1959

STATEMENT BY LELAND OLDS Before the Senate Select Committee on National Water Resources, on behalf of the Northeastern Ass'n of Rural Electric Cooperatives and the Municipal Electric Ass'n of Massachusetts at hearings at Augusta, Me., and Boston, Mass. December 7-8, 1959

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Mr. Chairman: My name is Leland Olds. I appreciate this opportunity to appear before your Committee on behalf of the members of the Northeastern Association of Rural Electric Cooperatives and the Municipal Electric Association of Massachusetts. Both groups are paying unnecessarily high rates for their bulk wholesale power supply, and are interested in the consistent application of Federal water resources policy in this region so that they can obtain the advantages of a competitive source of power supply.

My statement, although brief, is based on about 30 years of experience with the water resources of this region, as executive secretary of the Power Authority of the State of New York, member of the Federal Power Commission, with particular responsibility for river-basin work, member of the President's Water Resources Policy Commission, 1950-1951, and representative of the Secretary of the Interior on the New England-New York Inter-Agency Committee, 1951-1953. Since 1953 I have kept abreast of the further studies of all these rivers.

I shall begin by emphasizing three important considerations which have been deliberately overlooked or rejected here in the Northeast, and then I shall turn to a brief comment on the significance of the report of the New England-New York Inter-Agency Committee and the more recent International Joint Commission report on Passamaquoddy.

Unified Multipurpose River Basin Development

First, I want to suggest that one of democracy's greatest steps forward in terms of the future of its civilization is embodied in the principle and technique of unified multiple-purpose development of its river basins for flood control, conservation storage, water supply, irrigation, navigation, hydroelectric power, pollution abatement, recreation, and conservation of fish and wildlife. The principle was the product of the conservation movement which got its great impetus from the 1908 Governors' Conference called by President Theodore Roosevelt. The method was developed most completely in the administration of President Franklin D. Roosevelt, particularly through the Tennessee Valley Authority experiment.

I emphasize this today in order to call the Committee's attention to the fact that, tragically for the New England States and for the entire northeastern part of our country, that principle is not being applied to the region's rivers. The opposition of a certain kind of State isolationism or anti-Federalism, played on by power, rail, and coal interests, has blocked the true multiple-purpose planning and development of the region's river basins. As a result, flood control has been delayed; regulation of stream-flow has not made the rivers the cleansing, recreational assets they could become; and their hydroelectric power potential has not been fully developed. Subsequently, I shall comment on the sad results of the New England-New York Inter-Agency Committee survey to illustrate this point.

Importance of Right to Choose Public or Cooperative Power

Second, I want to suggest that one of democracy's most important contributions to assuring a low-cost energy economy, the electric power age which we are really only just entering, is the mixed enterprise approach in which the people always have a choice between so-called private enterprise, public ownership, and cooperative ownership in providing such public services as electric power. If time permitted, I could show you how this has consistently meant lower electric rates, improved power technology, and greater stimulus to economic development.

But here I want to point out that, in terms of modern power technology, that choice is no longer a real thing unless all systems, regardless of size, are assured ample supplies of bulk power from what must become regionally integrated wholesale power systems, using large modern steam units to carry base loads and hydroelectric power for peak loads and reserve capacity. The availability of such power supply to municipal and cooperative systems has been best assured where the Federal Government, or in some instances State agencies, have developed and integrated hydroelectric power as a part of multiple-purpose river basin programs.

I stress this today because in New England and more generally in the entire Northeast, that influence on wholesale power costs has been lacking. As a result, here in New England, some 80 municipal and cooperative rural electric systems are paying an average of about 1.4¢ for wholesale power supply. This is more than double the rate which rural electric cooperatives are paying private companies for power supply in the Southeast, the Southwest, and the Northwest, where power from Federal river-basin programs has been a competitive influence.

Place of Hydro in Modern Power Supply Technology

Third, I want to suggest that hydroelectric power, developed in connection with full control of our river-basin systems, is going to play an increasing, rather than a decreasing, part in democracy's next step forward in its dynamic power policy. I refer to what was originally christened "Giant Power" by Governor Gifford Pinchot of Pennsylvania. "Giant Power" takes full advantage of the tremendous reductions in capital and operating costs available from giant steam generating units and stations, located as closely as possible to fuel production and ample supplies of water for condensing purposes, integrated through extra high voltage transmission grids with hydroelectric developments providing most of the peak load and reserve capacity.

Many people today are susceptible to the argument that this very giant steam power progress is rendering hydro power out of date. That is because they don't understand the special characteristics of hydro. About ten years ago Mr. E. Robert deLuccia, then chief of the Federal Power Commission's Bureau of Power, speaking before the Western Society of Engineers, emphasized that hydro capacity, with its ability to start from standstill and synchronize with load in a small fraction of the time required for steam units, is going to be vitally important for peak load and reserve purposes.

