

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

New England Power Company

) Docket No. HB15-92-4-001

ORDER ON HEADWATER BENEFITS
IN THE CONNECTICUT RIVER BASIN

(Issued August 4, 1998)

Section 10(f) of the Federal Power Act (FPA) authorizes the Federal Energy Regulatory Commission (Commission) to assess annual charges to be paid by the owners of non-Federal hydropower projects that benefit from the construction of Federal headwater projects. The benefits received are in the form of increased energy production as a result of regulated river flows by Federal headwater storage projects. Headwater benefits are determined in accordance with the Commission's regulations at 18 C.F.R., Part 11, Subpart B.

The Commission completed a determination of headwater benefits in the Connecticut River Basin in New Hampshire, Vermont, and Massachusetts, from January 1, 1967, through December 31, 1991. This order summarizes the results of that investigation and finds New England Power Company's (NEP) Wilder, Bellows Falls, and Vernon hydropower projects received energy gains from the regulation of the U.S. Army Corps of Engineers' (Corps) Union Village, North Hartland, North Springfield, Ball Mountain, and Townshend headwater storage projects.

BACKGROUND

The Commission's last review of headwater benefits in the Connecticut River Basin was completed in 1962. There were seven Federal headwater projects in operation at that time. Our 1962 preliminary study found that regulation of streamflows by the Federal headwater projects provided negligible energy gains at the downstream hydropower projects.

The current study represents the Commission's second determination of headwater benefits for the basin. First, we reviewed the basin to identify and determine whether changes have taken place since the 1962 study that would warrant a reassessment of headwater benefits. The review found changes in the basin and project development that would have an impact on hydropower generation. This investigation includes the five Federal headwater storage projects that have come on-line since the last study.

Basin Description

The Connecticut River Basin is one of the largest in the New England area, stretching from Quebec Province in Canada to Long Island Sound off the coast of Connecticut. The basin has a maximum length in a north-south direction of about 280 miles with

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a total drainage area of 11,250 square miles. The principal tributaries to the Connecticut River are the Passumpsic, White, West, Ompompanoosuc, Ottauquechee, and Black Rivers in Vermont; the Ammonoosuc, Mascoma, Sugar, and Ashuelot Rivers in New Hampshire; and the Millers, Deerfield, Chicopee, and Westfield Rivers in Massachusetts. The Connecticut River Basin is shown in Figure 1.

