the Main Menu, click the circle in parentheses, next to where it says "Check Hourly Data from SCADA".

(3) The display shows the temperature and load, the total generation at Plant 1 and Plant 2, the (net) generation/capacity of the two hydro facilities, the net sale, and the tie flow, for each hour of the day, from Hour 1 through the last completed hour.

(4) Between Midnight and 1 AM, the display shows all 24 hours of the preceding day (which just ended at midnight).

(5) Click "Print Actuals" to get a printout of the display.

(6) If you click "Update Puffin", the program files are automatically changed to reflect the actual values of load, temperature, hourly unit outputs, and transactions, etc., plus other items (including spin transactions and ML&P SILOS), up to the current hour.

(7) Click "Return" to get back to the Main Menu. If the Puffin files were updated at step (6), you are informed that the program needs to be re-run, because program data may have changed.

RE-RUN AFTER UPDATING:

For the Sales Included Case, you may as well enter the current hour in the Actual Outputs Box (see preceding page), unless all 24 hours were updated (i.e., at just after midnight). In that case, you can use Pre-Specified Dispatch of Units instead (see page 25).

For the Sales Excluded Case, it is best to leave the Actual Outputs Box blank (at least don't put in a value equal to or later than the start of any NEW-type sale).

If you review the Ambient Temperatures (see page 9), be certain to use Choice (3): Hourly Profile from Last Case. And, of course, be careful not to change any values from Hours 1 to N, where N is the hour in which an update last occurred.

If you review the loads by using "Build Day's Load Using Factors", (pages 5-6), be sure to use "Last Run" (i.e., the TAN button) for the choice of the preliminary values. And, of course, be careful not to change any values for Hours 1 to N, where N is the hour in which an update last occurred.

And finally, be careful not to change any other hourly data, such as sales and purchases, or unit outages, for any Hour from 1 to N, where N is the hour in which an update last occurred.

## Run Mode Switches: Automated or Pre-Specified

When running a case for the first time, especially the first Sales Included Run, it is best to set the Run Mode Switches to Automated rather than Pre-Specified. This gives the program its best chance to find an optimal solution consistent with all of your objectives plus the constraints on the system.

In any case, doing this initial all-automated run is good, because you generate a set of starting values for subsequent pre-specified runs. That is, you can use the automated run for an initial guess at final hourly values, then fine-tune the initial guess by taking a pre-specified approach on the next pass.

So as greater detail is required, you simply reset the appropriate switches to Pre-Specified. For example, you may use Pre-Specified Commitments to address non-standard circumstances, e.g., running a non-economic unit, because it's being tested. Or you may want the commitments, with and without sales, to be the same. So you would use Pre-Specified Thermal Commitments for the No-Sales Run.

Sometimes you will need Pre-Specified Hydro to model unusual hydro situations. For example, once in a while Bradley Lake is credited for ML&P spin, even with generation 0. Sometimes Eklutna is worth more than ML&P's usual capacity share, e.g., when no other company is currently using it. And sometimes hydro scheduling is dictated by external circumstances, so direct data entry is mandatory.

There are other cases, of course, in which using the Pre-Specified Commitment option, Pre-Specified Hydro option, or both, is helpful or essential for obtaining accurate results. For example, when an unexpected generator outage takes place (as in page 20), you might need to use Pre-Specified rather than Automated Hydro, to make the full day's hydro dispatch fully realistic.

Finally, Pre-Specified Dispatch of Units is used at the end of the day, to run the program using the actual recorded outputs of every generating unit. This includes hydro, so Pre-Specified Hydro is a part of this last mode, the other part being thermal. This run is your final, end-of-day "match actuals" run.

## Pre-Specified Thermal Commitment

COMMITMENT OPTIONS:

If you click "Run Case", and use Pre-Specified Thermal Commitments, a Commitment Options Screen appears before the run actually begins. This screen comes up immediately, if Hydro Generation is Automated. Otherwise, two screens for Pre-Specified Hydro appear first.

There are three Commitment Options (choose one):

(1) Specify hourly commitment of each unit (default choice).

(2) Keep commitments and hourly transmission loss the same as in the previous "With Sales" run.

(3) Keep commitments and hourly transmission loss the same as in the previous "No Sales" run.

Click the circle next to your choice. Then click "Continue". If no option was chosen, choice (1) is assumed.

