OPERATIONAL VARIABLE ENERGY CONTENT CURVE (VECC) COMPUTATION PROGRAM

PROGRAM: OPVECC.EXE

INTRODUCTION. Each month during the January through July refill period, the Operational Variable Energy Content Curve (OPVECC) Computation program calculates the Variable Energy Content Curve (VECC) values for cyclical storage projects which do not have upstream storage. These OPVECC's are used as input to the Actual Energy Regulation (AER) run by the Northwest Power Pool. The program first computes a project's Variable Refill Curve (VRC) value using the power discharge requirements (PDR's) developed for VRC's in the Pacific Northwest Coordination Agreement (PNCA) refill studies for the current operating year. The PDR's are selected based on the current January through July "Earlybird" volume runoff forecast at The Dalles. Each project's VECC's are based on the volume runoff forecast at that project, the project's PDR, and the actual inflow which has occurred from 1 January to the present. The program then compares the computed VRC with the Base Energy Content Curve (BECC), which is defined as the higher of the Assured Refill Curve (ARC) and the first year Critical Rule Curve (CRC1). If the computed VRC is lower than the BECC, the operational VECC value for that period is defined as the computed VRC. However, if the BECC is lower than the computed VRC, the BECC is defined as the operational VECC. The operational VECC is then checked against the lower limit Variable Energy Content Curve (LLVECC); if the operational VECC is lower than the LLVECC, the operational VECC is raised to the same elevation as the LLVECC.

INPUT. The OPVECC program executes in batch mode, so it requires a control file named **C:\HYSSR\CONFILES\OPVECC.CON**. This control file defines the names of the input file, the output files, the Study Characteristics file, and the printer file. A sample control file follows:

```
* C:\HYSSR\CONFILES\OPVECC.CON
*
* This is the control file required to execute the Operational
* VECC program.  This control file defines the file names and
* parameters used to prepare the Operational VECC's.
*
* Unit 13 is the input data file for the OPVECC program
* Unit 6 is the output file for error messages and the list of the input data
* Unit 7 is the Study Characteristics file
* Unit 10 is the output listing of the OPVECC computations
*    designed to be printed on the HP laser printer
* Unit 11 is an output file where VRC's are written to record  code 63
*
*    FORMAT  T4,I2,T7,A26,T34,A11,T46,A7,T54,A10,T65,I4
*   UNIT FILE NAME
*   FORMAT     STATUS  ACCESS   RECL
*_____________________________________________________________
*
  13 C:\HYSSR\DATA\OPVECC97.IN   FORMATTED   OLD
   6 C:\HYSSR\DATA\OPVECC.PRN    FORMATTED   UNKNOWN
   7 C:\REFILL93\STCHAR97.STY    UNFORMATTED OLD
  10 C:\HYSSR\DATA\OPVECC.HP     FORMATTED   UNKNOWN
  11 C:\HYSSR\DATA\OPVECC63.DAT  FORMATTED   UNKNOWN
*_____________________________________________________________
```

The input data file uses standard HYSSR record format. Since the program sorts the input data, the records do not need to be in a specific order. The data for each project is identified by that project's external project number in columns 8 - 10 on the record.