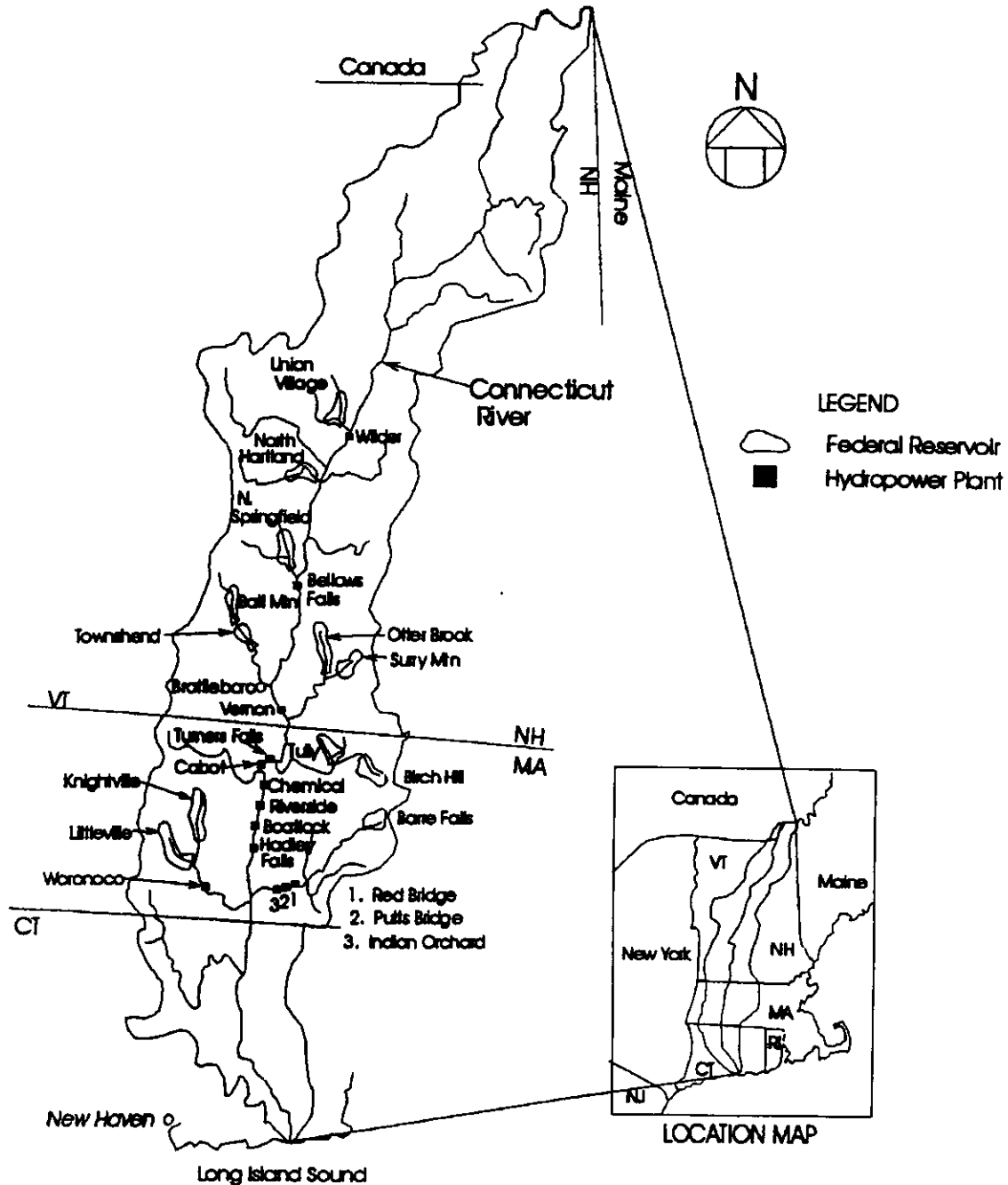


FIGURE 1

HEADWATER PROJECTS

Table 1 contains information specific to the Federal headwater projects included in our study. Conant Brook Dam, located on the Conant Brook tributary of the Chicopee River, was not included in the study since it has only 3,700 acre-feet of storage. All projects are owned and operated by the Corps.

Table 1
Federal Headwater Projects in the Connecticut River Basin

Reservoir	River	State	Initial Year of Operation	D.A. (Sq. mi.)	Usable Storage (acre-feet)
Union Village	Ompompanoosuc	VT	1950	126	38,108
North Hartland	Ottauquechee	VT	1961	220	71,400
North Springfield	Black	VT	1960	158	51,200
Ball Mountain	West	VT	1961	172	54,600
Townshend	West	VT	1961	278	33,600
Surry Mountain	Ashuelot	NH	1941	100	32,600
Otter Brook	Otter Br.	NH	1958	47	18,300
Tully	East Br. Tully	MA	1949	50	22,000
Birch Hill	Millers	MA	1942	175	49,900
Knightville	Westfield	MA	1941	162	49,900
Littleville	Middle Br. Westfield	MA	1965	52	32,400
Barre Falls	Ware	MA	1958	55	24,100

Downstream Hydropower Projects

The hydropower projects included in the headwater benefits determination consist of only those downstream of a Federal headwater project with an installed capacity greater than 1,500 kilowatts. There are 13 hydropower projects in the basin that meet these criteria, listed in Table 2. 1/

1/ Ottauquechee (P-2787), Texon (P-2986), and Chicopee Falls (P-6522) hydropower projects, with installed capacities greater than 1,500 kilowatts, were not included in the study since they are exempted from all the requirements of Part I of the FPA which includes headwater benefits.

