

DOCKET NO. 8

AN APPLICATION SUBMITTED BY  
NORTHEAST UTILITIES SERVICE  
COMPANY, AS AGENT FOR THE  
CONNECTICUT LIGHT AND POWER  
COMPANY FOR A CERTIFICATE  
OF ENVIRONMENTAL COMPATIBILITY  
AND PUBLIC NEED WITH RESPECT  
TO A NEW 115 KV OVERHEAD  
ELECTRIC TRANSMISSION LINE  
BETWEEN SHEPAUG AND BATES ROCK  
SUBSTATIONS IN THE TOWN OF  
SOUTHBUURY

POWER FACILITY  
EVALUATION COUNCIL

OCTOBER 25, 1976

F I N D I N G S

I. PROCEDURES

1. The Connecticut Light and Power Company (CL&P) acting by its agent, the Northeast Utilities Service Company, in accordance with the provisions of section 16-501 of the General Statutes of Connecticut, Revision of 1958, revised to 1976, as amended applied to the Power Facility Evaluation Council on December 30, 1975, for a certificate of environmental compatibility and public need for the construction of an additional 115 kV overhead transmission line which would run on a widened right-of-way parallel to the existing 115 kV line which now serves Bates Rock Substation in Northern Southbury from the Substation at the Shepaug hydroelectric generating station on the Housatonic River in Western Southbury.
2. The fee prescribed in 16-50v-1(b) of the Regulation of Connecticut State Agencies accompanied the application.
3. The application was accompanied by proof of service as required by section 16-501(b) of said General Statutes of the State of Connecticut. (tr. 4-12 p. 7)
4. Affidavits of newspaper notice as required by Statute and section 16-50r-1 of the Regulations of Connecticut State Agencies were also filed with the application. (NUSCO Ex. 1)
5. Pursuant to section 16-50m of said General Statutes of the State of Connecticut, the Power Facility Evaluation Council, after giving due notice thereof, held a public hearing at the Pomperaug High School and the Southbury Fire House in Southbury on April 12, 13, 15, 19, 26 and 28, 1976 and May 3 and 5, 1976. Evening session was held on April 13, 1976. (Record)

6. The parties to the proceeding are the applicant, the Connecticut Light and Power Company, and those other persons and organizations whose names are listed in the Decision and Order which accompanies these findings. (Record)
7. Upon receipt of the application, the Council retained Cahn Engineers, Inc., consulting engineers of Wallingford, Connecticut, to advise the Council. (Record)
8. Persons making a limited appearance pursuant to section 16-50j-15 of the Regulations of Connecticut State Agencies are noted in the record. All written statements were made part of the record. (Record)
9. The following state agencies filed written comments with the Council pursuant to section 16-50j(f) of the General Statutes of the State of Connecticut: The Department of Environmental Protection, The State Department of Health, The Council on Environmental Quality, The Public Utilities Control Authority, The Department of Planning and Energy Policy and the Department of Commerce. (Record)
10. On March 22 and 24, 1976, members of the Council made a ground inspection of the proposed route and alternates for the proposed line. Council members made additional ground inspections of the proposed and alternate route during the course of the hearing. (Record)
- II. NEED
11. The maximum capacity of the existing 115 kV transmission line is 215 MVA, which is adequate to carry existing and projected load. (NUSCO Ex. 1 p. 9)
12. There is no alternate 115 kV transmission supply to Bates Rock service area in the event that Shepaug to Bates Rock line should be out of service for any reason; and all customers served exclusively by the Bates Rock Substation would be out of service for the duration of the outage. (NUSCO Ex. 1 p. 9)
13. The Bates Rock Substation service area is too extensive, its loads are too large and the distances involved are too great for other substations to provide significant back-up capacity at distribution voltages. (NUSCO Ex. 1 p. 20 & 21)