Sample input data file:

```
11                  PD1   110000PD2    95000PD3    80000
02              97  JAN   120000FEB   145000MAR   141000AP1   153000
02              97  APR   153000MAY   150000JUN   153000
06       3          JAN     7040FEB     7361MAR     7036AP1     7720
06       3          APR     7720MAY     7770JUN     7929
06      31          JAN     5038FEB     5215MAR     4993AP1     5522
06      31          APR     5522MAY     5703JUN     6053
08       3          JAN        0FEB      267MAR      459AP1      810
08       3          APR      810MAY     1423JUN     3726
08      31          JAN        0FEB      375MAR      690AP1     1297
08      31          APR     1297MAY     2333JUN     4284
07       3      97  JAN   1758.9FEB   1202.8MAR   1095.9AP1   1058.0
07       3      97  APR   1058.0MAY    941.2JUN    728.9
07      31      97  JAN   1129.1FEB    797.7MAR    609.5AP1    511.0
07      31      97  APR    442.6MAY    374.2JUN    265.2
51       3          JAN    96.96
52       3          JAN    94.18FEB    97.14
53       3          JAN    90.81FEB    93.66MAR    96.42
54       3          JAN    88.05FEB    90.82MAR    93.49AP1    96.96
55       3          JAN    82.70FEB    85.29MAR    87.80AP1    91.07
55       3          APR    93.92
56       3          JAN    55.28FEB    57.02MAR    58.70AP1    60.88
```

```
56        3          APR    62.79MAY    66.85
57        3          JAN    19.60FEB    20.22MAR    20.81AP1    21.58
57        3          APR    22.26MAY    23.70JUN    35.45
51       31          JAN    94.43
52       31          JAN    88.23FEB    93.43
53       31          JAN    78.35FEB    82.98MAR    88.81
54       31          JAN    69.87FEB    73.99MAR    79.20AP1    89.17
55       31          JAN    57.98FEB    61.40MAR    65.72AP1    74.00
55       31          APR    82.98
56       31          JAN    26.98FEB    28.58MAR    30.59AP1    34.44
56       31          APR    38.62MAY    46.54
57       31          JAN     6.49FEB     6.88MAR     7.36AP1     8.29
57       31          APR     9.29MAY    11.20JUN    24.06
48        3          JAN    915.1FEB    889.9MAR    889.9
48       31          JAN   1516.2FEB   1455.5MAR   1452.8
12        3          JAN     1759FEB     1203MAR     1096AP1     1058
12        3          APR      999MAY      941JUN      729
12       31          JAN      462FEB      326MAR      250AP1      209
12       31          APR      181MAY      153JUN      108
41        3          JAN   4139.4FEB   4036.7MAR   3933.0AP1   3904.6APR
3899.3
41        3          MAY   4800.3JUN   5793.8JUL   5869.4AG1   4235.5AUG
4331.9
41        3          SEP   4401.8OCT   4395.7NOV   4340.0DEC   4239.6
41       31          JAN   2639.7FEB   2631.5MAR   2811.4AP1   3046.3APR
3017.0
41       31          MAY   3401.7JUN   3468.0JUL   3468.0AG1   2724.3AUG
2705.8
41       31          SEP   2677.0OCT   2672.7NOV   2685.0DEC   2665.1
15        3          JAN     4000FEB     4000MAR     4000AP1     4000
15        3          APR     4000MAY     4000JUN     5500JUL     9500
15       31          JAN     2000FEB     2000MAR     2000AP1     3000
15       31          APR     9565MAY     7000JUN     3000JUL     3000
14        3          JAN     4000FEB     4000MAR     4000AP1     4000
14        3          APR     4000MAY     4000JUN     8000JUL     8000
14       31          JAN     2000FEB     2000MAR     2000AP1     2000
14       31          APR     2000MAY     2000JUN     2000JUL     2000
13        3          JAN     4000FEB     4000MAR     4000AP1     4000
13        3          APR     4000MAY     4000JUN     7000JUL     7000
13       31          JAN     2000FEB     2000MAR     4000AP1     4000
13       31          APR     4000MAY     4000JUN     4000JUL     4000
42       31          JAN   2682.7FEB   2627.8MAR   2681.0AP1   2649.0APR
2765.3
42       31          MAY   3026.7JUN   3467.6JUL   3468.0AG1   3468.0AUG
3468.0
42       31          SEP   3223.2OCT   3141.9NOV   2929.9DEC   2768.0
42        3          JAN   3651.7FEB   3563.6MAR   3488.0AP1   3224.0APR
3248.2
42        3          MAY   4138.2JUN   5869.2JUL   5869.4AG1   5869.4AUG
5869.4
42        3          SEP   5802.9OCT   5646.7NOV   5182.1DEC   3869.5
```