A Preview of Giant Power in the Northeast

To illustrate what I am talking about I show you this map which symbolizes the possibility of a giant wholesale power system to meet the needs of the country's northeastern region by 1975. In 1958 utility generating capacity in this region totalled 62 million kilowatts with an output of about 284 billion kilowatt-hours. By 1975 it will require at least 140 million kilowatts of generating capacity with an output of perhaps 650 billion kilowatt-hours.

Federal Power Commission estimates show that undeveloped hydro which, through full river-basin development, could assist in meeting these requirements, totals about 15 million kilowatts with a potential annual output of nearly 50 billion kilowatt-hours. In addition to New England rivers, concerning which I shall have more to say, this includes among others the Delaware, Susquehanna, Potomac, James, and Roanoke Rivers, as well as the Ohio River basin, exclusive of its Tennessee and Cumberland tributaries. It does not include the Niagara and St. Lawrence projects which have already been developed by the New York State Power Authority. The general location of this hydro is shown in the following table:

Potential Hydro Available for Northeastern Grid

River Basins	Capacity (KW)	Energy (Kwh)
Maine	1,262,600	4,773,600,000
Other New England States	1,465,800	3,701,100,000
Middle Atlantic (excluding St. Lawrence and Niagara)	5,318,000	12,571,800,000
East North Central (excluding Wisconsin)	2,477,850	10,154,000,000
Maryland, Virginia & West Virginia	3,725,900	13,293,100,000
Kentucky (excluding Cumberland & Tennessee)	1,066,500	4,457,300,000
Totals	15,276,650	48,950,900,000

The location of some of this hydroelectric potential is shown on the map. And it may be noted that if only 8 million kilowatts with an output of say 16 billion kilowatt-hours a year is developed for peak load purposes, there will be a need for the equivalent of 72 new one million kilowatt steam electric stations generating some 350 billion additional kilowatt-hours per year to meet the region's needs in 1975. I have tried to indicate on the map by 2,000,000-KW circles, what this will mean in terms of finding sites which combine low-cost fuel and water for condensing purposes.

Most of these steam electric stations will be fired with conventional fuel. Some will be atomic, especially in New England. But, combined with present steam generating capacity which is carried over, they will require fuel equivalent to at least 225 million tons of coal. So there is little ground for coal industry opposition to sound river-basin programs, including hydro for peaking and reserve capacity purposes.

On the map, the high tension transmission grid that pools this vast supply of power is shown as a double circuit 345-KV system. Technical progress may eventually indicate higher voltage such as the Russians have under way. But, based on steam plant cost figures which power company witnesses placed before Congress in connection with certain bills to amend the Holding Company Act to permit joint ownership of giant power stations, as well as upon analysis of the costs of the American Electric Power System with its 345-KV grid reaching into Michigan, Indiana, Ohio, Kentucky, West Virginia, and Virginia, I estimate that the giant power grid symbolized on my map could make power available at substations throughout the region for about 7 mills per kilowatt-hour. This assumes full use of modern generation and transmission technology, including the lower-cost hydro project construction forecast by EBASCO Services, outstanding power company engineering consultants.

Federal River Basin Programs Hobbled in Northeast

Now, how is the Federal river-basin program meeting its share of the responsibility for assuring the region low-cost power supply? Members of the Committee are probably aware of the fact that throughout the entire region there is not a single Federal multiple-purpose river-basin project including hydroelectric power. I am going to deal specifically with this sickness in terms of New England. But I shall first touch briefly on a few of the other river basins of the ~~country~~ region.

The Corps of Engineers, in a report prepared for the President's Water Resources Policy Commission, told that body that there were vast amounts of undeveloped power in the Ohio River basin, but added:

> "Interests engaged in the production of coal in those States are firmly opposed to hydroelectric power development by the Federal Government because of their belief that such development would result in reduced use of coal. Public utilities and transportation interests serving the coal industry also are generally opposed to such developments." (p. III-8)

The fact is that the Ohio basin program is going ahead largely on a single-purpose navigation or flood control basis without the multiple-purpose conservation storage and power projects in the headwaters which would also regulate flows for power development at the new higher dam navigation projects on the river's main stem.

In the Delaware River basin all indications point to a combination program in which any power development will be left to private power companies.

In the Potomac basin the Corps of Engineers has been directed by Congress to limit its current restudy to single-purpose matters like water supply and to ignore the river's power potential. In fact, in spite of the obvious need of the Washington Metropolitan Area for augmented water supply and silt control, recreation interests are pressing for a park bill which would come close to condemning that river to eternal undevelopment. And a representative of the Corps of Engineers has just told the James River Development Association in Virginiathat the multiple-purpose program for that river is now uneconomic under the evaluation procedure required by the Federal Bureau of the Budget.

Meanwhile, the Appalachian Power Company, constituent of the American Electric Power System, and the Virginia Electric Power Company are proposing to go ahead with two hydroelectric projects on the upper Roanoke River (the South Mountain and Gaston projects) with combined capacity totalling more than half a million kilowatts. At these sites the Federal Power Commission estimates show only about one-third of that capacity.