PRE-COMMITMENT SCHEDULE:

Whatever the choice, the next screen is a schedule of commitments. You can either accept the given schedule, or edit it. Then click Continue to start the run (answer "Yes" to confirmation message).

Click Reset, if you made changes but want to start over with the initial schedule values. Click Cancel to abort the run.

Hours in which units are out of service are marked X. Otherwise a a unit is either committed simple cycle (S), or combined cycle (C), or is available but idle (tan = simple cycle, orange = combined).

Click a non-X cell to toggle between the committed and idle state.

Toggling carries forward from the hour clicked through to the end of the day, if Propagate Boxes is marked Yes. If marked No, only the current hour is affected.

## Pre-Specified Hydro Generation

HOURLY HYDRO SCREENS:

If you click "Run Case", and use Pre-Specified Hydro, two hourly hydro screens appear before the run actually begins.

The first is for Bradley Lake, and the second is for Eklutna.

If you are also using Pre-Specified Thermal Commitments, then the commitment options screen (see previous page) follows the Eklutna screen. If not, the program runs when you finish Eklutna.

BRADLEY LAKE:

You can edit or accept the hourly values in the WHITE BOXES for:

(a) Transmission Loss (MW)
(b) Generation (MW) -- at Plant Site
(c) Spin Credit (hr-MW)

The Delivered Power, in the blue box, is equal to the Generation (b) minus the Transmission Loss (a). Make sure this is never negative!!

Click Continue to proceed to Eklutna's schedule.

Click Cancel Run to abort.

The purple screen compares current values of Total Output, Losses, and Delivered Output with those used for the previous program run. Upon continuation, a message box notifies you of any changes.

EKLUTNA:

You can edit or accept the hourly values in the WHITE BOXES for:

(a) Eklutna's Output (MW)
(b) Capacity by Hour (MW)

Items (a) and (b) refer, of course, to ML&P's share of Eklutna, not the entire jointly-owned plant. The Hourly Spin value, in the blue box, is the Capacity (b) minus the Output (a). This cannot ever be negative, of course, and you should also be careful not to have any spin > 0 when output = 0, unless you know this to be the case.

Click Continue to proceed.

Click Cancel Run to abort.

The purple screen compares the current value of Eklutna Energy with that which was used the previous run. Upon continuation, a message box notifies you of any change.

## Pre-Specified Dispatch of Units

HYDRO FIRST:

If you click "Run Case", and use Pre-Specified Dispatch of Units, then the two hourly pre-scheduled hydro screens (page 24) come up first, before the run actually begins. So Pre-Specified Hydro is the first part of Pre-Specified Dispatch.

Pre-Specified Thermal Dispatch comes next. After the hydro units are finished, a screen appears for each thermal unit to have been on line at least once for the day, either in the previous program run, or in the data imported from SCADA.

NO NEW COMMITMENTS:

For Pre-Specified Dispatch of Units, the thermal commitments are assumed to have been settled already (we are changing dispatches, but not commitments per se). So even if you happen to have used Pre-Specified Commitment for the run, the Pre-Specified Dispatch choice takes precedence.

So if you want different commitments, you need to do another run of the program, before selecting Pre-Specified Dispatch.

THERMAL UNITS:

For each thermal unit, you can edit or accept the unit's hourly output values (MW). The Capacity depends on the hourly ambient temperature, or unit derating status if less than full capacity.

Be careful not to choose 0 for an output, and (of course) don't enter an output value greater than the actual capacity.

The Spin is the Hourly Capacity minus the Output Value.

The cells are all blank for the hours in which the unit wasn't on line in the last program run (or SCADA data). No new numbers can be written into these empty cells.

NEXT UNIT:

Click the yellow "Next Unit" button as you finish each committed unit. When the last unit comes, and "Next Unit" is clicked, the program produces a dispatch confirmation message.

If you click "Yes" to the question "Units Data Complete?", the program will run the match actuals case.

## Program Run Reports

RUNNING A CASE:

To run a case, click the Yellow "Run Case" Program Command Button. Wait a few seconds, then a message for Puffin Run Time will appear. Wait a few seconds more (listen to the hard drive to know when the computer is ready). Then click "OK" on the message panel.

LANDSCAPE DISPLAY:

This brings up a landscape-style display of run results, with the hours 1-24 arranged horizontally across the top. There are seven thermal units, where Units 5 and 7 include Unit 6 (if in combined cycle mode). Bradley Lake (BradLk) is shown as total generation, so the delivered power is this minus the Loss.

