DOCKET 370 – Consolidated proceeding pursuant to the Connecticut Energy Advisory Board (CEAB) Request for Proposal (RFP) process under C.G.S. §16a-7c. **Original application:** The Connecticut Light & Power Company application for Certificates of Environmental Compatibility and Public Need for the Connecticut Valley Electric Transmission Reliability Projects which consist of (1) The Connecticut portion of the Greater Springfield Reliability Project that traverses the municipalities of Bloomfield, East Granby, and Suffield, or potentially including an alternate portion that traverses the municipalities of Suffield and Enfield, terminating at the North Bloomfield Substation; and (2) the Manchester Substation to Meekville Junction Circuit Separation Project in Manchester, Connecticut. **Competing application**: NRG Energy, Inc. application pursuant to C.G.S. §16-50*l*(a)(3) for consideration of a 540 MW combined cycle generating plant in Meriden, Connecticut.	**CAOPLC Response To CSC Findings of Fact** **February 16, 2010**

ERRATA VERSION -- typographic corrections only; no new content was added.

Citizens Against Overhead Power Line Construction respectfully submits the following as our response to the CSC's draft Findings of Fact for docket 370.

CAOPLC first received the proposed CSC Findings of Fact via email from Lisa Fontaine on 2-10-2010 at 12:09 p.m. We wish to note that from the time of our first receipt of the CSC's FOF document, we have had only four working days[1] to analyze, write and physically prepare and deliver our comments. To apply some simple arithmetic to this issue, the CSC has allotted parties and intervenors approximately 5 minutes (4.93 exactly) to respond to each of the 365 findings of fact. This number assumes a working day of 7.5 hours x 4 days = 30 hours. There are 60 minutes per hour, so 60 minutes x 30 hours = 1,800 minutes divided by 365 findings of fact is 5 minutes per finding. We also noted that in prior dockets, for example docket 272, attorneys have voiced the same complaint about the CSC's practice of allowing insufficient time to respond.

CAOPLC would like to be on record that we feel that 5 minutes per finding of fact is insufficient time to fully review and look up the appropriate reference points in the testimony and in the voluminous applicant's materials for docket 370. We have nonetheless endeavored to provide the most accurate and complete commentary we are able to in the time so allotted to CAOPLC by the CSC.

Our response starts with what seems to be a logical place to begin, the established definitions of "fact." We researched the following definitions for "fact":

- A piece of information about circumstances that exist or events that have occurred.

- **A thing done; an action performed or an incident transpiring. An actual or absolute reality, as distinguished from mere supposition or opinion.** This definition is the definition for "fact" found in Black's law Dictionary.

- **A statement or assertion of objectively verified information about something that is the case or has happened**.

- An event known to have happened or something known to have existed.

- A concept whose truth can be proved; as in, "scientific hypotheses are not facts."

[1] One of which was President's Day, a legal holiday.

Our intent is not to be pedantic in our mention of the definitions for "fact." We think this reference point is appropriate because many of the proposed findings in the draft document do not seem to CAOPLC to follow with the established definition of "fact or facts," especially the Black's law definition of "fact." We have tried to address our comments and follow the guidelines set forth in the CSC's cover letter:

> "parties and intervenors may identify errors or inconsistencies between the draft findings of fact and the record."

We have both footnoted and directly annotated the finding of fact document. In order that CAOPLC'S comments are easily identified, we have used the **Arial MT Bold** font in 10 point type for our responses directly inserted within the CSC FOF document. We have omitted all sections in which we do not provide commentary.

General Comments

CAOPLC finds that there is a paucity of factual material included in the CSC FOF document from either the Town of East Granby's testimony or the Town of Suffield's testimony. With regard to the testimony submitted by CAOPLC, in the limited time we had to examine the FOF document CAOPLC could not find references to our testimony, or our supporting materials nor our requests or motions made to the CSC. To CAOPLC, viewed strictly from the material contained in the FOF document, it seems that we were not present at the GSRP hearings and provided no information or commentary worthy of consideration or any material that compared and contrasted with the testimony presented by CL&P in the GSRP's evidentiary proceedings and record. There are only two proposed FOF references to CAOPLC and they are to reference CL&P's answers to two of CAOPLC interrogatory questions. (See FOFs 174 and 283)

Perhaps that will change when we read the CSC's final decision and opinion but we feel that in order for the CSC to comport with and fully discharge its statutory obligations, some of CAOPLC's testimony and supportive materials should receive proper consideration and find their way into the GSRP docket's findings of fact

Specific Comments

EMFs

With regard to EMFs, CAOPLC finds that the proposed Findings of Fact as they relate to the evaluation of EMFs exposures and the proposed EMF Best Management Practices, and the GSRP's estimated EMF exposure levels (which are not by definition factual information, but only estimates) and all of CL&P's calculations to support its mitigation efforts are based on the "edge of the right of way" standard which is not consistent with the record and testimony. Nor is it based on, or responsive to, the actual, factual and real world situation that is present in East Granby and Suffield. CAOPLC agrees that edge of ROW EMF mitigation is appropriate in difference localities, those areas where the right of way does not have activity.

But, by using the definition, "**An actual or absolute reality, as distinguished from mere supposition or opinion"** and "**A statement or assertion of objectively verified information about something that is the case or has happened,**" the fact is this solution does not and will not work to protect residents health and safety in East Granby and Suffield because actual human EMF exposures occur where people congregate[2]. EMF exposures presumably increase with both frequency of exposure and the duration of

[2] CL&P's EMF discussion in the GSRP application, Volume 1 of 11, section EMF O-6 and O-7 stated "Any application must include an assessment of the impacts of any electromagnetic field produced by the proposed

the time exposed, and most importantly the level or magnitude of EMF radiation measured in milliGauss or mG. (Testimony of Dr. William Bailey in docket 370 and, by incorporation, from docket 272 and 217). The CL&P's EMF levels which are indicated in the CSC's proposed findings of fact in FOF #295, on page 42 is:

> FOF #295. Options to reduce magnetic fields along the 3.2-mile "focus area" of the GSRP Northern Route include:

Configuration	Max. level on ROW* (mG)	% reduction-west edge	% reduction-east edge	% cost increase
Base line	269.2	-	-	-
H-Frame +20'	179.5	3%	2%	0.4%
Delta	173.4	24%	22%	1.6%
Delta +20'	82.8	33%	27%	3.0%
Vertical	149.7	34%	24%	2.6%
Vertical +20'	72.5	45%	29%	3.5%
Split phase	77.0	90%	85%	10.1%
345/115-kV composite	132.0	20%	34%	11.0%

> (CL&P 1, Vol. 1, Appendix O-1, p. 12; CL&P 19, R. OCC-001-SP02)
>
> ***Typical location on the ROW for maximum magnetic field levels is directly underneath the conductor mid-span between the structures**. **(EMPHASIS ADDED)***

Starting with CAOPLC's written commentary to the CSC in its application for party status in docket 370, and in our testimony and exhibits and in our final brief to the CSC, CAOPLC has consistently tried to communicate, and specifically draw the CSC's attention to the actual FACT that throughout East Granby and Suffield, there exists a significant population of residents who will cross under the power lines in our daily activities and when we ingress and egress our properties. With no more than two or three homes excepted, the residents of the entire Wyncairne subdivision in East Granby will cross under the power lines a number of times each day.[3, 4]

---

transmission line including routes in proximity to residential areas, private or public schools, licensed child day care facilities, licensed youth camps and public playgrounds" (BMP page 4) and "electromagnetic field impacts on public health and safety" (§16-50 p(a)(3)(B)) **This is to be met by taking measurements of existing electric and magnetic fields at the boundaries adjacent to the above facilities** …"**Emphasis added.** It stands to reason that if no boundaries exist (see footnote 3 below) then the standard required by (§16-50 p(a)(3)(B)) is not met and cannot be met. Alternatively, if one wants to have an EMF reading, the Max level readings on the ROW would be operative. The FOF should note that the CT DPH commentary in docket 370 from Dr. Gary Ginsburg references CT DPH's standard of 3 to 4 mG as the safe range for EMF. Beyond that threshold, CT DPH feels there is an elevated risk for childhood leukemia.