New England-New York Inter-Agency Committee Report Represents Retrogressive Step in Evolution of Federal Water Resources Policy

The NENYIAC report leads essentially to a single-purpose rather than a multiple-purpose approach to the development of the region's rivers. After all its labors, it brought forth a series of inventories of the potentialities of the region in the various fields studied rather than comprehensive plans for full use of the region's river basin resources on a multiple-purpose basis.

A reading of the letters of comment from participating State Governors and Federal agencies leaves the impression that the main accomplishment was the establishment of an executive council to make all policy and practical decisions by majority vote of State and Federal representatives. This enabled certain State representatives to accomplish what the utility interests had been battling for since the 1930's, a final veto, apparently accepted by the Federal agencies, of Federal multipurpose river-basin programs including conservation storage and development of hydroelectric power.

The apparent acceptance of this result by Federal agencies may well be explained by the fact that final decisions were made after the change of administration in 1953.

In terms of the welfare of the States and particularly of the municipal and rural cooperative electric systems, for which I am speaking today, the most significant decisions gave NENYIAC's blessing to the divorce of flood control and power. The Committee then proceeded to evaluate the power projects on a single-purpose basis, assuming private fixed charges, and found them economically unjustified.

In other words, the NENYIAC report lists the flood control projects, noting that one or two have multiple-purpose possibilities, and finds that they have estimated flood control benefits of $12,400,000 a year, as compared with annual costs of $10,558,000. These costs are, of course, determined on the basis of Federal financing. It then lists all potential power projects for which "the annual benefits were estimated to be about six-tenths of the estimated annual costs." The report explains:

> "A benefit-cost ratio of less than unity was selected as a criterion in order to insure complete coverage of the hydroelectric potentialities of projects which might become feasible for development as a result of changing economic conditions." (p. 32-3)

The real reason for using the 0.6 to 1.0 benefit-cost ratio for screening projects on the basis of private fixed charges was the assumption that this was equivalent to a 1.0 to 1.0 ratio if the projects were publicly financed. The Federal agencies were obviously discounting a possible change of administration, as well as New England's attitude toward the undertaking of Federal multiple-purpose river basin programs which have brought such advantages to other parts of the country.

On this basis, having found that the St. Lawrence-Niagara combination had more than a 1.0 to 1.0 ratio, and that the Rankin Rapids project on the St. John River in Maine just sneaked through, the report found the rest of the projects in the power inventory not presently justified. Yet, in the previous discussion of flood control, the report says:

> "The flood control plans, as augmented by the power reservoirs that may be constructed, and the land treatment measures, if installed, would provide a high degree of protection to major damage centers." (p. 30)

The extent to which this setting up of a separate single-purpose flood control program, divorced from an unfavorably appraised inventory of hydroelectric projects, represents a departure from long-standing engineering judgment in the matter can be understood only in terms of a long background which I can only sketch here. It will be found in detail in a book entitled FLOOD CONTROL POLITICS, by William E. Leuchtenburg, published in 1953 by the Harvard University Press.

The broad facts are that, following the disastrous 1927 flood in New England, the Boston Society of Civil Engineers, under the leadership of H.K. Barrows of Massachusetts Institute of Technology, set up a committee to study the situation. In a series of reports, supported by the committee, Barrows stated that flood control could only be economically justified as power storage. He provided both Vermont and New Hampshire with overall plans for carrying out this recommendation through establishment of river regulating districts. The creation of the New Hampshire Water Resources Board, which built the Pittsburg Dam on a Connecticut River tributary, was a result of this recommendation.

Subsequently in 1936, when the Corps of Engineers came along with their "308" Report for the Connecticut River, they said that, although floods were comparatively frequent and caused serious damages in the Connecticut River basin, a comprehensive plan for flood control would be justified only if there was power development as well.

Down to the 1944 Flood Control Act the Corps of Engineers were for multipurpose programs in the Connecticut and Merrimack River basins. The contrast with the NENYIAC report and the single-purpose flood control programs which are today going forward in both basins is significant -- significant, among other things, of the success of the private power company battle to prevent municipal and rural electric cooperative systems in Maine New Hampshire, Vermont, and Massachusetts from obtaining a competitive source of power supply.

I shall illustrate the situation by brief reference to the Connecticut and Merrimack River programs. But first, I want to call attention to the failure of the NENYIAC report to give any consideration to possible regional gains through integration of hydroelectric developments.