The lower portion is a report of hourly spins, with separate plant components for thermal units (gas) and hydro, plus hourly imported spin (including ML&P SILOS), and hourly spin exports.

If the system is short on spin in any hour, a pink label appears, and announces the greatest shortage for the day.

Wait a second or two after this display comes up, before clicking any other button. If you listen to the hard drive, you will hear that a number of files are being processed at this point.

SALES SWITCH:

If the run was checked INCLUDED for (New) Energy Sales, all hourly values of sales and/or purchases of power and/or spin are included in the display, just as last entered in Sales, Purchases and SILOS (see pages 17-19).

If the run was checked Excluded, then all hourly transactions are assumed to have been zeroed, with the following exceptions:

(a) Any type-OLD transaction (sale or purchase of energy).

(b) Any transaction, OLD or NEW, if occurring in hours prior to or equal to the value N in the Actual Outputs Box (see page 20).

HYDRO REPORT:

Click the pink "Hydro Report" button, to obtain a report of hydro diagnostics and related matters. For each hydro unit, the OUTPUT is the net energy delivered for the day. Bradley Lake losses and its total (gross) generation are shown separately.

This report is used when the program is run with automated hydro, and it tells you when hydro MWh assignments need to be changed.

## Program Run Reports

HYDRO REPORT:

Since Bradley Lake has a fixed spin (e.g., 7 MW), for each hour a certain minimal generation is required to make full use of ML&P's capacity share (up to 30 MW), to prevent peaking units from being committed unnecessarily for spin.

In cases where peaking units could have been shut off had Bradley Lake been assigned more energy for the day, the hydro report says by how much its energy should be increased, to obtain the optimal commitments. So in shortage cases, a User Warning Message occurs in a special white box. If no white box appears, then you know Bradley Lake's energy allocation was sufficient for the day.

Note that if the program was run using automated commitments, the heading identifies which commitment strategy [N] the program used for its run. The number N has no intrinsic meaning. However, if you responded to a User Warning Message, you might sometimes find you get another User Warning Message the next run. In this case, check to see if strategy [N] maybe changed!

This could happen if as a response to the increased Bradley Lake allocation, (i) a new commitment strategy becomes more effective than the original one, but (ii) Bradley Lake's allocation is too low for optimal results, given the NEW strategy.

If Automated Hydro was used for this run, then BASE MWh = Eklutna hourly minimums for the day, plus any pre-specified outputs (i.e., Hours 1-N, if (page 20) the Actual Outputs Hour was N). RESV MWh = the energy needed for load or spin (usually 0 for Eklutna), and INCR MWh = leftover energy dispatched against highest incremental costs (i.e., highest values of hourly system lambda).

Note that if INCR values are really large, this suggests you can cut back on today's hydro, to save some for other times, without affecting unit commitments (you can use Pre-Specified Commitment too). If Pre-Specified Hydro is used, then BASE, RESV, and INCR are all zero, and there are no diagnostics.

GO TO MENU:

After reading the hydro report, click "Return" to go back to the Landscape Display. If you want, you can go directly to the Main Menu at this point, e.g., to do a new run. Click "Go to Menu".

Alternatively, you can look at one or more subsidiary reports by clicking "Continue" instead. There are three such reports:

(a) Unit Outputs -- Details for Each Unit. Can Print.
(b) Spins Report -- Hourly Spins by Plant. Can Print.
(c) Summary Report of Plant Outputs.

## Program Run Reports

UNIT OUTPUTS REPORT:

The display shows the hourly output of each unit, including separate values for Units 5 and 7, Unit 6, and Units 5/6 and 7/6. When Units 5/6 or 7/6 run, the steam portion is assigned to Unit 6 based on the value of Steam Turbine Share (see page 11), and the rest is assigned to the simple-cycle gas turbine.

The term Impt refers to net energy purchases (imports), and the term Expt refers to net energy sales (exports). If the Tie value is non-zero, a positive number refers to Inadvertent Tie-Line Outflow, and a negative number refers to Inadvertent Tie-Line Inflow.

In understanding the Tieflow sign, simply remember the word 'lesson', for 'minus' (i.e., 'less'), plus 'in'. Thus a minus sign signifies inflow, because 'minus' means 'less', and less+in = 'lesson'.