[3] Here is the statement made in CAOPLC's final brief to the CSC**: "It has been frustrating that our pleas to CL&P have been ignored to understand that measuring EMFs at the edge of the ROW are, for many residents and their children, meaningless calculations because so many of us have to go under the power lines in our daily routines. We hope this one last statement does resonate and that our pleas and fears about excessive EMFs directly under the power lines are heard and addressed by the CSC. And we do respectfully want to bring to the CSC's attention that the Bio-Initiative report has been noticed and is included in the record. (See Reference exhibit seven.)"**

[4] See also FOF, #286 and 2877 on page 40. With regard to EMF mitigation, the fallacy and inappropriateness of measuring EMF ROW "buffer zone" mitigation and using "buffer zone" mitigation as the standard metric for a best management practice solution in the East Granby and Suffield areas, and for EMF levels at ROW statutory facilities

EMFs and Statutory Facilities

- CAOPLC notes that while FOF #285 on page 40, is technically correct in saying that no child care center(s) exist next to the proposed GSRP right of way, to be factually correct, it should also say "at this specific time." The most factual and accurate information is that a business, File of Life, a non-profit corporation, (http://www.folife.org/) has obtained a CT business license for a child care center and is in the process of being certified to run a day care center for its employees. FOL expects its day care to be operational well before construction begins on the GSRP and most definitely before the lines are energized.[5] The child care center will be less than 300 hundred feet from the GSRP ROW.

- CAOPLC specifically mentioned in its October 2009 testimony, lines 269 to 274, that the Suffield Sportsman's Club (SSC) sponsors a number of recreational events in which children are present. No mention is made of this factual information and testimony from CAOPLC and no attempt has been made to ascertain if the SSC is or is not a statutory facility. In order for the CSC to comport with and fully discharge its statutory obligations, these two items must be addressed.

Issues Not Addressed

If the CSC's stated goal is that of a fair and transparent evidentiary hearing, CAOPLC feels it is important to note the issues and concerns that were raised in testimony and incorporated into the GSRP record, that have not found their way into the proposed Findings of Fact. We do not understand why they are not incorporated; perhaps the CSC could offer a rationale or commentary as to why they are not.

- Lethality Zones. CAOPLC's testimony and final brief sought to prohibit the practice of siting transmission towers so close to homes that if a tower should fall for any reason, the home and its occupants are put in peril. If this issue is more properly addressed in the D&M stage, we would agree to defer it until then.

- Property values, diminished value, diminished grand lists and tax bases. The CSC has not thus far addressed these issues. Testimony from CAOPLC and the towns of East Granby and Suffield indicated that severe economic burdens are being disproportionally placed on a few ROW property owners and abutting property owners and that CL&P refuses to address any form of compensatory remedies.

- Consolidation. CAOPLC in its testimony and final brief asked that all of NEEWS be evaluated as a consolidated docket so that any available solutions that come into play because of project scale, such as HVDC technologies and transmission lines are given proper and thoughtful consideration. CAOPLC testified and noted in its brief that we feel the CT consumer and ratepayer are put at a severe disadvantage by not considering NEEWS holistically. This viewpoint and position should be referenced, at least as a counterpoint to CL&P's testimony somewhere in the FOF document.

- Independent Consulting Engineer peer review. CAOPLC testified and reaffirmed in its brief that we believe the CT ratepayer would benefit from this type of detailed professional

---

is not consistent with the testimony presented by CAOPLC and the Selectmen of East Granby and Suffield that in actuality a "BUFFER ZONE" DOES NOT EXIST in and around the GSRP ROW. (CAOPLC testimony July 28, 2009, East Granby and Suffield testimony)

[5] Various letters (the most recent was sent on 2-12-2010) to CSC from Chet McGurk of FOL. The original McGurk letter was attached as an exhibit to CAOPLC's final brief to the CSC.

review. CAOPLC further noted in its final brief that in docket 272 the CSC did contract for and consider an independent review. That docket 272 review was done by KEMA but in docket 370, a review was not considered necessary or desirable.

CAOPLC feels the above issues are substantive in nature and should be addressed and resolved before the CSC issues its final decision. We submit these comments this 16th day of February, 2010.

Respectfully submitted,

Richard Legere, ARM
Executive Director
Citizens Against Overhead Power Line Construction

Notice of Service

I hereby affirm that a photocopy or email of this document was sent to each Party and Intervenor on the service list dated 11-13-2009.

Signed: _____

DOCKET 370 – Consolidated proceeding pursuant to the Connecticut Energy Advisory Board (CEAB) Request for Proposal (RFP) process under C.G.S. §16a-7c. **Original application:** The Connecticut Light & Power Company application for Certificates of Environmental Compatibility and Public Need for the Connecticut Valley Electric Transmission Reliability Projects which consist of (1) The Connecticut portion of the Greater Springfield Reliability Project that traverses the municipalities of Bloomfield, East Granby, and Suffield, or potentially including an alternate portion that traverses the municipalities of Suffield and Enfield, terminating at the North Bloomfield Substation; and (2) the Manchester Substation to Meekville Junction Circuit Separation Project in Manchester, Connecticut. **Competing application**: NRG Energy, Inc. application pursuant to C.G.S. §16-50*l*(a)(3) for consideration of a 540 MW combined cycle generating plant in Meriden, Connecticut.	}	Connecticut Siting Council February 11, 2010

CAOPLC Suggested Corrections to DRAFT Findings of Fact

- FOF # 30 NEEWS consists of four separate **but interrelated**[6] projects that would alleviate the deficiencies in the SNE transmission grid. The projects include:
  a. The GSRP and MMP – the subject of Docket No. 370A
  b. The Interstate Reliability project – a new 345-kV line from Millbury Switching Station in Massachusetts owned by National Grid to its West Farnum Substation in North Smithfield, Rhode Island, to CL&P's Lake Road Substation in Killingly, Connecticut and Card Street Substation in Lebanon, Connecticut.
  c. The Central Connecticut Reliability Project – a new 345-kV line from CL&P's North Bloomfield Substation to its Frost Bridge Substation in Watertown, Connecticut.
  d. The Rhode Island Reliability Project – A National Grid project entirely within the State of Rhode Island. This project would not come before the Council.
  (CL&P 1, Vol. 1, pp. F-10, F-11)

- Following its "Needs Analysis," the SNETR working group analyzed transmission solutions to satisfy the identified needs for every concentrated load area of SNE. Their draft report, which discussed detailed solution options for each area, was published by ISO-NE on its website in April 2008 with the title "New England East-West Solutions (Formerly SNETR) Report 2, Options Analysis." (CL&P 1, Vol. 1, pp. F-8, F-13, F-14)

---

[6] See http://www.transmission-nu.com/residential/projects/neews/default.asp CAOPLC believes it is factually accurate to note that CL&P and NU have at times on their web site and in materials sent to the public, portrayed NEEWS as a series of interrelated transmission projects. But in CL&P's docket 370 materials, NEEWS is defined only as four stand-alone projects. If this inconsistency is responsible for preventing the consolidated review of the NEEWS projects,, it should not be a barrier to that beneficial and holistic review.