Diversity of Great Lakes-New England Water Conditions - Dependable Power through Integration

The failure of the NENYIAC report to deal realistically with the value of the waterpower resources of the region is perhaps best illustrated by the lack of reference to the possibility of gaining 416,000 kilowatts of dependable hydroelectric capacity by integrating the operation of the St. Lawrence River project of the New York State Power Authority with the operation of power developments in the rivers of Northern New England and Northeastern New York. This plan is described in the report of the President's Water Resources Policy Commission, Volume II, TEN RIVERS IN AMERICA'S FUTURE, Part II, Chapter I, The Connecticut River. 1950

This report, on the basis of Federal Power Commission Bureau of Power analysis, showed what could be done to assure low-cost power for New England and New York through coordinated planning and operation of 41 river-basin projects with 1,043,000 kilowatts of installed capacity and an annual output of 3,824,000,000 kilowatt-hours in New England, 11 such projects with 123,000 kilowatts of capacity and 505,000,000 kilowatt-hours of output in Eastern New York, and the St. Lawrence project with 940,000 kilowatts of capacity and about 6,600,000,000 kilowatt-hours of output.

The New England hydro embraced in the hypothetical integrated power supply included 10,000 kilowatts from the St. Croix, 195,000 kilowatts from the Penobscot, and 260,000 kilowatts from the Kennebec basins in Maine; 107,000 kilowatts from the Androscoggin River in New Hampshire and Maine; 128,000 kilowatts from the Merrimack River in New Hampshire; 318,000 kilowatts from the Connecticut River in New Hampshire and Vermont; and 25,000 kilowatts from the Winooski-Lamoille basin in Northern Vermont.

The report indicates that the gain of 416,000 kilowatts of dependable capacity over the St. Lawrence and New England hydro development separately operated would be due (1) to the combined adaptability to meeting changing load characteristics; (2) to the diversity of seasonal and cyclical power, including the time lag in critical low St. Lawrence flow with respect to low flows in New England; and (3) to the effect of ice cover in diminishing availability of St. Lawrence power. The report states:

> "The cost of combined hydroelectric power delivered to market (9.7 billion kwh after transmission losses) has been estimated at about 6 mills. . . . It is estimated that a market area including Northeastern New York and Vermont, New Hampshire, and Maine, could absorb the above combined and coordinated output on a 55 percent load factor by about 1970." (p. 505)

The St. Lawrence project is now developed, with Vermont getting a share of this power. And the New England Power Company has also developed the Upper 15-Mile Falls project on the Connecticut River to a capacity of 140,000 kilowatts. But the concept of coordination is still important and should be broadened to include integration with giant steam power stations on the New England coast to assure savings of as much as 4.0 mills per kilowatt-hour in the present standard cost of transmitted wholesale power supply in New England.

No sound conclusions can be reached as to the full contribution of New England hydro to the power economy of the region until the studies embrace the possibilities of a regional power supply system combining base load steam located where fuel costs are lowest and hydro, including pumped storage, for peak loads and reserves. Today, integration of hydroelectric power from multiple-purpose developments in the rivers of northern Vermont with Vermont's share of St. Lawrence power would give the rural electric and municipal systems of the State a better break than they are getting from St. Lawrence power alone.

Present Merrimack Basin Program Provides Illustration

The present Merrimack River basin single-purpose flood control program includes three already constructed projects -- the Franklin Falls reservoir on the Pemigewasset, the Edward MacDowell project on Nubanusit Brook, and the Blackwater reservoir project on the Blackwater tributary. Under construction is the Hopkinton-Everett reservoir on the Contoocook-Piscataquog. Authorized, but inactive, is the Mountain Brook reservoir on the tributary of that name. All are in New Hampshire.

The Hopkinton-Everett project has just been dedicated by Vice President Nixon. According to a Federal Power Commission Memorandum, dated December 1, 1941, "150 million kwh of electrical energy annually, or nearly one-half the potentiality of the Merrimack River will be sacrificed should the Hopkinton-Everett reservoir be built." The Memorandum continues: "This is because the plan would place the main flood-control reservoir capacity below rather than above the power sites. This would destroy the multiple-purpose possibilities of river basin development by eliminating the control of stream flow required to make the Contoocook power projects economically sound."

When the Federal Power Commission opposed the Hopkinton-Everett project on this basis in accordance with its responsibility under the 1938 Flood Control Act, the Corps of Engineers set up a consulting board of three independent engineers to review the controversy. The Board supported the general position of the Commission.

The Merrimack basin flood control program should be promptly revised as a multiple-purpose program to eliminate the Hopkinton-Everett project and to authorize in its stead the Bennington and Beards Brook conservation storage projects and not less than the Long Falls and Riverhill power projects included in the NENYIAC report inventory, with a combined total of 32,000 kilowatts and 99,500,000 kilowatt-hour per year output. In addition, a 10,000-kilowatt installation producing 27,000,000 kilowatt-hours per year should be authorized with necessary modifications of the existing Blackwater project. All these are in the Contoocook River sub-basin.

On the Pemigewasset tributary, the Livermore Falls project, included in the NENYIAC inventories of both flood control and power projects, should be authorized with 135,000 acre-feet of flood control and 170,000 acre-feet of power storage. The authorization should include at least 24,000 kilowatts of new hydroelectric capacity capable of generating 69,800,000 kilowatt-hours annually.