SPINS REPORT:

The display shows the hourly spin at each thermal plant. The term Capy refers to the amount of capacity on line each hour (expressed to the nearest 0.1 MW), as determined by hourly temperature. The term HeatRt refers to the plant's hourly MCF use, divided by its net output (MW), including startup fuel.

The hourly Total Spin is the sum of the Thermal Spins, Hydro Spins, and Imported Spins (including SILOS), minus Exported Spins. Spare Spin refers to the Total Actual Spin minus the System Requirement. A negative value means a Spin Shortage.

SUMMARY REPORT:

You can click the Hydro Report (page 27) again, then Go to Menu, or click for the Previous Screen, as you please.

## Sales Summary Screen

SALES PRICES BUTTON:

After completing a pair of cases, Sales Included and Sales Excluded, you may click the "Sale Prices" button on the Main Menu, to receive an account of transactions. The program checks to see if the sales and no-sales runs are consistent, and informs you of any problems.

The Sales Included case contains all hourly values of sales and/or purchases of power and/or spin, as entered in Sales, Purchases and SILOS (see pages 17-19). The Sales Excluded case drops all of the transactions except for Type-OLD transactions, and transactions in hours up to the value N in the Actual Outputs Box (see page 20).

SALES COMPARISON:

Sales Pricing is therefore a comparison of two cases, one in which the sales load is included, the other in which it is not. Or when some of the sales are type-OLD, and others are type-NEW, this is a comparison of two cases, both of which contain the OLD-sales loads, but only one of which contains the NEW sales loads.

In the OLD vs NEW case, the comparison shows the incremental effect of a second tier of sales, i.e., the NEW Sales, where it is assumed the OLD Sales have already been agreed to, and priced out.

By comparing the two cases, Puffin can determine how much fuel (MCF) was used in additional generation for the (NEW) sales load, and also what effects if any these sales had on startup and overtime costs.

Knowing the sales MCF, the program can calculate the fuel costs for supply of each sale. Startup and overtime cost effects are applied as O&M penalties (i.e., if sales cause additional Plant 1 overtime, or higher startup costs, these are considered part of the O&M).

Using this information, the program calculates ML&P's sales margin, if the sale was either Fixed Price or Two-Price (see page 19). If a PreSet Margin was used, the program calculates the corresponding Fixed Price which would have to be charged to earn that margin.

In the case of a purchase, the program calculates how many MCF are saved, and by how much startup and overtime costs are reduced.

SUMMARY SCREEN:

The upper half of the Sales Summary Screen shows the dollar amounts associated with each sale (to the nearest whole dollar). The lower half gives the $/MWh equivalents. You can change prices or pricing methods for sales, or prices for a purchase, without having to run the two cases over again. Click the "Menu" button, to get back to the Main Menu, then select "Sales, Purchases and SILOS", make your changes, then re-click "Sales Prices".

## Sales Summary Screen

SUMMARY SCREEN:

The Sales Summary will be updated to reflect the changes in prices. Note however that if you would like to change any HOURLY values of transactions (i.e., MW), or change NEW to OLD, or OLD to NEW, then you must rerun the cases, because this changes the sales MCF.

OTHER SUMMARIES:

If ML&P is purchasing power today, click the "Purchases" button to obtain a summary of the day's purchases. Click Return when done.

Click the "Heat Rate" button, to see a summary of transactions MCF. The first line shows the MCF and system heat rate for the run with all transactions included. The second line shows the MCF and heat rate for the run with OLD transactions only (if any). The MCF and heat rate for sales is the difference. Click Return when done.

Click the "Starts & OT" button for a report of system startup costs and Plant 1 overtime (OT). The first line shows the sum of startup costs and overtime for the all-transactions-included run, where the Ratio is this amount, divided by the total thermal generation (MWh). The second line is the same thing for the run with OLD transactions only (if any). The difference is the O&M effect of transactions.

The total number of thermal startups is also shown for both cases, and as a difference. If a unit starts up simple-cycle, then goes to combined-cycle, this counts as 2 starts. (However, the second so-called startup -- conversion to combined-cycle -- has 0 cost.) Similar rules apply if a unit switches to simple-cycle, then back to combined-cycle, and so forth. Click Return when done.

EXCEL RUN:

When you are finished with transactions pricing, you can call for a final program run using these same prices and margins. This run is is called the "Excel Run", because one of the files the run creates is a special daily data file designed for direct export to an Excel Spreadsheet of archived ML&P daily data.