A description of the input data and the record codes follows:

RECORD CODE	DESCRIPTION OF DATA	REQUIRED

01	Official JAN-JUL forecast at The Dalles in KAF by project number and period.	Optional
02	"Earlybird" JAN-JUL forecast at The Dalles in KAF by study year and period.	Required
06	Probable, or 50%, Date - July inflow forecast in KAF by project number and period.	Required
07	95% forecast error for the date in KAF by project number and period.	Required

RECORD CODE	DESCRIPTION OF DATA	REQUIRED
08	Observed January - Date inflow in KAF by project number and period.	Required except JAN
11	Power Discharge Requirement levels (PDR levels) in KAF.	Optional

Identifier	level	default
PD1	high	95,000 KAF
PD2	mid	90,000 KAF
PD3	low	80,000 KAF

13	PDR values for the highest PDR level in CFS by project number and period. DEFAULT is release lower bounds (RLB) from the Study Characteristics file.	Optional
14	PDR values for the middle PDR level in CFS by project number and period. DEFAULT is RLB from the Study Characteristics file.	Optional
15	PDR values for the lowest PDR level in CFS by project number and period. DEFAULT is RLB from the Study Characteristics file.	Optional
41	ARC's in KAF by project number and period.	Required
42	CRC1s in KAF by project number and period.	Required
48	Lower Limit VECC's in KAF by project number and period. DEFAULT is Storage Lower Bounds (SLB) from the Study Characteristics file.	Optional
51	Inflow factors for January in percent for forecast date JAN	Required
52	Inflow factors for February in percent for forecast dates JAN and FEB.	Required
53	Inflow factors for March in percent for forecast dates JAN, FEB, and MAR.	Required
54	Inflow factors for the first half of April (AP1) in percent for forecast dates JAN, FEB, MAR, and AP1.	Required
55	Inflow factors for the last half of April (APR) in percent for forecast dates JAN, FEB, MAR, AP1, and APR.	Required
56	Inflow factors for May in percent for forecast dates JAN, FEB, MAR, AP1, APR, and MAY.	Required
57	Inflow factors for June in percent for forecast dates JAN, FEB, MAR, AP1, APR, MAY, and JUN.	Required

RECORD CODE	DESCRIPTION OF DATA	REQUIRED
63	VRC's for projects which have upstream storage. Input VRC's without the year and the VRC's will be output to record code 63 with years 29 through 78.	Optional
99	Comment record. Columns 1 and 2 must contain "99". Write any comments in columns 3 through 80.	