The CL&P web site states:

"New England East-West Solution (NEEWS) is four related transmission projects developed by a working group of planners from Northeast Utilities, National Grid and ISO-New England. … Together the four projects are needed to solve existing problems with the transmission system."

- FOF # 63 The conductors for the new 345-kV overhead line would consist of three bundles of two 1,590-kcmil aluminum conductors with steel reinforcement (ACSR). An overhead lightning shield wire would be installed above the line for protection; it also would contain optical glass fibers for communication[7]. (CL&P 1, Vol. 1, p. I-2)

- FOF #64 The **proposed base line design** supports for the new lines would be steel or wood-pole H-frame structures with the conductors configured horizontally. They would be approximately 90 feet in height, and spaced 570 feet apart, on average, although the spans would vary, due to the terrain. The maximum span length proposed is 1,136 feet. (CL&P 1, Vol. 1, p. I-4; CL&P 5, R. CSC-036)

Segment 2

- FOF #69 The Segment 2 ROW is 7.2 miles in length and approximately 305 feet in width. The existing transmission line facilities along the Segment 2 ROW consist of lattice-steel towers approximately 70 feet in height supporting two existing 115-kV circuits. (CL&P 1, Vol. 1, p. I-3)

- FOF #70 The existing Segment 2 ROW is 305 feet wide with approximately 110 feet currently being maintained for the existing transmission line. The addition of the proposed new 345-kV line would increase the maintained width of the ROW to approximately 205 feet[8]. The remaining approximately 100 feet of the ROW would not be affected by the proposed project. (CL&P 1, Vol. 1, p. I-4)

- FOF #71 As in Segment 1, the new support structures would be centered approximately 75 feet east of the existing lattice towers. In this segment, however, the lattice towers would remain in place. They would continue to support the existing double-circuit 115-kV lines, except that these two lines would be reconfigured as a split-phase line for a single circuit operating from Granby Junction to the Southwick Substation in Massachusetts. (CL&P 1, Vol. 1, p. I-4)

- FOF #72 Most of the residences adjacent to the ROW in Segment 2 are along the western side of the ROW. The existing 115-kV line is approximately 50 feet from the western edge of the ROW. The proposed 345-kV line is 125 feet from the western edge. (Tr. 10, p. 82; Tr. 10, p. 81)[9]

- FOF # 73 CL&P would expand the Segment 2 ROW by approximately three acres, including 100 feet of width for a distance of approximately 1,000 linear feet between Phelps Road and Mountain Road and for 400 linear feet east of Ratley Road. CL&P would acquire the additional three acres needed from two easements in the Town of Suffield from private landowners. (CL&P 1, Vol. 1, pp. I-4; N-37)[10]

- FOF # 74 In Segment 2, CL&P has identified as a "Focus Area" approximately 3.2 miles in length – between the closest point of Country Club Lane in East Granby and the crossing of Phelps Road in Suffield – where the Council's Electric and Magnetic Field Best Management Practices (EMF BMPs)

[7] It would be more factual to note the exact type of communication – for example is it SCADA communication technology? It is commercial and/or public use communication infrastructure?

[8] Unless as noted in FOF #291, the Delta design is employed in which case the land cleared is less.

[9] As this is written it is not factual and it is misleading. It is opinion and a murky one at that because of the use of "most." What does "most" mean numerically or as a percentage? A definitive census of exactly how many homes are situated west vs. east is in order. For example, Wyncairne with the exception of two homes, possibly three, is entirely located east of the ROW. There are homes on Newgate Road and Phelps Road to the east.

[10] It should be noted that this expansion does not affect the BMP focus area.

may need to be applied. See below under the "Electric and Magnetic Field" Section for further facts. (CL&P 1, Vol. 1, p. I-4)

Cost

- FOF # 75 The estimated capital cost of the Connecticut portion of the proposed GSRP facilities including the overhead 345-kV line from the state border to North Bloomfield Substation is approximately $41,290,000, not including substation improvements. (CL&P 1, Vol. 1, p. I-15)

North Bloomfield Substation

Cost

- FOF # 81 The estimated capital cost of the proposed substation construction is $92,080,000. (CL&P 1, Vol. 1, p. 1-15)[11]

PROPOSED UNDERGROUND ALTERNATIVE ROUTES AND DESIGNS

CAOPLC ANNOTATED COMMENTS FOR UNDERGROUND CABLE SECTION:

It is factually incorrect to generalize and incorporate both HVAC underground technologies and HVDC technologies into one commentary on underground technology. To be accurate, this section should make reference to only HVAC underground systems.

The problems noted below are not associated with HVDC systems (which admittedly have different issues to be overcome when integrated with HVAC lines) and the testimony from CAOPLC referencing materials from ABB shows this. HVDC Light transmission lines for example do not use splice vaults. They do not require deep trenching. HVDC is a "no EMF" technology. (See CAOPLC exhibits of the Murray Link project from ABB and October 2009 testimony.)

The entire Environmental Impact section is factually incorrect and not consistent with the dockets record unless it is corrected as shown to the use the phrase "**HVAC** transmission lines"**.**

Underground cable systems
Technical Features

- FOF #102 Underground **HVAC** transmission systems consist of buried electric cables and splice vaults that are installed at specific intervals. Underground electric cables may be used in situations when overhead transmission lines are undesirable or impractical due to environmental, social, construction, or regulatory issues. (CL&P 1, Vol. 1, p. H-7)

- FOF # 103There are several differences between the technologies of overhead lines and underground cables for electric transmission:

[11] While it is factual, it is misleading to not prominently combine the power line and sub-station cost and show it as $133,370,000. CT DPH mentioned this in its testimony that a "low balling" of cost figures was done by CL&P to reduce the 4% baseline for EMF mitigation. CAOPLC feels that it is appropriate to add not only the $133,370,000 construction cost but ALSO the 27% regionalized cost for the whole of the GSRP project that ISO-NE apportions ("socialized" was the term the CSC used) to CT ratepayers. That cost would be estimated at $200,000,000 giving CT rate payers at total cost for GSRP of $333,000,000. If 4% were applied to that number, $13.3 million would be available for EMF mitigation.

a. Underground cables are typically installed over short distances in urban environments with strong electrical sources. Cables installed over long distances or in suburban and rural settings require consideration to prevent damage and disruptions to the transmission system and potential damage to customer equipment.
b. **HVAC** Underground cables have a much lower current-carrying capacity compared with overhead lines. Therefore, multiple underground cables are required to achieve the same power-transfer capacity as an overhead line.
c. The capacitive charging currents of an **HVAC** underground cable system (the currents necessary to maintain a high level of power transfer) are significantly higher than those of overhead lines. The higher **HVAC** capacitive currents, in turn, are associated with higher voltages. For medium and long length underground **HVAC** 345-kV cable systems, special switching devices and large shunt reactors may be required to compensate for this difficulty in order to prevent unacceptably high system voltages from disturbing power flows during normal operating conditions.
d. For **HVAC** underground cables installed in isolated segments within an overhead 345-kV circuit, a two to four acre transition station must be installed at the location where the two technologies meet.
e. Also, in such **HVAC** hybrid transmission circuits, the special devices necessary for managing the underground segments may affect the overall dynamics of power flow such that excessive voltages build up and damage the cable itself, other electrical equipment associated with the overhead portion of the system, and potentially customer equipment.
f. The special charging and dynamic characteristics of underground and hybrid **HVAC** systems mean that whenever underground cables are contemplated for use in a given location special studies must be conducted to determine the maximum length of cable feasible to install without adverse effects on the New England transmission system overall.