Dewey Mills (P-513) and North Hartland (P-2816) hydropower projects, located at a Federal headwater project, were also
(continued...)

Table 2
Hydropower Projects in the Connecticut River Basin

Project Name	FERC Project Number	Owner	Installed Capacity (kW)	Year On-Line
Wilder	1892 <u>2/</u>	New England Power Co.	35,600	1950
Bellows Falls	1855 <u>3/</u>	New England Power Co.	40,800	1928
Vernon	1904 <u>4/</u>	New England Power Co.	24,400	1909
Cabot	1889 <u>5/</u>	Western Massachusetts Electric Co.	51,000	1916
Turners Falls	1889	Western Massachusetts Electric Co.	5,573	1905
Chemical	2004 <u>6/</u>	Holyoke Water Power Co.	1,600	1935
Riverside	2004	Holyoke Water Power Co.	7,600	1905
Boatlock	2004	Holyoke Water Power Co.	2,900	1921
Hadley Falls	2004	Holyoke Water Power Co.	30,800	1952
Red Bridge	10676 <u>7/</u>	Western Massachusetts Electric Co.	3,600	1901
Putts Bridge	10677 <u>8/</u>	Western Massachusetts Electric Co.	3,200	1918
Indian Orchard	10678 <u>9/</u>	Western Massachusetts Electric Co.	3,700	1896
Woronoco	2631 <u>10/</u>	International Paper Co.	2,700	1938

1/ (...continued)

excluded from the study since they pay annual charges under section 10(e) of the FPA for the use of a government dam.

- 2/ 9 FERC ¶61,322 Order Issuing New License, December 10, 1979.
- 3/ 8 FERC ¶61,122 Order Issuing New License (Major), August 3, 1979.
- 4/ 7 FERC ¶61,292 Order Issuing New License, June 25, 1979.
- 5/ 11 FERC ¶61,124 Order Issuing New License (Major), May 5, 1980.
- 6/ FPC Volume 8, Order Issuing Major License, Page 490.
- 7/ 60 FERC ¶62,198 Order Granting Exemption from Licensing (5 MW or Less), September 11, 1992.
- 8/ 60 FERC ¶62,197 Order Granting Exemption from Licensing (5 MW or Less), September 11, 1992.
- 9/ 60 FERC ¶62,196 Order Granting Exemption from Licensing (5 MW or Less), September 11, 1992.
- 10/ 15 FERC ¶62,243 Order Issuing License (Major), June 2, 1981.

BASIN REVIEW

According to the Commission's regulations, a new headwater benefits study can be initiated if changes occurred in the basin hydrology, project development, or other characteristics of the river that affect headwater benefits. 11/ Since completing our 1962 preliminary investigation of headwater benefits for the basin, five more Federal headwater projects came on-line.

ENERGY GAINS CALCULATIONS

Energy gains are the additional amounts of energy that a hydropower project produces as a result of the operation and regulation of streamflows by an upstream storage reservoir. A preliminary estimate of the energy gains was made using Flow Duration Analysis (FDA) methodology. The FDA methodology indicated downstream hydropower projects received energy gains from the regulation of the upstream Federal headwater projects. The magnitude of the energy gains was significant enough to warrant a detailed investigation using the Commission's Headwater Benefits Energy Gains (HWBEG) computer model. 12/

The HWBEG model requires daily flow and generation data as input and determines the energy gains or losses by simulating the operation of the downstream powerplants with and without flow regulation by the headwater project. Daily storage and annual cost data for the headwater projects were provided by the Corps. Owners of the hydropower projects provided daily flow and generation data for the 1980 to 1991 study period.