OUTPUT. The program creates three output files. One file contains the details of the VECC computations. This file is designed to be printed on a HP Laserjet printer for distribution to the Coordination Contract Committee members. A sample of this output file follows:

```
            LIBBY
      97%-CONFIDENCE FORECAST AND VARIABLE ENERGY CONTENT CURVE, FOR 1997
      FORECAST DATE ---------------->   JAN 1  FEB 1  MAR 1  APR 1  APR 15
MAY 1  JUN 1
 PROBABLE JAN1-31JULY INFLOW,KAF      7040.0 7628.0 7495.0 8530.0 8530.0
9193.011655.0
                        & IN KSFD     3549.3 3845.8 3778.7 4300.5 4300.5
4634.8 5876.1
 97% FORECAST ERROR FOR DATE,IN KSFD   886.8  606.4  552.5  533.4  533.4
474.5  367.5
 OBSERVED JAN1-DATE INFLOW, IN KSFD      0.0  134.6  231.4  408.4  408.4
717.4 1878.5
 97% CONF.DATE-31JULY INFLOW,KSFD 1/  2662.6 3104.8 2994.8 3358.8 3358.8
3442.9 3630.1

 ASSUMED FEB1-JUL31 INFLOW,% OF VOL.   96.96
 ASSUMED FEB1-JUL31 INFLOW,KSFD   2/  2581.6
 FEB MINIMUM FLOW REQUIREMENT,CFS 3/  4000.0
 MIN FEB1-JUL31 OUTFLOW,KSFD      4/   907.0
 MIN JAN31 RESERVOIR CONTENT,KSFD 5/   835.9
 MIN JAN31 RESERVOIR CONTENT,FEET 6/  2367.5
 JAN31 ECC,FT. 7/------------------>  2367.5
  BASE ECC=2418.2,LOWER LIMIT=2288.6
 ASSUMED MAR1-JUL31 INFLOW,% OF VOL.   94.18  97.14
 ASSUMED MAR1-JUL31 INFLOW,KSFD   2/  2507.6 3016.0
 MAR MINIMUM FLOW REQUIREMENT,CFS 3/  4000.0 4000.0
 MIN MAR1-JUL31 OUTFLOW,KSFD      4/   795.0  795.0
 MIN FEB28 RESERVOIR CONTENT,KSFD 5/   797.9  289.5
 MIN FEB28 RESERVOIR CONTENT,FEET 6/  2364.6 2320.2
 FEB28 ECC,FT. 7/------------------>  2364.6 2320.2
  BASE ECC=2415.5,LOWER LIMIT=2287.0
 ASSUMED APR1-JUL31 INFLOW,% OF VOL.   90.81  93.66  96.42
 ASSUMED APR1-JUL31 INFLOW,KSFD   2/  2417.9 2907.9 2887.6
 APR MINIMUM FLOW REQUIREMENT,CFS 3/  4000.0 4000.0 4000.0
 MIN APR1-JUL31 OUTFLOW,KSFD      4/   671.0  671.0  671.0
 MIN MAR31 RESERVOIR CONTENT,KSFD 5/   763.6  273.6  293.9
 MIN MAR31 RESERVOIR CONTENT,FEET 6/  2362.0 2318.6 2320.7
 MAR31 ECC,FT. 7/------------------>  2362.0 2318.6 2320.7
  BASE ECC=2412.7,LOWER LIMIT=2287.0
 ASSUMED APR16-JUL31 INFLOW,% OF VOL.  88.05  90.82  93.49  96.96
```

```
 ASSUMED APR16-JUL31 INFLOW,KSFD   2/2344.382819.742799.843256.65
 APR MINIMUM FLOW REQUIREMENT,CFS 3/  4000.0 4000.0 4000.0 4000.0
 MIN APR1-JUL31 OUTFLOW,KSFD      4/   611.0  611.0  611.0  611.0
 MIN APR15 RESERVOIR CONTENT,KSFD 5/   777.1  301.8  321.7 -135.2
 MIN APR15 RESERVOIR CONTENT,FEET 6/  2363.0 2321.4 2323.4 2256.9
 APR15 ECC,FT. 7/------------------>  2363.0 2321.4 2323.4 2287.0
  BASE ECC=2411.9,LOWER LIMIT=2287.0
 ASSUMED MAY1-JUL31 INFLOW,% OF VOL.   82.70  85.29  87.80  91.07  93.92
 ASSUMED MAY1-JUL31 INFLOW,KSFD   2/  2201.9 2648.0 2629.4 3058.8 3154.5
 MAY MINIMUM FLOW REQUIREMENT,CFS 3/  4000.0 4000.0 4000.0 4000.0 4000.0
 MIN MAY1-JUL31 OUTFLOW,KSFD      4/   551.0  551.0  551.0  551.0  551.0
 MIN APR30 RESERVOIR CONTENT,KSFD 5/   859.6  413.4  432.1    2.7  -93.0
 MIN APR30 RESERVOIR CONTENT,FEET 6/  2369.3 2332.2 2333.9 2287.3 2266.3