Click the "Excel" button to request this final run. Then click Yes on the Excel confirmation message. If you change your mind at this point, click No instead, to cancel the Excel run.

When the "Excel Run" is finished, a message for Puffin Run Time will come up (the same as when you click "Run Case"). Wait a few seconds for the files to be processed, then click "OK".

Then the Final Case Summary will appear. This Summary and the Final Reports for the day are described on the next page.

## Final Summaries and Reports

SUMMARY SCREEN:

The summary screen shows generation totals (top half of screen) and corresponding cost totals (bottom half) for the last With Sales and No Sales runs. If one or more of the transactions is type OLD, but the others are type NEW, then With Sales includes all transactions, both OLD and NEW, while No Sales includes only the OLD ones.

If all of the transactions were type NEW (as is normally the case), then the No Sales case includes native ML&P load only.

The comparison shows the cost of production for the sales loads, or the NEW sales loads as added to the OLD ones, as the case may be.

In the case of a purchase, if "Cost to Supply Sales" is a negative quantity, this is what ML&P is saving, as a result of the purchase. But if the Cost is postive, then the purchase isn't cost-effective for ML&P at the given price. Either drop the purchase, or try to get the seller to lower the price.

See page 3 of this manual for instructions on going back to menu from this screen.

PRINT CASE SUMMARIES:

The box at the lower left of the screen has two buttons for printing summary reports of "Transactions" and "Outputs". The "Transactions" report states ML&P's exchanges of power and spin with other railbelt companies by hour. The "Outputs" report states the hourly output of every unit (including Unit 6), plus hydro, ML&P load, system lambda, and so forth. You can't browse these reports on the screen, but to print them just click the button (be sure your printer is on).

SHOW DETAILS:

Click the "Show Details" button to see a listing of other reports for the last With Sales run. The Report Index is a list of items you can browse and/or print as you please. Highlight an item you want to look at, then click the orange "View Report" button.

Most of these reports are more than 28 lines in length (the height of the view screen). So there are UP and DOWN arrows on the right which you can use to move from top to bottom.

When you're through looking at an item, be SURE to move to the top using the UP arrow, BEFORE clicking Return. Also if you happen to have highlighted a particular row in the item, please RE-HIGHLIGHT the top of the page, BEFORE clicking Return.

Click the yellow "Continue" button on the Report Index screen when you are finished with Show Details.

## Tips for Fine-Tuning Runs

The program is normally easy to use, and in most cases there won't be any trouble in setting up and carrying out requisite runs for the day. However when unusual or abnormal situtations are encountered, you may sometimes find you need to use a little ingenuity, to get the program to produce accurate answers.

The following examples illustrate some of the techniques available in the program for coping with nonstandard situations at ML&P.

TOO COLD TO SHUT DOWN:

The daily ML&P load is usually such that when Unit 7/6 is on line, the peaking unit (e.g., Unit 5/6) can be shut down overnight, then started up again when its needed the next weekday morning. However, there are occasional winter-time cases where the ambient temperature is too cold to cycle units. That is, if Unit 5/6 is shut down at night, it may be too cold to restart it the next morning, so it stays on line.

If Unit 5/6 is on at midnight, go to Generator Specs, and use a number greater than 0 for Unit 5/6 Pre-Midnight On-Line Hours. This lets the program know that Unit 5/6 is already on line at midnight, and that it is expected to continue in operation the next day. When the case runs there will be a notice that other units besides (e.g.) Unit 7/6 are on line -- is this what you intended? Just say "Yes" to this notice.

If it is believed the next day will be very cold, and you want to keep the unit running, there are two ways to prevent Unit 5/6 from shutting down. Either you can adjust Unit 5/6's Minimum Run Time (page 11), by going again to Generator Specs, and setting the run time to some value X greater by at least 24 hours than its Pre-Midnight On-Line Value:

E.g., If Pre-Midnight On-Line Hours = 6, then make Unit 5/6's Minimum Run Time X = 30 or more, because 6 + 24 = 30. Be sure to reset the Minimum Run Time to a normal value when the cold snap ends!

Or, which is probably easier, you can do the runs with a Pre-Specified Commitment (page 23), where Unit 5/6 is pre-committed for the full day.