(CL&P 1, Vol. 1, pp. H-8, H-9; CL&P 15 Carberry/Newland, p. 25)

- FOF # 104 Typical operation of a transmission system includes daily energizing and de-energizing of the circuits, as well as frequent energizing/de-energizing transformers in response to customer loads. At these times, conditions on hybrid **HVAC** cables/lines can be particularly problematic for system operators, on account of their special characteristics, and the operators' response time is slow. (CL&P 1, Vol. 1, pp. H-10, H-11; CL&P 4, R. CSC-016)

- FOF# 105 The complexity of underground **HVAC** transmission cables by themselves, and especially when integrated with overhead lines in "hybrid" systems, merits special attention to system reliability. (CL&P 15, Carberry/Newland, p. 25)

- FOF # 106 The failure of an underground **HVAC** cable would result in extended repair time. A fault in an underground cable typically damages the cable. Following identification of the fault, the repair time for a cable can take weeks to complete, compared to hours or a few days for most overhead transmission lines. For this reason, a 345-kV **HVAC** underground circuit would be constructed with two cables per phase plus a spare cable that would be available if one was out of service. (CL&P 1, Vol. 1, p. H-11; Tr. 7, pp. 84, 85; CL&P 15, Carberry/Newland, p. 25)

HVAC Environmental Impacts

- FOF # 107 The construction of a new 345-kV **HVAC** underground cable would require a 40-foot to 60-foot wide work area. Additionally, **HVAC** splice vaults (approximately 10 feet wide x 10 feet deep x up to 32 feet long) would have to be located at approximately 1,600 foot intervals. (CL&P 1, Vol. 1, p. H-13)

- FOF # 108 While an overhead transmission line may span steep slopes, rock outcroppings, vegetation, wetlands and watercourses, an underground system requires a continuous trench and permanent access—that is, permanent vegetation clearing, including shrubs—along the entire length of the line during operation for maintenance and repairs. (CL&P 1, Vol. 1, pp. H-12, H-13, H-50)

- FOF # 109 Transmission engineers now prefer Crossed-link Polyethylene (XLPE) **HVAC** cable technology over high-pressure fluid-filled **HVAC** technology (HPFF) which was at one time a standard **HVAC** technology, in large part because it does not use insulating fluid, which can leak into the environment around the cables. (CL&P 1, Vol. 6, pp. 8-15; Administrative Notice Item 45)

- FOF # 110 Soil resources are significantly disturbed by the installation of an underground **HVAC** cable. An underground **HVAC** cable is installed in its trench in duct banks, and during the process the **HVAC** trench itself is amended to help make the cable work efficiently. The base of the **HVAC** trench and the area around the duct banks is filled with "flowable fill," a type of concrete material used for heat dissipation; then construction-grade backfill and native soil are placed on top. (Tr. 8, p. 117)

- FOF # 111 **HVAC** Underground cable systems installed in steep terrain may result in down-hill migration and overstressing of the cable and splices. (CL&P 1, Vol. 1, p. H-13)

- FOF # 112 The installation of an underground **HVAC** cable system, no matter what the setting, typically requires some in-water construction. Subsurface techniques, such as jack and bore or horizontal directional drill (HDD) may be used for some larger watercourse crossings. However, these techniques are costly and time-consuming and have significant temporary and permanent impacts on water resources, potentially including water quality. (CL&P 1, Vol. 1, p. N-55)

- FOF # 113 Most access roads will need to remain in place across existing wetlands and be properly maintained to provide access to **HVAC** splice vaults and transition stations, causing permanent impacts to wetlands. Also, where large embankments are needed for constructing wetland crossings, the width of wetland impacts may be 50 feet or greater. (CL&P 1, Vol. 1, p. H-51)

- FOF # 114 Underground transmission facilities, in any setting, have fewer visual impacts than overhead lines. However, the transition stations that are necessary for underground facilities do add visual impact. (CL&P 1, Vol. 1, p. H-51)

HVAC Underground Alternative Routes and Designs, with Environmental Impacts

All Underground HVAC In-ROW

Route and Design

- FOF # 115 An all-underground **HVAC** route along CL&P's existing overhead transmission line ROW was investigated and found to be technically feasible. (CL&P 1, Vol. 1, p. H-23)[12]

- FOF # 116 An all-underground transmission facility would consist of **HVAC** cables and splice-vaults buried entirely within the existing ROW (305-385 feet wide), adjacent to the existing 115-kV overhead transmission line. The **HVAC** splice-vaults are typically 1,600 feet apart with PVC conduits running between them along a trench 5-7 feet wide and 7-10 feet deep. There are nine 8-inch conduits for the 345-kV **HVAC** XLPE cables, three 2-inch conduits for the grounding conductors; three 2-inch conduits for the fiber-optic relaying cables; and three 2-inch conduits for the temperature-sensing fiber cables. (CL&P 1, Vol. 1, pp. H-23, H-58)

HVAC ***Environmental Impacts***

- FOF # 117 An all-underground in-ROW **HVAC** alternative would typically involve the disturbance to a 40-to-60-foot-wide section of the ROW along the 12 miles between the North Bloomfield Substation and the Connecticut/Massachusetts state border, as well as the excavation of a continuous trench and associated **HVAC** splice-vaults and would:
    a. Traverse numerous wetlands and watercourses, including the Farmington River;
    b. Disturb a total of about 100 acres of land;

[12] HVDC Light technology was not considered.

c. Adversely affect six acres of water resources by grading and trenching the permanent access road;
d. Convert an additional two to four acres at the Massachusetts border end of the underground cable system segment to utility use for the development of a transition station to interconnect the overhead and underground components of the transmission line;
e. Alter the vegetative community through permanent increase in clearing for the trench and access roads;
f. Decrease wildlife habitat (permanent vegetation removal affects birds and others, particularly less mobile wetland species such as amphibians; water resource disturbance affects fisheries).

(CL&P 1, Vol. 1, pp. H-51, N-58 to N-60)

- FOF #118 Approximately 3.6 to 4.6 miles of permanent access roads would be required for the in-ROW underground **HVAC** cable variations, compared to approximately 3.4 miles of narrower and lower-quality access roads for the **HVAC** overhead route. (CL&P 1, Vol. 1, pp. H-50, H-51)

All Underground HVAC In-Street

- FOF #119 An all underground **HVAC** in-street route was investigated for the installation of a 345-kV **HVAC** transmission cable system between North Bloomfield Substation and the Connecticut/Massachusetts border. The route would leave the North Bloomfield Substation, follow Tariffville Road east for approximately 600 feet; continue north along the existing transmission line ROW, crossing the Farmington River at Route 187/Main Street; then continue north along Route 187/Main Street for approximately 5.7 miles to Sheldon Street; east along Sheldon Street for approximately 0.5 miles to Grand Street; and north along Grand Street for approximately 4.5 miles to the Connecticut/Massachusetts border. Grand Street becomes Pine Street once it crosses the state border into Massachusetts; the route would continue north along Pine Street for approximately 0.2 miles to Barry Street; west along Barry Street for approximately 0.5 miles; and then terminate at a potential **HVAC** transition station south of Barry Street on WMECO property. (CL&P 1, Vol. 1, p. H-25)

