April 13, 2007

S. Derek Phelps
Executive Director
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06051

Dear Mr. Phelps:

As one who was closely involved with electric transmission and the work of the Connecticut Siting Council for many years, I read with great interest the recently published "Connecticut Siting Council's 2007 Life Cycle Costs of Electric Transmission Lines" (LCC) report. I was struck by how much the scope of the report has grown since the Council's first life cycle report in 1996. The new report reflects the depth and breadth of the technical information developed by the Council in its recent Dockets concerning the Southwestern Connecticut improvements, and it will provide a useful reference source for future dockets. Congratulations are due the Council and its consultant, KEMA, for an overall thorough and professional job.

I was also pleased to read Chairman Caruso's invitation to the citizens of Connecticut to "challenge the analyses contained" in the report, because I did note what appear to be a few serious errors that should be corrected or acknowledged before the report is relied upon in future proceedings. I hope that you will find my comments on these apparent errors, set out below, to be helpful. I am submitting the traditional original and 20 copies of this letter (I believe this is the correct number), so that it may be conveniently distributed to the members of the Council and the staff.

Section 3.3 of the Life Cycle Cost report:

> The report properly takes into consideration the limited ampacity of any available 345-kV underground HPFF or XLPE cable relative to the ampacity of bundled 1590-kcmil ACSR conductors by comparing the installed cost of two 345-kV underground cable circuits to one overhead 345-kV transmission line. The Council is aware that the combined ampacity of a parallel set of two of the largest underground 345-kV cables presently available is still less than the ampacity of the bundled 1590-kcmil ACSR overhead conductors presently used in new 345-kV overhead transmission line construction; therefore, to establish a more accurate cost comparison it is appropriate to consider the cost of multiple 345-kV underground cable circuits.

The same type of analysis must also be made when comparing the installed costs of a 115-kV overhead transmission line to that of an underground transmission cable circuit with the approximate equivalent ampacity ratings. The report compares the costs to install a single 115-kV underground cable circuit with 1750-kcmil copper conductors to that of a single 115-kV overhead transmission line with 1590-kcmil ACSR conductors. I believe NU's present standard is to install a single 1590-kcmil ACSR conductor on a 115-kV overhead transmission line which is part of the interconnected bulk power system and not a radial transmission line to a single or multiple substations. The equivalent ampacity of a 115-kV overhead transmission line with single 1590-kcmil ACSR conductors is more similar to that of two 115-kV underground cable circuits with 1750-kcmil copper conductors. It would be more appropriate for Table 3.6 to list the costs to install two 115-kV underground transmission cable circuits with 1750-kcmil copper conductors rather than a single underground cable circuit with 1750-kcmil copper conductors against the costs to install a single 115-kV overhead transmission line with 1590-kcmil ACSR conductors.

Section 3.3, Tables 3.6 and 3.7:

The installed costs of 115- and 345-kV HPFF underground transmission cables in Table 3.6 and Table 3.7 do not appear to pass a sanity check. Table 3.7 indicates that the total cost to install two 2500-kcmil copper 345-kV HPFF underground transmission cables is approximately the same as the total cost to install a single 1750-kcmil copper 115-kV HPFF underground cable (Table 3.6). The report appropriately documents that the 115-kV HPFF cost estimate was provided by UI and is for a shorter line in an urban environment, factors which would certainly increase the per mile cost. However, even allowing for this, I believe the total cost to install a single 115-kV HPFF underground cable circuit would be appreciably lower than those for two 345-kV HPFF underground cable circuits. The material cost of a single 345-kV cable is significantly greater than that of a 115-kV cable of equivalent conductor size by a factor of 1.2. The 345-kV underground transmission line includes the cost to procure, weld, and install the second pipe; the cost to pull a second underground cable circuit in the pipe; the cost to splice the second cable circuit in each splicing manhole; the cost of the second set of substation termination pot heads; the cost of the second insulating oil pressurization equipment; and the cost to pull vacuum and fill the second pipe with insulating oil. Combined, these costs are significant and do not apply to the case of a single 115-kV underground transmission cable. I agree with the report's statement that the cost to install a 115-kV underground transmission cable in an urban environment is appreciably greater than in a suburban environment; however, I cannot envision how the greater urban construction costs could approach the costs of installing two 345-kV underground transmission circuits in a common trench.

Section 5.2:

Section 5.2 states in part: "[E]ngineering technology exists to build a line in most any configuration desirable at any location." Had this LCC report been published prior to the Middletown – Norwalk Project Hearings, Docket 272, those communities which preferred a 345-kV underground transmission line in specific areas would have consistently referenced this statement. It's easy to interpret the statement to read that it's technically feasible to build a hybrid circuit in virtually any configuration, with many "porpoisings". The statement, especially because it includes the word *most,* must be challenged and at a minimum should include a limiting phrase such as: within the limits of physics or within the limits of electrical engineering. The owner of the hybrid transmission line must be able to energize the line and be able to transmit power over it. The hybrid transmission line must satisfy design and operating objectives while having no adverse impact on New England's, Connecticut's, or the nation's interconnected bulk power system. A hybrid transmission line with an unlimited number of transition stations or "porpoisings" will fail to meet any reasonable set of design and operating objectives. The number of "porpoisings" allowable along a hybrid transmission line is dependent on the line's location within the interconnected bulk power system, its length, the strength of the system behind each of the hybrid line's termination points, the length and capacitive reactance of each cable section, the amount of reactive compensation required to maintain system voltages within acceptable voltage levels, and the severity of transient and harmonic voltages during and immediately following NERC, NPCC, and ISO-NE recognized contingencies.

Section 8.3, Figure 8.3:

The magnetic field profiles for a typical 115-kV HPFF underground transmission cable circuit as shown in Figure 8.3 is incorrect and high by a factor of approximately ten. It is not appropriate to neglect the cancellation effect of the steel pipe when calculating the magnetic fields of HPFF cables. The peak magnetic field levels directly above buried HPFF cables would be in the range of 3 to 5 mG, not 30 – 45 mG as shown in Figure 8.3. I am cognizant that there is a footnote which states that the magnetic field profile illustrated in Figure 8.3 does not fully account for the magnetic field attenuation afforded by the steel pipe. Internationally, HPFF underground cables are always installed in steel pipes, and to ignore the attenuation effects of the steel pipe portrays the presence of an incorrect level of magnetic fields directly above the HPFF underground transmission cable circuit. Figure 8.3 should be corrected to account for the cancellation effect of the steel pipe.

I hope that the above comments are sufficiently clear. If required, I will meet with your consultant, the Council, the Council's staff, or provide additional written material in support of my comments.

Again, I thank Chairman Caruso for the opportunity to provide comment on the Connecticut Siting Council Life Cycle Costs of Electric Transmission Lines report.

Sincerely,

Roger Zaklukiewicz

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