For each hydropower plant, rating curves, i.e., flow vs. generation relationship, were developed based on the data provided by the owners. These rating curves were then translated to computer code and the HWBEG model was run with the reported streamflow to calculate energy generation. The calculated energy generation was compared with reported generation to determine if the model results were within the following initial error criteria: the calculated generation is within five percent of the reported monthly generation and within one percent of the reported annual generation. If the error criteria were not met, additional rating curves for shorter intervals of time, i.e., seasonal or monthly, were developed to assure that the HWBEG computer model accurately calculated the reported generation. Shorter periods for additional rating curves were based on the relationship between generation and streamflow because of events such as power outages, plant upgrades, and low/high water periods. Once the rating curves satisfied the initial error

11/ 18 C.F.R. Section 11.15(d)(2)

12/ 18 C.F.R. Section 11.13(a)

criteria, they were adjusted such that the difference between the reported and simulated annual generation is zero. The final rating curves were used in the model to determine energy generation with and without regulation by the upstream Federal storage reservoirs.

In the HWBEG model, the theoretical operation of each reservoir is simulated using a reservoir operating rule. Reservoir operating rules are used to determine water storage changes at reservoirs for theoretical inflow conditions. For example, when two or more reservoirs are located in a series, elimination of the upstream reservoir would create a theoretical inflow to the downstream reservoir, and a rule curve to predict its discharge as a function of the inflow is required. In the Connecticut River Basin, the Townshend and Ball Mountain reservoirs on the West River are in a series. Both reservoirs began operating within a five-month period in 1961 and their operation is similar. In addition, because the Townshend reservoir has limited storage capacity, it is unlikely its operation would change whether or not Ball Mountain was in operation. For these reasons we modeled the Townshend and Ball Mountain reservoirs separately assuming that Townshend would store and release in the same way whether or not Ball Mountain existed.

REVIEW COMMENTS

On July 9, 1996, we provided a Draft Report of Headwater Benefits Determination Connecticut River Basin, Assessment Period 1967-1991 to the beneficiaries and the Corps for comment. The issues raised by the beneficiaries and the Corps and staff's response are discussed below.

- (1) Turners Falls No. 1 Station was out of service from July 1973 through 1983 and its nameplate capacity changed from 4.84 MW to 5.572 MW. The apportionment of costs for the 1967 to 1979 period should be revised to reflect outage and lower capacity.

We reduced the energy gains for Cabot/Turners Falls Station No. 1 by 1.3 percent for the January 1967 through December 1972 period, and by 9.9 percent during January 1973 through December 1979 period to reflect outages reported by Western Massachusetts Electric Company. In addition, we adjusted the calculations to reflect a lower plant capacity of 4.84 MW before the station was upgraded in March 1983. The headwater benefits assessments reflecting lower plant capacity were included in the final draft report provided to the beneficiaries on January 29, 1998.

- (2) The draft determination of headwater benefits does not contain an analysis to ensure the assessments do not exceed 85 percent of the value of the energy during the assessment period as per 18 CFR 11.1(b)(5).

Section 11.11(b)(5) of the Commission's regulations on headwater benefits provides, in pertinent part:

No final charge assessed by the Commission under this subpart may exceed 85 percent of the value of the energy gains. If a party demonstrates that any final charge under this part, not including the cost of the investigation ..., exceeds 85 percent of the value of the energy provided to the downstream project for the period for which the charge is assessed, the Commission will reduce the charge to not more than 85 percent of the value....

The Commission applies the 85 percent cap to each year's charge based on that year's energy gains value when the energy gains are determined for each year. In cases where an average energy gains value is used for other years where a daily analysis is not performed, the 85 percent cap is applied to the total assessment for the period. 13/

In the Connecticut River Basin Headwater Benefits Study, we determined the energy gains each year during the 1980 to 1991 period. We then applied the 85% cap to the value of the energy gains for each year for this period. Since the energy gains for the 1967-1979 period were based on the average gains for the 1980-1991 period, we applied the 85% cap to the value of gains for this 13-year period. The headwater benefits assessments reflecting the 85% cap were included in the final draft report provided to the beneficiaries on January 29, 1998.

- (3) Replacement values of energy from 1992 onward are significantly lower than \$35.15, the average value used for the 1967 to 1991 period. Therefore, the interim assessments from 1992 onward should reflect lower replacement value of energy.

We agree. Staff requested the actual replacement values of energy from 1992 to 1997 from the beneficiaries. The interim annual assessments from 1992 to 1997 are based on the average annual energy gain and the replacement value of energy for each year provided by each beneficiary.