14. The proposed transmission line will supply the towns of Southbury, to the southern half of Woodbury, and to the Uniroyal plant and a few other customers in the western portion of Middlebury. (NUSCO Ex. 1 p. 7)
15. The Heritage Village area of Southbury, consisting of 2500 dwelling units, is served by two 13.8 kV subtransmission lines from Bates Rock. (tr. 4-12 p. 19)
16. In the Heritage Village area the MVA load is approximately one half of the Bates Rock Substation peak load which is 39.8 MVA (PFEC Ex. 1 p. 10)
17. Presently there are two 47 MVA 115-1318 kV transformers and associated 13.8 kV switch gear in service at Bates Rock. (NUSCO Ex. 1 p. 9)
18. In the event of the failure of one of these transformers, the other could be overloaded to about 63 MVA in the summer and 72 MVA in the winter for a 24-hour period, which would allow time for a mobile transformer to be installed. (NUSCO Ex. 1 p. 9)
19. Construction of a second 115 kV supply to Bates Rock will give the substation a capability of carrying loads up to approximately 63 MVA in the summer and 72 MVA in the winter for a 24-hour period despite the outage of one of the transformers or one of the transmission lines supplying the substation. (tr. 4-12 p. 25-26)
20. The determination of the level of load which requires a second supply is a matter of judgement and sound utility practice. (tr. 4-12 p. 19 & 20)
21. On many electrical systems all substations are initially constructed with at least two sources of supply. On some systems, a load of 10 to 20 MVA is considered to be the level requiring a second supply. (tr. 4-12 p. 19 & 20)
22. Thirty MVA is the largest load normally allowed by NUSCO and other New England area electric utilities to be supplied by one line, which load represents about 7,000 to 9,000 average use customers, or a lesser number of higher-use customers, such as industries, institutions or electrically heated homes. (tr. 4-12 p. 12; NUSCO Ex. 1)
23. The peak load of Bates Rock has already reached 39.8 MVA, a load which is the largest on any substation in New England which is dependent upon a single transmission circuit. (NUSCO Ex. 1 p. 9-12; tr. 4-12 p. 20)

24. Peak loads in the Bates Rock service area have increased during the ten year period 1965-1975 at an annual compound growth rate of 29% per year, which load growth rate is disproportionate compared with the CL&P System as a whole, and which can be attributed to the development of the Heritage Village complex. (PFEC Ex. 1 p. 10)
25. There are presently two 115 kV transmission lines feeding Shepaug Substation. One feed is from Triangle Substation, the second source of feed is from West Brookfield Substation. (NUSCO Ex. 1 p. 9)
26. Any outage of the existing circuit from Shepaug to Bates Rock whether fed from Triangle Substation or from West Brookfield Substation will result in an outage to Bates Rock. (NUSCO Ex. 1 p. 9)
27. Both the proposed and alternate routes would be adequate to supply Bates Rock and to reinforce the western Connecticut area. (NUSCO Ex. 1 p. 19; tr. 4-12 p. 26-27)
28. Construction along the alternative route from Carmel Hill Junction would have the marginal reliability advantage of a second supply to Bates Rock from a separate direction. (NUSCO Ex. 1 p. 19; tr. 4-12 p. 86, 102-103)
29. The proposed second circuit from Shepaug to Bates Rock would establish two feeds to Bates Rock, one from Plumtree and from West Brookfield. (NUSCO Ex. 1 p. 9)
30. The addition of such second circuit from Shepaug to Bates Rock will increase reliability. (NUSCO Ex. 1 p. 9-12)
31. At this time, substations providing power to 19 western Connecticut towns are being served by three 115 kV transmission lines from outside the western Connecticut area, and in late 1978 there will be a fourth 115 kV supply into that area, when the 345 kV line between Long Mountain in New Milford and Plumtree in Bethel is completed and a 450 MVA 345/115 kV autotransformer is installed at Plumtree. (NUSCO Ex. 1 p. 13; tr. 4-12 p. 27)
32. Should there be an overlapping outage of the autotransformer at Plumtree and one of the three existing 115 kV lines, electrical loads anticipated by 1979 will cause the overloading of one of the two remaining 115 kV lines. As the failure of the autotransformer could result in it being out of service for up to 12 months, it is necessary to provide facilities which should minimize the risk of such a long term loss of the fourth 115 kV supply to the western Connecticut area. (NUSCO Ex. 1 p. 13, 15; tr. 4-12 p. 27 & 28)

