

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

HAT CREEK PROJECT

British Columbia Hydro and Power Authority - Hat Creek Project -
Powerplant - Predicted Operating Regime - December 1980

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POWERPLANT

PREDICTED OPERATING REGIME


UNITS 1 - 4

29 APRIL 1981

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HAT CREEK PROJECT
POWER PLANT
PREDICTED OPERATING REGIME
UNITS 1 TO 4

1. GENERAL

(a) Start-up

The four coal fired units will be identical and are scheduled for commercial service on 1 August 1988, 1 August 1989, 1 August 1990 and 1 August 1991, respectively.

(b) Lifetime

For the purposes of planning, the project will have a nominal operating life of 35 years, from 1 August 1988 to 31 July 2023.

(c) System

The units will operate in a predominantly hydroelectric generating system which, current forecasts indicate, will have a peak demand of 9,340 MW and energy load of 52,885 GWh in 1988/89.

(d) Capacity Factor

All capacity factors quoted in this document have been calculated as a percentage of net output, i.e. 500 MW on a unit basis or 2,000 MW on a plant basis.

(e) Underfrequency Operation

The units will be able to supply 100% MCR continuously down to 58.5 Hz and will be capable of periodic excursions at this output down to 57.6 Hz as defined in the specification for the unit. If the time period at 57.6 Hz exceeds 30 cycles, all load will be shed and the units run, manually controlled and using auxiliary fuel, on house load until re-synchronizing is possible.

(f) Minimum Load

Normal planned minimum continuous load per unit without auxiliary fuel will be 30% of MCR. Operation on auxiliary fuel below 30% for other than short periods will be avoided.

(g) Mine

The associated open pit mine will operate on a three shift, seven day basis for 354 days per year. Production rates will

be dependant upon generation requirements forecast one year in advance. Once the mine production is set by the forecast, the permissible variation in annual output will be limited to about plus or minus ten percent. A 15 day stockpile will be provided at the power plant to accommodate short-term imbalances between mine production and power plant consumption.

(h) Make up Water System

Make up water will be pumped from the Thompson River to the station. A reservoir at the station will allow make up pumping to be scheduled independently of daily load and will also allow operation at maximum load without make up from the Thompson River for 70 days.

2. OPERATING MODES

(a) Availability

The long-term availability of Hat Creek units is estimated to be as follows:

Planned outage factor	11.5% (1,008 hours)
Maintenance outage factor	3.0% (260 hours)
Derating adjusted forced outage rate	12.0% (900 hours)
Incapability factor	25 %
Availability	75 %

During the early in-service period the estimated availability of each unit is expected to progress as shown in the table below:

<u>Year of service</u>	
1st	65%
2nd	70%
3rd and thereafter	75%

Each unit is estimated to be unavailable for six weeks in each year due to annual maintenance which results in the planned outage factor of 11.5% indicated above.

(b) Annual Operation

The following table illustrates the expected Hat Creek energy output for the duration of the project's life. The initial years are shown in detail to show the effects of changes in unit availability factors.

<u>Fiscal Year</u> <u>April-March</u>	<u>Maximum</u> <u>Availability</u> (GW.h)	<u>Energy Output</u>	
		<u>Minimum</u> (GW.h)	<u>Average</u> (GW.h)
88-89	2,140	1,700	2,000
89-90	5,150	4,100	4,700
90-91	8,380	6,700	7,700
91-92	11,670	9,300	10,800
92-93	12,780	10,200	11,500
93-94	13,060	10,500	11,700
94-95	13,140	10,500	11,800
thereafter	13,140	10,500	11,800

In addition to the generation above, each unit could produce about 1,300 GW.h in the six month commissioning period immediately prior to commercial operation.

Based on the expected average output, the lifetime capacity factor will be approximately 67%, varying between 60% and 75%.

The estimated Hat Creek energy outputs include minimum generation constraints imposed by the mine's inability to adjust to large annual variations in coal requirements.

(c) Monthly Operation

The 85 percent availability, when not on planned outage has been calculated from the assumed derating adjusted forced outage rate and the maintenance outage factor. Planned outage will likely be scheduled for the summer months, i.e. April through September.

Estimates of monthly variations in Hat Creek energy production are shown in Table 1 and illustrated in Figure 1.

Although the maximum monthly output shown is limited by the assumed plant availability, no generation plant or coal supply equipment should limit the ability of the project to operate at full output for extended periods of time (i.e. six months).

(d) Daily Operation

At all times during the units' lives it is necessary that Hat Creek will be capable of operating at relatively low capacity factors during high water conditions. This type of operation is likely to be more frequent in the later stages of the unit's life. For this reason the units must be suitable for the following types of operation: two-shifting, weekend shutdown, peaking (or cycling) and automatic generation control. A unit may also be held on line as operating reserve ready for rapid loading. Ramping rates between 30% and 100% of MCR are expected to approximate to 10 MW/min. under normal operating conditions. Immediate load acceptance will be 10% of MCR at full boiler pressure.