TESTING UNITS:

Sometimes ML&P runs a unit just to test its performance. For example, they might run Unit 8 at full output for an hour or two, in the middle of a day where (say) Units 7/6 and 5/6 are already committed. Program runs need to model this testing properly.

Probably the best thing to do is to start out with an initial run with the Run Mode Switches set to "Automated" (page 22), and sales included. The program will perhaps use Units 7/6 and 5/6 for the day, and ignore the test unit, Unit 8, because it isn't very economic. But next, make a second run using Pre-Specified Commitments, where Unit 8 is added in for the hours that it's actually on line for testing.

## Tips for Fine-Tuning Runs

TESTING UNITS:

During the actual test, ML&P would probably run Unit 8 at full output, and perhaps Unit 6 would be shut down so that Units 5 and 7 run simple cycle until the test is complete. Unit 8's dispatch can be controlled using Penalty Factors (see page 12 under Generator Specs). Low factor values (e.g., 0.500) will make the program dispatch Unit 8 in favor of other competing units, even when their TRUE costs are lower.

You can use the Outage and Derating Specs to take out Unit 6. This is done by making Units 5/6 and 7/6 unavailable during the testing period, but replaced by Units 5 and 7 simple-cycle.

Repeat the same procedures for the run with sales excluded. Then when both runs are compared using "Sales Prices", you'll know that the cost of transactions is accurate and fair, in the respect that the expenses associated with Unit 8's testing are common to both cases.

Be sure to reset the Unit 8 Dispatch Penalty Factors to their original values, and also reset the Outage and Derating Specs, after the Unit 8 test procedures have been completed.

UNEXPECTED SALES:

Once in a while ML&P may get an emergency sales request from a company in the middle of a day, where sales to other companies are already set up and priced out. The new sale should probably be evaluated for cost of service independently of the orginal sales whose costs were already established, and which were already agreed to by the buyers.

For example, suppose it's 5:00 in the afternoon of a day with sales to Company A, and suddenly Company B phones and says it needs:

| H-18 | H-19 | H-20 | H-21 | H-22 | H-23 | H-24 | |
|---|---|---|---|---|---|---|---|
| 30 | 30 | 30 | 25 | 20 | 15 | 15 | Total = 165 MWh |

Company B asks you whether your company ML&P can manage this new sale, and if so, what will be the price? How do you give a quick, accurate answer, given that you can't change the deal with Company A?

This is a case where you need to use (a) the Actual Outputs Hour Input (see page 20), and (b) the distinction between OLD and NEW transaction types as described on page 17. Since the new sale to Company B begins at Hour 18, the first part of the day through Hour 17 is unaffected by the sale, and so you enter 17 in the Actual Outputs Box. Also because the price for the first customer, Company A, was already set, the sale to A can be considered OLD, in relation to the B-sale, which is NEW.

With Actual Hour = 17, you can add the NEW sale to B, for Hours 18-24, knowing that the hydro dispatch for the Hours 1-17 already past won't be changed. Only the hydro that is actually left to be used today as of the current time 5:00 PM, is available to cover the new sale.

## Tips for Fine-Tuning Runs

UNEXPECTED SALES:

Therefore, to reach a quick decision whether ML&P can undertake this end-of-day sale to Company B, and if so, to determine the price ML&P should charge, do the following steps.

(1) Enter '17' in the Actual Outputs Box on the Main Menu.

(2) Click "Sales, Purchases and SILOS" from the Main Menu.

(3) Set Company A to Status OLD, and Company B to Status NEW.

(4) Select Company B for input (click its circle), and enter the hourly sales loads, using Propagate Boxes and Tab (page 18).

(5) Use a PreSet Margin (since you are trying to find the price). Enter a reasonable margin for ML&P to earn, e.g., $5.00/MWh.

(6) Return to the Sales Menu, then Save-and-Exit to the Main Menu.

(7) Set the Sales Switch to Sales INCLUDED, and (for most cases), use Automated for the Run Mode Switches (page 22).

(8) Click the Run Case Button (page 26), then "OK" on the Run Time Message. Then look at the Program Run Reports, especially the Hydro Report. Depending on how much time you have to respond, you can decide if you'd like to add more hydro energy for the the sale in Hours 18-24, and, if ML&P unit has to start a new unit, ask if Company B could prevent this by giving ML&P some spin credit, and so forth.