33. Construction of a second supply line to Bates Rock along the alternative route from Carmel Hill, from which the line could be extended easterly to the 345/115 kV substation at Frost Bridge, would constitute an additional 115 kV supply into the western Connecticut area and minimize the risk associated with a long term loss of the autotransformer at Plumtree. (NUSCO Ex. 1 p. 15; tr. 4-12 p. 28)
  34. Construction of a second supply line to Bates Rock from Shepaug would not constitute an additional 115 kV supply into the western Connecticut area and, therefore, in order to minimize the risk associated with the loss of the single autotransformer at Plumtree it would be necessary to install a second 345/115 kV autotransformer there. (NUSCO Ex. 1 p. 15; tr. 4-12 p. 28 & 29)
  35. The proposed transmission line from Shepaug to Bates Rock conforms to a long range plan for expansion of the electric power grid of the electric system serving the State and interconnected utility systems and will serve the electric system's economy and reliability. (tr. 4-12 p. 27-29; NUSCO Ex. 1 p. 19)
  36. The Public Utilities Control Authority believes a second 115 kV circuit to supply Bates Rock Substation is necessary to insure reliability of service to the area. (Record)
  37. The Department of Planning and Energy Policy reviewed projections of regional electric power demands and did not dispute the need for the proposed facility. (Record)
  38. The Department of Commerce has reviewed statistical data for the towns of Southbury, Woodbury, and Middlebury and has recommended approval of the proposed facility. (Record)
  39. Cahn Engineers, Inc., concluded that there is a need for the proposed facility to improve reliability to the Bates Rock Substation. (PFEC Ex. 1 p. 1)
- III. ENVIRONMENT
- A. General
  40. The proposed Shepaug-Bates Rock line will have minimal impact on the environment as it will run parallel to an existing line. For the most part, impacts associated with the proposed line have already been effected by the existing line between Shepaug and Bates Rock. ( DEP letter p. 6; tr. 4-12 p. 54-59; NUSCO Ex. 1 p. 31, 32)

41. The proposed line is consistent with the Federal Power Commission (FPC) "Guidelines for the Protection of Natural, Historic, Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities" because it makes use of an existing right-of-way. (NUSCO Ex. 1 p. 26)
42. The Carmel Hill-Bates Rock alternative is inconsistent with FPC Guideline number one because it requires the cutting of a totally new right-of-way. (NUSCO Ex. 1 p. 26)
43. The proposed construction of the Shepaug-Bates Rock line will conform to PUCA requirements and the National Electric Safety Code, and should not be a hazard to people or property in the area of the right-of-way. (tr. 4-12 p. 43)
44. The State Department of Health states that the proposed line is satisfactory because it does not cross any public water supply, reservoir or watershed. (Record)
45. The Department of Planning and Energy Policy has no objection to the location of the proposed line. (Record)
46. The Department of Environmental Protection is of the opinion that the Carmel Hill-Bates Rock alternative has a greater cumulative environmental impact and that the use of the existing Shepaug-Bates Rock right-of-way is more environmentally compatible than cutting a new right-of-way. (DEP letter)
47. The Public Utilities Control Authority prefers the Shepaug to Bates Rock route because the economic and environmental considerations preclude the required land acquisition. (Record)
48. There is no significant adverse impacts on historical value along either route although there could be some impact along the alternate route in Woodbury. (tr. 4-15 p. 18, 157; tr. 4-19 p. 46, 50, 69, 74, 77)
- B. Ecological
49. The Carmel Hill-Bates Rock route would have a greater ecological impact than the Shepaug-Bates Rock route (tr. 4-13 p. 44, 109; tr. 4-19 p. 183-184, 190-191; DEP letter; PUCA letter)
50. The construction of the proposed line would have less adverse impact on the environment than the construction of highways, houses or the use of land for farming. (NUSCO Ex. 1 p. 32; tr. 4-12 p. 58)