- FOF # 120 An all-underground In-Street **HVAC** transmission facility typically consists of three splice-vaults (two per each set of three **HVAC** XLPE cables), 10 feet wide by 10 feet deep by 32 feet long, buried approximately 1,600 feet apart along the route; nine 8-inch PVC conduits for the 345-kV **HVAC** XLPE cables running between them; three 2-inch PVC conduits for the grounding conductors; three 2-inch PVC conduits for the fiber-optic relaying cables; and three 2-inch conduits for the temperature-sensing fiber cables. This **HVAC** equipment would be placed in a trench normally 5-7 feet wide and 7-10 feet deep, although the large amount of infrastructure usually already in streets makes these dimensions particularly variable. (CL&P 1, Vol. 1, pp. H-58, N-55)

- FOF #121 Installing in-street underground transmission lines minimizes damage to natural resources to a certain extent. However, adverse impacts associated with water crossings cannot be avoided. (CL&P 1, Vol. 1, p. N-55)

- FOF #122 Due to CDOT regulations, **HVAC** splice-vaults cannot be constructed in-street, meaning that any underground **HVAC** installation involving state highways would require substantial construction of such **HVAC** vaults on adjacent private property. (Tr. 16, pp. 80-82; CL&P 1, Vol. 1, pp. H-37, H-38)

Other Feasible HVAC Underground Route Variations for the GSRP Northern Route

General[13]

- FOF # 123 There are four feasible underground line HVAC variations to a portion of the proposed overhead line GSRP—Northern Route between North Bloomfield and the Connecticut/Massachusetts state border. Each of the four would avoid locating the new 345-kV HVAC transmission line in an overhead line configuration on the existing ROW in the vicinity of certain residences, while leaving the existing 115- HVAC kV line on that section of ROW unchanged. Each of the four is an alternative to the others: that is, building more than one of them would be duplicative. (CL&P 1, Vol. 1, p. H-37)

- FOF # 124 CL&P investigated HVAC underground route variations that would substitute for the proposed overhead line along the ROW between Country Club Lane and Phelps Road. Potential HVAC route variations for this area include installation of an underground HVAC cable within the existing ROW for a distance of 3.6 to 4.6 miles or installation within or adjacent to public road ROWs for a distance of 6 to 8 miles. These route variations would replace a section of the proposed overhead 345-kV line over a distance of 3.6 to 5.1 miles. (CL&P 1, Vol. 1, pp. H-28, H-29)

- FOF # 125 The two underground line HVAC variations within or adjacent to road ROWs are referred to as the Newgate Road Underground Line Route Variation and the State Route 168/187 Underground Line Route Variation. The two underground line HVAC variations within portions of the existing transmission line ROW are referred to as the 4.6-Mile in-ROW Underground Line Route Variation and the 3.6-Mile in-ROW Underground Line Route Variation. Each HVAC variation is an alternative to the proposed overhead line and to the other underground variations. (CL&P 1, Vol. 1, p. H-37)

Newgate Road HVAC Underground Route Line Variation

Route and Design

- FOF #126 The Newgate Road Underground Line Route Variation would include the installation of HVAC cables within the existing transmission line ROW for a distance of approximately 1,000 feet and then within or along Turkey Hills Road (Route 20), Newgate Road and Phelps Road. HVAC Transition stations would be located adjacent to the ROW near Granby Junction (on CL&P property) and near the ROW intersection with Phelps Road (partially on CL&P property, partially on private land). This variation would replace a 4.6 mile section of overhead HVAC line. (CL&P 1, Vol. 1, p. H-39)

- FOF # 127 Additional ROW would be required at the northern transition station near Phelps Road; temporary and permanent easements may also be required at the HVAC splice-vault locations due to conflicts with existing utility facilities or requirements of the CDOT. (CL&P 1, Vol. 1, p. H-39; CL&P 15, Carberry/Newland, p. 39)

HVAC *Environmental Effects*

- FOF #128 The Newgate Road Underground variation would be installed directly in front of the NRHP-listed Old Newgate Prison, as well as another NRHP-listed structure and a historic cemetery. There is potential for significant adverse effects on these structures. (CL&P 1, Vol. 1, p. N-65)[14]

---

[13] This is much more opinion than fact, at minimum the use of "feasible" is debatable and at odds with recorded testimony. CAOPLC offered testimony that no in-road alternative is feasible because of the potential for increased EMF exposures. Also, the Old New Prison variation risks collapse to a national historic treasure thus is arguably not a "feasible" solution. Nor are the in-road options " feasible" according to DOT and CL&P's own testimony.

Thus if CL&P had to meet a standard for providing "feasible" alternatives and viable buildable options, CAOPLC does not feel that the testimony and evidence in docket 370 supports that CL&P has met that goal.

- FOF #129 A portion of the Newgate Road route would pass by Newgate Prison, which is listed on the National Register of Historic Places and designated as a National Historic Landmark. Underground copper mining tunnels that traverse Newgate Road are part of the historic site. Additionally, stone walls that comprise Newgate Prison are within ten feet of the edge of the Newgate Road pavement and may be affected by vibrations associated with construction. The variation would also pass Viet's Tavern, which is also listed on the National Register of Historic Places. Both Newgate Prison and Viet's Tavern are within nine feet from the edge of Newgate Road. (CL&P 1, Vol. 1, p. H-41, M-2; Tr. 7, pp. 181, 182)[15]

Route 168/187 HVAC Underground Variation
Route and Design

- FOF # 130 The Route 168/187 Underground Line Route Variation would include the installation of **HVAC** cables within the existing transmission line ROW for approximately 1,000 feet and then within or along Turkey Hills Road (Route 20), North Main Street, South Stone Street (Route 187) and Mountain Road (Route 168). This variation would replace a 4.6 mile section of **HVAC** overhead line. (CL&P 1, Vol. 1, p. H-41)

HVAC ***Environmental Effects***

- FOF # 131 See Findings of Fact above for "All Underground In-Street."

4.6 Mile In-ROW HVAC Underground Line Route Variation
Route and Design

- FOF # 132 The 4.6-Mile In-ROW **HVAC** Underground Line Route Variation would minimize long-term visual effects associated with an overhead 345-kV transmission line but would result in direct and significant impacts to environmental resources. Environmental impacts occur throughout the life of the project since a permanent access road would be required along the ROW to provide access to the entire **HVAC** cable system. The variation would cross a wetland that is approximately 1,500 feet long, located north of Turkey Hills Road. Crossing this wetland using HDD may be possible but would depend on subsurface conditions in the area. Also, HDDs are costly and there is a risk of the drilling fluid returning to the surface and affecting the wetland. (CL&P 1, Vol. 1, pp. H-43, H-44)

HVAC ***Environmental Effects***

- FOF # 133 See Findings of Fact above for "All Underground In-Street."

- FOF # 134 Wetlands, including vernal pools, lie along this route. A large wetland, approximately 1,500 feet long, located north of Turkey Hills Road, would be crossed. This distance may exceed the upper limits of the HDD. Further geotechnical investigations would be needed. (CL&P 1, Vol. 1, p. H-43)

3.6 Mile In-ROW HVAC Underground Line Route Variation
Route and Design

- FOF # 135 The 3.6-Mile In-ROW **HVAC** Underground Line Route Variation was developed to reduce the wetland impacts that would be associated with the 4.6-Mile in-ROW variation. This variation would extend from a potential **HVAC** transition station site approximately 0.8 miles south of Newgate Road to a potential transition station north of Phelps Road in Suffield. The **HVAC** transition station north of

---

[14] Here CL&P supports CAOPLC'S testimony that this variation and alternative is in truth and fact not an alternative, a "feasible" and buildable alternative because of the inherent risks and flaws in the route.

[15] Same as footnote 13 above.