The suggested conservation storage would make possible the development of as much as 58,000 kilowatts of additional capacity at one new and a number of existing Merrimack River power developments, offering an additional 218,000,000 kilowatt-hours in annual energy.

Altogether, this Merrimack Basin multiple-purpose program could provide an important competitive source of power supply for the New Hampshire rural electric cooperatives and for the municipal electric systems in Eastern and Central Massachusetts. And by this I do not mean that installations at the projects need be adapted to the load factor of such public and cooperative systems. Rather, they should be adapted to coordination with the integrated large steam plant economy on which the future power supply of the entire region will be dependent. But, under contracts assuring the best use of this hydroelectric potential, the Government can assure preference customers under the 1944 Flood Control Act ample supplies of the kind of power they need at much lower prices than they are now paying.

Revision of Connecticut Basin Program Also Indicated

The Corps of Engineers lists 16 authorized flood control reservoir projects as complete, under construction, or active in the Connecticut River basin. These would provide a combined flood control storage of 607,716 acre-feet. It also lists 8 other authorized flood control projects in the basin as deferred or inactive. These would add 314,300 acre-feet of flood control storage. Only two of these are listed in the NENYIAC undeveloped power inventory -- the Victory project on the Passumpsic River in Vermont for power storage only, and the Gaysville project on the White River in Vermont with a potential of 20,000-kilowatt capacity and 33,000,000 kilowatt-hours of average annual energy.

The President's Water Resources Policy Commission listed 28 undeveloped hydroelectric power possibilities in the basin which, including redevelopments, offered 830,000 kilowatts of capacity and 2,232,000,000 kilowatt-hours of average annual energy. They also offered 1,031,400 acre-feet of active storage capacity. The Commission indicated that 22 other new and redeveloped projects would bring the totals to 952,000 kilowatts and 1,241,400 acre-feet of storage, and noted that "other reservoirs not having power developed at the project sites would increase the total undeveloped storage capacity in the basin to about 1,500,000 acre-feet."

The Commission stated further that, if the listed projects were found feasible as a partial alternative to the single-purpose flood control program, "it is estimated that major floods would be reduced by more than 16 feet at Alcott Falls, 11 feet at Bellows Falls and Turners Falls, 5 feet at Holyoke, and 7 feet at Enfield," just above Hartford, Connecticut.

Six of the projects in the Commission's undeveloped hydroelectric power inventory, with a total of 162,000-kilowatt capacity and 319,000,000 kilowatt-hour annual output, are also included in the Corps of Engineers list of flood control projects completed, under construction, or active. But the Commission's list would result in a very important modification of the presently authorized program, to include the 120,000-kilowatt Williamsville project on the West River in Vermont with its average annual output of 110,000,000 kilowatt-hours and 220,000 acre-feet of active storage. As previously noted, the New England Power Company has already constructed the Upper 15-Mile Falls project, included in the report at 104,000 kilowatts of capacity but installed by the Company at 140,000 kilowatts. This project was listed as having 225,000 acre-feet of storage.

Reconsideration of the Connecticut River in terms of multiple-purpose Federal river-basin programs would result in the following immediate steps:

(1) Make sure that the Victory project is authorized to provide 71,900 acre-feet of active power storage as well as the 24,000 acre-feet provided for flood control.

(2) Authorize the Gaysville project as a multiple-purpose project with higher dam providing 77,800 acre-feet of storage for flood control and 29,200 acre-feet for power, together with 20,000 kilowatts of installed capacity.

(3) Authorize the North Hartland project on the Ottauquechee River in Vermont as a multiple-purpose project with a somewhat higher dam providing 100,000 acre-feet of storage instead of the presently authorized 71,400 acre-feet, together with 90,000 kilowatts of installed capacity.

(4) Authorize the additional multiple-purpose Perkinsville dam and reservoir project on the Black River in Vermont, including 10,000 kilowatts of capacity and 60,000 acre-feet of reservoir storage. This would take the place of a single-purpose flood control project on this river included in the NENYIAC report but not yet authorized. It would make possible redevelopment of the existing Springfield power development on the same river to add 6,000 kilowatts of capacity with an additional output of 20,000,000 kilowatt-hours a year.

(5) Authorize substitution of the Williamsville multiple-purpose dam and reservoir project on the West River, Vermont, for the Island and, if not too late, for the Townshend single-purpose flood control projects on that river. Also authorize Ball Mountain project on the same river as a multiple-purpose project with an installation of 20,000 kilowatts and an average annual output of 70,000,000 kilowatt-hours. I have already referred to the large additional capacity and energy which the Williamsville project offers the region. The new combination would more than double the reservoir storage now offered by the authorized single-purpose combination.