13/ See 61 FERC ¶61,256.

- (4) The net energy losses at the end of the study period should be offset against gains during the current study rather than with future gains.

In its July 31, 1997, comments on the draft report, New England Power Company (NEP) pointed out that FERC's method of adjusting energy losses results in a net energy loss at the end of the study period. NEP suggested including this loss in the current assessment rather than offsetting against future gains.

In order to determine the headwater benefits assessment for each year, we adjusted each year's energy gain to account for any net losses from prior years. We used these adjusted energy gains values along with the 10(f) cost to calculate the headwater benefits assessment for each year of the study period. This netting of energy losses to offset subsequent gains was addressed by the Commission in Order No. 453 14/ when it adopted the regulation at 18 CFR §11.13(a)(3), which states:

Annual energy losses at a downstream project, or group of projects owned by the same entity, that are attributable to the headwater project will be subtracted from energy gains for the same annual period at the downstream project or group of projects. A net loss in one calendar year will be subtracted from net gains in subsequent years until no net loss remains.

As New England Power Company points out, it is possible for a hydropower project to have a net energy loss from a headwater project at the end of the study period. However, this loss is offset with subsequent energy gains and is unlikely to have a major impact on the final headwater benefits assessment for the next study period.

- (5) Energy gains at the Wilder Project were over-estimated for the 1967-79 period.

New England Power Company claims that we over-estimated the energy gains for the 1967-79 period since the average gain for the entire 1980-91 study period is 51.2 MWh compared to the 65.2 MWh for the 1980-86 period.

We based the energy gains at the Wilder Project for the 1967-79 period on the average energy gains computed for the 1980 through 1986 period, before the capacity of the project

14/ 35 FERC ¶61,385, Payments for Benefits from Headwater Improvements, issued June 24, 1986.

was upgraded from 32.4 to 35.6 MW. Operation of the Union Village headwater project resulted in energy losses at the Wilder Project four out of five years during the 1987 to 1991 period. Therefore, the average energy gain at the Wilder Project for the 1980-91 study period was lower.

We agree that using the entire study period will result in a lower average value. Our analysis includes 6 years of flow and generation data for the project prior to capacity upgrade. Using the 1980-86 period to calculate the average energy gain for the 1967-79 period is more representative of actual project operations prior to the capacity upgrade.

HEADWATER BENEFITS CHARGES

We determined the joint-use cost allocated to the power function for each Federal headwater project using the average energy gains for the 1980 through 1991 study period and an average replacement value of energy. We then calculated and apportioned the section 10(f) costs among the beneficiaries based on the energy gains received at their downstream powerplants. For the 1967 to 1979 period, we apportioned the section 10(f) costs among the beneficiaries based on the average values of energy gains and replacement values for the 1980 to 1991 period.

In order to calculate the headwater benefits assessment for each beneficiary, we first calculated the total yearly assessment based on the energy gains received at all the powerplants owned by the beneficiary and the section 10(f) allocation. Next, we calculated 85% of energy value for that year by multiplying the total energy gains by the replacement value of energy. The final assessment for each year during the 1980 to 1991 period is the smaller of the 85% value of energy and section 10(f) allocation for the year. For the 1967 to 1979 period, the final assessment is the smaller of the total value of the energy gains and the total section 10(f) costs for the 13-year period.

A summary of headwater benefits assessments for the 1980 to 1991 and 1967 to 1979 periods is shown in Tables 3 and 4, respectively.