3. STARTS

The number of starts each unit is expected to experience during its lifetime is:

250	Cold Starts
375	Warm Starts
940	Hot Starts

MONTHLY VARIATION IN HAT CREEK ENERGY PRODUCTION
FOR VARIOUS STREAMFLOW CONDITIONS

ENERGY (GWH)													
FLCM YR.	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT.
40-41	1009	1220	1261	1261	1139	1261	987	946	915	946	946	997	12023
41-42	1261	1220	1261	1261	1139	1261	987	946	915	946	946	997	13140
42-43	1261	1220	1261	1261	1139	1261	987	946	915	946	946	997	13140
43-44	1261	1220	1261	1261	1139	1261	937	946	915	946	946	997	13140
44-45	1261	1220	1261	1261	1139	1261	987	946	915	946	946	997	13140
45-46	1261	1220	1261	1261	1139	1261	907	946	915	946	946	997	13140
46-47	1261	1220	1261	1261	1139	1261	907	946	915	946	946	997	13140
47-48	1251	1220	1261	1261	1093	1259	709	757	732	815	946	997	12332
48-49	1257	1220	1261	1261	911	1009	789	757	732	757	757	997	11700
49-50	1255	976	1009	1009	911	1009	709	757	732	757	757	997	10958
50-51	1261	1220	1261	1261	911	1009	789	757	732	757	757	997	11712
51-52	1261	1220	1261	1261	911	1009	709	757	732	757	757	997	11712
52-53	1093	1220	1261	1261	911	1009	709	757	732	757	762	997	11539
53-54	1140	976	1009	1009	911	1009	739	757	732	757	757	997	10651
54-55	1261	976	1009	1009	911	1009	709	757	732	757	757	997	10964
55-56	1261	1220	1261	1261	911	1009	709	757	732	757	757	997	11712
56-57	1261	1220	1261	1261	911	1009	789	757	732	757	757	997	11712
57-58	1261	1220	1261	1261	1139	1261	907	946	915	946	946	997	13140
58-59	1261	1220	1261	1261	911	1009	789	757	732	757	757	997	11712
59-60	1157	1220	1116	1009	911	1009	789	757	732	757	757	797	11011
60-61	1009	1220	1261	1009	911	1009	709	757	732	757	757	997	11203
61-62	1011	1220	1261	1261	911	1009	789	757	732	757	757	797	11263
62-63	1149	976	1009	1009	911	1009	789	757	732	757	757	797	10652
63-64	1024	1220	1009	1009	911	1009	709	757	732	757	757	797	10771
64-65	1009	1093	1009	1009	911	1009	709	757	732	757	757	997	10020
65-66	1074	1220	1261	1261	911	1009	789	757	732	757	757	997	11525
66-67	1253	1220	1261	1009	911	1009	709	757	732	757	757	995	11456
67-68	1009	1220	1261	1009	911	1009	709	757	732	757	757	797	11000
68-69	1170	1220	1016	1009	911	1009	709	757	732	757	757	997	11124
69-70	1257	1220	1261	1227	911	1009	789	757	732	757	757	997	11674
70-71	1261	1220	1261	1261	911	1009	709	757	732	757	757	996	11711
71-72	1261	1220	1261	1261	911	1009	709	757	732	757	757	797	11513
72-73	1249	1220	1261	1261	911	1009	789	757	732	757	757	995	11693
73-74	1261	1220	1261	1261	911	1009	709	757	732	757	757	797	11513
74-75	1009	1220	1224	1009	911	1009	709	757	732	757	946	997	11359
MINIMUM	1009	976	1009	1009	911	1009	789	757	732	757	757	797	10651
AVERAGE	1188	1189	1206	1174	969	1074	834	800	774	802	811	951	11770
MAXIMUM	1261	1220	1261	1261	1139	1261	987	946	915	946	946	997	13140