(6) Authorize reconstruction of two existing flood control reservoirs in Massachusetts for multipurpose use including power. This would make possible, according to Federal Power Commission estimates, development of 20,000 kilowatts with annual output of 30,000,000 kilowatt-hours at Tully Dam on the Millers River and 10,000 kilowatts with annual output of 20,000,000 kilowatt-hours at Knightville Dam on the Westfield River.

(7) Authorize Federal construction of the Enfield multipurpose navigation and power project in the Connecticut River above Hartford. Federal Power Commission estimates place the potential capacity of this project at 42,000 kilowatts and its annual output at 247,000,000 kilowatt-hours.

This new combination would require the elimination of only two of the authorized flood control projects -- the Island and Townshend dams in the West River basin, for which the Williamsville multipurpose project would be substituted. It would call for building several of the authorized projects as multipurpose rather than single-purpose projects.

The important advantage of this multipurpose approach would be the fact that it would make available 318,000 kilowatts of power for peak loads, with an annual output of 740,000,000 kilowatt-hours which would enable New England to take better advantage of its allotted share of St. Lawrence and perhaps Niagara base load power. This new power developed at Federal multipurpose projects would be located so that it would be of maximum help to the rural electric cooperatives and and municipal electric plants of Vermont, New Hampshire and Massachusetts, enabling them to perform their yardstick function of showing the way to lower electric rates for the customers of private power systems.

It should be emphasized that these suggestions are limited to reasonable modification of the presently authorized single-purpose flood control program for the Connecticut River. Once the program is started, other potential hydro in the basin can be included.

The Water Resources of Maine From a Power Standpoint

The NENYIAC report shows that only about one-fourth of Maine's ample hydroelectric power potential has been developed -- 452,080 kilowatts as compared with an undeveloped potential of 1,138,900 kilowatts, assuming private fixed charges and a six-tenths to one benefit cost ratio. But, with the exception of the St. John River basin, where it found a 1.03 to 1.00 benefit cost ratio, it found a ratio of less than 1.0 to 1.0 for all other Maine rivers, and an average of only 0.75 to 1.00 for the inventory of undeveloped power in the State.

It may be noted, however, that on the basis of NENYIAC's reasoning, the Kennebec and Androscoggin Rivers were found to have 461,000 kilowatts and 92,500 kilowatts of undeveloped power which with public fixed charges would have had better than one to one benefit cost ratios by a considerable margin. Together with 255,500 kilowatts of St. John River power, Maine would be offered, on this basis of evaluation, 809,000 kilowatts of potential capacity, with an average annual output of 2,852,150,000 kilowatt-hours of new power, economically justified if publicly developed -- which may be assumed to mean better than present power costs in the State.

But I can assert with some confidence that this undeveloped Maine hydroelectric power could be much better power than the NENYIAC report indicates, and that, if publicly developed, it could be an asset in terms of the economic development of the State. Specifically, my experience in the first two years of NENYIAC's work made it clear that the estimates being prepared for the report tended to over estimate the cost of potential hydroelectric projects. In specific instances I had cost estimates prepared on the basis of Bureau of Reclamation manuals of cost, which showed considerably more favorable figures. I shall later submit for the record memoranda referring to Kennebec and St. John river power showing Interior Department estimates of the per kilowatt-hour cost of power from such projects.

But more important support comes from the 1941 report on the Passamaquoddy Tidal Power Project, prepared by the Federal Power Commission in response to Senate Res. 62, 76th Congress, 1st Session. In that report the Commission indicated that for low-cost publicly-developed hydroelectric power, Maine should turn first to its rivers. It included estimates of a coordinated system of 17 hydroelectric plants on the Kennebec and Penobscot Rivers. The estimates assumed either Federal or State financing with the program carried out in three stages. (See table on page 14)

The first stage assumed the construction of five of these plants for a total capacity of 104,000 kilowatts, capable of producing 530,000,000 kilowatt-hours annually at an average cost of 1.5 mills per kilowatt-hour.

POTENTIAL HYDROELECTRIC POWER

PROJECTED PLANTS IN BASINS OF PENOBSCOT AND KENNEBEC RIVERS

COORDINATED SYSTEM OF 17 PLANTS

	Stage I	Stage II	Stage III	Total
Number of power plants	5	8	4	17
Proposed installed capacity, kilowatts 1/	104,000	176,000	260,000	540,000
Firm annual output, thousands of kilowatt-hours	530,000	870,000	1,044,000	2,444,000
Estimated capital cost 2/	$17,565,000	38,602,000 3/	48,715,000	104,882,000
Estimated annual fixed charges $	681,000	1,543,000	1,828,000	4,052,000
Estimated annual operation and maintenance expense $	113,000	198,000	200,000	511,000
Estimated total annual cost 2/ $	794,000	1,741,000	2,028,000	4,563,000
Unit cost of energy, mills per kilowatt-hour	1.50	2.00	1.94	1.87

1/ Installed capacity based on 60 percent load factor, plus allowance for reserve capacity

2/ Federal or State Financing: Cost of money, 3 percent; no allowance for taxes or insurance

3/ Includes storage works for river regulation

The second stage would have included the construction of eight additional plants with a total capacity of 176,000 kilowatts, capable of producing 870,000,000 kilowatt-hours annually at an average cost of 2.0 mills per kilowatt-hour.