Once you've finished the Sales Included Run, using extra hydro, or spin credits or whatever, then do the run with Sales Excluded, and then click "Sales Prices". The Sales Summary Screen will show the price ML&P must charge Company B (to earn the margin you specified in step (5) above). The Price and Margin for Company A, which was already established, will be the same (because its status is OLD).

UNEXPECTED SYSTEM CHANGES:

The example just given (Unexpected Sales) is one where there was a major, unanticipated change in the system during the course of the day. Successful simulation of the full day depended on making use of the Actual Outputs Hour Input (page 20), because the changes in system features (in this case sales loads) were sufficient to make the first and second parts of the day completely different.

That is to say, the second part had to be modeled independently of the first, as if beginning all over. For example, the day's hydro was planned, before the day began, as if the first part of the day would be representative of the whole day. The big change in sales called for a new plan, but the original day was already underway.

## Tips for Fine-Tuning Runs

UNEXPECTED SYSTEM CHANGES:

Since you didn't KNOW the change would occur until Company B called on the phone, you have to accept the first part of the day as being already done. Then you re-plan the second part as best you can, as based on where you were at the end of the first part.

UNEXPECTED UNIT OUTAGES:

Another example would be that of a unit's unexpected failure during the course of a day. For example, if at about 2:00 PM you are told that Unit 7/6 is going off line, you really need to break the whole day into two parts to do the full simulation properly.

For the Sales Included Run, simply enter Hour 14 (i.e., 2:00 PM) in the Actual Outputs Box, then go to Outage and Derating Specs, where you make Unit 7/6 unavailable beginning at Hour 15. If you run the case now, Unit 7/6 will go out in Hour 15, and be replaced by other units (e.g., Unit 8). But the first part of the day, up to Hour 15, will be the same as already recorded, including hourly hydro use.

Be sure to reduce the system spin requirement, beginning at Hour 15 (see General System Parameters, page 7). When Unit 7/6 is out, the the spin requirement on the railbelt as a whole is changed, as well as ML&P's own share of this requirement.

SALES EXCLUDED RUN:

The Sales Excluded Run will be a little more difficult to do for an outage case such this. The problem is the hydro. The idea for the Sales Excluded Run is to predict how the system would have been run under the assumption (contrary to fact) that there were no sales.

One prefers not to use the Actual Outputs Hour, because sales loads are included -- we are trying to model "no sales". But if one does the whole day with Blank Actual Outputs plus "Automated" Hydro, the No Sales Run will be biased, because as much hydro as possible will be held back until after Unit 7/6 gives way to more expensive units. But we'd have used the hydro this way only if we had KNOWN Unit 7/6 was going out, not if we were caught by surprise.

So to get an accurate "No Sales" run, with a realistic construction how hydro WOULD have been used if (i) there were NO SALES, but (ii) we didn't KNOW we'd lose Unit 7/6, some extra work might might well be required. Perhaps, start by running "No Sales" with Unit 7/6 in all day, and write down the hydro dispatch for Hours 1-14. This is how the hydro WOULD have been used, if the failure didn't occur.

Next, take Unit 7/6 out, and try to so adjust the hydro energy that only what's left after Hour 14 in the "No Sales" run above, is used in Hours 15-24 (with Unit 7/6 out). Then write these down too.

## Tips for Fine-Tuning Runs

SALES EXCLUDED RUN:

The final "No Sales" run would then use a Pre-Specified Hydro mode, where the assigned hourly values are the ones you have recorded for the two preliminary runs above. This would yield the most accurate answer to the question what would ML&P's costs have been, had there been "No Sales" today, but Unit 7/6 still failed UNEXPECTEDLY.

Note that in some cases, you can do the thing a quick and dirty way. Take out the unit in Hour 15, but Make Actual Outputs 14, not blank. Then run with "No Sales" and "Automated" Hydro. Next enter a blank for Actual Outputs, and repeat "No Sales" with Pre-Specified Hydro.

The second run, with Blank Actual Output, uses the same hydro as in the "With Sales" scenario through Hour 14 when Unit 7/6 was in, and then uses the rest for the "No Sales" situation, after it goes down. This approach is faithful to the UNEXPECTED nature of the outage.

The hourly hydro dispatch will be a little inaccurate for the first part of the "No Sales" day, but the overall energy amount should be roughly correct, especially if the sale was associated with Donated Spin, and thus not such as to have affected unit commitments (as in typical sales to Golden Valley).