MONTHLY VARIATION IN HAT CREEK ENERGY OUTPUT

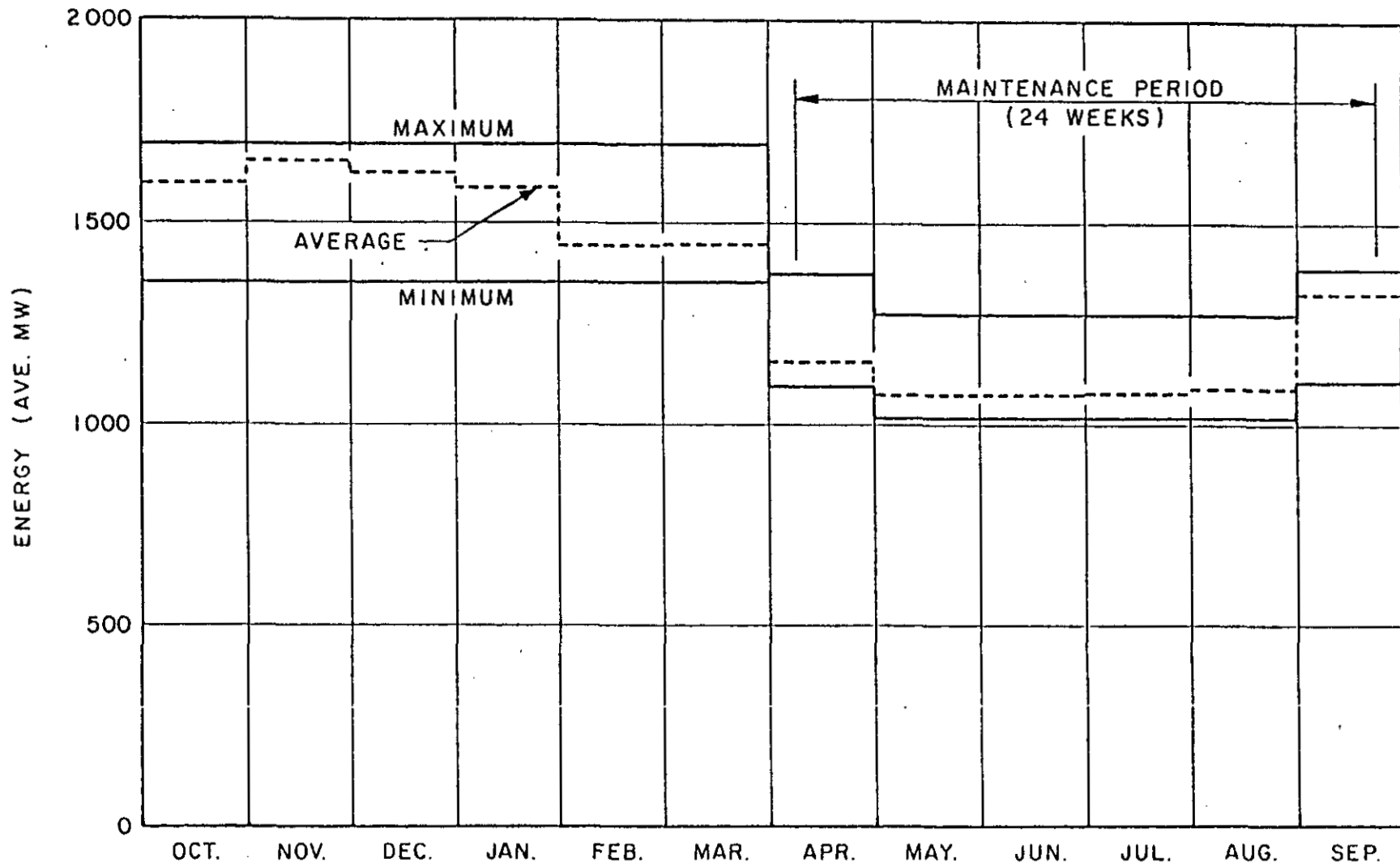


Figure 1

GLOSSARY OF DEFINITIONS

The principle source document for Definition of Terms shall be Appendix A of the CEA 1978 Annual Report on Generation Equipment Status. (File reference 604H-00585.)

Automatic Generation Control

The automatic regulation of the power output of electric generators within a prescribed area in response to changes in system frequency, tie-line loading, or the relation of these to each other, so as to maintain the scheduled system frequency and/or the established interchange with other areas within predetermined limits.

Availability

The percent of time the unit was available for service, whether operated or not. Equal to available hours divided by the total hours in the period under consideration, expressed as a percentage.

Base Load

Operation at essentially a constant output which forms part or all of the base load of the system.

Capacity Factor

The ratio of the average load on a machine or equipment for the period of time considered to the capacity rating of the machine or equipment.

Cold Start

Is one in which the first stage shell inner metal thermocouple is less than 300⁰F. This normally means a unit is shut down for one week or more.

Cycling

Operation in a spinning reserve mode which reduces unit load to the predetermined minimum (30%) then increases to a desired load when required.

Derating Adjusted Forced Outage Rate (DAFOR)

Is the ratio of equivalent forced outage time to equivalent forced outage time plus total equivalent operating time.

Hot Re-Start

Is one in which the first stage shell inner metal thermocouple is greater than 700⁰F. This normally means a unit is shut down for less than a day.

Maximum Continuous Rating (MCR)

Means the gross maximum electrical output (in megawatts) which a generating unit has been designed for and/or shown by acceptance test to be capable of producing continuously.

Operating Reserve

Is the unloaded generating capacity of firm resources ready at all times to take load upon demand, at least 50% of which must be on-line. The criteria for operating reserve is based on the Northwest Power Pool Principles and Procedures which provide a more detailed definition.

Peaking

The requirement to assist in meeting that portion of peak load which is above base load.

Two-Shifting

Operation in which the unit is taken off the line for an overnight period and resynchronized in the morning.

Warm Start

Is one in which the first stage shell inner surface metal thermocouple is between 300⁰F and 700⁰F. This normally means a unit is shut down for two to five days.