51. The ecological impact of the proposed route should be minor and construction of the line may even improve environmental conditions, such as correction of existing erosion problems along the route. (PFEC Ex. 1 p. 2, 6, 7, 23, 32; tr. 4-12 p. 91; tr. 4-15 p. 8, 9; DEP letter)
52. Erosion along a right-of-way can best result from construction activities and the use of access roads, but such erosion can usually be controlled by water bars, wood chips, baled hay, and construction of access ways along the contours on hillsides. (NUSCO Ex. 1 p. 43-44; tr. 4-12 p. 42-43)
53. The alternate Carmel Hill-Bates Rock route would necessitate the clearing of 80 feet of vegetation along a new 7.6 mile right-of-way, thereby disturbing the soil and creating potential erosion problems on steep slopes. (PFEC Ex. 1 p. 47; tr. 4-13 p. 223; tr. 4-15 p. 160-169; tr. 5-5 p. 117, 205-206; DEP letter)
54. The potential adverse impacts on watercourses is greater on the Carmel Hill-Bates Rock route than on the Shepaug-Bates Rock route. (tr. 4-12 p. 42, 69, 70, 71; tr. 4-13 p. 42-44)
55. Along the Shepaug route it will be necessary for construction equipment to cross about five narrow watercourses and several small wetlands. (tr. 4-12 p. 42, 69, 70-71; tr. 4-13 p. 43-44)
56. Along the Carmel Hill-Bates Rock route it will probably be necessary for construction equipment to cross nine watercourses and eight wetlands. In several cases the line would run parallel to a watercourse or a wetland. (Woodbury Ex. 1 p. 3)
57. The proposed line should have no significant adverse effects on water quality or fish and wildlife if care is taken in regard to initial construction, right-of-way maintenance and application of herbicides. (DEP letter; tr. 4-12 p. 42, 43)
58. The Carmel Hill-Bates Rock route might have an adverse impact on water quality, such as water temperature, siltation and turbidity. (tr. 4-12 p. 42, 69, 71; tr. 4-13 p. 42-44)

59. The Shepaug-Bates Rock route has less potential impact on wetlands than the Carmel Hill-Bates Rock route. The Shepaug route crosses approximately 2,200 feet of wetland soils, only three structures will be located in wetlands, and there is little necessity to construct access ways in wetlands since access ways presently exist. Trap rock and processed stone will be placed in stream beds where equipment needs to cross a brook. Culverts will not be used. Transylvania Brook will not be crossed by vehicles. (NUSCO Ex. 1 p. 32; tr. 4-12 p. 40-42, 44, 61, 57, 58, 69-71; tr. 5-3 p. 98-99)
60. The Carmel Hill route will cross about 4,500 feet of wetlands soils, several structures may have to be located in those soils, and about 2,400 feet of access ways may be necessary across wetland soils. (tr. 4-12 p. 40-41, 44, 61)
61. The Shepaug-Bates Rock route will require substantially less vegetation removal than the Carmel Hill alternative. Clearing for the Shepaug-Bates Rock route will total approximately 20 acres whereas about 75 acres must be cleared for the Carmel Hill route. (NUSCO Ex. 1 p. 19; tr. 4-12 p. 38)
62. Undergrounding the proposed line would cause severe impacts on natural systems. (DEP letter p. 4)
- C. Land Use
63. Widening the existing route will have limited land-use effects as it crosses agricultural land and rural areas used for farming or passive recreation. (tr. 4-12 p. 54, 55)
64. The widening of the existing Shepaug-Bates Rock right-of-way west of Route 172 at the Meadow Brook Acres subdivision will bring it closer to two residences, no residences will be taken. (tr. 4-13 p. 82-85)
65. Although the alternate route crosses an area relatively remote and undeveloped, several adverse land-use conflicts will be created by a new line. (NUSCO Ex. 1 p. 38; tr. 4-12 p. 59-60; DEP letter)