The third stage would have completed the program with the construction of four more plants with a total capacity of 260,000 kilowatts, capable of producing 1,044,000,000 kilowatt-hours annually at an average cost of just over 1.9 mills per kilowatt-hour.

With the system of 17 hydroelectric plants completed, Maine would have had a combination with capacity totalling 540,000 kilowatts, capable of producing 2,444,000,000 kilowatt-hours at an estimated average cost of just under 1.9 mills per kilowatt-hour.

On the basis of the increased cost of constructing hydroelectric projects since the date of the report, the per kilowatt-hour cost of energy from such a program should be about $2\frac{1}{2}$ times the original Federal Power Commission estimates.

This means that a State or Federal program should be able to offer a considerable block of energy for electro-metallurgical or electrochemical industries at a cost of about 4.7 mills -- certainly at not more than 5.0 mills. Taking into account savings in cost of constructing hydro projects, recognized by EBASCO Services, the future cost might be somewhat less. Such power would be attractive to this kind of industry.

It should be noted that, to the extent that certain proposed projects included in the Federal Power Commission's estimates of potential hydroelectric power in Maine are designed to furnish high load factor power for metallurgical or chemical industries, there will be a reduction in the total capacity which can be developed. For high load factor operation less capacity is used to produce approximately the same number of kilowatt-hours.

The quantity of low-cost electricity which can be expected from the Kennebec and Penobscot Rivers could be augmented by nearly one billion additional kilowatt-hours from future development of the St. John River in Maine. This power could be developed at approximately the same cost as that from the Kennebec-Penobscot combination.

A program for full development of the hydroelectric resources of the rivers of Maine would include considerable increase in provision for conservation storage, establishing more complete control of the flow of the rivers. This would open the way to more economic development of Passamaquoddy power. A transmission system could be set up for use of this combination of hydroelectric developments in such a way that the added transmission cost for delivery within the northern, eastern, and central portions of Maine would be less than one mill.

This analysis supports the conclusion that the NENYIAC report has over estimated the present cost of hydroelectric power from Maine river basin resources. The Federal Power Commission not only suggested that with public fixed charges Maine could obtain 2,444 million kwh at an average annual cost of just under 1.9 mills but stated that with private financing the cost would be only 3.26 mills per kwh which, all things considered, might today be rated as about 8.5 mill power or less than 60% of what NENYIAC is now showing as the cost per kwh of Maine's total undeveloped potential and somewhat less than the 9.2 mills which it is showing for its most favored St. John River development.

The memoranda on the St. John and Kennebec rivers, which I am submitting for the record, were prepared with the assitance of representatives of all Interior Dept. agencies participating in the NENYIAC work. They show that, in the interest of preserving valuable recreation and cold water fishing opportunities in those basins, we were proposing alternatives to the Rankin Rapids proposed for the St. John and the low Forks-Pierce Pond Division project proposed for the Kennebec. Yet, assuming 1959 construction costs and Federal financing, the alternative St. John project would have produced 990,000,000 kwh of energy at 3.9 mills per kwh, allowing for downstream benefits, and the alternative Kennebec project would have contributed 923,000,000 kwh at 4.6 mills per kwh.

The gains to recreation and fishing as compared with the projects now proposed would have been tremendous.

I offer these memoranda for the record.

Significance of the International Joint Commission Report on the Passamaquoddy Project

Analysis of the Report of the International Passamaquoddy Engineering Board to the International Joint Commission raises important questions involved in the Nation's water policy. As I understand the report it finds that the most economical undertaking of this huge tidal power development would be as a joint project with the Rankin Rapids storage and power project on the St. John River, described as an "auxiliary." The tidal project would have an installed capacity of 300,000 kilowatts provided by 30 generating units. The Rankin Rapids project would have an installed dependable capacity of 460,000 kilowatts in four generating units. The combined dependable capacity would be 555,000 kilowatts and an annual output of 3,063,000,000 kilowatt-hours. Without the auxiliary, the dependable capacity of the tidal project would be only 95,000 kilowatts.

(8)

The project has the merit of encouraging Federal construction of the Rankin Rapids project, with 2.8 million acre feet of storage. This would provide New Brunswick with the stream regulation which it needs for optimum use of its hydroelectric resources in the lower St. John River. As I understand it, this would in turn encourage the Canadian Government to cooperate with the United States in connection with upstream storage in the Canadian portion of the Columbia River basin.

But it is the matter of evaluation which raises the important questions of policy. The International Engineering Board, in its transmitted letter, refers to its "unusual conclusion that although the project would have a favourable benefit-cost ratio in the United States, the Canadian ratio is unfavourable."