Phelps Road would be located partially within the transmission line ROW and partially on land owned by the State of Connecticut (Newgate Wildlife Management Area). (CL&P 1, Vol. 1, p. H-46)

- FOF # 136 This **HVAC** variation could not be built unless CL&P were able to obtain the necessary rights to build a **HVAC** transition station on this state land. (CL&P 1, Vol. 1, p. H-46)[16]

HVAC *Environmental Effects*

- FOF # 137 See Findings of Fact under the "All Underground In-ROW" section.

Cost Comparisons: **HVAC** Overhead Vs. **HVAC** Underground

- FOF # 142 A unique cost for underground **HVAC** transmission systems is associated with **HVAC** transition stations. Each one (**HVAC**)would cost approximately $15 million. (Tr. 6, p. 173)

- FOF # 143 The cost of construction of an underground **HVAC** transmission cable route along or adjacent to public roads is approximately $479 million. The estimated maintenance costs over the life of the facility would be approximately $682 million. (CL&P 1, Vol. 1, p. H-26)

- FOF #144 The cost of the proposed overhead **HVAC** transmission line project versus the underground **HVAC** variations is shown in the table below.

Route	Total CT project Cost
CT portion of North Bloomfield to Agawam 345-kV **HVAC** overhead route (as proposed)	$133,370,000
CT portion of North Bloomfield to Agawam 345-kV route (incl. 3.6-mile in-ROW **HVAC** variation)	$286,957,000
CT portion of North Bloomfield to Agawam 345-kV route (incl. 4.6-mile in-ROW **HVAC** variation)	$317,817,000
CT portion of North Bloomfield to Agawam 345-kV route (incl. Newgate Road **HVAC** variation)	$380,631,000
CT portion of North Bloomfield to Agawam 345-kV route (incl. Route 168/187 **HVAC** variation)	$455,306,000
Southern Route Alternative Underground **HVAC** Variation	$184,000,000

(CL&P 1, Vol. 1, p. H-49; CL&P 15, p. 54)

- FOF #145 Costs passed on to the Connecticut electricity consumer would be higher than that listed in the table because of the federal tariff provisions. The GSRP is expected to qualify for the New England regional transmission rates, which shares costs throughout New England. Since Connecticut uses approximately 27 percent of the New England load, Connecticut consumers would pay approximately 27 percent of the project's entire costs, regardless of how much of it is located in Connecticut. ISO-NE determines what costs would be eligible for regionalization based on specific tariff provisions. If it is feasible for a transmission line to be constructed overhead and it is instead installed underground at an additional cost, the excess cost would not be included in regional rates but would be "localized" to the ratepayers in Connecticut. Therefore, Connecticut consumers would pay 27 percent of the cost of the overhead design of the line plus 100 percent of the difference between the overhead line cost and the cost of undergrounding the line and adding transition stations. (CL&P 5, R. CSC-031; Tr. 6, p. 44)

[16] Here CL&P again supports CAOPLC'S testimony that this variation and alternative is in truth and fact not an alternative because of the inherent risks and flaws in the route.

- FOF # 146 For each of the **HVAC** underground variations along the GSRP, Connecticut consumers would pay:

Variation	Cost of Variation	Cost (above overhead)	Cost to CT consumer
3.6 miles in-ROW	$166,000,000	$153,600,000	$156,948,000
4.6 miles in-ROW	$200,300,000	$184,800,000	$188,985,000
Newgate Road	$262,800,000	$247,300,000	$251,485,000
Route 167/187	$337,500,000	$322,000,000	$326,185,000

(CL&P 5, R. CSC-031)

- FOF # 147 Construction costs of 345-kV **HVAC** underground cables along the ROW would range from approximately $37,260,000/mile to $46,104,000/mile. Installation of 345-kV **HVAC** underground cables within roads would cost approximately $37,742,500/mile. Construction of the proposed H-frame overhead **HVAC** line would cost approximately $3,440,800/mile. These cost estimates do not include substation or transition station costs. (CL&P 18, R. Suffield-005)

- FOF # 148 Currently, the typical CL&P residential customer pays 20.3 cents per kilowatt hour. The construction of the proposed overhead GSRP would increase the rate by about an eighth of a cent – 0.13 cents – to 20.43 cents per kilowatt hour. An underground variation would increase the rate by about half a cent – 0.49 cents – to 20.79 cents per kilowatt hour. (Tr. 8, pp. 276, 277)

- FOF #149 An all overhead GSRP transmission line would increase a typical residential customer's monthly bill (700 kWh) by about $0.91 per month. An all underground **HVAC** variation would increase a typical residential customer's monthly bill by $3.43.[17] (CL&P 18, R. Suffield-013; Tr. 8, p. 277)

Noise

- FOF #174 The proposed GSRP lines are designed to not be a significant source of audible noise. The conductors proposed for the GSRP have a larger diameter than those used on other 345-kV transmission lines, which reduces the production of corona-caused audible noise.[18] (CL&P 23, R. CAOPLC-013)

- FOF # 175 Noise emissions associated with the construction of the proposed projects would be short-term and would generally be due to construction equipment, truck traffic, earth moving, vehicles and equipment, jackhammers and structure erection equipment. (CL&P 1, Vol. 1, p. N-46)

- FOF # 176The impact of construction-related noise emissions would vary depending on the location of the noise source due to sound attenuation with distance and with the presence of vegetative buffers or other barriers. Operation of the 345-kV transmission line would create noise that ranges from inaudible levels during fair weather to barely audible levels in relatively dry snow or light fog to distinctly audible levels in rain or wet snow[19]. (CL&P 1, Vol. 1, p. N-46)

Visual Resources

- FOF # 180 The National Park Service has expressed concern about the "potential environmental and scenic/recreational impact to the recently designated New England National Scenic Trail and Wild and

[17] An entirely different monthly cost figure was given in the Suffield Interrogatories of $1.39.

[18] This is OPINION and not a fact, or it is a very "sloppy fact." To make it factual, a range in decibels should be calculated and given to the CSC for evaluation.

[19] This is OPINION and not a fact, or it is a very "sloppy fact." To make it factual, a range in decibels should be calculated and given to the CSC for evaluation.

Scenic River Study of the Lower Farmington River and Salmon Brook" due to the proposed GSRP. (NPS comments dated July 28, 2009)[20]

Wildlife

- FOF # 196 The Connecticut portion of the proposed GSRP traverses 0.3 miles through property owned by the Suffield Sportsman's Association in Suffield. (CL&P 1, Vol. 1, pp. L-22, L-23)[21]

Visual Resources

- FOF # 229 The proposed 345-kV structures would be slightly more visible than the existing 115-kV structures from the Metacomet Trail. (Tr. 10, pp. 83, 84, 86)[22]

Historic and Cultural Resources

- Three historic cemeteries, which began use between c.1740-1784, were identified within approximately 0.25 miles of the proposed GSRP route, which include St. Andrew's Cemetery in Bloomfield; and a smallpox cemetery and Newgate Prisoners Cemetery both in East Granby. There would be no known or likely adverse visual impact on these cemeteries. (CL&P 1, Vol. 1, pp. L-46, N-45, Vol. 3, p. 33)

- Along the Northern Route there are no documented archaeological sites; however five Native American archaeological sites are within one mile of the proposed line. (CL&P 1, Vol. 1, p. N-45, Vol. 3, pp. 28, 29)

- Approximately 6.7 miles of the proposed GSRP route appears sensitive for undocumented Native American archaeological resources. Any sites determined to be eligible for the national Register of Historic Places would be avoided, to the extent possible. If avoidance is not possible, a mitigation strategy would be developed for review and approval by the State Historic Preservation Office (SHPO). (CL&P 1, Vol. 1, p. N-45)

- Old Newgate Prison is a national landmark and is listed on the National Register of Historic Places. The proposed overhead structures would not be DISTINCTLY visible from the Prison location. [23] (Tr. 7, pp. 179, 180)

---

[20] Also CAOPLC, the First Selectman of East Granby and the First Selectman Suffield each offered similar testimony (see GSRP testimony for the parties noted)

[21] Is the Suffield Sportsman Club a statutory facility? It sponsors frequent recreational events in which children attend with their parents.