66. The alternate route will clear an 80 foot wide right-of-way, and is not compatible with the following planned residential land uses:
- (a) Laurel Woods subdivision which is immediately adjacent to the alternate route, (b) Grassy Hill Road subdivision which is located in the path of the right-of-way, (c) a proposed 50 lot subdivision which is located in the Painter Hill Road area. (PFEC Ex. 1 p. 47; DEP letter p. 6; tr. 4-13 p. 10, 11; tr. 4-15 p. 168, 169)
67. The impact of the proposed and alternate routes on recreational open space is limited but the impact is somewhat greater in magnitude along the alternate route than the proposed route. Although the town has no present plans for development, the Carmel Hill route would pass through and bisect a portion of designated open space in the Town of Southbury-The Janie Pierce Tract. While the Shepaug-Bates Rock route will traverse the southeast edge of George Waldo State Park, DEP has no plans at present for the development of this park as a public recreation area. (tr. 4-13 p. 10, 11, 14, 15; DEP letter)
- D. Visual
68. The Carmel Hill-Bates Rock alternate would have a greater visual impact than the proposed route. (DEP letter)
69. The alternate route proposes the cutting of a new corridor which would require clearing 80 feet of vegetation for 7.6 mile right-of-way, whereas the proposed route requires widening an existing right-of-way for only 50 feet for approximately 5 miles. (NUSCO Ex. 1 p. 38; PFEC Ex. 1 p. 47; tr. 4-13 p. 223; tr. 4-15 p. 160-169; tr. 5-5 p. 117, 205-206; DEP letter)
70. The alternate route would run adjacent to the western edge of the Woodlake Development in Woodbury where it would be visible against a wooded background and where it might become a dominant feature in the landscape. (NUSCO Ex. 1 p. 38; tr. 4-12 p. 60-61, 157-158; tr. 4-13 p. 41; tr. 4-15 p. 67, 68; tr. 4-28 p. 125, 167-168; DEP letter)
71. The alternate route would cross Route 67 in Southbury where it would be visible from a new homes. It would cross four paved roads in Woodbury, and might be seen from homes near the Route 47 crossings. In general, the alternate route follows the contours at mid-slope or the base of ridges and would be seen against a wooded background. (NUSCO Ex. 1 p. 38)

72. The visual impacts of the proposed route would be relatively insignificant because of the presence of the existing line and the remote location of most of the route. (DEP letter; tr. 4-12 p. 54-59; NUSCO Ex. 1 p. 31, 32)
73. Along the proposed Shepaug-Bates Rock route, several homes in the Meadow Brood Acres subdivision in Southbury and two west of Route 172 will have a view of the proposed and existing lines. (NUSCO Ex. 1 p. 31, 33; tr. 4-12 p. 56)
74. The proposed route crosses three public roads, Route 172, Purchase Road and East Flat Hill Road. Route 172 is the only major route with significant amounts of traffic which has a view of the transmission lines. (NUSCO Ex. 1 p. 31, 33; tr. 4-12 p. 56)
75. The proposed Shepaug-Bates Rock line would be visible against a wooded ridgetop background from selected sites on Route 67. (tr. 4-13 p. 29)
76. In the Heritage Village area in Southbury, the applicant proposes to replace two single circuit wood H-frame structures with three double circuit steel poles. Each additional pole (in this area) would create additional impact for people residing in the immediate vicinity of the pole. (tr. 4-12 p. 38)
- E. Structures
77. From Shepaug to Bates Rock, the applicant proposes to use two-pole wood H-frame tangent structures, and three-pole wood angle structures through Heritage Village where three double circuit steel single pole structures are proposed. (NUSCO Ex. 1 p. 15; tr. 4-12 p. 37, 38, 135-137, 117)
78. The applicant proposed to widen the present Shepaug-Bates Rock route to the north and west by approximately fifty feet, except through Heritage Village where no widening is proposed. (NUSCO Ex. 1 p. 15; tr. 4-12 p. 38, 54, 55)
79. The proposed route through Heritage Village would require the replacement of two H-frame structures with three double circuit steel pole structures, and the replacement of two three-pole angle structures with two single pole angle structures. The height of the double circuit steel pole structures would range from 80 feet to 97 feet. (NUSCO Ex. 1 p. 15, 17, 35; tr. 4012 p. 38, 56, 139)