Table 3
Headwater Benefits Assessments Summary
New England Power Company
1980-1991

Year	Energy Gains Mwh	Replacement Energy Value \$/Mwh	85% of Energy Gains Value \$	Apportioned Section 10(f) Costs \$	Assessment Smaller of Cols. 4 & 5 \$
1980	120.3	35.15	3,594	5,915	3,594
1981	176.7	35.15	5,279	12,117	5,279
1982	133.6	35.15	3,992	8,217	3,992
1983	378.9	35.15	11,321	8,726	8,726
1984	581.4	35.15	17,371	12,230	12,230

1985	582.4	41.20	20,399	13,726	13,726
1986	458.1	30.30	11,798	11,393	11,393
1987	647.2	29.60	16,284	6,694	6,694
1988	223.7	28.90	5,495	3,334	3,334
1989	219.1	28.42	5,293	7,718	5,293
1990	199.8	27.10	4,602	19,572	4,602
1991	96.8	24.20	1,991	15,120	1,991
Total				\$124,761	\$80,855

Note: Numbers are Rounded

Table 4
Headwater Benefits Assessments Summary
New England Power Company
1967-1979

Year	Energy Gains MWh	Value of Energy @ \$35.15/MWh \$	Apportioned Section 10(f) Costs \$
1967	229.08	8,052	6,268
1968	329.18	11,571	9,117
1969	329.18	11,571	9,167
1970	329.18	11,571	9,199
1971	329.18	11,571	9,286
1972	329.18	11,571	9,687
1973	329.18	11,571	10,016
1974	329.18	11,571	9,880
1975	329.18	11,571	10,305
1976	329.18	11,571	10,841
1977	329.18	11,571	10,537
1978	329.18	11,571	11,400
1979	329.18	11,571	10,959
Totals		146,904	126,660
85% of Total Energy Value		124,867	
Assessment			\$124,867

Note: Numbers are rounded. Assessment is equal to smaller of total 85% of energy value and total section 10(f) costs for the 1967-79 period. Energy gains for the 1967-79 period are the average for the 1980-91 period.

INTERIM ASSESSMENTS

Interim annual headwater benefits assessments are charges assessed to recover section 10(f) costs for a specified period of energy gains pending determination of a final charge for that period. According to C.F.R., §11.17(b), the interim charge will be a percentage of the estimate by the Commission staff of the final charge. The interim charge can be either 100 percent or 80 percent of the final charge depending upon whether the Commission has completed an investigation or not for the project. Since we completed an investigation for the Connecticut River Basin, interim charges will be assessed at 100 percent of the final charge. We based the interim annual assessments from 1992 to 1997 on an average annual energy gain of 318 MWh and the replacement value of energy for each year provided by the New England Power Company. Interim annual assessments from 1992 through 1997 are summarized in Table 5.

Table 5
Interim Annual Assessments
New England Power Company

Year	Energy Gains MWh	Replacement Value of Energy \$/MWh	Interim Assessment \$
1992	318	21.46	6,824
1993	318	24.08	7,657
1994	318	21.03	6,688
1995	318	23.99	7,629
1996	318	21.69	6,897
1997	318	26.53	8,436
Total			\$44,131

Note: Numbers are rounded.

TOTAL HEADWATER BENEFITS ASSESSMENTS

The total payments to be made by New England Power Company, including the Commission's cost to complete the study, are summarized in Table 6.

Table 6
Total Headwater Benefits Assessments
New England Power Company

Item	Amount (\$)
Final Assessment 1967-1979	124,867
Final Assessment 1980-1991	80,855

Interim Assessments 1992-1997	44,131
Study Costs	35,138
Total 284,991	

Note: Total study costs are apportioned based on the energy gains received by the beneficiary to the total energy gains received by all beneficiaries during the study period 1980-91.

The Director orders:

(A) Within 45 days from the date of this order, New England Power Company shall pay the United States \$284,991 for study costs and headwater benefits received at the Wilder, Bellows Falls, and Vernon hydropower plants from the regulation of the Corps' Union Village, North Hartland, North Springfield, Ball Mountain, and Townshend headwater projects.

(B) The Headwater Benefits Payment shall be remitted by check or money order, or automated clearinghouse (ACH) transfer funds listing the bill number to:

MAIL	COURIER	ACH
Federal Energy Regulatory Commission Lock Box 93938 Chicago, IL 60673	ATTN: FERC Lock Box 93938 First National Bank of Chicago 525 West Monroe 7th Floor-Mail Room Chicago, IL 60606	First National Bank of Chicago ABA #071000013 FERC Account #11-14115

Payment instructions are attached to this order. The headwater benefits assessment is due by the date indicated on the billing statement and must reach the FERC Lock Box on or before the due date to avoid penalty or late charges.