[22] This is not factual; it is a statement of opinion and aesthetic perspectives. It also does not reference or incorporate the opinions of CAOPLC, the Towns of East Granby and Suffield which are the direct opposite of this statement of opinion. CAOPLC feels that the towers will be a visual pollutant and has so testified. So has the First Selectman of East Granby and Suffield. Further, the cross examination of Truescape by CAOPLC revealed that Truescape shows only the views and perspectives that CL&P and NU commissioned the Truescape simulation to show. It value as reliable evidence is problematic.

[23] Some CL&P transmission structures can be seen in the distance from the picnic area of Old Newgate Prison.

ELECTRIC AND MAGNETIC FIELDS[24]
General

- FOF # 275 Electric and magnetic fields (EMF) are two forms of energy that surround an electrical device. **HVAC** Transmission lines are a source of EMF. **HVDC transmission lines do not emit EMF radiation.(**CL&P 1, Vol. 1, p. K-3)

- FOF # 276 Electric field is a result of voltages applied to electrical conductors and equipment. Magnetic fields are produced by the flow of electric currents. The magnetic field at any point depends on the characteristics of the source, including the arrangement of conductors, the amount of current flow through the source, and its distance from the point of measurement[25]. (CL&P 1, Vol. 1, p. O-2)

- FOF #277 Agencies, including the World Health Organization and the Committee on Electromagnetic Safety have researched the scientific evidence regarding EMF. These agencies have determined a maximum level of occupational exposure for working environments, as well as for exposure for the general public. The International Committee on Non-Ionizing Radiation Protection has the strictest standard of 833 milligauss (mG) for a 60-hertz magnetic field. (Tr. 7, p. 108)[26]

- FOF #278 The Council's *"Electric and Magnetic Field Best Management Practices for the Construction of Electric Transmission Lines in Connecticut"* (EMF BMPs) were issued in December 2007 to address concerns regarding potential health risks from exposure to EMF from transmission lines. (Council Admin. Notice 3; CL&P 1, Vol. 1, p. K-3) (See footnote 19)

- FOF # 279 The Council's EMF BMPs support the use of effective no-cost and low-cost technologies and management techniques to reduce magnetic field (MF) exposure to the public while allowing for the development of electric transmission line projects. (Council Admin. Notice 3; CL&P 1, Vol. 1, p. K-3)

- FOF # 280 The Council's guidelines seek to achieve MF reductions at ROW edges of 15% or more as compared with the levels associated with a base line design, with an investment of up to 4% of the estimated project cost using the base line design (including the cost of each project's related substation work). (Council Admin. Notice 3; CL&P 1, Vol. 1, p. O-8)

- FOF # 283 EMF modeling is done for an assumed midspan height above ground level for the lowest conductors of 30 feet for the 115-kV line and 35 feet for the 345-kV line. Although the modeling is done at a uniform height, conductors are higher at support structures than they are along the spans between the structures. (CL&P 23, R. CAOPLC-002)

- FOF # 284 EMF levels at annual average loading for the proposed (**BASE DESIGN ?)** H-frame configuration at ROW edges for the section of ROW between North Bloomfield and Granby Junction were calculated to be:

---

[24] As a general comment for this entire section, CAOPLC rejects the ideas and efforts to mitigate EMF radiation at the edge of the ROW, because as we have testified, the East Granby and Suffield areas do not have distinct ROW boundaries as would be found for example in the more populated Danbury or Norwalk neighborhoods. Once again, EMF mitigation efforts using a ROW boundary are inappropriate when such a boundary does not in fact exist.

[25] See prior comments about the East Granby and Suffield residents having to be directly under the power lines each day and thus receiving no substantive benefit from EMF mitigation efforts at the ROW edge, other than by reducing the total EMF profile of the base design.

[26] This may not be technically correct and it should be accurately and definitively researched. Some European countries such as Spain may have enacted stricter EMF standards. CAOPLC introduced exhibit evidence that noted Spain's judiciary has deemed EMF exposures to be a human rights violation.

	Magnetic Fields (mG)		Electric Fields (kV/m)	
	west/north ROW	east/south ROW	west/north ROW	east/south ROW
Pre-construction	16.0	0.5	0.46	0.00
Post-construction	10.2	13.4	0.01	0.18

(CL&P 1, Vol. 1, p. O-20)

Statutory Facilities
GSRP-Northern Route

- FOF # 288 The proposed GSRP route would not be adjacent to any public or private school, licensed child day-care facility, licensed youth camp or public playground. There are a group of homes along the section of the existing ROW between the point where Country Club Lane in East Granby comes closest to the ROW and where Phelps Road in Suffield intersects with the ROW. This group of homes may be sufficiently dense enough to qualify as a statutory "residential area," which is referred to as the "focus area." CL&P proposes to construct the proposed 345-kV line in a delta configuration in the residential area to reduce EMF levels in accordance with the EMF BMPs. (CL&P 1, Vol. 1, pp. H-28, O-62, O-63)[27]

- FOF # 290 In the "focus area" from Country Club Lane to Phelps Road (in Suffield) there are 25 homes within 100 feet of the edge of the ROW and 50 additional homes within 101 and 300 feet of the edge of the ROW. (Tr. 10, pp. 79, 80)

- FOF # 291 The delta configuration would not require the widening of the existing ROW for the construction of the new 345-kV structures, while the proposed design in this portion of Segment 2 would require an expansion of the existing ROW[28]. The delta configuration would include 110-foot monopoles centered 75 feet east of the centerline of the ROW[29]. (CL&P 1, Vol. 1, pp. O-62, O-63)

- FOF # 292 The delta configuration would reduce magnetic field levels under modeled system average loading conditions by 22% to 24% at ROW edges, as compared to the magnetic field levels of the proposed H-frame line design. (CL&P 1, Vol. 1, p. O-63)

[27] See McGurk letter on FOL child day care center. See CAOPLC comments of Suffield Sportsman Club events in testimony and final brief.

[28] CAOPLC as it understands CL&P's materials does not believe that this statement of expanding the ROW is true through the focus area.

[29] By definition the center line of the right away is 305'/2' = 152.5 feet. That 152.5 feet plus 75 feet would be 227.5 feet from the western edge or 177.5 feet from the center line of the existing power line. This proposed siting is wasteful of ROW land and would force an eastward expansion of the right of way for future projects.