80. Use of four double circuit steel poles along the 2000 foot Heritage Village section rather than the proposed three steel poles would allow the pole height to be reduced to approximately 78 feet which is the average height of the existing structures. (NUSCO Ex. 6 question 14, 15)
81. The reconstruction through Heritage Village would necessitate a temporary 115 kV line near the edge of the right-of-way. The temporary line would be needed for about three months. (tr. 4-12 p. 161; tr. 5-5 p. 240-241)
82. Approximately forty-eight new structures will be required for the new line. (NUSCO Ex. 1 p. 32, 43; tr. 4-12 p. 40, 189)
83. Cahn Engineers, Inc., recommended the following construction for the proposed line:

<u>STRUCTURE #</u>	<u>CONSTRUCTION</u>
5275-5295	Single Circuit H-Frame
5296-5299	Double Circuit steel poles
5300-5303	" " wood "
5304-5306	" " steel "
5307-5314	" " wood "
5315-5321	" " 3-pole wood H-frames

- (PFEC Ex. 1; tr. 4-12 p. 47, 48, 49; tr. 4-15 p. 46, 47; NUSCO Ex. 16)
84. The modifications suggested by Cahn Engineers, Inc., would add from \$500,000 to \$870,000 to the cost of the proposed line. (PFEC Ex. 1 p. 1; tr. 4-12 p. 49)
85. The double circuit three pole H-frame structures from #5314 to #5321 would require an initial thirty feet of clearing of new right-of-way instead of fifty feet of new right-of-way clearing required for the proposed double circuit line. Once the temporary line is removed, only about twenty feet of new right-of-way would have to be maintained if three-pole H-frame structures were used. (tr. 4-12 p. 57; tr. 4-19 p. 196; tr. 4-26 p. 114; tr. 5-5 p. 248-251; NUSCO Ex. 27)
86. Cahn Engineers, Inc., recommended the use of double circuit three pole H-frames from structure 5315 to Bates Rock Substation (5321). (tr. 4-26 p. 114; tr. 4-19 p. 196; PFEC Ex. 1 p. 4, 5)
87. Testimony indicates that there may be engineering and maintenance problems associated with three-pole wood H-frame structures. Construction of three pole H-frames would also require the construction of a temporary line. (tr. 5-5 p. 249)

88. A single wood pole angle structure for the proposed line east of Purchase Road would be about twenty feet higher than the existing structures. A single pole would require less widening of the right-of-way and be environmentally preferable. (tr. 4-13 p. 66-70; tr. 4-15 p. 55; tr. 4-26 p. 72)
89. It would be possible to reduce the number of poles at the angles east and west of Route 172 from six to two at each angle by using single circuit wood poles with a vertical line configuration. As a result of this modification, the poles would be about twenty feet taller than the existing structures. (PFEC Ex. 1 p. 29 fig. 5C; tr. 4-15 p. 53, 54; tr. 4-19 p. 209-210)
90. Owners in the Meadow Brook Acres area prefer the two single circuit wood angle structures with the vertical configuration to the two proposed three-pole angle structures because there would be four fewer poles at each angle and the lines would be further from their homes. (tr. 4-12 p. 80-90, 169; PFEC Ex. 1 p. 29)
91. The single circuit wood pole angle structures (structures #5300 to #5303) east and west of Route 172 are preferable to double circuit single steel poles because they would be lower and have a less massive appearance. (tr. 4-19 p. 209-210)

#### IV. COSTS

92. The cost of the proposed line from Shepaug to Bates Rock is estimated to be \$1,224,000 in 1979 dollars. Of this total, \$174,000 is the estimated cost of the right-of-way acquisition. (NUSCO Ex. 21)
93. The cost of the alternate line from Carmel Hill to Bates Rock is estimated to be \$2,204,000 in 1979 dollars. Of this total \$1,015,000 is the estimated cost of the right-of-way acquisition. (NUSCO Ex. 21)
94. With the Plumtree autotransformer added into the calculations, the cost of the proposed line is estimated to be \$2,399,000 and that of the alternate line \$2,521,000. (NUSCO Ex. 21)
95. The estimated cost of undergrounding a 115 kV line between Shepaug and Bates Rock is approximately \$4,500,000 or about \$3,276,000 more than the estimated \$1,224,000 cost of the proposed overhead line. (NUSCO Ex. 1 p. 20)