This unusual conclusion is based on two simple facts, which none the less need explanation.

First, the Canadian basis of evaluation finds the cost of the combined power 11.5 mills per kwh while the United States basis finds the cost 8.4 mills per kwh. This is apparently due mainly to the fact that the Canadian representatives assume a 4-1/8% interest rate for both interest during construction and annual costs while the United States representatives use 2½%

Second, the Canadian representatives apparently found the value of similar power from an alternative source in New Brunswick about 6.7 mills per kwh after allowing for transmission while the American representatives apparently found corresponding power in Maine worth about 11.0 mills per kwh. These figures are derived from the cost benefit ratios in each case.

A glance at the table on page 252 of the report, showing the estimated bus-bar cost of steam electric power at certain locations in Maine and New Brunswick, may well cause the citizens of Maine to do some serious thinking about their competitive position in the matter of power to attract industrial development. The table shows that, assuming the same type of steam station operating an average of 4,500 hours per year throughout its useful service life, the total cost of production would be 7.7 mills per kwh in St. John and Bathurst, New Brunswick, as compared with 11.6 mills in Yarmouth and Belfast, Maine. The fuel costs are substantially the same in all locations. Of course the major explanation of the difference in costs is the use of public fixed charges for the plants located in New Brunswick and private fixed charges for those located in the United States.

There is one other factor in the evaluation formula used by the United States representatives which merits attention in a discussion of water resources policy. Although they used 2½% for interest as contrasted with the Canadian use of 4-1/8%, they decided to be consistent with Canadian practice in excluding "taxes foregone" as an artificial increase in the cost of a Federally constructed Passamaquoddy-Rankin Rapids combination.

Thus in two important particulars, the American representatives differed with the evaluation of hydroelectric projects in the State of Maine and elsewhere followed by their agencies in the NENYIAC study. They used Federal fixed charges based on 2½% interest instead of the private fixed charges based on 5½% return on money used by NENYIAC to determine costs. And they rejected taxes foregone which provided a considerable element of cost in the NENYIAC evaluations of hydro projects.

This analysis of the Passamaquoddy report in conjunction with the NENYIAC report suggests the importance of action by Congress to require Federal agencies responsible for river basin programs to determine costs on the basis of public fixed charges without including the artificial item for taxes foregone. It further suggests that the time has come for evaluation of potential hydroelectric power development in terms of the contribution which such projects can make to large, well-planned, modern regional power supply systems rather than in terms of small local steam stations at assumed load centers.

One further word on the Passamaquoddy proposal. The 8.4 mill estimated bus-bar cost of power will apparently be increased to at least 9.6 mills when transmission costs are included, and these costs are based on Federal financing. This could indeed provide a material reduction in the rates which the rural electric cooperatives of the State are paying for their wholesale power supply, such payments averaging over 15 mills per kwh to the Bangor Hydroelectric Company, and 22 mills to the Maine Public Service Co.

But, before a decision is made, the people of Maine may want to know what an investigation such as the Federal Power Commission made in 1941 would show as to the results of similar Federal investment in the full development of their river basin power resources. What is clear is that full-scale planning for lower power costs in Maine, as well as in New England as a whole, could well be associated with a water resources program.

Suggestions for Water Policy

I will conclude my statement with four suggestions for consideration by this Committee in its monumental task of dealing with the future use of the country's water resources:

(1) A more orderly basis should be established to assure the preparation and execution of comprehensive plans for multiple-purpose development of the water resources of the country's river basins in terms of the growing need for ample supplies of high grade water, economical bulk transportation, low cost electric power, and all phases of recreation.

(2) The starting point of such planning should not be a specific objective such as flood control, with reservoirs designed only to hold back temporarily a specified number of inches of run-off. Instead, the principal objective should be conservation storage to assure expert management of all run-off in the interest of the various purposes. The system of dams and reservoirs should be designed initially to establish maximum justifiable control of river flows, embodying one of the most important assets of any civilization -- water. Where such conservation storage does not fully provide for flood control, the remaining needs can be met through single-purpose flood control reservoirs, additional storage through increasing the height of conservation dams, local protection works, or flood forecasting.

(3) Confusion in this vitally important field of activity should be eliminated by recognizing comprehensive river basin programs, planned on a completely multiple-purpose basis, as embodying a wholly public function to be organized, planned, and carried out on that basis.

(4) In order to maintain the right of communities to choose public or cooperative ownership of their electric service as a force for lower electric rates, consideration should be given, among other things, to whether the Federal Government does not have the obligation to use its authority over river basin development as one means of assuring a competitive source of power supply to communities which have exercised this right. Modern technology has made this necessary, placing on government the responsibility to do for the people what they cannot do, or do so well, for themselves.

On behalf of the Municipal Electric Association of Massachusetts and the Northeast Association of Rural Electric Cooperatives, I want to close with a word of thanks for the opportunity to appear before this important Committee of the United States Senate.