 APR30 ECC,FT. 7/------------------>  2369.3 2332.2 2333.9 2287.3 2287.0
  BASE ECC=2411.8,LOWER LIMIT=2287.0
 ASSUMED JUN1-JUL31 INFLOW,% OF VOL.   55.28  57.02  58.70  60.88  62.79
66.85
 ASSUMED JUN1-JUL31 INFLOW,KSFD   2/  1471.9 1770.3 1757.9 2044.8 2109.0
2301.5
 JUN MINIMUM FLOW REQUIREMENT,CFS 3/  7000.0 7000.0 7000.0 7000.0 7000.0
7000.0
 MIN JUN1-JUL31 OUTFLOW,KSFD      4/   427.0  427.0  427.0  427.0  427.0
427.0
 MIN MAY31 RESERVOIR CONTENT,KSFD 5/  1465.6 1167.2 1179.5  892.7  828.5
636.0
 MIN MAY31 RESERVOIR CONTENT,FEET 6/  2409.0 2390.9 2391.7 2371.8 2367.0
2351.7
 MAY31 ECC,FT. 7/------------------>  2409.0 2390.9 2391.7 2371.8 2367.0
2351.7
  BASE ECC=2434.7,LOWER LIMIT=2287.0
 ASSUMED JUL1-JUL31 INFLOW,% OF VOL.   19.60  20.22  20.81  21.58  22.26
23.70  35.45
 ASSUMED JUL1-JUL31 INFLOW,KSFD   2/   521.9  627.8  623.2  724.8  747.7
816.0 1286.9
 JUL MINIMUM FLOW REQUIREMENT,CFS 3/  7000.0 7000.0 7000.0 7000.0 7000.0
7000.0 7000.0
 MIN JUL1-JUL31 OUTFLOW,KSFD      4/   217.0  217.0  217.0  217.0  217.0
217.0  217.0
 MIN JUN30 RESERVOIR CONTENT,KSFD 5/  2205.6 2099.7 2104.3 2002.7 1979.8
1911.5 1440.6
 MIN JUN30 RESERVOIR CONTENT,FEET 6/  2445.6 2440.8 2441.0 2436.2 2435.1
2431.9 2407.5
 JUN30 ECC,FT. 7/------------------>  2445.6 2440.8 2441.0 2436.2 2435.1
2431.9 2407.5
  BASE ECC=2459.0,LOWER LIMIT=2287.0
 JUL 31 ECC, FT.................     2459.0 2459.0 2459.0 2459.0 2459.0
2459.0 2459.0
 JAN1-JUL31 FORECAST,-EARLYBIRD,MAF 8/ 120.0  145.0  141.0  153.0  153.0
150.0  153.0
    AT THE DALLES    -OFFICIAL, MAF      0.0    0.0    0.0    0.0    0.0
 0.0    0.0
```

Another output file contains a list of the input data and any error messages generated by the program during execution. This output file assists the user in checking input data and discovering errors.

The final output file contains record code 63. If the input contains record code 63 data for projects with upstream storage, the program will write that data to this file. (Please note that the OPVECC program does not compute VRC's for these projects.) The input records do not have a year in columns 19 and 20, but the output repeats the input data for each year 1929 through 1978 adding the year. For projects for which operational VECC's have just been computed, the program outputs the computed VRC's to record code 63 repeating the same data for each year 1929 through 1978 and adding the year. This output looks just like the output from the VRC program and is used by including these"63" records as input to the TDMODS file which in turn is used as input to the HYSSR regulator.

PROGRAM EXECUTION ON THE PC. To execute the OPVECC program, have a copy of **OPVECC.EXE** in the local **C:\HYSSR\PGM** subdirectory. The program also requires that the Sort program, **SORTEX.EXE**, and the sort control file, **OPVECC.SRT,** be available in the local **C:\HYSSR\SORT** subdirectory. Now type **OPVECC** while in the **C:\HYSSR\PGM** subdirectory, and the program will begin execution.