(C) This order constitutes final agency action. Requests for rehearing by the Commission may be filed within 30 days from the date of issuance of this order, pursuant to 18 C.F.R. § 385.713.



Carol L. Sampson
Director
Office of Hydropower Licensing

INSTRUCTIONS

PAYMENT METHODS:

ACH: First National Bank of Chicago
ABA Number 071000013
FERC's Account Number 11-14115

Courier: First National Bank of Chicago
525 West Monroe
7th Floor - Mail Room
ATTN: FERC Lock Box 93938
Chicago, Illinois 60606

Mail: Federal Energy Regulatory
Commission
Lock Box 93938
Chicago, Illinois 60673

- Make your check or money order payable to FERC.
- Please write BILL NUMBER(S) on your check or money order.
- Return the SUMMARY SHEET with your check or money order.
- Include BILL NUMBER(S) on instructions for ACH transfer.
- Payment must be received at the Lock Box by the due date to avoid penalty and administrative charges.

REQUIREMENTS

The basis for the submission of this statement of annual charges is Section 10(e) of Part I of the Federal Power Act for licensees, and the Omnibus Budget Reconciliation Act of 1986 for exemptees.

Payment is due 45 days from the statement issue date (18 CFR, 11.20). Penalty and administrative charges accrue on any unpaid balance after the due date. The penalty is computed at a rate of 5% of the debt due for the first month or part of month, and 3% for each month thereafter until paid (18 CFR, 11.21). The Commission will assess an administrative charge based on the costs of handling overdue debts, and will include both direct and indirect in-house costs and the costs of any collection agency efforts. These charges may be assessed monthly (4 CFR, 102.13(d)).

APPEALS

If you believe this statement is incorrect, you must file an appeal with the Chief Financial Officer, no later than 45 days after rendition of the statement (18 CFR, 11.20). Written appeals may be sent to: Federal Energy Regulatory Commission, Chief Financial Officer, 888 First Street, NE, Washington, DC 20426. You may call Ms. Fannie Kingsberry at (202) 219-2885, with any questions. You must still make timely payment of the charges assessed to avoid penalty and administrative charges.

This statement of annual charges is subject to subsequent correction in case of error, even though payment will have been made. In such event, if the correction shows a decrease in the total charges, credit will be given on the statement for the following year. If the correction shows an increase, additional remittance will be required, upon notification.

REQUESTS FOR REHEARING

For the Commission to consider an argument of law or policy, you must file a Request for Rehearing, no later than 30 days from the Chief Financial Officer's decision on the appeal, under 18 CFR, 385.713. The request for rehearing is not a stay of the Commission's statement and you must still pay the charges, or the penalty and administrative charges will accrue. If you pay under protest, your protest will not be considered by the Commission unless you also file a request for rehearing according to the Commission's formal requirements (18 CFR, 385.2001). Send Requests for Rehearing to: Federal Energy Regulatory Commission, Secretary David P. Boergers, 888 First Street, NE Washington, DC 20426.

FERC's Federal ID: 52-1383541

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D. C. 20426

NEW ENGLAND POWER COMPANY
25 RESEARCH DRIVE
VENDOR #3283059
WESTBOROUGH, MA 01582

08/04/98

BILL NUMBER: B8100649	BILLED AMOUNT:	\$284,991.00
INT. RATE: 07.00%		
DATE BILLED: 08/04/98		
DATE DUE: 09/18/98		
DOE CID REFERENCE: M8HB924001	RECEIPTS:	\$0.00
	TOTAL DUE:	\$284,991.00

Dear NEW ENGLAND POWER COMPANY:

The attached letter describes the breakdown of annual charges for Headwater Benefits. Payment must be received at our LOCKBOX on or before the due date to avoid the assessment of penalty and administrative charges. If you have any questions regarding payment, please contact Mr. Jasper Cameron at (202) 219-2925.