96. The angle at Purchase Road (structure no. 5285) could be accomplished with a twenty foot higher single pole and with no significant change in cost. (tr. 4-13 p. 66-70; tr. 4-15 p. 55)
97. The existing and proposed angles at structures no. 5300 and 5303 could be accomplished with single pole wood structures. The result would be two rather than six poles at each angle. This would increase the cost of the proposed line by \$20,000. (tr. 4-15 p. 53, 54)
98. The installed cost of a typical 115 kV double circuit steel pole structure with a 90 foot pole is estimated to be \$20,000 in 1979 dollars. (NUSCO Ex. 20)
99. The installed cost of a typical 115 kV double circuit steel pole structure with a 70 foot pole is estimated to be \$18,700 in 1979 dollars. (NUSCO Ex. 20)
100. Three double circuit steel pole structures with 90 foot poles would cost an estimated \$62,700. Four double circuit steel pole structures with 70 foot poles would cost an estimated \$74,800. Using four of the lower poles rather than three of the taller poles through Heritage Village would add \$12,100 to the estimated cost of the proposed line. (NUSCO Ex. 20)
101. The installed cost of a typical 115 kV single circuit H-frame structure is estimated to be \$8,500 in 1979 dollars. (NUSCO Ex. 20)
102. The installed cost of a typical 115 kV double circuit wood H-frame structure is estimated to be \$12,700 in 1979 dollars. (NUSCO Ex. 20)
103. The installed cost of a double rather than a single circuit wood H-frame line would be an additional \$4,200 per structure. For the seven structures (#5313-5319) the additional cost of the double circuit structures would be \$29,400. (NUSCO Ex. 20)
104. The typical costs per mile of 115 kV construction are estimated to be \$154,000 for single circuit H-frame lines and \$273,000 for double circuit H-frame lines. (NUSCO Ex. 19)
105. NUSCO contends that the cost to construct a double circuit H-frame line for 0.9 miles between Heritage Village and Bates Rock is \$246,000. This is .9 times \$273,000. (NUSCO Ex. 27)
106. NUSCO contends that the cost to construct a single circuit H-frame line for 0.9 miles between Heritage Village and Bates Rock is \$140,000. This is .9 times \$154,000. (NUSCO Ex. 27)

107. The installed cost of the seven double circuit H-frame structures needed for this 0.9 miles is estimated to be \$88,900 (i.e. \$12,700 x 7). Subtracting this from the \$246,000 total cost leaves \$157,100 for the cost of the conductors and related hardware. (NUSCO Ex. 20 & 27)
108. The installed cost of seven single circuit H-frame structures for this 0.9 miles is estimated to be \$59,500 (i.e. \$8,500 x 7). Subtracting this from the \$140,000 total cost leaves \$80,500 for the cost of conductors and related hardware. (NUSCO Ex. 20 & 27)
109. Based upon the costs sited above NUSCO's computation of \$246,000 as presented in Exhibit 27 does not credit the construction of a double circuit H-frame line with the one set of conductors which would be reused from the existing line. (Findings 13-17)
110. The estimated cost for installation and removal of a temporary line for seven structures on the ledge between Heritage Village and Bates Rock is \$73,000 in 1979 dollars. (NUSCO Ex. 27)
111. The estimated costs for removal of existing line and for loss of useful life of existing section of line is \$19,000 for seven structures on the ledge between Heritage Village and Bates Rock. (NUSCO Ex. 27)
112. The use of double circuit H-frames rather than single circuit H-frames for seven structures on the ledge between Heritage Village and Bates Rock would result in a twenty foot narrower right-of-way and a savings in right-of-way costs of \$12,000. (NUSCO Ex. 27)
113. For the seven structures (#5313-5319) the estimated additional costs of a double circuit H-frame line rather than a single circuit H-frame line are as follows:

construction	\$29,400
temporary line	\$73,000
removal of existing line	\$19,000
right-of-way	-12,000

TOTAL  
\$ 109,400

(Findings 103, 110, 111, 113)