- FOF # 293 EMF levels at annual average loading at ROW edges for the section of ROW between Granby Junction and the Connecticut/Massachusetts state border are calculated to be:

	Magnetic Fields (mG)		Electric Fields (kV/m)	
	west/north ROW	east/south ROW	west/north ROW	east/south ROW
Pre-construction	8.7	0.1	0.09	0.00
Post-construction	23.5	12.6	0.11	0.15
EMF BMP	17.9	9.8	0.15	0.14

(CL&P 1, Vol. 1, p. O-30)

- FOF # 294 The delta configuration would cost approximately $2.2 million more than the proposed configuration. This expenditure equates to approximately 1.6% of the total project cost[30]. (CL&P 1, Vol. 1, p. O-64)

- FOF # 295 Options to reduce magnetic fields along the 3.2-mile "focus area" of the GSRP Northern Route include:

Configuration	Max. level on ROW* (mG)	% reduction-west edge	% reduction-east edge	% cost [31]increase
Base line	269.2	-	-	-
H-Frame +20'	179.5	3%	2%	0.4%
Delta	173.4	24%	22%	1.6%
Delta +20'	82.8	33%	27%	3.0%
Vertical	149.7	34%	24%	2.6%
Vertical +20'	72.5	45%	29%	3.5%
Split phase	77.0	90%	85%	10.1%
345/115-kV composite	132.0	20%	34%	11.0%

(CL&P 1, Vol. 1, Appendix O-1, p. 12; CL&P 19, R. OCC-001-SP02)
*Typical location on the ROW for maximum magnetic field levels is directly underneath the conductor midspan between the structures.

- FOF # 295 Although the split-phase configuration would provide the greatest reduction in magnetic field levels, it is a 10.1% increase over the cost of the base line configuration for the same section of ROW. (CL&P 1, Vol. 1, Appendix O-1, p. 13)

- FOF # 298 To decrease the height of the structures used for a split-phase configuration, the distance between the structures would have to decrease thereby shortening the spans of the conductors. Transmission line structures are typically 500 to 800 feet apart. The trade-off would result in double the amount of transmission structures, more access roads and a greater cost. (Tr. 6, p. 197; Tr. 8, pp 90, 91)[32]

---

[30] The basis of the project cost CL&P is using here for all EMF mitigation cost calculations should be clearly set down in black and white for the purposes of comparison and evaluation and accuracy.

[31] IBID and comment also applies to FOF # 295

[32] We do not understand why this FOF # 298 is included or significant. CAOPLC testimony specifically stated and reaffirmed in the final brief that if it is a choice between safety and EMF reduction and tower height, we reluctantly chose the higher towers and safety over aesthetics.

- FOF #300 Most of the homes along the proposed GSRP transmission lines are not close enough to existing statutory facilities to raise a potential health concern. There are homes along Newgate and Phelps Road in Suffield and East Granby that are very close to the edge of the ROW and construction of the proposed GSRP would result in increased magnetic fields at these residences. Installing the overhead lines in a split phase configuration in this area of concern would reduce field levels to 2.4 mG at the western edge of the ROW at a cost above that of the delta configuration. Increasing the distance of the proposed transmission lines, by moving the lines farther east within the ROW in the area along which the homes are closest to the ROW edge, in addition to using the delta configuration, would reduce the EMF levels. (DPH comments dated October 8, 2009)[33]

- FOF #301 DPH recommends minimizing the increase of EMF levels above current levels to the greatest extent possible. (DPH comments dated October 8, 2009)[34]

- FOF #302 Underground line variations to the GSRP would replace sections of the Granby Junction to the Connecticut/Massachusetts state border. Magnetic fields (in mG) from the underground **HVAC** line variations were calculated (at a distance of 25 feet from the underground cable centerline) to be:

	West/north ROW	East/south ROW
Post-Construction	23.5	12.6
In-ROW Variations	3.2	0.5
In-Road Variations	2.6	5.6

(CL&P 1, Vol. 1, pp. O-38)

- FOF #303 Magnetic fields from **HVAC** underground cables, when standing directly above, would generally be the same or greater than the magnetic fields directly below some overhead lines. (Tr. 8, p. 188)[35]

- FOF #304 Predictions for **HVAC** underground magnetic field levels are for the duct banks only. In the vicinity of **HVAC** splice vaults, due to the wider spacing of the **HVAC** cables, the **HVAC** magnetic field levels would be comparable to that of the **HVAC** overhead lines. (Tr. 8, p. 81)

High Voltage Direct Current (HVDC)

- FOF # 331 An HVDC option to deal with reliability problems in the Greater Springfield load area, among others in the tri-state area covered by NEEWS, was examined and rejected in the ISO-NE "Options Analysis," June 2008. (CL&P 1, Vol. 5, "Options Analysis", pp. 20-22)[36]

- FOF #332 HVDC transmission lines typically are not introduced into the middle of an existing grid because they have different electrical characteristics from normal transmission lines that carry

[33] Again when the word "most" is used, the statement is opinion and not fact. A specific accounting of the exact number of homes should be in the record and used by the CSC to correctly evaluate CL&P's claims.

[34] DPH also offered commentary that CL&P was using some creative and low ball accounting to keep the project costs low to minimize the amount that could be spent on EMF mitigation. (DPH comments dated October 8, 2009)

[35] HVDC cables do not produce EMFs because of the non-cyclical or non-phased nature of direct current.

[36] But a consolidated and holistic study of all of the NEEWS projects was not conducted. Nor was a combination solution of GSRP and NRG Meriden, nor NEEWS (holistically all projects in total) and NRG Meriden.

Alternating Current (AC)[37]. Every connection point between HVDC and AC lines requires a converter station, and these are expensive, both because of the technical equipment and the extra space involved[38]. Also, if a line is out of service in an **HV**AC system, the electricity immediately and automatically flows on the remaining **HV**AC lines to get to the customer, whereas an HVDC line has to be manually[39] operated. For these reasons, HVDC systems limit flexibility, and tend to be used only in special cases, such as the connection of power systems that differ operationally, asynchronous systems, and underwater cables. (Tr. 7, p. 84; Tr. 10, p. 118)

- Each HVDC converter station would cost approximately $200 million. Three or Four converter stations would be needed along the GSRP Northern Route. (Tr. 7, pp. 85, 86)

- FOF #334 A conventional HVDC system for 1,200 MW of capacity would cost approximately $2.3 billion. An HVDC "Light" system from Ludlow to Agawam to North Bloomfield would provide up to approximately 1,000 MW of capacity and would cost approximately $2.4 billion[40]. Either cost would be directly comparable – and far higher – than the GSRP cost of $714 million.[41] (Tr. 10, pp. 74-76)

- FOF #335 Estimated costs for HVDC systems include the installation of an HVDC system include 35 miles of HVDC underground, the 115-kV overhead work that would still be required in Greater Springfield and three converter stations. The estimate also includes spare HVDC transformers because lag time in acquiring these transformers is more than a year. The spare transformers would cost approximately $62 million. (Tr. 10, p. 103)[42]

- FOF #336 CL&P has concerns about whether an HVDC converter station could fit into the available land at Ludlow, Agawam, and North Bloomfield Substations. (Tr. 10, p. 118) (See footnote 27)

[37] This is more opinion than fact from reading the recent developments and materials from ABB and Siemens. Both manufacturers state that done correctly and integrated judiciously HVDC can add stability to transmission systems.

[38] This comment is accurate only for classic HVDC and not for HVDC Light. (See ABB materials referenced in CAOPLC October testimony. HVDC light stations have a footprint that is measure in meters rather than acres. (CAOPLC testimony October 2009 and ABB exhibits)

[39] Not necessarily with the advent and deployment of digital controls and software.

[40] This is CL&P's quick and dirty estimate, an opinion. No actual analysis and cost estimate was obtained from a manufacturer such as ABB as was done in docket 272. (CAOPLC testimony October 2009)

[41] Again, HVDC costs trail sharply downward as distance increases. (CAOPLC testimony October 2009) Was a combined GSRP and CCRP option modeled? Was a consolidated HVDC solution for all of NEEWS modeled? Can the CSC discharge its statutory obligations if these potentially beneficial options to CT consumers are not explored and factually brought to light?